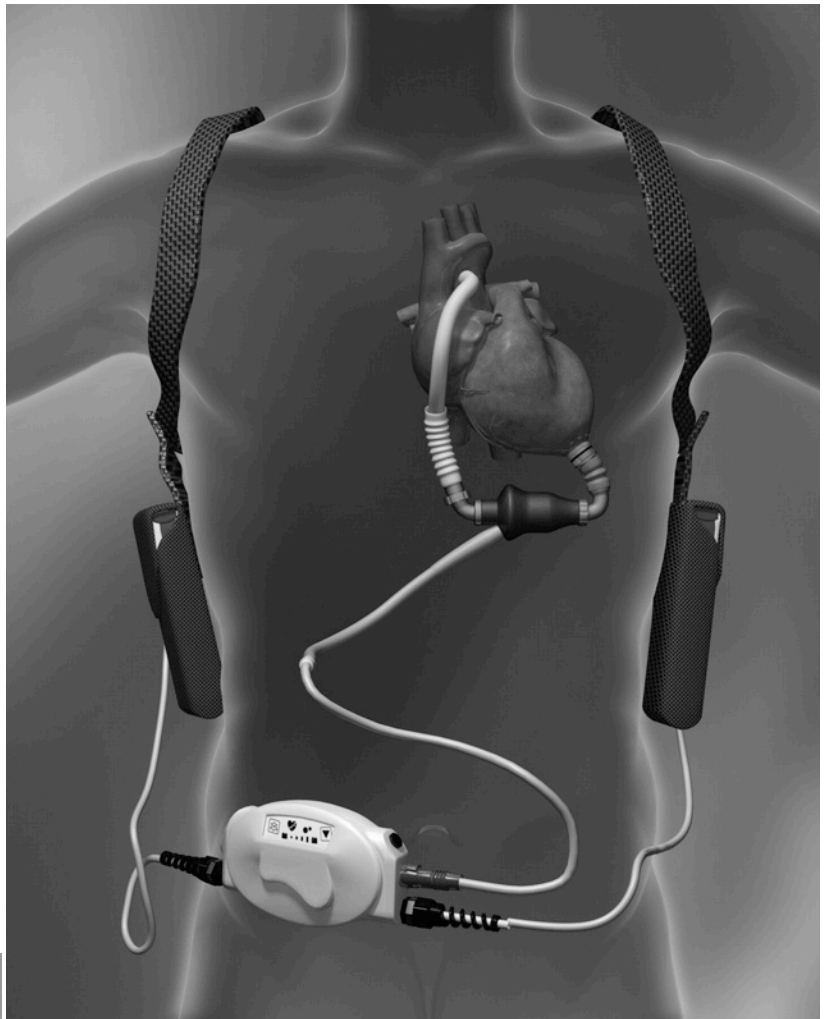
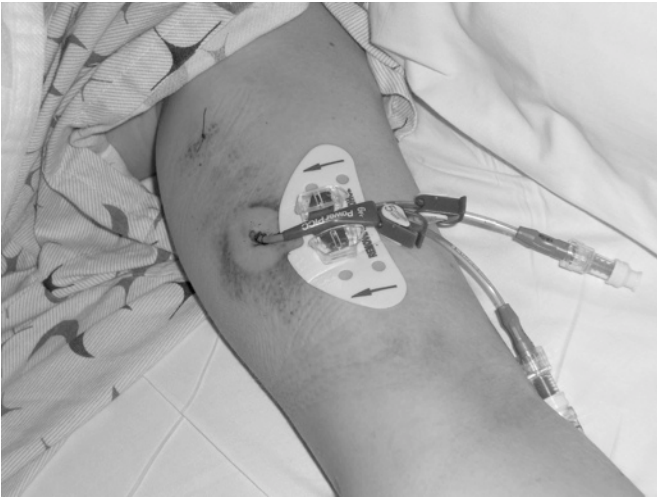


