

When EMS Confronts Complex Medical Devices...

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High Tech Moving into Home Care

- **Major shift toward home care with devices previously seen only in hospitals or special care facilities**
- **Families “trained” to handle them**
- **Hurricane or other power outage...**
- **Also ventilator-dependent nursing homes**
- **Result: Lots of EMS surprises that aren't in the protocols!!**

Paramedic Scope of Practice and Complex Medical Devices

- Courses/texts have little info, even on trach tubes
- Minimal or no “hands-on” practice
- Refresher/CEU hours cover higher priorities
- New critical care curriculum does not address most of these either
- High risk, complex info, rare use = won't remember training when needed anyway

911 Scenarios

- **“My defibrillator keeps firing”**
- **Vent-dependent nursing home: “we just need you to change his trach tube, not take him to the hospital”**
- **Mom of 2 year old special needs child with trach tube: “help him” + total panic, no supplies, no spare tube**
- **At scene of 50 yr old man unconscious, LVAD implanted: wife in total panic**

911 Realities

- **Patients and families:**
 - Panic and become totally useless
 - May not have any supplies or help #s
 - Don't stay home where their stuff is
 - Expect paramedics to know what to do
 - Told by their doctors to "just call 911"
- **Medical Control and receiving EDs:**
 - Don't know this stuff either!

Devices already out there:

- **AICDs and Vest Defibrillators**
- **Complex pacers**
- **Ventricular Assist Devices**
- **Tracheostomies**
- **Ventilators**
- **Various pumps, vascular access devices, med infusions**
- **Home dialysis, “wearable” dialysis**

General Concepts on Scene

- **Always treat the patient first:**
 - Assess and stabilize ABCs
 - Continue assessment
 - IV, O2, monitor
 - Start with your standard protocol
 - Remember the underlying disease/drugs
- **Problem with patient? With device?**
- **Ask the patient, family, friend to help:**
 - How is this supposed to look? To hook up?
 - Get us your supplies
 - Calm them down and help them function

On the scene...

- **Don't start changing things if you don't know what you're doing!!!**
- **Look for obvious:**
 - Power source, connection, spare battery
 - Disconnected/kinked tubes and cables
 - 24/7 phone number for immediate help—call the clinical support person and the patient's doctor
 - Instruction manual
- **Keep your wits about you!! Work as a crew.**
- **Talk to Medical Control Physician**
- **Give the ED a "heads-up"**
- **Transport to ED where device was placed, or biggest hospital within range**

AICDs

- **About 100,000 implants/year in US**
- **Reasons for placement (all ages)**
 - Serious underlying heart disease
 - Hard-to-treat lethal arrhythmias
 - Severe cardiomyopathy
- **Components: computer, sensor leads, battery, defib patches (10-30 sec to shock)**
- **Functions:**
 - Defibs VF/VT (1-50 joules, up to 5 shocks)
 - Cardioverts tachycardias
 - Overdrive pacing for tachycardias
 - Pacer for bradycardia

AICDs

- **Types of shocks:**
 - **Appropriate**
 - **Inappropriate**
 - **Phantom**
 - **High concern (repetitive, >3 per 24 hrs)**
- **Device malfunctions**
 - **Inappropriate shocks**
 - **Battery failure**
 - **Lead failure/breakage**
 - **Cell phone, magnet interference?**

AICDs and EMS

- **Safe for rescuers (might feel slight shock)**
- **Give EKG strips to ED, especially problems**
- **Cardiac arrest:**
 - **Standard BLS/ACLS incl. shocks and chest compressions**
 - **Pad placement: A/P (?), away from pulse generator**
- **Avoid magnets, cell phones next to patient.**
- **Inappropriate firing: transmit strip, ask Medical Control whether to “put magnet over device”**
- **Deaths: Deactivate device to protect others**

LifeVest—was he or wasn't he?

