Perspectives of Ventricular assist device (VAD) in heart failure patients

Mr. Murthi S, Department of Perfusion Technology

School of Allied Health Sciences, Vinayaka Mission’s Research Foundation – DU

AVMC & H, Puducherry, India

**ABSTRACT**

Congestive heart failure is a major cause of mortality and morbidity around the world. Heart failure affects more than 64 million people around the world. Despite many medical therapies available for heart failures like heart transplant ventricular assist devices offers an alternative when the heart transplant is limited by donor availability. And it also provides both pulsatile flow and non-pulsatile flow and depending upon the choice of temporary or permanent supportive device. The advancement in VAD helps in extended support, overall patient outcomes This article describes the ventricular assist device and pump types, components, indications, complication, hemodynamic criteria and evolution and current trends

**Keyword:** Ventricular assist device, pulsatile and non-pulsatile flow indications, complication,

1. **INTRODUCTION**

Ventricular Assist Device Ventricular assist device (VAD) is a mechanical pump which is surgically implanted to one or both ventricles of the heart, to augment or replace ventricular function. It is designed to support heart function partially (either the right "RVAD" or left "LVAD" ventricle) or completely (both at once "BiVAD") in people who have heart Failure.[1] VAD is implanted either as a bridge to transplantation or as a bridge to recovery or as an alternative to heart transplantation (called destination therapy, a patient who will never get a heart transplant). [2]

1. **WORKING PRINCIPLE**

Ventricular assist device takes blood from a lower chamber (ventricle) of the heart and helps pump it to the body or to the lungs, that decrease the workload of the heart thereby reducing myocardial oxygen demand, while maintaining adequate systemic perfusion. The increase in systemic perfusion improves myocardial oxygen supply.[3] That reduction in myocardial oxygen demand and improvement in myocardial oxygen supply helps in ventricular recovery.[4]

1. **Components**

The basic parts of a ventricular assist device include an inflow tube that carries blood out of heart , outflow tube that returns blood to ascending aorta or the main pulmonary artery, Driveline (A cord passes through the skin and holds the control and power wires, that connects the device to an external portable driver), Portable driver consisting of a control unit (that monitors the VAD functions) A power source (that may be worn around the waist, carried in a shoulder bag, or contained within a small bedside monitor). [5]

1. **Pump flow types**

Pulsatile and non-pulsatile (continuous flow) pumps are the two primary groups into which the pumps utilized in ventricular assist devices fall. Pumps with Pulsatile Flow: The majority of extracorporeal pulsatile devices have valves, an air chamber with a compressor-operated membrane, and a blood chamber. Blood enters by an inflow cannula, fills the blood chamber, and is subsequently expelled into the systemic circulation via an outflow cannula by a pneumatic pump that collapses the blood chamber by pumping air at a high pressure into it. As the ventricle empties into the blood chamber during native ventricular systole, pulsatile devices consecutively fill and empty. Pulsatile Flow Pumps imitate the heart's normal rhythmic pounding. The patients will therefore have measured blood pressure and palpable pulses. [6] [7]

1. **CLINICAL APPLICATION**

Ventricular assist devices can be used for a wide spectrum based on the therapeutic goals of circulatory support as well as the duration of treatment. They can be used for short term as well long-term duration. The indications are: bridge to recovery, bridge to transplantation, destination therapy, bridge to decision, post cardiotomy cardiogenic shock, and end stage cardiomyopathy [8]

