Gastrostomy tubes: Placement and routine care

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INTRODUCTION

Gastrostomy tubes may be placed endoscopically, surgically, or radiologically.

This topic will review the placement and routine care of gastrostomy tubes, including management of dysfunctioning gastrostomy tubes, with a focus on percutaneous endoscopic gastrostomy tubes. The indications for gastrostomy tube placement and complications associated with gastrostomy tubes are discussed separately. (See "Gastrostomy tubes: Uses, patient selection, and efficacy in adults" and "Gastrostomy tubes: Complications and their management".)

TECHNICAL CONSIDERATIONS

Options for gastrostomy tube placement — Gastrostomy tubes may be placed endoscopically, surgically, or radiologically. The choice of procedure will depend on local resources and expertise, anatomic considerations that may affect the ability to place the tube endoscopically or radiologically (eg, inability to endoscopically identify an appropriate placement site because of prior surgery or obesity), and whether the patient is undergoing surgery for other reasons [1].

Studies comparing surgical gastrostomy with percutaneous endoscopic gastrostomy (PEG) have shown no difference in morbidity or mortality [2]. However, PEG is less expensive and saves time. Thus, surgical gastrostomy is typically reserved for patients who are already going to the

operating room for another surgical procedure. Surgical gastrostomy may also be considered for patients in whom a gastrostomy tube cannot be placed either endoscopically or radiologically. Reasons a gastrostomy tube may not be able to be placed endoscopically or radiologically include esophageal obstruction (because placement requires passage of the tube through the esophagus) or the presence of an anatomic aberration that prevents a safe percutaneous approach for PEG tube placement (eg, colonic interposition between the stomach and the abdominal wall).

Whether there is a difference in morbidity and mortality between endoscopic and radiologic gastrostomy tube placement is not clear [3-8].

Techniques for gastrostomy tube placement

Endoscopic placement — A multitude of commercial kits and variations of the percutaneous endoscopic gastrostomy (PEG) technique have been introduced, including the push (Sachs-Vine), pull (Ponsky), introducer (Russell), and Versa (T-fastener) techniques. There are few studies that have compared these techniques [9]. The most commonly performed are the push and pull techniques. Here we describe how a PEG tube is placed using a pull technique. Prior to PEG tube placement, antibiotic prophylaxis should be given (table 1). (See "Antibiotic prophylaxis for gastrointestinal endoscopic procedures", section on 'Percutaneous endoscopic gastrostomy or jejunostomy placement'.)

Placement of a PEG tube requires another operator in addition to the endoscopist and normal support staff. The procedure begins with performance of an upper endoscopy to ensure that there are no anatomic obstacles to PEG placement (eg, esophageal obstruction or ulcer at the site where the PEG tube would be placed). With the endoscope in the stomach, the second operator locates an appropriate site on the abdominal wall by looking for transillumination through the abdominal wall. The position is confirmed when the second operator presses on the chosen area with one finger, and a clear indentation of the gastric wall is seen with the endoscope.

Relying on the combination of transillumination and finger palpation of the abdominal wall in choosing an appropriate PEG tube site, rather than one of these techniques alone, will increase the safety of PEG tube insertion. In questionable situations, the abdominal wall should be prepared with a topical cleanser, and an 18- or 22-gauge needle should be passed through the proposed PEG tube site prior to PEG tube placement. The needle should be withdrawn slowly with an attached syringe, creating back pressure. The presence of a sudden bolus of air or stool within the syringe suggests passage through the bowel. However, this technique has not been subjected to a prospective evaluation. Some endoscopists place the PEG with the patient in

reverse Trendelenburg to allow gravity to "lower" the colon away from the anterior gastric wall. If a safe access site cannot be determined, ultrasound or other image guidance can assist in delineating a safe location, or the gastrostomy can be placed by interventional radiology or surgically.

Once an appropriate site is selected, the abdominal wall is cleaned with an antibacterial solution, and the second operator dons sterile gloves. Lidocaine is injected at the site. The lidocaine should be injected superficially and deeply into the abdominal wall. A small skin incision may then be made at the site (approximately 1 cm in length). A hollow introducer needle is then passed through the incision into the stomach under endoscopic visualization.

Once the needle is within the stomach, a snare is placed around the needle. A soft looped wire is then passed through the needle and grabbed with the snare. The endoscope is removed, pulling the wire through the esophagus and out of the mouth (with the distal end still protruding from the introducer needle and held by the second operator). The wire is then attached to a loop at the tapered end of the PEG tube. Once attached, the second operator gently pulls on the wire to slowly advance the tube through the mouth and esophagus and into the stomach.