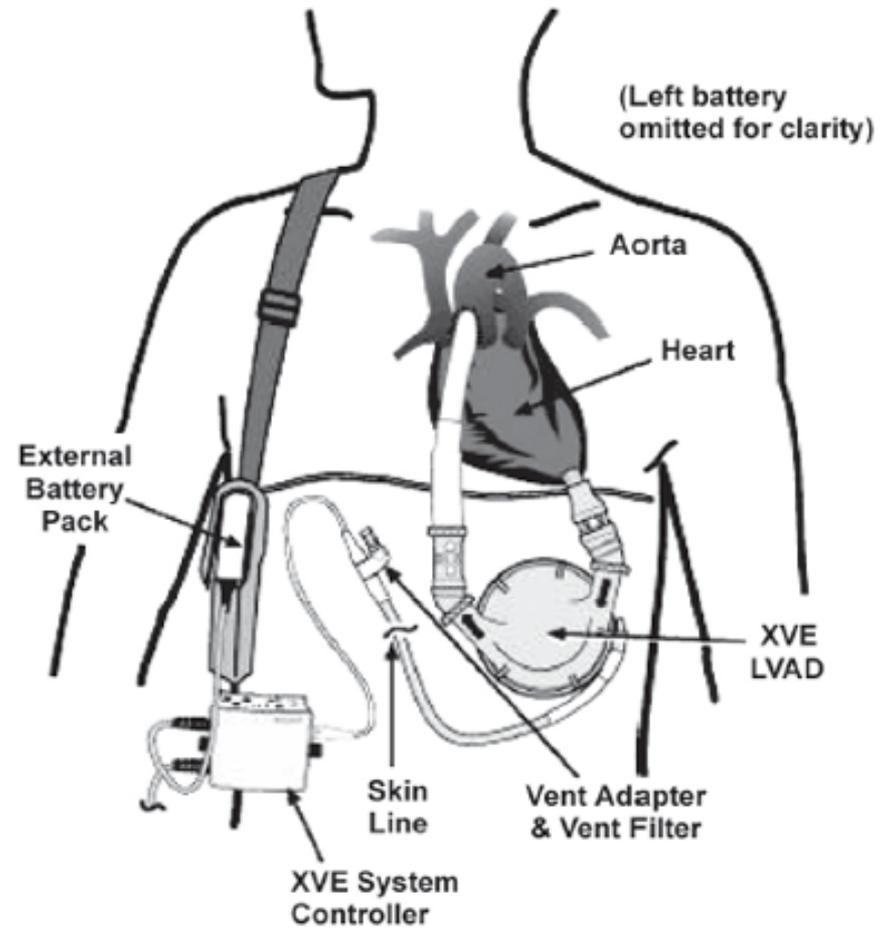
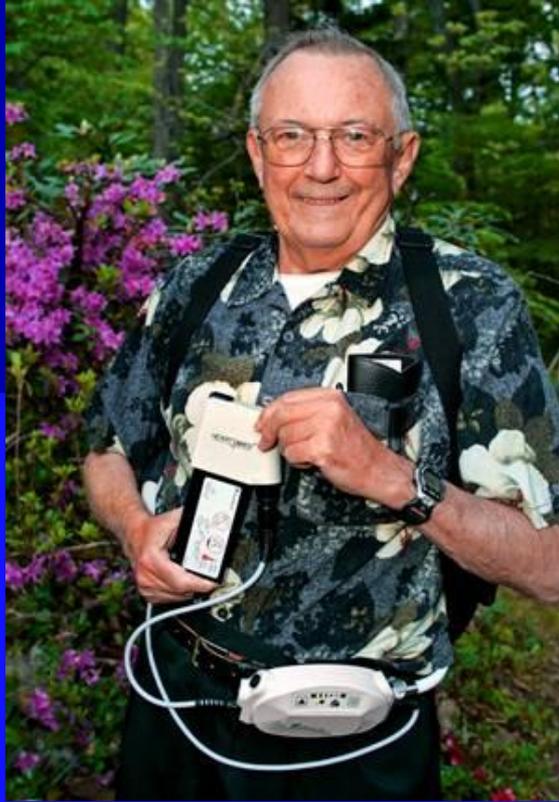


