Percutaneous Endoscopic Gastrostomy: A Review of Practice and Complications

Alaa Ghallab, MSc, FRCS* Ahmed Mohamed, MRCS** Martin Corbally, MB, BCH, BAO, MCh, FRCSI, FRCS(Ed), FRCS (Paed Surg), CCST (Paed Surg)***

Background: Percutaneous Endoscopic Gastrostomy (PEG) is the standard option for long-term nutritional support in infants and children with nutritional deficit due to feeding difficulties.

Objective: To assess the indications, complications and long-term efficacy of PEG.

Design: A Retrospective Study.

Setting: Our Lady's Children's Hospital, Crumlin, Dublin, Ireland.

Method: One hundred forty-eight patients underwent PEG insertion from October 2004 to December 2007. Data were reviewed from the Hospital Inpatient Enquiry (HIPE) and patients' charts.

Result: One hundred forty-eight patients underwent PEG insertion; 91 (61.5%) males and 57 (38.5%) females with a median age of 15 months (range 1-190 months). The procedure was abandoned in one patient due to unfavorable anatomy (failure rate 0.7%), and this patient is excluded from this report. PEG was indicated for feeding difficulties in 102 (68.9%) patients, recurrent aspiration pneumonia in 15 (10.1%) and failure to thrive in 32 (21.6%). No mortality was recorded; however, 15 (10.1%) patients developed stomal leakage and 3 (2%) of these required change of PEG. Nine (6%) patients developed a wound infection, 2 (1.4%) developed a gastrocolic fistula, 1 (0.7%) patient developed adhesive intestinal obstruction requiring laparotomy and adhesiolysis. Two (1.4%) patients had aspiration pneumonia, 3 (2%) had inadvertent tube removal, 4 (2.7%) had tube blockage, 3 (2%) had tube breakdown, 2 (1.4%) had tube migration, 5 (3.4%) had vomiting and 6 (4%) patients had excess granulation tissue.

Conclusion: PEG tube feeding is an efficient, well-tolerated method for medium and long-term enteral feeding with excellent results and minimal overall morbidity.

Bahrain Med Bull 2016; 38 (2): 74 - 77

Gauderer et al introduced percutaneous endoscopic gastrostomy (PEG) in 1980, which has replaced nasogastric tube (NGT) and open gastrostomy as the procedure of choice for providing long-term nutritional support[1]. Over 200,000 PEG procedures are performed annually in the USA to compensate for an existing nutritional deficit and to diminish or prevent malnutrition[2,3]. Enteral feeding requires a normally functioning gastrointestinal tract and compared with parenteral nutrition; PEG tube offers greater patient comfort, it is more practical and economical and with a low complication rate. It maintains structural and functional gastrointestinal integrity and thereby contributes to local intestinal defenses[4].

Various studies have revealed the superiority of PEG over nasogastric tube feeding and has proved to have less frequent episodes of reflux and aspiration, better nutritional result, better tolerated and cosmetically more acceptable[5]. PEG is an accepted procedure for patients at risk of malnutrition; however, it is performed under general anesthesia in children, an invasive procedure and it is not without potential risks.

The aim of this study is to evaluate the indications, effectiveness of PEG feeding and the short and long-term complications.

METHOD

One hundred forty-eight PEG in-patients were included in the study from October 2004 to December 2007. Data was collected from HIPE (Hospital Inpatient Enquiry) and patients' charts. The indications for PEG included inadequate or inappropriate oral feeding due to various conditions; it was considered if the need was more than one month. Explanation of the procedure to the parents and caregivers was done, and informed consent was obtained.

PEG insertion (Corflo PEG Kit, VIASYS MedSystems Wheeling K 60090) was performed under GA using the "pull" technique. No dressing was applied to the PEG site. Feeding was recommenced within 12 to 24 hours according to the protocol formulated jointly by the surgeon and dietitian; antibiotics were not routinely given. Once discharged, the parents and caregivers had direct access to the pediatric surgical team, the gastroenterology liaison nurse and community dietitian. We confirmed safe site selection by clear visualization of a finger indentation in the fundus midway between the greater and lesser curvature and demonstration of the colonic shadow (clear demarcation between the light and dark shadows)

* Registrar
** Senior House Officer
*** Consultant Pediatric Surgeon
Department of Surgery
Our Lady's Children's Hospital, Ireland
Professor and Head of Surgery, RCSI-MUB
Chief of Medical Staff
King Hamad University Hospital
Kingdom of Bahrain
E-mail: martin.corbally@khuh.org.bh

as contrasted by the intra-gastric light source was used to minimize inadvertent injury to the colon and/or small bowel. Simple descriptive statistics were used to analyze the data.

