State of New Hampshire

Department of Safety

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New Hampshire EMS Information Bulletin 13

DATE: June 8, 2011

SUBJECT: Interfacility Transfers, LVADs, & Head Injury Care

TO: New Hampshire EMS Providers, Medical Directors, EMS Unit Leaders, and EMS Hospital Coordinators

FROM: The NH Bureau of EMS and NH Medical Control Board

At the May 2011 Medical Control Board (MCB) meeting two changes were made to the 2011 NH Patient Care Protocols and a Best Practice Head Injury Instructions were approved. The latest version of the protocols can be found at http://www.nh.gov/safety/divisions/fstems/ems/advlifesup/patientcare.html. Unless a major error or omission is found, there will be no further modifications to the 2011 protocols.

1. Special Resuscitation Situations and Exception - Protocol 6.11: Additional language added to address Left Ventricular Assist Devices:
LVAD patients are generally managed like everyone else with a few exceptions. Most patients can be electrically cardioverted if need be and should be treated with all of the usual ACLS algorithms for loss of consciousness, arrhythmia and hypotension management excluding CPR. CPR carries with it the risk of disrupting the connections between the VAD cannulae and the aorta or left ventricle which would be fatal. CPR should only be performed if the VAD is not functioning (no audible or auscultatable hum) and there is no immediate means of restarting the device. In this scenario, the potential benefit of CPR would seem to outweigh the risks. If there is any doubt about whether the VAD is functioning, the patient should be transported as rapidly as possible to the implanting facility for evaluation. Patients should almost never be pronounced dead at the scene, particularly if there is any doubt about whether the device is functioning or not.
The management of a given patient will depend, in part, on the type of device. Patients and families themselves are often a good resource for information. They should also have emergency contact numbers for on-call medical staff. Most devices will have a percutaneous driveline that exits through the upper or mid abdomen that then connects to a small computer known as a "system controller." This is powered by batteries or a power based unit that connects to electrical outlets. The pump itself does not affect the ECG; realize, however that patients with LVADs can often remain conscious during very fast VT or even ventricular fibrillation. Unlike earlier generation pulsatile devices, the newer axial flow

pumps do not have the capability for "hand pumping." When transporting these patients to the emergency department, the patient's equipment should be transported with them.
(For more information see the attached article, “Pumping Life Into Failing Hearts” following this bulletin.)

2. Interfacility Transfer - Protocol 7.0: Additional language was added to the Critical Care Transfer level to address situations where CCT level service is not available and the risk of delayed transfer would have a negative impact on patient outcome.
The MCB recognizes there could be circumstances where, in the best interest of the patient, it would be of less risk to transport the patient with a PIFT crew than to wait for a CCT crew. In these situations, the sending facility should exhaust all possible means to acquire additional hospital staff to accompany the EMS crew and ensure all orders are within the paramedic’s scope of practice. Additionally, it will be required by BOTH the EMS Unit and the sending physician or hospital to report to the NH Bureau of EMS and the Unit’s EMS Medical Director to file documentation of this breach in protocol within 48 hours.

3. Head Injury Care – A Best Practice: The MCB approved a head injury care form to be piloted as a best practice for EMS providers. The form is intended to be used for those patients who have possibly sustained head trauma and are refusing transport. In essence, the form instructs patients and their families to look for signs and symptoms of head injury, and, if present, that the patient should see a physician for evaluation. The form was made using evidence based practices consistent with CDC’s recommendations. This form is attached at the end of this bulletin and will be available for download at http://www.nh.gov/safety/divisions/fstems/ems/index.html, under “Best Practices.”

Minutes from the Medical Control Board meetings can be found at:
http://www.nh.gov/safety/divisions/fstems/ems/boards/medicalcontrol/mbminutes.html

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Head Injury Care

You may have had a head injury today. You declined evaluation at the hospital for your injuries. If you change your mind, or, if you develop any of the symptoms below, please call 911 or go to the closest emergency room.

You must be watched closely by another person for 24 hours.

