

# Ventricular Assist Device Program - Toronto General Hospital Resource Manual

## Table of Contents

### Section 1 – Program Overview, Standard Orders and Protocols

Bridge to Transplantation .....	1-1
Bridge to Recovery .....	1-3
Patient Referrals .....	1-3
Differences Between Devices .....	1-4
VAD Equipment by Location .....	1-6
Guidelines to Determine Patient Suitability .....	1-7
Patients Accepted for VAD .....	1-8
Patients Turned Down for VAD .....	1-9
Emergency Situations .....	1-9
Withdrawal of Support .....	1-9
Disagreements Regarding Withdrawal .....	1-10
Post-op Standing Orders .....	1-11
Transfer CVICU to Ward .....	1-12
Infection Prevention Guidelines .....	1-13
Dressing Change Protocol .....	1-15
VAD Precautions .....	1-16
When to call/Who to call .....	1-18
Explanting a VAD .....	1-19

### Section 2 – Heartmate XVE

Instructions for Changing Power Sources .....	2-1
Batteries .....	2-2
Alarms .....	2-3
Hand Pump .....	2-4
Troubleshooting .....	2-5
Controller Self-Test .....	2-6
Pneumatic Drive Console .....	2-7

### **Section 3 – Novacor LVAS**

Compact Controller .....	3-1
Modes of Operation .....	3-2
Power Sources .....	3-3
Changing Power Sources .....	3-4
LVAS Monitor .....	3-5
Alarm Messages .....	3-7
Emergency Procedures .....	3-8
Daily Care .....	3-9

### **Section 4 – Thoratec VAD**

System Components .....	4-1
Dual Drive Console .....	4-2
Display Screens .....	4-3
Pressure/Vacuum Changes .....	4-4
TLC II Driver .....	4-5
Starting the TLC II .....	4-6
TLC II Panel Indicators .....	4-7
Power Sources .....	4-8
Battery Charger .....	4-9
TLC II Docking Station .....	4-9
Heart Touch Computer .....	4-10
VAD Settings .....	4-11
Alarms & Troubleshooting .....	4-12
Damaged Pneumatic & Electrical Leads .....	4-15
Emergency Situations .....	4-16
Alarm Messages & Responses .....	4-18

### **Section 5 – Abiomed BVS 5000**

Post-op Care Guidelines .....	5-1
Emergency Situations .....	5-6
Using the BVS Foot Pump .....	5-7
Changing the Console .....	5-8

### **Appendix 1**

Criteria for Acceptance for Heart Transplantation

### **Appendix 2**

Ethical release for Patients and Families

# **Overview of Toronto General Hospital Ventricular Assist Device Program**

Ventricular Assist Devices (VADs) are mechanical pumps that are implanted to improve the performance of the damaged left (LVAD), right (RVAD) or both (BiVAD) ventricles. VADs are indicated for patients with end-stage heart failure who are at risk of imminent death. They can be used for short-term support as a Bridge-to-Recovery or for longer periods as a Bridge-to-Transplant.

## **1. Bridge-to-Transplantation**

The Heartmate XVE LVAS and the Novacor LVAS are implantable systems that support left ventricular function for patients with end stage heart failure. These devices are indicated as a bridge-to-transplantation for patients with non-reversible left ventricular failure that are at risk of imminent death. The implantable VADs allow patients to recover end organ function and improve physical conditioning while waiting for a donor heart to become available.

Both systems consist of a pulsatile blood pump, an external power source and controller. They can be driven electrically via AC power from the power base unit or from a pair of wearable rechargeable 12-volt batteries. Patients are able to be up and out of bed and can participated in activities throughout the hospital. This reduces the complications associated with bedrest and optimizes the patient's condition until time of transplantation. Discharge home with an implantable LVAS is possible after an appropriate period of surgical recovery, convalescence and patient/family education.

The Thoratec VAD is a paracorporeal, pneumatically driven pump capable of providing left, right or bi-ventricular support. Due to the fact that the pumping mechanisms are situated outside of the body, this device can be used as a Bridge-to-Transplantation for small patients who are not candidates for the HeartMate or Novacor systems. The Thoratec device is the ONLY system that is capable of providing long term (months) BiVAD support. Patients on the Thoratec device can also be discharged home following an appropriate period of surgical recovery, convalescence and patient/family education. The Thoratec VAD can be used for either Bridge-to-Recovery or Transplantation.

