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Original Article

Fluoroscopy-guided placement of pull-type gastrostomy tubes; a single-center experience

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Abstract

Aim: Gastrostomy tubes provide nutritional access in patients with impaired oral intake. Gastrostomy tubes can be inserted with endoscopy or fluoroscopy assistance. The aim of this study was to describe the clinical features and complications of fluoroscopy-guided gastrostomy tube insertion and to compare these complications with those of the endoscopy-assisted gastrostomy technique.

Material and Methods: A retrospective data analysis was performed for gastrostomy tube placement procedures. Patients' age, gender, medical, neurological, and surgical diseases, major and minor complications, mortality rates, and length of hospital stay were compared between fluoroscopy-guided and endoscopy-guided pull-type gastrostomy tube placement.

Results: The medical records of 92 patients (60 male, 32 female; mean age ± SD: 63.1 ± 15.8 years; range: 24-92 years) who underwent endoscopy-guided (n=50) or fluoroscopy-guided (n=42) gastrostomy tube placement were reviewed. The indications for gastrostomy tube insertion mainly included neurological disease (n=39, 78%), such as cerebrovascular accident (n=22, 44%), in the endoscopy group and surgical disease (n=33, 73.3%), such as head and neck cancer (n=27, 60%), in the fluoroscopy group. There were no mortalities related to gastrostomy tube insertion in either group. There was no significant difference between the major complication rates of the two groups (P=0.62). The minor complication rate was higher in the endoscopy group (P=0.03). One patient in the fluoroscopy group required surgical intervention to treat a complication related to gastrostomy insertion.

Conclusion: Gastrostomy tube insertion via both endoscopy and fluoroscopy guidance provides a safe route for nutrition delivery. Fluoroscopy-guided placement of pull-type gastrostomy tubes is a reliable technique and should be the first choice for gastrostomy tube placement, particularly for patients with head and neck tumors in whom endoscopic placement is technically difficult.

Keywords: Complication; endoscopy; fluoroscopy; pull-type gastrostomy tube

INTRODUCTION

Gastrostomy tube insertion is usually indicated in patients with difficulty maintaining adequate oral nutrition. Common indications of gastrostomy tube placement include head and neck tumors, neck radiotherapy-related dysphagia or mucositis, neurological diseases (cerebrovascular accidents, intracranial hemorrhage, hypoxic brain injury, or cerebral palsy), and decompression of the stomach in cases of small bowel obstruction (1). Gastrostomies can be either permanent or temporary, depending on the recovery of oral intake and the initial indication for gastrostomy.

The three main methods of inserting gastrostomy tubes are endoscopic, radiological, and surgical. Pull-type percutaneous endoscopic gastrostomy (PEG) was first described in 1980 by Gauderer et al. (2) and has since largely replaced surgery for enteral access. This procedure is safer and easier to administer than surgical gastrostomy (3). Push-type percutaneous radiologic gastrostomy (PRG) was first introduced in 1981 by Preshaw (4). In conventional push-type PRG, a gastrostomy tube is inserted with external-internal access to the stomach through the abdominal wall using fluoroscopy guidance.

Pull-type fluoroscopic gastrostomy is the second PRG technique that has been adapted from PEG. It differs from conventional PRG in that the gastrostomy tube is removed from the stomach through the nasal cavity (or mouth) and the esophagus using a guidewire (5).

We aimed to compare the demographic data, clinical characteristics, and complications between two common gastrostomy tube placement techniques: pull-type PEG and PRG.

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MATERIAL and METHODS

Study design and data collection

A retrospective database search was conducted using the medical records of patients who underwent fluoroscopy-guided or endoscopy-guided pull-type gastrostomy tube insertion from January 2013 to January 2019. Pediatric patients (≤17 years old) were excluded. All successful gastrostomy insertions in the interventional radiology unit were included. Two patients were excluded from the study (one patient could not tolerate the procedure due to nausea and vomiting, and one patient experienced cardiac arrest immediately prior to the procedure at the fluoroscopy desk). Database search of the endoscopy group retrieved 345 procedures. Among them, 50 randomly selected adult patients were included for comparison. All patients or an authorized representative gave informed consent for the gastrostomy tube insertion procedure.

