
Percutaneous Endoscopic Gastrostomy

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Abstract

Percutaneous endoscopic gastrostomy (PEG) has become one of the most frequently used procedures to administer nutrition and also as an alternative to the surgical approach or nasogastric tubes. The technique is simple, safe and cheap; it can be performed by any moderately experienced endoscopist and so, since the original description in 1980, has become a popular method around the world. The main PEG indication is the nutrition of patients that cannot swallow, although there are other utilities. Contraindications and complications are very unusual in clinical practice. There are three technical modalities for the placement of the gastrostomy tube, with no one being better than the other. This chapter tries to explain in a very practical way the main aspects of the procedure and it especially focuses on technical points, incorporating some useful tricks that can help solve some eventually embarrassing situations.

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Percutaneous endoscopic gastrostomy (PEG) was first described by Ponsky and Gauderer in the year 1980 and was quickly accepted as a useful alternative to surgical gastrostomy and nasogastric tubes [1]. The endoscopic technique requires less instrumentation, reduces the stay in hospital and as a result, the economic cost compared to the surgical technique [2], and secondly, it avoids annoying and unsightly nasogastric tubes.

The standardization of this technique, the marketing of the kits and the simplicity in the replacement of the probe has made the PEG the procedure of choice in patients requiring long-term enteral nutrition. This chapter will review the indications, the contraindications, the different techniques of implantation and the possible complications of the placement of PEG tubes.

Indications

As a general rule, the implant of a PEG is indicated for those patients that, having a functioning gastrointestinal tract, suffer from dysphagia or any other problem that precludes nutrition by mouth for at least 4 weeks and for which there is no contraindication or inability to the introduction of an endoscope down to the stomach. In practice, the most common cause is represented by the neuromuscular diseases that occur with pharyngoesophageal motor impairment [3]. However, it can also be used in patients with obstructive dysphagia,

Table 1. Indications for PEG

Neurological disorders

Stroke
Anoxic encephalopathy
Alzheimer's disease
Multiple sclerosis
Parkinson's disease
Amyotrophic lateral sclerosis
Brain tumors
Huntington's chorea
Polio

Obstructive neoplasia

Head and neck tumors
Carcinoma of the esophagus
Carcinoma of cardia

Muscle diseases

Myotonic dystrophy
Dermatomyositis/polymyositis
Oculopharyngeal muscular dystrophy
Amyloidosis

Gastric decompression

Abdominal carcinomatosis
Hyperemesis gravidarum

Miscellaneous

Nutritional complement
Tracheoesophageal fistula
Chronic gastric volvulus
Macroglossia
Badly tasting drugs (pediatric use)
Recurring bronchial aspirations

especially secondary to head and neck tumors [4]. On the other hand, other utilities apart from nutrition have been described; for example, it can be used as a method for gastrointestinal decompression [5], prevention of recurrent gastric volvulus [6] or for the administration of badly tasting medicine to children [7]. Table 1 summarizes the main indications.

Contraindications

Different situations may contraindicate the implantation of a PEG, or by promoting the complications or by technically preventing it (table 2). The impossibility to pass the endoscope down to the stomach, severe disorders of coagulation, massive ascites, severe infections of the wall or the abdominal cavity, pyloric or intestinal obstruction, neoplastic infiltration of the abdominal wall or limited life expectancy are considered absolute contraindications. The presence of ascites, morbid obesity, portal hypertension, subtotal gastrectomy or peritoneal dialysis are relative contraindications. At present, recent myocardial stroke [8], the presence of a ventricular peritoneal shunt [9] or extensive burns of the abdominal wall are not considered contraindications [10].

Table 2. Contraindications for PEG

Absolute contraindications

Inability to pass the endoscope into the stomach
Severe disorders of coagulation and incorrigible
Massive ascites
Infection of the abdominal wall
Peritonitis
Neoplastic infiltration of abdominal wall
Pyloric or intestinal obstruction
Short life expectancy
Nervous anorexia

Relative contraindications

Morbid obesity
Ascites
Portal hypertension data
Peritoneal dialysis
Subtotal gastrectomy

Patient Preparation

The patient should fast for at least 6 h and his/her coagulation tests should be within the hemostatic levels. To reduce the risk of septic complications it is important to administer a dose of a broad-spectrum antibiotic 30 min before the process (e.g., 1 g of intravenous cefazolin) and perform a thorough cleansing and disinfection of the oropharyngeal cavity [11, 12]. Informed consent must be properly completed.

