CHAPTER 37

Feeding Tube Placement

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INTRODUCTION

Critically ill patients will almost invariably require nutritional intervention. Current guidelines support the preferential use of enteral nutrition over parenteral nutrition (1). While parenteral nutrition can effectively deliver protein and calories, it does not prevent intestinal mucosal atrophy (2,3). It is now well recognized that the healthy gut mucosal layer provides a barrier to pathogen invasion (4,5). Microbial invasion through the gut into the systemic circulation is thought to represent a major cause of the nosocomial sepsis, and possibly the multiple organ dysfunction, seen with critical illness (6–9).

Enteral nutrition is preferable to parenteral in terms of cost, complications, gut mucosal maintenance, and metabolic and immune function (10–13). However, feeding the patient via the gastrointestinal tract is not without challenges. Enteral feeding is commonly frustrated by gastric dysmotility, aspiration, diarrhea, and occasionally intestinal ileus (14). Feeding intolerance, fluid restrictions, and metabolic derangements further limit attempts to establish total enteral support. Appropriate gastrointestinal access can also be challenging to obtain and maintain, and may require surgical placement. Often, after successful access placement, feeding tubes become occluded by inspissated feeds or medications, become dislodged, or are inadvertently removed.

Mechanical complications of feeding tube placement can be life threatening. In deeply sedated or comatose patients, inadvertent placement of a nasoenteral tube into the bronchial tree is not uncommon. Percutaneous tube placement can be complicated by bowel perforation or insertion site infection. Thoughtful consideration of the appropriate tube placement method as well as careful technique will minimize complications.

Fortunately, there are a multitude of commercially available tube designs and a variety of placement techniques to meet most needs. The choice of tube type, access site, and placement technique will depend on a number of considerations including each patient’s unique requirements, clinician preference, and even available resources. This chapter will review the assortment of tube types, the differences between gastrointestinal placement sites, and the variety of access options available. In addition, it will describe the decision-making process required for choosing the best combination of tube, site, and method of placement.

DETERMINING THE MOST APPROPRIATE TUBE TYPE, SITE, AND PLACEMENT TECHNIQUE

When considering the initiation of enteral feeding, the clinician must first decide on the most appropriate type of tube to employ, the region in the gastrointestinal tract in which to place the tube, and the technique to access the lumen. Several factors influence the ultimate decision (15).

- Duration of enteral feeding
- Current status of the patient
- Coexisting medical conditions
- Functional status of the gastrointestinal tract
- Previous abdominal surgeries
- Tube brands in stock
- Availability of radiologic, gastroenterologic, and surgical support

Duration of Enteral Feeding

The initial consideration is the anticipated duration of enteral feeding. Based on the patient’s current status and comorbidity, it must be estimated whether the access requirement is to be short, intermediate, or long term. The distinction between the three classifications is somewhat artificial and there are no absolute time separations.

Short Term

Short term usually implies the need for enteral feeding for up to 2 weeks in duration. Short-term enteral feeding is commonly used for patients who tend to be free of significant underlying medical conditions, such as trauma victims and younger patients who undergo uncomplicated major surgery. In most of these patients, access requirements can be satisfied by placing the tube into the gastrointestinal tract using the nasal approach. These tubes are considered to be temporary in that they can be easily removed when they are no longer required. Placement techniques tend to be relatively inexpensive and minimally invasive, and carry a low complication rate. Although these tubes easily dislodge, replacement is usually straightforward.

Long Term

Long-term enteral access can be defined as the need to administer enteral nutritional support for an extended period of time or even permanently. Some authors describe long-term support as that requiring access for more than 4 to 6 weeks (16,17). Regardless of the time, the important consideration for these patients is that the tube needs to be more permanently secured. In most cases, nasally placed tubes are not adequate. For this subgroup of patients, tube placement tends to be more invasive and more expensive and has greater potential for complications. It also usually requires surgical or percutaneous procedures. Patients requiring long-term enteral nutrition are those whose illness is such that recovery will be delayed or permanently incomplete. These patients typically are older, have significant comorbid conditions or end-stage organ dysfunction, and have had a serious acute event.
Intermediate Duration

Intermediate duration is also a relative term but encompasses all patients with requirements for enteral feeding access for greater than 2 weeks but less than 6 to 8 weeks. These patients can be served by any of the available access routes. Though nasally placed tubes are less secure, the ease of replacement can often extend their use for the duration of their necessity. Tubes placed percutaneously or surgically tend to be considered permanent but can be removed without much difficulty should feeding access no longer be necessary. In most cases, the decision can be based on factors such as previous abdominal surgery and the availability of resources.

