

Endoscopic placement of feeding tubes

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ABSTRACT: It is no exaggeration to say that percutaneous gastrostomy has revolutionized the feeding of disabled patients with intact gastrointestinal tracts. The most common indication is inability to swallow. It is generally best to place a gastrostomy tube early to prevent malnutrition and minimize complications of procedures on poorly nourished tissue. If a patient is expected to live for only weeks to months, nasoenteric feedings are the nutritional route of choice. Contraindications to percutaneous gastrostomy include coagulation disorders, upper gastrointestinal fistulas, intestinal obstruction, varices, peritoneal dialysis, septicemia and esophageal obstruction. Three techniques are described: 'pull,' 'push' and 'introducer.' The most frequently reported complications are wound infection and pneumoperitoneum. Now that multiple methods for successful insertion of endoscopic percutaneous feeding tubes have been described, the literature appears to be concentrating on complications of the various techniques. Nevertheless, compared to the other options available for patients unable to swallow (allowing malnutrition to proceed, tube feeding, surgical gastrostomy, parenteral nutrition), percutaneous gastrostomy is the procedure of choice in virtually all cases if the intestine is functioning. *Can J Gastroenterol* 1990;4(9): 616-620

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Mise en place des sondes d'alimentation sous endoscopie

RESUME: La gastrostomie percutanée a révolutionné l'alimentation des patients débilisés dont les voies gastrointestinales sont intactes. La dysphagie est l'indication la plus commune de la gastrostomie. Il est généralement préférable de placer une sonde d'alimentation rapidement pour prévenir la malnutrition et réduire les complications attribuables à l'alimentation médiocre des tissus. S'il n'est pas probable que le patient vive au-delà de quelques semaines ou quelques mois, l'alimentation par voie naso-entérique est l'approche nutritionnelle de choix. Les contre-indications de la gastrostomie percutanée comprennent les troubles de coagulation, les fistules des voies gastro-intestinales supérieures, l'occlusion intestinale, les varices, la dialyse péritonéale, la septicémie et l'occlusion de l'oesophage. Trois techniques consistant à "tirer", "pousser" et "introduire" sont décrites. Les complications les plus fréquemment rapportées sont l'infection de la lésion et le pneumopéritoine. Après s'être longtemps attachés à décrire les multiples méthodes permettant l'insertion réussie des sondes d'alimentation percutanée par voie endoscopique, les auteurs semblent désormais s'intéresser aux complications propres aux diverses techniques. Néanmoins, quand on les compare aux autres options accessibles aux patients incapables d'avaler (malnutrition autorisée, alimentation par sonde, gastrostomie chirurgicale et nutrition parentérale), la gastrostomie percutanée est la procédure de choix dans presque tous les cas.

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SIGNIFICANT STRIDES HAVE BEEN made in the past 20 years in the area of nutritional support. Perhaps the most important has been a growing appreciation of the importance of ensuring proper nutrition for all patients, particularly when their illness precludes alimentation for more than seven to 10 days (1). It has become clear that prevention of malnutrition by maintaining optimal nutrition is preferable to treating already developed malnutrition (2).

Parenteral nutrition is often used in hospitalized patients for delivering nutritional support, but enteral feeding is the route of choice when the gastrointestinal tract is functioning. Compared to parenteral nutrition, enteral feedings are not only safer, but in most instances also more efficacious and less expensive (2). Feedings can be provided through 7 French weighted-tip nasoenteric tubes. If the tube can be passed beyond the pylorus, there is no risk of aspiration and in some patients the small diameter of the tube ensures patient comfort and compliance. However, most patients find nasoenteric tubes uncomfortable, particularly if they must remain in place for a prolonged period. Moreover, because of their small size, such tubes are prone to frequent occlusion and dislodgement.

