The Techniques for Percutaneous Radiologic Gastrostomy and Percutaneous Transesophageal Gastrotubing

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Introduction
Percutaneous endoscopic gastrostomy (PEG) was first described for feeding purposes by Gauderer in 1980 and has become a general technique worldwide for placing indwelling feeding and decompressive tubes [1-2]. The image-guided technique percutaneous radiologic gastrostomy (PRG) is performed for patients when PEG cannot be performed [3]. Other contraindications for PEG also exist and have led to the development of the percutaneous transesophageal gastrotubing (PTEG) technique [2]. PTEG was developed in Japan as an alternate route of access into the gastrointestinal tract. By avoiding placement into the abdominal cavity, PTEG can overcome contraindications for PEG [2, 4].

This article discusses the indication, technique, clinical outcome, and applied procedures for both PRG and PTEG.

Indication

Indication for PRG
The patients who are at high-risk of malnutrition, are unlikely to recover their ability to feed orally in the short term, or require long-term gastric decompression should be considered for gastrostomy [3].

PRG is indicated for conditions where PEG cannot be performed because of a significant stenosis of the upper GI tract, a large hiatus hernia, or substantial obesity where trans-illumination is difficult [3, 5].

Contraindications for PEG are described below in the indications for PTEG.

Indication for PTEG
PTEG has been performed for patients in whom PEG would be technically difficult to place or is contraindicated. These include prior gastrectomy, tumor invasion of the anterior gastric wall, massive ascites, presence of other organs between the stomach and abdominal wall, ventriculoperitoneal shunts, continuous ambulatory peritoneal dialysis catheters, and high-risk patients (pneumonia, 85 years of age or older). They are all recognized as absolute or relative contraindications for PEG [2, 4].

Head and neck lesions, coagulopathy, and right recurrent nerve paralysis are recognized as contraindications for PTEG.
Procedure Technique

Both procedures are performed under conscious sedation using intravenous premedication, such as pentazocine hydrochloride, and under local anesthesia, such as lidocaine hydrochloride.

The Technique for PRG

A nasogastric tube is inserted, and then, air is injected via the nasogastric tube to dilate the stomach. The puncture site of the dilated stomach is determined by fluoroscopy. If gastric peristalsis is active, scopolamine butylbromide or glucagon are intramuscularly administered as a sedative. Ultrasonography is used to confirm that no other organs, such as the liver or transverse colon, intervene between the stomach and abdominal wall.

The gastric wall should then be secured close to the abdominal wall with 2-point anchoring using a gastropexy device (T-fastener, Cope Gastrointestinal Suture Anchor Set; Cook Medical, Bloomington, IN, USA) (Fig. 1A). A needle, pre-loaded with a T-fastener, is passed into the stomach, and the T-fastener is then pushed through the needle into the stomach.

Following this, the gastric wall is percutaneously punctured under fluoroscopic guidance with an 18-gauge needle with a sheath, and the puncture site is dilated using a dilator with a peel-away sheath over the guidewire (Fig. 1B). Finally, a gastrostomy tube is inserted into the stomach, and the indwelling tube is secured with a nylon suture at the puncture site [3, 6] (Fig. 1C).

The Technique for PTEG

The technique for PTEG was established with the use of a PTEG kit (Sumitomo Bakelite, Tokyo, Japan; Fig. 2A). A rupture-free balloon (RFB) catheter made of chloroethylene is used to prevent rupture and increase visibility during ultrasonography (US) (Fig. 2B). The patient lies supine on a fluoroscopy table with the main operator standing on the left side.

RFB is inserted through the nose and advanced to the cervical esophagus. The RFB is inflated with approximately 10-15 mL of 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 should reveal 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. 3A, B). The RFB is punctured percutaneously by an 18-gauge needle with a sheath under US guidance, and a guidewire is inserted into the RFB through the needle (Fig. 4A). Correct puncture is confirmed if the contrast media escapes from the RFB with the removal of the inner needle.

The RFB and guidewire are advanced to the lower esophagus under fluoroscopy, and the RFB is then removed (Fig. 4B). The puncture site is dilated using a dilator with a
peel-away sheath over the guidewire (Fig. 4C), and then, 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. 4D, E).