RESULT

One hundred forty-eight patients underwent successful PEG insertion, and one was converted to open Stamm Gastrostomy due to unfavorable anatomy (excluded from the study). Ninety-one were males (61.5%) and 57 were females (38.5%) with a median age of 15 months (range 1-190). Hospital stay ranged from 3 to 21 days with a median of 4 days. The indications for PEG insertion were feeding difficulties in 102 (68.9%) patients, failure to thrive in 32 (21.6%) patients, recurrent aspiration pneumonia in 15 (10.1%) patients, see table 1. The predominant underlying illnesses are neurological diseases, 79 (53.4%) patients, cystic fibrosis, 11 (7.4%), recurrent aspiration pneumonia, 15 (10.1%) and various other anomalies in 10 (6.8%) patients, see table 1.

Table 1: Underlying Medical Conditions (n=148)

Etiology	Number of Patients	%
Recurrent aspiration pneumonia	15	10 %
Cystic Fibrosis	11	7.4 %
Facial anomalies	10	6.6 %
Renal impairment	6	4 %
Metabolic disorders	5	3.3 %
Prematurity	5	3.3%
Cardiac anomalies	3	2%
Esophageal stricture	3	2 %
Subglottic stenosis	3	2 %
Intrauterine growth retardation	2	1.3 %
Congenital hyperinsulinemia	2	1.3 %
Short bowel syndrome	2	1.3 %
Various Neurological Disorders	81	55 %
Total	**148**	**100%**

Follow-up ranged from 6 to 39 months (median 21). No deaths related to the procedure were reported. Complications were recorded in 41 (27.7%) patients, 12 (8.1%) had more than one complication, see tables 2 and 3.

Table 2: Minor Complications

Minor Complications	Number of Patients	%
Stomal Leakage	15	(10.1%)
Wound Infection (Minor)	8	(5.4%)
Tube Blockage	4	(2.7%)
Tube Breakdown	3	(2%)
Inadvertent Tube Removal	3	(2%)
Vomiting	5	(3.3%)
Granulation Tissue	6	(4%)
Tube Migration	2	(1.4%)

Table 3: Major Complications

Major Complications	Number of Patients	%
Aspiration Pneumonia	2	(1.4%)
Gastrocolic Fistula	2	(1.4%)
Adhesive Intestinal Obstruction	1	(0.7%)
Severe Wound Infection	1	(0.7%)

Fifteen (10.1%) patients developed stomal leakage, (11 within 2 months of insertion and 4 within more than 2 months of insertion); however, only 2 (1.4%) patients required a change of PEG; 1 (0.7%) patient of the late leakage required change of PEG after 2 years.

Nine (6.1%) patients developed a wound infection, 3 (2%) required oral antibiotics, 1 (0.7%) patient had severe cellulitis and leakage treated with removal of PEG, IV antibiotics, nasogastric feeds and reinsertion of PEG after the inflammation had settled and 5 (3.4%) required local wound care alone.

Two (1.4%) patients developed a gastrocolic fistula in the early postoperative period; one (0.7%) patient presented with diarrhea and passage of fecal matter via the PEG. The diagnosis was confirmed with contrast study showing the PEG tube in the transverse colon. The PEG was removed in both cases; one (0.7%) patient had Nissen fundoplication and Stamm gastrostomy two months later. One (0.7%) patient had peritonitis due to leakage from the gastric wall, which required laparotomy and closure of the fistula in addition to gastrostomy.

One (0.7%) patient with renal impairment, renal osteodystrophy and on peritoneal dialysis developed adhesive intestinal obstruction that required laparotomy and adhesiolysis in the first-month post insertion.

Three (2%) patients had inadvertent tube removal. Four (2.7%) patients had tube blockage. Three (2%) patients had tube breakdown. Two (1.4%) patients had tube migration, 1 (0.7%) into the subcutaneous tissue, the other in the stomach wall, both required replacement.

Five (3.4%) patients had vomited after insertion, which was resolved with conservative treatment, two of them had GORD.

Two (1.4%) patients had aspiration pneumonia, treated with antibiotics, 1 (0.7%) patient had aspiration in the perioperative period and had laparoscopic Nissen fundoplication previously; one (0.7%) patient had late aspiration. Both patients had cerebral palsy (CP), global developmental delay and epilepsy. Out of the 15 patients with recurrent aspiration pneumonia, 12 (8.1%) improved with PEG feeding. Six (4%) patients had granulation tissue at the stoma site which responded to topical silver nitrate.

