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ORIGINAL ARTICLE

Improved method of gastrostomy tube replacement using a small-caliber transnasal endoscope

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ABSTRACT

Conclusion: Gastrostomy tube replacement using a new approach through the abdominal-wall stoma with a small-caliber trans-nasal endoscope is feasible, fast, and safe compared with the trans-oral approach. **Objectives:** To evaluate the feasibility of a new technique using a trans-nasal endoscope for gastrostomy tube replacement. **Methods:** Between June 2005 and December 2013 in the Peking University Third Hospital, 69 patients underwent gastrostomy tube replacement using the trans-oral approach (conventional method) or a small-caliber trans-nasal endoscope inserted through the abdominal-wall stoma (new method). A retrospective review was performed of the medical records of those patients, including demography and information about the surgical procedure and any complications. Patients were classified into the conventional group and the new method group. Descriptive statistics for all continuous variables were mean \pm standard deviation and for categorical variables were number and percentage. **Results:** Gastrostomy tube replacement was achieved in 69 of 69 cases (100%); 23 of these procedures were performed using the new method. The surgery time with the conventional method (8.3 ± 2.0 min) was significantly longer than with the new method (6.0 ± 0.9 min, $p < 0.001$). With the conventional method, there was one patient (2%) with post-operative fever and skin infection; no complications occurred with the new method.

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Introduction

In 1980, Gauderer et al. [1] published their experience using a percutaneous endoscopic gastrostomy (PEG) technique as an alternative to surgical laparotomy for feeding-tube insertion in pediatric patients requiring long-term enteral nutrition. The original technique used a trans-oral endoscope to assist with placing the PEG tube through the abdominal wall.

Since then, multiple new PEG insertion techniques have been developed, including the use of trans-nasal endoscopy, to insert a PEG tube in patients with facial trauma or head and neck cancers that made per-oral endoscopy impossible [2–4]. Both the indications for PEG tubes and the number of PEG tubes placed annually have increased significantly since 1980 [5,6]. Some authors have estimated that $\sim 200\,000$ PEG tubes are placed annually in the US [6].

Feeding tubes generally last for 3–6 months and may last 12–18 months with proper care [7]. However, they may require replacement due to aging and deterioration, dislodgement, or irreversible clogging of the tube [8]. Lee et al. [9] compared the complications between per-oral endoscopic and percutaneous methods of replacing PEG tubes, and found that the percutaneous method was safer and more feasible in older patients. Nevertheless, there may be patients in whom an endoscopic method is preferred or required. Therefore, we developed a new method of performing gastrostomy tube replacement using a small-caliber endoscope inserted through the

gastrostomy stoma for the purpose of reducing the impact of the procedure on the patient. The aim of this retrospective study was to determine the feasibility and safety of this new method compared with the traditional trans-oral method.

Materials and methods

Patients

Between June 2005 and December 2013 in the Peking University Third Hospital, 69 patients underwent gastrostomy tube replacement using either the trans-oral approach with a trans-oral gastroscope (conventional method) or a new approach through the abdominal-wall stoma with a small-caliber trans-nasal endoscope (new method). Indications for gastrostomy tube replacement by both methods included tube aging or accidental tube displacement. This was a retrospective study of data collected from the medical records of the 69 patients undergoing these procedures, including demographic data and information about the surgical procedure and any complications. The study was approved by the ethics committee of the Peking University Third Hospital.

Main equipment

The procedures were performed by using a conventional trans-oral gastroscope (11-mm outer diameter

esophagogastroduodenoscope [EGD], EG-450; Fujinon Corporation, Saitama, Japan/GIF-Q240, GIF-Q130; Olympus Corporation, Tokyo, Japan), or a small-caliber trans-nasal endoscope (5.9-mm outer diameter, small-caliber EGD, EG-530N; Fujinon Corporation, Saitama, Japan), and a 450-cm guidewire with a soft tip (Zebra, Boston Scientific, Natick, MA). One type of PEG tube was used (PEG-24[®], Cook Endoscopy, Winston-Salem, NC).