Material Needed

To implant a PEG, the material normally used for an upper gastrointestinal endoscopy is necessary. The technique is performed under analgesic sedation, therefore all the necessary material should be available for its administration and monitoring. An additional aspirator should also be prepared. Everything must also be prepared to create a sterile field in the anterior abdominal wall, local anesthetic, scalpels, a small trocar, a guidewire, a polypectomy snare and the gastrostomy tube, of which there are many models on the market and come in kits with all the necessary materials for its implantation (fig. 1). The material which the tubes are made of is silicone or polyurethane. The use of either one is indifferent [13].

Implant Technique

The procedure is performed with the patient in supine decubitus position. For this reason there must be an additional aspirator to collect oropharyngeal secretions throughout the whole process. Before proceeding to place the probe, an endoscopic exploration of the esophagus, stomach and duodenum is performed in order to rule out any circumstance that contraindicates the implant. As regards the placement of the probe itself, the basic principle consists in insufflating

the stomach considerably, so that its anterior wall is in intimate contact with the anterior abdominal wall, thereby achieving a secure area in which to create a gastrocutaneous fistula without interposition of other organs.

There are three different methods for the placement of the probe. Some variations on them have also been described.

Pull Method or the Ponsky-Gauderer Method [1]

The technique is performed with the patient in the supine decubitus position, although to introduce the endoscope he/she may be placed in left lateral decubitus. Having explored the upper digestive tract, the site where the probe will be inserted should be chosen. For this, with the distal end of the endoscope placed in the stomach, insufflation is applied, and after darkening the room, the patient's abdominal wall is inspected to try to visualize the point of maximum transillumination, that it is usually located in the epigastrium slightly to the left. Then pressure with a finger is applied on this point, verifying endoscopically that this action causes a clear imprint in the gastric lumen (fig. 2, 3). This maneuver is the most important part of the procedure, as we ensure a secure puncture area in which to introduce the probe. To avoid that the probe once attached causes pain to the patient, we must be careful not to choose the insertion point at <2 cm below the costal ridge [14].

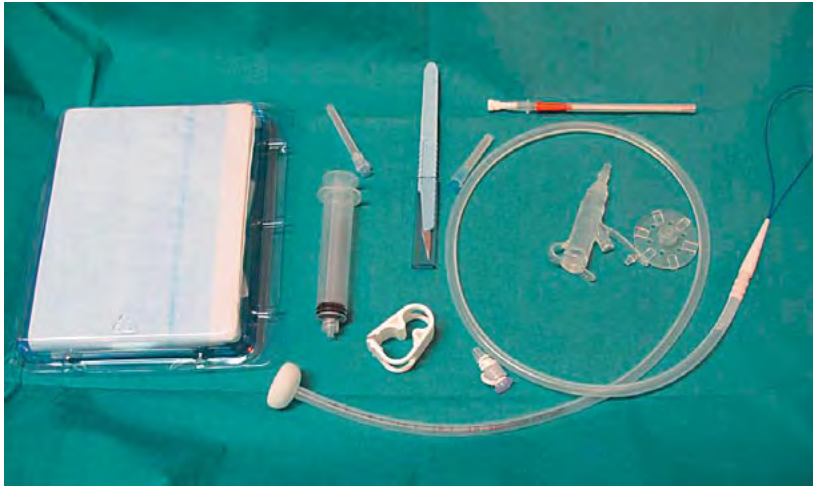
The skin is then disinfected, a sterile field is prepared and the selected point is infiltrated with local anesthesia, making the needle penetrate the abdominal wall and its tip be seen in the stomach. Then, with a scalpel, a skin incision of about 1 cm is made. The next step is to introduce the trocar with its stylet from the outside and through the incision to the gastric cavity, all of this under endoscopic control. Once this is done, the endoscopist will get the trocar using a polypectomy snare. Now the stylet will be withdrawn and the guidewire will be inserted through the trocar until the tip penetrates several centimeters into the stomach. At that time, and manipulating the handle of the snare, the endoscopist will release his hold on the trocar and catch the guide (fig. 4, 5). Immediately thereafter, the endoscope will be withdrawn, which will drag behind it the guide to make it come out of the mouth of the patient. In this way we will have the guidewire entering through the abdominal wall and coming out through the patient's mouth. After this, the pointed end of the gastrostomy tube is knocked to the end of the wire that comes out of the mouth, then the wire is tractioned from the opposite end, so that the probe penetrates through the mouth, sliding along the esophagus and stomach and finally, penetrates the gastric wall and the abdominal wall and appears on the exterior through the incision previously performed (fig. 6). The endoscope is then reintroduced and the tube pulled until the retainer cap of the probe presses against the gastric wall (fig. 7). Having done this, the outside retainer is placed avoiding excessive tension, for which we must verify that the probe can rotate on its axis (fig. 8).

