



Research paper

Retrospective analysis of the methods and complications following the insertion of a PEG tube in children

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ABSTRACT

Introduction: A long-term intragastric feeding is the indication for percutaneous endoscopic gastrostomy (PEG) placement in a patient. The procedure is performed in children with central nervous system (CNS) disorders, congenital heart defects and neoplastic or metabolic diseases. The PEG placement procedure is most commonly performed by a gastroscopy procedure.

Aim: The study aimed to retrospectively analyse the methods applied and complications following PEG tube insertion in patients of the Regional Specialist Children's Hospital in Olsztyn, Poland, in the years 2000–2019.

Material and methods: A retrospective analysis was conducted of medical histories and records of children qualified for PEG placement procedure. PEG procedure was performed on 48 children: 24 boys and 24 girls. The mean age was 7 years. PEG was inserted in cerebral palsy in 30 patients, congenital defects in 11 and genetic disorders in 7.

Results and discussion: The reasons for PEG insertion included dysphagia in 30 children, no weight gain in 7, aspiration of gastric contents to the bronchial tree in 6, and feeding difficulties in 10. Two methods for performing PEG insertion procedure were employed: a gastroscopy alone (31 cases) and a laparoscopic-assisted gastroscopy (17). The following complications were: local complications at the incision site (28), PEG dysfunction (13), vomiting (9), sepsis (2), buried bumper syndrome (1), oesophagitis (1), and gastrointestinal fistula (1).

Conclusions: The PEG placement procedure is burdened with a significant number of complications, however, they are mainly related to local inflammation or PEG dysfunction.

1. INTRODUCTION

Properly balanced nutrition is an essential condition for the health and proper mental and physical development of a child.¹

The most efficient nutritional method is physiological feeding via the oral route. In children for whom this is ineffective or impossible, other feeding methods should be employed. The main principle to follow when choosing an alternative feeding route is to introduce food using the longest possible section of the digestive tract. This principle enables the most efficient use of food.² One of the feeding methods is to insert a feeding tube into the stomach or small intestine, either through the nose or mouth. This is a short-term solution that allows nutritional treatment to be carried out for up to several weeks. This, however, carries a risk of complications, e.g. nasal mucosal pressure ulcers, aspiration pneumonia, or blockage of the tube and additional suffering due to the presence of the probe.³ When patient requires long term intragastric feeding the percutaneous endoscopic gastrostomy (PEG) is created.

The PEG procedure was first described in 1980 by Gauderer.⁴ PEG is recommended in patients with swallowing disorders, feeding difficulties, cachexia secondary to central nervous system (CNS) defects, neoplastic and metabolic diseases, and congenital heart defects.⁵

PEG significantly contributes to improving the quality of life of the children and their parents by simplifying and shortening the feeding time and enabling proper nutrition. It offers the possibility to administer medications via the enteral route, which enables better control of their assimilation.⁶ Regardless of the surgical technique used, placement of a gastrostomy tube may be burdened with a variety of complications, of which the most common ones include local complications, mainly skin inflammation at the tube entrance site, and those associated with PEG functioning, e.g. its dislodgement, fracture or obstruction.⁷

2. AIM

The study aimed to retrospectively analyse the methods applied and complications following PEG insertion in patients of the Clinical Ward of Paediatric Surgery and Urology, Regional Specialist Children's Hospital in Olsztyn in the years 2000–2019.

3. MATERIAL AND METHODS

A retrospective analysis was conducted of the medical histories and records of children admitted to Regional Specialist Children's Hospital in Olsztyn who underwent the percutaneous gastrostomy procedure. The results obtained from the analysis of the material were classified in accordance with the methodology provided in the literature. The data were collected using Microsoft Excel and Microsoft Word software.

The PEG placement procedure is most commonly performed by gastroscopy by a team comprising a gastroenterologist, paediatric surgeon and an anaesthetist. During the gastroscopic examination in a shaded area, gastric mucosa is assessed, and the optimal site is then selected on the anterior gastric wall for PEG tube placement. The light of the gastroscope creates a light marker on the skin of the abdomen, most commonly in the left epigastrium. The surgeon makes an incision in the skin at the light-indicated location, inserts a needle through the abdominal wall into the stomach lumen, and through the needle lumen, a strong guide wire loop from the PEG set. The guidewire with a loop at the end is pulled out with forceps through the mouth to the outside using a gastroscope. The other end of the guidewire remains outside the abdomen. The surgeon passes the sharp end of the PEG tube with another loop through the initial loop. A PEG tube with a 'mushroom' tip at the end is passed, using the guidewire, through the mouth and oesophagus, and then through the stomach, and pulled out through the opening 'punctured' by the sharply pointed end of the tube in the anterior gastric wall to the outside. The PEG tube is pulled out until the stomach is pulled up to the anterior abdominal wall to be fixed firmly on the gastric wall using the 'mushroom' tip. From the external side of the abdomen, the PEG catheter is fixed to the skin with the external bumper and clamp that are movable along the catheter. Stabilising the tube with the external bumper and internal mushroom tip ensures tightness of the stomach and, with time, will allow the gastric wall to fuse with the peritoneum.^{8,9}