Techniques

All endoscopic procedures and tube replacements were performed by experienced endoscopists and assisted by an experienced nurse. Patients signed an informed consent form and routinely fasted for 8 h before the procedure. Two methods were used: the conventional technique through the mouth, or a new technique through the abdominal-wall stoma.

In the conventional method, a trans-oral EGD is introduced into the upper gastrointestinal (UGI) tract under direct vision. The PEG-tube is cut outside the abdominal wall, and the ring guidewire is inserted into the stomach cavity along the tube. The ring guidewire is caught together with the mushroom-shaped head by an endoscopic snare and then pulled through the oral cavity with the endoscope. The subsequent steps are the same as in the initial PEG procedure for placing a new tube.

In the new method through the abdominal-wall stoma, the PEG tube is pulled out directly through the abdominal stoma. A small-caliber EGD is passed through the abdominal-wall stoma into the UGI tract under direct vision (Figures 1A and B). The endoscope is pushed retrograde into the stomach, esophagus, and the mouth (Figures 1C–F). Then, a yellow-zebra guidewire or ring guidewire is inserted into the endoscopic biopsy channel and out through the mouth (Figure 1G). This guidewire is attached to the PEG tube guidewire, which exits the stoma with the endoscope, guiding the PEG tube into place. External fixation of the new tube is completed in the area of the disinfected peristomal area (Figures 1H and I).

Statistical analysis

Patients were classified into two groups: the conventional group and the new method group. Variables are presented using descriptive statistics. Data for all continuous variables are presented as mean \pm standard deviations (SD), while categorical variables are presented as number and percentage. The operative time for procedures was measured as follows: the time for the conventional approach was from inserting the gastroscope via the mouth cavity to affixing the new PEG tubes, while the time for the new approach was from removing the old tubes to affixing the new PEG tubes. All analyses were performed using IBM SPSS Version 20 (SPSS Statistics V20, IBM Corporation, Somers, NY).

Results

Table I presents the characteristics for the 69 patients in the study. The main indications for PEG tube replacement were

aging of the tube ($n = 56$) and accidental removal of the tube ($n = 13$). Gastrostomy tube replacement was achieved in 100% of patients. The conventional oral technique was used in 46 cases, and the new approach through the abdominal-wall stoma was used in 23 cases.

Importantly, there was a significant difference in the average procedure time between the two techniques: the new technique required less procedure time. The surgery time for the conventional PEG tube replacement was 8.3 ± 2.0 min compared with 6.0 ± 0.9 min for the new method ($p < 0.001$).

Another important difference was in terms of complications. There were no complications with the new technique. However, in the group undergoing tube replacement with the conventional method, one patient had a post-operative fever and one patient had evidence of a skin infection, with a red, swollen, hot and painful area around the stoma.

Discussion

We developed a new method for replacing PEG tubes using a small-caliber, trans-nasal endoscope inserted through the abdominal wall stoma. In this study, we demonstrated that the new method is feasible, has an excellent success rate, is safe, and requires less operative time than the traditional trans-oral method.

Since PEG was first introduced in 1980 in chronically ill pediatric patients [1], the clinical applications of PEG have continued to expand in both pediatric and adult patients to include neurological diseases, cancer, poly-trauma, and many others [5]. Currently, PEG has become the preferred method of long-term enteral nutrition in patients. Although the exact number undergoing the procedure in the US is unknown, a review of the Medicare database from 1997–2000 found that enteral access procedures increased from 279 509 to 283 353 annually in Medicare recipients alone [10].

PEG has a high success rate and low complication rate: 13% of complications were minor, while only 3% were serious, such as gastric perforation, peritonitis, and bleeding. The 30-day mortality rate was reported to be 8% in 1992, but Janes et al. [11] reported a 3-fold increase in the 30-day mortality rate in 2002, while there had been a 10-fold increase in the insertion rate. A small-caliber endoscope (outer diameter of 5.1–5.9 mm) has been developed and has been used frequently for more than 10 years; it improves the safety of the endoscopic examination and has fewer adverse effects on cardiopulmonary function compared with a conventional trans-oral endoscope [12,13].

