

Original Article



Complications of Gastrostomy and Gastrojejunostomy: The Prevalence in Children

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Conflict of Interest

The authors have no financial conflicts of interest.

ABSTRACT

Purpose: This study aimed to provide an overview of the prevalence of the complications of a gastrostomy or a gastrojejunostomy with a low-profile gastric tube in children. The study also examined the effect of presence of the gastrostomy tube on the prevalence of complications.

Methods: In this cross-sectional study, parents were invited to complete an online questionnaire. Children aged 0–16 years with a low-profile gastrostomy or gastrojejunostomy tube were included in the study.

Results: A total of 67 complete surveys were conducted. The mean age of the included children was seven years. The most common complications during the past week, were skin irritation (35.8%), abdominal pain (34.3%), and the formation of granulation tissue (29.9%). The most common complications during the past six months were skin irritation (47.8%), vomiting (43.4%), and abdominal pain (38.8%). Most complications occurred within the first year after gastrojejunostomy placement and gradually decreased as the duration since the placement of the gastrojejunostomy tube increased. The prevalence of severe complications was rare. Parental confidence in caring for the gastrostomy positively correlated with increases in the duration of the gastrostomy tube. Even so, parental confidence in the care of the gastrostomy tube was reduced in some parents more than a year after its placement.

Conclusion: The prevalence of gastrojejunostomy complications in children is relatively high. The incidences of severe complications after the placement of a gastrojejunostomy tube were rare in this study. A lack of confidence in the care of the gastrostomy tube was noted in some parents more than a year after its placement.

Keywords: Pediatrics; Gastrostomy; Low-profile button; Complications

INTRODUCTION

Adequate nutrition is essential for growth and development during childhood [1]. However, inadequate nutrition due to feeding difficulties is common in children. This inadequate nutrition affects approximately 25% of children with normal development and up to 80% of children with developmental disabilities [2]. Feeding difficulties are associated with malnutrition, failure to thrive, micronutrient deficiency, osteopenia, and other nutrition-related comorbidities [1,3-5].

The first-line of treatment for inadequate nutrition is the administration of oral nutrition. However, alternative routes are required if oral nutrition is impossible or inappropriate. Alternate feeding routes include enteral and parenteral nutrition. Parenteral nutrition involves the intravenous administration of nutrition. Parenteral nutrition is the preferred feeding route in acute, critical settings. In addition, parenteral nutrition is the preferred feeding route when enteral feeding is contraindicated, such as in complete intestinal obstruction and necrotizing enterocolitis [6]. Enteral nutrition refers to all forms of nutritional support given through a tube [7,8] and is administered via the stomach or post-pyloric using a nasogastric or nasoduodenal tube via a gastrostomy or (gastro) jejunostomy [8].

The first use of enteral nutrition in history was in ancient Egypt, where enemas were used to promote good health and treat diarrhea [7]. The first intended gastrostomy was described in the mid-19th century; unfortunately, patients had short post-op survival times [9]. In the late 19th century, long-term survival was described in patients who underwent gastrostomy [9]. However, surgical techniques and associated applications have been successfully developed in recent decades [7,8].

Previous studies have detailed the complications of gastrostomy and its care in children and adults [8,10,11-13]. Even so, the prevalence of these complications in pediatric patients has yet to be fully elucidated. Consequently, this manuscript has a threefold aim. First, the study aimed to provide an overview of the prevalence of complications in children undergoing gastrostomy. Second, the study examined the correlation between the presence of gastrostomy and the prevalence of complications, and the frequency of using preventive treatments. Third, the study explored parental confidence in caring for their children's gastrostomies. This manuscript focuses on children with a gastrostomy or a gastrojejunostomy with a low-profile gastric tube (both tubes will be referred to as 'gastrostomy' from henceforth in this manuscript).

MATERIALS AND METHODS

This cross-sectional observational study discussed the prevalence of gastrostomy complications in children treated in the Pediatric Gastroenterology Department of the University Hospitals of Antwerp and Brussels, Belgium. A literature search of the PubMed and Embase databases was conducted for data published between January and April 2020. **Fig. 1** shows the summation of the complications during the gastrostomy placement. Subsequently, an online survey (in Dutch) based on these complications was created using the paid version of SurveyMonkey® (Web-Based Survey and Evaluation System, <http://www.SurveyMonkey.com>). SurveyMonkey® tested the technical functionality of the survey prior to distribution.

