

## Article

# What Is the Correct Way to Manage Children Requiring Gastrostomy? Single Center Experience

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**Abstract:** Children with complex medical issues often present different comorbidities that cause feeding difficulties. Gastrostomy is often helpful, and should be performed when nutritional supplementation is necessary for longer than 6 weeks. Recently, different techniques have been used for gastrostomy in children. The authors report on their experiences regarding the diagnostic and therapeutic management of children requiring gastrostomy. All patients managed in the last 10 years were reviewed, retrospectively. Everyone underwent investigation to exclude gastroesophageal reflux disease (GERD). A total of 148 patients: 111 cases (75%) were neurologically impaired patients, 18 (12%) had complex heart disease, 10 (6%) had metabolic diseases, 4 (3%) had fibrosis cystic, 4 (3%) had muscle disease, and one had chromosomopathy. After investigation, 49 patients had GERD. PEG was performed in 101 cases (68%), laparo-assisted gastrostomy was performed in 44 cases (29.7%), open gastrostomy was performed in three cases. At follow-up, all patients reported weight gain, but 13 cases had major complications. Currently, the surgeon has the possibility of choosing between several safe techniques for gastrostomy. In our experience, PEG is the most useful technique for patients without GERD, while a laparo-assisted technique is better for patients who require laparoscopic fundoplication.

**Keywords:** gastrostomy; children; gastroesophageal reflux; neurological impairment patient



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## 1. Introduction

Children with complex diseases often present different comorbidities, and feeding difficulty is one of these. Children with neurological impairment, syndromic patients, or children with severe heart diseases can suffer from oromotor dysfunction, eating disorders, dysphagia, malabsorption, or maldigestion [1]. In the long-term, these conditions can lead to severe malnutrition, heavily impacting the general status of these patients (i.e., severe growth problems). When nutritional supplementation is necessary, for longer than 6 weeks, access techniques for long-term enteral nutrition, such as a gastrostomy, should be performed [2].

In recent decades, the gastrostomy positioning technique has undergone several changes, from the open to the laparoscopic technique. The endoscopic technique: percutaneous endoscopic gastrostomy (PEG) was introduced in the 1980s [3].

Many papers have analyzed (and compared) the effectiveness of each technique, particularly in terms of efficacy, feasibility, and postoperative complications. Regarding this last aspect, a recent meta-analysis showed a higher risk of major complications in patients undergoing PEG [4].

In this article, the authors present their experiences, evaluating the characteristics of patients, the techniques used for the positioning of the gastrostomy, and the results obtained, evaluating the latter based on the data available in the literature.

## 2. Materials and Methods

For this retrospective study, we analyzed the cases handled over the past 10 years, from January 2010 to December 2019. The study was conducted in accordance with the principles of Helsinki, and it was approved by our ethics committee.

A pediatric surgeon evaluated patients prior to the procedure; all patients with symptoms underwent a contrast radiographic examination and pH metric study with impedance analysis (pH-MII) to assess the stomach/esophageal anatomy and the presence of gastroesophageal reflux disease (GERD). For each pH-MII study, the symptom index (SI; number of symptoms associated with reflux/number of all symptoms  $\times$  100) and the total number of refluxes were calculated. The study was considered pathological if the SI was  $\geq$ 50%, or in case of a high number of reflux episodes ( $>$ 70 episodes in 24 h in patients aged  $>$ 1 year and  $>$ 100 episodes in those aged  $<$ 1 year) [5].

The technique used for the gastrostomy was PEG (the pull-through technique with mushroom probe); subjects with GERD underwent laparoscopic fundoplication and laparo-assisted gastrostomy (a push-through technique with a balloon probe). Stamm surgical gastrostomy was adopted in cases where there were contraindications to PEG and laparoscopy. Children underwent surgical gastrostomy or laparoscopic gastrostomy (with or without fundoplication) followed by an antibiotic prophylaxis: amoxicillin 20 mg/kg every 8 h (clarithromycin in case of allergy), one hour before surgery, up to 5 days after surgery or until the signs of infection improved.

For purposes of the study, patients were divided by primary pathology that required gastrostomy, and by type of technique used. We assessed the complications by dividing them into major (those that required a second surgical approach) and minor (those treated in the clinic): peristomal infection (erythema, induration, and purulent discharge), peristomal wound leakage (treated conservatively), and peristomal granuloma. Regarding the postoperative management: patients fasted for at least 24 h and then feeding was gradually resumed. A longer time was observed in those undergoing more invasive surgery (fundoplication). In these, feeding began once intestinal canalization was reached.

