

Devices for the Delivery of Parenteral and Enteral Nutrition
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1. Objectives

- Review the variety of devices used for the delivery of PN and EN
- Discuss how to select the most appropriate access device
- Understand the methods used to insert an access device
- List the steps used to safely maintain an access device

2. Indications for a Vascular Access Device (VAD)

- Therapeutic infusion
 - Intravenous fluid
 - Parenteral nutrition
 - Chemotherapy
 - Antibiotics
- Obtain blood samples
- Blood pressure monitoring
- Hemodialysis
- Plasmaphoresis

3. Types of VAD used for PN

- Temporary
 - Peripheral
 - Central
- Semi-Permanent
 - Tunneled
 - Implanted
 - PICC

Comments: A large vein close to the heart is often referred to as a central vein. Concentrated IV solutions such as PN, which can cause injury to the lining of the vein with formation of a blood clot, must be given through a central vein where blood flow is brisk and dilution of the solution is rapid so it is less likely to cause a blood clot. The smaller veins in the arms and legs are called peripheral veins. PN given through these veins is less concentrated so the risk of a blood clot is low. Central VADs can remain in place for weeks, months or even years if they are properly cared for while peripheral VADs are often removed every three days to lower the risk of clotting and infection.. In the above list three types of central VAD that are used for home PN are listed. They are categorized as being semi-permanent because they may be kept in place for years but can be removed from the body if necessary. Finally, Peripherally Inserted Central Catheters (PICC) as their name implies, are inserted into a peripheral vein, but their tip ends near the heart and are therefore in a central location. And while they are used as a long-term VAD they are not anchored near the vein like a tunneled or implanted catheter.

4. VAD Materials

- IDEAL CHARACTERISTICS
 - Elastic and flexible to minimize damage to the intima (lining cells) of the vein
 - Resistant to the action of hydrolytic enzymes (proteins that circulate in the blood that breakdown foreign substances that may get into the bloodstream) to minimize physical damage
 - Hydrophobic surface to resist bacterial adherence
- MATERIALS THAT ARE AVAILABLE IN VAD PRESENTLY
- Non-tunneled
 - Polyurethane
 - Impregnated with antimicrobial drugs
- Tunneled
 - Silicone elastomer
 - Cuffed, 3 way slit valve
- Implanted
 - Titanium
 - Silicone septum
 - Non-coring needle

5. Venous Insertion Sites for Central VAD

- Subclavian
- Jugular
- Femoral
- Cephalic / Basilic
- Azygous
- Hepatic
- RA appendage

Comment: The first three central veins are used most often for placement of implanted and tunneled VADs used for home PN.

6. Methods for VAD Placement

- Insert on an elective basis only
- Perform a complete History + Physical Examination
 - Obtain a PMH (past medical history) that may affect successful VAD placement: Trauma, Surgery, Prior VAD, Pneumonia, Neck mass, Lung & Breast Cancer, Coagulopathy
- Obtain CBC, PT INR, aPTT
- Stop anticoagulants
- Adhere to strict aseptic technique
- Percutaneous approach (Seldinger technique) most popular
- Venous cut-down used occasionally
- Ultrasonography reduces risk of percutaneous placement
- X-ray used to confirm tip position

7. Tips for VAD Placement and Use

- Subclavian vein best for short-term access
 - Lowest risk of blood stream infection
- Internal jugular vein best for long-term access
 - Lowest risk of thrombophlebitis
- Temporary VAD in the femoral vein should be only be used for PPN

Comment: The tip of a VAD for home PN should be at the junction of the superior vena cava (SVC) and the right atrium of the heart or just above in the distal SVC to minimized the risk of a blood clot. If the tip of a VAD is in the middle or proximal SVC or a central vein further away from the heart IV solutions and PN should not have a concentration of salt and other particles of no more than 3 times that of normal saline. Normal saline has a tonicity just below 300 mOsm. This is the tonicity of normal blood. Therefore the maximal tonicity of PN solutions that are not given near the heart should not exceed a tonicity of 900 mOsm.

8. Comparison of Central VADs

Nontunneled:

Duration	Advantages	Disadvantages
Weeks	Placed at bedside Guidewire exchange Easily removed	Self-care difficult Easy to dislodge Requires dressing

Tunneled:

Duration	Advantages	Disadvantages
Months to years	Self-care easy Can repair Secured by cuff Decrease dressing after healed May clear CRBSI without VAD removal if improved with antibiotics	OR or X-ray placement Heparin flush May be difficult to remove

Implanted

Duration	Advantages	Disadvantages
Months to years	Site care only when accessed Maintains body image No external breakage	OR or X-ray placement Requires needle access Needle can displace Minor surgery to remove Remove for CRBSI

PICC:

Duration	Advantages	Disadvantages
Months	Avoids thoracic placement Placed by trained R.N.s Placed at bedside	Heparin flush Blood sampling difficult Self-care difficult