Surgical gastrostomy has been carried out for over a century. The two greatest advantages of this technique are first, that the feeding tubes have a large diameter (24 to 30 French), ensuring that occlusion is rare, and second, that they are positioned on the upper abdomen, thereby not interfering with patient comfort. The only disadvantage of surgical gastrostomy is that general

anesthesia and laparotomy are required, with all of the attending risks.

Thus for many years no satisfactory method was available to provide nutrition for ill patients. In 1981 Gauderer and Ponsky (3) described a technique for percutaneous insertion of a gastrostomy feeding tube under endoscopic control. Numerous reports since then have confirmed that percutaneous gastrostomy tubes can indeed be safely inserted without subjecting patients to the risk of surgical laparotomy (4-9).

INDICATIONS

In virtually all series, the most common indication for feeding gastrostomy tubes is inability to swallow secondary to central nervous system injury such as dementia, stroke, motor neuron disease, myasthenia gravis or brain tumour (5-10). Neoplasms in the oropharynx, injuries to the face and neck, and other otolaryngological diseases are also indications. Inability to swallow from severe psychomotor disease, birth injury, asphyxia and congenital disease constitute common indications in children.

It is often difficult to decide the proper route of nutrition when the prognosis is unknown. For example, should a percutaneous gastrostomy tube be inserted in a patient who has recently had a stroke preventing normal glutin?

In such cases, a small bore (7 French) nasogastric feeding tube should be inserted; however, if the patient finds this uncomfortable (as most do), the dilemma of whether or not to insert a percutaneous feeding tube persists. While no firm guidelines can be offered, it is generally best to place a gastrostomy tube early. This prevents malnutrition and minimizes complications, since the invasive procedure is done on well nourished tissue. Should the patient improve, it is usually technically trivial to remove the feeding tube.

Another particularly common problem in clinical practice is whether or not to offer gastrostomy feedings to patients with dementia or other irreversible conditions. This is an ethical decision, but it is important to emphasize that both insertion of gastro-

stomy tubes and their postoperative care are usually relatively simple and do not constitute "invasive aggressive life saving measures."

On the other hand, if a patient is expected to live for only weeks to months, nasoenteric feedings are the nutritional route of choice.

Gastrostomy feeding tubes have also been described as useful in children requiring unpalatable medications, in maintaining elemental feedings in inflammatory bowel disease, and for providing longstanding gastric decompression in obstructive bowel diseases (11).

CONTRAINDICATIONS

Percutaneous gastrostomy should not be offered to patients with coagulation disorders unless they can be at least temporarily corrected, and not in the presence of ascites or peritoneal diseases. Upper gastrointestinal fistulas, intestinal obstruction and gastric and esophageal varices are also considered contraindications by most authorities. Peritoneal dialysis is a relative contraindication, but gastrostomy feeding tubes can be inserted if the patient is at least temporarily switched to hemodialysis. Septicemia should be treated and esophageal obstruction alleviated as much as possible (esophagus dilated to 36 French) before a percutaneous tube is inserted. Gastrostomy can be performed safely, but exceptional care and skill is required in the presence of previous abdominal surgery (especially partial gastrectomy) or ventriculoperitoneal shunts (12).

TECHNIQUES

Three techniques have been described: the 'pull' (Ponsky-Gauderer) (3,4); the 'push' (Sacks-Vine) (6,7); and the 'introducer' (Russell, Brotman, Norris) (13).

The first steps are the same in all three methods. Feedings are withheld for at least 12 h before the procedure, and consideration given to prophylactic antibiotics. Gargling with povidone-iodine has been recommended to minimize colonization of the feeding tube as it passes through the mouth en route to the stomach (6). The esoph-

agus is then intubated with an endoscope in the usual manner after intravenous sedation and topical anesthesia of the posterior pharynx. Ideally, two assistants are present, one to ensure constant oropharyngeal suction, and the other to puncture the anterior abdominal wall. Most brands of gastroscopes are suitable for percutaneous gastrostomy, although if the pull or push techniques are used, it is important that the biopsy channel of the endoscope be large enough to allow passage of a snare. If a videoscope is to be used, there should be sufficient light emitting from the tip of the gastroscopes to allow proper abdominal wall transillumination.

