Percutaneous Endoscopic Gastrostomy with T-Fasteners versus "Pull Technique": Analysis of Complications

Alejandra Castrillo[1] Laura García-Martínez[1] Ana Laín[1] Carlos Giné[1] María Díaz-Hervás[1] Manuel López[1]

[1] Department of Pediatric Surgery and Urology, Vall d'Hebron University Hospital, Barcelona, Spain

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Address for correspondence Laura García-Martínez, MD, Department of Pediatric Surgery and Urology, Vall d'Hebron University Hospital, Passeig de la Vall d'Hebron, 119-129, Barcelona 08035, Spain (e-mail: laura.garciamartinez@vallhebron.cat).

Abstract

Introduction The T-fasteners gastrostomy (T-PEG) has become increasingly popular over recent years as an alternative to the "pull-technique" gastrostomy (P-PEG). This study aimed to compare P-PEG and T-PEG complications.

Materials and Methods A retrospective observational study of pediatric patients who underwent percutaneous endoscopic gastrostomy (PEG) placement. P-PEG was performed using the standard Ponsky technique and was replaced after 6 months by a balloon gastrostomy under sedation. T-PEG was performed using three percutaneous T-fasteners (that allow a primary insertion of a balloon gastrostomy). The balloon was replaced by a new one after 6 months without sedation. Complications were recorded.

Results In total, 146 patients underwent PEG placement, 70 P-PEG and 76 T-PEG. The mean follow-up was 3.9 years (standard deviation = 9.6). Age, weight, and associated comorbidities were comparable ($p > 0.05$). The overall complications were 17 (24.2%) in the P-PEG group and 16 (21.0%) in the T-PEG group ($p > 0.05$). P-PEG was associated with more sedation for button replacement (97 vs. 2.6% [$p < 0.05$]). P-PEG was associated with more early tube dislodgement during the first replacement (7.2 vs. 1.4% [$p = 0.092$]). Two of the five dislodged gastrostomies in the P-PEG group underwent laparotomy due to peritonitis, whereas the only dislodged gastrostomy in the T-PEG group was solved endoscopically. Altogether, P-PEG was associated with more complications that required urgent endoscopy, laparotomy, or laparoscopy (18.6 vs. 6.6% [$p < 0.05$]).

Conclusions P-PEG was associated with more sedation, complications during first button replacement, and complications requiring urgent endoscopy, laparotomy, or laparoscopy compared with T-PEG.

Keywords

- gastrostomy
- postoperative complications
- endoscopy

Introduction

The standard management of pediatric patients requiring long-term enteral nutritional support is a gastrostomy feeding tube, and percutaneous endoscopic gastrostomy (PEG) remains the technique of choice. Although different procedures for PEG placement have been described, the pull technique (P-PEG) and the T-fasteners technique (T-PEG) are the most frequent ones used in the pediatric population.[1] The comparison of T-PEG and P-PEG is clinically significant because, despite their widespread use, there is limited

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Georg Thieme Verlag KG,
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reported experience with the use of T-PEG in pediatric patients.[1]

The P-PEG technique, also known as the Ponsky technique, is the most commonly used, involving the anterograde insertion of a gastrostomy tube. Its main disadvantage is the solid internal bolster, which requires general anesthesia or sedation for its removal (either endoscopically or by traction) to perform the first tube replacement.[2–4] In contrast, the T-PEG technique allows for the direct insertion of a balloon gastrostomy tube. This is facilitated by T-fasteners anchoring the stomach to the abdominal wall, enabling its retrograde insertion through a Seldinger technique. The main advantage of T-PEG is the absence of the need for sedation or general anesthesia to replace the balloon gastrostomy tube, as it can be easily done by deflating it.[2,4–7]

Despite the growing popularity of the T-PEG technique, there is limited research available on its safety in pediatric patients, with only a few studies published.[2,4,6,8,9] Additionally, there is a shortage of literature comparing the incidence of complications between P-PEG and T-PEG in children, with only two studies published.[2,4] It is worth mentioning that complications related to PEG placement are common,[10] underscoring the critical importance of analyzing PEG, especially regarding pediatric patient outcomes.

This study aimed to analyze the complication rates in P-PEG and T-PEG placement procedures in pediatric patients, focusing on those complications that required anesthetic interventions for management.

