



RESEARCH

Complications of percutaneous endoscopic gastrostomy in children: a single-center experience

Çocuklarda perkütan endoskopik gastrostomi komplikasyonları: tek merkez deneyimi

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Abstract

Purpose: Percutaneous endoscopic gastrostomy is the most preferred method for feeding in children with intact gastrointestinal system functions when oral nutrition is insufficient due to neurological, neuromuscular, or oncological diseases. This study aimed to evaluate the indications for percutaneous endoscopic gastrostomy and associated complications in the patients we followed up.

Materials and Methods: In this descriptive study, the records of 130 patients who underwent percutaneous endoscopic gastrostomy for nutritional support between January 1st 2013- December 30th 2020 were retrospectively reviewed. Demographic data, indications, complications, and follow-up periods of the patients were examined.

Results: Of the patients, 75 were male and 55 were female. The mean age of the patients was 48 months (min 1 month-max 211 months). The evaluation of the patients with percutaneous endoscopic gastrostomy in terms of diagnosis revealed that 95 patients required nutritional support due to neuromotor retardation associated with neurological disease, 19 patients due to central nervous system tumor, and 13 patients due to metabolic disease. Considering complications, the most frequent minor complication was leakage in 11 of the 33 patients, while the most frequent major complication was colonic fistulation in 6 of the 9 patients. Two patients required open surgery in the early period due to intra-abdominal leak.

Conclusion: Although enteral nutrition with a percutaneous endoscopic gastrostomy tube seems to be an appropriate and reliable method to meet the nutritional needs of pediatric patients who have normal digestive system functions but cannot be fed orally due to swallowing disorders, it is necessary to pay attention to its complications like any surgical procedure.

Keywords: Child, gastrostomy, endoscopy, nutrition, percutaneous endoscopic gastrostomy

Öz

Amaç: Perkütan endoskopik gastrostomi, nörolojik, nöromusküler veya onkolojik hastalıklar nedeniyle oral beslenmenin yetersiz kaldığı, gastrointestinal sistem fonksiyonları sağlam olan çocuklarda en çok tercih edilen beslenme yöntemidir. Bu çalışma, takip ettiğimiz hastalarda perkütan endoskopik gastrostomi endikasyonlarını ve ilişkili komplikasyonları değerlendirmeyi amaçladı.

Gereç ve Yöntem: Tanımlayıcı tipte olan bu çalışmada, 1 Ocak 2013-31 Aralık 2020 tarihleri arasında beslenme desteği amacıyla perkütan endoskopik gastrostomi uygulanan 130 hastanın kayıtları retrospektif olarak incelendi. Hastaların demografik verileri, endikasyonları, komplikasyonları ve takip süreleri incelendi.

Bulgular: Hastaların 75'i erkek, 55'i kadındı. Hastaların yaş ortalaması 48 ay (en az 1 ay- en fazla 211 ay) idi. Perkütan endoskopik gastrostomi uygulanan hastaların tanı açısından değerlendirilmesinde nörolojik hastalığa bağlı nöromotor retardasyon nedeniyle 95, santral sinir sistemi tümörü nedeniyle 19, metabolik hastalık nedeniyle 13 hastanın beslenme desteğine ihtiyaç duyduğu görüldü. Komplikasyonlara bakıldığında en sık 9 hastanın 6'sında kolonik fistül oldu. İki hasta erken dönemde karın içi kaçak nedeniyle açık cerrahiye ihtiyaç duydu.

Sonuç: Perkütan endoskopik gastrostomi tüpü ile entereal beslenme, sindirim sistemi fonksiyonları normal olan ancak yutma bozuklukları nedeniyle ağızdan beslenemeyen pediyatrik hastaların beslenme ihtiyaçlarını karşılamak için uygun ve güvenilir bir yöntem gibi görünse de her cerrahi işlemde olduğu gibi cerrahi komplikasyonlarına dikkat etmek gereklidir.