The PEG was removed in 21 (14.2%) patients because they had regained the ability of oral feeding (5 to 23 month), 32 PEG tubes were changed to a “MICKEY” button for long term feeding. Seventeen PEG tubes were replaced in 13 (8.8%) patients due to complications, one replacement in 11

(7.4%) patients, and three replacements in 2 (1.4%) patients. Replacement was due to tube obstruction in 4 (2.7%) patients, tube fracture in 3 (2%) patients, inadvertent tube removal in 3 (2%) patients, tube migration in 2 (1.4%) patients, tube leakage in 3 (2%) patients, one of them was associated with stoma site infection.

DISCUSSION

PEG tube placement was originally devised as a technique for a suture-less gastrostomy in pediatric patients[1]. Aspiration and chest infections, reduction in choking episodes, concern over the long-term appearance of NG tube, as well as reduction in feeding time and stress are the main indications for PEG insertion[6]. Each case for PEG is unique and should be considered based on diagnosis, prognosis, ethical issues and the expected impact[7,8].

PEG has been a widely used technique for long-term enteral feeding in patients who have a functionally intact intestine but who could not eat or swallow due to other co-existent medical problems[1]. The decision to progress to a PEG could be difficult and emotionally laden[9]. Infants and children referred for the insertion of a PEG are often malnourished, with complex congenital malformations, chromosomal and metabolic abnormalities, neuro-developmental delay, central nervous system lesions and aspiration problems[10].

The primary aim of enteral nutrition is to correct significant nutritional deficiencies, to avoid further loss of body weight and promote growth in children[3,11]. Spinal deformity with kyphoscoliosis is common in patients with cerebral palsy, and this might make the insertion of PEG technically difficult[10]. However, in experienced hands, PEG insertion and feeding is a safe and effective procedure. Prospective clinical studies have shown that guidelines help patients' selection and play an important role for better outcome[9,12]. However, it is not without its complications, which could be major or minor. The mortality ranged from 0 to 3% in some studies[13]. There was no procedure-related mortality in our study. Major complications (5.5%) in this study were due to aspiration pneumonia, gastrocolic fistula, intestinal obstruction and severe wound infection.

Minor complications account for approximately 22% and were largely due to stomal leakage, wound infection, tube obstruction or migration, tube fracture and dislodgement, vomiting and formation of granulation tissue. Various studies reported up to 90% minor complications.

Stomal leakage is a common complication, which indicates the need for tube change[14]. Leakage may be due to poor or faulty connections, necrosis of the stomal site caused by pressure necrosis of a large tube or tube deterioration with splitting[10]. Ten percent of patients had stomal leakage in our study; one patient had persistent leakage, associated with wound infection and required removal of the PEG, IV antibiotics, nasogastric feeds and reinsertion of PEG after the inflammation had settled. Wound infection is fairly common and ranges from simple peristomal infection to life-threatening necrotizing fascitis[14].

In our study, wound infection was seen in 9 patients. Systemic antibiotics are required only in the presence of cellulitis or purulent discharge[10]. In our study, one patient with persistent infection required removal of PEG and re-insertion. Several meta-analyses and a Cochrane review had found that the use of prophylactic antibiotics leads to a reduction in the relative and absolute risk of wound infection[15,16]. Official guidelines of the European and American Societies of gastrointestinal endoscopy recommend a single prophylactic intravenous dose of antibiotics for all patients[17,18,19].

Tube blockage is a common problem with long-term PEG feeding, and it could be caused by failure to flush the tube regularly before and after use or owing to mixing medications with the feed[10,14]. Indeed, 16 to 31% of PEG tubes had at least 1 episode of significant blockage[20]. Tube blockage is managed initially by fizzy water, or if that fails, a solution of pancreatic enzymes could be tried as a flush. Mechanical disimpaction by milking the tube might be useful or gently passing an endoscope cleaning brush through the tube[10,14,21]. Only 4 of our patients had tube blockage.

Inadvertent tube removal is particularly problematic in the early postoperative period because of an immature tract, which could result in gastric leakage or peritoneal leakage of the formula. Tube dislodgement requires tube replacement as soon as possible as spontaneous closure could occur after about 6 hours[10]. If adequate facilities for replacement are not available, an infant feeding tube or Foley catheter can be inserted[14,21].