The survey was emailed to the parents of the patients who had received a gastrostomy. In addition, a link to the survey was posted in the "Sondevoeding ... So what!?" (Translation: "tube feeding... So What!?!") Facebook group in early July 2020. Reminders to complete the survey were sent on August 3, 2020, and the online survey was completed on September 1, 2020.

In the online survey, participants (the parents of the child with a gastrostomy or the child) were informed of the duration of the survey, the investigators, and the purpose of the study. Participation incentives were not offered. Informed consent was obtained before the start of the survey. The number of items per page ranged from one to five, for a total of nine pages. The time taken to complete the survey was five–ten minutes. All questions had to be

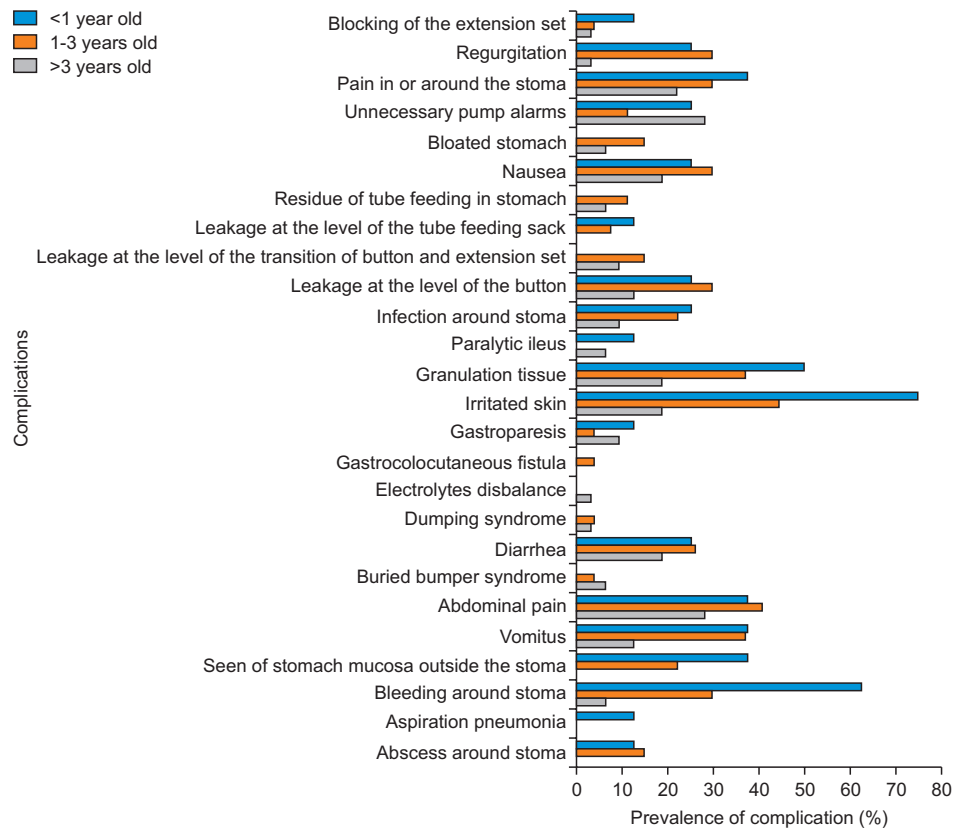


Fig. 1. Total (%) prevalence of complications in the past week per group. (Blue) Low-profile gastrostomies <one-year-old. (Red) Low-profile gastrostomies between one and three years old. (Gray) Low-profile gastrostomies >three years old.

answered before the survey was sent to the researchers. If a response from the participant met the exclusion criterion, the survey ended; these surveys were excluded from the analysis.

