Tubes and Lines: What You Need To Know

Gary Siskin, MD
Professor and Chairman
Department of Radiology
Albany Medical College
Albany, New York
Venous Access Devices
Venous Access Devices

"I'm Mr. Bagley's attorney. Do you promise to hit the vein, the whole vein and nothing but the vein, so help you God?............."
Venous Access Devices

- These are small tubes placed in large veins of patients requiring frequent access to the bloodstream for long periods of time.

- Indications
  - Administration of medications
  - Administration of fluids and nutritional compounds
  - Transfusion of blood products
  - Multiple blood draws for diagnostic testing
Venous Anatomy

- External Jugular
- Internal Jugular
- Right Subclavian Vein
- Superior Vena Cava
- Basilic Vein
- Median Cubital Vein
- Cephalic Vein
“What types of venous access devices are out there?”
Venous Access Devices

- Peripherally Inserted Central Catheters (PICC)
  - Long, thin, flexible catheter inserted through the skin and then directly into one of the large veins of the arm near the bend of the elbow.
  - There is both an internal and external portion of the catheter.
Venous Access Devices

- **Tunneled Catheters**
  - Long, thin, flexible catheter inserted through the skin and then tunneled under the skin for a short distance before entering one of the large, central veins.
  - There is both an internal and external portion of this catheter.
  - Examples (Hickman, Groshong, PASV, Broviac)
Venous Access Devices
Venous Access Devices

- Ports
  - Long, thin, flexible catheter inserted through the skin and is then tunneled under the skin for a short distance before entering one of the large, central veins. The other end of the tubing connects with the port, which sits under the skin of the upper chest or upper arm.
Venous Access Devices

Needles are passed through the septum to administer medication and draw blood samples.
Venous Access Devices

The port is only visible as a small bump under the skin.
Venous Access Devices

- **Ports**
  - Cosmetically appealing because it is completely internal but it is the most invasive catheter to place.
  - A needle stick is required to access a port.
  - Need to think about future imaging needs of the patient (there are MRI-compatible ports).
“How are these devices placed?”
Venous Access Devices

Placement

- Venous Access
  - Surgical Access
  - Percutaneous Access
    - Blind Access
    - Image-Guided Access
      - Ultrasound has become the standard way to identify the target vein before attempting to access the vein.
      - It is always a good thing to see what we are doing. When we don’t look, we miss the vein 20% of the time.
Venous Access Devices
Placement
Venous Access Devices
Placement

"Pull out! Pull out! ... You've hit an artery!"

Drawing: "Pull out! Pull out! ... You've hit an artery!"
Venous Access Devices
Port Placement
Venous Access Devices
Port Placement
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Venous Access Devices
Port Placement
Venous Access Devices Placement

- **Tip Position**
  - These lines are supposed to be central, which means the catheter tip should either be in the Superior Vena Cava (SVC) or Right Atrium (RA).
  - The high rate of blood flow in these veins can optimize catheter function.
Venous Access Devices Placement

- **Tip Position**
  - Actually, it is controversial as to whether or not the tip of the catheter should be in the SVC or RA.
    - **RA:** Can potentially lead to arrhythmias, perforation, and damage or infection of valves.
    - **SVC:** Can potentially lead to catheter malfunction or venous stenosis or thrombosis.
Venous Access Devices
Placement

- **Tip Position**
  - We believe the tip of a catheter should be at the junction of the RA and SVC with the tip actually dangling from the SVC into the RA.
  - RA position may be more important for dialysis patients (because higher flows are needed)
“The device is in...now what?”
Flushing

Technique

- Use a push-pause method of flushing to clean the inside of the device, to remove blood and fibrin from the port body and catheter tubing, and to help prevent the building of medication precipitate within the device.
- Make sure the catheter is functioning well before flushing.
- Use a 10 cc syringe or larger because large syringes create less pressure than smaller syringes.
Venous Access Devices
Device Maintenance

- Flushing
  - Technique
    - Remember that excessive flushing pressure can cause clots to be dislodged, catheter separation and/or catheter rupture.
Venous Access Devices
Device Maintenance

- **flushing**
  - type of solution
    - typically normal saline is used but you always need to take make sure that normal saline is compatible with what is normally going into the port.
    - 5-10 cc is used. it is not usually a problem to flush with too much fluid...but it can be a problem to use too little.
Venous Access Devices
Device Maintenance

- **Flushing**
  - **Frequency**
    - After blood sampling
    - When converting from continuous to intermittent therapy
    - Before and after medication administration
    - Before and after the administration of blood components
    - Before and after intermittent therapy
    - For maintenance of a dormant device
Venous Access Devices
Device Maintenance