Aspiration of food or fluid has been shown to decrease the survival in children with CP[22]. It may indicate the need for earlier PEG feeding although aspiration could also occur during or after PEG insertion[23-26]. It has been suggested that the insertion of a PEG in malnourished children with neurological impairment may be associated with resolution of GOR by improving the nutritional state[27,28]. In our study, we had two patients with CP and global developmental delay who had aspiration pneumonia post insertion of the PEG and initiation of tube feeding.

The risk of aspiration might be reduced by elevating the head of the bed to 30 degrees, using iso-osmotic feeds and continuous pump feeding and increased time off feeding overnight[21,29]. Insertion of PEG at the lesser curvature may decrease the incidence of gastro-esophageal reflux and subsequently decreases the incidence of aspiration[30].

Actual nutritional gain is an important issue and has gained significant attention internationally[31]. Periodic measurements of patients' weight and serum albumin were not available in all patients in our study because of the retrospective nature. However, the average weight-gain in 68 (45.9%) patients was between 3.5 to 6 kg/year.

CONCLUSION

The study revealed that PEG tube feeding is an efficient, safe and acceptable method for medium and long term enteral feeding. However, it provides excellent long-term results and facilitates improvement in nutritional status and the general well-being of such patients, especially those with neurological impairment. Prolonged use of NGT is avoided and the risk of aspiration pneumonia is greatly

reduced. PEG should be considered earlier in neurologically impaired patients who are NGT dependent.

Author Contribution: All authors share equal effort contribution towards (1) substantial contribution to conception and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content; and (3) final approval of manuscript version to be published. Yes.

Potential Conflicts of Interest: None.

Competing Interest: None. **Sponsorship:** None.

Submission Date: 4 February 2016.

Acceptance Date: 13 March 2016.

Ethical Approval: Approved by Department of Surgery, Our Lady's Children's Hospital, Crumlin, Ireland.

