Percutaneous Endoscopic Stomas for Enteral Feeding and Drainage

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The use of safe and cost-effective endoscopic techniques for the placement of tubes in the gastrointestinal tract has led to increased utilization of long-term enteral feeding in patients with impaired GI function, including many

Introduction

The idea that nutrients can be introduced into the gastrointestinal (GI) tract through a route other than the mouth is not new. This practice was started by the ancient Egyptians, who used nutrient enemas for preservation of general health. Greek physicians prescribed enemas containing milk and wine for treatment of diarrhea [1]. The introduction of nutrients into the rectum continued in Western medicine until its inadequacies were outlined at the beginning of this century [2]. Attempts to fashion tubes for placement in the upper GI tract originated in Venice in the 16th century, with the use of tubes made from animal bladder that were placed in the esophagus. A major development occurred at the end of the 18th century when a tube made of eel skin was used for 5 weeks to feed a patient with neurogenic dysphagia [1]. The use of nasogastric tubes for feeding or emptying the stomach became widespread in the 19th century. Thereafter, surgical gastrostomies and jejunostomies along with nasogastric tubes were used for these purposes.

The introduction of endoscopic techniques for the placement of tubes in the GI tract in the last 15 years has revolutionized the approach to enteral feeding and presented opportunities to improve the quality of life of patients, particularly those with impairment of GI function because of cancer. Although gastrostomy and jejunostomy tubes have been placed for many years by surgical techniques, the relatively high morbidity and mortality [3-5], and the requirement for an operating room have limited their use. In the last decade, there has been a marked increase in utilization of long-term enteral feedings. The Oley Foundation estimated that in 1992, 148,000 patients across the United States received long-term enteral feeding outside hospitals; 43% of these patients had cancer [6]. This increase can be attributed mainly to the development of simple, safe, and cost-effective endoscopic techniques for placement of tubes in the GI tract, and to the availability of a wide range of low-cost commercial enteral feeding solutions.

Percutaneous Endoscopic Gastrostomy

Gauderer and Ponsky [7] introduced the technique for placement of a percutaneous endoscopic gastrostomy (PEG) in 1980. This method has become so popular that, in 1990, it was reported to be the second most common indication for upper GI endoscopy in hospitalized patients [8]. Various modifications of the original technique have been reported, along with techniques for placement of tubes directly into the jejunum [9]. The majority of tubes placed in the upper GI tract endoscopically are used for enteral feeding. However, this technique can also be used to place wide tubes for drainage of an obstructed GI tract [10]. The technique involves the introduction of a thread or a guide-wire into the stomach or jejunum, which is used either to pull or push a tube through the mouth, esophagus, stomach, and abdominal wall.

Pull and Push Methods

The method of placement of a percutaneous endoscopic gastrostomy has been described in numerous reports [7,11-14]. The patient first undergoes a routine upper GI endoscopy. The stomach is then inflated, pushing the gastric wall against the abdominal wall. When the lights in the endoscopy room are dimmed, the light from the tip of the scope in the stomach can be seen transilluminating the abdominal wall. The transillumination identifies the part of the anterior gastric wall that is positioned directly against the abdominal wall. This is a safe area for the placement of the gastrostomy tube. After application of a local anesthetic, a 5-mm incision is made in the skin. A
16-gauge, smoothly tapered Medicut catheter is inserted through the incision into the stomach. The metal guiding stylet is removed, and a thread (pull method) or guide-wire (push method) is passed through the catheter.

**Pull Method**—In the pull method, the thread is grasped by a biopsy forceps or a snare (passed through the scope), and the endoscope is withdrawn, pulling the thread with it through the mouth. Thus, the thread passes through the abdominal wall, stomach, esophagus, and pharynx, and exits through the mouth.

The gastrostomy tube may range in size from 15 F to 28 F. One end of the tube has a widened mushroom shape, and the other end is attached to a tapered plastic or rubber dilator, the tip of which is hooked to a thread or wire. The thread exiting through the mouth is tied to the thread on the tapered end of the tube. The end of the thread exiting through the abdominal wall is pulled, moving the tube through the mouth into the stomach. The tapered dilator of the tube is then pulled through the abdominal wall, creating the channel through which the tube exits.

The endoscope is reintroduced, and, under endoscopic visualization, the tube is pulled out further until the mushroom end is positioned firmly against the gastric wall. The gastric and abdominal walls are secured firmly against each other by placing a bumper on the tube at the point where it exits from the abdominal wall.

**The Push Method**—In the push method [12], instead of a thread, a guide-wire is brought out of the patient’s mouth. A Sachs-Vine tube is pushed over the guide-wire until the dilator tip exits through the abdominal wall.

The performance of percutaneous endoscopic gastrostomies has been found to be safe, with a morbidity rate of 3% to 15% and mortality of 0.3% to 1% [11-15]. The tubes function well in the long-term, with very few complications [14].