Reading

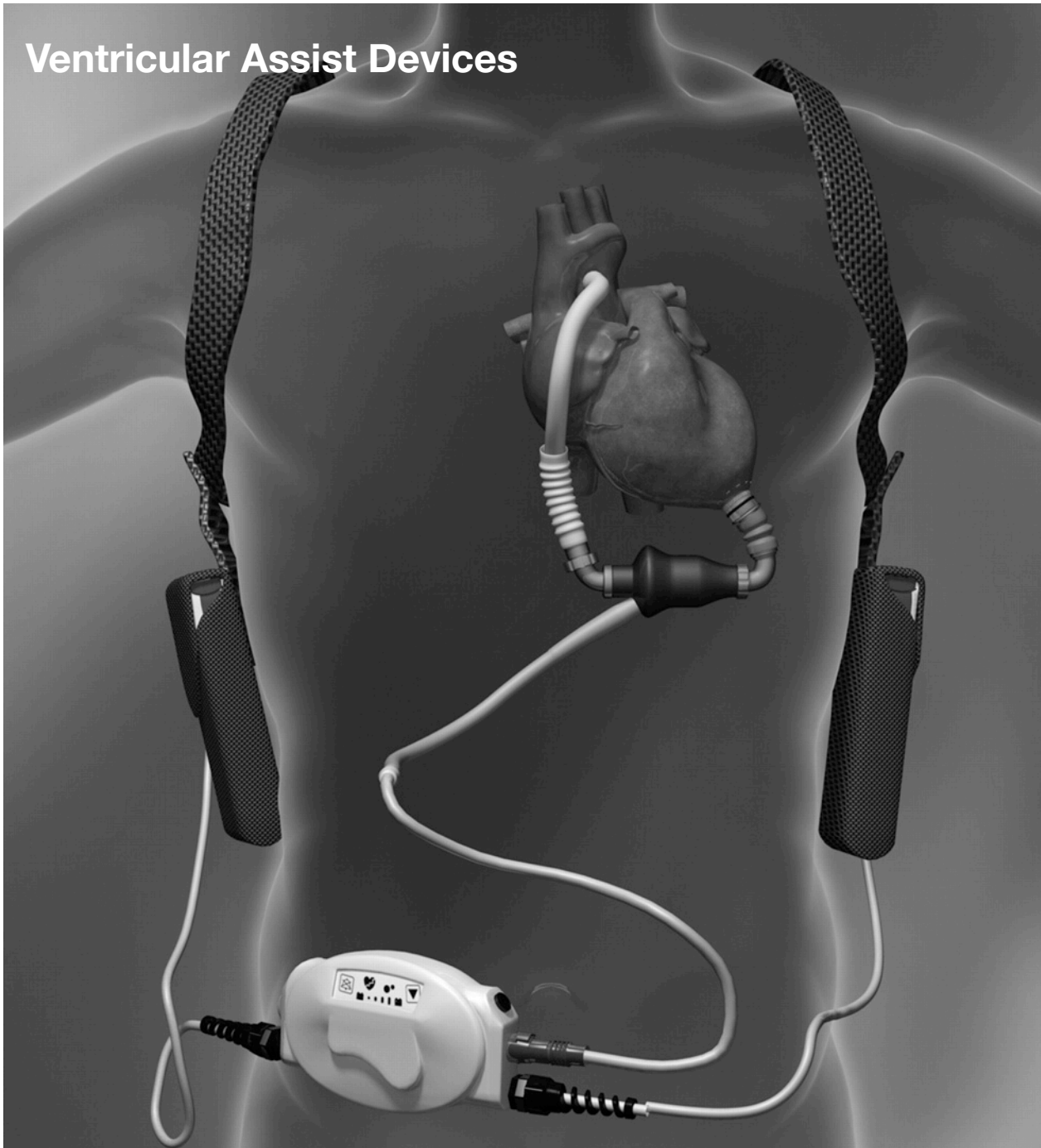
CEPCP

Professional Development: **Medical Devices**



Ventricular Assist Devices
Central Venous Access Devices
Tracheostomy Devices
Home Dialysis
Medication Pumps

Ventricular Assist Devices

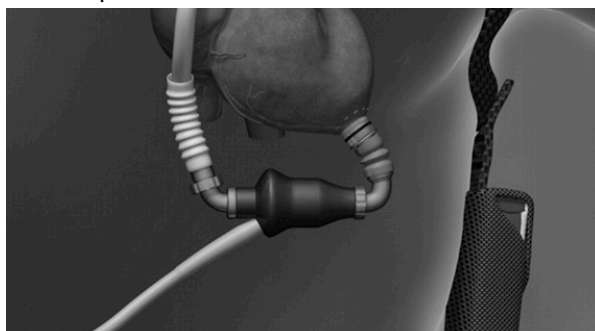


The last few years have seen a proliferation of Ventricular Assist Devices (VAD), sometimes referred to as Left Ventricular Assist Devices (LVAD). These devices most often consist of a pump that is connected between the left ventricle and the aorta. The pump assists the left ventricle in pumping blood to the systemic circulation. Traditionally these devices were only used in-hospital or very briefly as a 'bridging' device to

extend the amount of time a patient would have before requiring a heart transplant. However, as technology has advanced, these devices are now small and reliable enough that some patients are being released from hospital with a permanent VAD in place. Usually patients with a VAD have a severely weakened myocardium and will have significant hemodynamic compromise or even die should their VAD malfunction.

Unfortunately the sheer number of different devices that are being marketed along with the vast improvements to the various devices already on the market, make it impossible to learn the specifics of every possible device a paramedic may encounter. Luckily the patient and at least one of their caregivers get thorough training in the device and even have to pass a written test before being sent home with their device. There is also a contact person at the hospital that the patient can contact in an emergency. The key then for a Paramedic who encounters a patient with a VAD is to ask the patient or a caregiver about the special precautions they need to take with the device. If neither is available or reliable, try to get a hold of their contact person at the hospital for advice. The patient will usually have a travel kit in which they carry spare batteries and a spare controller whenever they are outside of the home, the contact information can usually be found in that kit. The patient may also have a wallet card, a bracelet or a necklace with a contact number.

Although there are many different versions of VADs there are some fundamentals that can be very helpful when dealing with a patient who has one of these devices implanted. First let's go over the components;



The pump itself is surgically implanted, usually below the diaphragm in the left upper abdominal quadrant but can be placed inside the pericardium as well. The pump is controlled and given its power through a cable that usually protrudes through the abdominal wall (although one model connects behind the patient's ear). There is also a model that is able to supply the power wirelessly through the patient's skin. Since infections through the cable

that protrudes through the skin is a common complication the wireless option through the intact skin will probably be further developed and become more common in the future.



The pump connects to a controller which is an electronic module with a few buttons, a battery indicator and various alarms. The power supply is also connected to the controller, in the form of battery packs (usually two) or a base-unit that is plugged into the wall.

Some important points to consider; if the controller becomes disconnected from the pump, the pump stops. If the power supply becomes disconnected or if the battery runs out, the pump stops. Try to ensure that the VAD has adequate battery strength and that the connections between the battery packs (or base-unit) are intact. If the patient is being transported to the hospital ensure that spare batteries are brought along. Also consider bringing the base-unit along as hospitals are unlikely to have the correct power supply available to keep batteries charged or the patient plugged in. Consult with the hospital contact person if at all possible. In the event of a power failure in the patient's home there is usually a back-up power supply that can power the VAD for several hours. However, in the event of a prolonged power failure the patient may have to be taken to the hospital to ensure continuous power is supplied to the VAD.

The components within the controller as well as the pump are designed and manufactured to an extremely high standard so failures are rare. Usually problems occur in the connections between the components, if at all. The controller has various alarms to alert the patient to problems.

There is usually a written guide to interpreting those alarms available in the travel kit as well.

