Percutaneous endoscopic gastrostomy in children: a single center experience

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Abstract

Aim: The aim of this study was to evaluate the demographic data and complication rates in children who had undergone percutaneous endoscopic gastrostomy in a three-year period in our Division of Pediatric Gastroenterology and to interrogate parental satisfaction.

Material and Methods: The demographic data, complications and follow-up findings of the patients who had undergone percutaneous endoscopic gastrostomy between March 2011 and March 2014 were examined retrospectively using medical files.

Results: Forty seven percutaneous endoscopic gastrostomy and percutaneous endoscopic gastrostomy related procedures were performed in 34 children during a three-year period. The median age of the patients was 2.25 years (3 months-16 years, first and third quartiles=1.0-6.0) and the mean body weight was 13.07±8.6 kg (3 kg-47 kg). Before percutaneous endoscopic gastrostomy procedure, the mean weight z score was -2.26±1.2 (-5-0) and the mean height z score was -2.25±0.96 (-3.85-0.98). The follow-up mean height and weight Z scores at the 12th month after the percutaneous endoscopic gastrostomy procedure could be reached in 24 patients. A significant increase in the mean weight Z score from -2.41 to -1.07 (p=0.000) and in the mean height Z score from -2.29 to -1.99 (p=0.000) was found one year after percutaneous endoscopic gastrostomy catheter was placed in these 24 patients. Patients with neurological and metabolic diseases constituted the majority (64.7% and 26.5% respectively). Peritoneal leakage of food was detected in one patient and local stoma infections were detected in three patients after the procedure. During the follow up period, "Buried bumper syndrome" was observed in one patient. Following percutaneous endoscopic gastrostomy, the number of patients using anti-reflux medication increased from 16 (47.1%) to 18 (52.9%) (p=0.62). One patient with cerebral palsy who had aspiration pneumonia after percutaneous endoscopic gastrostomy insertion had undergone Nissen fundoplication. Percutaneous endoscopic gastrostomy tube was removed in a patient. The parents had positive views related with percutaneous endoscopic gastrostomy after the procedure.

Conclusions: Percutaneous endoscopic gastrostomy is a substantially successful and reliable method in infants as well as in children and adolescents. The parents had positive views related with percutaneous endoscopic gastrostomy after the procedure. (Turk Pediatri Ars 2015; 50: 211-6)

Keywords: Parental satisfaction, children, complication, percutaneous endoscopic gastrostomy, infant

Introduction

Adequate nutrition plays a significant role in the follow-up and treatment of many diseases especially in children. In some cases, inadequate nutrition may even lead to worsening of the primary disease (1). Therefore, methods including nasogastric tube, nasoenteric tube, gastrostomy and enterostomy have been used for years with the purpose of providing enteral nutrition. Although 30 years have passed since the first percutaneous endoscopic gastrostomy (PEG), experience and studies in this area have increased in recent years (2, 3). Currently, PEG has superseded surgical gastrostomy which has a higher risk of complication. It is a method which is also used frequently in children (3). PEG which can be placed easily in experienced hands provides an opportunity for care and treatment in anatomical and functional disorders of the

upper gastrointestinal system as well as in neurological, metabolic and oncological diseases (4). In this study, it was aimed to examine the demographic data, complication rates and family satisfaction in children who underwent PEG procedure.

Material and Methods

In this study, the data of the patients who underwent PEG procedure between the years of 2011 and 2014 in our unit were examined retrospectively. The demographic data, underlying diseases, body weight Z scores before and after PEG, reasons for and times of change of PEG, complications related with the procedure, reflux rates (the diagnosis was made with the clinical findings) and follow-up periods were obtained from the patient files. Height and weight Z scores and presence of gastroesophageal reflux (GER) be-

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fore and after percutaneous endoscopic gastrostomy were evaluated by dividing the subjects into two groups as <two years and $\geq$ two years. The parents were asked by nutrition nurses who performed follow-up visits if they would let their children have a PEG catheter placed if they had to decide again. The procedure of percutaneous endoscopic gastrostomy was performed in operation room under general anesthesia following an eight-hour fasting using prophylactic antibiotic. The procedure was performed by two physicians (one physician for endoscopic intervention and one physician for percutaneous intervention). Percutaneous entrance was implemented in the epigastric region in accordance with sterilization rules considering the light of the endoscope which could be observed on the skin or the fluctuation sensed by fingers. Standard PEG set (Kimberly-Clark MIC® PEG set No: 10, 12, 14) was placed initially in all patients.

