

Retrograde Washout of a Pre-pump LVAD thrombosis in a patient on HeartWare support.

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Abstract

The success of the left ventricular assist device (LVAD) as a treatment for terminal left-side heart failure is still restrained by some severe complications associated with mechanical circulatory support. Pump thrombus still affects many patients. It is associated with high morbidity and mortality. The therapeutic options include augmentation of anticoagulation and antiplatelet medication, intravenous or catheter-guided thrombolysis, and pump exchange. Heart transplantation would be a desirable option in this population, but unfortunately, it is only theoretical given the increasing number of LVAD implants and decreasing number of organ donors. A retrograde washout maneuver may be a treatment option in pre-pump thrombosis in selected patients. Therefore, the decision should be made on an individual basis after balancing the risks and benefits of different treatment approaches.

Retrograde Washout of Pre-pump LVAD thrombosis in a patient on HeartWare? support.





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Abstract:

The success of the left ventricular assist device (LVAD) as a treatment for terminal left-side heart failure is still restrained by some severe complications associated with mechanical circulatory support. Pump

thrombus still affects many patients. It is associated with high morbidity and mortality. The therapeutic options include augmentation of anticoagulation and antiplatelet medication, intravenous or catheter-guided thrombolysis, and pump exchange. Heart transplantation would be a desirable option in this population, but unfortunately, it is only theoretical given the increasing number of LVAD implants and decreasing number of organ donors. A retrograde washout maneuver may be a treatment option in pre-pump thrombosis in selected patients. Therefore, the decision should be made on an individual basis after balancing the risks and benefits of different treatment approaches.

Keywords:

* Ventricular assist device * Thrombus * Medtronic/HeartWare HVAD * Retrograde washout * Peripheral thromboembolism.

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Case Presentation:

We present a 76-year-old male (1,78 m, 72,5 kg, BSA 1,89 m², BMI 22,8) stage D congestive heart failure status and HeartWare HVAD (Medtronic HeartWare International, Framingham, MA) ventricular assist device implantation as destination therapy three years prior. The patient had a cardioverter-defibrillator device (ICD) implantation five years earlier. His medical history was pertinent for type II heparin-induced thrombocytopenia, forefoot amputation secondary to chronic peripheral artery disease, and chronic kidney disease.

The patient experienced inappropriate shocks from his ICD. Consequently, he presented to our institution. The ECG in the emergency department showed sinus tachycardia. ICD Interrogation revealed evidence of a lead fracture. Admission to the hospital was recommended for definitive correction of his problem. Under local anesthetic, he was posted for ICD lead replacement. During the procedure, the patient constantly developed LVAD low flow alarm. Instantly echocardiography was performed, which showed insufficient unloading of the left ventricle. After successful implantation of a new right ventricle lead and closing of the wound, a prompt computed tomography angiography was undertaken, which was negative for pulmonary embolism and showed LV dilatation with no definitive outflow cannula thrombosis or significant stenosis.

HVAD interrogation showed a reduced average flow of 1,98 L/min and power of 3,1Watts at the speed of 2700 Rpm.

The diagnosis of an occlusive thrombus of the inflow cannula was made based on an acute decrease in power consumption and the calculated blood flow without changes in the acoustic signal, and there was no evidence of hemolysis.

The bedside transthoracic echocardiography showed the LV to be enlarged and ejecting. Thrombolysis therapy in our patient carried a very high risk because of the fresh wound and the possibility of developing a massive pectoral subcutaneous hematoma. The decision was made to perform a retrograde thrombus washout maneuver with the patient awake and spontaneously breathing. A neuroprotective device was omitted due to the emergency situation with low cardiac output syndrome and raised serum lactate levels. The mean blood pressure was increased to 100 mmHg with vasopressors, and with the intravenous administered adrenaline, the ventricle contractility was enhanced. After manually compressing both carotid arteries in Trendelenburg's position to avoid thromboembolism to the brain, the pump was stopped for ten seconds. After restarting the pump, the parameters returned to normal values with a flow of 4,2 L/min and power of 4,1 Watts at the speed of 2700 Rpm.

LV becomes unloaded again in the bedside transthoracic echocardiogram. The patient showed no perfusion or neurological deficits after the procedure, and he was then transferred to the normal ward after withdrawal of the catecholamine.

LVAD pump exchange was deferred because of the multiple co-morbidities of the patient (e.g., peripheral vascular disease and prior sternotomy) as well as the abolition of the HeartWare pump from the market,

which increased the burden of that procedure. The patient was then discharged home with normal HVAD parameters.

Discussion:

Durable mechanical circulatory support devices, such as LVADs, have improved heart failure outcomes when used as destination therapy compared to medical treatment alone ¹. Pump thrombosis is a complication of LVAD implantation, affecting approximately 5% of the patients ². Flow obstruction of the HVAD can be classified into pre-pump obstruction, in-pump obstruction, and post-pump blood flow obstruction (**Figure 1**).

(Figure 1): [backup here](#).

Pump exchange remains the standard in the treatment of LVAD thrombosis; however, not all patients are candidates for LVAD exchange.

On June 3, 2021, Medtronic stopped selling and distributing the HeartWare Ventricular Assist Device (HVAD) system. Leaving HeartMate 3 as the only available centrifugal pump on the market, however, HM3 does not fit into the HVAD sewing ring; the click-in mechanism for pump fixation of HM3 does not work with the HVAD ring ³. So, the change from HVAD to HM3 is feasible and was previously reported; however, many technical challenges increase the burden of the procedure.

Thrombolysis carried a high risk in our patient because of the fresh wound. The retrograde washout maneuver seemed to be a rational alternative for this patient. Still, this procedure carries a significant risk of peripheral thromboembolism, which the wedge thrombus can cause ⁴. The safety of this approach without using a neuroprotective device still needs to be studied in a more extensive series.

Conclusion:

As HVAD was abolished from the market, the retrograde thrombus washout approach seems promising in selected patients.

Abbreviation:

1. ICD Implantable Cardioverter-defibrillator
2. LVAD left ventricular assist device
3. ECG Electrocardiogram
4. MCS Mechanical circulatory support
5. LV Left ventricle
6. L/min Liter per minute
7. Rpm Revolutions per minute
8. HM3 HeartMate 3?
9. HVAD. Heart ware? ventricular assist device

Data Availability Statement:

The raw data supporting the conclusions of this article will be made available by the authors without undue reservation to any qualified researcher.

Ethics Statement:

The patient signed informed consent related to the clinical course; therefore, the Institutional Review Board was waived due to the retrospective nature of the educational case report.

Author contributions:

all authors contributed to this patient care, diagnosis, treatment, and in writing this article.

Conflict of interest:

The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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Figure Legend:

Figure 1: algorithms for the three types of Flow obstruction in the HeartWare HVAD.

Figure 1.



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