Participants were asked to provide basic information (age, time of operation, and type of gastrostomy) and identify complications from the past week and the past six months. All complications were clarified with a short but clear explanation; illustrations were provided for some of the complications. In addition to the complications, a question on the preventive use of medication or ointment without specifying the product was included. A Likert scale was used to determine parental confidence in caring for the gastrostomy. A score of 0 indicated that the parents did not understand the procedure and required assistance, while a score of 10 indicated that they understood the procedure and could perform it independently.

The researchers anonymized the answers. Children between 0 and 16 years who underwent gastrostomy were included in the study. Children with a percutaneous endoscopic gastrostomy (PEG-tube) tube were excluded. PEG tubes were excluded as the authors wanted to explore the complications in children with a low-profile gastric tube or gastrojejunostomy tubes alone. The children with a recent (last three months) surgical procedure (switch from PEG-tube to low profile gastric tube, granuloma removal, fistula repair, and correction of the buried bumper syndrome) were excluded from the last question “complications that were present during the last six months” because these complications could have been linked to these procedures [7,8]. To enable the analysis of the correlation between the age of the

gastrostomy and the frequency of complications, the children were subdivided into three groups: Group 1, gastrostomies less than one year old; Group 2, gastrostomies between one and three years old; and Group 3 gastrostomies older than three years.

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 27.0 (IBM Co.). Descriptive statistics were solely used for the analyses. The study was approved by the ethical committees of the Universities of Antwerp (20/02/2020) and Brussels (27/05/2020).

RESULTS

A total of 87 surveys were conducted. Twenty incomplete surveys were excluded from the analysis. Sixty-seven surveys were analyzed, including 39 male children (58.2%) and 28 female children (41.8%). Sixty-three (94.0%) children had gastrostomies, while four (6.0%) children had gastrojejunostomies. The mean age of the children was seven years; the youngest child was seven months old, while the eldest child was 16 years old. The main indication for a gastrostomy was oral food aversion in 25% of the children. Other indications for gastrostomies included feeding difficulties secondary to genetic disease (14%), cerebral palsy (10%), metabolic disease (8%), cystic fibrosis (6%), and other causes (21%); the indication for the gastrostomy was unknown to 13% of the parents.

The prevalence of complications in the past week and the past six months are summarized in **Table 1**. The most frequent complications in the past week were skin irritation (24, 35.8%), abdominal pain (23, 34.3%), and the formation of granulation tissue (20, 29.9%). Preventive ointment or medication had been used by thirty parents (44.8%) in the previous week. However, in the past six months, the most common complication was vomitus (23, 43.4%), followed by skin irritation (26, 49.1%) and abdominal pain (21, 39.6%). Twenty-four participants (44.4%) had used preventive ointment or medication in the past six months. There was no difference in the prevalence of complications between the sexes.

Classification of the gastrostomies based on their durations showed that eight (11.9%) gastrostomies were less than one year old (group 1), 27 (40.3%) were one to three years old (group 2), and 32 (47.8%) gastrostomies were older than three years old (group 3). Thirteen children (19.4%) had a surgical procedure on the gastrostomy in the previous three months. Consequently, the parents of these children did not complete the questionnaire section pertaining to complications in the past six months; this prevented complications of the recent surgery from being attributed to the gastrostomy.

Fig. 1 shows an overview of the prevalence of complications amongst the three groups over the past week. The following gastrostomy complications were absent in our study sample: necrotizing fasciitis, short bowel obstruction, gastroenterocutaneous fistula, mechanical ileus, intussusception, perforation, peritonitis, and volvulus.

A direct relationship between complications and the gastrostomy's age; complications occur less often when the gastrostomy is older than three years can be noted in **Fig. 1**. Although the incidence of complications in the group of children with gastrostomies older than 3 years was reduced, prevalent complications in this group included abdominal pain (28%), pain in or around the stoma (22%), diarrhea (19%), skin irritation (19%), the formation of granulation tissue (19%), and nausea (19%).

