Modified Percutaneous Endoscopic Gastrostomy Tubes : Experience in Thai Children

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Abstract

Background : Percutaneous endoscopic gastrostomy (PEG) is a well-established alternative to open gastrostomy for providing long-term enteral nutrition. Although the commercial PEG tube is available and suitable for the procedure, its cost is relatively high for low socioeconomic people. Therefore, modified PEG tubes have been used in our hospital.

Objectives : To evaluate the outcome and complications of PEG performed in children at Ramathibodi Hospital and compare the results between the commercial PEG and modified PEG tubes.

Method : All children who had PEG performed at Ramathibodi Hospital, from January 1999 to May 2002, were included in the study. The demographic data, indications for PEG, types of PEG tube, outcomes and complications were retrospectively reviewed. The modified PEG tube was made by connecting a Malecot four-wing catheter to the previously used, re-sterilized distal part of a commercial PEG tube.

Results : PEG was performed on 34 children, aged 4 months to 13 years, and successfully placed in 30 children (88.2%). The commercial and modified PEG tubes were used in 20 cases and 10 cases, respectively. Early complications occurring in the first 7 days post-procedure were found in 9 cases (30%) as follow: peritonitis (1 case), peristomal wound infection (7 cases), and subcutaneous emphysema (1 case). Late complications occurring at more than 7 days post-procedure were found in 15 cases (50%) and all were minor problems. There was no difference in complication rates between the 2 types of PEG tubes.

Conclusion : PEG is safe even in small infants. Minor complications are common but can be simply managed. The modified PEG tube is an alternative for a commercial PEG tube in an unaffordable situation.

Key word : Percutaneous Endoscopic Gastrostomy, Enteral Nutrition

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Percutaneous endoscopic gastrostomy (PEG) is a well-established alternative to open gastrostomy for providing long-term enteral nutrition in both adults and children. However, the procedure is associated with a number of complications[1,2]. In addition, the problem of performing the procedure in developing countries is the high cost of the PEG tube resulting in its limited use. Therefore, to reduce the cost, the authors modified the PEG tubes for patients whose families could not afford a commercial PEG tube. The efficiency and outcomes in using the modified PEG tubes in comparison to commercial PEG tubes is presented.

Objectives

The aims of this study were to evaluate the outcome and complications of PEG performed in children at Ramathibodi Hospital and compare the results between commercial and modified PEG tubes.

PATIENTS AND METHOD

All medical records of children who had PEG performed at Ramathibodi Hospital from January 1999 to May 2002 were retrospectively reviewed. The following data were recorded: the demographic data, indications for PEG, types of the PEG tube, outcomes and complications.

The patients were divided into 2 groups according to the type of PEG tube used. One was a 16 or 20-French, commercial PEG tube, EntriStar (Tyco International LTD. Company, USA) or Wilson-Cook (Wilson-Cook Medical Inc., USA) (Fig. 1 and 2). The other was a modified PEG tube made in Ramathibodi Hospital by using a Malecot four-wing, 14 or 16-French, catheter (Rusch UK Ltd., UK). Two pieces of tubing, each about 1.5 cm in length, were cut from the distal end of the Melecot four-wing catheter. One piece was used as the internal retaining part and another piece as the external retaining part. The internal retaining piece was passed over the catheter to the original retaining wings (Fig. 3). The previously used distal part of a commercial PEG tube, which consisted of the wire loop and tapered end, was re-sterilized and connected to the Malecot four-wing catheter (Fig. 1). Preparation of a modified PEG tube was performed under a sterile technique. The decision to use which type of PEG tube depended on the parent.