Anahtar kelimeler: Çocuk, gastrostomi, endoskopi, nutrisyon, perkütan endoskopik gastrostomi

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INTRODUCTION

Children need many different nutrients for their growth and development to continue in a healthy way. In some specific patient groups, these needs cannot be met through physiological routes. However, long-term nutritional disorders, swallowing difficulty, and impaired digestion and absorption may lead to severe malnutrition^{1,2}. Nutrition plays a key role in the follow-up and treatment of chronic diseases. In cerebral palsy, cystic fibrosis, congenital heart diseases, oncological diseases, esophageal diseases that limit oral feeding, and in children with swallowing difficulties, nutritional deficiency can lead to malnutrition, resulting in an increased number of hospital admissions, infections, and worsening of the underlying disease^{3,4}. Enteral nutrition is the preferred route of feeding for these children with chronic diseases who have preserved gastrointestinal system integrity but cannot meet their metabolic needs via oral route. Methods such as nasogastric tube, nasoenteric tube, gastrostomy, and enterostomy are used to provide enteral nutrition. Percutaneous endoscopic gastrostomy (PEG) can be considered the least invasive method among these. PEG can be easily performed on children who need long-term feeding with an enteral tube and is a preferable method as it requires only a short hospital stay³⁻⁶.

This study aimed to report the diagnoses, complications, and long-term follow-up results of patients who underwent PEG tube placement in our pediatric surgery clinic.

MATERIALS AND METHODS

This study has a retrospective and descriptive design. In this study, the data of 130 patients who underwent a PEG procedure in the Adana City Training and Research Hospital Pediatric Surgery Clinic between 2013 and 2020 were retrospectively analyzed. Demographic information, underlying diseases, and procedure-related complications of the patients were evaluated.

Procedure

PEG procedure was performed in the operating room and under general anesthesia, after fasting for eight hours and colon cleansing. Colon cleansing was

achieved by administering a rectal enema to the patients 12 hours prior to the procedure. The procedure was performed by two physicians (one physician for endoscopic intervention and the other for percutaneous intervention). Access to insert the gastrostomy tube was achieved using the “pull” technique (Seldinger/Gauderer) in which the PEG tube is pulled through the epigastric region⁶, taking into account the light of the endoscope visualized on the skin or the palpable fluctuation and adhering to the sterilization principles for percutaneous access. A standard PEG set (Flocare® PEG set No: 10, 12, 14, 16, 18, 20) was placed in all patients and another set (Kimberly-Clark MIC® PEG set No: 14) in 1 patient. Low-dose feeding was initiated 24 hours after the placement of the tube, and the feeding dose was gradually increased.

Statistical analysis

Statistical analysis was carried out using SPSS (Statistical Package for the Social Sciences) version 26.0 software package. Categorical measurements were calculated as numbers and percentages, and continuous measurements as mean and standard deviation (median and minimum-maximum where necessary). Chi-square test was used to compare categorical measurements between groups. Statistical significance was taken as 0.05 in all tests.

RESULTS

PEG intervention was performed on 130 patients (75 (57.7%) of whom were male) between January 2013 and December 2020. The median age of the patients was 5.6 ± 5.35 years. In 27 patients (20.8%) under the age of one year, the procedure was performed while they were in the neonatal intensive care unit. The primary diagnoses of the patients who underwent PEG tube placement and the mean age at PEG tube placement are shown in Table 1. Table 2 shows the demographic data of the patients. All of the patients were already fed through a nasogastric tube prior to the procedure. The patients were evaluated in terms of gastroesophageal reflux (GER) by questioning the symptoms and, if necessary, by taking an esophageal-gastric-duodenal X-ray. No GER was detected clinically or radiologically in any of the patients. Antireflux surgery was performed on only 2 patients, considering GER after vomiting and esophagitis two years later.

Table 1. Primary diagnoses of patients who underwent percutaneous endoscopic gastrostomy.

Diagnosis	Number of patients, n (%)	Mean age of patients (months)
Neurological Disease	95 (73.1%)	74.5±64.4
Metabolic disease	13 (10.0%)	45.6±40.5
Central Nervous System Tumors	19 (14.6%)	73.5± 67.1
Other	3 (2.3%)	40.5±68.5

Table 2. Demographic and clinical characteristics of patients.

Variables	n (%)
Gender	
Male, n (%)	75 (57.7)
Female, n(%)	55 (42.3)
Mean age	
Mean±SD (years)	5.6±5.35
Median (min-max) (years)	4 (0-18)
Gastrostomy status by age groups	
0-12 months	27 (20.0)
13-36 months	26 (20.0)
37 months and above	77 (60.0)
Mean follow-up duration	
Mean±SD (months)	19.6±25.5
Median (min-max) (months)	12 (0-159)
Tracheostomy	
Yes	42 (32.3)
No	88 (67.7)
Survival status	
Deceased	37 (28.5)
Survived	71 (54.6)
Unknown status	22 (16.9)

Table 3. Major and minor complications of PEG.