Push or Sacks-Vine Method [15, 16]

Basically it is similar to the previous one. It differs in the type of probe that is used, which is linked to a long, semirigid and pointed tube, so keeping the guide thread taut, the catheter is inserted by pushing it from the mouth of the patient until it comes out through the abdominal wall (fig. 9). The rest of the process is identical to the pull method.

The Introducer Method or the Russell Method [17]

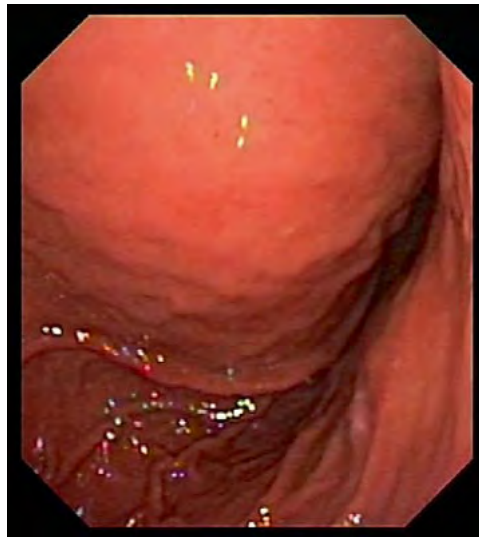
Using this technique, the endoscope is inserted only once, and also prevents the gastrostomy tube passing through the mouth, which may be desirable in certain situations. The steps are identical



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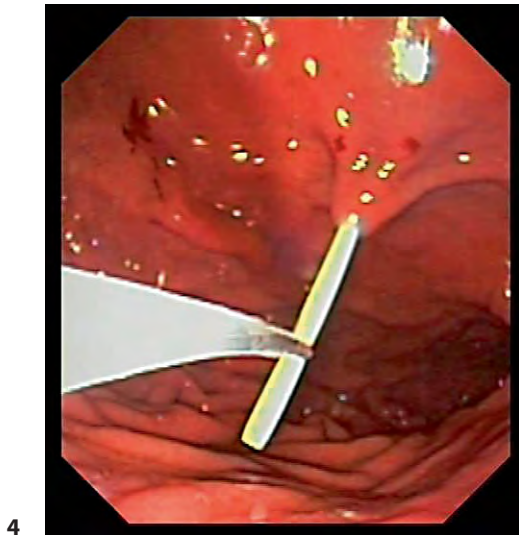
Fig. 1. Material needed for the PEG, included in a commercial kit.

Fig. 2, 3. External and endoscopic image of the digital imprint in the gastric cavity.

