Clogged or Broken: Trouble Shooting Tubes and Lines

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Central Venous Catheters

Types of Central Venous Catheters (CVC)

- Tunneled
  - Used for medium or long-term access requirements
    - Chemotherapy
    - TPN
    - Hemodialysis
  - Single, double, or triple lumen
  - Usually inserted via access to a neck vein
  - May be placed percutaneously by interventional radiology (IR) or surgically
  - The catheter is tunneled through the adjacent subcutaneous tissues to the vein then exits the skin over the chest wall
  - Likely provides a barrier to ascending infection
  - Will adhere to subcutaneous tissues over time
  - Less chance for dislodgement but removal may be difficult
  - Examples
    - Hickman, Groshong, Broviac catheters
    - Totally Implanted Venous Access Devices (iVADs or “portacath”)
      - Has a reservoir attached to the catheter that is buried in the subcutaneous tissue of the chest wall
      - Accessed percutaneously via a noncoring needle
      - Can be accessed up to 1,000 times
      - Has lower infection rates than external catheters
      - Best for intermittent therapies (e.g. factor or enzyme infusions)
      - Tolerates immersion for bathing

- Non-tunneled
  - Placed directly into the vein via a skin incision or puncture overlying the vein
  - Placed in the neck, upper chest, extremities
  - Examples
    - Triple lumen polyurethane catheters, percutaneous sheath introducer kits
      - Shorter-term therapies, such as during hospitalization
• Indications
  o Extended antibiotic treatment
  o Repeated blood sampling
  o Vasopressors
  o TPN
  o Hemodynamic monitoring (pulmonary artery catheters)

  ▪ Peripherally Inserted Central Catheters (PICCs)
    • Usually placed via the veins of the upper arm
    • For longer-term indications such as home therapies
      o Extended antibiotic treatment
      o Repeated blood sampling
      o Vasopressors
      o TPN
    • Can function for a year or more
    • Single and double lumen varieties
    • Easy, quick insertion
    • Inexpensive
    • Higher rate of thrombosis

Common Complications

• Systemic and local infections
  o Highest rates in non-cuffed, non-tunneled catheters
  o Lowest rates in PICCs and implanted ports
  o Local infection
    ▪ Includes exit site region and tunnel infections
    ▪ _Strep, Staph aureus, Candida, Enterococcus_
    ▪ Localized erythema, drainage, tenderness
    ▪ Cultures of the drainage and catheter tip (if removed) should be obtained
  ▪ Treatment
    • Infection limited to exit site
      o Warm compresses, topical antibiotic ointment, oral antibiotics
      o Non-compliant or immunosuppressed patients may require IV antibiotics (vancomycin)
      o Removal of the catheter may be required in some cases
    • Infection involving the tunnel or area over the port
      o IV antibiotics (vancomycin)
      o Catheter removal
      o In some institutions an attempt may be made to salvage the catheter by administering IV antibiotics through it
Systemic infection
- Malaise, nausea/vomiting, fever, chills, elevated white blood cell count, signs of localized or tunnel infection
- Immunosuppressed patients may have vague symptoms rather than signs of sepsis
- Sources
  - Skin contamination at insertion site
  - Contamination of the catheter hub during insertion
  - Contaminated intravenous fluids
  - Hematogenous spread of infection from another site
- *Staphylococci, Candida, Enterococcus*
- Once the catheter is colonized the organisms produce a biofilm that is resistant to phagocytic cells, antibodies, and antibiotics
- Blood cultures should be drawn peripherally and through the catheter before antibiotics are initiated
- Treatment:
  - IV antibiotics (vancomycin)
  - Catheter removal
- The use of antimicrobial-impregnated catheters has been studied but there is no consensus as to whether they should be used on a routine basis