Once the gastric wall is reached (at which point there will be a significant increase in resistance to passage of the tube), the introducer needle is removed, and moderate traction is placed on the wire by the second operator to pull the tube through the abdominal wall. The tapered end of the tube acts as a dilator. Once the entire tube has been pulled through the abdominal wall, the internal bolster will rest along the gastric wall. Care must be taken to not pull the internal bolster out through the abdominal wall. If there is any concern about whether the bolster is in the correct position, the endoscope can be introduced into the stomach for direct visualization. Once the tube is in place, an external bolster is placed on the tubing, allowing for 1 to 2 cm of in and out movement of the PEG. The measurement on the external tube where the external bolster is placed should be recorded in the endoscopy report for future reference. If not already done, endoscopic visualization of the internal bolster is often carried out to confirm proper placement.

Radiologic placement — Radiologically inserted gastrostomy tubes are placed using fluoroscopic guidance or CT guidance [10,11]. Radiologic insertion of a gastrostomy tube requires that the stomach be distended with air. This is often done with a nasogastric tube, though alternative techniques, such as ingestion of bicarbonate granules or direct cannulation of the stomach under ultrasound- or computed tomographic-guidance may also be used.

Once the stomach is distended, an appropriate site is chosen using fluoroscopy (typically the antrum or mid-body of the stomach). A 2-cm square around the site is designated, and local anesthetic is injected at the four corners. T-fasteners are then preloaded onto a slotted needle and inserted percutaneously into the stomach at each corner. A stylet is passed through the needle and deploys the T-fastener. The T-fasteners are then pulled taut and secured using a small metal cylinder that is crimped around the suture. At this point, the stomach is affixed to the anterior abdominal wall (gastropexy).

The center of the square is then anesthetized, and an incision is made. The needle used to place the T-fasteners is inserted into the stomach, and air is aspirated to confirm placement. A guidewire is passed through the needle, and the needle is removed. The percutaneous track is dilated with either fascial dilators or an angioplasty balloon. Once the track is dilated, the gastrostomy tube is placed over the guidewire and advanced into the stomach. Contrast material is injected to confirm correct tube placement, and an external bolster is placed on the tubing.

Whether T-fasteners are required for all radiologically placed gastrostomy tube is uncertain. In a study of 830 radiology placed gastrostomy tubes, there was no significant difference in complications for patients who had gastropexy with T-fasteners compared with those without gastropexy [12]. It must be noted that most patients who received a balloon gastrostomy tube had gastropexy, and this may infer that interventional radiologists routinely perform gastropexy when placing balloon-tipped gastrostomy tubes.

Another approach for radiology guided gastrostomy placement involves using ultrasound guidance at the bedside. The procedure has been performed in the interventional radiology suite and at the bedside in the intensive care unit (ICU) by radiologists or ultrasound-trained intensivists. The procedure has been approved by the US Food and Drug Administration (FDA) and involves insufflating the stomach with air using a standard nasogastric tube. A separate balloon tube with a magnet is passed into the stomach. Another magnet is placed against the abdominal wall to capture the balloon catheter against the anterior gastric wall. The balloon is inflated and identified by ultrasound. The abdominal wall is cleansed and an 18-gauge trochar is passed through the abdominal wall directly into the inflated balloon. A guidewire is passed through the trochar into the balloon. The balloon is fully deflated, trapping the guidewire within its internal compartment. The balloon catheter is removed from the patient's oral cavity and the wire is released from the balloon. The wire is attached to the looped end of a standard gastrostomy tube and that tube is pulled into proper position using the standard pull technique. Small studies have shown successful gastrostomy placement with this procedure and no increased risk of complications [13,14].

Surgical placement — Surgical gastrostomy can be carried out either laparoscopically or using an open approach. Laparoscopic gastrostomy tube placement is performed similarly to radiologic gastrostomy tube placement. After the laparoscope is inserted, the gastrostomy site is chosen and grasped. T-fasteners are then used to affix the stomach to the abdominal wall, and the gastrostomy tube is placed. (See 'Radiologic placement' above.)

Open insertion of a gastrostomy tube involves creation of a midline incision. The stomach is located, and a gastric incision is made. The gastrostomy tube is then inserted, and the gastric and midline incisions are closed.