While the upper gastrointestinal tract is inspected endoscopically, the assistant prepares the feeding gastrostomy tube. Then a site is selected at which to puncture the anterior abdominal wall. This is a crucial step. The optimal site is the point at which the stomach and anterior abdominal wall are in closest contact without interposed tissue. This site is recognized by inspection of the anterior abdominal wall after the room lights are dimmed, and searching for transillumination on the anterior abdominal wall from the anteriorly deflected gastroscopes. Finger pressure at the site of greatest illumination should cause marked indentation of the stomach wall, visualized endoscopically. Most often the optimal site will be the left upper quadrant, about two-thirds of the distance from the umbilicus to the left costal margin. Occasionally the stomach is too small or too high, and the anterior abdominal wall and stomach simply cannot be closely interposed. This can easily be recognized by failure to observe a point of bright illumination and/or inability to detect a definite indentation of the gastric wall after gentle finger pressure at multiple sites along the abdomen. In this situation the procedure should be stopped, since the risk of gastrostomy is increased.

Once a site has been selected that is considered satisfactory by the endoscopist, the area is prepared under sterile conditions, and the skin and subcutaneous tissue infiltrated with local

anesthesia. Using a #11 scalpel blade, the assistant then makes an incision approximately 1 cm in length at the chosen site. It is important to ensure that this incision is sufficiently long and deep to allow easy passage of the gastrostomy tube through the subcutaneous tissue; if the incision is too short, the gastrostomy tube will be too tightly apposed against the skin and subcutaneous tissue of the anterior abdominal wall, and tissue necrosis may result from the ensuing ischemia.

The next step in all three techniques is to thrust a cannula through the incision site, through the abdominal wall and then into the stomach lumen under endoscopic visualization while the endoscopist inflates the stomach with as much air as possible. However, the cannula that is used depends upon the chosen procedure (Medicat for pull technique, Seldinger for push and introducer techniques). With the pull technique a suture or silk is passed through the cannula into the gastric lumen, where it is caught by an endoscopic snare. The snare, suture and endoscope are then pulled up through the esophagus and out of the patient's mouth. The 'mouth-end' of the suture is tied to the end of the gastrostomy tube, and the assistant then pulls the 'proximal' end of the suture dangling out of the anterior abdominal wall, while the endoscopist guides the feeding tube itself through the esophagus and stomach, finally visualizing the tube as it emerges from the abdominal wall.

In the push technique a flexible wire rather than a suture is passed through the cannula; this wire is then similarly caught by a snare, and brought out through the mouth. A tapering gastrostomy tube is subsequently 'loaded' onto the wire at the mouth end, and the tube 'pushed' through the open mouth, esophagus and stomach while the wire is held taut. Details of these procedures can be found in the instruction manuals which accompany commercially available percutaneous endoscopic gastrostomy feeding tube kits, as well as in several reviews (6,10,11,14).

A key step with both push and pull techniques comes after the feeding tube

has been inserted through the anterior abdominal wall. At this point it is important to decide how tightly to pull the gastrostomy tube against the stomach wall. If the tube is too loose, a proper seal cannot form between the gastric wall and the parietal peritoneum, risking leakage of gastric contents into the peritoneum. On the other hand, if too much pressure is applied and the gastrostomy tube is too tight against the gastric mucosa, mucosal necrosis will occur. Ideally, the 'bumper' (or crossbar) end of the gastrostomy tube should be just touching the gastric wall, without any blanching or dimpling of the mucosa. This can be properly ascertained only by endoscopic visualization - ie, the endoscope must be reinserted in the stomach after the gastrostomy tube is in place. A useful rule of thumb is to tighten the feeding tube as much as possible, while at the same time ensuring that the mucosa is not altered when the tube is rotated. In the past, the tendency was to apply excessive pressure, which led to mucosal necrosis.