Ventricular Assist Devices

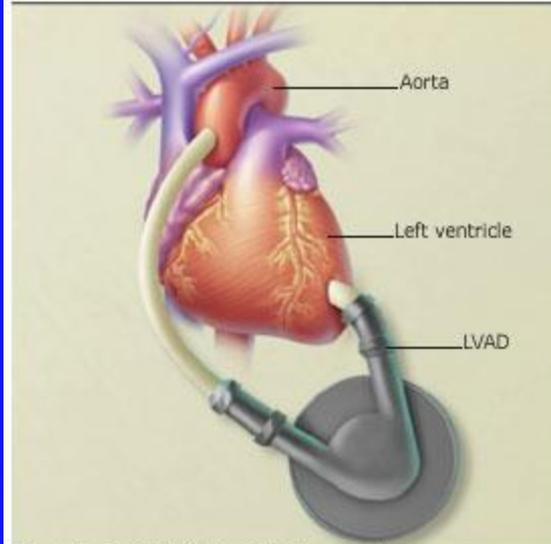
- **Purpose: Support for pump failure**
 - “Bridge to transplant”
 - Temporary support until better
 - Permanent use (“destination therapy”)
 - Better quality of life (home, work, play, travel)
- **Variety of types**
 - Pulsatile vs. continuous flow
 - Components:
 - Electric pump and connections
 - Internal controller (computer)
 - Power supply (internal, external; portable, plug-in)

LVADs, then and now





LVAD



Life with VADs

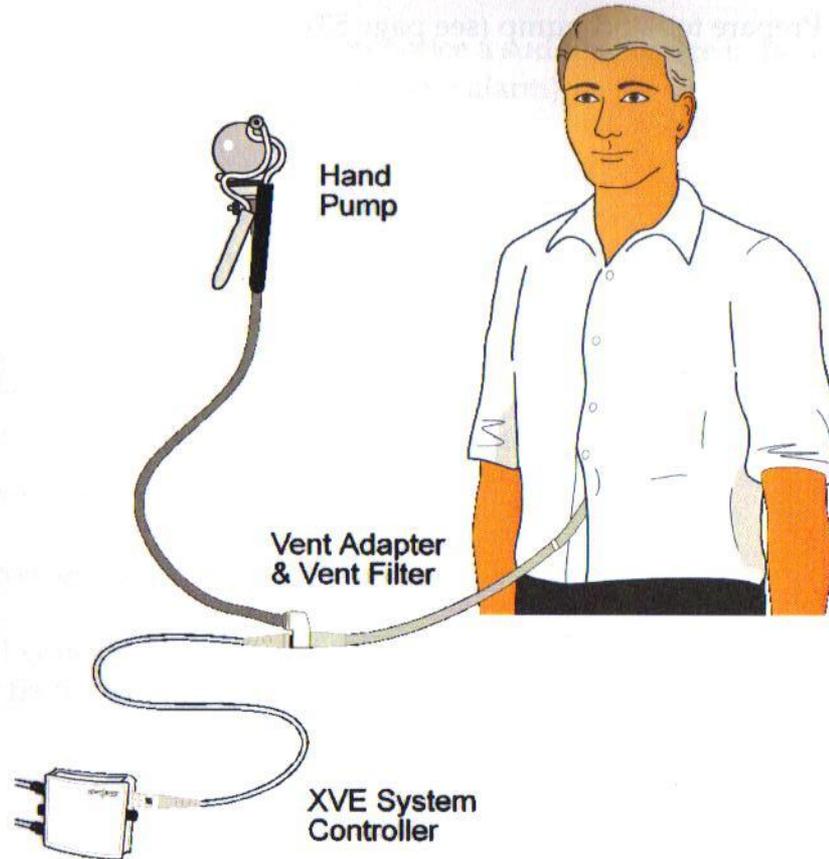
- **Family/friends/patient receive considerable training**
- **Companion is ALWAYS present with patient**
- **Patients may:**
 - live a few hrs from center
 - spend short periods on internal power
 - shower (not swim)
 - be kids
- **Ventricular Assist Team available 24/7**