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Table 1. Comparison of the prevalence of complications between the past week and the past six months

Complications	Past wk			Past six mo (n=53)
	(n=67)	No procedure <3 mo (n=54)	Procedure <3 mo (n=13)	
Blocking of the extension set	3 (4.5)	2 (3.7)	1 (7.7)	7 (13.0)
Regurgitation	11 (16.4)	9 (16.7)	2 (15.4)	11 (20.4)
Pain in or around the stoma	18 (26.9)	10 (18.5)	8 (61.5)	19 (35.2)
Unnecessary pump alarms	14 (20.9)	10 (18.5)	4 (30.8)	16 (29.6)
Bloated stomach	6 (9.0)	2 (3.7)	4 (30.8)	10 (18.5)
Nausea	16 (23.9)	8 (14.8)	8 (61.5)	15 (27.8)
Residue of tube feeding	5 (7.5)	3 (5.6)	2 (15.4)	5 (9.3)
Leakage at the level of the tube feeding sack	3 (4.5)	1 (1.9)	2 (15.4)	3 (5.6)
Leakage at the level of the transition of button and extension set	7 (10.4)	6 (11.1)	1 (7.7)	9 (16.7)
Leakage at the level of the button	14 (20.9)	10 (18.5)	4 (30.8)	17 (31.5)
Infection around stoma	11 (16.4)	5 (9.3)	6 (46.2)	16 (29.6)
Paralytic ileus	3 (4.5)	/	3 (23.1)	/
Granulation tissue	20 (29.9)	14 (25.9)	6 (46.2)	18 (33.3)
Irritated skin	24 (35.8)	13 (24.1)	11 (84.6)	26 (48.1)
Gastroparesis	5 (7.5)	1 (1.9)	4 (30.8)	2 (3.7)
Gastrocolocutaneous fistula	1 (1.5)	1 (1.9)	/	1 (1.9)
Electrolytes disbalance	1 (1.5)	/	1 (7.7)	/
Dumping syndrome	2 (3.0)	1 (1.9)	1 (7.7)	1 (1.9)
Diarrhea	15 (22.4)	9 (16.7)	6 (46.2)	21 (38.9)
Buried bumper syndrome	3 (4.5)	/	3 (23.1)	/
Abdominal pain	23 (34.3)	14 (25.9)	9 (69.2)	21 (38.9)
Vomitus	17 (25.4)	9 (16.7)	8 (61.5)	23 (43.4)
Stomach mucosa outside the stoma	9 (13.4)	5 (9.3)	4 (30.8)	9 (16.7)
Bleeding around stoma	15 (22.4)	7 (13.0)	8 (61.5)	11 (20.4)
Aspiration pneumonia	1 (1.5)	/	1 (7.7)	/
Abscess around stoma	5 (7.5)	1 (1.9)	4 (30.8)	3 (5.6)

Values are presented as number (%).

/: not applicable.

The total prevalence of complications over the past six months amongst the three groups is shown in **Fig. 2**. Complications not presented or listed in **Fig. 2** included aspiration pneumonia, buried bumper syndrome, short bowel obstruction, electrolyte imbalance, gastroenterocutaneous fistula, mechanical ileus, paralytic ileus, intussusception, necrotizing fasciitis, perforation, peritonitis, and volvulus. As shown in **Fig. 1**, there was a direct relationship between complications in the past six months and the duration of the gastrostomy: there was a decreased prevalence of complications in children with gastrostomies that were older than three years.

The prevalence of using preventive medications or ointments was assessed. In Group 1, 63% of the parents used preventive measures in the past week compared to 56% of the parents in Group 2 and 31% of the parents in Group 3. In the past six months, all of the parents in Group 1 used preventive measures. Preventive measures were also used by 55% of the parents in Group 2 and 31% of the parents in Group 3.

Fig. 3 shows the distribution of parental confidence in caring for gastrostomies. Parental confidence in caring for the gastrostomies was assessed using the classification of the gastrostomies based on their duration. Parental confidence in the care of the gastrostomy positively correlated with the duration of the gastrostomy. The median parental confidence score in Group 1 was 8, while the median parental confidence scores were 8.5 and 9.5 in Groups 2 and 3. However, 4 of the 59 parents of children with gastrostomies older than 3 years had an average score equal to or less than 6. This indicates that uncertainties in the care of gastrostomies persisted in “experienced” parents.