Site of Tube Placement and Technique

Although the patient’s current medical status and comorbid conditions indirectly influence the choice of tube by their effects on the duration of tube utilization, these factors also directly impact the choice of placement site and technique. The more critically ill patients are less likely to tolerate a surgical or endoscopic procedure. In these patients, if enteral feeding is desired, less invasive techniques such as nasal access can be used temporarily until conditions are more conducive to long-term access placement. Patients with complications such as intestinal fistulae, laparotomy wound infections, open abdomens, or sepsis from other sources also may be inappropriate for surgically or percutaneously placed tubes. Other groups at increased risk for complications with surgically or percutaneously placed tubes include obese patients and those with diabetes, cancer, malnutrition, immunocompromised conditions, end-stage liver disease, cirrhosis, ascites, renal failure, uremia, thrombocytopenia, coagulopathy states, and significant heart disease.

Inadequate gastric emptying is common in critically ill patients, occurring in roughly half of general intensive care unit (ICU) patients and up to 80% of patients with traumatic brain injury (18–20). Interleukin-1, a cytokine released during stressed states, has been shown to delay gastric emptying when administered to rats (21). Many underlying conditions such as diabetes mellitus, medication use, gastritis, sepsis, and electrolyte abnormalities also affect gastric emptying (22). Due to concerns about inadequate gastric emptying and potential aspiration, many physicians feel compelled to place the tip of the feeding tube in the small bowel. However, while postpyloric feeding has a lower incidence of gastroesophageal regurgitation and a trend toward less aspiration compared to gastric feeding (23), evidence that postpyloric feeding improves outcomes is somewhat lacking.

The Canadian Critical Care Nutrition Guidelines recommended feeding in the small bowel whenever feasible (1). Small bowel feeding improves nutrient delivery and may reduce the risk of pneumonia, although there is no difference in ventilator days or mortality compared to gastric feeding (24). Given this data, it seems reasonable to place the feeding tube postpyloric whenever feasible. However, attempts at postpyloric placement should not unduly delay the start of enteral nutrition, as gastric feedings are often well tolerated.

The extra workload and cost to place the feeding beyond the pylorus is not trivial. While nasogastric tubes can typically be placed fairly easily, placement of postpyloric tubes has historically involved multiple attempts, usually with each attempt followed with a radiograph. If the tube cannot be properly positioned with a blind technique, endoscopy or fluoroscopy may be required, the latter requiring a trip out of the unit with the associated costs and personnel requirements. Recently developed bedside techniques that improve the success of tube placement are discussed below.

BEDSIDE TECHNIQUES

Motility Agents

If gastric feeding is used, the addition of a promotility agent may be helpful. Metoclopramide increases upper gastrointestinal motility by blocking dopamine receptors. It has been shown to improve gastric emptying and decrease gastric residual volumes in ICU patients (25–27). Erythromycin, a macrolide antibiotic that is also a motilin agonist, increases gastric emptying and tolerance to gastric feeding (27–29). The commonly used dose is 200 mg, but 70 mg may be just as effective (30). Unfortunately, patients often develop tachyphylaxis to the drugs after several days, requiring close monitoring of gastric volumes and feeding tolerance (27). Safety concerns should be taken into account when using motility agents. Metoclopramide is associated with movement disorders, which may be irreversible. Erythromycin can prolong the Q-T interval and has many drug interactions.

Functional Status of Gastrointestinal Tract

The functional status of the gastrointestinal tract also may influence the technique of tube placement in other ways. Gastroesophageal disease or obstruction may preclude the ability to pass tubes nasally and may also make percutaneous tube placement using the endoscopic approach difficult or impossible. Adhesions from previous upper abdominal surgeries or the anatomic alterations seen after procedures such as gastrectomy or pancreaticoduodenectomy diminish the likelihood of endoscopic and radiologic placement and may make a surgical placement more complicated.