The pump may either be designed to run continuously or enhance the heart's pumping action in a pulsatile fashion. The continuously running pump will not produce a palpable pulse which can be confusing to emergency responders. Blood pressures and SpO2 monitoring will be unreliable or impossible with either type of pump. The Paramedic must rely on clinical signs of perfusion to guide interventions. Auscultation over the left upper abdominal quadrant should reveal the whirring sound of the pump.

ECG monitoring can be performed as usual. However, it is best to avoid cardioversion and pacing until after consulting with the contact person and/or BHP. Defibrillation can be performed as usual (avoid placing the pad directly over the left upper quadrant of the abdomen). However, CPR is likely to cause serious damage to the pump and its connections which may be catastrophic. Having said that, it may be required in the case of a complete pump failure.

Keep in mind that the pump may be operating without producing a palpable pulse which could be confusing if the patient is unresponsive. Look for other clues of perfusion such as skin colour and auscultate the left upper abdominal quadrant for the sound of the pump. Try to consult with the contact person prior to starting CPR if at all possible.

Any trauma to the chest or abdomen has the potential to cause damage to the pump or its connections. Always transport patients with a VAD implanted for further assessment if they have been involved in a mechanism involving potential chest trauma such as having been an occupant in a vehicle where air bags have deployed.

Any patient with a VAD should be transported to the cardiac center that is following the patient's care. In some cases CEPCP has been notified that a patient in our catchment area have a VAD and a letter has then been provided to the patient authorizing the Paramedic's to transport to the appropriate cardiac center. If the patient does not have such a letter available, then a BHP patch is appropriate to request by-passing closer hospitals.

VAD Prehospital Considerations

- ensure connections are intact
- ensure adequate power is available for the transport phase and that power will be available at the hospital
- auscultate for pump operation
- BP and SpO2 is unreliable
- there may not be a palpable pulse
- ECG monitoring is done as per normal
- cardioversion or pacing should only be done after consulting with the contact person or BHP
- defibrillate as per usual
- avoid CPR if pump is running
- Transport the patient to the cardiac center that follows the patient's care

Central Venous Access Devices



Many patient's who require repeated administration of intravenous medications will have a central venous access device (CVAD) inserted to avoid suffering through repeated skin punctures every time medication administration is necessary. Common examples are those who require IV antibiotics or chemotherapy drugs.

Some devices are tunneled under the skin with one end in the vena-cava and the other protruding through the chest wall with one or several medication ports attached to the end. Others are inserted in the antecubital vein and threaded into the vena-cava, these are called 'Peripherally Inserted Central Catheters' (PICC). Others are inserted in the AC but are not threaded all the way into the vena-cava and are thus not truly 'central' venous access. Luckily knowing exactly what type of catheter the patient has is not critical to us as Paramedics in an emergency. The most important points to keep firmly in mind when faced with accessing any of these devices are that they are portals for serious infections and they can cause air or blood emboli. Do not use a CVAD unless absolutely necessary! As the medical directive spells out '*..Cardiac arrest or pre-arrest. No apparent accessible peripheral veins..*'.

It may seem daunting and intimidating to finally decide to use a CVAD knowing there are several, potentially serious complications. There are also several sequential steps involved in

minimizing the risk of those complications.

However, we will break down the steps along with the rationale for each below. Hopefully, if it makes sense, it will be easier to recall when needed.

CVAD Prehospital Access (ACP Only)

Prepare equipment

- two 10 cc syringes, one empty and one with 10 cc saline drawn up
- several alcohol swabs
- a primed AIR FREE IV set
- clean, preferably sterile, gloves

Close clamps

If the catheters have clamps on them it is imperative that they remain closed while connecting or disconnecting anything from the catheter.

A catheter open to the air could allow air to enter the venous system or cause severe bleeding.

If there are no clamps on the lines they have valves in the inserted tip that will prevent back-flow of blood, or air from entering the venous system.



Wipe med-port and luer lock with alcohol swab.

Wiping the 'business end' of the catheter will ensure that it is free from contaminants prior to opening it.

Remove med-port from luer lock

Wipe the exposed end with a clean alcohol swab. Allow the area to air dry, never blow on the wiped area to speed up drying as this can cause contamination.



Attach the empty syringe,

Open the clamp (if present)

Withdraw whatever fluid is within the catheter until approximately 2cc of blood is in the syringe

This step may not be required for emergency use. The reason for it is to remove any heparin that may have been infused into the line to prevent it from clotting. However, many lines do not use this method of preventing clotting, the ones that do usually only contain a small amount of heparin that would not be harmful if injected.

Continued...

CVAD Prehospital Access (cont'd...)

Close clamp

Attach the syringe with saline

Open the clamp, and slowly inject the saline using a push/pull technique. If resistance is met discontinue attempt

The push/pull technique simply means to intermittently stop the injection and pull back the plunger a bit to create a turbulent flow within the IV line.

Close clamp

Attach the IV line

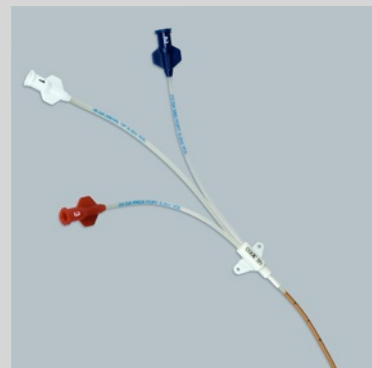
Open clamp

Run the IV as per normal, administering IV drugs through the medication ports on the IV set

