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Enteral Nutrition: Options for Short-Term Access

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Abstract

The preferred method of nutrition support in the presence of a functional gastrointestinal tract is enteral nutrition (EN). Many factors contribute to the selection process for the type of enteral access device to be used. Short-term enteral access tubes are placed into the nares or, sometimes, orally, usually at bedside. The short-term access provides a means to meet patient nutrient needs and can provide a chance to assess tolerance of the tube feedings if more permanent long-term placement is determined to be required. Access for nutrition support does not come without a risk; it can be challenging, requiring an individualized approach for each patient. The selection type and access location can greatly impact the success of EN. The most advantageous tube choice must be determined carefully, taking into account the multiple considerations reviewed in this paper. (*Nutr Clin Pract.* 2018;33:170–176)

Keywords

enteral nutrition; feeding tube; gastrointestinal intubation; gastrostomy; jejunostomy

Enteral nutrition (EN), also known as tube feeding, is administered through the gastrointestinal (GI) tract usually from a tube, catheter, or stoma. If the GI tract is functional, EN should be the first option vs parenteral nutrition using venous access. Enteral access provides means for short-term or long-term delivery of nutrition into the GI tract of patients who cannot maintain adequate nutrient requirements.[1] The 2016 Society for Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN) Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient recommend that early EN begin within 24–48 hours in the critically ill patient who cannot consume adequate oral nutrients.[2] Nutrition therapy in critically ill patients has been shown to help improve wounds, reduce complication rates, and improve mortality.[3] Nutrition support in the form of EN is also of benefit for the non-critically ill patient as well, although the critically ill are usually beginning EN with short-term enteral access compared with a long-term enteral access route that may be more permanent. Although patients in the intensive care unit (ICU) often require nutrition support in the form of EN, the information in this review can be applied to all hospitalized patients requiring short-term enteral access. Ideally, enteral access should be easily obtained, effective in delivery of EN, inexpensive, and confer low rates of morbidity and mortality. A variety of delivery methods are used for patients who are unable to consume oral intake for their nutrition. A multidisciplinary approach that often includes multiple clinicians, such as dietitians, nurses, pharmacists and physicians, is a good approach to determine the best needs of the patient. This review focuses on short-term enteral access using nasoenteric tubes.

History

The earliest record of tube feeding was found in papyrus, 3500 years ago. Often enemas were used to infuse nutrients because rectal feeding was the method of choice for thousands of years due to the difficulty accessing the upper GI tract.[4] Feeding in the upper GI tract was documented as early as the 12th century. The Levin tube, a large-bore gastric catheter, was developed in 1921 and was used for decompression or feeding via a single lumen.)[5,6] Until the 1960s this was a common gastric feeding tube; today smaller and stiffer tubes made of PVC are available. The nasogastric tube (NGT) is still commonly used for short-term enteral access; it is relatively simple and inexpensive and does not require additional devices or materials for placement.[5] In 1910, Einhorn experimented with feeding directly into the

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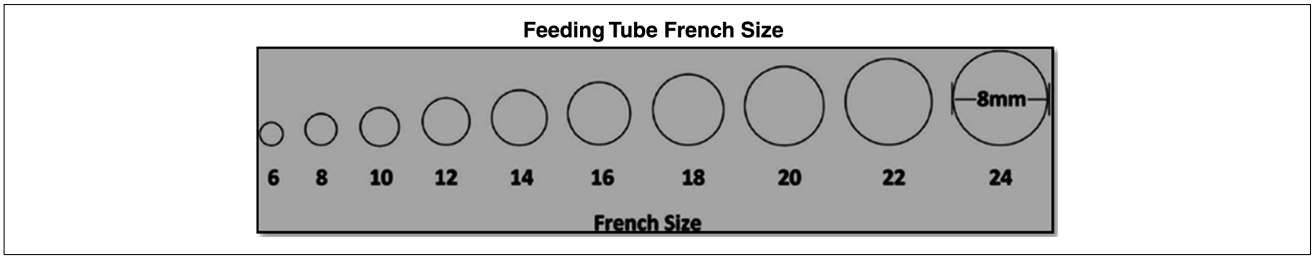

Figure 1. Adapted from, Kozeniecki M, Fritzshall R. Enteral nutrition for adults in the hospital setting. *Nutr Clin Pract.* 2015;30:634–651.

small bowel.[4] After following patients who had his rubber tube inserted and used, he concluded that feeding into the duodenum had many advantages vs rectal feeding.[4,5] This was the beginning of small bowel feedings, while a majority of patients still received gastric-only feedings.