If you show any of these symptoms or signs after your head injury, you or the person watching you should call 911 or go to the Emergency Room:

- Fainting or abnormal sleepiness
- Confusion
- Change in behavior (acting strange, saying things that do not make sense)
- A worsening headache
- Any vomiting/throwing up
- Change in vision
- Difficulty walking
- Problems with memory
- Weakness of any parts of your body
- Seizure (any jerking of the body or limbs)

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Pumping Life Into Failing Hearts

What EMS providers should know about ventricular assist devices

Posted: March 22nd, 2011 05:48 PM CDT

Medic 14 is dispatched to a call to a residence for difficulty breathing. On arrival crew members find a 52-year-old male sitting in bed and working a hand pump. He says his left ventricular assist device (VAD) alarm went off, and his device does not appear to be working. He says he has a diseased heart and is on the list for a transplant. He also says the only thing keeping him alive at this point is his hand pump, which circulates his blood. He denies any chest pain or difficulty breathing at this time, but needs a new battery for his device. The patient is transported to the hospital where he received his device for evaluation and placement of a new battery.

Just recently, VADs were in the news when former Vice President Dick Cheney was released from a suburban Washington hospital following surgery to install what media described as a "pump that helps his failing heart work." Cheney, 70, has had five heart attacks since he was 37 and suffers from congestive heart failure. He disclosed in a statement last July that he had undergone surgery the previous week after what he called "entering a new phase of the disease when I began to experience increasing congestive heart failure." Cheney said the pump, a left ventricular assist device, would allow him to resume an active life.

The left ventricle is the large, muscular chamber of the heart that pumps blood out to the body. A ventricular assist device (VAD) is a battery-operated mechanical pump-type device that's surgically implanted. It helps maintain the pumping ability of a heart that can't effectively work on its own. This device is sometimes called a "bridge to transplant."

People awaiting heart transplants often must wait a long time before suitable hearts become available. During this wait, patients' already-weakened hearts may deteriorate and become unable to pump enough blood to sustain life. A VAD can help a weak heart and buy time for a patient.

A common type of VAD has a tube that pulls blood from the left ventricle into a pump. The pump then sends blood into the aorta (the large blood vessel leaving the left ventricle). This effectively helps the weakened ventricle. The pump is placed in the upper part of the abdomen. Another tube attached to the pump is brought out of the abdominal wall to the outside of the body and attached to the pump's battery and control system. VADs are now portable and are often used for weeks to months to years. Patients with VADs can be discharged from hospitals and have an acceptable quality of life while waiting for donor hearts to become available.

VADS are used in three clinical situations:

- As a "bridge to transplant" in people with severe chronic heart failure. That is, they can help ease the work of the heart in people waiting for transplantation.
- In some patients with heart failure, insertion of a VAD can allow a damaged left ventricle to "rest" and repair itself. Examples in which the underlying cardiac problem can often improve include heart failure after cardiac surgical procedures, major acute heart attacks and acute myocarditis.
- VADs can be used as "destination therapy" in people with severe end-stage heart failure who are not candidates for transplantation (because of other factors such as age, kidney disease or lung disease), and who have an extremely poor prognosis without mechanical support. In these patients, the VAD is the treatment; there is little reasonable expectation that it can ever be removed.

In a study published in *Circulation* in 2005, VADs restored failing hearts in some patients with heart failure, eliminating the need for transplant. According to an abstract presented at the American Heart Association's 2005 Scientific Sessions, VADs reduced the risk of death in end-stage heart failure patients by 50% at six and 12 months and extended the average lifespan from 3.1 months to more than 10. These devices are becoming more ubiquitous, and EMS systems will be encountering them on a more frequent basis.

Types of VADs

There are several different types of VADs. Some of the older versions approved for all uses by the FDA are about the size of a CD-ROM or DVD and implanted in the abdomen. There are newer VADs that are much smaller--the size of a C battery--and can be implanted in the chest. They aren't yet approved for all uses, but can be used in many patients in investigational protocols. These devices are very effective at essentially replacing the work of the weakened left ventricle and substituting for the heart muscle itself.

Commonly used VADs include the Thoratec PVAD and IVAD, the HeartMate II (also from Thoratec), and Abiomed's BVS 5000 and AB5000. More information on these companies and their products can be obtained at www.thoratec.com and

www.abiomed.com.

