1. Estimation of Tube Length
To place the drainage eyes in the proper location in the stomach (Fig. 46.1), the length of tube to be inserted can be estimated by adding the following three measurements together:

a: Measurement from the patient’s xiphoid process to the earlobe
b: Measurement from the earlobe to the tip of the nose
c: 15 cm

2. Nares Patency Check, Anesthesia, and Vasoconstriction
Patency of the nares should be checked before placing an NGT. This can be done by direct visualization or by having
Fig. 46.1  To estimate the length of nasogastric tube to be inserted, add together the measurement from the patient’s xiphoid process to the earlobe (A), plus the measurement from the earlobe to the tip of the nose (B), plus 15 cm (C). (From Samuels LE. Nasogastric and feeding tube placement. In: Roberts JR, Hedges JR, editors. Clinical procedures in emergency medicine. 4th ed. Philadelphia: Saunders; 2004. pp. 794-816.)
The tube is passed through the nose into the posterior pharynx with the fingers in the pharynx to direct the tube into proper location (Fig. 46.3).

Verifying Tube Placement
Radiographic verification is the most sensitive test to detect proper placement, but it is not necessary to meet the standard of care. Methods that are normally used to verify tube placement at the bedside are as follows:

- Insufflation of air causing or resulting in borborygmi (gurgling) sounds heard over the epigastrium verifies that the tube is in the stomach.
- Aspiration of gastric fluid; a pH less than 4 is correlated with a 95% likelihood that the tip of the tube is in the stomach.
- In a conscious patient, normal clear speech without coughing is suggestive of proper tube placement.

Securing the Nasogastric Tube
The NGT is taped in place once proper tube insertion is verified. Silk tape is torn into a butterfly configuration, with one end of the tape placed on the nose and the torn ends of the tape wrapped around the tube in opposite directions. Tincture of benzocaine can be used on the skin before placement of the tape to more securely adhere both the tube and tape.

COMPLICATIONS
Placement of an NGT has a complication rate between 0.5% and 1.5%. Common complications are as follows:

- Epistaxis
- Tracheal or bronchial placement
- Pneumothorax
- Intracranial placement
- Esophageal or pharyngeal perforation
- Gastric or duodenal rupture
- Esophageal obstruction or rupture
Gastrointestinal Devices, Procedures, and Imaging

CHAPTER 46

Gastrointestinal Devices, Procedures, and Imaging

Problems with transabdominal feeding tubes include:
- Gastrothorax and tension gastrothorax
- Pulmonary aspiration; the NGT may induce a hypersalivation response, a depressed cough reflex, or mechanical or physiologic impairment of the glottis

TRANSCUTANEOUS FEEDING TUBES

Feeding tubes are placed to provide long-term nutritional support. They are classified both by the location of their terminal lumen and by the method of placement. Gastrostomy tubes have a terminal lumen located within the stomach and are now typically placed via a percutaneous endoscopic technique; they are thus called PEG (percutaneously placed gastrostomy) tubes. Several manufacturers make various types of PEG tubes. The other most frequently encountered feeding tube is a J tube, or jejunostomy tube. Such tubes are longer, smaller-caliber tubes that terminate in the jejunum. Unlike a gastrostomy tube, a J tube does not have an inflated balloon on its terminal end.

The classic open surgical gastrostomy procedure is less commonly performed than the percutaneous techniques. Percutaneous tubes can be placed by a gastroenterologist via endoscopy or by a radiologist via fluoroscopy. Fewer complications are seen with radiographically placed tubes than with tubes placed either by an open technique or endoscopically.

MAJOR COMPLICATIONS OF TRANSABDOMINAL FEEDING TUBES

Serious complications seen with transabdominal feeding tubes include obstruction, perforations, gastrointestinal (GI) bleeding, volvulus, and gastric outlet obstruction. Serious infections include bacteremia, pulmonary aspiration, sepsis, peritonitis, advanced local cellulitis, and necrotizing fasciitis. Other complications of gastrostomy tubes are prolapse with and without intestinal obstruction, extraluminal position of the tube, and fistula formation.