The 'introducer' technique also starts with insertion of a cannula through the anterior abdominal wall into the lumen of the stomach. Subsequently, a guidewire is passed through the cannula and the needle removed. Tapered silastic catheters of increasing diameter are then sequentially passed over the guidewire into the gastric lumen, thereby gradually enlarging the diameter of the 'gastrocutaneous fistula.' Then, an introducer surrounded by a peel-away sheath is passed over the guidewire into the gastric lumen, the introducer and wire removed, and a 14 French Foley catheter (or similar tube) inserted through the sheath lumen into the stomach. The sheath is then peeled away and the Foley balloon inflated in the usual manner.

POSTOPERATIVE CARE

The catheter can be sutured to the skin, but it is just as effective to anchor the tube by a feeding adapter cuff fitted to the cut end of the tube.

Most authorities advise that feedings be withheld for 24 h to ensure that complications have not occurred (5,11). If the patient is then feeling well

and bowel sounds are present without significant abdominal distension, feedings can be started. If enteral feedings have not been given previously, a small amount (100 to 200 mL) of a full strength commercial liquid diet (1 kcal/mL) is administered every 4 h, provided no residue remains in the stomach. The volume of feedings given daily is then gradually increased; it is probably best to give feedings only when the patient is upright during waking hours. If the patient was being fed enterally before the tube was inserted, the previous feeding rate can be ordered.

COMPARISON OF TECHNIQUES

Each of the three techniques outlined above has been reported to be effective and safe, but systematic comparisons have been rare. Theoretically the introducer technique is the most appealing because there is no oral contamination of the feeding tube and, in patients with pharyngeal or esophageal obstruction, the 'bumper' (or mushroom or crossbar) of the feeding tube does not have to be passed through a possibly obstructed esophagus.

Moreover, only one passage of the gastroscope is required (since the gastrostomy tube is simply a Foley catheter whose position need not be checked endoscopically). On the other hand, there has been less experience with this technique than the others, and difficulties have been described in piercing the gastric wall with the peel-away sheath and introducer; there is a tendency for the introducer to simply push the stomach wall away from the peritoneum. In addition, at least two cases of inadvertent migration of the gastrostomy tube into the peritoneal space have been reported after placement of the Foley catheter in the stomach (13,15).

The pull and push techniques are so similar that it is difficult to imagine that randomized trials will ever find a significant difference between them. Probably operator technique is more important than the actual method used to insert the gastrostomy tube. Accordingly, it is not surprising that the three

small series that have compared techniques have shown that, in expert hands, only minimal differences exist between the push and pull methods (16-19).

Most authorities recommend that the novice initially choose one technique to master. Once experience has been gained, the technique should be chosen on the basis of the individual needs of the patient.

PERCUTANEOUS ENDOSCOPIC JEJUNOSTOMY

A jejunostomy feeding tube rather than a gastrostomy tube should be considered in patients with severe gastric esophageal reflux, pneumonia, delayed gastric emptying or gastric outlet obstruction (20). To insert a jejunostomy feeding tube, the procedure begins exactly as outlined above. However, the feeding tube itself is longer than a gastrostomy feeding tube, and once in the stomach, needs to be guided with a snare into the jejunum. Accordingly such tubes are better termed gastro-jejunoscopy tubes. Double-lumen tubes (one port in the stomach, the other in the jejunum) can also be used.