Selection

The patient's disease state, GI anatomy, function, and accessibility, as well as expected duration of therapy should be considered for selection of a short-term enteral access device.[1] Short-term access is usually reserved for patients requiring EN for up to 4–6 weeks. Often, short-term access is used in the ICU, but it also has a place with cancer, trauma, and neurologic patients that may only require short-term nutrition on a more temporary basis. Placement considerations include going through the nose or mouth with the feeding tube tip terminating within the stomach, past the pylorus, or distal to the ligament of Trietz. Nasoenteric feeding tubes are any feeding tubes that are inserted nasally, compared with those inserted orally (oroenteric). More specifically, nasoenteric or oroenteric feeding tubes are often referred to as nasogastric/orogastric, nasoduodenal/oroduodenal, nasojejunal/orojejunal, and nasogastric-jejunal tubes because they are the typical selections based on desired end tip location. Nasoduodenal and nasojejunal are also referred to nasointestinal. For EN therapy lasting >4 weeks, more permanent access options include gastrostomy, jejunostomy, and gastrojejunostomy tubes. Long-term enteral access is generally required for individuals who cannot consume or tolerate oral nutrition intake for an extended period. For all patients who require an enteral access device, close monitoring is required to maintain patient safety and to prevent events such as inadvertent tube displacement.[1] The 2016 SCCM/ASPEN guidelines for the provision of and assessment of nutrition support suggest tube feeding delivery to be postpyloric in critically ill patients with aspiration risk or patients who have exhibited intolerance to gastric feedings.[2] According to consensus, it is acceptable to initiate EN in the stomach of critically ill patients without risk.[2] A thorough medical history and focused physical assessment, including the anatomy and upper airway functionality (including esophagus and GI tract), is imperative for the selection of the appropriate enteral access device.[7] Proper patient review and assessment is critical prior to tube placement. Additional consideration should be given to any contraindications regarding the nasal/oral passage of tubes, including skull fracture, bleeding risk (including coagulation values), esophageal varices, and recent banding.

Tube Qualities and Composition

Enteral access devices often vary with composition and elements of tubing material and size, which is measured using the French (Fr) scale. Most manufactured feeding tubes that are commercially available are made of polyurethane or silicone. The Fr size is a measure of the external diameter of a catheter. One Fr unit is equal to 0.33 millimeters. Thus, the larger the Fr, the larger the catheter.[1] The most common tube sizes used in the adult population range from 8 Fr–24 Fr (Figure 1).[1] Large-bore (≥14 Fr) tubes are typically comprised of stiff polyvinyl material and are least likely to clog, compared with a smaller bore feeding tube. Large-bore tubes are more reliable when aspirating gastric contents, but they are not indicated for primary use as an enteral feeding tube. According to manufacturer guidelines, they are indicated for suction, lavage, and/or decompression. Despite specific indications for use, sometimes a large-bore NGT may be used to deliver EN. Tubes with an indication for enteral feeding (enteric tubes) are often small bore (8 Fr–12 Fr) and made of silicone, polyurethane, or a mixture of both components (Table 1). They are softer, a bit pliable, and more comfortable for the patient, but they are more prone to clogging and difficult to use for aspiration of gastric contents due to their smaller diameter.[1] Nasoenteric/oroenteric tubes, which are specifically indicated for EN, come in a variety of sizes and lengths (Table 1).[7] Some enteric feeding tubes have weighted tips, while some do not. Critical analysis of the literature does not demonstrate a clear advantage with the use of weighted or unweighted tips. It is commonly believed that weighted tubes are easier to pass into the small bowel when they are placed blindly; however, non-weighted tubes have actually been shown to

Table 1. Short-Term Enteral Access: Tube Type.