For the follow-up, a specific "gastrostomy outpatient clinic" was set up at our center in which a pediatric surgeon and a nurse registered the patients, and at each control, recorded the weight (World Health Organization growth charts), the frequency of respiratory and neurological episodes, and checked the gastrostomy, changing the probe when necessary. All children had the first control one week after gastrostomy, then one month later, and every 6 months for the replacement of the gastrostomy tube. The times were different in the cases involving complications.

## 3. Results

During the review period, we applied gastrostomy to 159 children (mean age: 4 years, range 1 day–15 years). The indication for gastrostomy was a dietary difficulty in all cases: 140 had poor nutritional status (less than one standard deviation of weight for age); four cases (neurologically impaired patients) needed the ketogenic diet for the treatment of epilepsy (Table 1).

**Table 1.** Indications to gastrostomy of 159 patients.

Symptoms	Case	(%)
Chronic inadequate oral intake	144	(90.6)
• Inability to swallow	30	
• Dysphagia	34	
• Recurrent respiratory tract infections	25	
• Vomit	55	
Ketogenic diet support	4	(2.5)
Impossible oral intake	11	(6.9)
• Esophageal atresia		

Eleven were excluded from this study because gastrostomy was performed with an open technique: neonate with esophageal atresia (long gap or extremely low weight).

Therefore, the considered population consisted of 148 patients. Analyzing the pathologies of the children who required gastrostomy shows that most patients (75%) were neurologically impaired (NI), followed by heart and metabolic diseases (Table 2).

**Table 2.** Pathologies that required gastrostomy.

Pathology	Case	(%)
Neurologically impaired children	111	(75)
Complex heart disease	18	(12)
Metabolic disease	10	(6)
• Mucopolysaccharidosis	4	
• Niemann-pick disease	2	
• Nonketotic hyperglycinemia	2	
• Unspecified metabolic disease	2	
Cystic fibrosis	4	(3)
Muscle disease	4	(3)
• Congenital muscular dystrophy		
Chromosomopathy	1	
• Trisomy 18 syndrome		

The mean age was different for pathology. In fact, the group of NI and cystic fibrosis (CF) had a mean age of 7 years (range 2 years–15 years), while the others had a mean age of 6 months (range: 1 month–6 years)

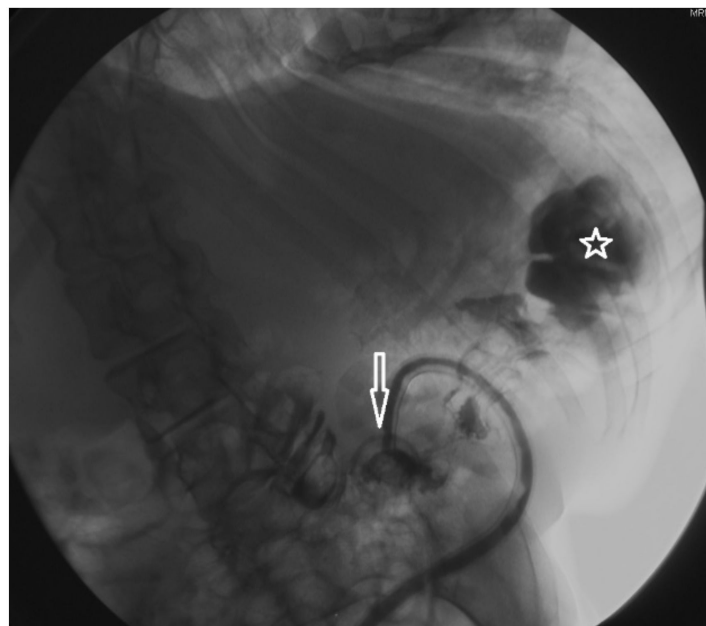
Diagnostic tests performed before gastrostomy showed the presence of GERD in 49 (33%) patients, of which 10 had a hiatal hernia. Regarding the technique: the PEG was performed in 101 (68%) patients, the laparo-assisted technique in 44 (29.7%), who had laparoscopic fundoplication for GERD, in three (2%), an open gastrostomy was performed (Stamm technique). In five cases (patients with pathological gastroesophageal reflux), a gastrojejunostomy tube was placed for general contraindications to laparoscopic fundoplication. A tracheotomy was necessary in three cases (patients with congenital muscular dystrophy).

In the present series, early complications were not recorded. There were 13 major complications (8.7%): seven cases of infections with gastrostomy dislocation (median time after gastrostomy: 2 months, range 1–3 months), five buried bumper (median time after gastrostomy: 15 days, range 7–21 days) (Figure 1), and one gastrocolic fistula (24 months after gastrostomy) (Figure 2). Minor complications were 62 (41.9%): peristomal granuloma in 41 cases, wound infections in 10 cases, and peristomal wound leakage in 11 (Table 3). The complications were divided according to the age of the child (if greater than or less than 2 years) in order to verify a difference between those with NI and FC compared to the others, without finding any differences (Table 4). At follow-up: all children reported weight

gain (average weight for age improving: two standard deviations), and improvements in general conditions (less respiratory problems for patients with GERD and improved treatment regimens in neurological impaired patients). Two patients with neurologic disorders and important spasticity showed recurrence of gastroesophageal reflux, but were not treated surgically. One patient died from worsening of cardiac disease (Type IV truncus arteriosus with interrupted aortic arch and Simpson–Golabi–Behmel syndrome).