Proper placement of the external bolster — As noted above, the bolster on the external tubing should be positioned such that 1 to 2 cm of in and out movement can be achieved. Loose apposition of the bolster to the abdominal wall does not result in peritoneal leakage since an early gastrostomy tract forms as a result of tissue edema and associated tissue secretions. If the tissue between the internal and external bolsters is compressed, it may lead to pressure necrosis, buried bumper syndrome, or breakdown of the gastrostomy tract.

For percutaneous approaches, it may also be important to make at least a 1 cm skin incision prior to gastrostomy tube placement to avoid creating an overly tight fit of the gastrostomy tube within the wound. However, there is some controversy with this practice. A randomized trial assigned 50 patients to PEG tube placement with or without an abdominal wall incision [15]. There was no difference in wound healing between the two groups at seven days. Twelve percent of the no abdominal wall incision group ultimately required an abdominal wall incision for the PEG tube procedure to be completed. Our practice is to perform a skin incision as part of PEG tube placement.

Postprocedure observation — The optimal duration of observation following gastrostomy tube placement is uncertain, and data are limited. In a study including 33 patients who had gastrostomy tube placement, complication rates at three months were not significantly different between patients who were observed ≥4 hours compared with patients observed for ≥24 hours before hospital discharge. However, the impact of the duration of postprocedure observation on other outcomes (patient compliance with tube feeding and nutritional status) was not reported [16]. (See "Gastrostomy tubes: Complications and their management".)

Special settings — A number of settings may be encountered that lead to increased risk with PEG tube or radiologically inserted gastrostomy tube placement or that require modification of the standard technique.

Gastric varices — The presence of gastric varices increases the risk of severe bleeding and is generally seen as a contraindication to endoscopic or radiologic insertion of a gastrostomy tube

[10].

Prior abdominal surgery — Patients who have had prior abdominal surgery can undergo placement of a percutaneously inserted gastrostomy tube. However, extra care needs to be taken to avoid passing the tube through interposed bowel [17]. If the gastrostomy tube is being placed endoscopically, a safe access site needs to be confirmed by both finger palpation and transillumination.

Obesity — It may be difficult to transilluminate the abdominal wall in patients who are obese or have a thick abdominal wall, which may make PEG tube placement difficult. In such patients, an adequate percutaneous access site can usually be palpated. A larger bedside incision can be made, and the fat tissue spread until the anterior rectus fascia is reached, after which a standard PEG tube can be placed using conventional technique [18]. The external wound should then be closed with sutures or clips. If an appropriate site cannot be identified, options for gastrostomy tube placement include radiologic placement and surgical placement.

Use of a spinal needle (9 cm long) as the introducer needle has been described in patients who are markedly obese (BMI >40 kg/m2) [19]. In most instances, abdominal wall transillumination could not be obtained, but finger palpation could be seen on the gastric mucosa with the endoscope. As the spinal needle was advanced, continuous aspiration on the needle was maintained to monitor for entry into the colon or small intestine. A 0.025 cm guidewire was required to fit through the spinal needle. This technique has been reported with success and without complications in six patients with a BMI >60 kg/m2 [20]. (See "Gastrostomy tubes: Complications and their management", section on 'Colocutaneous fistula'.)

Pregnancy — Case reports have demonstrated safe percutaneous gastrostomy tube placement in women as late as 26 weeks of pregnancy [21]. The risk of moderate sedation must be weighed against the need for nutritional support in these patients. In addition to close involvement by obstetrical staff, an anesthesia consult can assist in delivering safe sedation [22]. (See "Gastrointestinal endoscopy in adults: Procedural sedation administered by endoscopists", section on 'Special populations'.)

Ascites — The presence of ascites in the abdominal cavity is often a contraindication to percutaneously inserted gastrostomy tube placement because of the fear of abdominal fluid leakage and peritonitis. However, gastrostomy tube placement may be possible if large-volume paracentesis is performed before and for the first week after gastrostomy tube placement, along with the use of broad-spectrum antibiotics. This approach has been described in case reports of patients undergoing PEG tube placement and has been associated with good patient outcomes [23]. There have been no prospective trials confirming the safety of this technique.

TYPES OF GASTROSTOMY TUBES

There are several types of gastrostomy tubes. It is imperative to know what type of tube is in place prior to attempts to remove or replace the tube. If the type of tube cannot be determined based on examination of the tube or the patient's medical record, then an endoscopy should be performed to confirm what type of internal bolster is present in the stomach.