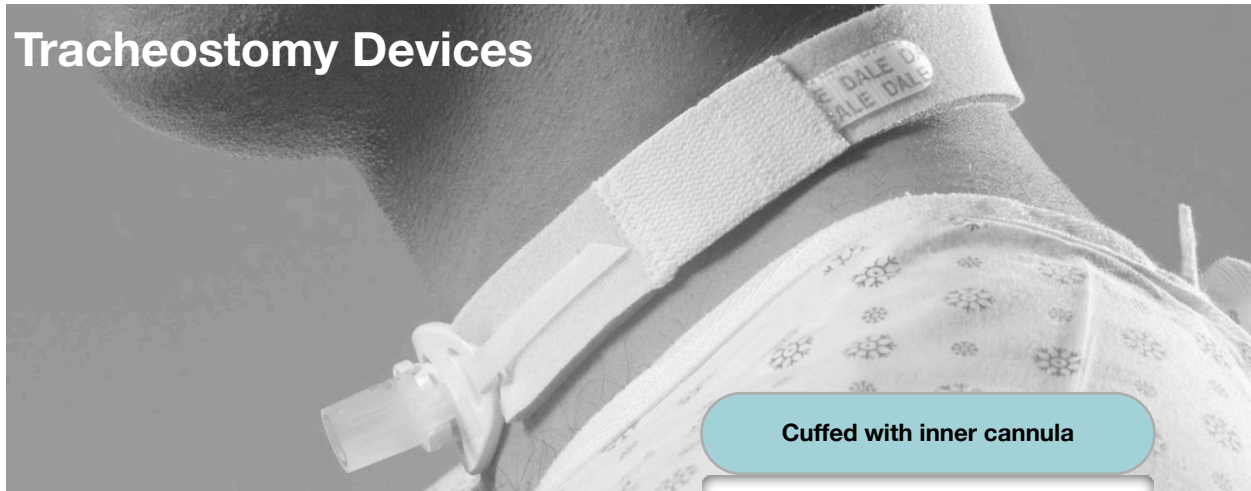
As long as the line flush was successful without any resistance, a pressure infuser can safely be used on a CVAD. In fact some CVADs have valves in the tip that lies within the vein. The valves prevent blood from entering the device. These valves require a little bit of pressure to open and a gravity fed IV line might not be enough to ensure a continuous flow.

RED OR BLUE?

Most CVAD's have more than one end with different colours. So the million dollar question is; which one should we use? The safest answer is to stay away from the red one. On most devices it doesn't matter as all the ends lead to the same vein but in rare instances (such as a hemodialysis cannula) the red end leads to an artery and the other (usually blue) to the vein. Clearly we would not want to connect IV tubing to the artery so stay clear of the red one.



Tracheostomy Devices



Cuffed with inner cannula



Un-cuffed with inner cannula



Fenestrated with inner cannula



Types of Devices

There are a variety of different tracheostomy devices on the market, too many to list and describe in this document. However, there are a few main types that the paramedic should be familiar with.

- Cuffed vs uncuffed (uncuffed more common on non-ventilated patient's)
- Inner cannula vs no inner cannula (inner cannula more common)
- Fenestrated (will allow the patient to speak and swallow more normally)

Typically EMS will be called when a tracheostomy has lost its patency for some reason. It is up to us to troubleshoot the device and restore patency ASAP - the patient's life will depend on it.

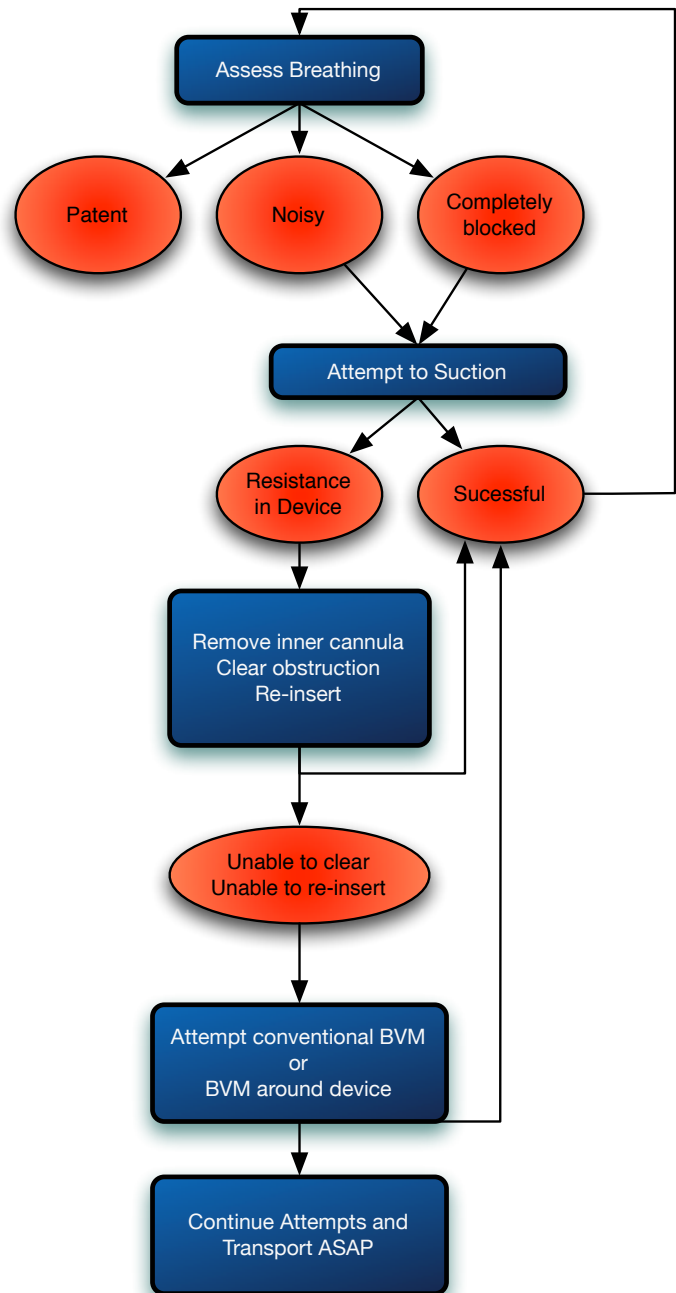
The most common problem with tracheostomies is mucous plugging. Because air bypasses the warming and humidifying effects of the upper airways the air that reaches the lungs is drier, cooler and thus cause increased mucous production. Usually the patient and their caregivers are well versed at maintaining the tracheostomy so don't hesitate to consult them about the ins and outs of their particular device.