**Indications for Placement**

Table 1 shows the indications for placement of a feeding gastrostomy tube. Among cancer patients, the most common indications are cancer of the head and neck with obstruction and or severe dysphagia. Originally, prior abdominal surgery was considered a contraindication for the placement of percutaneous endoscopic tubes. However, it is clear now that the procedure can be performed effectively and safely in patients who have undergone major abdominal operations, as well as in those with disseminated abdominal carcinomatosis and ascites [9,10,15,16]. Successful long-term enteral feeding requires that the patient and a family member be trained thoroughly to perform the feeding safely and avoid complications, particularly aspiration. It is also essential to establish an orderly medical follow-up program, to ensure that the patient is adequately nourished and that problems arising from the feeding are appropriately addressed. Feeding through a gastrostomy tube can be accomplished by infusing boluses of 300 cc to 500 cc, three to four times a day. In this system, up to 3,000 calories can be provided safely.

**Button Gastrostomy**

With the increase in survival in patients on long-term enteral nutrition, issues of quality of life, comfort, and esthetics have become important. Although a percutaneous endoscopic gastrostomy offers these patients a simple and convenient access for feeding, the protruding tube can get caught in clothes, is esthetically unappealing, and interferes with sexual activity and body image. The skin level button gastrostomy (Figure 1) offers an advantage by eliminating the protruding tube [17-19]. This device is particularly advantageous in cancer patients with good performance status who have severe dysphagia and require long-term enteral feeding [18]. Placement of a button gastrostomy requires a mature gastrocutaneous or jejunocutaneous fistula and is usually performed 4 to 6 weeks after the initial placement of a percutaneous endoscopic gastrostomy or jejunostomy tube. Technically, the button is placed by stretching it over a metal stylet, which is then pushed through the fistula into the stomach. Safety considerations require that an upper GI endoscopy be performed so that the stomach can be distended prior to insertion. The endoscopy also ascertains that the button is appropriately placed inside the stomach [20]. The device functions well long-term, and requires replacement on average only after 1½ to 2 years [18].

**Percutaneous Endoscopic Jejunostomy**

Aspiration can be a serious problem in patients fed through percutaneous endoscopic gastrostomies. Various reports indicate that in those prone to aspiration because of their underlying diseases, enteral feeding through a gastrostomy tube can be associated with aspiration in more than 30% of patients [21-24]. Providing nutrient solutions at a site distal to the ligament of Treitz will eliminate aspiration problems [8]. Such a method of feeding is also useful in patients with gastric outlet or
duodenal obstruction who have functional small bowel distal to the obstruction. These considerations prompted the development of endoscopic techniques for placement of feeding tubes directly into the jejunum. Placement of a percutaneous endoscopic jejunal stomy (PEJ) is a modification of the gastrostomy technique. It requires the use of a long endoscope. The tip of the scope is advanced into the proximal jejunum, and a loop of the jejunum is pulled anteriorly against the abdominal wall with the tip of the endoscope [9]. Special attention is required to ensure that no organ (colon, liver, stomach) is lodged between the abdominal wall and the jejunal loop. This can be ascertained by identifying a discrete light transilluminating the abdominal wall. At this point, the steps used to place a percutaneous endoscopic jejunal stomy tube are similar to those used to place a gastrostomy tube; however, because of the narrow lumen and motility of the jejunum, special precautions must be used to ascertain that the tip of the Medicut catheter is directed into the jejunal lumen and to avoid it going astray in the abdominal cavity.

Indications
This technique of jejunal tube placement is suitable for patients with an intact GI tract [9], as well as those with gastric resection and a gastrojejunal or esophagojejunal stomy [25]. In 113 cancer patients, the success rate has been 96% and the major complication rate, 1.6%, with no mortality (Shike M, unpublished data). In this study, the two most common indications for jejunal tube placement were gastric outlet obstruction and dysphagia associated with aspiration (see Table 2). Because of the narrow diameter of the jejunum and lack of reservoir capacity, providing nutrition through a jejunal tube requires a well-controlled slow infusion of no more than 200 cc/hr. This can be accomplished by establishing a schedule of nocturnal feeding over 8 to 10 hours while the patient is asleep. The infusion rate is controlled by a pump. This feeding method allows provision of up to 2,300 calories a day.

The term percutaneous endoscopic jejunal stomy has also been inappropriately used to describe a technique of placing a narrow feeding tube (6 F to 8 F) through a wider gastrostomy tube and advancing the tip of the feeding tube into the jejunum with the help of an endoscope [26-28]. Although this procedure is commonly described as a percutaneous endoscopic jejunal stomy, the term is inappropriate, since a jejunal stomy implies a direct opening through the jejunal wall [29]. Jejunal feeding tubes threaded through gastrostomy tubes have been suggested for use in patients with esophageal reflux at risk for aspiration and for patients with gastric outlet obstruction. When appropriately placed, these tubes can be used effectively and safely for enteral feeding [8,30]; however, the experience has not been uniformly successful [31,32]. The most common causes of malfunction of these feeding tubes are clogging (because of the relatively small diameter of the tube), kinking of the tube in the stomach or jejunum, and misplacement of the tip of the feeding tube in the duodenum rather than in the jejunum, thus risking aspiration [8]. Because of the technical problems with using a feeding tube threaded through a gastrostomy, it is preferable to place a jejunal stomy directly when jejunal feeding is indicated.