Methods

We conducted a retrospective, observational cohort analysis of 146 pediatric patients who underwent PEG placement procedures between 2010 and 2021. The inclusion criteria comprised all pediatric patients under 16 who were recommended to undergo PEG placement. Each patient was evaluated by a multidisciplinary team of pediatric gastroenterologists and pediatric surgeons to assess the indication for PEG placement. The exclusion criteria involved neonates under 3 months old due to our consistent recommendation for the placement of a P-PEG within this age group. The limited abdominal space in neonatal patients may not allow for the placement of the three anchors required for T-PEG, and the use of a long dilator could potentially injure the posterior wall of the stomach. These anatomical space limitations regarding T-PEG in neonatal patients were previously documented.[4] Our center initially used P-PEG as the primary method for PEG placement (2010–2016). However, since 2016, we have shifted our preference to T-PEG as the primary technique.

All PEG placement procedures were performed using an endoscopic, percutaneous approach. Laparoscopy was employed in selected cases, such as those requiring concomitant antireflux surgery or those with severe hepatomegaly and scoliosis, to ensure greater intraoperative safety. The gastrostomy placement technique and surgical steps remained identical, whether or not laparoscopy was employed simultaneously. The stomach was insufflated, and the abdominal wall was transilluminated. Translighting and digital pressure showed the best site for gastrostomy placement. Intraoperative intravenous antibiotics (Cefoxitin) were administered and maintained for 24 hours, according to the guidelines specified in our center's protocol for surgical antibiotic prophylaxis in pediatric patients.[11] Progressive enteral tolerance was initiated 24 hours after the surgical procedure. After achieving adequate enteral intake, all patients were discharged and subsequently received follow-up at the outpatient clinic, where a multidisciplinary team consisting of a specialist nurse, a pediatric surgeon, and a gastroenterologist conducted regular assessments. Complications were recorded either during outpatient clinic visits or when patients presented to the emergency department. The postoperative evolution was recorded over 1.5 years in all patients.

Patients were divided into two groups depending on the technique used (P-PEG vs. T-PEG). Data collected included age, weight, sex, and associated comorbidities (classified as neurological, cardiac, respiratory, and others). Complications were categorized based on the Clavien–Dindo classification[12] and divided into three primary groups: overall complications, complications associated with the first gastrostomy tube replacement, and those requiring urgent endoscopic, laparoscopic, or laparotomy interventions.

For the statistical analysis, qualitative variables were analyzed using the chi-square and, when necessary, the Fisher's test. For quantitative variables, nonparametric tests were employed, as they did not meet the criteria for normal distribution.

The study was approved by the institutional ethics committee and complied with the good clinical practice guidelines.

Pull-Technique Gastrostomy

P-PEG was performed by placing a single percutaneous puncture under endoscopic control, according to the method described by Ponsky[2] (►Fig. 1). The procedure involved the utilization of a *MIC Percutaneous Endoscopic Gastrostomy KIT* (AVANOS®; GA). A percutaneous guide was inserted into the stomach and subsequently removed through the mouth using an endoscope. Next, a 14-Fr gastrostomy tube was attached to the guide and pulled through the stomach in an anterograde fashion. The length of the intracorporeal portion of the gastrostomy tube was then adjusted based on the abdominal wall thickness of each patient.

T-Fasteners Gastrostomy Technique

T-PEG was performed by placing three percutaneous T-fasteners under endoscopic control (►Fig. 2). The procedure involved the utilization of an *Introducer Kit for MIC-KEY Gastrostomy Feeding Tube* (AVANOS®; GA). The fasteners were released from the needle tip using a stylet and secured in place. A guide and an 18-Fr dilator were then inserted between the T-fasteners using a modified Seldinger technique.[5] Subsequently, a 14-Fr balloon gastrostomy tube was retrogradely placed. The length of the gastrostomy tube varied (12, 15, or 17 mm) depending on the abdominal wall thickness of each patient. T-fasteners typically dislodge spontaneously during the first postoperative month.