- Locking
  - Technique
    - The goal of locking is to prevent the reflux of blood from the vein into the lumen of the access device when the device is not being used.
    - Must maintain positive pressure on the syringe before removing it from the device.
Venous Access Devices

Device Maintenance

- **Locking**
  - **Type of Solution**
    - Normal Saline: Often used with valved devices
    - Heparin: Often used with open-ended devices
      - May be helpful in reducing bacterial colonization of the devices and subsequent catheter-related infection.
      - Use the lowest therapeutic concentration that will maintain device patency in order to avoid bleeding complications.
      - Remember to withdraw the heparin before using the device in order to avoid systemic delivery of this medication (especially if the device was locked with concentrated heparin).
Venous Access Devices
Device Maintenance

- Locking
  - Frequency
    - Following each use of the device
“What can go wrong?”
Venous Access Devices
Potential Problems

- The device isn’t working
  - What does this mean?
    - Difficulty flushing the device
    - Difficulty aspirating blood from the device
    - It hurts when the device is being used
Venous Access Devices
Potential Problems

- The device isn’t working
  - What would this be happening?
    - The catheter could be in the wrong position
    - The catheter could be broken
    - The catheter tubing could be blocked (occluded)
      - Thrombotic (clot, fibrin)
      - Non-Thrombotic (drug precipitate)
Venous Access Devices
Potential Problems

- The device isn’t working
  - What should you do?
Venous Access Devices
Potential Problems

- The device isn’t working
  - What should you do?
    - First, look at the device (inside and out)
      - Take the dressing off and look.
      - A simple chest X-ray can answer a lot of questions
      - Many times, a device that is broken can be replaced and a device that is out of positioned can be repositioned.
Venous Access Devices
Potential Problems

- The device isn’t working
  - What should you do?
    - If the device looks good, then it is reasonable to treat for a catheter occlusion.
    - The initial treatment for an occluded catheter is low-dose thrombolytic therapy (t-PA dose of 2 mg…Cathflo) because these occlusions are presumed to be thrombotic.
    - Medication or TPN-related occlusions can potentially be treated with ethyl alcohol.
Venous Access Devices
Potential Problems

- The device isn’t working
  - What should you do?
    - Some people believe that devices should be locked with t-PA to maintain patency and reduce infection risk. It is therefore reasonable to consider low-dose t-PA even before a CXR.
Venous Access Devices
Potential Problems

- The device isn’t working
  - What should you do?
    - If the catheter function remains poor after initial therapy, consider the following:
      - Fluoroscopic Evaluation of the Device
        - Inject the device with contrast (X-ray dye) while watching under “live X-rays”.
        - This will help detect clot or fibrin around the tip of the device which can often explain poor catheter function.
A fibrin sheath can form around the tip of the catheter. This can cause problems with drawing blood but not usually with medication administration.
Venous Access Devices
Potential Problems

- The device isn’t working
  - What should you do?
    - A fibrin sheath or clot around the catheter can be treated with high-dose t-PA (2.5 mg/lumen/hour × 2 hrs). This is done on an outpatient basis.
    - If high-dose t-PA fails, consider device replacement.
Venous Access Devices
Potential Problems

- Arm Swelling
Venous Access Devices
Potential Problems
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Venous Access Devices
Potential Problems

- Arm Swelling
  - Consider anticoagulation to prevent progression of the clot.
  - Consider removing and replacing the device in a different vein.
Venous Access Devices Potential Problems

- Infection
  - This can lead to the following:
    - The skin is sore, red, puffy or just doesn’t feel right.
    - Fever, chills…especially after an infusion is started.
Venous Access Devices
Potential Problems

- Infection
  - Evaluation
    - Have a practitioner examine the site.
    - Blood cultures need to be drawn through the line and peripherally to see if there is a bloodstream infection.
    - Remember that the appearance of the skin surrounding a device could be due to an allergy to the dressing material or sensitivity to prep solution.
Venous Access Devices
Potential Problems

- Infection
  - Treatment: This depends upon the organism and the location of the infection.
    - Bloodstream infections are treated with antibiotics.
    - Pocket or tunnel infections may need device replacement.
    - Exit site infections may be treated with aggressive site care.
Feeding Tubes
Feeding Tubes

Indications

Nutritional Support

- Supplementation or Improved Dietary Control (e.g., overnight continuous feeding)
- Dysphagia (e.g., stroke, cancer, dementia)
- Anorexia
Feeding Tubes

- Tube Selection
  - Duration
    - <30 days: NG
    - >30 days
      - G-Tube (Gastrostomy)
Feeding Tubes