PEG procedure was performed in 48 patients, of which 24 subjects were boys and 24 were girls, which is presented in Figure 1.

The youngest patient was 3 months old, and the oldest was 16 years old (the mean age was 7 years). The distribution of patient ages is presented in Figure 2.

The reasons for PEG insertion were diseases occurring in the children and were divided into three categories: cerebral palsy (CP) – 30 cases, congenital defects – 11, and ge-

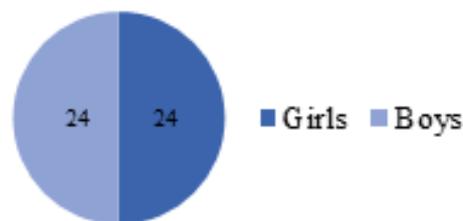


Figure 1. Breakdown of patients subjected to PEG placement procedure by gender.

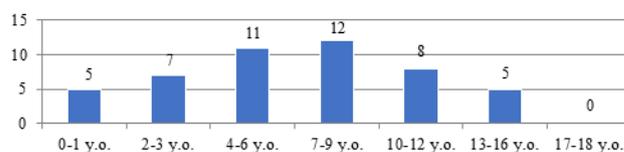


Figure 2. Distribution of patient ages at the time of performing PEG placement procedure.

Table 1. The diseases that were the reason for performing PEG placement procedure.

Disease	N
Cerebral palsy	30
Isolated	20
Concomitant with microcephaly	2
Concomitant with hydrocephalus	2
Concomitant with Down syndrome	1
Concomitant with myelocele and hydrocephalus	1
Hypoxic ischaemic encephalopathy	4
Genetic disorders	7
Mucopolysaccharidosis	1
Edwards syndrome	1
Angelman syndrome	1
Spinal muscular atrophy	4
Congenital defects	11
Wolf-Hirschhorn syndrome	2
Agenesis of the corpus callosum	2
Pachygyria	1
Semilobarholoprosencephaly	1
Foetal alcohol syndrome (FAS)	2
Tetralogy of Fallot	1
Congenital hydrocephalus	2

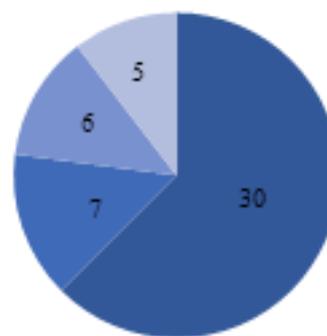
Table 2. Comorbidities that were not the reason for direct PEG placement.

Comorbidities	N
Spinal deformity	12
Cardiomyopathy	6
Preterm birth	5
Hydrocephalus with ventriculoperitoneal shunt	4
Thrombocytopenia	3
Renal failure	1

Table 3. Type of procedure for performing PEG insertion.

Procedure	N
Gastroscopy	31
Laparoscopic-assisted gastroscopy	17

netic disorders – 7. CP was concomitant with such defects as microcephaly (2 cases), hydrocephalus (2), myelocele (1), Down syndrome (1) and hypoxic ischaemic encephalopathy (4). Most commonly, CP occurred as an isolated disorder (20). The congenital defects included Wolf-Hirschhorn syndrome (2), agenesis of the corpus callosum (2), pachygyria (1), semilobarholoprosencephaly (1), FAS (2), tetralogy of Fallot (1) and congenital hydrocephalus (2). The genetic disorders included mucopolysaccharidosis (1), Edwards syndrome (1), Angelman syndrome (1), and spinal muscular



■ **Dysphagia** ■ **Recurrent aspiration pneumonia**
 ■ **Insufficient body weight gain** ■ **Feeding difficulties**

Figure 3. Number of patients per individual indications for PEG placement.

atrophy (4). The occurrence of diseases is presented in detail in Table 1.