### **Indications for Bridge-to-Transplantation:**

Patients who are currently listed on the TGH cardiac transplantation list will be considered for Bridge to Transplantation when:

1. A low output state persists despite the use of at least 2 intravenous inotropic agents and/or intra-aortic balloon pump support. Hemodynamic parameters include:
  - Systolic blood pressure <80mmHg
  - Pulmonary capillary wedge pressure (PCWP) > 20mmHg
  - Cardiac index <2.0L/min/m<sup>2</sup>
2. End-organ failure is imminent
  - Mixed venous saturation <60%
  - Rising serum creatinine in association with oliguria
3. There is a risk of imminent death

All other candidates **must** be screened and accepted for cardiac transplantation prior to consideration of device implantation (see Appendix 1).

The TGH Cardiac Transplantation/VAD team will use the following scale to determine the risk associated with VAD implantation:

Preoperative Ventilation	4 points
Temporary LVAD in-situ	2 points
Redo Sternotomy	2 points
CVP>16mmHg	1 point
PT>16sec	1 point.

Patients who present with a summation score above 5 face almost a 50% risk of mortality compared to less than 15% if they have a preop score <5. The UHN LVAD program will attempt to limit the predicted risk of potential device recipients by declining any patient with a summation score >5.

## **2. Bridge to Recovery:**

Two devices are available to provide ventricular assistance as a Bridge-to-Recovery, the Abiomed BVS 5000 and the Thoratec VAD. The Abiomed BVS 5000 is a paracorporeal, pneumatically activated pump capable of providing left, right or bi-ventricular support. This device is the most commonly utilized mechanical support system for post-cardiotomy shock. Although the average duration of support is short (5-7 days), the device is capable of providing assistance for longer periods (over 28 days). Unfortunately, prolonged support is associated with coagulopathy, thromboembolism, thrombocytopenia and hemolysis. The Thoratec VAD can also be used as a Bridge-to-Recovery device.

### **Indications:**

1. Post-cardiotomy shock in appropriate candidates.  
Intraoperative consults should be initiated within one hour of the initial attempt to wean from cardiopulmonary bypass despite IABP and the presence of at least 2 inotropic agents.
2. Temporary right ventricular assistance in recipients of an implantable LVAD.
3. Temporary mechanical support for acute myocardial infarction when recovery is anticipated.
4. Temporary mechanical support for acute myocarditis when recovery is anticipated.

### **Patient Referrals to the TGH VAD Program:**

During normal business hours, referrals may be made through the Cardiovascular Surgery Triage office, at 416 340-4474 (fax: 416-340-4811). Once a referral is made a member of the Cardiac Transplantation/VAD team will contact the physician for more information and request a copy of pertinent medical information. Whenever possible this information will be discussed with the team and a decision communicated back to the referring physician within 24 hrs.

## Differences between Mechanical Heart Devices (HeartMate®, Novocor, Thoratec and Abiomed®)

	HeartMate®	Novocor	Thoratec	Abiomed®
Performing external chest compressions	No	No	No	No
Defibrillating/cardioverting	Yes	Yes	Yes	Yes
Is there manual operation?	Yes – hand pump	No	Yes – hand pumps - 2 per VAD	Yes – 1 foot pump for all VADS
Power configuration	12. AC – supplied by PBU 2. Battery – supplied by 2 12-volt batteries in clips	1. AC supplied by LVAS monitor 2. Battery – Primary and Reserve power packs Must always have 2 sources, Reserve and 1 other	DDC – AC alone TLC driver - needs 2 sources <b>1. AC (supplied by AC adapter) plus 1 battery</b> 2. 2 batteries in TLC driver	AC – console should be plugged in at all times  Battery – self contained in console
Normal battery life	4-6 hours	Primary – 4 hours Reserve – 1 hour LVAS internal battery – 1 hr	- 80 minutes for single VAD support - 55 minutes for BiVADs	1 hour if fully charged
Alarm codes	Yellow wrench – Non-critical situation requiring attention Red heart – Critical situation requiring immediate attention	Pop-up screens	Yellow light Red Normal Red Urgent	High & Low Driveline & Blood Flow Alarms  Message displayed on screen
Nursing documentation requirements	LVAD rate, stroke volume, mode, noted Q 1H in ICU, Q 4H on ward	Pump rate, pump output, stroke volume, residual volume noted Q 1 H in ICU, Q 4 H on ward	See Thoratec Nursing Documentation Record	Pump Rate Flow L/min $SVR = \frac{MAP - CVP}{CO} \times 80$ CO (LVAD flow) $PVR = \frac{PAP - PCWP}{CO} \times 80$ CO (RVAD flow)

