Institutional guidelines for the care of the patient with a ventricular-assist device requiring non-cardiac surgery

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Abstract

Patients requiring support for end-stage heart failure with long-term ventricular assist devices (VADs) are increasingly in need of non-cardiac surgery. There is little literature regarding the peri-operative management of these complex and sick patients with regards to facilitating multi-disciplinary communication to insure good outcomes. We present the results of our institutional task force that was convened to develop policies and procedure for the peri-operative management of patients with VADs requiring non-cardiac surgery.

Keywords: ventricular assist devices, non-cardiac surgery, policy and guidelines

Ventricular assist devices (VAD) are increasingly used for the treatment of end-stage heart failure as either a bridge to transplantation or destination therapy. Not only are more patients undergoing VAD implantations, their rates of survival are increasing as well. Recent studies have demonstrated a >70% 2-year survival for patients receiving VADs for either destination therapy (1) or as a bridge to transplant (2, 3). As these patients are living longer, the probability for non-cardiac surgery is also increasing (4). Similarly, there are various VAD complications such as gastrointestinal bleeding that present diagnostic and therapeutic challenges in the patients who require anticoagulation (5). However, the understanding of VAD technology and the care of these patients are typically beyond the scope of knowledge and experience of most health care providers outside of the primary VAD surgical and support team. Due to quality of care concerns and appropriate utilization of resources, a task force at our institution was gathered to develop a policy for the peri-operative management of patients with VADs who require non-cardiac surgery (Table 1). This policy statement is based upon similar experiences with other implantable life-support devices such as cardiac pacemakers and implantable cardioverter defibrillators (6). By presenting the outcome of this multi-disciplinary task force and the resulting policy, it is our goal that our efforts might be of value to those centers who might need to address similar clinical, communication, and process issues.

Policy statement

Patients with an implanted VAD require additional planning and resources to ensure safety in their care while undergoing non-cardiac surgery outside of the cardiac surgery operating room (OR) environment. The VAD patients will be admitted to the adult cardiac surgery service if admitted the day of surgery. Surgery will be performed in the cardiac surgery OR unless consensus is reached that the procedure can be safely and more appropriately performed in a specialty-specific operating room by the cardiac anesthesiologist, cardiothoracic surgeon (typically the implanting VAD surgeon), perfusionist, OR charge nurse, and post-anesthesia care unit (PACU) charge nurse (i.e. neurosurgery, advanced laparoscopy). Similarly, post-operatively, the patient will be...
admitted to the adult cardiac surgery service under the supervision of the VAD surgical and support team with the non-cardiac operating surgical team serving as consultants. Alternatively, if the post-operative needs of the patient are deemed to be best served by direct management of the non-cardiac surgery Team then the patient may be admitted to that service after a similar consensus discussion (with involvement of nursing management from the patient care unit where the patient will be admitted). A VAD will be noted in the comments section of the OR surgery schedule. It is the responsibility of the attending non-cardiac surgeon to notify the cardiothoracic/VAD surgeon to discuss the anticipated operative and post-operative plan of care.

The VAD surgical and support team is defined as the adult cardiac surgery attending surgeon, cardiovascular anesthesia VAD coordinator, perfusionist and adult cardiac surgery nurse practitioner, and specialty practice pharmacist.