9. VAD Home Care

- Dressing type and frequency of change
 - Gauze - 3/wk
 - Semi-permeable transparent - 1/wk
 - Whenever wet, soiled or loose
- Skin preparation:
 - Chlorhexidine
 - Povidone-iodine / alcohol
- Infusion set changed daily

Comment: Chlorhexidine is considered to be more effective than the combination of povidone-iodine and alcohol. It is also more convenient to use. However, either method is considered acceptable for maintenance of the VAD

10. Indications for an EN Access Device

- Enteral nutrition
- Delivery of medications
- Decompression of the GI tract

11. EN Device Design

- Size
 - Nasoenteric 5 Fr – 12 Fr
 - Enterostomy 12 Fr – 28 Fr
- Materials
 - Silicone
 - Polyurethane
- Connectors
 - Y-shaped
 - Balloon ports
 - Jejunostomy tubes

Comment: The external end of most tubes is Y-shaped with two ends that are covered with a cap. This design is for your convenience as it allows you to administer medications and extra water without having to disconnect the tube feeding administration set. If you need to do this you should shut off the tube feeding pump while you are using the side port. You should also remember to flush the tube with water before and after all medications so they do not mix with the nutrient formula within the tube as this can cause the tube to clog. A balloon port may be on the end of your tube if your tube is held in place with a balloon on the internal end. A specific amount of water is instilled into

balloon port, usually with a luer tip syringe, for optimal function. This is usually written on the side of the balloon port. Some tubes have one inner tip that ends in the stomach and another that goes further down stream into the jejunum (small bowel). This type of tube is used when one has to remove air or fluid from the stomach because of poor gastric emptying. The external end of these feeding devices will have two places to connect special tubing; one to drain the stomach and one to deliver tube feeding. This type of tube can have an additional connector on the outside if the device is held in by a balloon. In addition the feeding or jejunal port may have a Y-shape for convenience (medications and water flushes as noted above). It is therefore important to know the various features of your tube and it works.

12. EN Device Configuration

- Nasoenteric
 - Designs to assist bedside placement and maintenance of proper position
 - Weighted vs. unweighted
 - Sensors, Magnets, and Curved ends
 - Length
 - Outflow port
 - Stylet
- Enterostomy
 - Design for non-operative placement
 - Traction, Guidewire, Peel away catheters
 - Internal and external bolsters
 - Traction or endoscopic removal
 - Standard vs. low profile

Comment: Your doctor will select a tube based on the ease with which it can be put into place, whether one end needs to be in the stomach and small bowel, and how it is held in place. If you have a long-term device it will need to be changed every 3-12 months depending on the type of inner bolster used. Generally, balloon bolsters are changed every 3-6 months while formed bolsters are changed every 6-12 months. When you need to change the tube you need to know if this can be done from the outside of our body or whether an endoscope needs be used to assist with the change. Finally, low profile tubes, sometimes called buttons, may be desirable if you are physically active. On the other hand, it is harder to connect the tube feeding administration set to these tubes and so they require fairly normal manual dexterity to manage. In this case a standard style feeding gastrostomy or jejunostomy should be used. Some of these issues should be discussed with your doctor before and after placement of an enteral access device.

13. Questions to Ask Prior to Placement of an EN Access Device

- How long will the device be needed?
- Short-term
 - Nasoenteric & Oroenteric (insertion site)
 - Gastric or Tranpyloric (ending point of the device, temporary devices through the nose or mouth need to pass through the pylorus, junction between the stomach and small bowel, before

they get into the small bowel, hence they are referred to as transpyloric)

- Needle catheter jejunostomy
- Long-term
 - Gastrostomy (through the skin and abdominal wall into the stomach)
 - Gastrojejunostomy (same as above, but with another end of the tube passing through the pylorus into the small bowel, often ending in the duodenum)
 - Jejunostomy (through the skin and abdominal wall into the jejunal part of the small bowel)
 - Pharyngostomy (through the skin of the neck and wall of the pharynx, the area between the back of the mouth and beginning of the esophagus. The tube usually ends in the stomach. Used for people who have fluid in their abdomen where placement of one of the former long-term tubes can not be placed)
- Where should EN be delivered to the gut?
- Gastric feeding
 - Normal gastric emptying
 - Easiest site to use
 - Least expensive
- Post-pyloric feeding
 - Delayed gastric emptying
 - High risk for aspiration
- What technique will be used to place the device?

<i>Available Methods</i>	<i>Short-term</i>	<i>Long-term</i>
Bedside	x	
Endoscopic	x	X
Radiologic	x	X
Operative	x	X

14. Gastro/enterostomy Device Care

- Keep exit site clean and dry
- Avoid excessive traction or inadvertent removal
- Dressing not needed if well healed and no drainage
- (Can be physically active and get wet)

15. Conclusions

- Selection of an appropriate access device is a pivotal step in the delivery of PN and EN
- Technical considerations should minimize the risk of placement associated complications
- Proper after care should improve the longevity of these devices

16. References

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