	<b>HeartMate®</b>	<b>Novocor</b>	<b>Thoratec</b>	<b>Abiomed®</b>
Unique features	1. flashing yellow battery alarm refers to the battery powering the system controller 2. attach white leads first then black	Back-up system controller always contains most recent patient settings	1. TLC driver has an emergency battery 2. No acetone products near device or cannulae	Only 1 bed plate mount, kept in OR with perfusion, will be transferred with pt  Pump Tubing Insulators
	<b>HeartMate®</b>	<b>Novocor</b>	<b>Thoratec</b>	<b>Abiomed®</b>
Mode of operation	Auto/Fixed	Fill Rate Trigger/Fixed Rate Trigger	Auto/Fixed	On/Off, Wean
Web-based resources	<a href="http://www.thoratec.com">www.thoratec.com</a>	<a href="http://www.worldheart.com">www.worldheart.com</a>	<a href="http://www.thoratec.com">www.thoratec.com</a>	<a href="http://www.abiomed.com">www.abiomed.com</a>
Company emergency contact numbers	1-800-456-1477 (for medical personnel)	1-888-THE-LVAS 1-888-843-5827	1-800-456-1477 (for medical personnel)	1-800 422-8666 (for medical personnel)
Emergency equipment	Pneumatic drive console – stored in CVICU equipment room - PMCC 2-529	2 <sup>nd</sup> LVAS monitor and cart stored on 4 West B	- 1 hand pump per VAD - Back-up to DDC is TLC driver - located on 4West A - Back-up to TLC driver is DDC located in OR - for uniVAD operation with DDC backup is the 2 <sup>nd</sup> compressor of DDC	Extra Console stored in CVICU equipment room - PMCC 2 - 529
Treat arrhythmias?	Yes – because of impact on pre-load	Yes – as with HeartMate	- Yes if 1 ventricle only is supported - Not necessary if pt has BiVAD	Yes if a RVAD or LVAD  Not necessary if BiVAD

### VAD Equipment by Location

	<b>HeartMate®</b>	<b>Novocor</b>	<b>Thoratec</b>	<b>Abiomed®</b>
Operating Room	<ul style="list-style-type: none"> <li>- Implant kit</li> <li>- Explant kit</li> </ul>	<ul style="list-style-type: none"> <li>- Implant kit</li> <li>- Explant kit</li> </ul>	<ul style="list-style-type: none"> <li>- Implant kit</li> <li>- Disposable pumps</li> <li>- Dual Drive Console and 2 hand pumps</li> </ul>	<ul style="list-style-type: none"> <li>- Implant kit</li> <li>- Disposable pumps</li> </ul>
Cardiovascular ICU	<ul style="list-style-type: none"> <li>-Horizontal drain holder</li> <li>-Pneumatic Drive Console</li> </ul>	<ul style="list-style-type: none"> <li>- Horizontal Drain holders</li> </ul>		
CV Surgery Inpatient Unit	<ul style="list-style-type: none"> <li>-Horizontal drain holder</li> <li>-Vent filters</li> <li>-Cart containing Power Base Unit and Cables, batteries, System Monitor, plastic bin holding spare equipment (1 cart on 4 West A behind reception – cart #2 in 4C-436 storage room at main entrance to A side)</li> </ul>	<ul style="list-style-type: none"> <li>- 2 carts each containing 1 LVAS monitor, 2 primary power packs, 1 reserve power pack, 2 compact controllers (both carts located on 4 West B behind telemetry)</li> </ul>	<ul style="list-style-type: none"> <li>1 cart with 1 TLC-II driver, battery recharger, 2 batteries, AC adapter (in drawer)</li> <li>- kept on 4 West A behind reception</li> </ul>	

## **Guidelines to Determine Patient Suitability for Ventricular Assist Device Implantation**

The Cardiac Transplantation team is charged with the responsibility of appropriate allocation of VADs taking the following ethical principles into account:

1. Autonomy
2. Beneficence
3. Non-Malificence
4. Distributive Justice

The Cardiac Transplantation team will respect the patient/families right to confidentiality, cultural and value differences. The team does not permit any payment or exchange of goods to be made in exchange for treatment.

The Cardiac Transplantation team realizes that the above principles may be in conflict for any given case and there may be difficulty in balancing decisions. Both morality and law require that patient autonomy be accorded preference over non-Malificence and beneficence.

