Techniques for percutaneous transesophageal gastrotubing

Yozo Sato*, Shohei Chatani, Takaaki Hasegawa, Shinichi Murata, and Yoshitaka Inaba

Abstract

Percutaneous transesophageal gastrotubing (PTEG) procedure was developed in Japan as an alternative access route into the gastrointestinal tract, and it has been performed for patients in whom percutaneous endoscopic gastrostomy would be technically difficult to place or is contraindicated, such as in a prior gastrectomy and massive ascites. In the PTEG procedure, an indwelling tube is inserted through the cervical esophagus, which gives the patient a slight discomfort after the tube placement. Therefore, PTEG is performed not only for enteral feeding, but also for bowel decompression as a palliative care in patients with malignant gastrointestinal obstruction. Recently, several reports of PTEG from countries outside Japan indicated a high technical success rate without major complications. Furthermore, the usefulness of PTEG for bowel decompression as a palliative care was reported in prospective studies. In fact, PTEG is a technically feasible and safe procedure worldwide.

Introduction

Percutaneous endoscopic gastrostomy (PEG) was first described for feeding purposes by Gauderer et al1 in 1980 and has become a general technique worldwide for placing indwelling feeding tubes. However, relative contraindications for PEG exist, such as a prior gastrectomy, massive ascites, and peritoneal dialysis catheter, and have led to the development of percutaneous transesophageal gastrotubing (PTEG).2 PTEG was developed in Japan as an alternative access route into the gastrointestinal tract. PTEG can overcome the contraindications for PEG by avoiding placement into the abdominal cavity.2,3 Recently, PTEG has been performed for malignant gastrointestinal obstruction as a palliative procedure.2,6 Although this condition is treated by surgical procedures, such as gastrointestinal bypass and stoma formation, these are indicated in a very limited number of patients owing to poor performance status, multiple gastrointestinal obstructions due to peritoneal dissemination, and poor prognosis.2 If surgical treatment is not feasible, transnasal gastric or small-bowel tube insertion is typically performed for gastrointestinal tract decompression.2 However, the transnasal gastric tubing can add distress to the patient and reduce the quality of life.2 In PTEG, the tube is inserted through the cervical esophagus, which gives the patient a slight discomfort after the tube placement.3

This article described the indication, technique, clinical outcome, and advanced techniques for PTEG.

Indication

PTEG has been performed for patients in whom PEG would be technically difficult to place or is contraindicated, including prior gastrectomy, tumor invasion of the anterior gastric wall, massive ascites, presence of other organs between the stomach and abdominal wall, ventriculoperitoneal shunt, continuous ambulatory peritoneal dialysis catheter, and high-risk patients (pneumonia, 85 years of age or older). They are all recognized as absolute or relative contraindications for PEG.2,3

Head and neck disorders, including hyperthyroidism, tumor, and lymph node metastasis, esophageal lesions, including tumor, ulcer, and varix, coagulopathy, tracheostomy, and right recurrent nerve paralysis are recognized as the contraindications for PTEG.3

Techniques

PTEG is performed under conscious sedation using an intravenous premedication, such as pentazocine hydrochloride, and under local anesthesia, using lidocaine hydrochloride.
The technique for PTEG was established with the use of a PTEG kit (Sumitomo Bakelite, Tokyo, Japan) (Fig. 1A).²³ A rupture-free balloon (RFB) catheter made of chloroethylene is used to prevent rupture and increase visibility during ultrasonography (US) (Fig. 1B).

The patient lies supine on a fluoroscopy table with the main operator standing on the left side, because the cervical esophagus is positioned left rear to the trachea. The RFB is inserted through the nose and advanced to the cervical esophagus. The RFB is then inflated with approximately 10 mL of a dilute contrast media and positioned in the cervical esophagus above the level of the clavicle. Traction is then maintained on the balloon to keep it in the cervical esophagus. US reveals that the inflated RFB, which displaces the vessels (carotid artery and internal jugular vein) laterally and the thyroid medially, is detected just under the skin (Fig. 2).

The RFB is punctured percutaneously by an 18-gauge needle under US guidance, and a guidewire is inserted into the RFB through the needle (Fig. 3A). A correct puncture is confirmed if the contrast media overflows from the RFB upon the removal of the inner needle. The RFB and guidewire are advanced to the lower esophagus under fluoroscopy, and the guidewire is removed from the RFB. The guidewire is kept in the lower esophagus, and the RFB is then removed (Fig. 3B). Subsequently, the guidewire is advanced further to the stomach, and the puncture site is dilated using a dilator with a peel-away sheath over the guidewire (Fig. 3C). It is significant to tilt the dilator toward the patient’s abdomen, and thereby, the dilator aligns with the guidewire under fluoroscopy. Moreover, an indwelling tube is appropriately inserted into the stomach via the esophagus through the sheath. Finally, the sheath is peeled away, and the indwelling tube is secured with a nylon suture at the puncture site (Fig. 3D, 3E). After the procedure, local skin care and catheter maintenance are performed similar to those performed for other gastrostomy tubes.¹⁻³ We usually exchange the PTEG tube every 2 to 3 months.

**Complications**

Minor complications, including wound infection, stoma leakage, localized bleeding, and tube obstruction, have been reported in 18% to 23% of cases.³⁻⁸ Stoma leakage and wound infection are more common when PTEG is used for drainage, and tube obstruction is more common when PTEG was placed for feeding.³

As a major complication, tracheoesophageal fistula that caused aspiration pneumonia after the procedure was reported in a prospective study.⁵ Furthermore, arterial bleeding at the puncture site treated with transarterial embolization during the procedure was observed in our experience. This case of gallbladder cancer presented with thrombocytopenia (3.4 × 10⁴/µL) due to secondary myelodysplastic syndrome, and PTEG was performed.
after platelet transfusion. The puncture site was dilated using a dilator, and arterial bleeding at the puncture site occurred. The bleeding persisted even though compression using a dilator was performed. Therefore, transarterial embolization was performed using a mixture of N-butyl cyanoacrylate and lipiodol (ratio, 1 : 4), and hemostasis was achieved (Fig. 4). Finally, the indwelling tube could be inserted, and no further bleeding was observed.