Operative technique

The standard pull technique described by Gauderer et al[3] was used in all cases. Flexible endoscopy was inserted into the stomach. The stomach was insufflated and both transillumination and finger

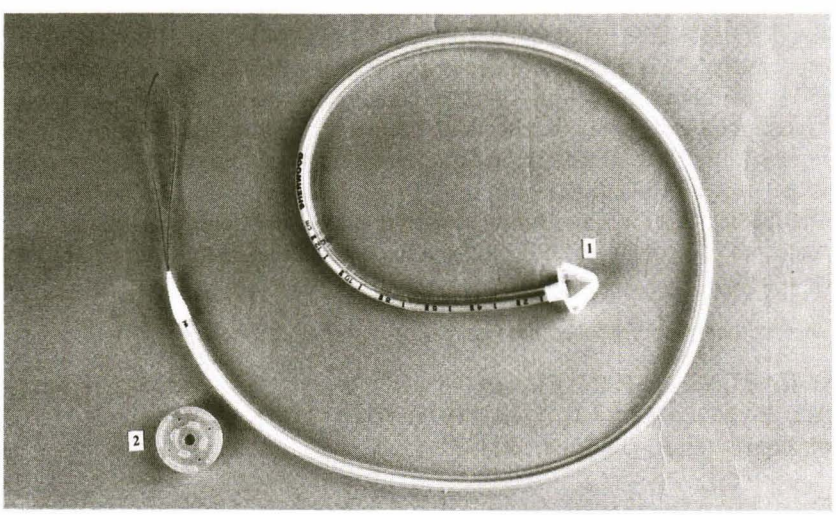

Fig. 1. The commercial PEG tube with internal (1) and external retaining devices (2).

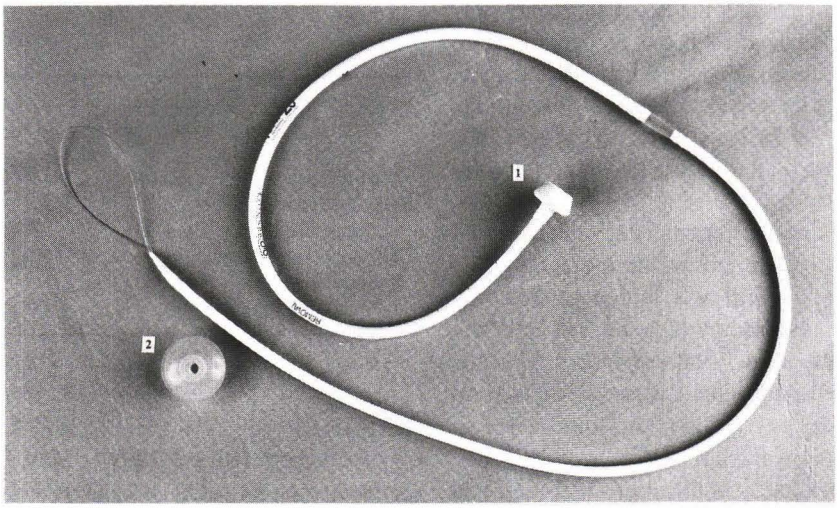

Fig. 2. The commercial PEG tube with internal (1) and external retaining devices (2).