**Figure 1.** Endoscopic image of a bumper retraction.



**Figure 2.** Radioscopic image of gastrocolic fistula: injection of contrast in the gastrostomy tube (with arrow) and its presence in the colon (with star).

**Table 3.** Complications after gastrostomy differentiated according to the different techniques used.

Complication	Peg	Laparo-assisted	Open	Case (%)
N° of cases operated	101	44	3	
Major	10	3	0	13 (8.7)
• Infections with gastrostomy dislocation	4	3	0	1
• Bumper retractions	5	0	0	5
• Gastrocolic fistula	1	0	0	7
Minor	42	19	1	62 (42.9)
• Peristomal granuloma	31	10	0	41
• Wound infections	5	4	1	10
• Peristomal wound leakage	6	5	0	11

**Table 4.** Complications divided by patient's age.

Complication	Age < 24 months	Age > 24 months	Case (%)
N° of cases operated	63	85	
Major	4	9	13 (8.7)
• Infections with gastrostomy dislocation	3	4	
• Bumper retractions	1	4	
• Gastrocolic fistula	0	1	
Minor	21	41	62 (42.9)
• Peristomal granuloma	10	25	41
• Wound infections	5	11	10
• Peristomal wound leakage	6	5	11

#### 4. Discussion

Enteral tube feeding helps prevent further loss of body weight, corrects nutritional deficiencies, promotes growth in children with intellectual disabilities, and improves quality of life [6,7].

One problem to keep in mind in this type of patient, already suffering from other comorbidities, is the possibility of GERD, as forced enteral feeding could cause serious diseases of the respiratory tract at any age [8,9]. This prompts a preliminary study before placing a gastrostomy so that gastroesophageal reflux can be corrected at the same time as the gastrostomy, although a recent meta-analysis shows that positioning the gastrostomy alone exposes the patient to fewer postoperative complications [10].

In our opinion, the patient's gastroesophageal study is important for proper surgical treatment. In this series of 148 cases (excluding patients with esophageal atresia), we performed the pH-MII study in each child with suspected symptomatology for gastroesophageal reflux, so in 144 cases (excluding patients with epilepsy and the need for a ketogenic diet). We performed a laparoscopic fundoplication with laparo-assisted gastrostomy in 44 patients out of 144 (30.5%); this number is probably because we looked for GERD in all candidates with the gastrostomy who presented symptoms.

The endoscopic technique used by us was the "pull" method, but there was the possibility of a one-step push technique that allowed the insertion of the gastrostomy under an endoscope view [11]; this is feasible at the pediatric age, but we have no experience.

Our experience shows that there is no better technique, but both can be performed, according to the type of patient, with the same risk of complications.

In our series, there were cases that did not allow this type of approach, so we preferred to place a gastrojejunostomy tube, and then wait for the improvement of the general conditions to correct gastroesophageal reflux, as recommended by other authors [12]. In some cases, the general conditions could worsen over time and create difficulties in managing the gastrostomy tube [13–15].



As for the best technique to perform gastrostomy, the least invasive is the endoscopic technique (PEG), but in the case in which a laparoscopic fundoplication is associated, the laparo-assisted technique is, in our opinion, the first choice, although other possibilities of laparoscopic interventions are possible [16]. Several authors have compared the open technique, the laparoscopic technique, and the PEG, but none has shown significant results in favor of a particular procedure [17,18].

In our series, we divided the complications into major complications; (i.e., those who required a second surgery) and minor (i.e., those who were treated in the clinic). Major complications occurred in 8.7% of cases—numbers comparable to those reported in the literature [19,20]. Minor complications are quite common, but easily managed on an outpatient basis.

## 5. Conclusions

Nutritional surgery in the pediatric field presents numerous difficulties because the patients being treated have serious underlying conditions, and most of the time they arrive for surgery in debilitated conditions. Nowadays, surgeons have the possibility of choosing between techniques that, over the years, have proven to be of similar effectiveness.

In our experience, the PEG technique represents the best approach in the patient who only needs a gastrostomy, while the laparo-assisted technique is the best choice for patients who require laparoscopic fundoplication.

In our opinion, children with GERD and bad general conditions can undergo PEG with a gastro-jejunal probe, pending improvement of the conditions that make fundoplication safer.

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