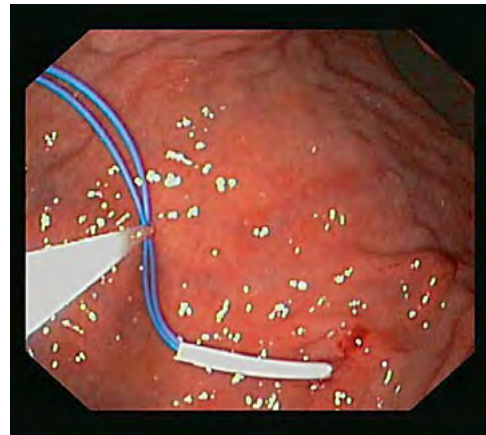
to those of previous techniques until the trocar is inserted. From then the guide is introduced, the trocar is removed and several plug-shaped dilators are introduced. Finally a thicker sheath trocar is introduced, through which the gastrostomy tube which is a Foley type passes. Then the balloon is inflated, the sheath is removed, the probe is pulled until it stops and finally is fixed externally with a retainer, as in the other techniques.

Postprocedural Care

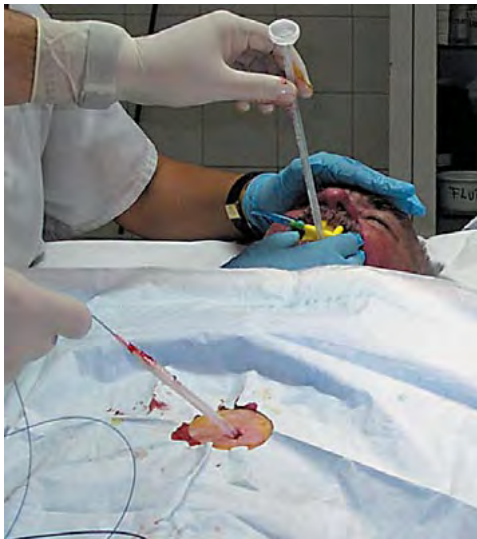
During the early days, wound care will be undertaken. Later, cleansing with soapy water once a day will be sufficient, keeping the area without covering up with bandages or dressings. It is



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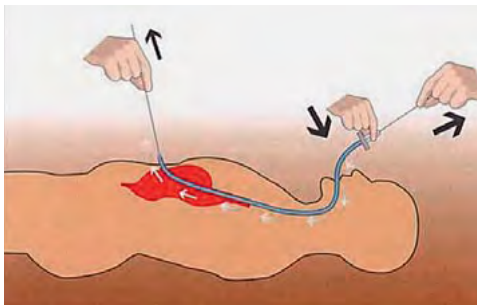
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Fig. 4, 5. Pull method. The snare grabs the catheter first and then the guidewire. **Fig. 6.** Pull method. Pulling the wire, the probe penetrates through the mouth and exits through the abdominal wall. **Fig. 7.** Gastric internal bumper. **Fig. 8.** Final aspect of the PEG with the external retainer. **Fig. 9.** Schematic representation of the push technique.

possible that the patient will complain of pain where the puncture took place, the days after the implantation. In this case, and once discarded complications, the necessary analgesia will be administered. The intake of food can be started immediately after placing the probe but in many hospitals 24 h is waited. To prevent the internal bumper from migrating and getting stuck to the wall of the stomach, it is highly desirable, several weeks after the implant, to loosen the tension of the outer retainer, sliding it along the tube towards the proximal end 2–3 cm, and also regularly checking that the probe can be rotated on its axis.

Removal and Replacement of the Probe

If the dysphagia or any other indication that would have led to the implantation of the PEG has disappeared, the tube can be withdrawn. However, 2–3 weeks must have passed after the placement, as this is the time required for the gastrocutaneous fistula to mature, to become fibrous and prevent the passage of gastric contents into the peritoneal cavity after the removal of the probe; the fistulous hole will close spontaneously within a few days. If the internal bumper of the gastrostomy tube is soft, one can simply remove the tube by pulling it up from the outside until one overcomes its resistance. If the retainer is rigid, it will be necessary to cut the tube where it meets the skin and insert the endoscope to remove the retainer through the mouth.

