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

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**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**

Cardiopulmonary Assist Device A mechanical pump called a ventricular assist device (VAD) is surgically implanted into one or both ventricles of the heart to improve or replace ventricular function. It is intended to assist cardiac function in persons with heart failure either partially (either the right "RVAD" or left "LVAD" ventricle) or entirely (both at once, "BiVAD").[1] VADs are implanted as a substitute for heart transplantation (called destination therapy, a patient who will never receive a heart transplant), a bridge to transplantation, a bridge to recovery, or both. [2]

1. **WORKING PRINCIPLE**

The heart's workload is decreased by using a ventricular assist device to help pump blood from the lower chamber (ventricle) to the body or the lungs. This maintains adequate systemic perfusion while reducing myocardial oxygen demand. The improvement in myocardial oxygenation is caused by the rise in systemic perfusion.[3] Ventricular recovery is aided by the improvement in myocardial oxygen supply and decrease in myocardial oxygen demand.[4]

1. **Components**

 An inflow tube that transports blood from the heart, an outflow tube that returns blood to the ascending aorta or the major pulmonary artery, and other basic components make up a ventricular assist device. Driveline (a cord that runs through the skin and holds the device's power and control wires while connecting it to a portable, external driver), A portable driver with a control unit that keeps track of the VAD's operations a power source (which may be housed inside a small bedside monitor, carried on one's shoulder, or wrapped around the waist). [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**

Depending on the therapeutic objectives of circulatory support and the length of the treatment, ventricular assist devices can be applied in a variety of situations. They can be used both temporarily and permanently. The following conditions are indicators: end stage cardiomyopathy, after cardiotomy cardiogenic shock, destination therapy, bridge to transplantation, and bridge to decision [8].

1. **CLINICAL COMPLICATION**

 Right ventricular failure, sepsis, device thrombosis, cable malfunction, mechanical device failure, neurologic impairment, and infection are the most frequent problems associated with VAD implants.[9]

1. **CURRENT TRENDS AND EVOLUTION**

First-generation pulsatile pumps (Novacor® and HeartMate VE®) gave way to second- and third-generation continuous flow LVAD technologies.[10] The architecture of second-generation pumps is axial, and a turbine system creates a parallel flow to the rotating axis. Compared to heart mate I, heart mate II is substantially smaller and has a higher survival rate. [11] The third-generation LVAD, the last group, is the most popular. At the ENDURANCE study, HeartWare® (HVAD) with the hybrid centrifugal flow was not inferior to HeartMate II®, making the exchange practicable.[12] Long-term morbidity and mortality between the two centrifugal DT-LVAD devices were not evaluated in clinical trials. However, certain descriptive data indicated that HeartMate III® had fewer problems and mortality than 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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