Complications, n (%)	0-12 months, n (%)	13-36 months, n (%)	37 months and above, n(%)	Total, n (%)
	(27/20.8)	(26/20)	(77/59.2)	(130/100)
Minor complications				
None	14 (21.5)	10 (15.4)	41 (63.1)	65 (50)
Unknown	6 (27.25)	6 (27.25)	10 (45.5)	22 (16.9)
Leakage	0	3 (27.3)	8 (72.7)	11(8.5)
Granulation tissue	5 (55.5)	1 (11.1)	3 (33.4)	9 (6.9)
Rash and ulcer	1 (12.5)	2 (25)	5 (62.5)	8 (6.2)
Tube obstruction	1 (20)	2 (40)	2 (40)	5 (3.8)
Major complications				
Gastrocolic fistula	0	1 (16.7)	5 (83.3)	6 (4.6)
Intestinal obstruction	0	0	1 (0.8)	1 (0.8)
Detachment of the tube from the posterior gastric wall and embedding in the stomach wall	0	1 (33.3)	2 (66.7)	3 (2.3)

The mean time to mortality was 3.0±9.5 months after PEG tube placement in patients who died. The reasons for mortality were generally related to the

patient's underlying chronic disease. Only 2 patients died due to sepsis in the early period. The analysis of the early complications of our patients showed

obstruction in one patient and migration from the gastric wall into the abdomen on postoperative day 10 in two of our patients, which required open surgery. Open surgery was performed on one of our patients who developed brid ileus, in another patient with embedded tube in the stomach wall (buried bumper syndrome) during PEG kit replacement, and on six of our patients who developed gastrocolic fistula and intestinal problems within two years. Table 3 shows the complications associated with the PEG tube. Antireflux surgery was performed on two of our patients 2 years later due to esophagitis and vomiting. In two of our patients, the PEG tube was removed upon the request of their family at 6 months. The number of patients who still have a

PEG tube and are followed up is 69. As a consequence of the anatomical incongruity observed in the patients, it was deemed necessary to opt for open surgery over laparoscopic surgery. In our study, we conducted Pearson chi-square tests to evaluate the relationship between various variables and the occurrence of complications. The results of the chi-square tests are presented in the Table 4. As shown in the table, the chi-square test for diagnosis yielded a p-value of .330, indicating that there was no significant association between diagnosis and the occurrence of complications. Similarly, the chi-square tests for gender, gauge of tube, tracheostomy, and type of disease did not yield significant results, with p-values of .441, .981, .898, and .206, respectively.

Table 4. Results of Pearson Chi-Square tests comparing complications.

Variable	Chi-Square	df	Sig.
Diagnosis	43,367	40	.330
Gender	4,799	5	.441
Gauge of Tube	12,645	25	.981
Tracheostomy	1,624	5	.898
Type of Disease	19,176	15	.206

DISCUSSION

This study, which was conducted with the aim of retrospectively examining patients with percutaneous endoscopic gastrostomy in terms of indications and minor and major complications of PEG, revealed that PEG was mostly placed due to neurological diseases, with gastrointestinal fistula being the most frequent major complication and leakage being the most frequent minor complication.

PEG was first described by Gauderer in the 1980s and its use has become increasingly popular since then⁷. Owing to advantages such as a lower rate of nasal irritation compared to nasogastric tube, less aspiration of gastric content, and shorter hospital stay, PEG tube placement is a preferred method for enteral nutrition of pediatric patients who have swallowing difficulty, whose nutritional needs cannot be adequately met via oral route, and who have difficulty in getting sufficient nutrients^{2,6,8}. Indications for PEG tube placement, and minor and major complications associated with PEG were evaluated in this study. Swallowing dysfunction was the most common cause of PEG tube placement. Our most important patient group suffering from

swallowing dysfunction had neurological diseases. When the distribution of the 130 patients in this study was analyzed, patients with neurological problems were found to comprise the largest group. This is consistent with large series published in the world^{7,9,10}. Srinivasan et al.¹¹ reported the most common indications for PEG as neurological diseases, followed by congenital heart diseases and chronic lung diseases, cleft palate, cleft lip, genetic diseases, malignancies, and metabolic diseases, respectively. In other studies, the most significant indications for PEG included dysphagia due to neurological disorders¹⁰, neuromuscular and metabolic causes, congenital heart diseases, oncological diseases, cystic fibrosis, and esophageal diseases^{1,8,9,12}.