On the other hand, and as a consequence of the action of the acid, the probes deteriorate in some time and must be replaced. In this case, after the removal of the probe of the first implant, a substitution probe of the same caliber will be put in its place. There are two types of these probes on the market: with a balloon retainer or with a circular retainer which includes a rectifier. They are both placed from the outside without the need for endoscopic control, and can be both put in place by nurses. It is important to ensure that the probe glides smoothly through the fistula and its tip reaches the stomach light. In case of doubt, its correct position should be checked by endoscopy or radiology. Replacement button-type probes, with a flat profile, can also be found on the market and they are especially useful in patients with an active life or in children. However, its use should be individualized, as some serious complications associated with them have been described [18, 19].

Useful Tricks

As in other endoscopic procedures, it is useful to know a number of tricks that will help us avoid some complications and which will help us resolve issues that may arise during the implantation or replacement of the PEG.

Reduction of the Risk of Stoma Infection

Stoma infection by germs carried from the oropharynx during the implantation of the probe is the most frequent complication. Cleansing and disinfection of the mouth and pharynx together with antibiotic prophylaxis decreases the risk. One can also use two tricks to avoid this complication: (1) Leave an overtube placed in the first pass of the endoscope, so during the implant maneuvers, when the probe is pulled, contact with the oropharynx is avoided [20]. (2) The use of the Russell method.

Difficulty to Introduce the Endoscope

At times and for different reasons, it is very difficult to pass the endoscope through the mouth or the pharyngoesophageal junction. If the push or pull methods are used, it is necessary to reintroduce the endoscope to check the correct position of the probe, with which the problem repeats

itself. We can avoid this problem in several ways: (1) Placing the probe without reintroducing the endoscope, that is to say without endoscopic control, sensing by touch the moment the retainer cap presses against the internal gastric wall and adjusting the external retainer to approximately 4 cm of the marks indicated in centimeters on the outer tube [14]. (2) Reinserting the gastroscope guided by the probe itself, by knotting its distal end to a polypectomy handle, so that the endoscope and the probe form a single body [21]. (3) Using the Russell method. (4) Performing the gastrostomy through the nose. The procedure for placement of the probe may be conducted wholly through the nose, using ultrathin or pediatric endoscopes and conventional probes, with the sole condition that the internal retainer is soft and can be folded for insertion through the nostrils [22].

Avoiding the Puncture of Adjacent Organs (Especially Liver and Transverse Colon)

To prevent viscera from being placed between the abdominal wall and the stomach, we can use various tricks: (1) Insufflating the stomach sufficiently, so that there is extensive contact between the anterior gastric and abdominal wall. (2) Placing the patient in an anti-Trendelenburg position. In this way the transverse colon caudally tends to fall not standing between the stomach and the abdominal wall. (3) Introducing the trocar connected to a syringe with serum, gently pulling on the plunger while puncturing and advancing towards the stomach light. The sight of bubbles before viewing the tip of the trocar in the stomach will announce that a hollow organ has been penetrated [21]. (4) Selecting the puncture site assisted by ultrasonographic endoscopy.

Patients without Adequate Transillumination in the Abdominal Wall

In certain occasions a failure of correct transillumination may occur. However, it is possible to select a safe insertion point in several ways: (1) Checking that the external digital compression produces a very clear imprint on the gastric light. (2) Locating the insertion point guided by fluoroscopy, CT or ultrasonographic endoscopy [23].

Results

There are comparative studies between the three techniques for the placement of the PEG but none has shown significant differences in terms of treatment success or complications [24, 25]. The success rate of the technique is greater than 95% [26]. In a large meta-analysis a morbidity and mortality of 9.4 and 0.53% was respectively estimated [27]. In other series the morbidity rate ranged from 9 to 17%, but major complications occur in only 1–3% of cases [28, 29].

Complications

Major Complications

(1) *Hemorrhage*: Produced by accidental puncture of a vessel. If bleeding occurs in the stomach it can be seen as an upper gastrointestinal bleeding, and if it is produced by peritoneal puncture of a vessel as hemoperitoneum. This complication is more common in patients with portal hypertension.