**Clinical Outcomes**

In 1994, Oishi et al. developed the PTEG method that involves the percutaneous insertion of a tube through the cervical esophagus, giving the patient a slight discomfort after the tube placement. In a total of 115 patients in the study of Oishi et al., the PTEG placement was described to be for feeding in 67 and decompression in 48 patients, with a 100% technical success rate. All patients who had transnasal gastric tubing were relieved of their nasal discomfort and pharyngalgia. In drainage cases, nau-
sea and abdominal distension were improved. In addition, other reports from countries outside Japan indicated a high technical success rate of PTEG for decompression and enteral feeding.\textsuperscript{5,10}

Furthermore, a prospective phase II study of PTEG for decompression in 33 patients with malignant gastrointestinal obstruction was reported. The technical success rate was 100\%, and the procedure was considered effective (more comfortable than transnasal gastric tubing) in 30 of 33 patients.\textsuperscript{5}

Recently, a randomized, controlled trial to evaluate the superiority of PTEG over transnasal gastric tubing as a palliative care for malignant gastrointestinal obstruction was reported.\textsuperscript{6} Twenty-one and 19 patients were allocated to the PTEG and transnasal gastric tubing groups, respectively. The PTEG procedure was successful in all patients of the PTEG group. In terms of quality of life, PTEG was superior to transnasal gastric tubing as a palliative care. However, minor complications, such as minor bleeding and puncture site infection, were observed in the PTEG group.

As mentioned above, the PTEG procedure is technically feasible and safe. Additionally, it is a useful palliative procedure in patients with malignant gastrointestinal obstruction.

Advanced Techniques

No rupture-free balloon

The RFB is the crucial material for the PTEG procedure, and most studies regarding PTEG used this kit. However, the complete PTEG kit is not available in most institutes outside of Japan. To overcome that weakness, the technique of hydro-dissection assisted puncture of an esophageal balloon for the PTEG procedure was recently reported.\textsuperscript{11} In this report, due to the unavailability of the RFB, an 18-mm diameter esophageal balloon was used instead. Most of the patients had an insufficient space between the thyroid gland and the neck vessels. To create a safe access route, 5 to 10 mL of lidocaine was injected into the soft tissue between the thyroid gland and the neck vessels. Then, the esophageal balloon was punctured using a 21-gauge needle to prevent an acute collapse.

Gastrointestinal tubing via the percutaneous transesophageal gastrotubing route

In patients with malignant gastrointestinal obstruction, decompression by PTEG may be insufficient because full drainage of the small bowel cannot be achieved by only gastrotubing. In those patients, small-bowel tubing via the PTEG route is a possible procedure after an adequate fistula formation (Fig. 5). Moreover, the technique of double tube insertion via the PTEG route for gastric cancer with outlet obstruction was reported;\textsuperscript{12} one was a decompression tube in the stomach and the other was a feeding tube in the distal duodenum through the pyloric stenosis. Further, in the management of anastomotic leakage after an upper gastrointestinal surgery, transnasal bowel drainage is needed for long-term use. Small-bowel tubing via the PTEG route is a feasible procedure to relieve nasal discomfort.\textsuperscript{13,14}

Post-esophagectomy

Generally, PTEG is not indicated after esophagectomy because percutaneous gastrojejunostomy is technically feasible.\textsuperscript{15} However, percutaneous gastrojejunostomy is also technically difficult for subtotal esophagectomy with a gastric tube reconstruction of the posterior mediastinal route. Previously, we performed PTEG...

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**Fig. 5.** Small-bowel tubing via the percutaneous transesophageal gastrotubing (PTEG) route. (A, B) PTEG was performed in patients with malignant gastrointestinal obstruction. A 14-Fr ileus tube was inserted via the PTEG route after 1 week.

**Fig. 6.** Percutaneous transesophageal gastrotubing after subtotal esophagectomy with a gastric tube reconstruction of the posterior mediastinal route. (A, B) Computed tomography and contrast study of the upper gastrointestinal tract were performed to confirm the position of the residual cervical esophagus (arrows). (C) Ultrasonography revealed the inflated rupture-free balloon at the right supraclavicular portion (arrow). (D, E) A 12-Fr feeding tube could be inserted to the duodenum via the right-side cervical approach (arrows).
using the right-side approach in a patient who underwent subtotal esophagectomy with a posterior mediastinal route reconstruction. The case suffered from refractory aspiration pneumonia, and PTEG was attempted for the enteral feeding. Fortunately, US revealed the inflated RFB at the right supraclavicular portion, and PTEG could be performed via the right-side approach (Fig. 6).

**Conclusions**

PTEG is the alternative procedure for patients in whom PEG would be technically difficult to place or contraindicated. Furthermore, the indication of PTEG has been expanding with advanced techniques. Moreover, PTEG is useful as a palliative care in patients with malignant gastrointestinal obstruction.

**Conflicts of Interest**

No potential conflict of interest relevant to this article was reported.

**ORCID**

Yozo Sato, https://orcid.org/0000-0001-7605-8434
Shohei Chatani, https://orcid.org/0000-0001-5080-2333
Takaaki Hasegawa, https://orcid.org/0000-0001-6701-8836
Shinichi Murata, https://orcid.org/0000-0002-6163-5451
Yoshitaka Inaba, https://orcid.org/0000-0002-0850-6327

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