

Summary – IV Use Access & Complications Mona Inocentes, Thrive Rx

Objectives The following are the objectives for this discussion. Readers may also follow along with the slides which accompany this talk.

- *Name/describe the types of IV access used in parenteral Nutrition (PN) therapy (parenteral means through blood vessels, more specifically a vein)*
- *Describe the etiology (causes) of line infections and the most common pathogens associated with them*
- *List other major complications associated with central lines (a central line is a line which goes into a large vein near the heart)*
- *List the preventative measures that can be taken to avoid line infections/complications*
- *Name/describe the types of IV caps that are used on IV lines (see pictures on slides)*

Types of Lines *Long Term: PICC Lines* These lines are longer than others (14 - 20 inches) and are placed above the antecubital fossa (elbow) extending into the central circulation. An X-Ray is needed to confirm correct positioning of this line but it can be inserted at the bedside. PICC lines are easy to remove but do have a higher risk for occlusion (blockage), dislodgement, and malposition than tunneled CVC's (Central Venous Catheters). PICC lines are generally used for shorter term therapy - 6-12 weeks. Usually if longer therapy is needed (ie, longer than 12 weeks), a different line will be used. These are very thin lines as measured by gauge (diameter of the lumen) or size (circumference measured in millimeters). It is recommended that full barrier protection be used when inserting PICC lines to insure sterility. At one time PICC lines were stitched in place, but that is generally NOT the case now because this tended to cause irritation and infection. Some sort of device is needed, however, to hold the PICC line in place - so there is a slight risk of dislodgment - but the risk is small.

Long Term: Tunneled Catheters These are long lines which are surgically tunneled under the skin and extend into the central circulation for long term therapy. They are not inserted directly into a vein, but rather under subcutaneous tissue, then into the vein. X-Ray confirmation is also needed for these lines to confirm positioning. The catheter extends out from the skin level about one foot. Some brand name tunneled catheters are Groshong, Hickman (for adults) and Broviac (for children). They all can be used for parenteral therapy but must be inserted by an experienced physician in the OR. Though the slide says that these are used for longer term therapy, they generally are used for shorter term therapy. The importance of central lines - that is a line that goes into the central circulation is that they ensure that the substances being infused get into the circulation quickly and they are in contact with blood vessels for a shorter period of time, therefore, less likely to cause damage. Central lines are placed into a large vein, the

superior vena cava, which then enters the right atrium of the heart insuring that the solution gets pumped out into circulation quickly.

The slides which accompany this discussion show what tunneled catheters look like. There are also "protective caps" which tissue can grow around and prevent bacteria from entering the system. Different brand lines have different tips, some using heparin to prevent clotting, others making it easier for flushing or for drawing blood.

Long Term: Implanted Ports These catheters are short (about 6 inches) and are surgically placed under the skin of the chest or abdomen extending into the central circulation. They are indicated for long term or intermittent therapy (therapy needed about once a week). Port access uses a non-coring needle like a Huber which needs to be changed weekly. These lines are best used for intermittent treatments like chemotherapy or antibiotics, and are seldom inserted for parenteral nutrition alone.

These port a caths are usually made of plastic or silicone and the whole mechanism is under the skin. They use a special needle called a "Huber" which allows the patient to take a shower and even go swimming. Some patients like having the needle in place and the freedom it provides, while others do not. As with other lines, Heparin is generally used to prevent clotting; some need daily flushing while other need weekly or even monthly flushing.

The accompanying slides show the differences between kinds of ports, demonstrating how some are almost invisible. The important thing to remember here is that only a Huber needle can be used for these implanted catheters.

Catheter complications Catheter complications include, catheter related blood serum infections (CRBSI), occlusions, and thrombosis.

CRBSI The slides demonstrate how numerous and how costly these infections can be. In ICU's where the catheters are handled frequently, the incidence is significantly higher than in the home setting where the catheters are not handled frequently. For example, home setting incidence is about 1 infection per 1000 catheter days, while the ICU incidence is 4-8 infections per 1000 catheter days. It is estimated that this costs anywhere between \$296 million to \$2.3 billion per year in the US and accounts for about 12 - 25% of mortality. It is important to note, however, that the majority of central lines are not in ICU's as one might expect, but rather on regular medical floors, oncology floors and at home.

