Standard of Care: Inpatient Intervention for Patients after Implantation of a Ventricular Assistive Device

Case Type / Diagnosis: (diagnosis specific, impairment/ dysfunction specific)
This standard of care applies to patients who have undergone placement of a ventricular assist device (VAD) for end-stage heart disease. Patients may have a Left ventricular assist device (LVAD), Right ventricular assist device (RVAD), or biventricular assist device (BiVAD).

Currently, the most commonly used VAD machines at Brigham and Women’s Hospital (BWH) are the Thoratec (paracorporial), and the Heartmate. The purpose of the VAD is to support the heart’s pumping action, often serving as a bridge to heart transplant. In some patients, VADs are now also being used as a permanent alternative to transplant—called destination therapy. In rare cases, a VAD may also be used temporarily to allow adequate myocardial recovery, and it is then explanted.

The primary goal of inpatient occupational therapy for a patient status post VAD placement is to maximize the patient’s functional independence and safety prior to discharge from the hospital, or to maximize their independence and endurance while on the VAD at BWH. Patients are engaged in meaningful life roles and routines that promote occupational performance and patient mastery/satisfaction. Occupational Therapy (OT) intervention provides guidance on how to adapt activity demands, modify environmental obstacles, and promote quality of life in order to allow the patient to remain active in their daily routine at home with the device.

Given the strong multi-disciplinary approach to treating VAD patients, all occupational therapists should attend training classes and complete VAD competencies prior to providing independent intervention.

Indications for Treatment:
- Potential skin breakdown at cannula site(s)
- Impaired cardiovascular and respiratory functions associated with prolonged illness, bedrest, and de-conditioning
- Impaired musculoskeletal and movement-related functions related to de-conditioning, neurological events, or medication-induced weakness
- Altered cognitive, affective, or behavioral functions associated with disturbed sleep/wake cycles/quality of sleep, response to chronic or acute pain, anxiety surrounding critical illness, body image changes, and loss of autonomy
- Loss of independence in self-care, leisure, and/or vocational skills
- Knowledge deficit regarding the adaptation of one’s daily routine with a VAD
Contraindications / Precautions for Treatment:

- Coagulopathies—patients on the Thoratec device are anti-coagulated. Their INR must between 2.5 and 3.5 before mobilizing them. Seek medical clearance if the INR is above 4.0
- Unstable or potentially fatal arrhythmias—seek medical clearance if patients are experiencing ventricular fibrillation or ventricular tachycardia in their native heart rate, as this may disrupt the VAD functioning
- Low flow VAD values—hold intervention for flows less than 3.5L/min
- Sternal Precautions: (following sternotomy for 6-8 weeks)
  - Avoid simultaneous bilateral shoulder flexion, abduction greater than 90 degrees
  - Avoid lifting, pushing, and pulling greater than ten pounds for 3 months (no posey ladder or trapeze)
  - Avoid strong contraction of the abdominal muscles by using a log roll technique for bed mobility
  - Avoid full weight bearing through the UE’s (patient must be at least partial weight bearing for ambulation
  - Avoid activities that may cause the valsalva maneuver
  - Use a pillow to encourage splinting of chest when coughing
  - No driving and no sitting in a passenger seat behind an airbag for 4 weeks
- No slideboard transfers in patients with the Heartmate device. Static created during the transfer can short circuit the device. Educate patient to avoid touching computer or television screens without “grounding” their hand first.
- Modify bending, twisting or turning motions that cause abdominal or incisional discomfort; these motions may also place stress on cannula line(s)
- Avoid getting any part of the device, drive lines, or cannula(s) wet
- Device Alarms: (See flow sheets for pictorial decision tree)
  - Infection control/contact precautions: Wash hands or use a hand disinfectant, don a gown and gloves prior to each treatment session.
- Heartmate Device:
  - Yellow wrench alarm: (intermittent tone) non-life threatening, indicates low flow, power advisory, disconnection of one of the leads from a power source, or controller malfunction
  - Red heart alarm: (continuous tone) indicates an emergent situation in which the pump has stopped or is about to stop
- Thoratec Device:
  - Normal Alarm: a single light with an audible alarm; type of alarm and action required are visible on message display
  - Back-up Urgent Alarm: lights up with a continuous alarm that indicates the machine is running on emergency back-up system

Patients with a Thoratec device cannot shower. Patients with a Heartmate LVAD must use a special shower kit. Clearance from the physician and instruction from the nurse practitioner is required prior to showering. This typically occurs 30 days after the LVAD placement, once the retention sutures are removed.