ENDOSCOPIST VERSUS RADIOLOGIST

Multiple publications have demonstrated that percutaneous gastrostomy feeding tubes can be safely inserted by endoscopic control (5-11); similarly, multiple articles in the radiology literature have documented that such tubes can be just as safely inserted percutaneously under fluoroscopic guidance (21-23). A significant advantage of fluoroscopic control is that less expense is incurred because endoscopy is not performed. On the other hand, at least two recent series have shown that endoscopy reveals clinically unsuspected disease in the upper gastrointestinal tract in about one-third of patients (24,25). For example, Wolfson et al (25) found that of 201 patients undergoing percutaneous endoscopic gastrostomy, 35 had severe reflux esophagitis, 29 peptic ulcer disease, two fungal esophagitis, and two gastric outlet obstruction. The chief ad-

vantages ascribed to fluoroscopic control – lack of oral contamination of the feeding tube and percutaneous insertion of the feeding tube itself so that an obstructed esophageal lumen is not a hindrance – are also true for the endoscopic introducer technique.

IS ANTIBIOTIC PROPHYLAXIS NECESSARY?

In a prospective, randomized trial from the Mayo Clinic (26), cefazolin 1 g intravenously 30 mins before gastrostomy insertion decreased the incidence of peristomal infection to 7% compared to 32% after placebo. Similar efficacy of preprocedural antibiotics was demonstrated in another small trial (27). Many of the peristomal infections were not clinically significant (27), and in most centres the incidence of peristomal sepsis has fallen since the appreciation of the importance of not pulling the gastrostomy tube too tightly against the stomach wall. Accordingly, in a recent study from Seattle, wound infections were rare, and no benefit was observed from cefazolin prophylaxis (28). The present authors' experience has been similar.

COMPLICATIONS

The most frequently reported complication is wound infection, usually treatable by antibiotics and local debridement (5-10). Necrotizing fasciitis has also been described, occasionally causing death (29,30). These complications are becoming less common as the anterior abdominal wall scalpel incision is being made sufficiently long, and the gastrostomy tube is not being pulled too tightly against the gastric mucosa.

Probably the most frequent current complication is pneumoperitoneum secondary to leakage of air (and presumably fluid) into the peritoneal cavity during the procedure. This problem is clinically significant only if the amount of peritoneal air increases after the gastrostomy tube has been inserted, indicating a continuing leak. In this situation, water-soluble contrast material should be installed through the gastrostomy tube under radiological guidance. Leakage from the stomach into the peritoneal cavity is most often

due to poor approximation of the stomach against the anterior abdominal wall, in which case gentle traction on the gastrostomy tube can sometimes solve the problem. If the leakage is minimal, strict bowel rest (ie, nothing by mouth or feeding tube), nasogastric suction, antibiotics (eg, cefoxitin or a combination of drugs covering both Gram-negative aerobes and anaerobes) and histamine H₂ antagonists (to decrease the volume and acidity of gastric secretion) are indicated. However, if signs of sepsis develop, or if perforation of a hollow viscus has occurred, then surgery is usually necessary. If pulmonary aspiration occurs, the gastrostomy should be converted to a jejunostomy. In several reports, a number of gastrocolic fistulas occurred, usually controlled by simple withdrawal of the feeding tube (31). In other cases, however, surgery has been necessary to close the fistula. Other reported complications include inadvertent passage of the gastrostomy tube through the liver, lodging of the gastrostomy tube in the esophagus, and hematomas at the gastrostomy site (11).

If the gastrostomy tube becomes dislodged within 24 h of being inserted, some degree of peritoneal soilage is expected to occur. Usually conservative management, as outlined above for pneumoperitoneum, is satisfactory, although surgical intervention is necessary if clinical deterioration occurs.

After the procedure it is good practice to observe the area of skin around the gastrostomy site each day. Rarely, erythema and fluctuation can be detected around the tube, indicating formation of a peritubal abscess. This can almost always easily be managed by incising the area with a #11 scalpel blade.

According to the literature, the 30 day procedural mortality of percutaneous gastrostomy insertion is high, but the majority of these deaths are due to the underlying medical condition of the patient and not to the gastrostomy insertion. Major complications (death, gastric perforation, bleeding) occur in most series in 3 to 5% of cases. Pulmonary aspiration is the most frequent late complication.

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