The previous computed tomography (CT) examinations of the patients were evaluated before the procedure. If the patients had not already undergone abdominal CT, additional CT was not performed. The institutional review board approved this study with waived informed consent because of the retrospective study design.

Patients' gender, age at the time of the procedure, antiaggregant or anticoagulant medication status, and laboratory findings, including hemoglobin, platelet, albumin, aspartate aminotransferase (AST), and alanine aminotransferase (ALT) levels and the international normalization ratio (INR), were analyzed. The gastrostomy tubes inserted in both groups were all bumper type 20 Fr gastrostomy tubes. The medical, neurological, and surgical diseases of the patients were recorded.

Peri-procedural mortality was defined as mortality related to complications due to the percutaneous gastrostomy procedure itself. The mortality rates related to the gastrostomy procedure and overall mortality rates were compared. The complications of the procedures were divided into major and minor categories. Major complications included all serious complications, such as peritonitis, intra-abdominal abscess formation, gastric and/or intra-abdominal bleeding, tracheobronchial aspiration, and colon perforation. Minor complications were defined as transient findings that did not require any surgical procedures and were conservatively treated. The locations in which the procedures were performed, the intensive care unit (ICU), endoscopy unit, and interventional radiology unit, were noted.

Fluoroscopy-guided pull-through gastrostomy

All fluoroscopy-guided pull through gastrostomy procedures were performed by an interventional radiologist with at least 3 years of clinical experience. Prior to the procedure, all patients fasted overnight for at least eight hours and ingested oral barium sulphate for opacification of the bowel segments to reduce the risk of bowel traversing during gastric puncture. All patients had compensated coagulation. Sedation with anxiolytics was not routinely performed.

An 8 Fr nasogastric tube was inserted before PRG. The stomach was insufflated with room air. Local anesthesia with prilocaine was administered at the site of the gastric puncture. The inflated stomach was punctured with an 18-Gauge needle under fluoroscopy and ultrasonography guidance. After gastric puncture, a 5 Fr introducer sheath was placed in the stomach, and then a hydrophilic stiff guidewire (0.035-inch) was doubled midway and introduced into the gastric lumen through the introducer sheath. A hydrophilic guidewire (0.035 inch, Terumo) was introduced into the gastric lumen through a nasogastric tube, and it was captured with the other guidewire. A gastrostomy tube was tied to the guidewire through a nasogastric tube, and the whole construct (guidewires, introducer sheath, and fixed gastrostomy tube) was pulled through the esophagus, stomach, and gastric and abdominal walls until the gastrostomy tube exited the abdominal wall. The gastrostomy tube was fixed with an outer fixation plate. The proper position of the tube was confirmed by contrast injection. After the procedure, the patients continued to fast for the next 12 hours (Figure 1).

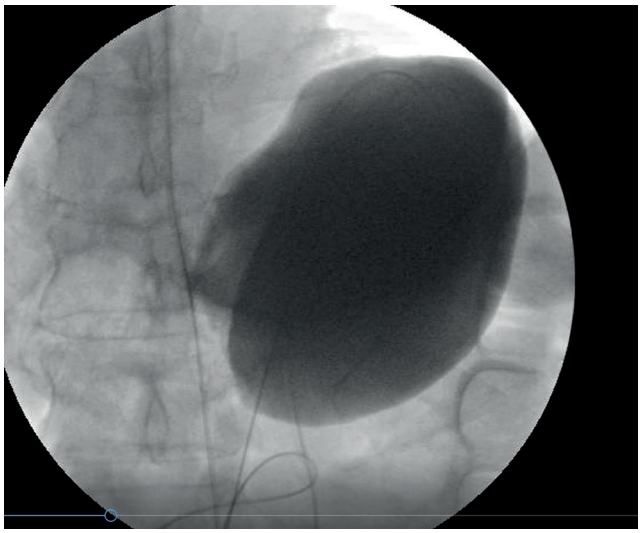

Figure 1. The image shows the captured transnasal hydrophilic guidewire by the other guidewire through the percutaneously placed introducer