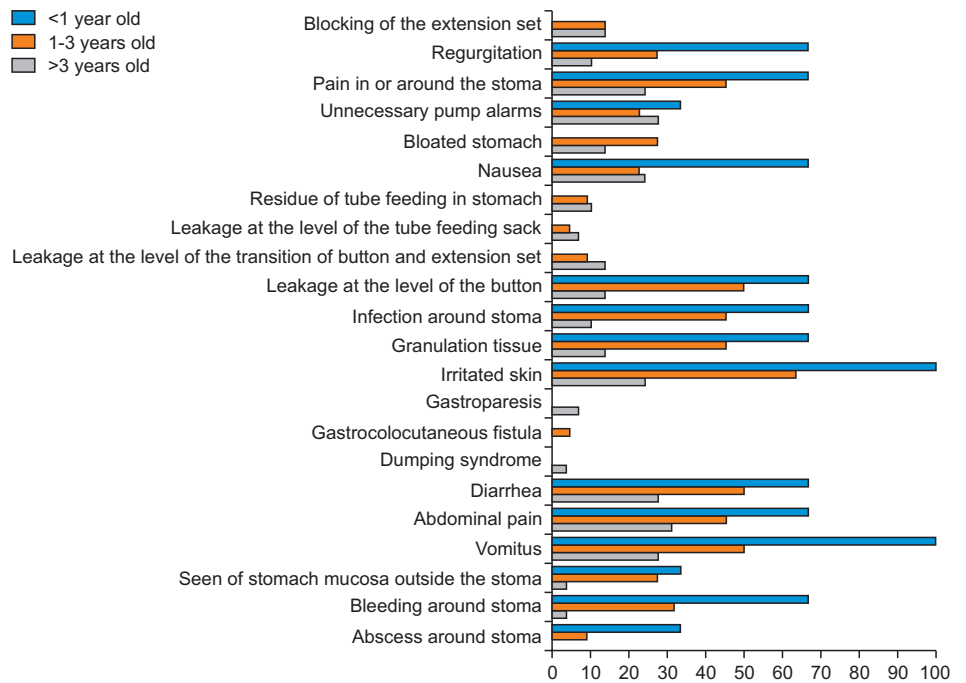


Fig. 2. Total (%) prevalence of complications in the past six months per group. (Blue) Low-profile gastrostomies <one-year-old. (Red) Low-profile gastrostomies between one and three years old. (Gray) Low-profile gastrostomies >three years old.

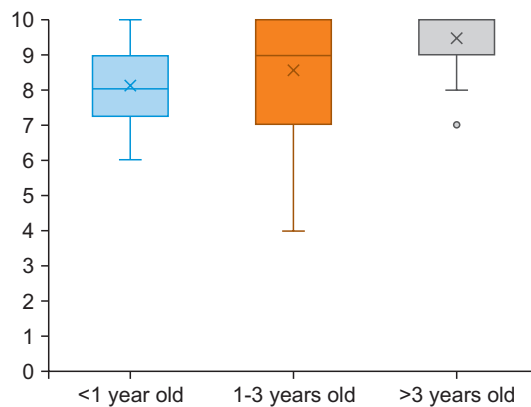


Fig. 3. Boxplot demonstrating differences in successful gastrostomy placement by age. (Blue) Children <one-year-old with low-profile gastrostomy tubes. (Red) Children between one and three years old with low-profile gastrostomy tubes. (Gray) Children >three years old with low-profile gastrostomy tubes. Values 0 'I do not understand the procedure and require assistance.' 10 'I understand the procedure and can perform it independently.'

DISCUSSION

Our results indicate a high prevalence of complications in children undergoing gastrostomy. In the past six months, 81% of these children had one or more complications. Thirty-two percent of these children had three or more complications, 19% had five or more complications, and 11% had 10 complications in the past six months. This study identified a higher prevalence of complications associated with gastrostomies than the prevalence (18%) of complications reported by a single-center study that comprised a 12-year follow-

up of patients that commenced at the placement of a PEG-tube [14]. A narrative review of the complications of PEG and low-profile gastric tubes showed a 16–70% prevalence of complications [15]; the results of this review were congruent with that of this study.