REFERENCES

1. Gauderer MW, Ponsky JL, Izant RJ Jr. Gastrostomy without laparotomy: A Percutaneous Endoscopic Technique. J Pediatr Surg 1980; 15(6): 872-5.
2. Gauderer M. Twenty Years of Percutaneous Endoscopic Gastrostomy: Origin and Expanded Applications. Gastrointest Endosc 1999; 50(6):879-83.
3. Hujala K, Sipila J, Pulkkinen J, et al. Early Percutaneous Endoscopic Gastrostomy Nutrition in Head and Neck Cancer Patients. Acta Otolaryngol 2004; 124(7):847-50.
4. Baskin WN. Advances in Enteral Nutrition Techniques. Am J Gastroenterol. 1992; 87(11):1547-53.
5. Park RH, Allison MC, Lang J, et al. Randomized Comparison of Percutaneous Endoscopic Gastrostomy and Nasogastric Tube Feeding in Patients with Persisting Neurological Dysphagia. BMJ 1992; 304(6839):1406-9.
6. Heine RG, Reddihough DS, Catto-Smith AG. Gastroesophageal reflux and Feeding Problems after gastrostomy in children with severe neurological impairment. 1995; 37(4):320-9.
7. Angus F, Burakoff R. The Percutaneous Endoscopic Gastrostomy Tube: Medical and Ethical Issues in Placement. Am J Gastroenterol 2003; 98(2):272-7.
8. Lennard-Jones JE. Ethical and Legal Aspects of Clinical Hydration and Nutritional Support. BJU Int 2000; 85(4):398-403.
9. Löser C, Aschl G, Hébuterne X, et al. ESPEN Guidelines on Artificial Enteral Nutrition-Percutaneous Endoscopic Gastrostomy (PEG). Clinical Nutrition 2005; 24(5):848-61.
10. Kutiyanawala MA, Hussain A, Johnstone JM, et al. Gastrostomy Complications in Infants and Children. Ann R Coll Surg Engl 1998; 80(4):240-3.
11. Loser C. Clinical Aspects of Long-Term Enteral Nutrition via Percutaneous Endoscopic Gastrostomy (PEG). J Nutr Health Aging 2000; 4(1): 47-50.
12. Sanders DS, Carter MJ, D' Silva J, et al. Percutaneous Endoscopic Gastrostomy: A Prospective Audit of the Impact of Guidelines in Two District General Hospitals in the United Kingdom. Am J Gastroenterol 2002; 97(9):2239-45.
13. Nicholson FB, Korman MG, Richardson MA. Percutaneous Endoscopic Gastrostomy: A Review of Indications, Complications and Outcome. J Gastroenterol Hepatol 2000; 15(1):21-5.
14. Potack JZ, Chokhavatia S. Complication of and Controversies Associated with Percutaneous Endoscopic Gastrostomy: Report of a Case and Literature Review. Medscape J Med 2008; 10(6):142.
15. Sharma VK, Howden, CW. Meta-Analysis of Randomized, Controlled Trials of Antibiotics Prophylaxis before Percutaneous Endoscopic Gastrostomy. Am J Gastroenterol 2000; 95(11):3133-6.
16. Lipp, A, Lusardi G, et al. Systemic Antimicrobial Prophylaxis for Percutaneous Endoscopic Gastrostomy. Cochrane Database Syst Rev 2006; 4:CD005571.
17. Rey JR, Axon A, Budzynska A, et al. Guidelines of the European Society of Gastrointestinal Endoscopy (E.S.G.E.) Antibiotics Prophylaxis for Gastrointestinal Endoscopy. Endoscopy 1998; 30(3):318-24.
18. Synder J, Bratton B. Antimicrobial Prophylaxis for Gastrointestinal Procedures: Current Practice in North American Academic Program. J Pediatr Gastroenterol Nutr 2002; 35(4):564-9.
19. Loser C. Perkutane endoskopische gastrostomie (PEG) - Empfehlungen der Deutschen Gesellschaft fur verdauungs- und Stoffwechselkrankheiten (DGVS) fur die Durchfuhrung endoskopischer Untersuchungen. Stuttgart, 3 Auflage: Demeter Verlag; 2002:228-38.
20. Gibson SE, Wenig BL, Watkins JL. Complications of Percutaneous Endoscopic Gastrostomy in Head and Neck Cancer Patients. Ann Otol Rhinol Laryngol 1992; 101(1):46-50.
21. Pearce CB, Duncan HD. Enteral Feeding. Nasogastric, Nasojejunal, Percutaneous Endoscopic Gastrostomy, or Jejunostomy: Its Indications and Limitations. Postgrad Med J 2002; 78(918):198-204.
22. Morton RE, Wheatley R, Minford J. Respiratory Tract Infections Due to Direct And Reflux Aspiration in Children with Severe Neurodisability. Dev Med Child Neurol 1999; 41(5):329-34.
23. Sulaeman E, Udal JN Jr, Brown RF, et al. Gastroesophageal Reflux and Nissen Fundoplication Following Percutaneous Endoscopic Gastrostomy in Children. J Pediatr Gastroenterol Nutr 1998; 26(3): 269-73.
24. Brant CQ, Stanich P, Ferrari AP Jr. Improvement of Children's Nutritional Status after Enteral Feeding By PEG on Interim Report. Gastrointest Endosc 1999; 50(2): 183- 8.
25. Grant JP. Percutaneous Endoscopic Gastrostomy. Initial Placement by a Single Endoscopic Technique and Long Term Follow up. Ann Surg 1993; 217(2): 168-74.
26. Larson DE, Burton DD, Schroeder KW, et al. Percutaneous Endoscopic Gastrostomy. Indications, Success, Complications and Mortality in 314 Consecutive Patients. Gastroenterology 1987; 93(1): 48-52.
27. Lewis D, Khoshoo V, Pencharz FB, et al. Impact of Nutritional Rehabilitation on Gastroesophageal Reflux in Neurologically Impaired Children. J Pediatr Surg 1994; 29(2):167-9; discussion 169-70.
28. Van Someran RNM, Benson MJ, Hawcett H, et al. Origin of Pulmonary Aspirate in Percutaneous Endoscopic Gastrostomy. Gastrointest Endosc 1994; 39:A172:290.
29. Burry KD, Jambunathan G. Effects of Elemental Diets on Gastric Emptying and Gastric Secretion in Man. Am J Surg 1974; 127(1):59-64.
30. Seekri IK, Rescorla FJ, Canal DF, et al. Lesser Curvature Gastrostomy Reduces the Incidence of Postoperative Gastroesophageal Reflux. J Pediatr Surg 1991; 26(8): 982-4; discussion 984-5.
31. Anis MK, Abid S, Jafri W, et al. Acceptability and Outcomes of the Percutaneous Endoscopic Gastrostomy (PEG) Tube Placement-Patients and Care Givers' Perspectives. BMC Gastroenterol 2006; 6:37.