Catheter occlusion
- Common causes
  - Malposition of the catheter
    - Tip position against the vessel wall
      - Characterized by the ability to flush the catheter, but failure to aspirate
      - Injection of contrast medium will demonstrate asymmetric or oblique flow away from the tip
    - Catheter kink, coil, or curl
  - Diagnosis: check catheter position radiographically
  - Treatment
    - A forceful injection of saline through the catheter may encourage the tip to return to its original position
    - Placement of a guidewire through the catheter lumen may stiffen the catheter to allow repositioning
    - Catheter may need to be repositioned or exchanged with a new catheter
  - Intraluminal catheter thrombus formation
    - When neither aspiration nor infusion are possible
• Diagnosed by injecting contrast through the catheter to identify the site of obstruction
• Increases risk of infection
• Higher rates in patients with malignancy
• Occurs in catheters that are inadequately or infrequently flushed, or that are in small vessels with a low volume and rate of flow
• Treatment
  o Try saline flush first
  o If unsuccessful, consider a small dose of a fibrinolytic agent if no contraindications exist
    ▪ Streptokinase (250,000 U in 2 mL)
    ▪ Tissue plaminogen activator (1 mg)
    ▪ Urokinase (5,000 to 10,000 units)
• It is unclear if low-dose warfarin (1mg/day) is of benefit in preventing CVC-related thrombosis

- Pericatheter venous thrombosis
  • Characterized by the ability to flush the catheter, but failure to aspirate
  • Influenced by how long the catheter has been present in the vessel, the size of the catheter, vein used, infusate type, and systemic comorbidities
  • Placement high in the superior vena cava results in an increased incidence of thrombosis
  • Arm/head/neck swelling, headache, venous distension, erythema, phlegmasia
  • Many cases are asymptomatic
• Diagnosis
  o Venography or “venogram”
    ▪ Injection of contrast medium via a peripheral cannula
    ▪ Will demonstrate an irregular jet flow away from the catheter tip
  o Ultrasound
• Treatment
  o Initiate anticoagulation in the ED
  o Consult IR regarding possible catheter directed thrombolysis and/or CVC exchange

- Fibrin sheath thrombus
  • Characterized by the ability to flush the catheter, but failure to aspirate
  • Consists of a protein layer (albumin, lipoprotein, fibrinogen) and coagulation factors that surround the intravascular portion of the catheter
• Begins to form within 24 hours of insertion
• Will eventually cover any catheter
• Causes malfunction when it extends around the catheter tip
• Colonized by microbes which increases risk of infection
• Can act as a ball valve at the catheter tip
• Does not predict subsequent development of DVT
• Rarely embolizes
• Diagnosis: venography or “linogram” contrast study
  o Complete fibrin sheath
    ▪ Prevents any contrast medium from flowing away from the tip
    ▪ Back tracks along the intravascular portion of the catheter and spills into the soft tissues
    ▪ Results in swelling at the access site during catheter flushes
  o Incomplete fibrin sheath
    ▪ Narrowing of the contrast jet with delayed fanning
• Treatment involves removal of the fibrin sheath by stripping of the CVC using a snare catheter that is inserted through the femoral vein
  ▪ “Pinch-off syndrome”
    • Difficulty aspirating blood and resistance with infusion of fluids
    • Compression of the catheter between the clavicle and first rib
    • Diagnosis:
      o Chest radiograph “pinch-off sign”
      o Contrast dye study
    • May be remedied by laying the patient supine or having the patient raise the ipsilateral arm or shoulder
    • The catheter should ultimately be removed to avoid fracture and embolization
• Catheter tip migration
  o Migration to the internal jugular vein
    ▪ May cause pain in the neck, ear, or shoulder
    ▪ Patients may report hearing an odd sound when the catheter is flushed
  o Tip position against the vessel wall
    ▪ Characterized by the ability to flush the catheter, but failure to aspirate
• Injection of contrast medium will demonstrate asymmetric or oblique flow away from the tip
  o Trouble shooting
    ▪ Check catheter position radiographically
    ▪ Catheter will likely need to be repositioned or exchanged with a new catheter

**Rare complications**

- **Vascular erosion and perforation**
  o A catheter tip abutting the vein wall or curling is a sign that the tip is compressing the vein
  o Associated with cardiac tamponade, hemothorax, hydrothorax
  o CVC should be repositioned to lie parallel to the vessel wall

- **Catheter fracture and/or fragment embolization**
  o Usually occurs during insertion as a result of needle shearing
  o May result from “pinch-off syndrome” (see above)
  o Complications include sepsis, endocarditis, cardiac perforation with tamponade, and arrhythmias
  o Fragments can be retrieved percutaneously by IR using a snare