Endoscopically and radiologically placed tubes — Endoscopically placed tubes typically have a soft cupped bolster within the stomach (the internal bolster) and a second bolster that is placed over the tube near the abdominal wall (the external bolster). The internal bolster will deform and allow the tube to be removed through the tract by applying traction on the tube. While less commonly used, some tubes have a rigid internal bolster that can only be removed endoscopically after cutting the tube at the skin's surface. The internal bolsters of radiologically placed tubes may be soft cupped bolsters, a pigtail configuration, or balloons.

Some tubes will have a J-tube extension (gastrojejunostomy tubes) and will thus have a Y configuration with two ports (a gastric port and a jejunal port).

Surgically placed tubes — Some surgically placed tubes have a balloon for an internal bolster along with a second external bolster, similar to radiologically placed tubes. These tubes are not sutured in place. An alternative tube for surgical placement is a Malecot tube. These tubes are sutured into place and lack an external bolster. The internal bolster is comprised of three or more wings at the distal end of the tube. In order to remove a Malecot tube, an obturator must be placed through the tube to collapse the wings for traction removal. Once the gastrostomy tract has matured (which may take up to four weeks), the tube may be removed and a replacement tube that does not require sutures can be placed. (See 'Replacement tubes' below.)

Replacement tubes — Replacement tubes have a balloon at the distal tip. These tubes should only be placed once the gastrostomy tract has matured (up to four weeks after placement). Once the tube is placed through the gastrostomy tract, the balloon is inflated. An external bolster is then placed to secure the placement of the tube. To remove these tubes, the balloon is deflated and the tube withdrawn through the gastrostomy tract.

There are also gastrostomy replacement tube devices where a flexible bolster, rather than a balloon, serves as the internal bolster. The internal bolster is distended with a rigid stylet, which is used to advance the bolster through the gastrostomy tract. The tube can be removed by applying traction to the tube. However, the stylet can cause damage to the existing gastrostomy tract on insertion if not placed properly.

A Foley catheter may also be used as a temporary replacement gastrostomy tube. This is particularly helpful if a patient's tube is inadvertently removed and a replacement tube is not readily available. The catheter is placed through the gastrostomy tract, and the balloon on the distal tip is inflated. To create an external bolster, a 2 to 3 cm piece of tubing can be cut from a second Foley catheter. A hole is then cut in the middle of the 2 to 3 cm piece of tubing, and the tubing of the replacement gastrostomy tube is passed through the hole.

Replacement tubes with skin-level buttons are also available. Like other replacement tubes, these tubes generally have a balloon at their distal tip.

If there is ever a concern about the possibility of a replacement gastrostomy tube being positioned into the peritoneal cavity, a water-soluble contrast study through the gastrostomy tube should be obtained to confirm proper position prior to the initiation of feedings.

Issues related to feeding tube adapters — The US Food and Drug Administration (FDA) has mandated a transition to products specifically designed for use with feeding tubes (eg, feeding administration set adapters, syringes) [24]. This was an effort to prevent misconnections between gastrointestinal tract devices and other medical devices (eg, intravenous line, tracheostomy, chest tube). The change in feeding-tube-related devices is known as the International Organization for Standardization (ISO)-80369-3, or by the tradename, EnFit. With the transition to Enfit products, it will be difficult for a non-feeding tube with a legacy feeding port (such as a funnel port) to be connected to any tube feeding set or syringe. This will result in limited use of devices that were not specifically manufactured for use as a feeding tube (eg, red rubber catheters, Foley catheters).

INITIATION OF TUBE FEEDS

We allow delivery of water and medications through the gastrostomy tube four hours after tube placement, with initiation of tube feeds the next day. Tube feeds have traditionally been delayed for several hours to overnight after gastrostomy tube placement because of concern that earlier feeding would increase the risk of peritoneal leakage or aspiration. However, studies have suggested that early feeding (≤4 hours after gastrostomy tube placement) may be as safe as later feeding [25].

A meta-analysis of six randomized trials with 467 patients that compared early versus delayed or next-day feeding found no statistically significant differences in patient complications or death [25]. However, an increase in gastric residual volumes during day one was noted in the early group, the clinical significance of which was unclear.

Because of the relatively small number of patients included in the trials, there is still uncertainty about initiation of tube feeds early. This was reflected in the 95 percent confidence interval for the risk of death within 72 hours in the above meta-analysis, which ranged from an 80 percent decrease in the risk with early feeding to as much as a 75 percent increase in the risk. Thus, more studies are needed before such a practice can be confidently adopted.