National and local donor rates are currently stable and the presence of a VAD program will not increase the number of transplants done at TGH. However, it will change the management of a fixed donor organ pool by changing the order of those "waiting in line." This may result in issues of distributive justice balanced against patient autonomy and beneficence.

Resource allocation involves not only the availability of VADs but also the availability of beds in critical care areas, nurses, physicians and other allied health professionals as well as impacting the resources within other areas of the institution (blood bank, nephrology, infectious diseases).

When possible The Cardiac Transplantation team will formally meet and discuss following conditions before a patient will be accepted for VAD implantation:

1. Medical criteria have been met for bridge to recovery, bridge to transplantation
2. Medical consultations are complete with a written report
3. Psychosocial review as per cardiac transplantation criteria
4. Discussions have occurred with patient/family with both pre & post-implantation review and debriefing.
5. Informed Consent regarding possible outcomes and device withdrawal.

If the above conditions are met then the patient will be accepted for VAD implantation.

If the team is unable to reach consensus on patient acceptability for VAD implantation they will discuss the case or specific elements of the case with one or more of the following resources:

1. Other professional members of staff when medical or psychosocial aspects of the case need clarification
2. UHN Clinical Ethics committee for further clarification of ethical factors related to the case.
3. Legal Counsel when legal aspects require clarification.
4. Hospital Administration when there are organizational or Public Relation concerns.
5. Outside resources and consultation (ethical or legal counsel independent of UHN/University of Toronto) when it would appear that complete impartiality of involved staff may be questioned.

Once consensus is reached representatives from the Cardiac transplantation/VAD team will meet with the patient and family to discuss the recommendations.

### **Patients Accepted for VAD implantation:**

Consent must be given freely after complete disclosure of relevant information by the clinician. The patient must have the capacity to comprehend and to give the decision voluntarily, free of manipulation or coercion. VADs are a continuing therapy and consent should be viewed as an ongoing agreement rather than a discrete event.

The patient shall be given full information regarding:

- Risks and benefits.
- Expected outcomes with VAD and/or cardiac transplantation.
- Alternatives to VADs and/or cardiac transplantation and their expected risks and outcomes.
- Current expected statistics with VADs and cardiac transplantation.
- Acknowledgement of our experience with VAD support and cardiac transplantation.
- Possibility of device withdrawal in the event of complications.

Information regarding risks and benefits must be presented in a way that is easy to understand and assimilate taking into account their language and educational level. All efforts will be made to contact approved hospital employees to act as translators. Family should not be used as interpreters since they may not be impartial towards the information being discussed.

Whenever possible formal Advance Directives and identification of the substitute decision-maker will be established and documented prior to VAD implantation.

The cardiac transplantation team will endeavor to ensure that the principles of informed consent are met prior to VAD implantation. However, there will be patients who require short-term VAD support with the Abiomed BVS 5000 or

Thoratec VAD for failure to wean off cardiopulmonary bypass. Although in consenting to cardiac surgery the patient agrees to all measures to maintain life, the risks and benefits as well as the possibility of device withdrawal will not have been fully disclosed to the patient prior to surgery. In these situations the cardiac transplantation/VAD team will have ongoing discussions with the patient/family regarding the risks and benefits of VAD support and the possibility of device withdrawal.

**Patients turned down for VAD Implantation:**

When a patient is deemed unsuitable for VAD implantation, representatives from the Cardiac Transplantation team will discuss the decision at length with the patient/family. If a patient has been referred in from an outside institution/service, the referring physician will be notified by the TGH consulting cardiologist/surgeon regarding the decision. All efforts will be made to transfer the patient back to the referring center/service. This issue will be discussed with all referring physicians prior to accepting the patient for transfer to TGH.

**Emergency Situations:**

In emergency cases every attempt is made to balance the patient's autonomy with the need to ensure the recipient is an appropriate candidate. In these situations, 2 members of the Cardiac Transplantation team will discuss the case and decide appropriateness for VAD implantation. If they are unable to reach consensus they will contact additional team members until consensus is achieved. Once a decision is reached representatives from the Cardiac Transplantation team will communicate the decision to the patient/family.

**Withdrawal of VAD Support:**

The treatment decision to withdraw LVAD support should be considered in the context of the overall goal of the total treatment plan. If the medical team considers that the overall goal of treatment; transplant or recovery, can no longer be achieved than it is reasonable to consider withdrawal.

It is imperative that the aim of treatment withdrawal is not to precipitate death and that withdrawal of treatment does not promote death at a steeper trajectory than the underlying disease.