Six percent (four in total) of the study population had a gastrojejunostomy tube. The incidence of complications in children with gastrojejunostomies was high. These children had five or more complications. The most frequent complications were nausea (4/4), vomiting (3/4), abdominal pain (2/4), skin irritation (2/4), stoma infection (2/4), and an abscess around the stoma (1/4). Brett and Argáez [16] reported similarities in mortality, aspiration, or overall gastrointestinal complications (diarrhea, abdominal distension, reflux, and minor or major gastrointestinal bleeding) between children with a gastrostomy and those with a gastrojejunostomy. Compared to those with gastrostomies, a significantly lower risk of pneumonia and vomiting was identified in children with gastrojejunostomies [16].

The most frequent complications were skin irritation (48%), vomiting (43%), and abdominal pain (39%). The incidence of the following severe complications of gastrostomies was rare or absent: aspiration pneumonia (1%), buried bumper syndrome (4%), short bowel obstruction (0%), necrotizing fasciitis (0%), perforation (0%), peritonitis (0%), and volvulus (0%). These results were consistent with a 2018 meta-analysis [17] and a 2019 single-center study [14].

The children were classified into three groups based on the age of their gastrostomies to examine the correlation between the duration of gastrostomies, the prevalence of complications, and the frequency of preventive treatments. A previous study on children with a PEG tube [18] identified a higher prevalence of complications in newly placed PEG tubes. Similarly, our study noted a higher prevalence of complications during the first year after gastrostomy placement. These complications included vomiting and skin irritation, even after three months of placement. A positive correlation was identified between an increased gastrostomy duration and a reduced prevalence of complications. However, a high prevalence of some complications, like abdominal pain (31%), vomiting (43.4%), and diarrhea (38.9%), were observed in gastrostomies older than three years.

The use of preventive measures such as medication and ointment was high. In Group 1, where the gastrostomies were less than one year old, all parents used preventive measurements. In contrast, only 55% and 31% of the parents in Group 2 and Group 3 had used preventive measures.

Increased gastrostomy duration positively correlated with parental confidence in caring for the gastrostomies. However, some parents still lacked confidence in caring for the gastrostomy more than a year after its placement. This may imply a reluctance to seek clarification on the standard of care for gastrostomy. Moreover, the standard of care for gastrostomies should be discussed proactively in each visit; thus, mitigating the parental lack of confidence in caring for their child's gastrostomy.

Another important step in understanding and applying appropriate gastrostomy care is knowing the diagnosis and the indications for performing a gastrostomy [19]. Remarkably, 13% of the parents were unaware of the indication for the gastrostomy placement in their child. Parent education on their child's diagnosis may improve the parent's ability to perform gastrostomy.

Our findings provide useful information for physicians to educate parents and children on complications associated with gastrostomies. Furthermore, parent and patient education on the complications and preventive treatment options of gastrostomies may be beneficial in reducing the prevalence of non-life-threatening and recurrent complications. In addition to providing accurate information before placement of the gastrostomy, the prevention and treatment of complications should be discussed with parents and children at follow-up visits within months and after years of placement of the gastrostomy tube. Consequently, this parent and patient education should increase parental confidence in the care of the tube and improve the quality of life of the children [19,20].

The study had some limitations. The mode of disbursing (via email and in a Facebook group) the questionnaires made it difficult to predict the response rate. Recall bias was possible due to collecting data from the past six months. Voluntary response sampling bias may be present since the study was conducted by distributing the questionnaires through the mail and social media. Nevertheless, the study elucidates the prevalence of gastrostomy complications in children. Although all of the complications in the survey were explained and clarified, parental underestimation may have still been possible. The survey was developed after literature reviews and was checked by two pediatric gastroenterologists. The survey asked for specific and objective clinical information; therefore, examining psychometric characteristics was unnecessary. The validity of the questionnaire has yet to be was not formally tested.

CONCLUSION

The prevalence of gastrostomy complications in children is high, but the prevalence of severe complications was low prevalence or absent in this study. Some parents noted a lack of confidence in caring for gastrostomies more than a year after placement. Therefore, parents and children should be educated on all of the possible complications and standard care for gastrostomies to prevent the onset of complications before and during follow-up. This parent and patient education may reduce the incidence of complications and simultaneously increase parental confidence in caring for gastrostomies.

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