- **Tube Selection**
  - **Duration**
    - <30 days: NG
    - >30 days
      - G-Tube (Gastrostomy)
      - GJ-Tube (Gastrojejunostomy)
Feeding Tubes

- **Tube Selection**
  - **Duration**
    - <30 days: NG
    - >30 days
      - G-Tube (Gastrostomy)
      - GJ-Tube (Gastrojejunostomy)
      - J-Tube (Jejunostomy)
Feeding Tubes

- **Tube Selection**
  - G-tubes are most commonly placed.
  - GJ-tubes are placed in the following situations
    - Poor Gastric Emptying (Gastroparesis, Gastric Outlet Obstruction)
    - Gastroesophageal Reflux: GJ tubes decrease the risk of aspiration (Stroke Patients, Trauma, Children)
  - J-tubes are used infrequently for post-operative problems.
Gastrostomy Tubes Placement

- Surgery (10%)
- Endoscopy (74%)
- Percutaneous (16%)
Gastrostomy Tubes
Placement

Before

After
Gastrostomy Tubes Placement

Abdominal wall in cross-section
Feeding tube

Stomach in cross-section
Gastrostomy Tubes Placement

- Surgery
Gastrostomy Tubes Placement

- **Endoscopy (PEG)**
  - An endoscope is passed into the mouth, down the esophagus, and into the stomach so the physician see the wall of the stomach.
  - Under direct visualization with the endoscope, a PEG tube passes through the skin over the abdomen into the stomach.
  - A balloon is then blown up on the end of the tube, which keeps the tube in the stomach.
Gastrostomy Tubes Placement

- Percutaneous Technique
  - NG Tube Placement
  - Determine Puncture Site: This is done by distending the stomach with air through the NG tube.
Gastrostomy Tubes
Placement
Gastrostomy Tubes Placement
Gastrostomy Tubes
Placement
Gastrostomy Tubes Placement

- Percutaneous Technique
  - Pass a wire into the stomach
Gastrostomy Tubes Placement

- Percutaneous Technique
  - Gastrostomy Tubes
    - Pass enlarging dilators over the wire.
    - Pass a peel-away sheath over the wire.
    - Pass the tube through the sheath and then remove the sheath.
    - Inflate the balloon and secure the tube.
Gastrostomy Tubes Placement

- Percutaneous Technique
  - Gastrojejunostomy Tubes
    - Pass a catheter over the guidewire and direct the catheter from the stomach into the small intestine.
    - Pass enlarging dilators over the wire.
    - Pass a peel-away sheath over the wire.
    - Pass the tube through the sheath and then remove the sheath.
    - Inflate the balloon and secure the tube.
Gastrostomy Tubes Placement

- Percutaneous Technique
Gastrostomy Tubes Placement

- Balloon Catheters
Gastrostomy Tubes Placement

- Buttons
Gastrostomy Tubes Placement
Gastrostomy Tubes Placement

- **Buttons**
  - There is no long tube coming from the skin since the actual “feeding tube” is removed once feeding is done (it looks better). However, be careful that the tube can become disconnected during feeding.
  - Easy to care for because it is simpler to secure the tube since it is flush to the skin.
  - The valve that stops formula from coming up feeding tube may get clogged and stop working.
Gastrostomy Tubes

- Using the Tube
  - Preparation
    - Check to make sure the tube is clear.
    - Check for placement by attaching syringe to tube and pulling back to check for gastric secretions or air.
    - Then slowly push 10 cc of warm water through tube.
Gastrostomy Tubes

- Using the Tube
  - Tube Feeds
    - Most of the time, you need to wait 24 hours after placement before using the tube for the first time.
    - There is data to support immediate use of tubes as well.
Gastrostomy Tubes

- Using the Tube
  - Tube Feeds
    - Definitions
      - Continuous Feeding: Feedings are given over an extended time period by a pump at a slow rate (e.g., 30 cc/hour X 24 hours)
      - Bolus Feeding: A larger amount of feeding is given 3-6 times per day. Sometimes given by a pump over a certain amount of time (one hour) or simply allowed to run into the stomach by gravity.
      - Direct Feeding: Direct feeds are given with the feeding set hooked directly into the gastrostomy tube.
Gastrostomy Tubes

- Using the Tube
  - Tube Feeds
    - Most children are started on continuous feeds which are then changed to bolus feeds after 1-2 weeks.
    - When the gastrostomy tube is new, a full stomach can sometimes cause or encourage leakage and poor healing around the tube.
Using the Tube