GASTROSTOMY TUBE CARE

Routine care — There are three major considerations with regard to routine gastrostomy tube care: ensuring that the external bolster is positioned properly to avoid compression of the tissues between the internal and external bolsters, maintaining a clean gastrostomy site, and flushing the tube to prevent clogging. To prevent inadvertent gastrostomy tube removal, external tubing should be secured so that it is not accidently pulled out (eg, as may happen with a patient with delirium or dementia). (See "Gastrostomy tubes: Complications and their management", section on 'Inadvertent gastrostomy tube removal'.)

If the tissue between the internal and external bolsters is compressed, it may lead to pressure necrosis, buried bumper syndrome, or breakdown of the gastrostomy tract. The external bolster should be positioned such that 1 to 2 cm of in and out movement can be achieved. Loose apposition of the bolster to the abdominal wall does not result in peritoneal leakage since an early gastrostomy tract forms as a result of tissue edema and associated tissue secretions. When replacing a gastrostomy tube, knowing the location of the external bolster when the gastrostomy tube was originally placed can be used as a guide to proper external bolster placement; the bolster may need to be adjusted if the patient gains or loses weight.

Gauze pads should be placed over the external bolster, **not** underneath, which would create pressure on the gastrostomy tube tract. In addition, the gastrostomy tube itself should be pushed forward into the wound slightly and rotated during daily care. This will ensure that the internal bumper does not become buried into the gastric mucosa. After rotation, the gastrostomy should be placed back into its original position.

Wound care is important following gastrostomy tube placement. As with any other surgical procedure, less manipulation is better with regard to tampering with a fresh wound. There are no prospective evaluations supporting the use of topical antibiotics as a preventative measure for wound infection following gastrostomy tube placement. For the first week following gastrostomy tube placement, we clean the wound with full strength hydrogen peroxide and cover it with a clean gauze dressing. However, this practice is not universal. Some centers prefer to avoid hydrogen peroxide since it can irritate the skin, and instead keep the site clean with

soap and water. In addition, some centers prefer to leave the wound open to the air to prevent holding moisture against the wound, provided there is no leakage around the tube.

After a week, we clean the wound with soap and water and eliminate the gauze dressing, provided there is no leakage around the gastrostomy tube that is soiling a patient's clothing. When cleaning the site, the gastrostomy tube should be inspected for signs of tube deterioration. If these develop, a replacement tube will be needed. (See 'Replacement tubes' above and 'Tube deterioration' below.)

Gastrostomy tube sites may also develop complications of hypergranulation tissue and inflammation of the skin surface from peritubular leakage of enteric contents. Hypergranulation tissue may be treated by the use of silver nitrate ablation [26]. In addition, hypertonic saline, sprinkled salt to create a hypertonic environment, and steroid creams have also been used [27]. Skin inflammation from peritubular enteric content leakage has been treated by this author with the use of skin barrier creams, including zinc oxide and silicone-based creams.

Flushes of 15 to 30 mL of water should be performed after the administration of medications or tube feeds to decrease the risk of clogging.

Gastrostomy tube removal — There are several types of gastrostomy tubes, and the methods for removing the tubes vary significantly (including tubes that are removed by placing traction on the tube, tubes that are removed after deflating a balloon at the distal tip, and tubes that must be removed endoscopically). It is therefore imperative to know what type of tube is in place prior to attempts to remove the tube. If the type of tube cannot be determined based on examination of the tube or the patient's medical record, then an endoscopy should be performed to confirm what type of internal bolster is present in the stomach. (See 'Types of gastrostomy tubes' above.)

Once the tube is removed, the gastrostomy site should be covered with a clean dressing until the gastrostomy track closes. As a general rule, the gastrostomy tract closes within 24 to 72 hours of gastrostomy tube removal. Occasionally, a fistula persists following tube removal. (See "Gastrostomy tubes: Complications and their management", section on 'Persistent gastric fistula following gastrostomy tube removal'.)

Managing dysfunctioning gastrostomy tubes — Problems that may be seen with gastrostomy tubes include clogging and deterioration of the tube.

Clogging — One of the most common problems with gastrostomy tubes is tube dysfunction secondary to clogging from medications or tube feeds. All medications should be delivered in

liquid form (if available) or dissolved in water or an appropriate liquid substance. For medications that cannot be crushed, alternatives that can be delivered via intravenous, intramuscular, subcutaneous, intranasal, or rectal routes should be sought. The prescribing clinician or a clinical pharmacist should be consulted if there are questions about giving specific medications (eg, finding alternatives to medications that cannot be crushed).