(2) *Acute peritonitis*: It is produced by the passage of gastric contents into the peritoneal cavity. It has been described in patients whose probe was tried to be changed within 2–3 weeks. In these cases, the fistulous tract may not yet be ripe and the end of the replacement tube instead of entering the stomach is located in the peritoneal cavity [30]. What can also occur if the probe

is placed with excessive tension is an ischemic necrosis of the gastric wall and a migration of the probe towards the peritoneal cavity.

(3) *Bronchial aspiration*: It is the most common major complication. It can occur during the procedure of the placement of the probe. It is therefore important to aspirate the oropharyngeal secretions throughout the procedure. It can also occur following the administration of nutrition. To prevent it, the patient should be incorporated 30° while he/she is fed, and shall be kept in this position for the following 2 h.

(4) *Necrotizing fasciitis*: It is the most serious complication but also the less common and is associated with high mortality. It is an infection and subsequent necrosis of the soft tissues of the abdominal wall. It is accompanied by fever, cellulitis and edema, and subcutaneous emphysema can be observed. It requires treatment with broad-spectrum antibiotics and surgical debridement.

(5) *Gastrocolic fistula*: It occurs when the transverse colon is placed between the gastric wall and the abdominal wall by placing the PEG. It can cause acute symptoms of intestinal obstruction or peritonitis, or evolve in a hidden way, with chronic subocclusive symptoms. Sometimes this complication is found when the first replacement of the probe takes place and the end of the replacement tube is placed at the level of the light of the colon, causing diarrhea when nutrition is administered. To solve this, it may be enough to remove the tube to close the fistula spontaneously, but occasionally surgical treatment will be required.

(6) *Metastatic tumor implantation at the stoma*: Cases of metastasis of oropharyngeal and esophageal tumors in the stoma due to the dragging of malignant cells during the placement of the probe have been described [31]. With the Russell technique or the placement of an overtube, we can avoid this complication.

Minor Complications

(1) *Infection of the stoma*: It is the most frequent complication. It is managed with antibiotics and local treatment. It is sometimes necessary to withdraw the probe.

(2) *Extrusion of the probe (buried bumper)*: It consists of the migration of the internal retainer towards the gastric wall, leaving an impact on it and sometimes being completely covered by gastric mucosa, hindering or preventing both nutrition and the replacement of the tube. To avoid this we must avoid excessive tension on the external retainer by loosening the outside retainer and by regularly rotating the probe on its axis.

(3) *Overflowing*: It consists on the oozing of gastric contents around the tube, causing skin irritation and interfering with the patient's care and hygiene.

(4) *Miscellaneous*: Complications that can usually be resolved without major difficulties are: hematoma of the abdominal wall or stomach, fever, subcutaneous emphysema, asymptomatic pneumoperitoneum, granuloma of ostomy, catheter obstruction, rupture of the tube and others.

Some Tricks to Resolve Some Complications

Burial of the Retainer in the Gastric Wall (Buried Bumper Syndrome)

There are several ways to resolve this complication: (1) Introduce a dilatation balloon [32] or a Savary dilator with a diameter slightly greater than that of the probe [33] through the lumen of it and push to the gastric cavity until the retainer is unstuck. For this maneuver, we can help ourselves by pulling the dilator with a polypectomy snare introduced through the working channel of the endoscope. (2) Putting a new probe by the pull method, inserting the guidewire through the lumen of the buried probe; in this way, when we pull the wire the new probe will drag the old and

it will become unstuck [34]. (3) Make incisions with a needle knife sphincterotome or with argon plasma coagulation, on the lining that covers the internal retainer to release and remove it.

Stenosis of the Stoma

Very often if the probe is removed and the substitution probe is not placed promptly, the fistulous tract narrows, preventing the entry of the substitution probe. To solve this complication we can: (1) Dilate the fistula with Savary plugs or balloon dilators. (2) Introduce the replacement tube over a biopsy forceps used as a guide which are introduced by the stoma to the stomach [35]. (3) Introduce a guidewire by the fistulous tract and then perform the complete first implant procedure.