	Large-Bore NG/OG Tubes	Small-Bore NG/OG Tubes
French size	5-24	5-10
Material	Polyvinyl	Silicone, polyurethane, mixed
Tube tip location	Gastric	Gastric, small bowel
Intended use	Gastric decompression, lavage	Enteral feeding
Insertion	Bedside	Bedside, endoscopy, fluoroscopy, radiology, magnetic guidance

NG, nasogastric; OG, orogastric.

pass at a more successful rate.[8,9] The choice is left to the clinician placing the feeding tube, based on their preference for mode of placement.

Orogastric/Nasogastric Tubes

Oral and/or NGT are large bore in nature and are different from oroenteric/nasoenteric feeding tubes that are indicated for EN as described in the tube type section of this paper. NGT, which can also be placed orally (orogastric), have limitations due to patient discomfort and are more suitable in intubated and sedated or chemically paralyzed patients.[1] NGT are the least difficult to place. Usually they can be placed by a clinician of all levels of training. NGT (Salem Sump, Cardinal Health, Dublin, OH) are commonly used for gastric decompression, medication administration, gastric pH, or residuals.[8] The 2016 SCCM/ASPEN guidelines no longer recommend checking gastric residual volumes as a sign of tolerance.[2] However, in practice, residuals may still get checked via an NGT. Using the hard, plastic like, large-bore tubes of stiff polyvinyl does allow the practitioner an early opportunity to gain quick access into the stomach to start EN as soon as possible.[9] The oro/nasogastric tube provides a temporary delivery route that can be immediately used, following correct placement confirmation.[9] Large-bore NGT, when used for tube feeding, should be replaced with a more pliable tube with a smaller diameter tube within 5–7 days to help reduce morbidity and improve patient discomfort.[1,9] They can also provide opportunities to assess patient tolerance of EN prior to placement of permanent feeding tubes. In patients with facial or cranial trauma, NG tubes are contraindicated because they may be inadvertently passed through the cribriform plate into the cranium.[6] In such situations an orogastric tube should be used. Mucosal trauma on insertion can cause bleeding (especially the nasopharynx). Other complications, such as pharyngeal or vocal cord paralysis, rhinorrhea, sinusitis, nasal irritation with erosion of the nasal skin or septum, and otitis media, can occur. Additional morbidity affiliated with NGT placement and feedings include malposition of the tube that can result in a pulmonary injury (including pneumothorax, pneumonia, and empyema); laryngeal, pharyngeal, esophageal, and gastric ulcerations or perforations; esophageal strictures; tracheoesophageal fistula; ruptured gastroesophageal varices with bleeding; and gastroesophageal reflux with aspiration and pneumonia[6,11] Despite listed morbidity risk, NGTs are advantageous for overall ease of insertion, low risk of the incidence of complications, and relatively low cost.

Oroenteric/Nasoenteric Tubes

Enteric feeding tubes are tubes made for and indicated for use in EN in both gastric and small intestine regions, such as the duodenum and jejunum. They are ideal for short-term feeding, especially patients at risk for aspiration, reflux, and gastric emptying delay. Oroenteric and nasoenteric feeding tubes can be placed bedside or using endoscopic or fluoroscopic techniques. Bedside placement of nasoenteric (gastric or small bowel) feeding tubes can be achieved without the use of technology; however, use of certain technology has demonstrated success rates as high as 90%.[1,10-19] Stylets or guidewires are provided with most enteric feeding tubes to provide structure and guidance during placement. They are designed to be shorter than the length of the tube and to have a flexible distal tip to avoid perforation into the GI mucosa.[7] Water-activated lubricant may be used to coat the feeding tube's internal lumen for ease of use and removal of the guidewires. As a rule, confirmation of the feeding tube tip position should be obtained before commencement of EN. Complications that may arise from oroenteric or nasoenteric tube placement include epistaxis, sinusitis, esophageal perforation, and unintentional placement into the bronchopulmonary tree.[1,19] Enteric feeding tubes have either 1 port for feeding or 2 ports that are in a "Y" configuration: 1 for feeding and 1 for medication. The ports can accommodate a feeding syringe or feeding set.[7] Certain tubes are considered to be self-propelling and are blindly placed and constructed to aide when the desire is postpyloric.[8] The design is intended to mimic and help peristaltic migration through the pylorus. Various manual, bedside feeding tube placement techniques for inserting nasoenteric tubes have been defined with variable success rates. The easiest and most common technique is a simple insertion of the feeding tube into the stomach. After placement into the stomach, with time, the feeding tube is usually able to passively progress spontaneously into the duodenum. Modification of small-bore feeding tubes include different tip shapes, i.e., various sizes and weights and composition, that are attached to the tip of the tube to promote spontaneous passage of the feeding tube into the small intestine.[6]

