Ambulatory Ventricular Assist Device Patient Management

Tonya Elliott, MSN, RN, CCTC, CHFN[a],
Lori G. Edwards, MSN, RN[b,*]

KEYWORDS

• Ambulatory care guidelines • Infection guidelines • End-of-life care

KEY POINTS

- As patients survive longer on durable left ventricular assist device (LVAD) support, it is critical for programs to develop a platform for the care of patients with a ventricular assist device (VAD) in the outpatient setting.
- Understanding the patient pump interface and developing expertise in monitoring this population will maximize patient outcomes.
- The purpose of expert, focused, routine outpatient surveillance of this population is to facilitate the integration of pulseless, electrically dependent VAD patients into the community.

THE EVOLUTION OF OUTPATIENT VENTRICULAR ASSIST DEVICE CARE

This article describes strategies, protocols, and resources necessary to care for the ambulatory ventricular assist device (VAD) patient population. Historical milestones and innovations over the past 20 years in mechanical circulatory support (MCS) technology resulted in an expansion of the number of patients with a VAD and the length of time supported living in the community. In September 1998, the Food and Drug Administration (FDA) made a ground-breaking decision and permitted patients with a Heart Mate XVE (Thoratec, Pleasanton, CA) and Novacor (Novacor, Berkley, CA) to be discharged from the hospital.[1] These first-generation, volume-displacement pumps were implanted and had wearable external accessories allowing for untethered operation for a couple of hours on the same set of batteries. Patients were able to perform activities of daily living while supported on these devices, making discharge to home possible while awaiting transplantation. This single action by the FDA forced VAD programs to shift resources and modify protocols, as VAD teams prepared the community for the technology and outpatient clinics for follow-up care. Before 1998, patients with a VAD were relegated to life in the hospital until transplant. Discharging patients with a VAD to their home environments was associated with a positive impact on patient quality of life.[2]

The REMATCH[3] trial then transformed the treatment paradigm for advanced heart failure by allowing VADs to be implanted in patients who are not transplant candidates, called destination therapy (DT). VADs are now used in the treatment

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[a] MCS Program, MedStar Heart and Vascular Institute, 110 Irving Street, Northwest, Washington, DC 20010, USA; [b] Advanced Heart Failure/Mechanical Circulatory Support, INOVA Fairfax Hospital, 3300 Gallows Road, Falls Church, VA 22042, USA
* Corresponding author.
E-mail address: Lori.edwards@inova.org

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of advanced heart failure, expanding the indications for implant and therefore the number of possible candidates. Between August 1985 and February 1991, 34 patients at 7 different medical centers were treated with the 1000 IP LVAD as a bridge to transplantation.[4] All but 1 of the patients were male, and their ages ranged from 17 to 62 years.[4] The evolution of second-generation and third-generation LVADs with continuous flow (CF) technologies (including the HeartMate II, HVAD, and HeartMate 3) further expanded LVAD candidacy to include patients with smaller body surface areas, such as women and children.[5] In the HeartMate II clinical trials, patients with a body surface area as low as 1.5 m^2 could be enrolled and the cohort was 20% female. The HeartWare bridge to transplant (BTT) and DT studies enrolled patients as small as 1.2 m^2 with female representation of 20% to 28%.[6]

As programs grow and implant a more diverse cohort of patients, consideration for intrapersonal issues that concern patients of all genders and cultures must be taken into account. Psychosocial factors, such as adaptation to the equipment, coping with changes in body image and lifestyle, and managing perceived loss of independence need to be addressed by the multidisciplinary team (inclusive of psychology or social work) perioperatively and on an ongoing basis during follow-up visits.[7]

Finally, as patients survive longer on durable LVAD support, it is critical for programs to develop a platform for the care of patients with a VAD in the outpatient setting. CF physiology created pulseless patients with unique infectious, neurologic, and hematologic complications. Understanding the patient pump interface and developing expertise in monitoring this population will maximize outcomes and is the goal of the care of the ambulatory patient population. Collaboration of MCS staff with other specialists is imperative for care coordination and management of non-VAD surgical interventions and medical complications encountered while on device support.[8] The purpose of expert, focused, routine outpatient surveillance of this population is to facilitate the integration of pulseless, electrically dependent patients with a VAD into the community. To accomplish this goal, the multidisciplinary team must promote quality of life, maintain equipment integrity, optimize VAD support, and monitor for common VAD-related complications. Additionally, this long-term monitoring must include ensuring viability as a heart transplant candidate for BTT patients, consideration for patients implanted as DT to become transplantable, and monitor for possible recovery.

DISCHARGE READINESS

Discharge activities are carefully orchestrated by implanting VAD programs to empower patients to care for themselves successfully in the community. VAD programs mobilize a multidisciplinary team to maximize patients' rehabilitation and assimilations into the community while minimizing the possibility of complications.[9] Personnel involved, but not limited to, include occupational and physical therapists, infectious disease specialists, VAD coordinators, heart failure attendings, cardiac surgeons, pharmacists, nutritionists, financial coordinator, social workers, family members, and patients.

Patients and caregivers need to demonstrate competency managing VAD equipment, alarm response, and dressing change procedures before discharge. These are all topics that can and should be reviewed frequently during early return visits based on patient and caregiver needs.[10] VAD programs are required to provide patients and community stakeholders with emergency contact information and have a plan for responding to VAD emergencies. Patients and caregivers must rehearse calling the emergency notification system to demonstrate familiarity with the step before discharge.

An assessment of the home environment is important for patient safety and success at home. Assessments ensure presence of a grounded and reliable electricity supply as well as telephone services. The local electrical providers are notified by some implanting centers that customers are dependent on electricity.[9] Patients need to be able to communicate via telephone for emergencies. Key aspects of contingency plans developed for outpatient LVADs include ensuring an uninterrupted electricity supply, a plan for extended power outages, maintaining access to a working telephone, and understanding the limitation of LVAD battery life.[11]

Educating Prehospital Providers

Before discharge, VAD teams notify local emergency medical service (EMS) providers that a potentially pulseless, electrically dependent patient with a VAD lives in their first due vicinity. EMS VAD field guides developed in 2010 contain information and pictures to assist with troubleshooting equipment issues.[12,13] VAD equipment can be labeled with the implanting center emergency contact and VAD model.[13,14] Transporting patients with a VAD back to the implanting center is preferable, as implanting centers know their patients best and have equipment and expert training in monitoring and managing VAD