- **Air embolization**
  o Fatal in 50% of cases
  o More commonly associated with catheter removal
  o Patients receiving hemodilaysis or IV infusions are at greatest risk
  o Tunneled catheters inserted through peel-away sheaths increase risk
  o As little as 100 mL of air can be fatal (14 g needle in 1 second)
  o Consider in patients presenting with chest pain, dyspnea, dizziness, diaphoresis, hypotension, tachycardia
  o Treatment
    ▪ Identify the catheter and seal the open end using a clamp or hemostat if necessary
    ▪ Place patient in a left lateral decubitus and Trendelenburg position
      • Allows air to rise to top of the right ventricle
      • Prevents entry of air into pulmonary circulation
    ▪ Consider hyperbaric oxygen if available
  o Stroke occurs when there is pulmonary shunting or a patent foramen ovale

- **Burning and/or erythema during or after infusion**
  o Causes include catheter leak, kink, disconnection, and fibrin sheath formation
  o Diagnosis: extravasation of the contrast on “linogram”
o Treatment
  ▪ Stop the infusion
  ▪ Aspirate 3-5 mL of blood
  ▪ Instill appropriate antidote if applicable
  ▪ Flush with saline
  ▪ Apply cold compresses
  ▪ Consider a steroid cream
  ▪ Consider hyperbaric oxygen, oral pentoxifylline
  ▪ Severe skin necrosis requires surgical debridement

Other Complications

- Phlebitis and thrombophlebitis
  o Pain, redness, and swelling over a superficial vein
  o Treat with warm compresses, NSAIDS
  o Could be related to IV solutions

Trouble-shooting a Clogged Central Venous Catheter

<table>
<thead>
<tr>
<th>Check the catheter itself</th>
<th>Is there a break?</th>
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<tbody>
<tr>
<td></td>
<td>Is there wear at the clamp site?</td>
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<td></td>
<td>Is there a tight skin suture restricting flow?</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Confirm catheter placement and integrity with chest radiography</th>
<th>Is there a kink? loop? twist? migration?</th>
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<tbody>
<tr>
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<td>Is the reservoir detached?</td>
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<table>
<thead>
<tr>
<th>Attempt to flush and aspirate catheter</th>
<th>Inability to aspirate, ability to flush</th>
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<tbody>
<tr>
<td></td>
<td>Fibrin sheath</td>
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<td></td>
<td>Catheter tip thrombus</td>
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<td>Catheter tip positioned against a vessel or chamber wall</td>
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<thead>
<tr>
<th>Inability to aspirate or flush</th>
<th>Inability to aspirate or flush</th>
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<tbody>
<tr>
<td>In intraluminal catheter thrombosis</td>
<td>Pinch-off between clavicle &amp; rib</td>
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<tr>
<th>If not contraindicated, administer a fibrinolytic agent</th>
<th>Allow 15 to 60 minutes for the solution to remain in the catheter</th>
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<tr>
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<td>Reevaluate for patency</td>
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<td>If successful, the catheter should be flushed and locked with a heparin solution</td>
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<td>If remains occluded, consider a contrast-enhanced study or consult IR</td>
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Nephrostomy Tubes

Nephrostomy tubes can be placed transcutaneously under fluoroscopic, ultrasonographic, or CT guidance or during an open surgery. Placed to maintain temporary or permanent urinary drainage.

Indications
- Decompression of an obstructive uropathy
- Hole in the ureter or bladder
- Preparation for surgery (e.g. removal of a large kidney stone)
- Access to the renal pelvis for a radiological procedure (e.g. insertion of an antegrade stent)

Common Complications
- Decreased urine output to collection bag
  - Less than 30 mls/hr is a concern
  - Trouble shooting
    - Check that the 3-way stopcock is in proper position to allow for drainage
    - Evaluate for leaks or kinks in the external tubing
    - Try flushing the catheter
      - Prepare 5 to 10 mL of preservative-free normal saline
      - Swab the injection port on the stopcock with alcohol
      - Turn the stopcock off to the urine collection bag, gently flush the nephrostomy tube, do not aspirate
      - Turn the stopcock off to the nephrostomy catheter, flush the tubing that drains to the urine collection bag
      - If unsuccessful in restoring flow, call interventional radiology or urology for catheter replacement
    - Evaluate for catheter dislodgement (see below)
    - Assess for other conditions such as dehydration, hypotension, and renal failure
- Dislodgement
  - The most common cause of catheter malfunction
  - Patients may present with flank pain secondary to hydrenephrosis
  - Incidence is variable ranging from 1-36% (likely a result of varying definitions and duration of follow up)
  - Complete dislodgment requires recannulation
  - CT or catheter injection study should be performed to evaluate catheter position and determine need for replacement
- Hematuria
  - Bleeding should decrease within 48-72 hrs of the procedure
Generally requires no special management