Endoscopic pull-through gastrostomy

All endoscopic pull-through gastrostomy were performed by a general surgeon with at least 3 years of clinical experience. All patients fasted for at least 12 hours prior to the procedure. Intravenous midazolam was administered to provide mild sedation during the procedure. Prior to gastrostomy tube placement, the esophagus, stomach, and duodenum were evaluated with endoscopy for particularly obstructing tumoral lesions. The gastric antrum and fundus junction were determined appropriate for tube placement. The appropriate location was determined by applying pressure with the finger from the outside using the advantage of the light of the endoscopy device. Local anesthesia with prilocaine was administered, and an 18-Gauge needle was introduced into the gastric lumen. The location of the needle tip inside the gastric lumen was confirmed by endoscopy.

The gastrostomy tube was placed using a guidewire with the pull-through technique. Enteral feeding through the gastrostomy tube was started 12 hours after the procedure.

Statistical analysis

All statistical analyses were performed using the Statistical Package for Social Sciences version 21.0 software for Windows (SPSS Inc., Chicago, IL, USA). Chi-square, Fisher's exact, Mann–Whitney U, and Student t tests were performed to compare categorical and continuous variables between the two groups. A P value of <0.05 was considered statistically significant.

RESULTS

Patients

The medical database search revealed 45 pull-type PRG procedures performed in the interventional radiology unit between January 2013 and January 2019. The technical success rate was 100%. Three patients who were <18 years old were excluded. The database search provided 345 pull-type PEG procedures during the same time period. A randomized selection in the PEG group was performed, and finally, a total of 42 PRG and 50 PEG procedures were included in the study population. The mean age of the patients was 63.1±15.8 years (range: 24–92 years).

Table 1. The demographic data, medications, and biochemical results of patients.

	PRG (n=42)	PEG (n=50)	P value
Age (years±SD)	61.3±15	64.5±16.5	0.33
Gender (male/female)	61.3±15	64.5±16.5	0.33
Antiaggregant or anticoagulant use	15/27	17/33	0.86
Steroid use	13 (31%)	40 (80%)	< 0.01
Biochemical results	10 (23.8%)	10 (20%)	0.65
Hemoglobin (g/dL)	11.3±1.6	10.4±1.3	< 0.01
Platelet (cells/mm^3)	290.5±90.4	235.3±116	0.04
INR	1.1±0.1	1.2±0.3	0.01
Albumin (g/dL)	3.1±0.7	2.6±0.5	< 0.001
Creatinine (mg/dL)	0.6±0.2	0.7±0.4	0.63
AST (IU/L)	24.1±13.1	36.3±34.5	< 0.01
ALT (IU/L)	19.3±13.8	30.5±19	< 0.01

PRG,Percutaneous Radiologic Gastrostomy; PEG, Percutaneous Endoscopic Gastrostomy

Table 2. Comorbidities of patient in both groups

	PRG (n=42)	PEG (n=50)	P value
Medical disease	10 (23.8%)	26 (52%)	0.006
Respiratory failure	6 (14.3%)	16 (32%)	0.047
Cardiac failure	1 (2.4%)	6 (12%)	0.12
Diabetes mellitus	4 (9.5%)	10 (20%)	0.03
Renal failure	0	2 (4%)	0.49
Hepatic failure	0	2 (4%)	0.49
Neurological disease	12 (28.6%)	39 (78%)	< 0.001
Cerebrovascular accident	5 (11.9%)	24 (48%)	< 0.001
Traumatic brain injury	2 (4.8%)	10 (20%)	0.05
Parkinson's disease	0	3 (6%)	0.24
Motor neuron disease	3 (7.1%)	3 (6%)	1
Dementia	1 (2.4%)	2 (4%)	1
Other	1 (2.4%)	0	0.45
Surgical disease	31 (73.8%)	12 (24%)	< 0.001
Head and neck carcinoma	27 (64.3%)	8 (16%)	< 0.001
Other	4 (9.6%)	2 (4%)	0.40