Percutaneous Endoscopic Gastrostomies For Drainage
Percutaneous endoscopic gastrostomies were originally developed as an access for enteral feeding. However, this technique offers an alternative to the nasogastric tube for drainage of the GI tract in patients with mechanical obstruction, particularly from diffuse abdominal carcinomatosis [29,30]. Although ascites and neoplastic peritoneal involvement have been considered relative contraindications to placement of a percutaneous endoscopic gastrostomy [33-35], it is clear that the procedure can be performed safely in patients with these problems, and offers comfort and improved quality of life [10]. The alternative nasogastric tubes cause severe discomfort and do not always drain the stomach efficiently. They can be associated with an overall complication rate of 4%, including GI perforation, ulceration, hemorrhage, and intussusception [36-39]. Nasogastric tubes are easily displaced by disoriented patients, and prolonged use predisposes to kinking and inefficient drainage [40]. Surgical gastrostomies also carry a high risk in these patients [41]. Thus, percutaneous endoscopic gastrostomies and jejunal stomies are effective alternatives to nasogastric tubes or surgical gastrostomies.

Percutaneous endoscopic gastrostomies for drainage require wide tubes. Currently, the widest tubes available have a diameter of 28 F. This diameter ensures effective drainage of the stomach. To allow optimal drainage, the tube has to be fashioned in such a way that a perforated terminal part of 3 to
5 inches remains in the stomach [10]. Such tubes also allow patients with complete gastric outlet or intestinal obstruction to drink and eat soft foods, which can subsequently be drained out through the wide gastrostomy tube. In patients with malignant obstruction from abdominal carcinomatosis, large masses in the abdomen and ascites are usually present, and these present a difficulty in bringing the gastric or intestinal wall anteriorly in contact with the abdominal wall. Nevertheless, placement of drainage gastrostomy tubes was successful in 89% of such patients [10]. In patients with nonmalignant obstruction, the success rate has been 100%. The overall complication rate of placement of drainage percutaneous endoscopic gastrostomies was low—4% [10]. The tubes were used successfully for an average of 66 days in patients with terminal abdominal carcinomatoses (mostly ovarian cancer), allowing the patients to drink and eat, and providing an effective drainage route.

**External GI Bypass**

The obstructed GI tract presents a challenge in the patient with advanced cancer who is not a candidate for a surgical procedure. In such patients, there is a need to drain the stomach and simultaneously to provide fluids and nutrition. Total parenteral nutrition (TPN) can be used in these patients; however, this is a complex, expensive therapy and can be associated with serious complications.

When the obstruction is in the distal stomach, duodenum, or proximal jejunum, it is possible to place a drainage percutaneous endoscopic gastrostomy and simultaneously a feeding percutaneous endoscopic jejunostomy distal to the obstruction. The gastrostomy and jejunostomy can be attached externally with an intervening small pneumatic pump (Figure 2). Such a pump can be operated either by a rechargeable battery or a hand-operated bulb. All gastric fluids can be pumped back into the jejunum distal to the obstruction. In addition, the patient can drink and eat solid foods, and pump the gastric contents into the jejunum.

**Advantages**

This apparatus has been used successfully for up to 3 months (Shike M et al, unpublished data). It has numerous advantages that facilitate management and improve the patient's quality of life:

1. It allows the patient to eat and drink in spite of the obstructed GI tract.
2. It recirculates the gastric and salivary secretions, thus preventing losses of fluids and minerals, which complicate management and require infusion of large amounts of intravenous fluids.
3. It eliminates the need for a drainage bag attached to the patient.
4. It allows supplemental enteral feedings through the jejunostomy.
5. It is cost effective and eliminates the need for intravenous hydration and fluid.

Another use for the external gastrointestinal bypass is in the post-esophagectomy patient who ends up with an interrupted upper GI tract because of postoperative complications. Such patients usually have a draining cervical esophagostomy and a feeding gastrostomy; they cannot eat, and they have the double burden of having to repeatedly empty the bag draining the saliva, and to administer enteral feedings and fluids and minerals to replace the salivary losses. Colonic or jejunal interposition is usually performed to establish continuity of the upper GI tract. However, at times, patients with this complication are elderly, may have concurrent medical problems, and are not candidates for extensive surgery. An active esophageal prosthesis connecting the cervical esophagostomy to a button gastrostomy with an intervening pump has been devised to make it possible for such patients to eat, drink, and avoid the loss of saliva (Figure 3). This device has been successfully utilized in patients for up to 18 months [42], allowing them to ingest all the nutrients and fluids required, and eliminating the need for enteral or parenteral nutrition.

**References:**


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