Blocked Device

When attending to a patient with a potentially blocked tracheostomy the first step is to assess the degree of obstruction by doing the classic 'look, listen, feel' technique. If there is some air movement with gurgling or other upper airway sounds coming from the device, or if the blockage appears to be complete, then attempting to suction is the best option. Use the largest french catheter that will fit through the device (normally this will be the largest one carried). Set the suction pressure to 120 mmHg and if available prepare a container with saline or sterile water to flush the suction catheter between attempts. Advance the catheter until resistance is met (carina), occlude the suction port to begin suctioning and slowly withdraw the catheter. If resistance is met **within** the device (i.e. before the point where you would expect to reach the carina) then abort the attempt and remove the inner cannula from the tracheostomy device. In a spontaneously breathing patient, removing the obstructed inner cannula might be enough to restore adequate respirations. However, if assisted ventilations are required a BVM cannot be attached directly to the device without the inner cannula attached so either try to clear out the cannula and re-insert it or try to establish a mask seal around the device using a pediatric mask attached to an adult BVM. Alternatively conventional BVM ventilations may be attempted while manually occluding the device.

If no resistance is met and suctioning is successful then limit suction attempts to 10-15 seconds to avoid worsening hypoxemia.

Managing a Patient with a Blocked Tracheostomy



Displaced Device

In the event that a tracheostomy device has become partially displaced, the best action is to simply try to re-insert it. The vast majority of out-of-hospital devices are un-cuffed so re-inserting it should be fairly easy. If re-insertion is not possible then remove the device.

If removing the device restores adequate breathing then simply monitor the patient en-route to hospital. If assisted ventilations are required then conventional BVM ventilations can be attempted. If required, conventional orotracheal intubation can also be attempted (ACP only). If conventional orotracheal intubation is unsuccessful a 6mm ETT can be inserted into the stoma (surgical opening) and used to ventilate the patient.

As indicated above there are many options when dealing with a displaced tracheostomy. Rely on your knowledge of airway anatomy and common sense to direct your decision making. In situations of a compromised airway the solution that restores patency in the least invasive way, is the correct one.

Home Dialysis



There have been a number of paramedics recently asking about information regarding dialysis and dialysis patients. There are more dialysis patients receiving treatment at home and there are more issues about the possibility of encountering dialysis patients in our daily duties. This is a brief review of some aspects of the dialysis patient to inform you about patient treatment options and problems that may arise from the treatments.

The Kidneys

The kidneys are located retroperitoneally at the level of the 12th thoracic vertebrae to the 3rd lumbar vertebrae. They process 1700L of blood every day and produce 1500 ml of urine daily. The kidneys serve many functions related to homeostasis, including maintaining fluid, electrolyte and acid base balance. The kidneys are also involved in the secretion of hormones such as aldosterone and ADH, and synthesis of erythropoietin and prostaglandins.

The three main processes the kidneys provide in relation to urine production are;

filtration, re-absorption, and secretion. The blood flows from the aorta to the renal arteries and into the kidney. It enters the nephron, the functional unit of the kidney, which is divided into the glomerulus and tubules. As blood enters the glomerulus filtration takes place. Water and solutes such as sodium, potassium, chloride, and nitrogenous wastes like urea are filtered into Bowman's capsule and start the journey through the nephron. As the filtrate enters the proximal convoluted tubule sodium, water, glucose and amino acids are all reabsorbed. The filtrate continues to the Loop of Henle. Here chloride and sodium are reabsorbed but water does not follow because the tubule walls are impermeable to water. Water is then reabsorbed by the distal convoluted tubules which also secrete potassium, hydrogen and ammonium and thus concentrates the wastes in the filtrate. The filtrate, now urine, passes to the ureter and on to the bladder.

What are the numbers?

Serum creatinine: Creatinine is produced at a relatively constant rate by the body. It is a byproduct of creatinine phosphate in muscle. Creatinine is mainly filtered by the kidney. There is little to no tubular reabsorption of creatinine and only a small amount is actively secreted. If the kidney function is deficient then blood levels rise. Serum levels of creatinine can therefore be used to reflect the glomerular filtration rate and measure kidney function.

GFR glomerular filtration rate (GFR): is the volume of fluid filtered from the renal glomerular capillaries into the Bowman's capsule per unit time. This is measured to determine renal function. GFR can be measured by:
Injecting inulin (not insulin). Inulin is neither reabsorbed nor secreted by the kidney so its rate of excretion is directly proportional to the rate of filtration.

Use the serum creatinine levels to reflect the filtration rate

Calculate urine frequency and volume over a twenty four hour period and calculate in volume per time.(E.g. milliliters per minute)

Urea (NH₂)₂CO: Urea is an organic compound also known as carbamide. Urea is highly soluble in water and so is the perfect vehicle for getting rid of nitrogen waste from the body. Since it is neither acidic or basic it has little effect on pH.

Potassium: is secreted by the distal tubule and so the serum levels can be used to give information about kidney function. Kidney disease patients are at high risk of high potassium levels because of the loss of the kidney's ability to excrete it.

Phosphorus: is an element that is necessarily present in your body. With renal failure patients the kidneys lose their ability to excrete phosphorous leading to high levels of the element.

Calcium: is an electrolyte that is affected by its relationship to phosphorous and therefore has a relationship with kidney failure.

Albumin: is a large protein found in the blood. It is a major contributor to oncotic pressure in the vascular space and therefore can have a large effect on dialysis. Low albumin levels can also show protein wasting and progression of kidney disease.

Why Dialysis?