- Copious hemorrhagic output through the nephrostomy tube or via the bladder is rare
  - Diagnosis requires a catheter injection study to exclude communication with the renal vasculature or pseudoaneurysm formation
  - Occurs in 1-3% of cases
  - May require transcatheter embolization

**Less Common Complications**

- **Infection**
  - Infected urine within the renal collecting system can result in sepsis due to compression of the renal vascular bed
  - Incidence 1-2.5%
  - Minimized with post-procedural antibiotics and by limiting manipulations within the collecting system
  - May be caused by catheter dislodgment

- **Abdominal pain**
  - Hydronephrosis related to catheter dislodgement or obstruction (see above)
  - Infection
  - Peri-operative complications
    - Puncture of the liver or spleen can occur and result in intra-abdominal hemorrhage
    - Puncture of the colon can occur and result in peritonitis
    - Diagnosis
      - Plain film radiography can be used to check for perforation
      - CT scan to assess for intrabdominal hemorrhage, perforation, perioperative fluid collections

- **Urinary extravasation**
  - A nephrostomy tube that continues to leak urine from around the entry site will likely require replacement with a larger catheter

- **Urine leakage after nephrostomy tube removal**
  - A small amount of urine will leak from the cutaneous entry point for 2 to 3 days after catheter removal
  - If leakage continues, IR should be called to evaluate the patient
Enterostomy Tubes

Introduction
- Three options for G tube placement:
  - Surgery (open or laparoscopic)
    - Performed since 1870s
    - Now less commonly used but may be indicated if the patient requires a surgery for related or unrelated abdominal problems
    - Higher complication and mortality rates
    - Can be replaced with a low profile balloon-inflated device in 6 to 8 weeks
  - Percutaneous endoscopic gastrostomy (PEG)
    - Introduced in 1980 as a way of providing long term nutritional support
    - Placed through the skin, subcutaneous tissue, peritoneum, and anterior or anterolateral stomach wall using endoscopy
    - After several weeks a fistulous tract forms as these different layers become adherent to one another
    - Use of endoscopy provides additional diagnostic capabilities
    - Can be replaced with a low profile balloon-inflated device in 3 to 6 months
  - Percutaneous radiological gastrostomy
    - Insertion is done using fluoroscopy by IR
    - Minimally invasive and can be done under local anesthesia in some cases
    - Lowest major complication rate
    - Can be replaced with low profile balloon-inflated device after 6 weeks

- Anatomy of a G-tube
  - 3 components
    - Internal portion
      - Loop/pigtail, balloon, or bulb at the distal end holds the tube in the stomach
    - External portion (body)
      - Visible on the outside of the skin
      - Generally has an external disk that prevents inward and outward catheter migration
    - Feeding port
      - For the initial insertion a tube-type device is used but this may be converted later to a skin-level device once the tract matures
  - Skin level devices
    - Are more aesthetically pleasing
    - Have less movement in the tract
Do not require a stabilizing device
- Are less likely to be removed accidentally
- Require attachment of an external tubing for feedings

- There are two main types of skin level devices
  - Balloon-inflated devices
    - Inflated with 5-6 mL of water or saline solution
    - Generally easy to replace
    - Last 4 to 6 months
    - Broken balloon is the most common reason for replacement
  - Mushroom style devices
    - Mushroom tip holds it into the stomach
    - Last longer because there is no balloon to break
    - Flatter design makes it more difficult to grab
    - More difficult to place
    - Removal is done with traction which is more painful

- Gastrojejunostomy tubes (GJ tubes)
  - A balloon holds the tube in the stomach and an additional piece of tubing extends off the stomach portion of the tube and is placed in the jejunum
  - Indications
    - Gastroparesis
    - Reflux
    - Aspiration
    - Gastric outlet obstruction
    - Pancreatitis
    - Gastric leak

- Jejunostomy tubes (J tubes)
  - A balloon holds the tube in the jejunum which is then affixed to the abdominal wall
  - Usually placed surgically rather than radiographically
  - Indications similar to GJ tubes

Complications arising from GJ tubes and J tubes are nearly identical to those described for G tubes below.