Hospital Resources

Hospital resources—both supplies and personnel—also influence the decision-making process. Hospitals may have a limited selection of tube products, as the cost has become a significant determinant of hospital purchasing. Because many tube designs are similar, substitutions can be successful, and the inability to obtain a specific tube should not preclude the use of enteral nutrition. Human resources also vary from facility to facility. Not all hospitals offer equal expertise in each of the support services required. The choice between radiologic, gastroenterologic, or surgical support may be based to some degree on the strength and weaknesses of these departments within the hospital.

Summary

The selection of the most appropriate tube type, access site, and placement technique for the critically ill is based on the consideration of these interrelated factors. Therefore, the final decision varies from patient to patient. Success is never
ensured but occurs most often when all of the dependent variables are considered and the approach is flexible to allow for change when the situation warrants creativity. To aid in the decision-making process, a useful algorithm is provided (Fig. 37.1).

**TUBE OPTIONS AND DESIGNS**

Currently, a large variety of tube designs are commercially available. For nasal placement, tubes tend to be thin, soft, and flexible. Most are polyvinyl chloride, silicone, or polyurethane. Many are weighted at the tip with mercury, whereas others are unweighted. Most contain a thin metal stylet to assist in placement. All are radiopaque to enable confirmation of position by radiographic study. Their soft, flexible construction and narrow diameter enables these tubes to be well tolerated by the patient. However, these tubes are prone to occlusion, particularly if feeding is interrupted without irrigating the tube free of formula and when the tube is used for the delivery of crushed or dissolved medications.

**Percutaneous**

Percutaneously placed tubes also come in a variety of commercially prepared designs. These tubes tend to be wider in diameter than those used for nasal placement, which decreases but does not completely eliminate the likelihood of occlusion. Placement requires fluoroscopic or endoscopic assistance to direct the tube into the appropriate lumen after skin puncture. These tubes are less likely to dislodge but can leak, cause pain at the insertion site, and induce a local soft tissue infection. The rubber tubes also have been known to deteriorate with time. Some models on the market have multiple lumens and ports to allow for gastric decompression and jejunal nutrient infusion.

**Jejunostomy Tubes**

Feeding tubes used for jejunal access tend to be smaller in diameter than surgically placed gastrostomy tubes but larger than the nasally inserted models. In the early 1970s, the needle catheter jejunostomy was introduced (31). This consisted of a tube similar in design to those used for nasal insertion in that it was extremely narrow in diameter. Although easy to insert, the needle catheter jejunostomy has fallen from favor because it is a poor conduit for most enteral formulas. The small tube size employed was prone to kinking and frequently was too narrow to allow rapid flow of the more viscous feeding solutions (15,32), and the small diameter did not allow for medication administration through the tube. Other acceptable options for jejunostomy placement include soft rubber tubes and biliary T tubes. Their wider internal diameter improves infusion and decreases the likelihood of occlusion. Red rubber or Robinson catheters are excellent choices. Unfortunately, these tubes are prone to dislodgement and need to be secured diligently. Balloon- and mushroom-tipped tubes are less susceptible to
inadvertent removal because their tips are wider than their shafts and anchor them in place. Although popular with some, these tubes are disdained by many. The widened tip can potentially obstruct the narrow lumen or erode the wall of the jejunum. The biliary T tube provides some of the security of the balloon- and mushroom-tipped tubes with less risk of intestinal obstruction or erosion, but must be fashioned for easy removal. As with the gastric tubes, tube deterioration, leakage, and site infection may occur.

PLACEMENT TECHNIQUE OPTIONS

The myriad techniques available for feeding tube placement ensure the potential for obtaining enteral access in nearly all critically ill patients. As stated earlier, the many factors involved in choosing the most appropriate tube type and access site also determine the technique for placement.

Nasogastric

The least complicated and quickest feeding access is the nasogastric tube. Although the stiffer, wider tubes used for gastric decompression also can be used for feeding, it may be preferable to replace these tubes with the thin, softer, more flexible tubes. Placement is similar to that of the drainage sump tubes. The tube is lubricated and then passed blindly through a nostril. It travels down the posterior pharynx into the esophagus and then into the stomach. Placement is aided by wire stylets or weighted tips. Complications are similar to those of the sump tube, such as epistaxis, rhinitis, esophageal perforation or hemorrhage, pneumothorax, and inadvertent placement into the trachea or bronchus.