How can central lines get infected? Any foreign material that enters the body causes a local reaction and this makes it easier for bacteria to take hold. The highest risk of infectious agents entering is at the cap where you flush (80% of infections begin here), so it is imperative to use meticulous care when handling the line for any reason, but especially when flushing. Microorganisms from the skin can also travel down the lumen of the tube and enter a vein thus causing infection.

Great care should be taken that exposed catheters not be immersed in water even

where there is a tight seal. Something called an AquaGaurd can be used to wrap and coil around the tubing and cover it completely. Warm water therapy is probably best avoided due to potential bacteria in warm water while cold ocean water is probably the safest.

Common pathogens associated with CRBSI's Staph epidermis (from skin) has a low mortality rate and can be easily treated with systemic Vancomycin and possibly an antibiotic lock. 90% of the time the line can be saved. Staph aureus has a higher mortality rate, but can be treated with Penicillin or Penicillin derivatives. Most of the time the line can also be saved, unless it is a MRSA - then it is less likely. Both staph infections are caused by microorganisms which can be found on the surface of our skin. Gram negative bacteria like E. coli, Klebsiella and Pseudomonas can also cause CRBSI's. E. Coli comes from GI sources or water and can occur as cross contamination when the patient has other lines (especially GI lines). Klebsiella is from the respiratory tract, and can be treated with cephalosporin. Pseudomonas may need several antibiotic treatments before the infection is cleared, and several may be tried before the line is removed. Sometimes a patient who has a cold and coughs or one who has a tracheostomy may infect his central line. Infection by Candida is serious and has a higher mortality rate than some of these others and almost always the line has to be removed. It can be treated with Ampho, Ambisome, or Flucanazole but the side effects of these drugs are significant.

How do you diagnosis a CRBSI? There are several different ways to diagnosis a CRBSI. First, you can pull the line and culture the tip. But what if you want to save the line? Then you can try to take blood cultures peripherally and from the central venous line (from the arm and from the catheter) and compare them. If the culture from the central line has 5-10 times more colonization than the peripheral blood, OR if the culture from the central line grows positive 2 or more hours before the peripheral blood, then you have an infection related to the central line.

Preventing CRBSI's There are several different ways to help prevent the occurrence of infection, but none is more important than meticulous hand washing and careful handling of the line and site of entry. There are prophylactic antibiotic locks (different antibiotics are used depending on the kind) which usually dwell for about 12- 24 hours. One example is a Vancomycin lock. There is some controversy about using antibiotics this way because of the question of causing resistance. Ethanol locks are another preventative measure. These use a solution of Ethanol instilled into the catheter and withdrawn after 1-2 hours. So far these have shown great promise, but currently are used only for patients who have demonstrated a history of multiple line infections (Children's Hospital in Boston is one place which has used this method successfully). Other methods which show promise in preventing central line infections include the use of these: Tetrasodium EDTA, Sodium Citrate, Ethanol Trisodium Citrate (mostly used for dialysis catheters), and Taurolidine (mostly in Europe). Grip Locks are also used to prevent infection by stabilizing the line. The slides show lots of different products that can be used. Hub guards are used for peripheral catheters with good success (they

can be used on G tubes and J tubes as well). These are not recommended, however, for children or for families where there are young children because they can fall off.

Red, irritated skin under the catheter dressing can be addressed by first trying different dressing products - some are even hypoallergenic. Occasionally the irritation could be due to the infusion solution itself or even to the microbial used to clean the site. All possibilities need to be investigated if skin irritation occurs.

Again, the key to preventing infections is still scrubbing the site with alcohol wipes and allowing to dry thoroughly.