Peritube Leakage of Gastric Contents

It can be solved: (1) Removing the probe for several hours for the fistulous tract narrow and then placing the replacement probe. (2) Replacing the probe with another one with a larger caliber. (3) Removing the PEG and finally placing a new tube in another location.

Conclusion

The PEG procedure is technically simple and accessible to any endoscopist, providing quick, inexpensive enteral access with few complications. In this chapter we have reviewed in a concise way the technical aspects, indications, contraindications and complications of the technique. However, we must take into account that the endoscopist should not merely be a technician who only places the probe, but who must be involved in the process advising the clinicians responsible for the patient, the patient himself/herself and his/her family, describing the advantages, disadvantages risks of the technique and its alternatives. The decision to place probes for artificial feeding, especially in the final stages of life, must be based on the expectations of the progression of the disease, the chances of obtaining benefits and the desires of the patient and his family.

References

- 1 Gauderer NW, Ponsky JL, Izan RJ Jr: Gastrostomy without laparotomy: a percutaneous endoscopic technique. *J Pediatr Surg* 1980;15:872–875.
- 2 Steigmann GV, Goff JS, Silas D, Pearlman N, Sun J, Norton L: Endoscopic versus operative gastrostomy: final results of a prospective randomized trial. *Gastrointest Endosc* 1990;36:1–5.
- 3 Ponsky JL, Gauderer MWL: Percutaneous endoscopic gastrostomy: indications, limitations, techniques and results. *World J Surg* 1989;13:165–172.
- 4 Stellata TA: Expanded applications of percutaneous endoscopic gastrostomy. *Gastrointest Endosc Clin N Am* 1992;2:249–257.
- 5 Cannizzaro R, Bortoluzzi R, Valentini M, Scarabelli C, Campagnutta E, Sozzi M, et al: Percutaneous endoscopic gastrostomy as a decompressive technique in bowel obstruction due to abdominal carcinomatosis. *Endoscopy* 1995;27:317–320.
- 6 Eckhauser ML, Ferron JP: The use of dual percutaneous endoscopic gastrostomy in the management of chronic intermittent gastric volvulus. *Gastrointest Endosc* 1985; 31:140–142.
- 7 Gauderer MWL: An updated experience with percutaneous endoscopic gastrostomy in children. *Gastrointest Endosc Clin Am* 1992;2:195–205.
- 8 Cappel MS, Iocovone FM Jr: The safety and efficacy of percutaneous endoscopic gastrostomy after recent myocardial infarction: a study of 28 patients and 40 controls at four university teaching hospitals. *Ann Gastroentrol J* 1996;91:1599–1604.
- 9 Graham SM, Flowers JL, Scott TR, Lin F, Rigamonti D: Safety of percutaneous endoscopic gastrostomy in patients with a ventriculoperitoneal shunt. *Neurosurgery* 1993;32:932–934.
- 10 Patton ML, Haith LR, Germain TJ, Goldman WT, Raymond JT: Use of percutaneous endoscopic gastrostomy in burn patients. *Surg Endosc* 1994;8:1067–1071.