Nasoduodenal and Nasojejunal

Zaloga (33) found that only 5% of weighted small-bore feeding tubes pass spontaneously through the pylorus. Manually passing the soft, thin, flexible tube across the length of the stomach and beyond the pylorus is often challenging. Often, the tube coils back into the fundus or cannot easily be negotiated through the antrum and pylorus. In most cases, the difficulty in tube advancement into the duodenum is related to the blind nature of the passage and to the inability to steer or guide the tube (Fig. 37.2). Success varies from 49% to 92% (33,34).

Several techniques have been described to aid in passage. Some authors have reported improved success with simple maneuvers such as placing the patient in the right lateral decubitus position, giving the tube a gentle clockwise twist as it is being passed, or bending the tip of the stylet (33,35). Using a dedicated feeding tube placement service, Zaloga reported a success rate of 92% with such a technique. House officers who learned the technique were able to achieve placement rates of 70% to 80%. Instillation of 10 mL/kg of air into the stomach increased the success rate of small bowel positioning on the first attempt from 44% to 92% in pediatric patients (36).

The use of ultrasound (37) or electrocardiogram (38) for locating the tip of the tube during insertion have all been described and may decrease the time of insertion and the number of confirmatory radiographs. However, these techniques do not actually guide the tube in its course. A technique using an industrial magnet to guide a magnet-tipped tube into the duodenum has also been described (39). All these techniques have reported success rates above 75%, but large trials comparing them to other techniques are lacking.

Another approach to postpyloric feeding tube placement involves the administration of a promotility agent just prior to tube insertion. Metoclopramide and erythromycin have been commonly used to increase upper gastrointestinal motility. In one study of 10 patients, metoclopramide, 20 mg IV, given 10 minutes before insertion increased the success rate of transpyloric feeding tube placement compared to placebo (40). However, a larger study using 10 mg of metoclopramide showed no benefit (41). Kittinger et al. (42) found that when metoclopramide was given after tube insertion into the stomach, it improved tube passage only in diabetic patients. The data for erythromycin are limited but more consistent. Administration of erythromycin 200 mg or 500 mg IV prior to feeding tube insertion has been shown to increase the success of postpyloric placement and to decrease the time needed for insertion (43,44).

pH monitoring has been described to facilitate passage by enabling recognition of the tube tip location (41,45). Generally, lower pH values are found in the stomach compared with the duodenum, even in patients receiving H2-receptor antagonists (33). This device may obviate the need for radiographic confirmation of tube location. Serial or continuous pH monitoring also can be used to indicate if the tube has migrated back into the stomach. Strong et al. (45) reported a 100% correlation between the radiographic documentation of tube location with the measured pH in eight patients. However, the ability to use pH values to determine location may be less accurate in the setting of H2-blocker administration or with achlorhydria, where the stomach has less acid production and, hence, higher than normal pH readings. Despite the advantages of knowing tube tip location, Heiselman et al. (41) were still only 79% successful in getting the tip of the tube beyond the pylorus.
Fluoroscopic guidance is an excellent method for placing the tip of the feeding tube beyond the pylorus (46). Because the tubes are radiopaque, they are easily seen under fluoroscopy. Tube passage can then be guided by “direct vision.” Though this technique increases the likelihood of success, it has several drawbacks: the critically ill patient must be transported to the radiology department or the radiography equipment must be brought to the ICU. The technique also exposes the patient to radiation. Endoscopy provides an alternate means of delivering the tube past the pylorus, but it is also the most invasive. After positioning the tube into the stomach, an esophagogastroduodenoscopy is performed. The tip of the tube, or a suture secured to the tip, can then be grasped with a biopsy forceps that was passed through the endoscope and dragged into the duodenum. Although this technique is effective, the tube may get pulled back into the stomach by the withdrawal of the endoscope, and the procedure places the patient at risk for all of the complications associated with endoscopy, including injury to the esophagus, stomach, or duodenum; perforation; bleeding; and aspiration. Nasoenteric tubes also can be placed at the time of laparotomy for patients requiring temporary jejunal access.

There is no consensus in the literature as to whether weighted or unweighted tubes pass into the duodenum more often. Levenson et al. (47) demonstrated that there was no apparent difference in the likelihood of tube passage between weighted and unweighted tubes. Lord et al. (48) found that with the addition of preinsertion metoclopramide, unweighted tubes were significantly more likely to pass than weighted (84% vs. 36%, respectively). In contrast, Whatley et al. (40) found that 80% of weighted tubes passed when metoclopramide was given before insertion.