Bulking agents (eg, psyllium) and resins (eg, cholestyramine) should **never** be placed through the gastrostomy tube. Patients and caregivers should be educated in the importance of flushing 15 to 30 mL water through the gastrostomy tube after all medication and enteral formula delivery.

In the event of a gastrostomy tube obstruction, the first step is flushing the tube using a 60 mL syringe. The best irrigant is warm water, which is superior to other liquids such as juices or colas [28]. Pancreatic enzymes dissolved in a bicarbonate solution that are left to dwell within the gastrostomy tube can also be effective [29]. After two to three minutes the enzymes are flushed out with water. One option is to use pancrelipase crushed with a 650 mg bicarbonate tablet. This is then mixed with warm water in a 10 mL syringe [30]. If this technique fails, the gastrostomy tube can be cleared with an endoscopic cytology brush, a dedicated gastrostomy tube brush, or a commercial device that uses a proprietary clearing system attached to a device that generates a mechanical vibratory force.

Tube deterioration — Another common problem with gastrostomy tubes is deterioration of the tube. Deterioration can be recognized by the presence of discoloration, irregular beading of the tube, and an unpleasant odor. Although this presents no direct risk to the patient, the tube can develop leaks and break, which makes tube feedings difficult or impossible. No preventative measures have been established as being effective for preventing this problem. Our practice is to flush the tube daily with 3 to 5 mL of ethanol in an attempt to "sterilize" the tube lumen in patients who are known to have a history of rapidly deteriorating tubes. There is no absolute time period after which gastrostomy tubes should be removed and exchanged to prevent tube dysfunction. The standard of care is to permit the tubes to remain in place until tube dysfunction, such as clogging or deterioration, prevents adequate feedings or medication.

Microscopic examinations have demonstrated that tube deterioration is caused by yeast implantation into the wall of the tube [31]. A randomized trial suggested that deterioration leading to tube dysfunction was significantly more common with silicone compared with polyurethane gastrostomy tubes [32].

Early balloon deflation — Another aspect of gastrostomy tube failure is early deflation of the balloon that acts as an internal bolster. This is usually encountered with the use of balloon

gastrostomy replacement tubes. Early deflation of the balloon leads to dislodgement and loss of the gastrostomy tube. Placement of a replacement tube with a flexible internal bolster rather than a balloon resolves the balloon deflation issue.

There are no prospective data comparing one manufacturer's gastrostomy tube balloon to another manufacturer's gastrostomy tube balloon. Evaluation of gastrostomy tube materials suggest that balloons constructed of polyurethane may be more durable than balloons constructed of silicone [33].

Managing complications of tube feeds — Complications related to the administration of tube feeds are discussed elsewhere. (See "Nutrition support in critically ill patients: Enteral nutrition", section on 'Monitoring'.)

SUMMARY AND RECOMMENDATIONS

- Gastrostomy tubes may be placed endoscopically, surgically, or radiologically. The choice of procedure will depend on local resources and expertise, anatomic considerations that may affect the ability to place the tube endoscopically or radiologically, and whether the patient is undergoing surgery for other reasons. (See 'Options for gastrostomy tube placement' above.)

- There are several types of gastrostomy tubes. It is imperative to know what type of tube is in place prior to attempts to remove or replace the tube. (See 'Types of gastrostomy tubes' above.)

- We allow delivery of water and medications through the gastrostomy tube four hours after tube placement, with initiation of tube feeds the next day. (See 'Initiation of tube feeds' above.)

- There are three major considerations with regard to routine gastrostomy tube care: ensuring that the bolster is positioned properly to avoid compression of tissue between the internal and external bolsters, maintaining a clean gastrostomy site, and flushing the tube to prevent clogging. (See 'Gastrostomy tube care' above.)

    - The external gastrostomy tube bolster should be positioned such that 1 to 2 cm of in and out movement can be achieved. Loose apposition of the bolster to the abdominal wall does not result in peritoneal leakage since an early gastrostomy tube tract forms as a result of tissue edema and associated tissue secretions. If the tissue between the internal and external bolsters is compressed, it may lead to pressure necrosis and

breakdown of the gastrostomy site. (See 'Proper placement of the external bolster' above.)

- For the first week following gastrostomy tube placement, we clean the wound with full strength hydrogen peroxide and cover it with a clean gauze dressing. However, this practice is not universal. Some centers prefer to avoid hydrogen peroxide and leave the wound open to the air. After a week, we clean the wound with simple soap and water. We eliminate the gauze dressing, provided there is no leakage around the gastrostomy tube that is soiling a patient's clothing. When cleaning the site, the gastrostomy tube should be inspected for signs of tube deterioration. If these develop, a replacement tube will be needed. (See 'Replacement tubes' above and 'Tube deterioration' above.)