REPLACING A TUBE

Transabdominal feeding tubes must be replaced for many reasons, including expulsion, malfunction, leakage, tube deterioration resulting in cracks or fissures, and aneurysmal dilations of the tube. It is important that a patient’s tube be correctly identified with respect to type, size, and manufacturer before an attempt at replacement. A dislodged tube should be replaced as quickly as possible to maintain patency of the feeding tube tract. When replacing a feeding tube it is important to clarify whether the terminal end was in the stomach versus the jejunum. After placement, the anchoring balloon in the replacement tube should be inflated in G tubes but never in J tubes.

REMOVING A NONFUNCTIONAL TUBE

If the nonfunctioning PEG tube was placed under fluoroscopic guidance by a radiologist, it can usually be removed by deflation of the balloon and gentle retraction. Some devices have
a flange rather than a balloon, and these flanges usually collapse with slow, gentle traction. If the tube was placed by a gastroenterologist or a surgeon, it may have an anchoring device or an internal component that prevents the tube from becoming dislodged from the gastrostomy tract. Such a tube cannot be removed by gentle traction alone; the internal component must be removed endoscopically. If resistance is met when attempting removal, a gastroenterologist, interventional radiology, or surgeon should be consulted.

As an alternative method, the tube is lifted off the abdominal wall skin to allow the tube to be cut as close to the skin as possible. The internal component is then pushed into the GI tract so that it is free to pass through the intestines and be eliminated rectally. Most internal components pass within 2 weeks. There have, however, been reported cases of intestinal obstruction, perforation, and rarely death with this method. Studies have found that a silicone Foley catheter with a retention disk and ring has the same efficacy and complication rate as a commercially available replacement gastrostomy tube. The retention disk and ring are used to prevent distal migration of the tube into the GI tract. However, many institutions do not stock silicone Foley catheters.

**FOLEY CATHETERS VERSUS COMMERCIAL FEEDING TUBE PRODUCTS AS REPLACEMENTS**

Both commercially available feeding tubes and Foley catheters can be used to replace a dislodged feeding tube. Commercial feeding tubes are more expensive than Foley catheters. Studies have found that a silicone Foley catheter with a retention disk and ring has the same efficacy and complication rate as a commercially available replacement gastrostomy tube. The retention disk and ring are used to prevent distal migration of the tube into the GI tract. However, many institutions do not stock silicone Foley catheters.

**Foley Catheters Used as Replacement Feeding Tubes**

A few simple modifications to a standard Foley catheter can maximize its longevity as a feeding tube, as well as reduce the chance of complications. When using a Foley catheter to replace a feeding tube, an external bolster, or anchor, is fashioned to prevent ingress of the tube into the ostomy and distal migration into the GI tract. An external bolster may be constructed by cutting a 3-cm section from a large rubber catheter. The outer bolster should be secured approximately 1 cm from the skin to prevent trapping of moisture and maceration. Its construction is as follows:

1. Cut a 3-cm section from the proximal segment of a Foley catheter to be used as a bolster, the end without the balloon. A silicone catheter is preferred over a latex one (Fig. 46.7, A).
2. Fold this segment in half and make a diagonal cut on each side of the fold to create a diamond-shaped opening in the middle of each side of the 3-cm segment of tubing. Cut the holes slightly smaller than the tube to be inserted and used as the feeding tube to ensure a snug fit of the bolster on the replacement tube (see Fig. 46.7, B and C).
3. Insert a hemostat through the two holes created in the bolster.
4. Grab the proximal end of the replacement tube with the hemostat and pull the tube through the bolster (see Fig. 46.7, D).
5. Advance the bolster to its proper location about 1 cm above the skin of the abdomen (see Fig. 46.7, E).

**Verifying Tube Location**

No standard method for verifying tube placement has been established. The safest and best practice is to obtain radiographic confirmation when a feeding tube is replaced. Radiographic confirmation should be obtained in the following circumstances:

- With replacement of a recently placed feeding tube (less than 3 months) because the tract may not be mature
- When tube replacement was difficult

**Fig. 46.6 Steps for replacing a transabdominal feeding tube.**

Determine location and size of tube
- Use same size as previous tube
- Check old records for size
- If unknown, start with 16F G tube or Foley for gastric tubes, and smaller 8–14F for J tubes

Clean skin (betadine)

Remove old tube—deflate balloon and apply gentle traction or gentle traction alone if flange is known to be present. Do not attempt removal if current tube has a bolster or one is suspected based on method of placement

Lubricate stoma and tract with water soluble material

Attempt to pass the replacement tube using gentle pressure

Successfully placed—inflate tube with 20mL of water if located in stomach. Do not inflate balloons in the jejunum.