- 11 Sharma VK, Howden CW: Meta-analysis of randomized controlled trials of antibiotic prophylaxis before percutaneous endoscopic gastrostomy. *Am J Gastroenterol* 2000;95:3133–3136.
- 12 Saadeddin A, Freshwater DA, Fisher NC, Jones BJ: Antibiotic prophylaxis for percutaneous endoscopic gastrostomy for non-malignant conditions: a double-blind prospective randomized controlled trial. *Aliment Pharmacol Ther* 2005;22:565–570.
- 13 Santori S, Trevisani L, Nielsen I: Longevity of silicone and polyurethane catheters in long-term enteral feeding via percutaneous endoscopic gastrostomy. *Aliment Pharmacol Ther* 2003;17:853–856.
- 14 DeLegge MH: Percutaneous endoscopic gastrostomy. *Am J Gastroenterol* 2007;102:2620–2623.
- 15 Sacks BA, Vine HS, AM speakers, HP Ellison, D Shropshire, R Lowe A non-operative technique for establishment of a gastrostomy in the dog. *Invest Radiol* 1983;18:485–487.
- 16 Foutch PG, Woods CA, Talbert GA, Sanowski RA: Critical analysis of the Sacks-Vine gastrostomy tube: a review of 120 consecutive procedures. *Am J Gastroenterol* 1988;83:812–815.
- 17 Russell TR, Brotman M, Forbes N: Percutaneous gastrostomy: a new simplified and cost-effective technique. *Am J Surg* 1984;148:132–137.
- 18 Gauderer MWL, Picha GL, Izant RJ Jr: The gastrostomy button. A simple, skin level non-refluxing device for long-term enteral feedings. *J Pediatr Surg* 1984;19:803–805.
- 19 Kozarek RA, Payne M, Barkin J, Goff J, Gostout C: Prospective multicenter evaluation of an initially placed button gastrostomy. *Gastrointest Endosc* 1995;41:105–108.
- 20 Maetani I, Yasuda M, Seiko M, Ikeda M, Tada T, Ukita T, et al: Efficacy of an overtube for reducing the risk of peristomal infection after PEG placement: a prospective, randomized comparison group. *Gastrointest Endosc* 2005;61:522–527.
- 21 Ponsky JL: Percutaneous endoscopic gastrostomy. *J Gastrointest Surg* 2004;8:901–904.
- 22 Vitale MA, Villoti G, D'Alba L, De Cesare M, Frontespezi S, Lacopini G: Unsedated transnasal PEG placement in selected patients. *Endoscopy* 2005;37:48–51.
- 23 Chaves DM, Kumar A, Lera ME, et al: EUS-guided percutaneous endoscopic gastrostomy for enteral feeding tube placement. *Gastrointest Endosc* 2008;68:1168–1172.
- 24 Hogan RB, DeMarco DC, Hamilton JK, Walker CO, Polter CE: Percutaneous endoscopic gastrostomy: to push or to pull. *Gastrointest Endosc* 1986;32:253–258.
- 25 Kozarek RA, Ball TJ, Ryan JA: When push comes to shove: a comparison between two methods of percutaneous endoscopic gastrostomy. *Am J Gastroenterol* 1986;81:642–646.
- 26 Larson DE, Burton DD, Schroeder KW, et al: Percutaneous endoscopic gastrostomy Indications, success, complications and mortality in 314 consecutive patients. *Gastroenterology* 1987;93:48–52.
- 27 Wollman B, D'Agostino HB, Walus-Wigle JR, et al: Radiologic, endoscopic and surgical gastrostomy, an institutional evaluation and meta-analysis of the literature. *Radiology* 1995;197:699–704.
- 28 Disario J: Endoscopic approaches to enteral nutritional support. *Best Pract Res Clin Gastroenterol* 2006;20:605–630.
- 29 Lin HS, Ibrahim HZ, Kheng JW, et al: Percutaneous endoscopic gastrostomy: strategies for prevention and management of complications. *Laryngoscope* 2001;111:1847–1852.
- 30 Bender JS, Levison MA: Complications after percutaneous endoscopic gastrostomy removal. *Surg Laparosc Endosc* 1991;1:101–103.
- 31 Khurama V, Singh T: Percutaneous endoscopic gastrostomy site metastasis in esophageal cancer. *Gastrointest Endosc* 2005;62:612.
- 32 Strock P, Weber J: Buried bumper syndrome: endoscopic management using a balloon dilator. *Endoscopy* 2005;37:279.
- 33 Klein S, Hear BR, Soloway RD: The 'buried bumper syndrome: a complication of percutaneous gastrostomy. *Am J Gastroenterol* 1990;85:448–51.
- 34 Venu RP, Brown RD, Pastika BJ, et al: The buried bumper syndrome: a simple management approach in two patients. *Gastrointest Endosc* 2002;56:582–584.
- 35 Kumer S, Dreyer JS: Stylet reinforcement method for replacement of a percutaneous gastrostomy tubes: a useful technique using endoscopic biopsy forceps. *Endoscopy* 2004;36:466.

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