PRG, Percutaneous Radiologic Gastrostomy; PEG, Percutaneous Endoscopic Gastrostomy

The demographic data of the groups did not reveal any significant differences. While the platelet, albumin, and hemoglobin levels were significantly higher in the PRG group, the ALT, AST, and INR levels were significantly higher in the PEG group. There was no difference in the other biochemical results. The demographic data, biochemical results, and medications, including antiaggregant-anticoagulants and corticosteroids, of patients are listed in Table 1. Antibiotic prophylaxis was not used in the fluoroscopy group, while 96% of patients in the endoscopy group received antibiotic prophylaxis.

The medical, surgical, and neurological diseases of patients in the PEG and PRG groups are shown in Table 2. Surgical diseases were more common in the PRG group, and neurological diseases were more common in the PEG group. In the PEG group, 78% of patients had a neurological disease, while in the PRG group, only 38.6% of patients had a neurological disease. There were no statistically significant differences among the medical diseases between the two groups.

Comparison of complications

Complications, including the major and minor complication subgroups, are shown in Table 3. The overall complication rates were 54% and 23.8% in the PEG and PRG groups, respectively. There were more minor complications in the PEG group than in the PRG group, while there was no significant difference in the major complication rates between the two groups. In the PEG group, no intraprocedural complications were detected. One intraprocedural complication (transverse colon perforation) was observed in the PRG group as a major complication. All complications in the PEG group were treated with medical therapy, and one patient required surgery in the PRG group because of colon perforation during PRG. There were no mortalities related to gastrostomy in either the PEG or PRG groups. The overall mortality rate, which was due to comorbidities in both groups, was higher in the PRG group than in the PEG group (28.6% and 16%, respectively).

While all gastrostomy tube insertion procedures were performed in an interventional radiology room in the PRG group, 41 (82%) tubes were inserted in the ICU and 9 (18%) tubes were inserted in an endoscopy room in the PEG group. The mean hospital stay after gastrostomy tube insertion was 8.2±8.1 days in the PRG group and 10.9±7.7 days in the PEG group, with no significant difference.

Table 3. Complication rates of pull-type PRG and PEG procedures

	PRG (n=42)	PEG (n=50)	P value
Overall complications	10 (23.8%)	27 (54%)	0.003
Major complications	1 (2.4%)	3 (6%)	0.62
Intraperitoneal hemorrhage	0	3 (6%)	0.24
Colon perforation	1 (2.4%)	0	0.45
Minor complications	10 (23.8%)	27 (54%)	0.003
Pneumoperitoneum	1 (2.4%)	1 (2%)	1
Subcutaneous hemorrhage	5 (11.9%)	9 (18%)	0.56
Local infection	1 (2.4%)	6 (12%)	0.12
Abscess (peristomal)	0	9 (18%)	0.003
Tube dislocation	3 (7.1%)	9 (18%)	0.21

PRG,Percutaneous Radiologic Gastrostomy; PEG, Percutaneous Endoscopic Gastrostomy

DISCUSSION

Percutaneous gastrostomy techniques via radiological or endoscopic guidance have replaced surgical gastrostomies because of the risk of anesthesia and the increased morbidity associated with laparotomy (1, 6). In clinical practice, endoscopy-assisted gastrostomy tube placement is much more preferred than radiologic techniques. However, the benefits of PRG have led to recommendations to use PRG in patients at higher risk or those in whom endoscopy is technically challenging or contraindicated (7). In this study, a comparison between these two common techniques of gastrostomy tube insertion was performed.