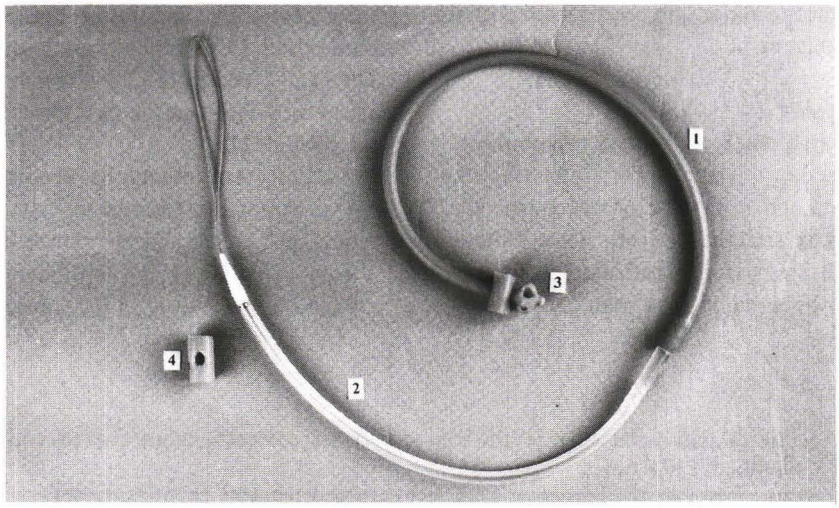

Fig. 3. A modified PEG tube consisting of a Malecot four-wing catheter (1) connected to the previously used distal part of a commercial PEG tube (2). The original four wings and a small tube cut from the distal end of a Malecot catheter functioned as an internal retainer (3) and the external retainer was also made of a small piece of Malecot catheter (4).

indentation were confirmed before cannulating the stomach with an 18 - gauge cannula. A thread was passed into the stomach, grasped with a snare or biopsy forceps, and retrieved by withdrawal of the endoscope. The PEG tube was secured to the thread and pulled antegradely. The internal retainer was lubricated and manipulated to avoid injury to the esophagus. The final position of the internal retainer

was confirmed by a second endoscopy before completion of the procedure. Finally, the gastrostomy tube was secured by passing the external retainer over the tube to the skin level. All the procedures were performed in the operative room, under general anesthesia. All children received intravenous cefazolin 1/2 hour before and for 24 hours after the procedures. Feedings were started after gastric decompression for 12-24 hours.

Removal of the commercial and modified PEG tubes was performed when indicated. The replacement tube was either a button gastrostomy tube or a balloon gastrostomy tube. For patients with a financial problem, a Foley catheter was used as the replacement tube. Endoscopic removal of a commercial PEG tube was required in some cases in whom manual removal had failed.

Early and late complications were defined as complications which occurred within 7 days and more than 7 days after PEG insertion, respectively. The complications were also classified into major and minor complications as described by DiLorenzo et al[4]. The complications that required surgical consultations or interventions were defined as major complications. In contrast, minor complications required only simple management.

Statistical analysis

Descriptive analysis and non-parametric statistics were used in this study. For comparing the demographic data and complication rates between the 2 groups, Fisher's Exact test and Mann-Whiney U test were used. Statistically significant difference was defined as the p-value less than 0.05

Table 1. Indications for percutaneous endoscopic gastrostomy (PEG) placement.

Indication	Number of patients
Inability to swallow or feeding difficulty	29
Neurological impairment	19
Multiple anomalies	2
Pharyngeal incoordination	8
Inadequate energy intake	2
Congenital heart diseases	2
Continuous enteral feeding	3
Short bowel syndrome	1
Malabsorption	2

RESULTS

From January 1999 to May 2002, PEG was performed on 34 patients, 19 boys and 15 girls. Their ages ranged from 4 months to 13 years. Fourteen patients (41.2%) were below 1 year of age. The indications for PEG are shown in Table 1. PEG was successfully placed in 30 patients (88.2%). PEG placement failed because the finger indentation could not be identified in 2 cases and the stomachs could not be accessed by cannulas in 2 cases. Commercial and modified PEG tubes were used in 20 cases (66.7%) and 10 cases (33.3%), respectively. The clinical characteristics of the two groups were not different (Table 2).

Early complications occurred in 9 cases (30%) as follow: peritonitis in 1 case, peristomal infection in 7 cases and subcutaneous emphysema in 1 case. There was no significant difference in complication rates between the 2 types of PEG tube

Table 2. Clinical characteristics of the two groups of patients, using commercial *versus* modified PEG tubes.