**Tube Maintenance**

- Most site problems can be prevented by maintaining a sealed system created by the intragastric seal (balloon or mushroom) and transabdominal seal (segment of tissue between the stomach and external abdominal wall)
- Balloon volume should be checked twice a week and reinflated if needed
- External tube length should be checked daily to make sure it has not migrated
Common Complications

- Dislodgement
  - The fistulous tract will begin to close within hours
  - Removal of the tube before maturation can result in leakage of the stomach contents into the peritoneal cavity with subsequent development of intra-abdominal sepsis and its associated complications.
  - Patients with a history of trauma to the tract and tract immaturity should have radiographic confirmation using a water-soluble contrast agent
  - Tube placed less than 2 weeks ago:
    - Risk of false passage into the peritoneal cavity and subsequent morbidity
    - Blind placement of a replacement tube is **not** recommended
    - Patients without signs of peritoneal spillage should be observed with a new tube placed in 5 to 7 days
    - Patients with peritonitis require surgical evaluation and irrigation of the peritoneal cavity, closure of the gastrostomy, and placement of new enteral access
  - Tube placed between 2 and 8 weeks ago:
    - Immediately insert a lubricated urinary catheter (one size smaller) into the stoma
    - Signs of correct placement
      - Lack of resistance to passage
      - Lack of resistance to the insufflation of air
      - Rapid return of gastric fluid upon aspiration
    - Do not inflate the balloon
    - Do not use the catheter for feeding
    - Order a contrast study to confirm its location within the stomach: an irregular contour with uneven margins suggests peritoneal leakage
  - Tube placed greater than 8 weeks ago and no trauma:
    - Place a lubricated urinary catheter into the stoma
    - Consider restarting tube feeding if you are able to aspirate gastric contents
    - Otherwise, order a contrast study to confirm tube location within the stomach
  - Use of an abdominal binder may prevent accidental dislodgment

- Blockage
  - Patients should only place water, formula, juice, electrolyte solutions and medications through the G tube
  - Medications known to block G tubes: ciprofloxacin, clarithromycin, cholestyramine resin, corn starch, cotazym, iron, kayexalate,
lactulose, magnesium oxide, nelfinavir mesylate, pyridoxine

- Tubes should be flushed with warm water (3-5 mL peds, 10 mL adults) after each use or every 4 hours if the patient is on continuous feeds
- Troubleshooting a blocked tube
  - Flush with small amounts of a carbonated beverage or warm water in a push and pull fashion
  - Pancrelipase
    - One tablet crushed and mixed with 1/8 tsp baking soda dissolved in 5 mL water (or one 650mg sodium bicarbonate tablet in 30 mL of water)
    - A pancreatic enzyme concentrate of porcine origin containing standardized lipase, protease, and amylase as well as other pancreatic enzymes
  - Other commercial products are available that come with a small diameter hollow applicator that helps to instill solution into the tube and disrupt the clog

- Leakage of small amounts of fluid from the tube site
  - A small amount of drainage is normal
  - Gentle traction on the tube may help
  - May be related to hypergranulation tissue (see below)
  - Risk factors include increased gastric acid secretion, hydrogen peroxide use at site, site infection, tube movement and traction
  - Replacement with a larger tube does not help and results in a larger stoma that continues to leak
  - Patient may need tube removed to allow the stoma to heal

- Skin irritation
  - Generally due to acidic gastric contents, tape, or friction from the tube
  - Skin should be washed daily with soap and water, keeping the stoma dry
  - Surrounding skin can be protected with a barrier cream
  - Acid blocking agents and topical sucralfate powder may help severe excoriation

- Pressure ulcers can be prevented by ensuring that the tube comes straight out of the tract and is not taped down flat on the skin
  - Several commercial securing devices are available
  - An infant pacifier can also be used as a securing device
    - Remove the handle of the pacifier
    - Cut a small hole in the tip and up the side
    - Place this around the tube and secure with tape
    - A gauze or foam dressing can be placed under the pacifier
Hypergranulation tissue
- One of the most common problems associated with G tubes
- Prevents a skin seal around the tube
- Can occur within one week of placement
- Patients and family members assume there is an infection if not familiar with the appearance of this tissue and the associated drainage
- Drainage may be clear, yellow, serosanguineous
- May have associated surrounding skin irritation, excoriation, or candida
- Treatment options include debridement and topical steroids such as triamcinolone cream 0.5% TID
- Bleeding from granulation tissue can be treated with cautery or silver nitrate sticks
- Hydrogen peroxide should not be used as it may interfere with wound healing