End Infusion Location

According to the 2016 SCCM/ASPEN guidelines, the end location of enteral infusion into the stomach, duodenum, and/or jejunum can be determined within each ICU patient or particular practitioner based on experience and use of feeding tube placements within policy and procedures.[2] Critically ill patients often require enteral feedings as their primary source of nutrition. Whether EN should be delivered as a gastric vs small bowel feeding in the critically ill patient population remains a contentious topic. Davies et al compared early nasojejunal with nasogastric feedings in critical illness. Davies et al[3] found no difference in clinical outcomes between the gastric-fed group and small bowel group. There was no difference in length of stay, mortality, caloric and protein delivery, and incidence of pneumonia in the largest multicenter randomized controlled trial (RCT).[2] Six trials showed increased nutrient delivery with small bowel feedings (weighted mean difference = 11.06%; 95% confidence interval [CI], 5.82%–16.30%; $P <$ .00001), and 12 trials showed a risk reduction of pneumonia compared with gastric EN (relative risk = 0.75; 95% CI, 0.60–0.93; $P = .01$).[2,3] Metoclopramide and erythromycin were given to both nasojejunal and nasogastric groups. The mechanically ventilated patients with mildly elevated gastric residual volumes, conservatively defined as >150mL and who were already receiving nasogastric feedings, did not have increased energy delivery or reduction of pneumonia.[3] It was noted that a high proportion of the nasogastric group received metoclopramide or erythromycin, which may have explained why they received >70% of energy needs and lack of benefit experienced by the early nasojejunal group.[3] Previous RCTs of ICU nasojejunal vs nasogastric infusions have shown increased energy delivery in the nasojejunal group.

Although there is no change in mortality or length of stay between small bowel and gastric feeding proven in the literature, the notion of feeding into the small bowel is believed to decrease the possibility of pneumonia. Since aspiration pneumonia is a significant EN-related complication that may affect patient outcomes, it is important to recognize aspiration risk factors, such as mechanical ventilation, supine position, neurologic deficits, impaired level of consciousness, advanced age, and gastroesophageal reflux disease.[16-19] However, aspiration risk itself is not an absolute contraindication for gastric EN, as patients who exhibit some of the risk factors for aspiration may still tolerate gastric EN.[16] When routine placement of small bowel feeding tubes is not feasible, it is important for the clinician to be able to recognize patients who will achieve the most from the additional effort required to provide small bowel feeding.[16] The SCCM/ASPEN guidelines suggest that when timely access of feeding tube placement into the small bowel is not possible, early EN into the stomach may provide more benefit than delayed initiation of feeding while awaiting access into the small bowel.[2] SCCM ASPEN, the European Society for Parenteral and Enteral Nutrition (ESPEN), and the Canadian Clinical Practice Guidelines (CCPG) are not in consensus on preferred routes of gastric vs small bowel. No research to date demonstrates a significant difference between the 2 feeding routes in terms of patient mortality, ventilator days, or ICU length of stay; however, studies provide some evidence that there may be additional benefits to using a small bowel feeding route in critically ill patients.[16,17] A recent meta-analysis from Li et al[17] in China analyzed 8 RCTs that included 838 mechanically ventilated patients. They discovered that upon review, patients with postpyloric feeding had a lower incidence of ventilator-associated pneumonia compared with gastric feeding. No other differences were observed in other outcomes, such as time on vent, length of stay, or mortality.[17] While guidelines can help steer practice, staying current with new research on this topic is essential. With the conflicting information that exists regarding how to best provide EN, the decision is at the discretion of the institution and the judgment of the clinician.[16] There are contingent advantages to each tube location, with clinical practice based more on preference than on evidence.