Thoratec PVAD and IVAD--The Thoratec PVAD and IVAD provide support to the left side of the heart (LVAD), the right side of the heart (RVAD) or both sides (BiVAD). The company says its PVAD has been proven in more than 240 centers and 4,000 patients worldwide. A person on such a device can live a relatively normal life outside the hospital until transplantation is completed.

Abiomed BVS 5000--The Abiomed BVS 5000 is used for temporary left, right or biventricular support in patients with potentially reversible heart failure. This air-driven pump is outside the body and powered by electricity. It may be used as a bridge to another device or to heart transplantation.

As stated on the Abiomed website, "The BVS 5000 was the first extracorporeal, or outside the body, ventricular assist device on the market and is still the most widely used bridge-to-recovery device, with systems located in more than 700 institutions throughout the world. The BVS 5000 has supported thousands of patients ranging from 8 to 84 years old in over 500 medical centers. It was the first FDA-approved device for the support of all patients with reversible heart failure."

Abiomed AB5000--Abiomed's AB5000 is used for recovery and/or as a bridge to heart transplant. This device is used for left, right or biventricular support in patients with heart failure. This air-driven pump is outside the body and powered by electricity. Abiomed says, "The AB5000 console is designed to allow patients to leave their hospital rooms and walk within the hospital and on hospital grounds. Multiple studies have shown that patient ambulation, or walking, greatly assists the recovery process."

Thoratec HeartMate II--The HeartMate II is Thoratec's non-pulsatile axial flow left ventricular assist device. This device is small and durable. It provides a constant flow of blood from the heart to the body. This device has been designed to dramatically improve survival and the patient's quality of life. The patient, once stable, can be discharged from the hospital and live a relatively normal life. This device runs off batteries and AC power. The HeartMate II is currently FDA approved as a bridge-to-recovery therapy and was approved in January 2010 for destination therapy use in non-transplant candidates.

When the unit is tethered, the power supply is provided by a device called a power base unit that is plugged into an electrical outlet. When the unit is untethered, rechargeable batteries are used when the patient wants to be mobile. The batteries are changed as needed. The power base unit or an alternative source is used to recharge the batteries. The controller and batteries can be worn in a belted waist pack or alternative carrying device. *Figure 1* shows a diagram of the HeartMate II and its components.

VADs are designed to function reliably for long periods of time. Before leaving the hospital, the patient and their family are trained in the proper function and management

of the device. A staff member (likely the VAD coordinator) will thoroughly discuss device operation and accessories. The device will also be checked at follow-up visits. In the event of a problem, the device will alert the patient so immediate action can be taken.

Prehospital Assessment

When you are evaluating a patient with a VAD in the prehospital setting, there are some important concepts to remember:

- Peripheral pulses may not be palpable.
- Assess the patient for signs of good circulation to determine if perfusion is adequate.
- Standard measures to obtain blood pressure and pulse oximetry may produce unreliable and inaccurate readings.
- Pump flow is dependent on preload and afterload.
- Some VADs do not have valves, so retrograde flow back into the left ventricle can occur if the pump stops.
- Patients are at risk of bleeding due to anticoagulation and antiplatelet therapy.

Safety Concerns

Although the safety associated with VADs has improved dramatically over the years, there are still many problems with them. These include:

- VADs require meticulous daily maintenance and careful monitoring to make sure they are always attached to a good power source.
- Significant bleeding problems occur in a substantial minority of patients.
- Infections still occur in up to 25% of patients with VADs.
- The risk of stroke (from blood clots) is between 10% and 15% a year.
- Batteries can go dead and patients may need to use their hand pump to maintain a blood pressure.
- Malnutrition.
- Hemodynamic instability.

Prehospital Treatment

Here are some basic guidelines to caring for VAD patients who call EMS for assistance:

- If you are called for a patient who has a VAD, you should always assess and treat for other, non-VAD-related injuries and complications. Perform airway and breathing assessments and interventions according to your EMS or ACLS protocols.
- Keep in mind that all VADs are dependent on adequate preload in order to maintain proper function, so volume resuscitation in an unstable VAD patient may be your

initial therapy. Start an IV and be prepared to give fluids on all VAD patients.