Placement of a nasoduodenal tube using an electromagnetic transmitter is a relatively new technique with success rates similar to those of fluoroscopically and endoscopically placed tubes (49). A specialized stylet transmits a signal that is detected in real time by a receiver that is placed over the patient’s xiphoid process. A tracing on a monitor allows the course of the tube to be followed, providing early detection of incorrect positioning and allowing the final placement to be confirmed (50). This technology provides several potential advantages, including early detection of the tube tracking into a bronchus, quicker placement, and earlier initiation of feeding (51).

Complications of nasoenteric or oroenteric feeding tubes are not uncommon and can range from nuisances such as mild bleeding to life-threatening events. Inadvertent placement of tubes into the tracheobronchial tree has been reported to occur in 1.3% to 2.4% of insertions (52,53). Patients at increased risk of malpositioning are those who are intubated and/or sedated and those with neurologic injury (53). Tracheobronchial placement can cause pneumothorax, which may be life threatening. There are also reports of tracheobronchial positioning being misinterpreted as an enteric position, with subsequent instillation of tube feedings resulting in devastating consequences (54,55). Enteric perforation has also been reported (54). Limiting tube insertion depth to 35 cm and then taking a radiograph to confirm esophageal rather than bronchial placement before further advancement significantly reduced procedure-related pneumothorax (52).

It has been suggested that the electromagnetic feeding tube (EMFT) technique may allow confirmation of proper positioning without x-ray confirmation. Several studies have reported the safety of this practice (56,57). However, search of the FDA’s Manufacturer and User Facility Device Experience (MAUDE) database demonstrates a much more concerning picture (58). While a MEDLINE search revealed no pneumothoraces or undetected airway placement in 1,725 patients between 2007 and 2012, review of the MAUDE database over the same time period revealed 20 bronchopulmonary placements, with 17 pneumothoraces and 2 deaths. Given that the MAUDE database relies on voluntary reports, the true number of adverse events is likely significantly higher.

Even after successful nasoenteric placement, tubes easily can be inadvertently removed or pulled back into the stomach. A nasal bridle is a fairly effective method to secure the nasoenteric tube and prevent dislodgement. This device is typically a string, umbilical tape, or soft tube that goes in one nostril, wraps around the nasal septum, and comes out the other nostril. The ends of the string are tied to the tube. In a randomized study, briding of a nasojejunal feeding tube resulted in lower rates of unintentional dislodgement (18% vs. 63%) and a higher percentage of goal calories (78% vs. 62%) (59).

Percutaneous Gastrostomy

Although surgically placed gastrostomy tubes were long the gold standard for obtaining stable, long-term gastric luminal access, numerous published reports demonstrate that percutaneous placement offers all of the same advantages but with a significantly lower complication rate. This technique involves the placement of an access tube into the gastric lumen using a direct puncture of the skin and abdominal and gastric walls. Endoscopic or radiographic assistance is essential. Percutaneous endoscopic gastrostomy (PEG) tube placement generally requires one of two techniques, termed push and pull. There are numerous commercially available insertion kits that contain the tube and the equipment necessary for placement. A formal esophagogastroduodenoscopy is performed first to rule out upper gastrointestinal disease that precludes tube placement. The endoscope is then steered against the anterior gastric wall to transilluminate the stomach’s position through the abdominal wall and skin. If successful, a small needle is then passed through a skin puncture into the gastric lumen. With the pull technique, a long nylon guidewire is inserted through the needle and grabbed with a snare that was fed through the endoscope. The guidewire is then dragged out of the patient’s mouth and used to guide the tube down the esophagus, into the stomach, and out through the skin. With the push method, the catheter is passed directly over the guidewire with a peel-away sheath.

The incidence of major complications with PEG is generally described as between 1% and 3%, and the reported mortality rate is about 0.5% (60,61). Complications include colonic injury, gastric perforation, hemorrhage, leakage with peritonitis, necrotizing fasciitis, and skin infection (62,63). In addition to having a lower complication rate than the open technique, the PEG procedure has been shown to require less time (10–30 minutes) to perform and has a lower cost overall (61,64,65). It also can usually be performed under local or intravenous sedation. Conditions that preclude the ability to perform upper endoscopy such as obstruction, varices, and severe Candida esophagitis are contraindications to this procedure. Relative contraindications include ascites—with
its attendant risk of peristomal leakage as well as peritonitis from gastric leakage—and previous upper abdominal surgery, because the adhesions that form after surgery may prevent the stomach from being manipulated up to the abdominal wall. If transillumination cannot be achieved, the procedure should be aborted.