The nasogastric tube is removed at the completion of the procedure. Local skin care and catheter maintenance are the same as for other gastrostomy tubes [2, 4, 7].

Clinical outcomes

RPG

Radiologically inserted gastrostomy was first described in 1981 by Preshaw [8]. It is a Seldinger technique wherein the stomach is insufflated with air following the passing of a nasogastric tube or peroral catheter. Consistently high success rates for placement of RIG tubes have been reported (95–100 %) [9-12].

Minor complications, such as superficial peristomal infection (25–45%), leakage (11.4%), tube occlusion (4.5%), and tube dislodgement (1.3–4.5%), have also been reported. Major complications, such as hemorrhage (1.4%), peritonitis (1.3%), and death due to the procedure (0.3%), have also been noted [3].

PTEG

In 1994, Oishi et al developed the PTEG method that involves percutaneous insertion of a tube through the cervical esophagus so the patient feels little discomfort after tube placement [13]. They described the results of PTEG placement in 115 patients with a 100% technical success without any major complications, and minor complications, such as tube obstructions, stomal leakage, wound infection, unrecovered tube migration, and minor bleeding, occurred in only 27 patients (23.5%) [4].

Several other reports from countries outside Japan indicated a high technical success rate of PTEG for decompression and enteral feeding [14-15]. Furthermore, according to a multicenter prospective study in 33 patients with malignant gastrointestinal obstruction, the technical success rate was 100%, and the procedure was considered effective (more comfortable than NGT) in 30 of 33 patients. The one recorded complication was a tracheoesophageal fistula that caused grade 2 aspiration pneumonia [7].

Applied procedures

PRG

If nasogastric tube insertion was unsuccessful, the stomach was punctured directly with a fine needle (23- to 21-G needle) under US guidance and air was injected to dilate the stomach, and then, all the steps following stomach dilation were performed [6].
**PTEG**

In patients with malignant gastrointestinal obstruction, decompression by PTEG may be insufficient because full drainage of the small bowel could not be achieved by only gastrotubing. In those patients, ileus tube insertion via the PTEG route is a possible procedure after adequate fistula formation (Fig. 5A, B).

**Conclusion**

In conclusion, PRG and PTEG are safe and effective nonvascular interventional procedures for patients in whom PEG would be technically difficult to place or was contraindicated.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Abbreviations**

PEG: percutaneous endoscopic gastrostomy  
PTEG: percutaneous transesophageal gastrotubing  
RFB: rupture-free balloon

**References**


1A: The gastric wall was secured close to the abdominal wall with 2-point anchoring using a gastropexy device (T-fastener).

1B: The puncture site is dilated using a dilator with a peel-away sheath over the guidewire.

1C: A gastrostomy tube (15.5-Fr Malecot-type gastrostomy tube; Cook Medical, Bloomington, IN, USA) was inserted.
Figure 2.

2A: PTEG kit including straight-type guidewire (first guidewire) (1), RFB (2), 18-gauge puncture needle with sheath (3), J-type guidewire (second guidewire) (4), 8-F dilator (5), 16-F peel-away sheath (6), and indwelling tube (7).

2B: A RFB is inflated with approximately 10-15 mL of dilute contrast media.
Figure 3.  
US reveals that the inflated RFB placed at the cervical esophagus, which displaces the vessels (carotid artery and internal jugular vein) laterally, is detected just under the skin.

1, esophagus; 2, thyroid gland; 3, trachea; 4, carotid artery; 5, jugular vein; 6, RFB

3A: Ultrasonography (US) before RFB inflation

3B: After RFB inflation
Figure 4.

4A: A J-type guidewire is inserted into the RFB through the outer sheath of the puncture needle.

4B: A J-type guidewire and the RFB catheter are advanced to the lower esophagus.
4C: The puncture site is dilated using a dilator with a peel-away sheath over the guidewire.

4D: An indwelling tube is appropriately inserted into the stomach via the esophagus.
4E: An indwelling tube is secured with nylon suture at the puncture site.

Figure 5.
5A, B: PTEG was performed in patients with malignant gastrointestinal obstruction. A 14-F ileus tube was inserted via the PTEG route after one week.