This study was approved by the ethics committee of Süleyman Demirel University, Medical Faculty (09/07/2015-152).

Statistical analysis

Statistical analysis was performed using Statistical Package for Social Sciences version 15.0 software (SPSS Inc.; Chicago, IL, USA, 2006). Since the age range was too wide, the median and first quartile-3rd quartile values were given. The other data of the patients were expressed as mean $\pm$ standard deviation and the categorical data were expressed as percentage. Chi-square test was used for the difference between the categorical variables and paired t test was used for comparison of dependent groups. A p value of <0,05 was considered significant.

Results

In a three-year period, 47 PEG and PEG-related procedures were performed in 34 children (34 first PEG, 12 switching from standard PEG to button PEG, one removal of PEG). Twelve (35%) of the patients were female and 22 (65%) were male. The median age of the patients was 2.25 years (3 months - 16 years, 1st and 3rd quartile=1.0-6.0) and the mean weight was found to be 13.07 $\pm$ 8.6 kg (3 kg-47 kg). The number of patients aged below two years was 16 (47.1%).

The majority of the patients was constituted by children with a diagnosis of neurological (22/34; 64.7%, mean age 4.73 $\pm$ 5.14) and metabolic disease (9/34; 26.5%; mean age 2.5 $\pm$ 1.69). Cerebral palsy was the most common indication for placement of PEG (Table 1). Neurologic damage had developed in all patients with a diagnosis of metabolic disease. Dysphagia was present in all patients with a diagnosis of neurological and metabolic disease. Low body weight

(body weight by age Z score <2 SD) was found in association with dysphagia in 15 (68.2%) of the patients with neurological disease and in four (44.4%) of the patients with metabolic disease. Percutaneous endoscopic gastrostomy catheter was placed in two patients (5.9%) who had pseudohypoaldosteronism because of inability to provide a high level of oral salt intake and in one patient who had panhypopituitarism and motor-mental retardation (2.9%) because of inability to provide oral water intake.

Before placement of PEG catheter, the mean body weight Z score of the patients was found to be -2.26 $\pm$ 1.20 (-5-0) and the mean height Z score was found to be -2.25 $\pm$ 0.96 (-3.85-0.98). The body weight and height measurements of only 24 patients at the 12th month after placement of PEG catheter could be reached. The mean body weight Z scores before placement of PEG catheter and one year after placement of PEG catheter were found to be -2.41 $\pm$ 1.28 and -1.07 $\pm$ 1.33 (p=0.000) in these 24 patients. It was observed that there was a significant increase in the mean values of height Z score (-2.29 $\pm$ 0.99 and 1.99 $\pm$ 0.89, respectively, p<0.001). The weight and height Z scores of these 24 patients are shown in Table 2.

The patients who were aged below (16/34) and equal to or above two years at the time of placement of PEG and at the end of the first year were compared in terms of nutritional status, complications and GER rates. In the group aged two years and older, the number of patients with a low body weight before PEG was significantly higher

Table 1. Primary diagnoses of the patients in whom percutaneous endoscopic gastrostomy was performed

Diagnosis	Number of patients n (%)
Neurological disease	22 (64.7)
Cerebral palsy	11
Hypoxic ischemic encephalopathy	6
Hydrocephaly	3
Congenital muscular dystrophy	1
Tuberous sclerosis	1
Metabolic disease	9 (26.5)
Tay-Sachs disease	2
Adrenoleukodystrophy	2
Zellweger disease	1
Glutaric aciduria type II	1
Pompe disease	1
Mitochondrial disease	1
Undefined	1
Pseudohypoaldosteronism	2 (5.9)
Panhypopituitarism	1 (2.9)

($p=0.09$). No difference was found in terms of other properties (Table 3).