Procedure

(1) A patient with a VAD will require a consultation with a cardiovascular (CV) anesthesiologist.
   (a) The attending non-cardiac surgeon will request, if time allows, for a pre-operative evaluation appointment through the out-patient pre-operative assessment team that consists of members of the anesthesia team who will evaluate the patient for anesthetic risks and assist in formulating an anesthetic plan in patients scheduled for same-day admission. These cases will then be alerted on the operating room schedule. If a CV anesthesiologist is not physically available for this outpatient visit and the patient is seen by a non-CV anesthesiologist, the patient’s information must be relayed to a CV anesthesiologist for an opinion. After discussing the patients information, the decisions will be made on a case by case basis whether a cardiovascular anesthesiologist should perform or assist in the anesthesia.
   (b) If time does not allow for an official out-patient Anesthesia pre-operative assessment, the non-cardiac surgeon should contact the Department of Anesthesiology and request a formal consultation with a CV anesthesiologist.
   (c) There is no requirement that a CV anesthesiologist perform the anesthetic for non-cardiac surgery on the patient with a VAD but this is highly recommended. This is to be decided on a case-by-case basis by the VAD surgical and support team based upon the physiologic status of the patient, the associated co-morbidities (e.g. right heart failure, pulmonary hypertension), and the nature of the procedure being performed. However, if a CV anesthesiologist is required for anesthetic management during non-cardiac surgery, then every means should be taken to allow the case to be performed in a cardiac surgery OR in a cardiac surgical block scheduling time block period – otherwise, it is the responsibility of the CV anesthesiologist to ensure appropriate patient and hemodynamic monitoring consistent with the needs of the patient and procedure.
   (d) Pre-operative antibiotic prophylaxis is critical. The VAD surgical and support team, anesthesia care provider, and attending surgeons should discuss the appropriate antibiotic prophylaxis for the patient. Peri-operative antibiotic dosing, duration, and spectrum of coverage should be consistent with the standard of care for the specific procedure being performed and surgical care improvement project measures are taken or appropriate documentation for extended antibiotic duration when indicated. For most procedures, antibiotic choices should provide broad-spectrum gram-positive and gram-negative coverage. For intra-abdominal procedures (i.e. hernia repairs, bowel resections, gastric banding), anaerobic coverage is required and typically should also include an anti-fungal.

(2) The attending non-cardiac surgeon should collaborate with the attending adult cardiac surgeon who oversees the care and management of the patient with a VAD.
   (a) If the patient with a VAD requires non-cardiac surgery during the index admission for the VAD insertion, the patient may be scheduled in a cardiac surgery OR in a cardiac surgical block

Table 1. Task force disciplines represented

- Cardiovascular surgeons
- Cardiovascular anesthesia
- General anesthesia
- VAD coordinators
- Peri-operative nursing leadership
  - General operating rooms
  - Cardiovascular operating rooms
- Peri-operative nursing
  - General operating rooms
  - Cardiovascular operating rooms
- Perfusion
- VAD inpatient nurse practitioner
- Patient care unit nurses
- Pharmacists
- Respiratory therapy

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The attending non-cardiac surgeon should ensure a perfusionist or other qualified person to be present in the OR at the beginning and end of the case, and be immediately available during the case. This is to ensure proper care and functioning of the VAD. This should be coordinated in advance by the VAD surgical and support team.

(a) A note indicating, ‘perfusionist required’ should be recorded on the OR schedule when scheduling the VAD patient for surgery.

(b) To contact/arrange for a perfusionist, the perfusionist manager should be directly contacted. A perfusionist is on call for emergencies, after hours and on week-ends and the name and contact information is available through the hospital telephone operator and is listed on the institutional call schedule.

(c) As many of these patients already have existing pacemakers and/or defibrillators, the patient must have a pre-operative evaluation with the appropriate device management team for reprogramming, device deactivation, or post-procedure interrogation (6). It is critical that the operating and anesthesia teams be aware that despite the presence of a functioning VAD, these patients are at considerable risks for developing symptomatic arrhythmias – including potentially life-threatening ventricular fibrillation.

(d) The peri-operative Team should ensure that a perfusionist is available before the patient is transported to the OR.

(e) The anesthesia care provider should confer with the perfusionist before preparing the patient to undergo general anesthesia.

(f) The perfusionist will communicate during the ‘Sign In’ or ‘Time Out’ process in the OR that all necessary equipment and functioning of the VAD have been evaluated and addressed. This needs to be documented in the medical record.

(4) Considerations for care of the VAD

(a) The pumps should be kept visible at all times and should never be covered with bed linen.

(b) Dressing changes are conducted by the nursing staff per institutional VAD guidelines.