An alternative method for percutaneous gastrostomy is the radiographic approach. The stomach is distended with air using a nasogastric tube. Radiopaque contrast is then instilled in the stomach to enable it to be seen with fluoroscopy. The abdominal wall then can be pressed down onto the stomach. A needle is passed into the lumen and a guidewire inserted through the needle. The tract is dilated to the appropriate diameter and the tube is pushed into the lumen. This technique eliminates the need for endoscopy; however, many of the same contraindications and complications apply. In addition, this method does not allow inspection of the mucosa before tube placement or direct visualization of tube position after it is in place.

**Percutaneous Jejunostomy**

For patients with a significant risk of aspiration or abnormal gastric motility, specialized two-lumen tubes can be placed through the stomach, with a gastric port for decompression and an extended jejunal limb for feeding. These tubes can be inserted either by the endoscopic technique or with radiographic assistance (66). Alternatively, feeding tubes can be placed directly into the jejunum, using a technique similar to that of a PEG. With proper patient selection and experienced providers, percutaneous endoscopic jejunostomy can be a safe and effective procedure. In one center, a 90% success rate was achieved, with a low rate of adverse events and no mortality (67).

While early reports of percutaneous endoscopic jejunostomy placement noted high rates of complications (68–70), more recent reports suggest much lower rates (67). Complications include bowel perforation, peristomal infection, leakage around the stoma, bleeding, and tube dysfunction (67,69). Occlusion is often secondary to inspissated feeding solutions or the use of the tube to deliver crushed tablets. Proper use and maintenance of the catheters should minimize these problems.

**Surgical Jejunostomy**

Like the surgically placed gastrostomy, the technique for open jejunostomy tube placement is generally safe; however, it can be more risky in patients who have had abdominal surgery, and typically requires general anesthesia. The most commonly employed techniques minimize the risks of leak from the bowel around the tube by either placing a purse-string suture around the tube (Stamm) or creating a serosal tunnel from the bowel wall overlying a portion of the tube (Witzel). After tube insertion into the jejunal lumen, the bowel is plicated to the undersurface of the anterior abdominal wall with three to four silk sutures placed circumferentially around the tube to further minimize the risk of leak and peritonitis (Fig. 37.3). The bowel is also carefully positioned for plication to prevent kinking or tube erosion.

To facilitate tube placement and minimize the risk of leak, the needle catheter jejunostomy technique was developed. It was first described by Delaney et al. (31) in 1973 as a safe and simple alternative to standard jejunostomy tube placement.

**Surgical Gastrostomy**

Before the development of safe and effective methods for percutaneous tube placement, surgical techniques were the most commonly employed. After entering the abdominal cavity, a large-bore tube is placed directly into the gastric lumen and then pulled through the abdominal wall and out through the skin. The tubes used are usually balloon or mushroom tipped to prevent dislodgement. To minimize the risk of leakage and peritonitis, the tube is secured with two or three concentric purse-string sutures, and the anterior wall of the stomach is tacked to the undersurface of the abdominal wall to obliterate any potential space around the tube. This technique is generally referred to as the Stamm gastrostomy. While traditionally an open procedure, gastrostomy placement may also be performed laparoscopically (71).

The overall complication rate varies from 2.5% to 24% in the literature, with a major complication rate of about 10% (60,61). However, the wide range may be more indicative of the severity of illness of the patient populations than from the procedure itself. In addition to the complications associated with any gastric tube, surgical placement adds the increased risks associated with surgery and anesthesia. For patients requiring laparotomy for other reasons, the gastrostomy tube can be inserted at that time with minimal additional time or morbidity. However, for patients not requiring abdominal surgery, this technique requires a laparotomy and an anesthetic. In patients without previous abdominal surgery, the procedure can be brief and limited. The incision type can be either limited vertical midline or small left upper quadrant transverse one. Some surgeons can perform this procedure with local anesthesia, which avoids the risk associated with general anesthetics. Patients who have had previous abdominal surgery may pose a greater risk for complications because the procedure may be more involved. Adhesions—scar tissue that forms in the abdominal cavity as a result of surgery—may extend the incision size and the length of time necessary for tube placement. In addition, it increases the likelihood of injury to the stomach or intestines.
This method employs a narrow tube that is inserted by needle puncture through the antimesenteric border of the jejunal wall obliquely to create a subserosal tunnel. The tube is secured with a purse-string suture and then passed through the abdominal wall and skin. Few major complications were reported with this technique. Page et al. (72) had a 1% major and 1.5% minor complication rate in 199 patients. As stated earlier, these tubes tend to be unreliable and therefore are unpopular with many surgeons.