Occlusions & Thrombosis An occlusion is a blockage, and about 90% of occlusions are thrombotic in nature. A thrombosis is a blood clot. Unique to those patients receiving TPN are lipid and mineral occlusions. Again, it is imperative to keep the catheter clean, but also to keep it stabilized. The less movement, the less occlusion (and less bacterial movement and infection). There are a number of different antimicrobials that can be used for line care. Currently the use of chlorhexadene is incorporated into several products: a spongy swab on a stick and a tegaderm-like clear dressing are two examples. There are also swab caps which contain isopropyl alcohol and can be used by school aged children to keep their lines clean. Treatments for a thrombotic occlusions include various medications that can be instilled to flush the catheter (these are dosed according to kg weight of the individual. For lipid occlusions, 3.0 milliliters of 70% Ethanol or Sodium Hydroxide is recommended, while for mineral occlusions, 3.0 milliliter of a 0.1N hydrochloric acid solution (VERY WEAK) is recommended.

Venous Thrombosis (a blood clot in the vein where the central line lies) can be caused by stasis (if the catheter is too large for the vein for example), by injury to the vessel wall by trauma, infection irritability /reaction to chemo or TPN, or hypercoagulability. The symptoms of venous thrombosis are pain, edema (swelling), and erythema (redness). This could lead to serious consequences like pulmonary embolism (clot to the lungs) or cerebral anoxia (stroke) so early diagnosis is important. This can be done by venography, then treated quickly with anti-coagulants and in extreme situations with clot lysis (clot buster drugs).

There are a few other Central Venous Line complications; superior vena cava syndrome is rare but can be caused by a clot or by a tumor pressing against the superior vena cava. The symptoms include significant upper body edema, cyanosis (blue coloring of lips), and can lead to increased intracranial pressure. The diagnosis can be confirmed through radiography, then anticoagulants can be given to treat. Alternative access needs to be considered and supportive treatment of all symptoms provided.?

IV Line Caps The slides show numerous IV line caps. Some of these include:

- Split Septum (Interlink made by Bard) and QStyle
- Mechanical Valve (CLAVE, Clearlink, SmartSite, SafeSite)

- Positive Pressure Valve(MaxPlus, CLC2000, Posi-Flow, UltraSite, SmartSite Plus, Flolink)
- Neutral Valve (InVision Plus, MicroClave)

It is important for users to find out from the company/manufacturer what kind of cap they have and what kind of flushing technique that cap requires. Be sure you are clear about this because caps can have very different requirements.

Other innovations Baxter has come up with a new product called the U-Link: "the first antimicrobial IV connector with a unique coating designed to help prevent microbial contamination and growth of pathogens in the device."

Preventing Catheter Related Complications

1. Knowledge is key. Know the size and type of catheter you have in place. Ask questions: Is it a midline or a PIC? Where exactly is the tip located? Is it a Hickman or a Groshong? What kind of dressing is being used? Is it falling off or is it irritating and too sticky?
2. Follow the manufacturer's recommendations for catheter flushing and maintenance.
3. Use Chlorhexadene to cleanse insertion site.
4. Transparent semipermeable membrane dressing changes at least ONCE per week.
5. Know what kind of cap is on the end of the catheter and follow manufacturer's recommendations: is it split septum, mechanical, positive pressure or neutral valve cap?
6. Scrub cap with alcohol wipe for 15 - 30 seconds before each connection, use friction, and let dry.
7. Know signs and symptoms of potential complications

Summary There has been some concern nationwide over a potential shortage of TPN ingredients. Companies/manufacturers are investigating alternative sources for families, and those concerned should check with their infusion companies to be sure this is being addressed.

The question of whether to go with a central line or not may be difficult, but it is individual and personal and should be made carefully by the patient with his/her physician. Some things to consider when making this decision are:

- Is the therapy to be long term or long term?
- Is the infusion to be every day or intermittent?
- Are there others to provide/support and or assistance?
- How do you feel about the visibility of the catheter?
- Consider with physician infections, esthetics, self-care and support

Additional resources, including free patient education modules, can be found at http://www.oley.org/Education_Module1.html and www.thriverx.net

And finally, use the following to help guide your care of central lines:

SAVE THAT LINE

S Scrupulous hand hygiene before and after contact with all vascular access devices and prior to insertion

A Aseptic technique during catheter insertion and care

V Vigorous friction to hubs. Vigorous friction with alcohol where ever you make or break a connection to give meds, flush, or change tubing or access injection port or add on a device

E Ensure patency by flushing all lumens with adequate amounts of saline to maintain patency per institutional policy