Gastric Feeding

EN therapy that is introduced in the stomach can be easier than small bowel access and may decrease the time to initiation of EN.[2] Access into the stomach is often easier because the tube does not need to make the turn and advance past the narrow opening of the pylorus. Gastric feeding is usually reserved for patients with a normal gastric emptying and a normal GI tract with low risk of aspiration. The SCCM/ASPEN guidelines state that if prompt achievement of an enteral access device into the small bowel is not performable, early EN through the gastric route may provide more benefit than delayed feeding initiation while awaiting access into the small bowel.[2]

Small Bowel Feeding

Delivery of nutrition into the small bowel may be preferable to gastric because it has more of an absorptive capacity and is less subject to impaired gastric motility.[3] Small-bowel feeding-tube placement may also allow for adequate infusion of EN in ICU patients who are typically believed to be inappropriate for early initiation of nutrition or are unable to tolerate goal-rate infusion via the gastric route.[17] Small bowel feeding is not without complications. Severe complications can occur, adding increased risk of morbidity and mortality if a feeding tube is placed blindly, becomes malpositioned, or if enteral formula is delivered into a

feeding tube that does not reside within the GI tract.[10] A main benefit of small bowel feeding is the immediate use of the small intestine postoperatively. The small intestine is the first portion of the GI tract that regains function and absorptive capacity, and it returns with motility within 6–8 hours.[6] Gastric decompression can be done if needed while simultaneously feeding into the small intestine.[6] It is believed that since nasojejunal nutrition is delivered further down into the GI tract, the risk of pneumonia from regurgitation is reduced, as well as gastric residual volumes, thus leading to fewer interruptions of EN delivery. Small bowel feedings are the preferred method in certain conditions, such as a gastric outlet obstruction, gastroparesis, and risk of aspiration.[7] Nasoenteric access in gastric outlet obstructions can be difficult to place and sometimes require longer term access, for example, a jejunostomy in some instances. The use of gastrojejunal tubes allows for simultaneous gastric decompression and feeding into the small bowel. There is some consensus that small bowel feeding may help with increased delivery of nutrition due to decreased interruptions of infusion via a gastric tube that may be stopped for medication, lavage, or even pulled out or removed.[17,18]

Small Bowel Feeding Methods

Clinicians use various methods for insertion of small-bore feeding tube into the small bowel, such as blinded, endoscopy, fluoroscopy, radiology, and magnetic guided. Success rates of 80% or more can be achieved when a well-trained clinician places the small-bore feeding tube at the bedside.[9] Cresci and Mellinger[5] reported the highest success rate at 95% for bedside placement completed blindly. Although there is clear advantage of blind placement technique without the need for anesthesia and sedation, there is risk. A recent review of 5 trials of 9931 nasoenteric tubes by Sparks et al[10] saw a malposition rate of 1.9%, and 20% of malpositioned tubes caused pneumothorax, with 5 deaths blamed due to the complication. Each clinician has his/her own individual technique. Bending the stylet, placing the patient in a right lateral decubitus position, rotating the feeding tube clockwise while attempting to pass through the pylorus ("corkscrewing"), filling the stomach with air, and adding air through the feeding tube during advancement are familiar techniques used by a variety of clinicians to aid with bedside placement.[6] All insertion methods can be combined with various techniques and the use of pharmacologic agents. At present, there is not a preferred or leading method for gaining proper placement at the bedside for each facility.

Pharmacologic Measures

Medications with promotility properties have been used to assist advancement of feeding tubes into the small bowel. Prokinetics are often added to bedside placement techniques to help increase successful placement.[7] Because it increases peristalsis, metoclopramide IV appears to be most effective when given 10–15 minutes before tube insertion. Erythromycin also has promotility properties and can be used for tube placement. In adults, an IV dose of 500 mg administered prior to tube insertion has been shown to facilitate placement.[8] Use of pharmacologic agents are usually within the 10-10-10 protocol, wherein the patient is given 10 mg of metoclopramide 10 minutes prior to the initiation of the procedure.[5,7,8] The small bore feeding tube is placed leaving only 10 cm of tube out of the nare.