1. **CLINICAL COMPLICATION**

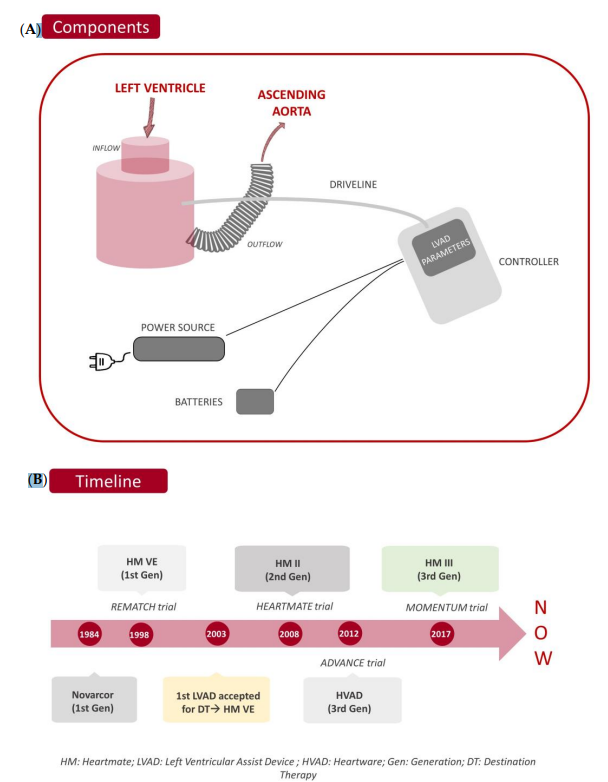
The most common complications of VADs implanted include: Haemorrhage including pericardial tamponade, right ventricular failure, sepsis, device thrombosis, cable malfunction, mechanical device failure, neurologic dysfunction, and infection.[9]

1. **CURRENT TRENDS AND EVOLUTION**

LVAD technology evolved from first-generation pulsatile pumps (Novacor®, and HeartMate VE®) to the continuous flow of second and third-generation).[10] Second-generation pumps have an axial design with a turbine system that provides a parallel flow to its rotation axis. Heart mate II is very small] in size then heart mate I and significantly better survival [11]The final group, third-generation LVAD, is the most widely used. HeartWare® (HVAD), with the hybrid centrifugal flow, was not inferior to HeartMate II® at the ENDURANCE trial , being the exchange feasible in practice[12]There were no clinical trials that compared long-term morbidity and mortality between both centrifugal DT-LVAD devices. However, some descriptive data showed fewer complications and mortality with HeartMate III® than with HeartWare®[13]

Nevertheless, HeartMate III® signaled a revolution in medicine. It is a totally magnetically levitated robust LVAD that improves hemocompatibility by reducing bloodstream friction and presenting broader route gaps. Overall heart mate III is not improved in overall survival rate than heart mate II but heart mate III lower rates of gastrointestinal bleeding as well as aortic insufficiency. [14]

Even though there were no changes in the incidence of right heart failure, arrhythmia, or infections, hemocompatibility-related events (bleeding, stroke, and device thrombosis) occurred at reduced rates in the HeartMate III® group.[15] But if biventricular assistance is required, negative effects are far more common, with bleeding and infection occurring on more than [16] Despite the use of HeartMate III, there was only one reported case of both and 25%, respectively. [17] Long-term morbidity and mortality between the two centrifugal DT-LVAD devices were not evaluated in clinical trials. Nevertheless, some illustrative data revealed fewer. HeartMate III® has fewer side effects and lower fatality rates than HeartWare® [18]. Perhaps there will be another choice in the near future.



**Figure 1: Components and timeline of VAD**

1. **CONCLUSION**

In the care of severe heart failure patients who are ineligible for transplantation, mechanical circulatory support is a highly sensible alternative that increases their functional ability. Implantable pumps increased exponentially in terms of event-free survival as they became more sophisticated. Additionally, highly specialized non-transplant LVAD centres came to be. At two and five years, the predicted survival rate is currently greater than 70% and 50%, respectively.

However, meticulous preimplant patient selection determines the short- and medium-term prognosis. Evaluation of the baseline situation is crucial, paying close attention to factors including frailty, the psychosocial environment, renal function, hemodynamic indicators that can assist determine prognosis and RVF, and ultimately, the surgical strategy used for the heart. A multidisciplinary shared decision process is particularly pertinent in these cases, particularly in patients who have several conditions and under uncertain circumstances.

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