

The Ventricular Assist Device team in the management of patients treated with long-term Mechanical Circulatory Support

Citation: Amato S., Battisti A., Napolitano D. "The Ventricular Assist Device team in the management of patients treated with long-term Mechanical Circulatory Support" (2024) *infermieristica journal* 3(3): 165-168. DOI: 10.36253/if-2867

Received: July 11, 2024

Revised: August 25, 2024

Just accepted online: August 31, 2024

Published: September 30, 2024

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Data Availability Statement: All relevant data are within the paper and its Supporting Information files. This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record

Competing Interests: The Author(s) declare(s) no conflict of interest.

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Abstract

The number of people with heart failure is increasing rapidly worldwide. Despite preventive measures, optimal medical therapy, and cardiac transplantation, the overall morbidity and mortality of this syndrome remain high. Ventricular assist devices are well established as a treatment for heart failure and are increasingly used globally, both for destination therapy and as a bridge to cardiac transplantation. The management of these patients requires the training of a highly specialized team to ensure optimal outcomes. This article focuses on implementing a multidisciplinary team on the ventricular assist device, ensuring comprehensive care for implanted patients to mitigate potential complications early.

Keywords: VAD; VAD Team; Nursing; Multidisciplinary Team; VAD Coordinator.

The number of people with heart failure (HF) is rapidly increasing worldwide. In the United States alone, approximately 5.3 million people are affected by heart failure, with a prevalence of about 10 in 1,000 among those over the age of 65¹. It is currently estimated that 660,000 new cases of heart failure decompensation are diagnosed

annually in individuals over the age of 45. In 2008, heart failure resulted in over 1 million hospitalizations, costing \$34.8 billion. Despite preventive measures, optimal medical therapy, and heart transplantation, the overall morbidity and mortality of this syndrome remain high².

Ventricular assist devices (VADs) are well

established as a treatment for heart failure and are increasingly utilized globally, both for destination therapy and as a bridge to heart transplantation³.

VADs have revolutionized the heart transplant process by offering a means of organ perfusion for certain patients awaiting a donor heart. Compared to medical management alone, VADs have extended and enhanced the quality of life for patients on the transplant waiting list. Since 2004, the majority of VADs implanted have been continuous-flow devices, which represent an improvement over pulsatile devices in terms of durability, patient comfort, and the reduction of some complications⁴.

The indications for implanting VADs are diverse. VADs can serve as a bridge to transplantation, supporting patients while they await a compatible heart. They can also function as a bridge to recovery, helping patients until their hearts regain normal function. Additionally, VADs can serve as a bridge to decision-making, allowing time to determine the best treatment for each patient, or as destination therapy for those ineligible for heart transplantation.

Managing these systems is highly complex and requires specialized personnel. In Italy, to ensure high standards of care, a document was published on 2 July 2015⁵ by the Permanent Conference for relations between the State and the Regions. This document emphasizes the importance of establishing dedicated VAD teams in centers where ventricular assist systems are implanted.

The VAD Team is a multidisciplinary team, consisting of cardiologists, cardiac surgeons, anesthesiologists, cardiovascular perfusionists, nurses, and psychologists¹².

The VAD Team's activity begins already in the pre-operative phase with the selection of patients through risk assessment and optimization of clinical conditions before system's implantation. These activities are usually carried out by Cardiologists, Cardiac Surgeons and Nurses.

In the intraoperative phase, the Cardiac Surgeon takes care of the implantation of the system and the Cardiovascular Perfusionist, in addition to taking care of the management of the extracorporeal circulation⁶, necessary to perform the implant, also takes care of the technical control of the device, verifying its correct functioning. Furthermore, Cardiac surgeon, Cardiovascular Perfusionist, Nurse and

Anesthesiologist cooperate during the weaning phase from the extracorporeal circulation and the beginning of the support with the VAD.

In the immediate post-operative phase, the Cardiovascular Perfusionist deals with the management of some alarms which can occur especially in this initial phase of assistance. This assistance continues throughout the duration of hospitalization both in intensive care and in the ward.

Patients treated with VADs face a high risk of hemodynamic instability, necessitating continuous monitoring of vital signs to provide a customized combination of vasopressors, inotropes, and fluids. Ongoing monitoring is critical for the prevention and early intervention of potential complications.

Nursing surveillance is vital for the timely identification and management of changes in blood pressure, heart rate, cardiac output, and tissue perfusion. This involves frequent assessment of vital signs, heart rate, urine output, and the utilization of invasive multiparameter monitoring devices^{13,14}.

Given the patient's high level of dependency and potentially debilitated condition, intensive care nurses play a pivotal role in overseeing life support devices, reducing complications, promoting early mobilization, and educating both patients and healthcare providers. Critical clinical conditions can reduce mobility, compromise skin integrity, and increase the risk of pressure injuries¹⁵.

Therefore, it is essential to regularly assess the skin and tissues, implement effective preventive measures, and provide an anti-decubitus mattress⁹.

A significant reduction in calorie intake impacts patient outcomes and influences insulin and protein metabolism. Early nutritional support through continuous enteral feeding via gastric tube¹⁰ tube is advisable, collaborating with a clinical nutrition specialist to assess optimal energy, protein, and micronutrient intake.

In this post-operative phase, the patient is assisted, according to competence, by all members of the VAD team. In particular, the Cardiovascular Perfusionist also takes care of training the patient and care givers for the management of the device. Furthermore, provides information on system maintenance, on how to change the power batteries and on how some maneuvers must be carried out in case of

emergency such as replacing the VAD controller in case of malfunction of the same⁷.

Nurses provide information on the care of the drive line entry site, in order to reduce the most serious and feared complications; the infectious risk.

According to the analysis of the INTERMACS registry, infections are highlighted as the leading cause of long-term death in patients implanted with VADs¹¹.

The work of the VAD team does not end once the patient has been discharged. In fact, patients are provided with a telephone number to always stay in touch with a member of the team. Once a month, patients are called to the hospital for routine checks¹⁶. On this occasion the team collects data on the functioning of the system such as: The Pump Speed at which the pump is set, the flow delivered and other parameters indicative of good functioning of the system. During the visit to the clinic, blood pressure is also measured and an electrocardiogram is performed. All these parameters are recorded in the database. Sometimes small repairs to the external portion of the cables are necessary⁸. On this occasion the functionality of the power batteries is also evaluated and if necessary they are replaced. In some patients it may be necessary to change the pump setting to optimize assistance. In this case, the “Ramp Test” is carried out in the presence of the multidisciplinary Team. An invasive test that allows the evaluation of residual cardiac function and the optimization of the VAD pump speed.

Managing patients receiving mechanical circulatory support is highly complex and requires collaboration among various healthcare professionals. Establishing a multidisciplinary team is crucial to allow each professional to operate within their specific competencies. This approach, as recommended by the document published by the Permanent Conference for Relations between the State and the Regions, ensures high-quality care for VAD treated patients and promotes standardization across centers utilizing this therapy. Nowadays it is becoming increasingly necessary for a VAD coordinator who can coordinate the entire team and who can manage the large amount of information contained in the database¹².

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