Once placed, feeding tubes generally last for several months; however, they may require replacement due to deterioration, irreversible clogging of the tube, or displacement [14]. Rosenberger et al. [15] performed a retrospective analysis of PEG placements in their institution and found an early dislodgement rate of 4.1% and a total lifetime accidental dislodgement rate of 12.8% [15]. Thus, the need to replace PEG tubes appears to be rather common.

Lee et al. [9] compared the trans-oral endoscopic method and percutaneous methods of replacing PEG tubes and found an overall complication rate of 4.8%. In the percutaneous

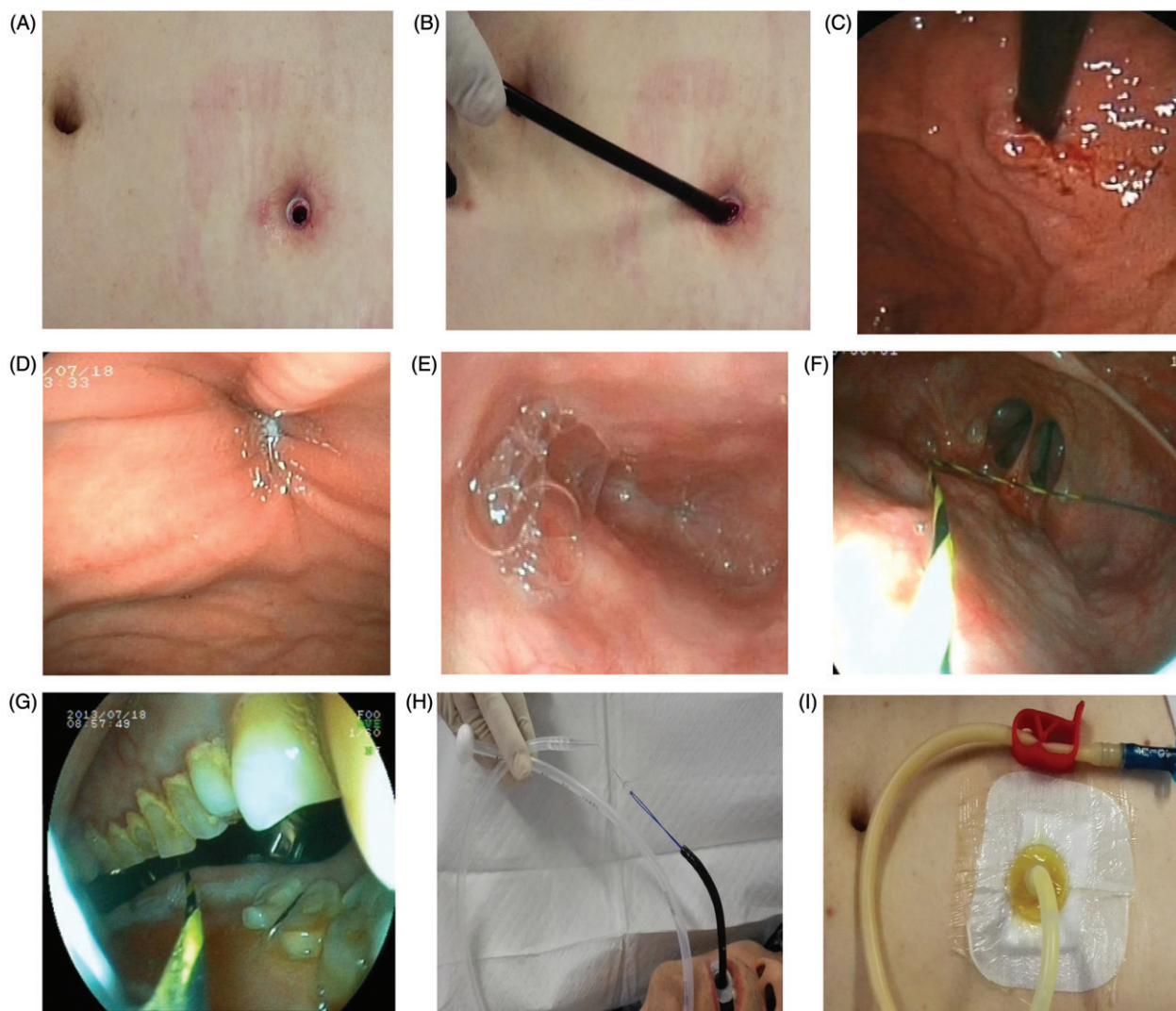


Figure 1. A new method of PEG tube replacement. (A) Abdominal-wall stoma. (B) Small-caliber endoscope passed through the abdominal-wall stoma. (C) Endoscope entering the gastric cavity. (D) Entering the gastric cardia. (E) Entering the esophagus. (F) Entering the oropharynx. (G) Entering the mouth. (H) Guidewire connected to the fistula ring wire. (I) External fixation of tube.

Table I. Clinical characteristics and outcomes.

Groups	Number of patients	Age (years)	Number of surgical successes	Surgery ^a time (min)	Post-operative fever	Skin infection
Conventional method	46	72 ± 9	46 (100%)	8.3 ± 2.0	1 (2%)	1 (2%)
New method	23	65 ± 24	23 (100%)	6.0 ± 0.9	0	0

^at-test, $p < 0.001$; Mann-Whitney, $p < 0.001$; Normality test, $p < 0.001$.

group, 1.3% experienced peristomal bleeding; in the endoscopic group, 7.4% suffered a mucosal laceration, and 0.6% suffered esophageal microperforation. Late complications (peristomal infection and PEG site leakage) occurred in 1.9% of the percutaneous group and 2.8% of the endoscopic group. In that study, old age was a risk factor for esophageal laceration and microperforation during PEG tube replacement; therefore, the authors concluded that the percutaneous method might be safer in older patients [9]. Since the percutaneous method cannot be used in all patients, e.g. in those with a mushroom-tip tube, an improved technique for endoscopy-assisted PEG tube replacement would be useful.