Parameter	Commercial PEG tube (n = 20)	Modified PEG tube (n = 10)	P-value
Age : median (range) (year)	1.05 (0.3-13.0)	0.7 (0.2-10.0)	0.426
Weight : median (range) (kg)	8.25 (3.8-31.0)	7.30 (3.6-38.0)	0.451
Sex (male)	12	5	0.705
Underlying diseases			
Neurological impairment	11	6	1.0
Others			
- Multiple anomalies	0	2	
- Pharyngeal incoordination	6	2	
- Congenital heart diseases	2	0	
- Malabsorption	1	0	

(Table 3) except that peritonitis occurred in one patient using a modified PEG tube. The cause of peritonitis was a displacement of the external retainer resulting in separation of the stomach and abdominal wall. He was successfully treated with antibiotics and an external retainer was put into the proper position. Subcutaneous emphysema in one patient resolved spontaneously. All peristomal wound infections were treated with local wound care and antibiotics orally or parenterally.

Regular follow-up for at least a 3-month period was available in 28 out of 30 cases. Late complications occurred in 15 cases (50%) and all were minor. Eleven episodes of complications occurring in 9 cases of the commercial PEG tube group included 2 peristomal wound infections, 7 granulation tissues and 2 accidental removal of the tubes. Six episodes of complications occurring in 6 cases of the modified PEG tube group included 2 peristomal wound infections, 3 granulation tissues and 1 accidental removal of the tube. There was no significant difference in the complication rates between the 2 groups (p-value = 0.435).

DISCUSSION

Percutaneous endoscopic gastrostomy (PEG) is a well-established technique for long-term enteral nutrition in children. It was first described by Gauderer et al in 1980[3]. Since then, it has become popular and has been widely performed both in adults and children because it is less invasive than surgical gastrostomy. Moreover, there are many advantages over surgical gastrostomy such as shorter operative time and anesthetic time, less post-operative pain and shorter hospital stay[1,2,5]. Early feeding as soon as six hours following the procedure has been demonstrated to be safe in children[6]. The procedure is less expensive than surgical gastrostomy in many countries[1,2,5]. However, in our hospital the expense of the procedures are equal but the costs of a commercial PEG tube is much higher than a conventional mushroom or Malecot tube used in surgical gastrostomy. The relatively high cost of the commercial PEG tubes has resulted in limited use. Therefore, for economical reasons, modified PEG tubes were developed in our hospital.

In general, a commercial PEG tube is well designed, safe and suitable for the procedure[7,8]. It is recommended for single-use. When a commercial PEG tube is placed, the tube is cut leaving the proximal part with the patient. The distal part containing the wire loop and tapered end is usually thrown away. The authors used this part of the commercial PEG tube, after re-sterilization, connecting to a Malecot four-wing catheter (Fig. 3). The modified PEG tube was successfully performed in 10 patients. The present study demonstrated that there was no difference in the complication rates between the patients using the commercial PEG tubes and the modified PEG tubes. However, one patient in the modified PEG tube group had peritonitis 24 hours after the procedure. He was successfully treated with antibiotics and an external retainer was put into the proper position. Therefore, one should be aware that peritonitis may develop in patients using the modified PEG tube due to the separation of the stomach and abdominal wall.

PEG is based on the simple principle of sutureless approximation of the stomach to the peritoneum by a catheter[3]. The internal retainer or bumper of the Malecot four-wing tube is smaller than that of the commercial tube. In addition to the original

Table 3. Early complications of percutaneous endoscopic gastrostomy (PEG) placement.

Complications	Types of PEG tube		P-value
	Commercial (n = 20)	Modified (n = 10)	
Major			
Peritonitis	0	1	-
Minor			
Peristomal wound infection	5	2	0.68
Subcutaneous emphysema	1	0	-

retaining wings of the Malecot catheter, the authors put a small piece of latex rubber tube, cut from the distal end of the Malecot catheter, close to the wings (Fig. 3) for better internal stabilization. The external retainer was also made of a piece of latex rubber tube. Both internal and external retainers of a modified tube are softer than those of the commercial PEG tube and may not be able to keep the gastrostomy as tight as a commercial PEG tube. This may be the predisposing factor of peritonitis in one of the presented patients. However, peritonitis has been reported in patients using commercial PEG tubes as well[2,9,10]. Whether the occurrence of peritonitis in the patients using the modified PEG tubes is higher than that of commercial PEG tubes is not known. The limitation of the present study is the small sample size. Further study in more patients is required to verify this speculation.