Medications

- Pills must be crushed into a powder and mixed with water or formula (10-20 cc).
- Capsules should be opened and the powder mixed with water or formula (10-20 cc).
- Liquid medication should be diluted with warm water before administration.
Gastrostomy Tubes

- **Using the Tube**
  - **Medications**
    - Suggest that medication be given at the beginning of a feeding. In this way, the remainder of the feeding can help flush the medication through the tube.
**Gastrostomy Tubes**

- **Using the Tube**
  - **Flushing**
    - Use a large catheter-tip or bulb syringe and slowly push 10-20 cc of warm tap water into the tube to keep it clean and open. This should be done after every feeding and after medication is given.
Gastrostomy Tubes

- **Using the Tube**
  - **Venting:** Sometimes, air or fluid may need to be removed from the stomach (bloating, distension)
    - Leaving the tube attached to a drainage bag can help vent the tube if needed. This can also be done by aspirating excess air from the stomach before using the tube for a feeding.
    - Contact your doctor if this needs to be done frequently.
Gastrostomy Tubes

- Maintaining the Tube
  - Site Management
    - Wash your hands with soap and water.
    - Remove the old dressing.
    - Inspect the site.
      - Look for redness, swelling, green or yellow liquid drainage or excess skin growing around the tube.
      - A small amount of clear tan liquid drainage is normal.
Gastrostomy Tubes

- Maintaining the Tube
  - Site Management
    - Cleaning the Skin
      - First 2-3 Weeks
        - Use half-strength hydrogen peroxide (dilute with water). This will clean the skin and promote healing of the tissue.
        - Use a Q-tip around the tube to remove any drainage or crusting at tube. Clean gently around sutures if present.
        - This should be done at least once a day.
Gastrostomy Tubes

- Maintaining the Tube
  - Site Management
  - Cleaning the Skin
    - After 3 weeks, cleaning may be done with an antibacterial soap and water. However, if irritation occurs, use the 1/2 strength hydrogen peroxide again.
    - Do not use ointments around the tube site unless directed by your child's doctor or nurse.
Gastrostomy Tubes

- Maintaining the Tube
  - Site Management
    - Redress the Site
      - Remember to pat the area dry after cleaning.
      - Gauze is not usually needed unless there is drainage from the tube site. Gauze promotes warmth and moisture, which can lead to bacterial growth and infection.
Gastrostomy Tubes

- Maintaining the Tube
  - Site Management
    - Secure the Tube
      - The tube needs to be secured in order to make sure that it does not fall out and that there is no leakage around the tube.
Gastrostomy Tubes

On the inside, make sure that the balloon is inflated and pulled back against the wall of the stomach (mark the tube to know how much tube should be outside)

On the outside, make sure that the disc, clamp, or crossbar is tight against the skin but not making an indentation (rotate it regularly to protect the underlying skin).
Gastrostomy Tubes

- Maintaining the Tube
  - Site Management
    - Secure the Tube
      - On the Outside
        - Don’t let anybody pull on the tube.
        - Keep a t-shirt covering the tube (one-piece snapped t-shirts work best for infants and toddlers).
        - A cloth or netlike cummerbund (or girdle) or vest can help secure the G-tube.
Gastrostomy Tubes

- Maintaining the Tube
  - Site Management
    - Secure the Tube
      - On the Outside
        - You can put a piece of tape around the tube and pin it to a folded piece of tape on the stomach or pin it to a diaper or T-shirt.
        - You can place a cotton roll (like the dentist uses in your mouth) on either side of the G-tube and then tape the tube to the skin.
Gastrostomy Tubes

- Maintaining the Tube
  - Activity Restrictions
    - For two weeks, Your child should not lift anything heavier than 5 pounds and should not participate in vigorous activity.
    - After two weeks, regular activity can be resumed (crawling, walking, running, jumping, etc.)
Gastrostomy Tubes

- Maintaining the Tube
  - Activity Restrictions
    - Your child can lie on his/her stomach. If that hurts, you can put a foam doughnut around the G-tube site to keep pressure off the stomach.
    - Your child can go to school but make sure the teacher and school nurse know about the tube (what to do and who to call in an emergency).
Gastrostomy Tubes

- Maintaining the Tube
  - Bathing
    - Your doctor will determine what is the best time to begin tub baths for your child.
    - Typically, a child may bathe or swim after one week unless there is a stitch in place. Bathing and swimming have to wait until any stitches are removed.
Gastrostomy Tubes

- Maintaining the Tube
  - Bathing
    - Remember the Following
      - Clamp the G-tube or close the valve on the gastrostomy button prior to placing your child in the water.
      - Avoid overly warm water that can irritate tender skin.
      - Use only mild soaps and soft washcloths.
Gastrostomy Tubes