In 12 (35%) of our patients, standard PEG was switched to button PEG. The mean time for switching from standard PEG to button PEG was found to be 8 ± 3.4 (5-13) months.

No complication related with change of button PEG catheter was found. Food escape into the peritoneal cavity occurred as a complication in one patient following placement of PEG. In the long-term, development of peristomal granulation tissue was observed in six patients (17.6%) and this was the most common minor complication. This was treated by topical silver nitrate application. In three patients (8.8%), topical stroma infection was found. Use of topical antibiotic was sufficient for treatment. "Buried bumper syndrome" developed in one patient and PEG was

removed from the abdominal wall by withdrawing without using surgical procedure and button PEG was placed instead.

Our patients were examined in terms of GER before the procedure (all patients were interrogated in terms of reflux complaints and the diagnosis of GER was made based on the clinical findings). While the number of patients who used anti-reflux drugs before PEG was 16 (47.1%), this number was observed to increase to 18 (52.9%) after placement of PEG catheter ($p=0.62$). Nissen funduplication was performed five months after placement of PEG catheter in one patient with a diagnosis of cerebral palsy who did not respond to anti-reflux treatment and was hospitalized with recurrent aspiration pneumonia.

Percutaneous endoscopic gastrostomy catheter was removed in one patient. Percutaneous endoscopic gastrostomy catheter was placed at the age of nine months because of excessive salt requirement, switching to button PEG was implemented during the study period and button PEG was removed at the age of 5.5 years because salt requirement decreased in this patient who had a diagnosis of pseudohypoaldosteronism.

The mean follow-up period was found to be 19.4 ± 10.3 months (6 months-42 months). In this period, nine patients (26.4%) were lost because of factors related with the underlying diseases. Five patients were lost to follow-up.

Table 2. Body weight and height Z scores before and 12 months after placement of percutaneous endoscopic gastrostomy catheter in 24 subjects

Subjects	Weight Z before PEG	Weight Z score at the first year after PEG	Height Z score before PEG	Height Z score at the first year after PEG
1	-5.00	-3.50	-3.85	-3.14
2	-3.00	-2.00	-2.44	-2.11
3	-3.75	-2.50	-2.32	-2.00
4	-3.20	-2.50	-2.57	-2.26
5	-2.10	-1.50	-2.59	-2.37
6	-2.00	-1.00	-1.89	-1.74
7	-3.50	-2.50	-2.13	-1.99
8	-1.96	-1.00	-1.39	-1.00
9	-1.50	0.00	-3.24	-2.83
10	-3.20	-2.00	-2.41	-1.99
11	-4.00	-2.50	-3.10	-2.78
12	-4.20	-1.00	-3.22	-2.97
13	-1.50	0.75	-2.11	-1.97
14	-1.00	0.00	-2.96	-2.53
15	0.00	0.50	0.98	0.99
16	-2.50	-1.00	-3.10	-2.99
17	-1.00	0.00	-0.53	-0.52
18	-2.50	-1.00	-1.98	-1.92
19	-2.00	0.00	-2.40	-1.97
20	-3.00	-2.00	-2.79	-2.00
21	-4.00	-3.00	-3.21	-2.89
22	-1.00	1.00	-1.98	-1.58
23	-1.00	1.00	-2.34	-2.00
24	-1.00	0.00	-1.50	-1.43

PEG: Percutaneous endoscopic gastrostomy

Table 3. Nutritional status and rates of complications and gastroesophageal reflux at the time when percutaneous endoscopic gastrostomy was applied and at the end of the first year by age groups

	<2 years Mean $\pm$ SD	$\geq$ 2 years Mean $\pm$ SD	P
Mean weight Z score before PEG	-1.99 $\pm$ 1.17	-2.66 $\pm$ 1.31	0.15
Mean weight Z score at the first year after PEG	-0.75 $\pm$ 1.38	-1.26 $\pm$ 1.3	0.36
Mean height Z score before PEG	-1.96 $\pm$ 1.22	-2.49 $\pm$ 0.81	0.12
Mean height Z score at the first year after PEG	-1.64 $\pm$ 1.09	-2.21 $\pm$ 0.71	0.25
	n/%	n/%	
Weight Z score before PEG <2 SDS	7/43.8	13/72.2	0.09
Weight Z score at the first year after PEG <2 SDS	3/18.8	6/33.3	0.33
GER before PEG	9/56.3	7/38.9	0.31
GER at the first year after PEG	10/62.5	8/44.4	0.29
Complication	7/63.6	4/36.4	0.16