The gender and age of the patients in the two groups did not differ significantly. Among the biochemical results, the hemoglobin, platelet, and INR levels were higher in the PRG group, and the albumin, AST, and ALT levels were higher in the PEG group. This result may be attributed to the different gastrostomy indications in the two groups. When we compared the medication status of the groups, corticosteroid use was similar, but antiplatelet or anticoagulant use was higher in the PEG group (78% vs. 31%). This difference may have caused the higher rate of minor complications, such as subcutaneous or intraperitoneal hemorrhage, in the PEG group. In terms of indications, neurological diseases were more common in the PEG group, and surgical diseases were more common

in the PRG group, which is consistent with previous reports in the literature comparing PRG and PEG (8-10).

Several reports in the literature have compared the complication rates between PRG and PEG. In a study conducted by MacLean et al. (8), complication rates were significantly higher in the PRG group (70% vs. 22%). Similarly, Neeff et al. (11) reported a higher complication rate in the PRG group (44% vs. 11%). When the complications were categorized as major and minor complications, several studies revealed significantly higher minor complication rates in the PRG group (12, 13), and others found no significant difference in major and minor complication rates (10,14,15). The major complication rates in our population were 2.4% and 6% for PRG and PEG, respectively, and did not show a significant difference. In contrast, the overall and minor complication rates were higher in the PEG group in this study.

Our results are not similar to those of the abovementioned reports. Several factors may explain this issue. First, the gastrostomy tubes in previous reports generally differed in the PRG and PEG groups, and push-type PRG tubes were more common in these studies. In contrast, we used the same type and size (20 Fr) pull-type gastrostomy tubes in both groups. Second, there was more antiplatelet-anticoagulant medication use in the PEG group in our study. Additionally, the platelet count was lower and the INR values were slightly higher in the PEG group than in the PRG group. These factors may increase minor hemorrhagic complications. The majority of PEG procedures were performed at bedside in the ICU, and this method may be a cause of the increased minor complications related to the procedure. and this method may be a cause of the increased minor complications related to the procedure.

Haber et al. (16) compared pull-type and push-type PRG tube insertion and reported that major (7% vs 6%, respectively) and minor complication rates (13% vs 19%, respectively) were similar for both groups. They used 20 Fr mushroom type and 18 F balloon gastrostomy tubes for these techniques. However, Yang et al. (5) reported that push-type PRG tube insertion has more major and minor complications than pull-type PRG. The overall complication rates in this study were 14.8% and 34.4% for the pull and push procedure types (P=0.002), respectively. Another study reported an overall complication rate of 16.7% for pull-type PRG (17). Currie et al. (18) reported similar major complication rates (5.3% vs. 5.6%, respectively) for push-type and pull-type PRG. However, the minor complication rate was higher in push-type PRG (17.2% vs. 7.5%, P=0.045). Furthermore, they compared pigtail and balloon gastrostomies as subgroups of push-type PRG, and the minor and major complication rates of these subgroups did not significantly differ. In our study, the overall, major, and minor complication rates in pull-type PRG were 23.8%, 2.4%, and 23.8%, respectively.

A recent study by Kulvatunyou et al. (19) compared pull-type and push-type PEG and found similar overall complication rates (20% vs. 22%, respectively, P=0.61). In our study, the overall, major, and minor complication rates in pull-type PEG were 54%, 6%, and 54%, respectively.

The strength of this study is that it was conducted in a tertiary care hospital. The inserted gastrostomy tube was the same brand in the two groups. In previous studies comparing PRG and PEG, the tube diameter and type generally differed (10). Retrospective data analysis and a small sample are other limitations of this study. There were significant differences in the comorbidities and some biochemical results between the groups. We could not compare the duration of the gastrostomy insertion procedure due to the retrospective design of the study.

CONCLUSION

Gastrostomy tube insertion via both endoscopic and radiological methods is a safe approach for enteral nutrition. While there was no significant difference in the major complication rates between the two groups, the minor complication rate was higher in the PEG group. Pull-type PRG provides low complication rates and should be considered as the first choice technique for gastrostomy tube placement, particularly for patients with head and neck tumors in whom gastrostomy tube insertion with endoscopy guidance is challenging.

Competing interests: The authors declare that they have no competing interest.

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