Standard of Care: Ventricular Assistive Device
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Evaluation

Medical History:

History of Present Illness:
- Emergent versus elective VAD placement
- Name of device and which ventricle(s) are supported
- Indication for VAD placement (temporary versus bridge-to-transplant versus destination therapy)
- Complications during surgery or in the post-operative period
- Response to weaning of sedation and extubation
- Medications required to maintain cardiopulmonary stability
- Typical VAD rates (fixed or automatic), flows and volumes for this patient
- Vitals signs: blood pressure and oxygen saturation

Occupational Profile:
- Social/environmental information from the chart (if the patient is intubated or unable to communicate)
- Home layout, environmental barriers, DME used at home
- Family/caregivers involved prior to admission, and availability to assist upon discharge (patients must have twenty-four hour assist available to return home)
- Functional status in activities of daily living (ADL’s), instrumental activities of daily living (IADL’s), leisure interests, and vocational roles prior to admission
- Daily routine including performance patterns and activity demands
- Patient’s goals and priorities for returning to daily occupations

Motor Skills
- ROM: Assess bilateral upper extremity (UE) active range of motion (AROM) and passive range of motion (PROM) within the limitations of the sternal precautions
- Strength: Assess the patient’s UE and pinch strength within the limitations of the sternal precautions through functional activities
- Sensation: Assess UE sensation integrity to light touch and sharp/dull
- Coordination: Assess the smoothness of movement, motor planning, and manipulation of objects during ADL’s
- Functional Mobility: Assess functional mobility and transfers in the room and bathroom (indicate need for assistive device)
- Vision: Assess vision for functional acuity (including the need for corrective lenses at baseline), ocular motor tracking, and fields of view
- Tolerance/Endurance: Monitor vital signs for cardiovascular intolerance, monitor VAD flows, rates, and volumes, indicate presence of shortness of breath (SOB), rate perceived exertion at rest, during activity, and after intervention
Process, Communication/Interactive Skills

- Cognition: Assess level of arousal, alertness, attention span (selective, sustained, divided), ability to follow multi-step commands, memory, ability to learn new material, problem solving, and insight into deficits. Assess the best mode of learning.
- Communication: Assess the patient’s ability to express and understand verbal and/or written material, articulate and form questions, and express concerns or fears.

Performance in areas of Occupation

- Activities of Daily Living (ADL’s): Assess self-feeding, grooming, hygiene, sponge bathing, dressing and toileting skills. Note the need for adaptive equipment or adaptive strategies in order to complete the task.
- Education: Provide the patient and family with education on the role of OT and the plan of care during the acute hospital stay, the importance of engaging in daily ADL’s to promote activity tolerance, and the need to adhere to sternal precautions.

Patient Factors

- Pain: Assess the patient’s pain via the Visual Analog Scale (VAS), numerical or faces scale if they are verbal, or via observation of grimacing and/or changes in vital signs in a non-verbal patient
- Vital signs: Document changes in VAD flows and rates with activity, indicate the need for supplemental oxygen to maintain appropriate O2 saturation with activity
- Skin integrity: Observe sternotomy wound and note any drainage. The cannula site is typically observed when nursing staff is performing a dressing change.

Assessment

Problem List:

- Decreased endurance or activity tolerance, abnormal hemodynamic response
- Decreased UE strength, hand grip/pinch strength
- Impaired fine motor coordination
- Decreased performance in ADL’s
- Decreased performance in functional mobility
- Inefficient pacing skills
- Lack of knowledge regarding the role of OT, operation of the VAD, proper use of binder
- Impaired coping skills

Prognosis and Expected Outcomes:

The outcome for each patient is affected by many variables, including, but not limited to pre-morbid functional level, available family/social support, flexible coping strategies, presence of co-morbidities, and post-operative course.

The uncomplicated VAD recipient may be discharged to home within 3 weeks of VAD placement, however their hospital course may also be extended. Many patients require 4 to 8
weeks of inpatient intervention before discharge home. Some VAD patients stay at BWH until their heart transplant.

**Age Specific Considerations:**
The typical VAD patient population at BWH ranges in age from 20 to 75. Very rarely, an adolescent may be hospitalized for VAD placement at BWH, and their family must be co-educated with the patient in order to assure competence and carryover of VAD operational tasks.

**Goals:**

**Short Term Goals:** anticipated to be met within 10 days. Appropriate goals include (but are not limited to):
- Patient will perform UE exercise program with stand by assist/minimal/moderate/ cueing in preparation for ADL’s
- Patient will perform sponge bathe and dressing activities with stand by assist/ minimum/moderate/maximum assist, with use of adaptive equipment as needed
- Patient will demonstrate good safety awareness, requiring minimal/moderate/maximum cueing to navigate using VAD equipment within hospital setting
- Patient will demonstrate sufficient hand strength and endurance to hand pump for two/five/seven minutes
- Patient will demonstrate necessary fine motor coordination to change VAD batteries, press appropriate indicator lights on VAD devices
- Patient will integrate pacing and energy conservation techniques into ADL’s with stand by assist/minimum, moderate/maximum cueing.
- Patient will demonstrate use of healthy coping and problem- solving skills to manage VAD alarms with standby assist/minimum/moderate/maximum assist.
- Patient will initiate/sustain/integrate engagement in leisure activities into daily routine to promote quality of life and wellness.