Imaeda et al. [16] have previously demonstrated that transgastrostomy endoscopy with an ultrathin endoscope was useful and safe, resulting in less distress and risk of aspiration than esophagogastroduodenoscopy through the oral cavity. Additionally, ultrathin endoscopes have been inserted through a mature gastrostomy for the performance of procedures, e.g. placement of jejunal feeding tubes and performance of endoscopic retrograde cholangiopancreatography [17,18]. We found no previous reports of the use of transgastrostomy endoscopy to assist with PEG tube replacement. In our new technique, a small-caliber endoscope, with a guidewire in the biopsy channel, is inserted into the

gastrostomy stoma and maneuvered out through the oral cavity. The replacement PEG tube is attached to the guidewire and pulled through the abdominal wall. This technique obviates the need for oral endoscopy. It was shown to be faster than the conventional trans-oral endoscopy method, and it was safe, with no complications. Furthermore, the physicians who used the new method found that it caused less throat irritation, resulted in better patient co-operation, and was a quieter operative process.

The retrospective design was one limitation of this study. Other limitations of our study include the small number of patients and the fact that the new procedure was performed at only a single center. Further study is needed in a larger and more diverse patient population. Additionally, more research is warranted in order to determine how much reduction in the duration of the procedure would represent a clinically significant decrease.

Conclusions

In summary, a transgastrostomic endoscopic procedure for replacement of mushroom-tipped PEG tubes has been shown to be feasible and effective. In this study, the new approach of PEG tube replacement was also faster than the conventional, trans-oral endoscopy method and had no adverse effects.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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