There are many types of renal diseases and diseases that have a secondary effect on the kidneys, but there is a common link to dialysis. When the function of the kidneys is decreased to ten to fifteen percent of normal it is considered end stage renal disease. At this point renal replacement therapy is necessary. The treatment options available at this time are: no treatment, hemodialysis, peritoneal dialysis, and kidney transplant.

We will not deal with the patient who chooses to have no treatment in this document and the majority of patients who choose to have a transplant will have to go through dialysis treatment before a kidney is available. So we will spend our time talking about dialysis.

Since the kidneys are unable to filter out an adequate amount of waste from the bloodstream, dialysis is a method whereby a treatment is introduced that will filter out the

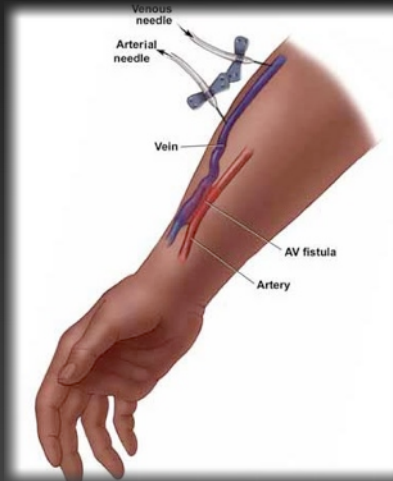
wastes. There are two basic types of dialysis: hemodialysis, and peritoneal dialysis. These two types of dialysis are considered as two totally different treatments in the kidney disease world so we are going to start talking about them as two different things as well.

Hemodialysis

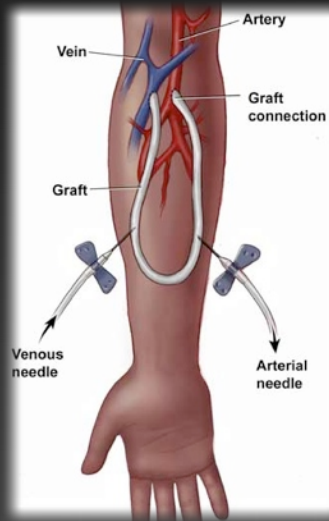
Hemodialysis is the treatment whereby a patient's blood is rerouted outside of their body through a filtration process and then replaced back into their circulation. The hemodialysis machine (artificial kidney) consists of three parts: the blood delivery system, the dialyzer and the dialysis fluid (dialysate).

The blood delivery system is the tubing that removes blood from an artery in the patient and transports it to the dialyzer and then returns it to a vein in the patient. There are three types of vascular accesses that the blood delivery system can be connected to: fistula, graft, or central line.

An AV fistula requires advance planning because a fistula takes a while after surgery to develop—in rare cases, as long as 24 months. But a properly formed fistula is less likely than other kinds of vascular access to form clots or become infected. Also, properly formed fistulas tend to last many years—longer than any other kind of vascular access. A surgeon creates an AV fistula by connecting an artery directly to a vein, most often in the forearm. Connecting the artery to the vein causes more blood to flow into the vein. As a result, the vein grows larger and stronger, making repeated needle insertions for hemodialysis treatments easier.



If the patient has small veins that won't develop properly into a fistula, they can get a vascular access that connects an artery to a vein using a synthetic tube, or graft, implanted under the skin in their arm. The graft becomes an artificial vein that can be used repeatedly for needle placement and blood access during hemodialysis. A graft doesn't need to develop as a fistula does, so it can be used sooner after placement, often within 2 or 3 weeks. Compared with properly formed fistulas, grafts tend to have more problems with clotting and infection and need replacement sooner. However, a well-cared-for graft can last several years.



If the kidney disease has progressed quickly, the patient may not have time to get a permanent vascular access before they start hemodialysis treatments. The patient may need to use a venous catheter as a temporary access. A venous catheter is a tube inserted into a vein in their neck, chest, or leg near the groin. It has two chambers to allow a two-way flow of blood. Once a catheter is placed, needle insertion is not necessary. Catheters are not ideal for permanent access. They can clog, become infected, and cause narrowing of the veins in which they are placed. But a catheter will work for several weeks or months while a permanent access develops.



The dialyzer is a machine that has a series of parallel vessels. One vessel transports the blood and the adjacent vessel is full of dialysate fluid. As the blood passes alongside the dialysate, waste products are diffused across a semi-permeable membrane into the dialysate fluid. The dialysate fluid is chosen dependent upon a patient specific prescription. The blood is then returned to the body with the waste removed. The dialysate fluid, now containing the waste products, is then collected for disposal.

Dialysis in Our Region

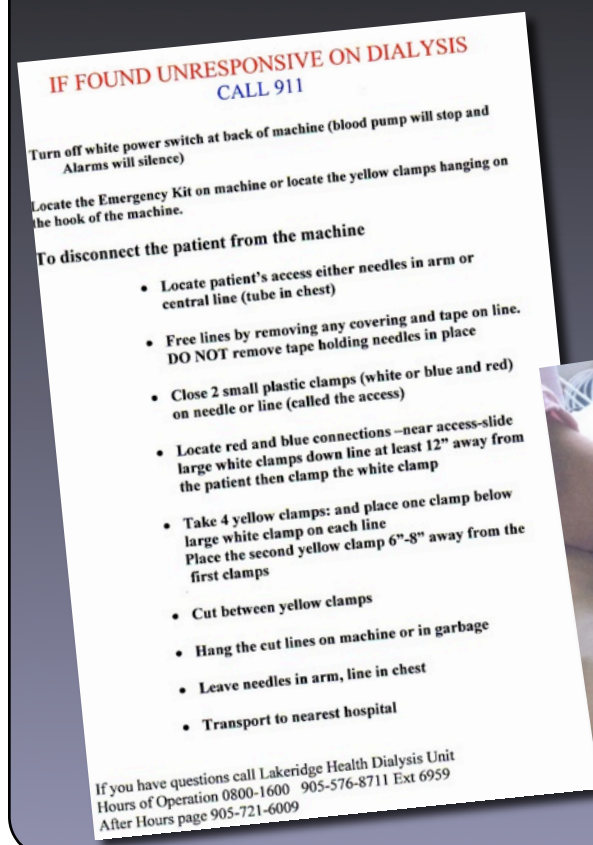
The Lakeridge Health Hemodialysis Unit has approximately 40 patients on home hemodialysis throughout Durham and beyond. Other areas are serviced by other Regional Dialysis Units and we don't know the home hemodialysis patient count

for these hospitals. What is known is that home dialysis is a growing trend and so we will see more of our patients fall into this category.