- Flushes of 15 to 30 mL of water should be performed after the administration of medications or tube feeds to decrease the risk of clogging. (See 'Clogging' above.)

- Problems that may be seen with gastrostomy tubes include clogging and deterioration of the tube. (See 'Managing dysfunctioning gastrostomy tubes' above.)

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GRAPHICS

Antibiotic regimens: Prophylaxis for endoscopic procedures

Procedure	Condition(s)	Antibiotic and dose*	Interval for intraoperative re-dose for prolonged procedure (timed from initiation of preoperative dose)
High-risk endoscopic procedures needing antibiotic prophylaxis¶ Δ			
PEG/PEJ placement	MRSA risk absent	Cefazolin 2 g for patients weighing <120 kg, 3 g for patients weighing ≥120 kg (pediatric dose 30 mg/kg) IV within 60 minutes before procedure. **If penicillin or cephalosporin hypersensitivity:** Clindamycin 900 mg (pediatric dose 10 mg/kg) IV within 60 minutes before procedure.	Cefazolin: four hours Clindamycin: six hours
	MRSA risk present Pre-procedural screening for MRSA and attempted decontamination before feeding tube placement is recommended if practical	Vancomycin 15 mg/kg (maximum 2 g) IV infused over 60 to 90 minutes and beginning within 120 minutes before surgical incision.	Vancomycin: re-dosing is generally not required
ERCP◇	- Biliary obstruction AND cholangitis - Biliary obstruction unlikely to be successfully drained at	Ciprofloxacin 500 mg (pediatric dose 15 mg/kg§) orally given within 60 to 90 minutes prior to procedure or	Ciprofloxacin: re-dosing is generally not required

	ERCP (including malignant hilar obstruction and primary sclerosing cholangitis) - Inadequate biliary drainage following ERCP - Biliary complications following liver transplantation if drainage is unlikely	400 mg (pediatric dose 10 mg/kg[§]) IV over 60 minutes beginning within 120 minutes prior to procedure **AND/OR**	
		Amoxicillin-clavulanate 1750 mg (pediatric dose 45 mg/kg) orally within 60 minutes prior to procedure or ampicillin-sulbactam 3 grams (pediatric dose 50 mg/kg ampicillin component) IV within 60 minutes prior to procedure **OR**	Amoxicillin-clavulanate: two hours
		Ampicillin 2 grams (pediatric dose 50 mg/kg) IV **plus** gentamicin[¥] 5 mg/kg (pediatric 2.5 mg/kg) IV within 60 minutes before procedure. **If penicillin hypersensitivity:** Substitute vancomycin 15 mg/kg (maximum 2 g) IV infused over 60 to 90 minutes beginning within 120 minutes before procedure plus gentamicin[¥] 5 mg/kg IV (pediatric 2.5 mg/kg) within 60 minutes before procedure.	Ampicillin: two hours Vancomycin: re-dosing is generally not required Gentamicin: single dose only
		ALL above regimens are discontinued post-procedure when drainage is established absent evidence of cholangitis. For antibiotic dosing post-	

		procedure with incomplete drainage, refer to the individual Lexicomp drug information monograph.	
EUS-FNA of cystic lesion(s)[‡]	- Mediastinal cysts	Ciprofloxacin 500 mg orally (pediatric dose 15 mg/kg[§]) 60 to 90 minutes prior to procedure or 400 mg IV (pediatric dose 10 mg/kg[§]) IV given over 60 minutes beginning within 120 minutes prior to procedure. Continue 3 days post-procedure.	Ciprofloxacin: re-dosing is generally not required
Interventional EUS procedures including transmural or transluminal drainage of pancreatic fluid collections	- Mediastinal cysts - Pancreatic cysts - Cysts outside pancreas (excluding solid lesions) - Walled-off pancreatic necrosis	Ciprofloxacin 500 mg orally (pediatric dose 15 mg/kg[§]) 60 to 90 minutes prior to procedure or 400 mg IV (pediatric dose 10 mg/kg[§]) IV given over 60 minutes beginning within 120 minutes prior to procedure. Continue 3 days post-procedure.	Ciprofloxacin: re-dosing is generally not required
Natural orifice transluminal endoscopic surgery (NOTES)	Insufficient data to make recommendation. Antibiotic prophylaxis seems reasonable.		
High-risk patients needing antibiotic prophylaxis[¶]			
All endoscopic procedures with high risk of bacteremia, including procedures not listed above (eg, routine endoscopy	- Immunocompromised patients (eg, severe neutropenia [absolute neutrophil count <500 cells/mm^3], advanced hematologic malignancy)[†]	Amoxicillin 2 grams (pediatric dose 50 mg/kg) orally within 60 minutes before procedure **OR**	Amoxicillin: two hours