Whenever possible, the possibility to withdraw VAD support must be discussed with the patient, family and/or surrogate decision-maker. The decision will be recorded in the Clinical Notes and discussed with all staff involved in patient care.

### **Resolving Disagreement regarding Device Withdrawal:**

It is critical to ensure that all team members as well as the patient/family and substitute decision makers are aware that VADs are a 'bridging' device and not as a life-sustaining device. If the patient, family and SDM view the device as life sustaining then conflict may arise if there is a medical decision to withdraw support.

The Cardiac Transplantation team will be responsible for decisions regarding appropriate termination of LVAD support. Where there is a lack of agreement or serious reservation re initiation or withdrawal of LVAD support, consultation may be sought from the Hospital Ethics Committee and other relevant experts within and outside the University Health Network.

## **Standard Orders and Daily Care Post-Op ICU Standing Orders for Ventricular Assist Devices**

Bedrest – turn q2h

Keep Head of Bed elevated 30 °

LVAD driveline dressing change daily & prn (see Protocol)

### **Medications:**

1. Pepcid 20mg IV BID
2. ECASA 650mg po/pr OD when extubated
3. Antibiotics:
  - Ancef 1 Gm q8h x 48 hrs
  - Fluconazole 400mg IV 12 hrs after pre-op dose
  - Nystatin swish & swallow TID until antibiotics are D/Cd
  - Bactroban to both nares x 5 days
4. Tylenol supp 650mg q 4-6h prn for pain
5. Plavix 75mg daily

### **Routine Bloodwork:**

CBC, lytes, Cr ACT/PTT, ECG as per current CVICU protocol

Bili, AST, ALT, ALP, total protein, albumin immediately post-op and OD

Target ACT for Thoratec and Abiomed 180-200 seconds

### **Hemodynamic Parameters:**

Notify MD/VAD Team for:

BP < 90 or > 140 mmHg systolic

CVP < 7 or > 15 mmHg

LVAD pump flow < 4 or  $\geq$  1L/min drop in flow within 12 hrs

Temp > 38.5C

Chest tube drainage > 200cc/hr

Urine output < 30cc's/hr for 2 consecutive hours

Arrhythmias

**Call VAD Coordinator if you are unable to resolve alarm  
states**

## **Transfer CVICU to Ward**

Keep Head of Bed elevated 30 °

LVAD driveline dressing change daily & prn (see Protocol)

Daily weights

Q4h vital signs, LVAD rate, flow stroke volume, mode (ensure patient is in auto mode unless otherwise ordered)

Telemetry x 5 days

CBC, lytes, Cr daily x 7 days then prn

ECG, daily x 3 days

LFTs, PTT/INR q 2 days x 1 week then prn

### **Medications:**

Ferrous Sulphate 300mg BID

Plavix 75mg daily

Coumadin to maintain INR 2.0-2.5

ECASA 650 mg daily

### **Notify MD/LVAD team for:**

- LVAD flows < 4L/min or  $\geq$  1L/min from previous day
- Systolic BP < 90 or > 140 mmHg
- Temp > 38.5C
- All Arrhythmias

**Call VAD Coordinator if you are unable to resolve alarm states.**

## **Infection Prevention Guidelines**

### **Pre-operative**

1. Remove old IV Access lines 12-24hrs pre-op.
2. Antibiotic prophylaxis:
  - Ancef 1 Gm q8h x 48 hrs
  - Fluconazole 400mg IV 12 hrs after pre-op dose
  - Nystatin swish & swallow TID until antibiotics are D/Cd
  - Bactroban to both nares x 5 days
3. Pre-op scrub the night before and morning of surgery with Chlorhexidine and clip/shave if needed.

### **Intra-Operative**

1. Using Fit model for device positioning not actual device
2. Wrap implantable material in antibiotic soaked lap sponges
3. Pre-peritoneal vs intra-peritoneal device implant
4. Tunnel percutaneous leads to right upper quadrant, sub-costal region exiting in the mid-clavicular line 4-6cm below costal margin (pass percutaneous lead through a long intramuscular tunnel). Orient the 5-7cm of percutaneous lead towards axillary fold (see figure1).
5. Immobilize LVAD with fixation at 2 or more points
6. Irrigate all surfaces with antibiotic solution prior to closing.
7. Place thoracic and pocket drains
8. Immobilize percutaneous lead with retention suture and exit site dressing. Occlusive dressing to remain in-situ for 24-48 hrs.