Trouble-shooting VADs

- Power supply
- Call Ventricular Assist Team immediately
- Hand pumps on some types—try it before chest compressions
- IV fluid bolus is fine
- No defib if patient awake/alert in VF
- Defibs may damage VAD, but do if needed
- Listen to the companion!

Hand Pumping

- Step 1** Obtain hand pump(s) from carrying case. **Note:** One (1) hand pump is needed for each VAD.
- Step 2** Depress metal clip(s) to disconnect pneumatic lead(s) from the TLC-II Driver and then connect the hand pump(s) to the pneumatic lead(s).
- Step 3** Squeeze hand pump(s) once per second. Use your foot if necessary.
- Step 4** For 2 VADs (BiVADs), squeeze each hand pump at the same rate. Never hand pump the right VAD (RVAD) faster than the left VAD (LVAD), as this may cause pulmonary edema.
- Step 5** Switch to the backup Driver as soon as possible (see below).



continued

More on VADs

- Older devices may break with chest compressions (i.e., death)
- Ground/air transport to nearest VAD center
- *Keep the companion with the patient*
- If it's the companion who's the patient, must deal with both

Half Yellow Wrench

Once-per-second beep



Controller inoperable

Controller malfunction
Rate control fault

Current limit advisory

Power cable or battery is disconnected

1. Check all XVE system controller connections.
2. Change vent filter, and check vent port for foreign matter.
3. Replace XVE system controller.
4. Replace the power base unit (PBU) cable.
5. Replace PBU.
6. If the Yellow Wrench persists and the XVE LVAD remains operational, seek additional help.

Yellow Wrench

Once-per-second beep



Flashing Yellow Battery

No audio tone



XVE system controller battery module voltage low

1. Replace XVE system controller battery module.
2. Perform XVE system controller self-test to clear alarm.

Yellow Battery

Once-per-second beep



Low voltage advisory
(Less than 15 minutes of battery power remain)

Change to alternate power source

If the XVE system controller is connected to the percutaneous tube and all power is removed, the XVE system controller will elicit a continuous audio tone signalling the loss of power. This condition is not accompanied by a visual alarm.

Red Heart

Continuous Audio Tone



NO OP or LOW BEAT RATE
(Less than 35 BPM)

LOW STROKE VOLUME*
(Less than 25 ML)

LOW FLOW*
(Less than 1.5 LPM)

1. Check connections between XVE system controller and XVE LVAD percutaneous tube, and between XVE system controller and batteries or power base unit (PBU).
2. Remove vent filter, and check vent port for foreign matter.
3. If condition persists, disconnect power and initiate hand pumping.
4. Seek additional help.

Red Battery

Continuous Audio Tone



LOW VOLTAGE
(Less than 5 minutes of battery power remain)

1. XVE LVAD will automatically go to PowerSaver mode (50 BPM).
2. Immediately replace batteries or connect to power base unit (PBU) cable.
3. If AC or battery power is unavailable, use emergency power pack (EPP).
4. If AC power, battery power and EPP are unavailable, disconnect power and initiate emergency hand pumping.