Skin infection
- Erythema, tenderness, discharge from the exit site
- A relatively uncommon problem
- Increased risk with diabetes, malnutrition, corticosteroid use
- Local wound care (warm salt water soaks or saline compresses) and antibiotics (cephalexin or amoxicillin/clavulanate) are required
- Cellulitis requires systemic antibiotics and tube removal
- Generally polymicrobial but *S. aureus* and beta-hemolytic strep are common
- Mild candidiasis can be treated with nystatin cream. More severe cases require oral nystatin.

Less Common Complications

Leakage of **large** amounts of fluid from tube site
- Dislodgment of the tube into the subcutaneous tissue tract
  - Can result in a peritoneal leak
  - Diagnosis: contrast study
  - Requires immediate tube removal and replacement
- Dislodgment of the tube into the gastric outlet
  - Can occur when a urinary catheter or low-profile tube slips further into the stomach causing the balloon to block the gastric outlet
  - A barium study will show inability of the stomach to empty
  - Decreasing the balloon volume from 5 mL to 3 mL may resolve the issue
- Patients who are acutely ill may not be able to tolerate their normal rates and volumes
Patients who continue to leak large amounts of their feedings may require conversion to a gastrojejunostomy tube

- Vomiting and tube migration
  - May be due to the balloon obstructing the duodenum or gastric outlet
  - Measure the tube length from the skin outward and pull it back if necessary
  - Check tube location with a contrast study

- Aspiration
  - Can occur after or during tube insertion
  - May be a result of malposition or dislodgement
  - Frequently results in pneumonia
  - In order to prevent aspiration patients with significant reflux may require GJ or J tube feeding as well as medical antireflux therapy

- Peritonitis
  - Characterized by fever, vomiting, tachycardia, abdominal pain
  - Causes
    - Leakage of small amounts of gastric contents into the peritoneal cavity
      - Diagnosed by injecting dye into the tube to check placement
      - Requires surgical management
    - Perforation during insertion
      - Check radiograph for free air
        - Pneumoperitoneum is a normal finding immediately after tube insertion but should resolve in 24-48 hrs
        - An increasing amount of air results from a continued leak secondary to perforation
    - Gastrocolocutaneous fistula
      - Caused by injury to the colon at the time of insertion or by migration or erosion of the G tube into the colon
      - Patients present with stool appearing in the tube or with diarrhea that results from tube feeds entering the colon directly
      - Diagnosed by injecting dye into the tube to check placement
      - Surgery is required when the fistula fails to close
  - Treatment: IV antibiotics should be started immediately if peritonitis is suspected
“Buried bumper syndrome”
- Excess traction causes the internal bumper of the PEG to erode through the stomach wall
- Eroded area re-epithelializes and covers the bumper
- May present as increased leakage around the tube, infection, immobility of the catheter, resistance to flow in the tube, or abdominal pain
- Requires removal of the tube

Hemorrhage
- Can occur from a vessel puncture during insertion or from gastritis or ulceration at the site
- Excess traction on the tube should be avoided
- Tube position should be evaluated with a contrast study
- Small amounts of bleeding can be treated with conservative management or injection of lidocaine with epinephrine
- Active bleeding may require angiography to determine the source

Leakage from the tubing
- Leaks can be sealed with tape until the tube can be replaced