Thirty-three patients had comorbidities that were not the reason for direct PEG placement, including cardiomyopathy (6), hydrocephalus with ventriculoperitoneal shunt (4), spinal deformities (12), thrombocytopenia (3), preterm birth (5) and renal failure (1). These are presented in Table 2.

Among the analysed patients, 5 died from causes unrelated to the PEG procedure, and PEG was permanently removed in 11 child.

4. RESULTS

The reasons for PEG insertion included dysphagia (30), no weight gain (7), aspiration of gastric contents, causing recurrent aspiration pneumonia (6), and feeding difficulties (10), which is shown in Figure 3.

In the analysed patients, a PEG insertion procedure was performed by means of gastroscopy (31) and laparoscopic-assisted gastroscopy (17), which is shown in Table 3. Of the 17 laparoscopic procedures performed, 15 additionally involved the performance of a Nissen fundoplication. In 12 children, spinal deformity occurred, and in 8 cases among them, the procedure was performed with laparoscopic assistance.

PEG placement procedure was burdened with various complications, e.g. local complications (28), PEG dysfunction (13), vomiting (9), sepsis (2), buried bumper syndrome (1), oesophagitis (1), and gastrointestinal fistula (1), which are presented in Figure 4.

The local complications included skin inflammation in 15 children, bleeding from the PEG insertion site in 7, granulation tissue in 5, and ulceration around the PEG site in 1 child. The complications related to PEG dysfunction include PEG dislodgement in 6 patients, accidental PEG removal in 3, PEG rupture in 2, and sudden obstruction of the catheter in 2 patients. Detailed data are presented in Table 4.

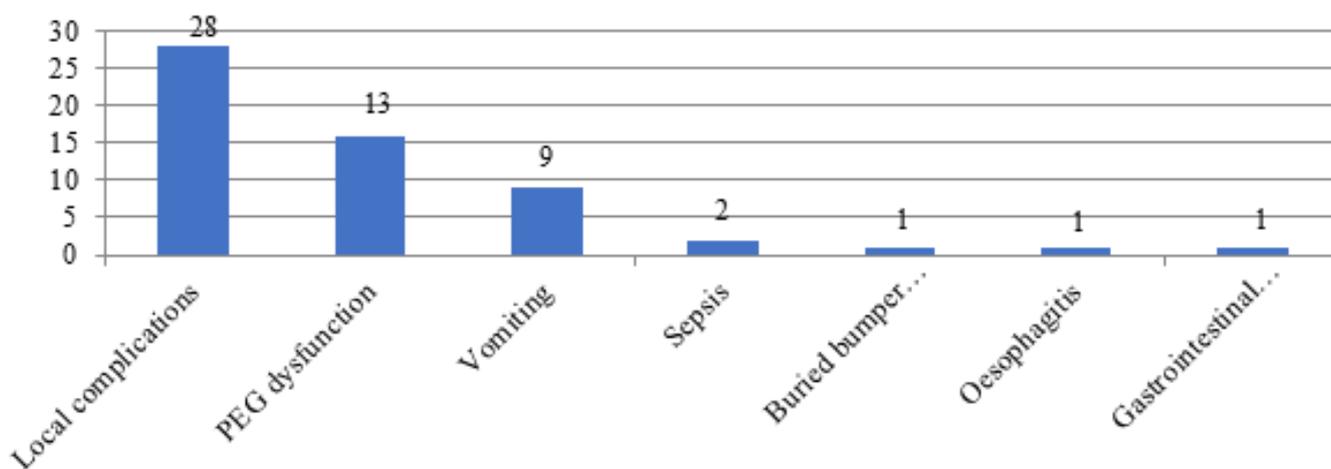


Figure 4. Types and numbers of complications noted in patients following PEG placement.

In 10 children, no complications were noted. Averagely after 1.5 year there was scheduled exchange of PEG due to outwearing of it. Detailed data are presented in Figure 5. Vomiting, that occurred after PEG insertion and was noted immediately after starting feeding, was associated with feeding intolerance and inadequate composition of the food formula. Dermatitis had been associated with a discharged of gastric contents due to incorrect PEG attachment or PEG care errors.

5. DISCUSSION

When analysing the causes and diseases in patients who had a PEG inserted, the authors focused on the incidence of complications and the type of method employed for this procedure, i.e. gastroscopy or laparoscopic-assisted gastroscopy.