PEG: percutaneous endoscopic gastrostomy; GER: gastroesophageal reflux
SD: standard deviation

When the study was completed, 20 patients were being followed up with PEG catheter. The families of these patients were asked by nutrition nurses who performed follow-up visits if they would let their children have a PEG catheter placed if they had to decide again and a positive answer was obtained from all parents.

Discussion

Long-term enteral nutrition is generally used in patients who have a long life expectancy, but lack the chance of being fed orally for a long-term (4-6 weeks) (1). Adequate nutrition of children who are growing and developing is very important to provide growth and development processes compatible with their genetic potentials. It is difficult to subsequently eliminate physical, functional and social disabilities arising from nutritional deficiency at early ages. Therefore, enteral nutrition which is the closest route to natural nutrition should be initiated as soon as possible in children who can not be fed orally (3).

There are a few studies examining placement of PEG in infants (5). Previous guidelines recommended the appropriate body weight for placement of PEG to be approximately 10 kg (6). Currently, some investigators recommend use of laparoscopic video-assisted technique for placement of gastrostomy catheter in young infants. In recent publications, it has been reported that this technique can also be used safely in young infants below the age of one year with a body weight as low as 2.6 kg (7). In addition, infants with a weight of 2.3 kg and 3.5 kg in whom PEG was placed with the pull method without any problem have been reported (5). The youngest infant in our study was four months old and had a body weight of 3 kg. No complication developed in this patient and he reached the age of two years without any problem when the study was completed. Although the pull method is frequently used for placement of PEG catheter, safer technical methods are being investigated for young infants.

Children with dysphagia generally have neurological diseases. When the distribution of 34 patients included in this study was examined, it was observed that the patients with neurological problems were in the first order. This was compatible with the large series published worldwide (8, 9). In two studies conducted in our country, it was reported that children with neurological diseases were in the first order among the pediatric subjects in whom PEG was placed (4, 10). In our study, it was observed that metabolic diseases were in the second order (n=9). In the study of Srinivasan et al. (9), it was reported that 160 (41.6%) of 384 subjects in whom PEG was placed had neurological problems and seven (1.8%) had metabolic problems.

When compared with our study group, a significant difference was observed between the numbers of subjects in whom PEG was placed because of metabolic disease. The reason for this may be the fact that metabolic diseases are observed more frequently in our country because of consanguineous marriage or genetic predisposition. The indication for placement of PEG in nine subjects who had a metabolic disease was dysphagia related with neurological sequela which developed during the course of the disease. In three patients, the indication for placement of PEG was excessive salt and water requirement.

Previous studies have shown that nutritional status improves following application of PEG. There are limited number of studies investigating the effect of enteral nutrition on height gain (11). It has been reported that one of the reasons for this is problems related with measurement of height due to neuromuscular disorders which are present in most children in whom a PEG tube has been placed. Therefore, it has been emphasized that it is not possible to generalize the positive effect of nutrition by PEG on growth to all patient groups (11). In a study including 32 children with cerebral palsy, the height measurements of 14 patients in the follow-up could be obtained and nine of them were reported to have height gain (12). In the series of Lalanne et al. (11) composed of 368 children who were followed up for a 13-year period, it was found that a significant increase occurred in both height Z scores and weight for height Z scores in 231 subjects whose height measurements could be reached. Similarly, a significant increase was found in the mean body weight and height Z scores in the first year of follow-up in this study.

Although application of PEG is efficient and safe, complications may be observed during or after the procedure. The most common complication following PEG is wound infection. It usually has a mild course and improves with intravenous antibiotic treatment. In a study which included 747 children which is the largest series so far, the rate of early postoperative complication (wound infection, pneumoperitoneum, tissue necrosis and most importantly separation of the stomach from the abdominal wall) was found to be 4% (8). The rate of minor complications including wound infection and formation of granuloma after discharge was found to be 20% and gastrocolonic fistula was reported only in one patient (8). In our series, local stoma infection which developed as a result of placement of PEG was observed in 8,8% of the subjects. The patients improved with antibiotic treatment without any problem. Changes in regional anatomy which may be observed in children with neurological disease increase the possibility of complications (8). In our study, the subject in whom food escape into the peritoneum developed was a patient

with scoliosis who was being followed up with a diagnosis of cerebral palsy and epilepsy.