Obtain radiographs with water-soluble contrast material to ensure proper location and functioning (see text)

Not successful—consult surgery, gastroenterology, or interventional radiology

Unable to pass tube—use smaller caliber tube and re-attempt.

Successfully placed—continue algorithm

Fig. 46.7

- A
- B
- C
- D
- E

SECTION IV GASTROINTESTINAL DISEASES
When gastric material cannot be aspirated after placement
• When the patient is unable to communicate about symptoms such as pain with tube placement and use

Radiographic confirmation can be accomplished with fluoroscopy or by injection of water-soluble contrast material into the tube followed by plain radiography. Typically, 20 to 30 mL of contrast material is injected into the tube via a catheter tip syringe. An abdominal film should be obtained within 1 to 2 minutes. Generally, a flat-plate abdominal view is sufficient to verify tube placement. If insertion of the tube was very difficult or malposition is suspected, a two-view abdominal film may be required to ensure proper tube location. Proper location of the replaced tube is indicated by (1) ease of injection of the contrast material and (2) visualization of the gastric and intestinal walls as they are outlined by the contrast material. If extravasation of the dye is seen outside the stomach or intestine, tube malposition is verified.

Recently, two newer verification techniques have been described in small studies. The first uses air insufflation through the replacement tube to verify proper placement. Once the tube is replaced, a total of 240 mL of air is insufflated through the tube with a 60-mL syringe. The tube is considered properly replaced if it can be seen clearly within an air-distended stomach on a plain radiograph.11 The second technique was described in a small study with 10 subjects. Ultrasound was used to visualize the new tube as it was placed in the established tract. After insertion, color Doppler was applied over the catheter tip while it was gently oscillated to enhance visualization11 (Fig. 46.8).

**CLOGGED FEEDING TUBES**

Larger-diameter feeding tubes are less likely than smaller tubes to become clogged. A tube can become obstructed if kinking occurs or the lumen is clogged with debris. A recently
placed or reinserted tube is prone to kinking. A kink can be treated by withdrawing the tube a few centimeters and then advancing it again. Contrast-enhanced radiographs should be obtained whenever significant tube manipulation has occurred to evaluate for patency and proper location. A persistently clogged tube needs to be removed and replaced.

**PROCEDURE**

The following equipment is needed:

- Gloves and personal protective equipment
- GEBT tube
- NGT if the tamponade tube does not have an esophageal aspiration lumen
- Traction device
- Manometer or sphygmomanometer
- Y-tube connector
- Emesis basin
- Water-soluble lubricant
- Suction device with connectors
- Tubing to connect to suction
- Clamps or nonserrated hemostats
- Silk sutures
- Tape and gauze

The procedure is as follows:

1. If needed, intubate the patient before placement of the tube.
2. Check the balloons for patency and leaks before use: use 100-mL increments of air to inflate the gastric balloon, and check the pressure with a sphygmomanometer after each increment. These pressure measurements should be recorded for each 100-mL increment of air and will be used to compare pressure readings once the tube has been inserted (step 12). The pressure in the gastric balloon should not increase more than 15 mm Hg with inflation of each 100 mL of air.
3. If an NGT is to be inserted, tie a suture around it and the GEBT tube to secure them together. The tip of the NGT should be located 3 to 4 cm proximal to the esophageal balloon.
4. Lubricate the tube or tubes with a water-soluble lubricant.
5. Position the patient either upright angled at 45 degrees or in the left lateral decubitus position.
6. Anesthetize the posterior pharynx or nasopharynx with topical anesthetic spray or nebulized lidocaine (or both; see previous discussion on NGT insertion).
7. Place an NGT and evacuate the stomach before placing a GEBT tube to decrease the chance of emesis and aspiration. Once the gastric contents have been evacuated, remove the NGT.
8. Deflate all balloons and either clamp the ends of the tubes or place plugs in each lumen if provided by the manufacturer.
9. Pass the tube to a minimum level of 50 cm as marked on the tube.
10. Connect suction to the gastric and esophageal lumens to check for contents and to decrease the likelihood of aspiration.
11. Confirm proper tube placement with radiographs even if gastric contents or blood is evacuated. The tip of the tube or balloon should be located below the diaphragm if properly placed.
12. Remove the clamps or plugs and inflate the gastric balloon slowly with 100-mL increments of air. Check the pressure of the gastric balloon after each injection; with each 100 mL of air insufflated, the pressure should not be more than 15 mm Hg higher than the pressure measurements previously obtained for the same volume of air (step 2). If the pressure rises by more than 15 mm Hg, the balloon may be located in the esophagus and not in the stomach. If this occurs, deflate the balloon and obtain...
another radiograph to ensure proper tube location before resuming air insufflation. Generally, 400 to 500 mL of air must be insufflated to obtain the proper pressure; check the manufacturer’s recommendation for the tube being used.

13. Once proper pressure is obtained, clamp or plug the lumens of the gastric balloon and the air inlet.
14. Gently pull back on the GEBT tube until it snugly fits against the diaphragm and applies pressure at the gastro-esophageal junction.
15. Secure the GEBT tube to the traction device to be used while applying a small amount of tension to the GEBT tube to keep constant pressure on the lower esophageal sphincter. The traction devices may be an orthopedic trapeze apparatus or another device provided by the manufacturer.
16. If the tube was passed nasally, place the sponge rubber cuffs provided by the manufacturer into each nostril or pad the nostrils with gauze to prevent pressure ulcers.
17. Once the tube is properly placed and secured, lavage the stomach with room-temperature water to assess for active bleeding. Attach the gastric lumen to high-pressure, intermittent suction.
18. If blood continues to be aspirated from the gastric lumen, the esophageal balloon can be inflated to a minimum pressure level to control the bleeding or to the maximum pressure advised by the manufacturer (typically 50 to 45 mm Hg). Clamp or plug the lumen of the esophageal balloon once a desired pressure level is obtained.
19. Frequent manometer readings of the esophageal balloon should be obtained to decrease the risk for complications.
20. If bleeding continues, the most likely source is gastric; tension on the gastric balloon may be increased gradually to help control the bleeding.
21. Obtain radiographs any time that the position of the tube comes into question.
22. Once the bleeding is controlled, attempts should be made to decrease the pressure in the esophageal balloon by increments of 5 mm Hg every 3 hours until a pressure of 25 mm Hg is reached (or as recommended by the manufacturer). Typically, a pressure of 25 mm Hg can be maintained for 12 to 24 hours if the bleeding is controlled.
23. If the esophageal balloon requires inflation at pressures greater than 30 mm Hg, the balloon should be deflated every 6 hours for 5-minute intervals to prevent complications such as mucosal ischemia and necrosis.
24. To prevent vomiting and aspiration, the esophagus must be emptied continuously even if the esophageal balloon is not inflated. The gastric balloon will preclude passage of secretions into the stomach. Aspirate with either an esophageal aspiration port in a Minnesota tube or an NGT with its tip located in the esophagus next to the GEBT tube. The volume of oral and esophageal secretions can total up to 1500 mL/day.
25. Once the GEBT tube is properly inserted and bleeding has been controlled, the tube should not be disturbed for 12 to 24 hours.

26. If bleeding cannot be controlled, further therapies are indicated, such as emergency surgery, endoscopic interventions, or angiographic embolization.

**COMPLICATIONS**

Use of the GEBT tube is associated with many minor and major complications (Box 46.2). Such tubes should be used only when life-threatening bleeding occurs and other available modalities have failed. Approximately 8% to 16% of patients treated with GEBT tubes have a major complication, with reported mortality rates of 3%.

**SUGGESTED READINGS**


**REFERENCES**

References can be found on Expert Consult @ www.expertconsult.com.
REFERENCES