In our study, patients with central nervous system tumors (n=19) comprised the second largest group. Nutritional deficiency is more common in cancer patients due to many factors such as the effects of chemotherapeutic drugs on the gastrointestinal system and decreased appetite¹³. Since the hospital where this study was conducted addresses a large region in the south of Turkey and has clinics that follow up oncological patients, our patient group

with PEG tube placement included a high number of oncological patients. PEG tube placement due to metabolic disease ranks second in other studies conducted in our country, while it was the third most common reason (n=13) in our study^{14,15}. The indications for PEG due to metabolic diseases include neurological sequelae resulting from metabolic disorders and associated swallowing dysfunction. The low rate of PEG in children with metabolic diseases in our study was associated with the lack of a metabolic diseases outpatient clinic and therefore the limited follow-up of these patients in our hospital.

The most common major complication in this study was gastrointestinal fistulas. In our study, 10 of our patients developed major complications. Of these, a gastrocolic fistula was noted in 6 patients (4.6%), intestinal obstruction in 1 patient (0.8%), and buried bumper syndrome in 3 patients (2.3%). Among the major complications, the rates of gastrocolic fistula and buried bumper syndrome were found to be higher than the rates reported in the literature. We believe that the reason for this difference is the high rate of morbidities associated with the comorbidities of our patients who developed complications, the fact that gastrostomy was not performed by the same physician in all cases, and inadequate post-gastrostomy care.

The most common minor complication in this study was leakage. Although the PEG procedure is effective and reliable, various adverse events can occur when adequate care is not provided during or after the procedure. These include obstruction of the tube, leakage from the side of the tube, formation of hypergranulation tissue, and buried bumper syndrome. In their 2018 literature review of 18 articles on PEG-related adverse events, Balogh B. et al.¹ reported minor complications in 1518 (32.8%) of a total of 4631 patients. The most common minor complications were granulation tissue (n=478, 10.3%); local infection (n=384, 8.3%); leakage (n=279, 6%), and skin ulcer or rash (n=188, 4.1%). Unplanned tube removal was performed in 65 patients, 2% of whom had tube migration and obstruction, while 464 (10%) of these patients had developed major complications. It was reported that approximately 50% of these complications were associated with infections, 21 (0.45%) patients had gastrocolic fistula, 13 patients (0.3%) had esophageal and intestinal perforation, and 1% of the patients had buried bumper syndrome. In our study, minor

complications were leakage (n=11, 8.5%), followed by granulation tissue (n=9, 6.9%), rash and ulcer (n=8, 6.2%), tube obstruction, or unplanned tube removal (n=5, 3.8%). The study by Leo et al. (10) in 84 patients reported a rate of 2.4% (n=2) for buried bumper syndrome, one of the major complications. There was no difference in our minor complication rates as compared to the literature.

Our study had a retrospective design. The small sample size is one of the limitations of our study. In addition, our study was not planned to analyze long-term outcomes such as the effects on improvement in growth and weight gain in children requiring a PEG tube. Our most important limitation is the inability to analyze the anthropometric data of patients due to the lack of such data at the time of admission. Although we are aware of these limitations, we aimed to identify our patient population with nutritional problems and describe the procedures used to provide nutritional support, treatment, and care to vulnerable children.

In conclusion, PEG is a practical, cost-effective, and safe feeding method with low morbidity and mortality rates, a shorter hospital stay and feasibility of being performed even at the bedside. PEG is frequently and safely performed in patient groups with neurological diseases who suffer from swallowing difficulties and in those with severe weight loss due to malignancy. In patients with malnutrition and a high risk of growth retardation, feeding through a PEG tube is a convenient and comfortable feeding method for caregivers, which increases the quality of life and survival of patients. PEG tube placement should be performed by experienced physicians and we are of the opinion that complication rates will decrease if families are provided with care and treatment training on PEG care and use. This study shows that the rate of major complications occurs more frequently in long-term follow-ups in patients undergoing PEG. Therefore, long-term follow-up is important.

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