- It is also important that you not administer nitrates unless instructed by the patient's physician or implanting center's VAD coordinator. VAD patients may be in lethal arrhythmia but remain stable. Treating arrhythmia is still important, though, because ultimately the VAD is a preload-dependent device. If the native heart is not able to deliver adequate blood flow to the VAD, the patient's circulation will suffer. Cardioversion and defibrillation are permitted and acceptable in LVAD patients.
- Do not initiate CPR unless instructed by a physician or the implanting center's VAD coordinator. Internal hardware may become displaced and cause internal bleeding and possibly death.
- Locate the number for the implanting center's VAD coordinator and listen to family and friends. They are most likely the experts on how the VAD works and have been trained on how to manage it. Look in the patient's equipment bag for manuals and quick guides.
- Try to transport to the implanting center when able. Not all hospitals are equipped to manage these complex patients, and they may just have to transfer them.

The HeartMate II LVAD is one of the more common VADs currently utilized. With this particular model, if the patient is unstable, perfusion is inadequate or the LVAD has stopped, quickly perform the following steps:

- Check that the percutaneous lead is connected to the system controller. If it becomes disconnected, the pump will stop and could result in serious injury or even death.
- Check that both system controller power leads are connected to power. Never remove both batteries at the same time, or the pump will stop. This could result in serious injury or death.
- Check the battery fuel gauge. If the LVAD stops operating, retrograde flow may occur, and if blood is stagnant in the pump for more than a few minutes, there is a risk of stroke or thromboembolism should the device be restarted.
- Check the system controller for active alarms.
- Connect the EKG monitor to the patient. In the event of cardiac arrest, external chest compressions pose a risk due to the location of the LVAD outflow graft on the aorta and inflow cannulation of the left ventricle. Disruption of an anastomosis site could lead to fatal hemorrhage. Use clinical judgment when deciding whether to perform external compressions; calling the VAD center may provide guidance.
- Avoid cutting the percutaneous lead or power leads, and keep them close to the patient.
- Keep the system controller connections dry at all times.
- Use the 'Silence Alarm' button to silence alarms. Do not unplug the controller or power cables to do it.
- Remember that the patient may not have a palpable pulse. Assess for signs of adequate perfusion other than checking for a pulse, such as capillary refill, skin color, etc.

You should allow the patient's caregiver to remain with the patient and transport all VAD equipment with them. Remember that all equipment and cords attached to the patient should be secured and tangle-free for transport to prevent damage.

VAD patients may call 9-1-1 because they experience a decrease in energy or feel weakness. However, it is important to note that someone with a VAD may go into ventricular fibrillation and still be conscious and speaking to you because the pump is working to propel blood to the brain. Treating cardiac arrhythmias like VF and VT using cardioversion or defibrillation is necessary and important, although not always as urgent. Patients' symptoms may be atypical, like dizziness and nausea versus loss of consciousness. Defibrillation is safe. It is not recommended to do with the patient plugged in to the AC outlet. Devices should be operating on battery power if use of a defibrillator is necessary. Calling the phone number on the device and speaking to personnel at the hospital where the patient received it is always the best way to get specific guidance on treating these patients in the field.

Conclusion

The ventricular assist device is increasingly utilized as a "bridging" strategy for people who have weakened hearts and need a transplant. Instead of being caught by surprise when running on one these patients, it is best for EMS personnel to familiarize themselves with VAD devices and the complications associated with them.

Preplan Your Response

Being prepared is always the best way to be ready for any emergency call. If you become aware that there is a patient in your district who has one of these devices implanted, it would be advisable to do the following:

- Pay a visit to the patient's home. Introduce yourselves as EMS providers for the local agency and make sure the patient and their family/friends know how far away you are when they call 9-1-1.
- During your visit, talk to the patient and their family/friends and familiarize yourself with their device and equipment.
- Communicate with the other EMS personnel who may run on that patient and let them know what you learned in your visit.
- Have a plan of action and/or a protocol in place so your approach to these patients becomes standardized and familiar.

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