Flashing Yellow Battery, Red Heart, & Yellow Wrench

Continuous Audio Tone



XVE system controller disconnected from patient

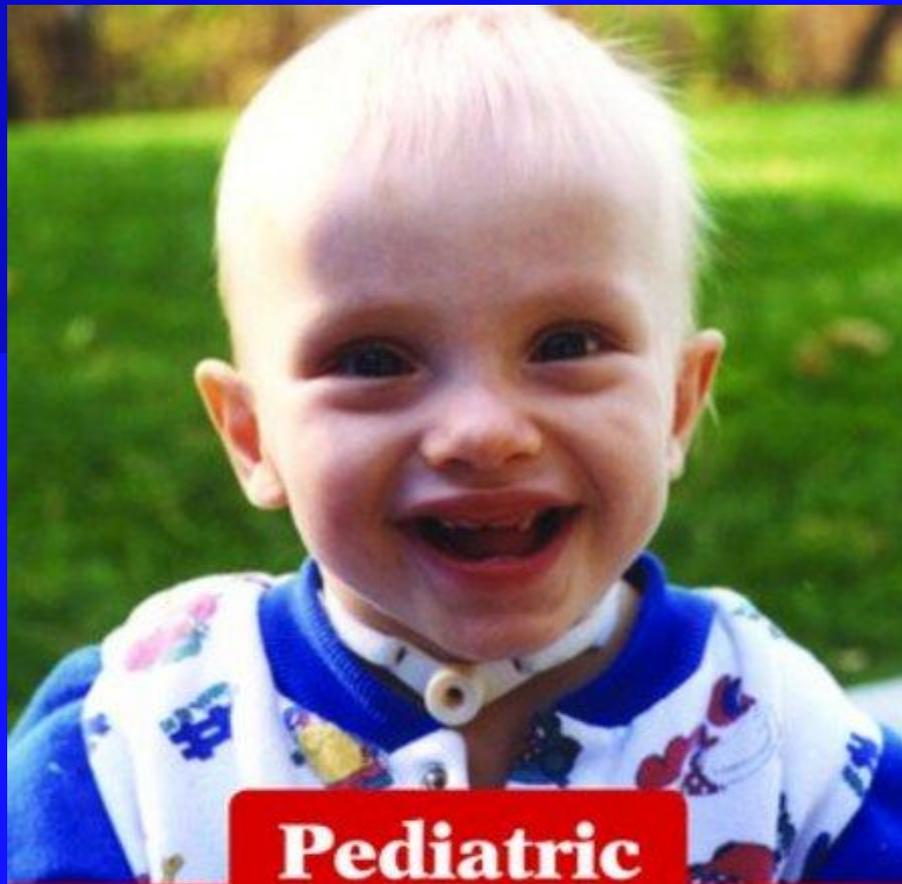
1. Check XVE system controller cable connection to XVE LVAD percutaneous tube.
2. Insure that both batteries are properly inserted into the battery clips; XVE system controller power cables are properly connected to the power base unit (PBU) Cable.
3. Ensure that PBU Cable is connected to back of PBU.
4. If condition persists, disconnect power and initiate hand pumping.
5. Seek additional help.

* **Note:** DO NOT hand pump if there is blood in the vent port. Conditions that affect pump filling, such as hypertension, hypovolemia, or mechanical defects, may limit the restoration of normal pump flows until the conditions are resolved. Hand pumping may be ineffective under these conditions.



Tracheostomies

- **Anatomy?**
 - Oropharynx may or may not connect to trachea
- **Trach tube types**
- **Typical scenarios**
 - Tube plugged
 - Tube came out
 - Bleeding from trach
 - Infection
- **Changing the tube is easy!! (but causes great fear, especially with pedi patients)**



Pediatric
Tracheostomy
Home Care Guide

Cynthia M. Bissell

Home Hemodialysis



Home Dialysis

- **Hemo vs. peritoneal**
- **New “wearable” dialysis unit**
- **Major risks**
 - **Bleeding**
 - **Sepsis**
 - **Electrolyte and acid base imbalances**
 - **Air Embolus via vascular access opened to air**
 - **Volume overload**

What's in your territory?

- **Contact local medical centers and teams**
 - Develop EMS protocols with their input
 - Teach them about the EMS system
- **Awareness of local use—nearest station**
- **Availability of information**
 - 24/7 resource contacts
 - Computer access to device info
- **Training**
- **Incorporate trachs into PALS and Airway hands-on classes**