Home hemodialysis is done with the patient reclined or supine. These patients are well versed on the use of their machines. They are almost always the ones that connect to and disconnect themselves from the dialysis machine. Patients often read, watch TV or nap while their dialysis is being completed. The process can take from two to four hours. The most likely cause of home hemodialysis patients becoming unresponsive will be volume issues. Hypovolemia, cardiac dysrhythmias, and cardiac arrest are some of the more common emergencies for these patients. Sepsis and infection at the access site is an ongoing issue for dialysis patients as well as fluid and electrolyte balance issues, and plugged or clogged catheters or fistulas.

The Lakeridge Health Hemodialysis Unit has an instruction package that is hung on each of the home hemodialysis machines for their patients. This instruction package tells what to do in case the patient is found unconscious and the paramedic (or family member) has to disconnect the patient from the machine. The package consists of an instruction sheet and two photographs and some yellow clamps as outlined below.

The instructions tell you how to turn off the machine and then how to clamp and cut the blood delivery system lines. The recommendation is not to try to remove the needles as this may cause issues with sepsis and bleeding may be difficult to control as it is arterial and thus under high pressure.



Acute complications of hemodialysis	Usual causes of hypotension
Hypotension 20 – 30 %	MI
Cramps 5 – 20 %	Pulmonary embolism
N and V 5 – 15 %	Air embolus
Headache 5 – 10%	Bleeding
Chest pain 2 – 5 %	Tamponade
Pruritis 5%	Sepsis
Fever and chills <1 %	<i>*Dr Marc Goldstein, St Michael's Hospital, University of Toronto</i>

Peritoneal dialysis

Peritoneal dialysis is the treatment whereby the peritoneal cavity is filled with fluid, waste is slowly diffused into this fluid across the peritoneal membrane, and then this fluid is drained and disposed of. Although this achieves the same result as hemodialysis it is a very different procedure and the two types of dialysis should not be confused.

For a patient to undergo peritoneal dialysis they must have a permanent catheter surgically inserted into their abdominal cavity. Dialysis then involves three phases: drain, fill and dwell.

During the drain phase the dialysate fluid is removed from the peritoneal cavity, the fill phase puts fresh dialysate into the abdomen and then it is left there; the dwell phase, where diffusion and osmosis occur to remove wastes and excess fluid.

Continuous Ambulatory Peritoneal Dialysis (CAPD) is a treatment where a patient is involved in the manual draining and filling of the peritoneal cavity. No machine is involved, the patient is drained and filled and then goes about activities for a while and then is drained and filled again. This may take place up to five times in a 24 hour period.

Continuous Cycling Peritoneal Dialysis (CCPD) is a treatment that usually occurs through the night. The patient is hooked up to a machine that automatically cycles through the drain, fill and dwell cycles while the patient sleeps. The machine

is programmed to have a final fill that will stay with the patient throughout the day.

The dialysate fluid varies from patient to patient. The strength of the dialysate is determined by the osmotic agent they use:

- **0.5% dextrose** – considered hypotonic. Fluid will be drawn from the dialysate to the blood.
- **1.5% dextrose** – considered isotonic and allows minimal fluid shift between dialysate and blood
- **2.5% and 4.5% dextrose** – are hypertonic and will remove fluid from the patient's volume.
- **7.5% Icodextran** - is a hypertonic solution containing a large molecule that is not readily absorbed across the peritoneal membrane. This maintains a concentration gradient that will facilitate high filtration and remove larger amounts of fluid from the patient.
- **Amino acid solution** – is glucose free. It is considered isotonic and is used in instances of fragile nutritional status

The amount of fluid, the type of fluid, the number of fills, and the frequency of the treatments are individualized with a patient prescription.

Drain times usually run from 10 to 20

minutes for a volume of 2 litres. Fill times are also in the range of 10 minutes (200ml/min).

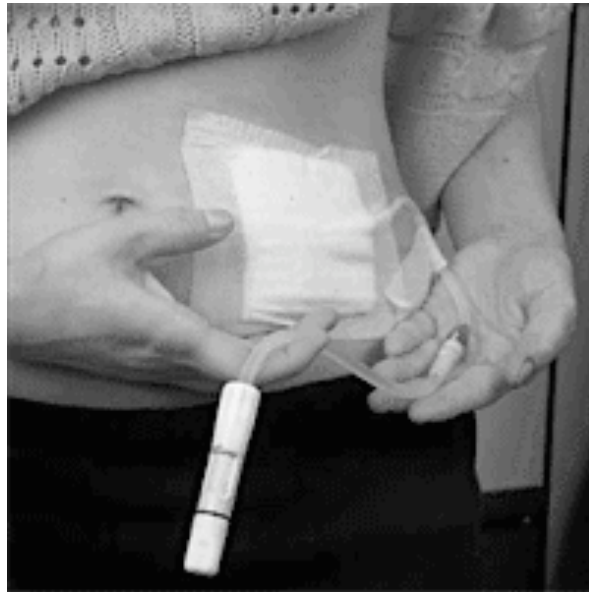
Dwell times may vary from 1.5 to 16 hours. Patients and their families are often trained to complete the dialysis procedures at home but it is also common to have an RN or RPN come into the home. This means that Peritoneal dialysis is a more common home treatment than hemodialysis.