### **Post-operative:**

1. Continue antibiotic prophylaxis as ordered. If long-term antibiotics are indicated, consideration should be given to antifungal prophylaxis.
2. Use aseptic technique for monitoring and access lines – remove lines ASAP. Change lines every 7 days if needed.
3. Chest tubes/Drains:

Remove chest tubes when drainage < 150cc/12hrs

Remove pocket drains when drainage < 50cc/day (usually 3 days)

Remove retention suture around percutaneous drain at 1 week.

4. Dressing Changes:

- Use sterile technique with masks and sterile gloves x 1-week then aseptic technique for all dressing changes.
- Change dressing daily & prn following protocol (see attached).
- Ensure proper positioning and immobilization to avoid tissue trauma around percutaneous lead exit site (see attached).
- Patient/family education to include avoidance of undue torque and pressure at exit site.
- Swab exit site q week for culture & sensitivity q Thursday
- Change vent filter weekly (q Thursday with site C&S swab) and prn

5. Bathing:

- Bed baths until exit site has healed with good tissue in-growth around percutaneous lead keeping exit site dry and vent line free from fluids.
- May take shower with HeartMate shower kit one exit site is well healed.

## Dressing Change Protocol

The dressing change is done initially by nursing staff until the technique can be taught to patient/family member. Aseptic technique is followed regardless of who is performing the dressing change.

### Supplies:

Dressing tray
Sterile Gloves
0.5% Chlorhexidine solution
Sterile specimen container if taking swab for C&S
4x4 drain sponges, 4x4 sponges
Tape

### Procedure:

1. Remove old dressing.
2. Wash hands and arms with water and antiseptic soap.
3. Apply clean gloves.
4. Maintaining aseptic technique, open dressing tray and establish sterile field.
5. Drop sterile drain sponges and sterile gauze onto sterile field.
6. Examine exit site for signs of infection including:
  - Unusual drainage
  - Redness
  - TendernessSwab site for C&S if any drainage present or weekly swab.
7. Remove clean gloves, put on sterile gloves.
8. Clean exit-site with Chlorhexidine swabs – remove any old deposits and gently clean edges of wound avoiding trauma to tissue.

**Redress the exit site with dry 4x4 drain sponges around percutaneous lead alternating the direction of perforated edges to cover and protect the entire exit site with a close fit and secure the dressing with tape.**

# VAD Precautions

**No External Chest  
Compressions**

**Do Not Restart Pump if  
it has been Off for More  
Than 3 Minutes –  
Please Notify VAD  
Coordinator or Surgeon**

## Defibrillation/Cardioversion for VAD Patients

**You do not need to disconnect the controller for cardioversion/defibrillation.**

Follow ACLS Guidelines for Defibrillation/Cardioversion.

Ensure proper functioning of VAD when defibrillation/cardioversion complete.

Notify the VAD team of defibrillation/cardioversion.

## When to Call/Who to Call

**During day time hours (0800-1700)** call the VAD Coordinator when:

1. After following the guidelines for troubleshooting alarms, the alarm(s) remain unresolved.
2. The patient meets the criteria for clinical issues requiring the attention of the VAD team i.e.
  - LVAD flows < 4L/min or  $\geq$  1L/min from previous day
  - Systolic BP < 90 or > 140 mmHg
  - Temp > 38.5C
  - All Arrhythmias
3. If the patient has been cardioverted or defibrillated

**After day time hours (1700-0800)** check with other on-duty VAD authorized nurses for assistance with troubleshooting equipment issues or contact the MD on-call for VAD patient related issues, as listed above.

**At any time**, if the VAD has been off (or is suspected to have been not functioning) for more than 3 minutes contact the MD on-call for VAD patient issues immediately.

If the VAD coordinator is scheduled to be out of town, there is always a designated nurse available to respond. At present, a Clinical Educator (for technical/device issues) and an Advanced Practice Nurse (for patient issues) will be identified who will take calls. Contact information will be widely available.

## **Explanting a VAD**

1. Ensure that VAD CV Surgeon on-call has been notified.
2. Call 6ES and arrange for the spare bedside cart with spare Power Base Unit and batteries to be brought to the patient's location. The patient and family know where the spare equipment is and they may go to 6ES and bring it with them.

**The patient must go to the OR with the bedside cart containing the PBU, cables, travel bag and hand pump. The remainder of equipment is to stay with the family. The VAD coordinator will contact the family to arrange a time for equipment drop-off.**