with esophageal stricture dilation or endoscopic sclerotherapy); For procedures in the biliary tree (eg, ERCP with drainage or EUS-FNA of any lesion type) in a patient who is at high risk for infection, refer to antibiotic recommendations listed above	- Cirrhosis with ascites**	Ampicillin 2 grams (pediatric dose 50 mg/kg) IV or IM within 60 minutes prior to procedure. **If penicillin hypersensitivity:** Clindamycin 600 mg (pediatric dose 20 mg/kg) orally within 60 minutes before procedure or 900 mg IV (pediatric dose 10 mg/kg IV) within 60 minutes prior to procedure.	Ampicillin: two hours Clindamycin: six hours

The preprocedural antibiotic recommendations presented in this table are generally consistent with those of American Society for Gastrointestinal Endoscopy[1] and the 2013 guidelines developed jointly by the American Society of Health-System Pharmacists and collaborating organizations[2]. A 2009 guideline available from the British Society of Gastroenterology[3] also recommends antibiotic prophylaxis in these conditions, but includes, in some cases, different choices and dosing regimens depending upon specific clinical scenarios. When available, recent culture and sensitivity results should be considered in selecting antibiotic prophylaxis.

PEG: percutaneous endoscopic gastrostomy; MRSA: methicillin-resistant *Staphylococcus aureus*; ERCP: endoscopic retrograde cholangiopancreatography; EUS-FNA: endoscopic ultrasound-guided fine-needle aspiration; GI: gastrointestinal.

* Pediatric dose should generally not exceed adult dose. Doses shown in table are for patients with normal renal function. Dose modification for renal impairment is needed for some agents.

¶ Antibiotic prophylaxis solely to prevent infective endocarditis is **not** recommended in patients undergoing endoscopic procedures. For patients with the highest-risk cardiac conditions (eg, prosthetic heart valve, prior endocarditis) who have ongoing GI or genitourinary tract infection or who are undergoing a procedure for which antibiotic therapy to prevent wound infection or sepsis is indicated, the American Society for Gastrointestinal Endoscopy (ASGE) and American Heart Association (AHA) suggest an antibiotic regimen that includes an agent active against enterococci (eg, ampicillin, piperacillin-tazobactam, or vancomycin). Refer to topic review of antimicrobial prophylaxis for bacterial endocarditis section on gastrointestinal tract.

Δ A separate table that summarizes the types of procedures and patients needing antibiotic prophylaxis is available in UpToDate. Low-risk endoscopic procedures that do not need routine antibiotic prophylaxis in most patients (eg, routine upper endoscopy, colonoscopy, flexible sigmoidoscopy, others) are listed in that table.

◇ Patients with cholangitis require antibiotic therapy and additional prophylaxis is not required.

§ While fluoroquinolones have been associated with an increased risk of tendinitis/tendon rupture in all ages, use of these agents for single-dose prophylaxis is generally safe.

¥ Gentamicin use for surgical antibiotic prophylaxis should be limited to a single dose given preoperatively. Dosing is based on the patient's actual body weight. For overweight and obese patients (ie, actual weight is greater than 120% of ideal body weight), a dosing weight should be used. A calculator to determine ideal body weight and dosing weight is available in UpToDate.

‡ While antibiotic prophylaxis is recommended by the ASGE for all patients undergoing EUS-FNA of cystic lesions, we generally reserve antibiotic prophylaxis for patients undergoing EUS-FNA of mediastinal lesions and in those who are at high risk for infection. Antibiotic prophylaxis is not required for patients undergoing EUS-FNA of solid lesions.

† Patients at high risk for postprocedural infections may also include those with decreased gastric acidity and motility resulting from malignancy or acid suppression.

** In patients with cirrhosis and upper gastrointestinal bleeding, antibiotics are indicated even if endoscopy is not planned.

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Additional data from:

1. *Red Book: 2012 Report of the Committee on Infectious Diseases, 29th ed, Pickering LK, ed, Elk Grove Village, IL: American Academy of Pediatrics, 2012, p.808.*

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