Lakeridge Health Dialysis Unit reports that they have over 120 home peritoneal dialysis patients in the greater Durham area.

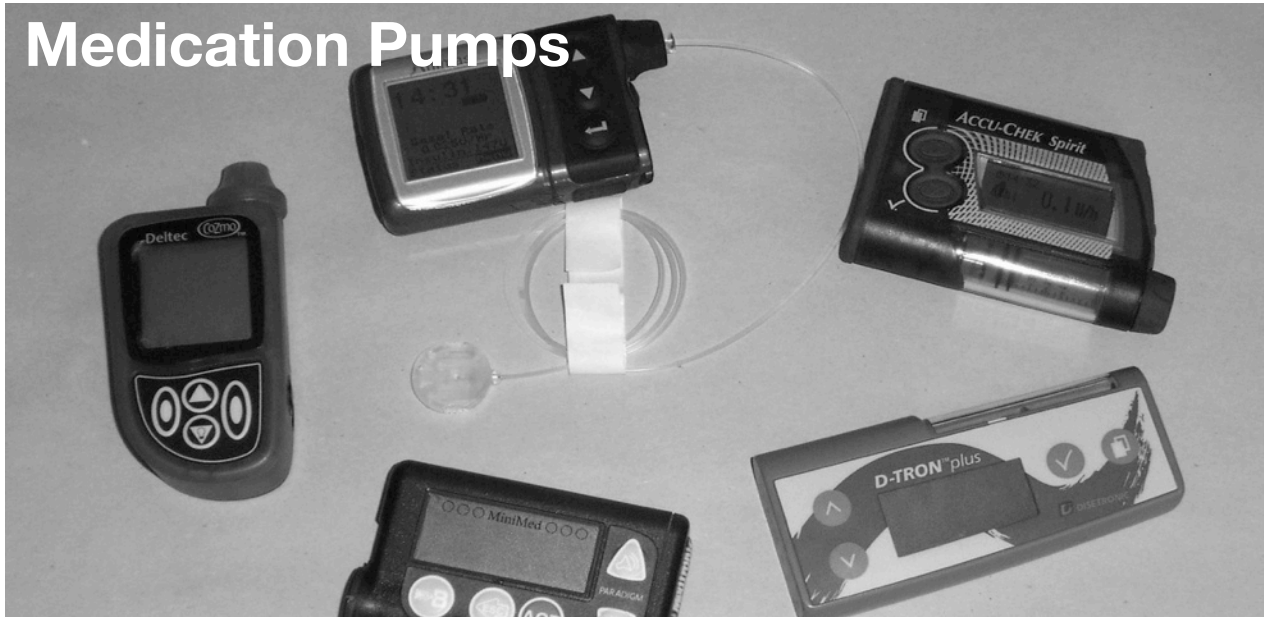
Since the dialysate often contains dextrose, it is recommended that we **use the patient's own glucometer to test the patient's blood glucose**. Their machine has been **specially calibrated** to better match the patient.

As with most dialysis patients the most common emergent issues that these patients have are those of fluid balance, electrolyte balance, and acid base balance. They may also experience abdominal cramping, nausea and vomiting.

To disconnect a patient from peritoneal dialysis, **turn the machine off** (if they are using a machine), **clamp the fluid line** that runs from the patient catheter to the bag and then you **disconnect the fluid tubing** from the peritoneal catheter. **DO NOT CUT THE CATHETER**. This catheter is surgically implanted and if you cut it, a surgical repair is necessary. Remember to maintain aseptic technique as best as possible, disconnect the tubing from the peritoneal catheter and cap the catheter with the sterile cap that is in a kit that the patient should have.



Medication Pumps



Another group of devices that paramedics may encounter, are medication pumps. As the size of electronic circuitry get smaller and battery technology advance, the use of portable infusion pumps will continue to increase.

The two main categories of pumps are; large volume pumps (feeding pumps) and small volume pumps (insulin, opiates etc).

The use of insulin pumps has given diabetic patients much more flexibility and control in how they manage their blood sugar levels. The technology behind insulin pumps are making great strides, including insulin pumps that communicate wirelessly with the patient's glucometer to help adjust the amount of insulin delivered. Although there are currently no completely automatic systems that both monitor blood sugar levels and deliver the appropriate insulin (without the patient's input) those systems are likely soon to be reality.

A common question from Paramedics in regards to insulin pumps is whether we should turn an insulin pump off if the patient is hypoglycemic. Although the thought is correct in that additional insulin would lead to a further lowering of the blood sugar, it is not usually an issue since insulin pumps are implanted subcutaneously thus the absorption will be slow enough to not significantly interfere with your treatment. So the best advise is to not attempt to turn the pump off.

The same question can be asked in regards to a patient on an opiate pump for pain control that is found unresponsive. Normally these types of

pumps have large safety margins to prevent an accidental overdose. If such a patient appears to be unresponsive as a result of an opiate overdose, there is likely a co-ingestion with another type of opiate in addition to the one infused by the pump. Again, the best thing to do is simply treat the patient as you normally would with airway / ventilatory support and consideration of naloxone.

FloLAN is a medication delivered via a medication pump that is important to be aware of. FloLAN is used to treat primary pulmonary hypertension, a rare but serious disease. The FloLAN is given through a central venous catheter using a portable infusion pump. Interrupting the infusion for more than a few minutes can have serious, life-threatening consequences, this is truly a patient's life-line. So in summary the best way to deal with any medication pump is to simply leave it alone. If you have a strong reason to believe that the pump is causing serious harm to the patient, then patch to a BHP for advice on how to proceed. In the unlikely event that the BHP orders you to turn the pump off and no one on scene is familiar with its operation, try to proceed through the following steps (if applicable to the specific pump);

- clamp tubing
- press 'stop', 'hold', or 'pause' (depending on pump)
- press and hold ON/OFF button until the pump turns off.