Fluoroscopy and Radiologic Techniques

Procedures can be performed in the radiology department or at the bedside if portable fluoroscopy is available. Some ICUs have fluoroscopy procedure rooms and even ICU rooms that have radiologic capability. Fluoroscopy has shown greater success with postpyloric placement and is similar in cost compared with blind placement.[9] An average time of 22 minutes during the fluoroscopy procedure has shown a 53% success rate for jejunal positioning.[5] Placement into the distal duodenum has been documented as successful in 86% of cases, with reported aspiration rates of only 2%.[5] C-arm fluoroscopy, a placement option for critically ill patients, uses a fixed piece of X-ray equipment that is portable and mobile for use in a patient's room, procedure room, or operating suite. When available, bedside fluoroscopy with a portable C-arm imaging unit eliminates patient transfer complications.[11] Fluoroscopic placement of jejunal feeding tubes at the bedside is fast, safe, and has a high success rate when performed by well-trained ICU staff. Using this method is more efficient in the ICU when no gastroenterologist is available for endoscopy.[12]

A substitute to fluoroscopic feeding tube placement is the use of bedside ultrasound guidance. It has recently been shown as an alternative.[5] The advantage of this technique is that it is highly portable and involves no radiation exposure. Placement is performed with a stylet in place, using intermittent saline or water injections that show ultrasonic tube localization. Postpyloric placement rates substantially improved compared with standard bedside methods, including a documented jejunal placement rate of 42% with an average procedure time of 18 minutes.[5]

Endoscopy

Endoscopy can facilitate feeding tube positioning into the small bowel. Tubes guided with endoscopy allow for immediate assurance that the tube is in the GI tract and allows for distal guidance under direct visualization. This is often accomplished with transnasal endoscopy or a standard endoscope using specialized techniques that

transfer the guide wire from the oropharynx to the nasopharynx.[9] As endoscopy is done under direct visualization, X-ray confirmation may not be needed; however, friction from the endoscope may drag tubes back as the endoscope is removed. In such instances, post-procedure radiographs are recommended.[8] It may be difficult to achieve postpyloric placement beyond the ligament of Treitz in some cases. Often in the ICU it is time consuming to obtain a GI consult wherein the gastroenterologist comes to the ICU to perform bedside placement via endoscopy, including the tower of equipment needed to place the feeding. This method is commonly reserved for difficult to place postpyloric feeding tubes, often after other methods have been exhausted. The method in the ICU has demonstrated success, but there is limited data on success in the non-ICU patient using transnasal endoscopic placement of nasoenteric feeding tubes. Mahadeva et al[18] collected data on non-ICU patients with GI disorders undergoing transnasal endoscopic placement. Results showed that attainment of postpyloric placement allowed for sufficient EN in the non-ICU patient with GI dysfunction.[18]