The study involved 24 girls and 24 boys. This reflects the literature, which reports no clear gender predominance.^{7,10,11}

The mean age of the analysed patients was 7 years. This index was higher than that reported in the literature (from 1.5 to 6 years).^{11–13}

As regards the reasons for PEG insertion, the authors distinguished dysphagia, feeding difficulties, aspiration of gastric contents and no body weight gain, which are similar

to the indications provided in the literature.^{10,12} The most common reasons for being qualified for the PEG placement procedure in the analysed children included dysphagia (30), followed by insufficient weight gain (7), which was not confirmed in other analyses, which reported that the most common reason for PEG placement was a lack of body weight gain, followed by dysphagia.^{11–14}

In the analysed material, PEG placement using gastroscopy was performed in 31 patients, while laparoscopic-assisted gastroscopy was performed in the remaining 17 patients. A similar frequency of the use of both methods was described by some authors.^{10,13,15} The performance of laparoscopic-assisted PEG placement procedure was due to the need to ensure the safety of the procedure, i.e. to avoid accidental damage to peritoneal cavity organs, or involved the performance of a Nissen fundoplication in 15 children, which is confirmed in an analysis by Viktorsdóttir et al.¹⁶

In the current study, the indications for PEG insertion were divided into three categories in accordance with the classification found in the literature: CP in 30 cases, genetic disorders in 7 cases, and congenital defects in 11 cases.¹¹ According to the authors, the indications for PEG insertion were due to neurological, oncological, metabolic and cardiovascular diseases and neuromuscular disorders.¹⁷ In the study group at the RSCH, mainly CNS disorders were noted, with CP being the most common (30).^{11,14} In the current study, there are no patients for whom the PEG placement procedure was indicated by an oncological disease, which is a common reason for the performance of PEG placement reported in the literature.^{7,10}

Table 4. Detailed number of complications, including local complications and PEG dysfunction.

Complications	N
Local complications	28
Skin inflammation	15
Granulation tissue	5
Ulceration around PEG insertion site	1
Bleeding from PEG insertion site	7
PEG dysfunction	13
PEG dislodgement	6
Accidental PEG removal	3
PEG fracture	2
Sudden PEG obstruction	2

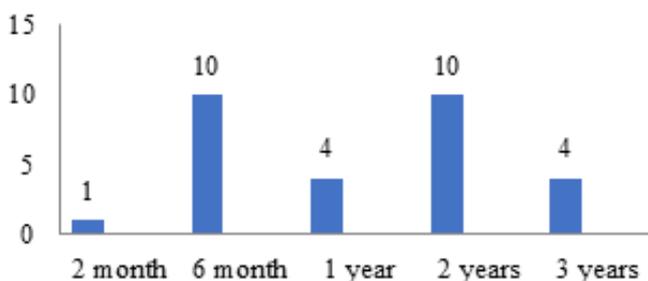


Figure 5. Number of patients who were scheduled exchange of PEG.

The most common complications occurring in the patients in the current study are local complications (28), including skin inflammation that was mainly caused by the leakage of gastric contents around the PEG tube, which is found in analyses by other authors.^{7,15,18} Equally frequent complications included PEG dysfunctions in 13 patients, e.g. PEG dislodgement (6), rupture (2), or sudden obstruction (2) and accidental PEG removal (3), which is also confirmed by the literature.^{7,11}

Rare complications in the patients included sepsis (2), gastrocutaneous fistula (1), buried bumper syndrome (1) and oesophagitis (1). Buried bumper syndrome occurs when the internal bumper of the PEG tube erodes into the gastric wall. In the literature, there are reports of similar incidence of these complications.^{15,16,19} The complications occur most frequently in the postoperative period and are related to the surgical technique.¹¹

Comorbidities that had no effect on the performance of the PEG insertion procedure have been reported in the literature as risk factors for complications. However, no statistical significance was demonstrated for the association between the occurrence of these comorbidities and an increase in the rate of complications following the PEG insertion procedure.^{7,10,18} Out of 12 patients with spinal deformity, 8 had the laparoscopic-assisted PEG insertion procedure performed, which could have contributed to a reduced risk of complications, as demonstrated by Hermanowicz et al.¹⁴

6. CONCLUSIONS

- (1) Although the PEG placement procedure is associated with a significant number of complications, they are mainly related to local inflammation or PEG dysfunction.
- (2) Life-threatening complications, e.g. sepsis or peritonitis, occur rarely.

Conflict of interest

We have no conflict of interest to declare.

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