(c) The pump (if external) and external driveline should be secured with a binder or holster at all times. The pump controller or console unit must be placed in an area to prevent damage from being knocked over, exposed to liquids, or sudden impacts.

(d) The pump should not be touching the skin at any time due to the risk of burns.

(e) Products with acetone (e.g. a permanent marker or nail polish remover) should not be used near the pump insertion site due to the risk of cannula degradation.

(f) Electrosurgical pencil can be used during the surgical procedure.

(5) VAD management

(a) Adjustments to VAD parameters should only be performed by the perfusionist in collaboration with the adult cardiac surgery attending or CV anesthesiologist (if present) and will be communicated to the anesthesia and operating teams as they are occurring. Intra-operative communication regarding blood loss, fluid administration, and initiation of vasoactive or inotropic medications is critical in avoiding ventricular dysfunction and/or adverse effects on VAD parameters. Hypoxemia, hypercarbia, and acidosis with their adverse effects on pulmonary artery pressures and right ventricular dysfunction are to be avoided and/or minimized.

(6) Post-operative care

(a) The patient will be transferred to a CV post-anesthesia care unit (PACU) for immediate post-anesthesia care. The patient will be admitted to the adult cardiac surgery service for observation and post-operative management under the primary care of the adult cardiac surgeon in collaboration with the attending non-cardiac surgeon.

(b) Many VAD patients also have pacer/ICDs and the issues related to the management of these should also be addressed separately per policy on patients with such devices.

Discussion

As more patients undergo treatment with a VAD, the spectrum of their non-cardiac morbidities increases. Although there are numerous reports of non-cardiac surgery in the VAD patient, many are small series (7) focusing on the surgical (8, 9) or the anesthetic (10) management of these complex patients. Nevertheless, good outcomes in terms of survival and eventual transplantation can be accomplished. Attention to medical-surgical details and excellent multi-disciplinary communication are imperative to a successful outcome. In one series, VAD patients requiring non-cardiac surgery...
experienced a 12%, 30-day mortality, with no deaths directly related to the surgery and had similar eventual transplantation rates (72%) compared to those who did not require non-cardiac surgery (71%) (11).

In our institution, the chronic management of patients requiring VAD support involves a multi-disciplinary team. This team consists of heart failure cardiologists, surgeons, anesthesiologists, outpatient coordinators, pharmacists, nurse practitioners, perfusionists, nurses, and social workers. Although each plays a critical role in the management of these complex patients, typically when the issues of surgical decision-making and management occur (even for non-cardiac surgery) the cardiologists will defer to the surgical teams (cardiac and non-cardiac) for input.

The goal of this report is not necessarily to describe our clinical experience, but more to outline those steps that we have incorporated to facilitate the care of these patients in the peri-operative period. Although there are aspects to our health care system that might challenge translating our policy and protocol to other systems, hopefully the guidelines will be of value administratively. For example, in our Institution the cardiovascular OR (and PACU) and cardiac (medical and surgical) patient care beds are in a separate stand-alone hospital. While this might reflect geographical differences in the care of VAD patients – hopefully the principles of how and where these patients should be cared for can translate into most major health care environments.

Since the implementation of this policy, there have been no cancellations of elective cases in VAD patients and all patients were successfully managed by the multi-disciplinary teams. There were no major peri-operative problems or concerns with regards to communication, hand-offs, or the transitions of patient care in the peri-operative period. While adverse outcomes and complications have occurred, most are attributed to the challenges in managing these extremely complex and sick patients.

**Conclusion**

The management of patients with VADs requiring non-cardiac surgery is complex. As the number of these patients is increasing and they are living longer, the need for non-cardiac surgery is also becoming more common. Our institutional policy on the management of VAD patients requiring non-cardiac surgery will hopefully address and eliminate the potential for communication problems and the issues of patient flow through a health care system in the peri-operative period. Hopefully our experience in developing this policy will assist other centers faced with similar obstacles.

**Conflict of interest and funding**

There is no conflict of interest in the present study for any of the authors.

**References**


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