There is little evidence indicating that PEG increases GER (13). Its effect on previously present reflux complaints is unclear (8). Although it is known that esophageal pH monitoring is more valuable in identifying the severity of reflux compared to the severity of complaints, its role in assessment before PEG has not been well specified (13). It is known that the frequency of GER is increased in patients with neurological diseases (14). Some studies have supported the view that the severity of GER increases after PEG in these patients and some others have reported the opposite (15-17). However, Puntis et al. (17) recommended that simultaneous antireflux operation should not be performed in these patients and investigations for GER should be avoided in patients without complaints. All of our patients were investigated in terms of possible GER before PEG (detailed history and clinical findings). Although it was observed that the requirement for anti-reflux drugs increased after placement of PEG catheter, this increase was not statistically significant. One limitation of our study was the fact that we could not explain the relation between PEG and GER, because our study was a retrospective study and GER was not investigated with further tests in practice other than clinical evaluation. Detailed studies with larger series are needed to explain the relation between PEG and GER. In the study of Durakbaşı et al. (2), GER requiring surgical treatment was found after application of PEG in one (4%) of 25 patients. Akay et al. (10) performed anti-reflux operation in two patients after application of PEG (one patient in whom repair of accompanying esophagus atresia was performed and one patient who developed aspiration pneumonia following PEG). Anti-reflux operation was performed in only one of our patients because of recurrent aspiration pneumonia after PEG. In patients who need placement of gastrostomy tube because of any reason, gastrostomy can be performed with the PEG method which is a simple invasive method without invasive investigation and invasive surgery and detailed examination and invasive surgery can be performed subsequently (15).

Recent guidelines recommend use of prophylactic antibiotics (18, 19). A single dose of antibiotic before PEG has not been shown to be superior to multiple doses and penicillin has not been shown to be superior to cephalosporin (20). A single dose of cephalosporin was given to all patients included in our study before the procedure. Systemic infection was not observed in any of our patients.

When the procedures related with PEG were examined, it was found that the procedure of removal of PEG took

a significant place in the total number of procedures (4). Srinivasan et al. (9) reported 49 of a total of 601 procedures were removal of PEG in their study. In our series, PEG removal was performed in only one of 34 children. The reason for the low number of removal of PEG in our patients may be the fact that PEG is frequently placed in chronic patients who are not expected to recover fully in our clinic.

Many studies investigating the acceptability of percutaneous endoscopic nutrition by parents have been conducted (21-23). While the majority of parents resisted to placement of PEG initially, most of them were satisfied with the outcome (21). In the study of Avitslan et al. (23) in which 121 children who had a PEG catheter were evaluated retrospectively, 98% of the parents reported that they could again decide to let their children have a PEG catheter placed. Similarly, positive answers were obtained in our study when the parents were asked if they would let their children have a PEG catheter placed if they had to decide again. Life is very difficult for children who experience chronic feeding difficulty and for their parents. Nutrition by tube reduces the burden and stress of the parents, shortens the time spent for nutrition and the risk of aspiration (24). It is not possible to state that these children are cared and supported sufficiently. Mothers sometimes spend long hours during the day to feed their children and to give them their medications. However, PEG is a very efficient application which should be considered for children who require supportive or continuous enteral nutrition because of different causes independent of presence of a neurological background (2).

In conclusion, PEG is a considerably successful and safe method in infants as well as children and adolescents. Major complications are observed rarely. The opinions of parents related with PEG after the procedure are positive. It is a very efficient application which should be considered in children who need supportive or continuous enteral nutrition because of different causes.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Süleyman Demirel University Faculty of Medicine (09/07/2015-152).

Informed Consent: Written informed consent was not obtained from patients due to the retrospective nature of this study.

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