**Long Term Goals:** These goals are anticipated to be met after the patient has completed all occupational therapy services for this episode of care. Appropriate goals include (but are not limited to):
- Pt will be independent in UE exercise program
- Patient will be independent with sponge bathing and dressing, using adaptive equipment and strategies as needed
- Patient will be independent with don/doffing of VAD binder
- Patient will be independent in toileting and functional mobility within the hospital context
- Patient will demonstrate sufficient grip strength and endurance to sustain independent and effective hand pumping of VAD device for ten minutes
- Patient will demonstrate effective motor control and fine motor coordination to allow independent changing of batteries or power source for VAD device
- Patient will be independent in integrating pacing and energy conservation skills into ADL’s
- Patient and or caregivers will be independent with using adaptive showering kit, including necessary protection of cannula site (Heartmate patients only).
Treatment Planning / Interventions

Interventions most commonly used for this case type/diagnosis.

- ADL retraining/adaptive equipment training:
  - In the early post-operative period, many patients tolerate only light grooming or sponge bathing. Activity is progressed as the patient tolerates increased time out of bed and their ability to sit in a supported setting.
  - Patients often require long-handled adaptive equipment to perform lower body ADL’s. Bending, leaning, and twisting movements may be painful or interrupt flow through the cannula(s). The VAD device also inhibits abdominal flexibility in many patients.

- Functional mobility retraining:
  - Graded progression of activity from a bed level to a seated level and then to an ambulatory level must be accomplished with incorporation of sternal precautions, body mechanics, and a developing integration of the VAD device into all tasks.
  - The focus of intervention initially is in the context of daily activities in the room and bathroom. Eventual progression to incorporating simulated kitchen and home environments along with safe mobilization with the VAD device is incorporated before discharge.

- Graded UE/hand therapeutic exercise and strengthening activities:
  - Exercise may begin at a supine or supported sitting level for PROM and AAROM of UE’s, with adherence to sternal precautions
  - Theraputty or hand exercisers are often issued to promote hand strength; this facilitates the necessary endurance for hand pumping the VAD device
  - Progression to graded UE AROM exercises with light weights (one to two pounds), is initiated as the patient tolerates pain-free UE activities

- Patient/Family education (in conjunction with VAD nurse practitioner):
  - Purpose, fit and don/doffing of VAD binder
  - Changing power sources, monitoring skin integrity at wound site, hand pumping, and shower kit management (Heartmate patients only)

- Cognitive retraining (if indicated):
  - Compensatory strategies for difficulty learning new material, memory deficits, and performing tasks requiring divided attention, can be incorporated into all aspects of care as needed.
Pacing and energy conservation strategies:

- Written and verbal information is incorporated into all activities, to promote independent integration into ADL’s, IADL’s, functional mobility, and leisure interests.

Frequency & Duration:
Frequency may vary during the patient’s hospital course. Initial treatment in the ICU is often 1-2 visits for binder measure and fit. If medically ready and able to tolerate, frequency may increase to 2-3x/wk for pre-ADL training, light UE ROM exercises, and initiating education. Frequency for OT typically increases when the patient is transferred to the step-down unit, often progressed to 3-5x/wk until goals are met.

Patient / family education:
(focuses on, but is not limited to):
- VAD/binder/Support Devices: purpose (comfort, infection control, VAD protection and positioning), proper fit, how to don/doff
- Sternal precautions as integrated into ADL’s and IADL’s
- VAD Management: changing power sources, monitoring battery time, skin monitoring/wound care, hand pumping, and shower kit management.
- Progression of activity to safely include light IADL’s in the home setting.
- Pacing and energy conservation

Recommendations and referrals to other providers:
Physical Therapy and Occupational Therapy are consulted on all VAD patients. A multidisciplinary team approach is essential during the inpatient acute stay, and upon discharge home. During the acute care stay, physicians, nurse practitioners, dietitians, social workers, chaplains, and psychiatry may all be involved in the patient’s care.

Prior to discharge home, local fire departments, first responders, and VNA personnel are trained in emergency procedures for VAD management.

Re-evaluation
Patients are re-evaluated every 7-10 days to provide a current functional status and to update their STG’s. If STG’s are not being met, the factors limiting progress should be identified in the documentation.

Discharge Planning
Discharge planning for the VAD patient is a multidisciplinary approach, and is started at the time of the initial OT evaluation. The patient going home with a new VAD has to demonstrate knowledge of the handling the VAD on a daily basis (including the ability to switch to their portable device) and in emergency situations (including hand pumping). Their family members/outside supports must also be able to demonstrate these procedures before the patient
can safely be discharged from BWH. Community support is often necessary when a VAD patient goes home, and local fire departments are often trained in emergency procedures of the VAD.

Upon discharge from BWH, patients do not typically require continued home or outpatient-based occupational therapy. However, it is not uncommon to arrange for a home safety evaluation.

Brigham and Women’s Hospital has a monthly support group for patients with VADS to provide on-going support, education, and medical oversight of their issues.

Authors:  Brooke Reilly, OTR/L
          Nancy Kelly, OTR/L

Reviewers:  Noreen Dillon, OTR/L
            Alicia Savini, OTR/L

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REFERENCES
BWH the of Rehabilitation Services Cardiac Medicine & Surgery Standard of Care

BWH Department of Rehabilitation Services VAD resource book