- Problem-Solving
  - The G-tube fell out
Gastrostomy Tubes

- Problem-Solving
  - The G-tube fell out

Don't Panic!
Gastrostomy Tubes

- Problem-Solving
  - The G-tube fell out
    - If this happens, there may be some bleeding and stomach contents may leak out of the tract.
    - Cover the site with a clean dressing and tape and call your doctor.
Problem-Solving

- The G-tube fell out
  - Replace the Tube
    - This needs to be done as soon as possible so the tract between the skin and the stomach does not close. Replacing a tube back through the tract can usually be done successfully within 6 hours.
    - If you can place the tube back easily, do it and secure the tube. If not, let your doctor take care of it.
    - Once the tube has been replaced, its position should be confirmed with an X-ray before using it.
Gastrostomy Tubes

- Problem-Solving
  - The G-tube is clogged
    - This is often caused by thick formulas or medication given through the tube without routine flushing.
Gastrostomy Tubes

- Problem-Solving
  - The G-tube is clogged
    - Management
      - Try to slowly push 10-20 cc of warm water into the tube with a syringe. If that does not work, try using 10-20 cc of diet coke or sprite.
      - Never try to push any object into the tube to unclog it.
      - If you are unable to unclog the tube call your doctor. We can often unclog the tube enough to change the tube over a guidewire.
Gastrostomy Tubes

Problem-Solving

- The G-tube is clogged
  - Remember
    - Flush the tube before and after each feeding and after giving medicine.
    - Flush every three to four hours if your child is being fed continuously.
    - Routine catheter changes are recommended every 3-6 months so that unanticipated clogging does not occur.
Gastrostomy Tubes

- Problem-Solving
  - The G-tube is broken
    - Most tubes will last for 3 to 6 months.
    - Eventually the rubber tube will break down and become harder to use. Many times the end used to feed with will break off or split.
    - When this happens, the tube needs to be replaced.
Gastrostomy Tubes

- Problem-Solving
  - Vomiting
    - This may be caused by the tube moving forward into the stomach and blocking the stomach.
    - Know how much of the tube should be outside of the body and check that regularly. If too much of the tube is “inside”, pull it out until it is snug against the inside of the stomach.
Gastrostomy Tubes

Problem-Solving

Skin Irritation

Possible Causes

- Leakage
- Granulation tissue
- Infection
- Infrequent cleaning
- Tape irritation
- Allergic reaction to soap

Management will depend on the cause
Gastrostomy Tubes

- Problem-Solving
  - Skin Irritation
    - General Principles
      - Keep skin clean and dry
      - Clean more frequently and/or change dressing more often
      - Consult with physician
Gastrostomy Tubes

Problem-Solving

- Leakage around the tube
  - Possible Causes
    - The tube size does not match the tract size (tube is too small or the tract has widened or stretched)
    - The tube or balloon is broken
    - Rate of feeding is too fast; the stomach is full
    - The patient is constipated
Gastrostomy Tubes

Problem-Solving

- Leakage around the tube
  - Things to do
    - Correct the Leakage
      - Check water in balloon
      - Check placement of tube
      - Re-secure the tube
    - Stop or slow down the tube feedings
  - Clean and protect the skin. Need to be aware of the possibility of secondary infection due to the damage to the skin caused by the leakage.
Gastrostomy Tubes

- Problem-Solving
  - Leakage around the tube
    - If these strategies do not work, contact your doctor because the tube may need to be replaced with a larger tube.
Gastrostomy Tubes

Problem-Solving

Granulation Tissue Formation
- This is characterized as pink/red tissue forming around the tube (rosebud appearance). It is actually a healing response.

Possible Causes
- May form with excessive movement of the tube within the tract.
- May be related to dilantin use to treat seizures.
Gastrostomy Tubes

- Problem-Solving
  - Granulation Tissue Formation
    - This tissue can bleed easily and can also result in soreness and increased leakage around the tube.
  - Treatment
    - Silver Nitrate
    - 0.1% Kenalog Ointment 3X/day
    - Surgical Excision
Gastrostomy Tubes

- Problem-Solving
  - Infection
    - Red and tender skin in association with thick pus-like drainage and fever (>101°F or 38.5°C).
Gastrostomy Tubes

- Problem-Solving
  - Infection
    - Helpful to culture the drainage from the site.
    - First try OTC antibacterial (bacitracin, neosporin) or antifungal (micotin, lotrimin) ointments, which should work within 3 days.
  - Next Steps
    - Systemic antibiotics
    - Tube removal and replacement after healing occurs