Magnetic/Signaling Devices

Other bedside methods are available for short-term feeding access. Such methods include carbon dioxide (CO_2) sensing, direct visualization using a tube and a camera, and electromagnetic devices. Such methods allow the clinician to have a general reference of position. Alternative strategies for safe nutrition support into the small bowel include a "signaling" device system (CorTrak®2 Enteral Access System [EAS],™ Halyard Health, Alpharetta, GA). The system uses a tube that contains an electromagnetic transmitter at the distal tip. The distal tip location is detected using an external receiver and monitor. The feeding tube contains a stylet with an electromagnetic tip which sends a signal to a receiver placed over the patient's xiphoid process. An image is created from the signal that was sent via a sensor at the tip of the feeding tube stylet and shown on a monitor. Location of the feeding tube tip placement is shown on the monitor's screen in 1 of 4 quadrants that correspond with the patient's anatomy.[11,13-16] To have correct placement in the stomach, the electromagnetically guided nasogastric tube (e-NGT) must follow the midline of the screen and end in the right lower quadrant of the screen (marked anatomically as the lower left quadrant), below the horizontal line indicating the diaphragm.[11,13,14] Deviations into the upper right or left quadrant are considered a diversion into the respiratory tract.[14] Baskin[11] reported that Powers et al found 99% agreement between the radiograph and device location of the feeding tube. The electromagnetic device system was reported to be equivalent to direct visualization of postpyloric placement from endoscopy. Other studies reported a reduction in time to place feeding tubes to commencement of EN delivery as well as fewer X-rays, therefore decreasing cost.[11] Bear et al[13] retrospectively compared the position of NGTs using an electromagnetically guided NGT that demonstrated via chest X-ray (CXR) lung placements avoided and the time lapsed to initiate enteral feeding. A total 121 NGT placements in 113 patients were reviewed in the study. They found a sensitivity of 98% (95% CI, 93.9%–99.7%) and a specificity of 100% (95% CI, 48.0%–100.0%) with the electromagnetically guided NGT compared with CXRs. Fifty-one independently reviewed images showed that nine lung placements were avoided. The average time from NGT placement to CXR was 185 minutes and time to feeding initiation was 404 minutes.[13] They concluded that their method for determining NGT position, using electromagnetically guided NGT, minimized feeding delay and the need for multiple CXRs, with ensuing cost reduction.[13] Gray et al[15] compared an historic group whereby the 10-10-10 protocol was used and compared results with that of the CorTrak®2 EAS™ system which helped initiate early EN and reduced the risk of complications associated with transporting critically ill patients to radiology. In an effort to ascertain which enteral tube placement techniques achieved postpyloric placement on initial insertion attempt without difficulty, Boyer et al[20] conducted a retrospective study comparing the Tiger 2™ tube (T2T) (Cook Medical, Bloomington, IN) and CorTrak®2 EAS™. The study addressed postpyloric placement, comparing real-time tube placement with X-ray confirmation, including complications. The T2T is a self-propelling nasojejunal tube with 5 side ports and winged tips on the side of the tube that advances through the action of peristalsis. In the Boyer study, the T2T was postpyloric 62% (44/71) of attempted placements. CorTrak®2 EAS™ achieved postpyloric placement 43% (32/74) of attempts ($P = 0.03$).[20] CXR findings were 83% and 82% for postpyloric and non-postpyloric insertion, respectively, using CorTrak. They concluded in their retrospective review that the T2T was more effective at postpyloric placement on the first attempt; however, the primary benefit of the signaling system may be real-time visualization.[20] The authors of this study did indicate that their practice showed the system to be user dependent and likely led them to believe that was the reason for less success with postpyloric placement.

Radiographic confirmation of tube placement before use is considered gold standard; however, recent studies suggest that radiographic confirmation may not be required when electromagnetic imaging technology is used for placement. CorTrak®2 EAS™ has been approved by the FDA for placement that does not require a confirmation X-ray.[20] The patient benefits by avoiding additional radiologic exposure and feeding can be initiated immediately. A variety of short-term feeding tube access-placement procedures exist to validate tube-tip end location, but the gold standard remains with radiograph confirmation; however, before obtaining a

visual radiograph, the methods addressed in this paper can be useful prior to final confirmation.

Summary

Early and adequate nutrition support improves outcomes in patients unable to tolerate oral intake. Enteral access requires an interdisciplinary approach to determine best options and placement procedure for the patient. The estimated duration of treatment and the intended location of feeding are important considerations when selecting the type of feeding tube to place. There is not clear consensus on the exact duration of use for short-term enteral access other than the 4–6-week time frame mentioned. A 2015 review of adults with swallowing disturbance in the Cochrane Database suggests PEG rather than NGT for long-term enteral access.[1] The review did not specify in what time frame the transition from short-term to long-term access should occur. The 2017 ASPEN guidelines state that the healthcare team should make the decision whether to place the distal tip of the feeding tube in the stomach or small bowel.[21] The recommendations for gastric access are generally appropriate for patients with a functional stomach, without delayed gastric emptying, fistula, or obstruction. Patients with gastric outlet obstruction, severe gastroparesis, and those with known reflux should have small bowel feedings.[21] Enteral access should be based on patient-specific factors, such as anticipated duration of therapy, GI function, and anatomy. Careful evaluation and consideration should be given when determining the most appropriate placement method for short-term enteral access.

Statement of Authorship

E. Pash drafted the manuscript, agrees to be fully accountable for ensuring the integrity and accuracy of the work, and read and approved the final manuscript.

Supplementary Information

Additional supporting information may be found online in the supporting information tab for this article.

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