Although a commercial PEG tube has many advantages over the modified one such as more convenience, better material (silicone for Wilson-Cook and polyurethane for EntriStar) and longer duration for use[7,8], they are generally used for 6 months to few years[8]. In contrast, the duration of the use of a Malecot four-wing catheter, which is made of latex, is shorter. Most of the modified PEG tubes in the presented patients had to be changed within 3 months. The cost of a commercial PEG tube in Thailand varies from 80-130 USD while a modified PEG tube is about 10 USD. Therefore, modified PEG tubes may be useful for patients who cannot afford the commercial tubes.

Generally, PEG is safe but a number of complications have been reported[1,2,9-11]. The complication rates in children reported by many studies varied from 10 to 43 per cent [1,2,9-11]. The complications have been classified as major and minor [4]. The major complications are severe and require surgical consultations or interventions. Peritonitis, colonic perforation, gastrocolic fistula, gastrojejunal fistula, small bowel perforation, esophageal injury, and necrotizing fasciitis have been reported as major complications[1,2,9-13]. The only major complication in the present study was peritonitis in 1 case. There was no mortality in the present study.

The minor complications are less severe and can be easily managed. Minor complications were common in the present study as well as others[9-11]. The most common early complication in the present study was peristomal wound infection. All patients were successfully treated with local wound care and either oral or parenteral antibiotics. None required removal of the PEG tubes. Previous studies also demonstrated that peristomal wound infection was very common after PEG insertion[2,9-11]. Prophylactic antibiotics significantly reduced the risk of infection[14-16]. So it has been suggested that prophylactic antibiotics should be given[14-17]. However, various antibiotics have been used, such as cefotaxime[14,17], cefazolin[15], combined cefuroxime and metronidazole[11], combined piperacillin and tazobactam[14,17] and amoxicillin and clavulanic acid[17,18]. Despite the use of cefazolin for prophylactic antibiotics in the presented patients, peristomal wound infection was still common. One possibility is that the strict criteria for diagnosis of peristomal wound infection as described by some authors[14,15] was not used in the present study. Since peristomal inflammation is common during the first few days after the procedure, over diagnosis of peristomal wound infection might occur. The other contributing factor for wound infection is the procedural technique. Some experts suggested that peristomal wound infection can be reduced by increasing the length of the skin incision[8,10]. The authors also observed that the infection rate was reduced when the length of the skin incision was increased. The infection was not related to the re-used part of the PEG tube since it was re-sterilized using ethylene oxide which is the standard sterilization technique in hospitals[19]. Moreover, the infection rates were not different between patients using the commercial and modified PEG tubes. Further studies are required to find better techniques and interventions for the prevention of wound infection.

Late complications were common in the present study as well as in other studies[18]. All were minor and the most common one in the presented patients was granulation tissue around the exit site. The treatment consisted of either single or repeated topical application of silver nitrate. None required removal of the PEG tube.

In conclusion, the present study demonstrates that PEG is a safe procedure for children even small infants. Minor complications are common but are not serious and can be controlled with simple

management. The complication rates were not different between the patients using commercial PEG tubes and modified PEG tubes. A modified PEG tube is an alternative to a commercial PEG tube in an unaffordable situation.