Troubleshooting Enterostomy Tubes

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<tr>
<th>Problem</th>
<th>Possible Causes</th>
<th>Plan of Action</th>
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<tbody>
<tr>
<td>Vomiting</td>
<td>Balloon obstruction Malposition</td>
<td>Check tube length, pull back tube</td>
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<tr>
<td></td>
<td></td>
<td>Check placement with contrast study</td>
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<tr>
<td>Diarrhea</td>
<td>Fistula</td>
<td>Check for fistula with contrast study</td>
</tr>
<tr>
<td>Tube fell out</td>
<td>Less than 2 weeks old</td>
<td>Call IR, do not replace tube</td>
</tr>
<tr>
<td></td>
<td>2 to 8 weeks old</td>
<td>Place urinary catheter in stoma and confirm placement with contrast study</td>
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<tr>
<td></td>
<td>Greater than 8 weeks old</td>
<td>Place urinary catheter in stoma and confirm placement with contrast study</td>
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<tr>
<td></td>
<td></td>
<td>if any history of trauma</td>
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<tr>
<td>Tube Clogged</td>
<td>Review medication list for possible causes</td>
<td>Flush with warm water</td>
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<tr>
<td></td>
<td></td>
<td>Flush with carbonated beverage</td>
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<tr>
<td></td>
<td></td>
<td>Consider pancrelipase if available</td>
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<tr>
<td></td>
<td></td>
<td>Call IR for replacement</td>
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<tr>
<td>Tube leaking</td>
<td>Check connection joints and look for holes in tube</td>
<td>Seal with tape</td>
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<td></td>
<td></td>
<td>Replace tube</td>
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<tr>
<td>Erythema at site</td>
<td>Increased tube mobility Skin sensitivity to tape</td>
<td>Secure tube</td>
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<tr>
<td></td>
<td>Leakage of gastric acid</td>
<td>Change tape</td>
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<tr>
<td></td>
<td>Granulation tissue Infection</td>
<td>Add acid blocking agent</td>
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<td></td>
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<td>Cauterize with silver nitrate</td>
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<td>Start antibiotics</td>
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Urinary Catheters

Most urinary catheters have a distal balloon that is filled with 5-10 mL of water to prevent dislodgement. The balloon must be emptied in order to remove the catheter.

Retained Catheter Balloon

- **Causes**
  - Blockage of the inflation channel by debris
  - Malfunction of the inflation valve from clamping, crushing, or kinking of the inflation channel
  - Crystallization of the fluid within the balloon
    - Occurs when the balloon is filled with saline rather than water
    - Generally develops when the catheter has been retained for a long period of time
- **Trouble shooting**
  - Advance the catheter to make sure it is in the bladder
  - **Cut the balloon port** proximal to the inflation valve which removes the valve function and allows the water to drain
  - If this does not work, the obstruction is likely along the length of the catheter or at the balloon entrance
  - After instilling 200 mL of water into the bladder (if empty), pass a lubricated fine-gauge wire through the inflation channel
    - If debris is blocking the port, this should permit drainage
    - If the balloon remains intact the sharp end of the guide wire can be used to rupture the balloon
  - A 22-gauge central venous catheter can be thread over the guide wire until the tip is into the balloon, then the guidewire is removed
  - If the balloon still does not deflate it can be dissolved chemically with 10 mL mineral oil which is injected into the inflation port
    - If the balloon does not dissolve within 15 minutes, repeat the mineral oil
    - Ether, toluene, chloroform, and acetone are not recommended as they can damage the bladder epithelium
    - Once removed the balloon should be inspected for possible retained fragments
    - Success rate is reported to be 85-90%
  - The final step in the ED is to try rupturing the balloon with a sharp instrument such as an intravenous cannula or spinal needle using a transurethral, transabdominal, transvaginal, transperitoneal, or transrectal approach
Female approach
- A 20 gauge angiography catheter can be used with the sheath of the catheter advanced over the needle tip to prevent urethral discomfort
- The angiography catheter is then advanced parallel to the urinary catheter while gentle traction is applied to it
- Once resistance of the balloon is felt, the needle is advanced out of its sheath to puncture the balloon

Male approach
- After anesthetizing the suprapubic region a 25 gauge spinal needle is inserted through the abdominal wall and into the region of the bladder neck to deflate or rupture the balloon
- Ultrasound guidance is recommended and is used to locate the balloon within the bladder as the catheter is held in place with gentle traction
- The bladder should be filled with 50 mL of saline prior to the procedure.
- If the catheter balloon has been dislodged into the urethra, aspiration through the anesthetized ventral surface of the penis can be performed
  - If the above techniques are unsuccessful, endoscopic puncture may be performed by a urologist
  - The hyperinflation or “balloon bursting” technique is not recommended as it may be painful, cause bladder rupture, and result in retained catheter fragments that require removal with a cystoscope

Balloon Deflated but the Catheter is Stuck

- Generally a result of “balloon cuffing”
  - Balloon does not deflate flush with the catheter
  - An elevated cuff remains which acts as a hook preventing catheter removal
  - Allowing passive deflation into a syringe can prevent this
  - Treatment involves instilling 0.5-1 mL of water which should smooth out the cuff and allow removal
  - More common in suprapubic catheters
References