More commonly used is a large-bore, soft flexible catheter with additional holes placed into the jejunal lumen with a single purse-string suture. A biliary T tube can also be used for jejunal feeding, and is less likely to dislodge than the straight tube (Fig. 37.4). The limbs are each cut to approximately 3 cm in length and the back of the T limb is slit lengthwise to facilitate removal. After tube insertion into the jejunal lumen, the bowel is plicated as described earlier.

As with gastrostomy tube placement, laparoscopic insertion techniques also have been developed. One such procedure attaches the jejunum to the anterior abdominal wall with four specially designed T fasteners. After this is completed, a large-bore needle is inserted into the jejunal lumen. A guidewire is then threaded through the needle and the catheter passed over a guidewire with the use of a peel-away introducer (73).

Jejunostomy tubes often become occluded, leak, or are removed either deliberately or inadvertently. Replacement is most easily performed with fluoroscopic assistance and should be attempted as soon as dislodgement is noted to prevent the tract from closing (67). This technique may even be successful for reinserter tubes that have been removed in the distant past. Because the jejunal limb used for the jejunostomy is routinely fixed to the undersurface of the abdominal wall, luminal access can be achieved by passing a needle catheter through the skin site or scar. Once the tip of the needle is in the lumen, a long guidewire is then directed into the lumen and used to direct the tube.

### SUMMARY

Enteral nutrition is fully recognized as an important addition to the comprehensive care of the critically ill and the preferred means of nutritional support. However, the successful establishment of secure and dependable enteral feeding access may be challenging. Several factors, including the patient’s current condition, past medical and surgical history, status of the gastrointestinal tract, and hospital resources available to the clinician determine the best tube type, access choice, and placement method. Fortunately, several options are currently available so that there should be few reasons—short of gastrointestinal tract dysfunction—that preclude the use of enteral nutrition.

No single enteral access combination is superior to the others. Using a flexible strategy based on the unique characteristics of the patient and the patient care environment will maximize the likelihood of success. Persistence also pays dividends. Failure of one attempt should not be a cause to abandon enteral feeding. A fresh new approach, possibly using another access option, may ultimately succeed. Only with patience, determination, and an understanding of the available access options will the greatest number of critically ill patients reap the benefits of enteral nutrition.

### Key Points

- The initial consideration for determining the choice of an enteral access system is the anticipated duration of enteral feeding.
  - **Short term**: Patients predicted to need enteral feeding for 2 weeks or less are said to have short-term requirements. These patients are best served with bedside placement of a nasoenteric tube.
  - **Long term**: Patients thought to need enteral feeding for greater than 6 to 8 weeks are described as having long-term requirements. Percutaneous or surgically placed tubes are most appropriate for this subgroup of patients.
  - **Intermediate**: Patients with the anticipated need for enteral feeding for greater than 2 weeks but less than 6 to 8 weeks are said to have an intermediate requirement. These patients are well served by nasally, percutaneously, or surgically placed feeding tubes.

- Roughly half of critically ill patients have gastric emptying dysfunction. For these patients, enteral tubes may need to be placed beyond the pylorus.

- Several bedside techniques have been described to aid in achieving postpyloric placement of tubes inserted through the nose. These techniques are highly successful in experienced hands.

- While fluoroscopic or endoscopic support may be necessary for passing the tip of the nasoenteric tube beyond the pylorus, newer techniques such as the use of electromagnetically guided tubes provide similar success rates. However, even with the assistance of these modalities, success is not guaranteed, and complications still occur.

- Percutaneous gastrostomy has been shown to be less costly and less time consuming, and has fewer complications than surgical gastrostomy.
• While bolus gastric feeding may occasionally be used, continuous infusion of enteral feed is better tolerated than bolus feeding.
• Surgically placed jejunostomy tubes are excellent for long-term infusion feeding, but expose the critically ill patient to the risks and complications of an operative procedure.

References