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การใส่สายสวนกระเพาะอาหารผ่านทางผิวหนังโดยใช้กล้องตรวจส่องชนิดดัดแปลง : ประสบการณ์ในเด็กไทย

สุพร ตรีพงษ์กรุณา, พ.บ., วิชัย พันธ์ศรีมังกร, พ.บ.**, ปานียา เพียรวิจิตร, พ.บ.*, จิณภัค กลกาลกุล, วท.ม.***, อุมาพร สุทัศน์วรวุฒิ, พ.บ.**

การใส่สายสวนกระเพาะอาหารผ่านผิวหนังโดยใช้กล้องตรวจส่อง (percutaneous endoscopic gastrostomy – PEG) เป็นวิธีการใส่สายสวนกระเพาะอาหารโดยไม่จำเป็นต้องผ่าตัดเปิดช่องท้อง เป็นวิธีการที่ยอมรับกันทั่วไปเพื่อให้อาหารแก่ผู้ป่วย สายสวนกระเพาะอาหารสำหรับวิธีดังกล่าว (PEG tube) เป็นสายสำเร็จรูป ผลิตโดยบริษัทต่าง ๆ ที่ออกแบบพิเศษเหมาะสมสำหรับการทำหัตถการดังกล่าว แต่ราคาแพง ในโรงพยาบาลรามาธิบดีจึงมีการดัดแปลงทำ PEG tube สำหรับผู้ป่วยเด็กที่ยากจน

วัตถุประสงค์ : เพื่อประเมินผลและภาวะแทรกซ้อนของการทำ PEG ในผู้ป่วยเด็กในโรงพยาบาลรามาธิบดี และเปรียบเทียบผลระหว่างสายสวนกระเพาะอาหาร 2 ชนิดคือ สายสำเร็จรูปและสายดัดแปลง

วิธีการ : เวชระเบียนของเด็กทุกรายที่ได้รับการทำ PEG ในโรงพยาบาลรามาธิบดี ระหว่างเดือนมกราคม 2542 ถึงเดือนพฤษภาคม 2545 ได้รับการทบทวนและบันทึกข้อมูลพื้นฐาน ข้อบ่งชี้ของการใส่สายสวนกระเพาะอาหาร ชนิดของสายสวนกระเพาะอาหารและภาวะแทรกซ้อน PEG tube ชนิดดัดแปลงทำจากสาย ,Malecot four–wing ต่อกับชิ้นส่วนที่ใช้แล้วของสายสำเร็จรูป

ผลการศึกษา : มีการทำ PEG ในเด็ก 34 ราย อายุตั้งแต่ 4 เดือน ถึง 13 ปี และทำหัตถการสำเร็จในเด็ก 30 ราย (88.2%) มีการใช้ PEG tube ชนิดสำเร็จรูปในเด็ก 20 ราย และชนิดดัดแปลงในเด็ก 10 ราย ภาวะแทรกซ้อนในสัปดาห์แรกหลังทำหัตถการพบ 9 ราย (ร้อยละ 30) ได้แก่ เยื่อบุช่องท้องอักเสบ 1 ราย แผลรอบสายสวนอักเสบ 7 ราย และมีลมแทรกในชั้นใต้ผิวหนัง 1 ราย พบภาวะแทรกซ้อนหลังสัปดาห์แรกของการทำหัตถการ 15 ราย (ร้อยละ 50) ล้วนแต่เป็นปัญหาเล็กน้อยไม่รุนแรงทั้งหมด ไม่พบความแตกต่างระหว่างอัตราการเกิดภาวะแทรกซ้อนระหว่างสายสวนกระเพาะอาหาร 2 ชนิด

สรุป : การใส่สายกระเพาะอาหารผ่านผิวหนังโดยใช้กล้องตรวจส่องเป็นวิธีการที่ปลอดภัย แม้กระทั่งในเด็กทารก ภาวะแทรกซ้อนชนิดไม่รุนแรงนั้นพบได้บ่อย สามารถรักษาได้ง่ายไม่ยุ่งยาก ในกรณีผู้ป่วยเด็กที่ยากจนสามารถเลือกใช้สายสวนกระเพาะอาหารชนิดดัดแปลงแทนสายสำเร็จรูปได้

คำสำคัญ : การใส่สายสวนกระเพาะอาหารผ่านทางผิวหนัง, การให้สารอาหารทางหลอดเลือด

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