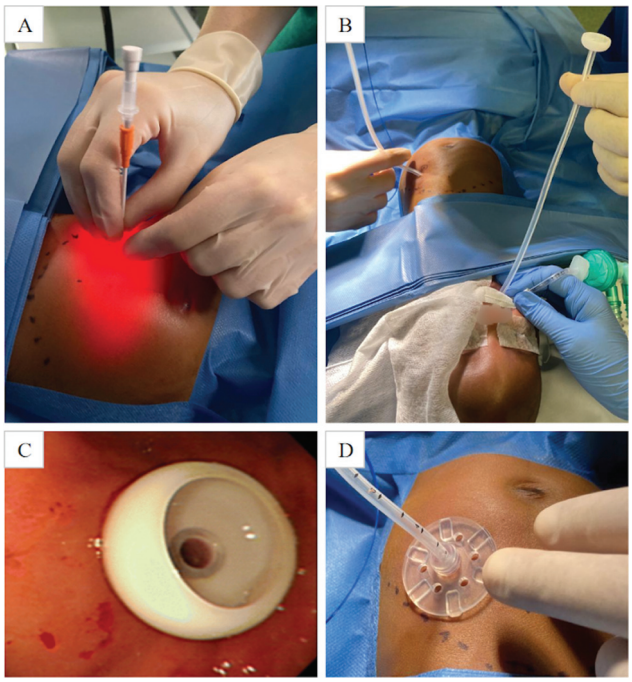

Fig. 1 Steps to perform the P-PEG. (**A**) A guide is inserted percutaneously into the stomach and removed through the esophagus assisted by endoscopy. (**B**) The gastrostomy tube is tied to the guide and the guide is pulled, allowing the gastrostomy tube placement in an antegrade way. (**C**) Endoscopic P-PEG final appearance. (**D**) Extracorporeal P-PEG final appearance. P-PEG, pull-technique-percutaneous endoscopic gastrostomy.

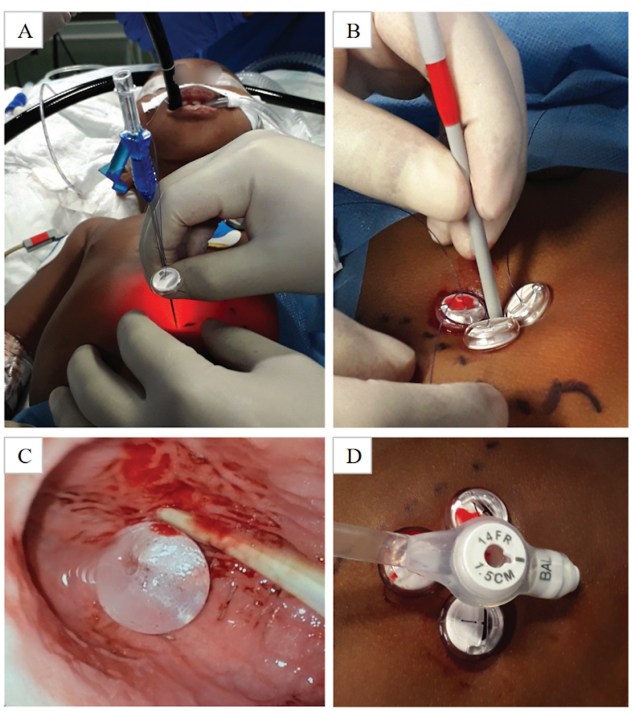

Fig. 2 Steps to perform the T-PEG. (**A**) The percutaneous T-fasteners are placed. (**B**) The guide and the dilator are inserted, allowing the gastrostomy tube placement in a retrograde way. (**C**) Endoscopic T-PEG final appearance. (**D**) Extracorporeal T-PEG final appearance. T-PEG, T-fasteners percutaneous endoscopic gastrostomy technique.

Gastrostomy Replacement

In both the P-PEG and T-PEG groups, the first gastrostomy replacement was conducted 6 months after the placement, and a MIC-KEY gastrostomy feeding tube was inserted in all cases. During the replacement, the tube size varied according to the patient's needs, with either a tube of the same size (14 Fr) or a larger one (16 Fr). In the P-PEG group, the replacement was performed endoscopically or by traction under sedation; in the T-PEG group, the balloon gastrostomy was replaced without sedation in the outpatient clinic.

Results

One hundred and forty-six patients underwent PEG placement, 70 (48.0%) P-PEG and 76 (52.0%) T-PEG. The follow-up period for all patients in both groups was 1.5 years. The mean weight at the time of surgery was 14.1 kg (standard deviation [SD] = 9.6) and the mean age was 5.1 years (SD = 5.3).

The main indication for PEG placement was a diagnosed swallowing disorder. The most frequent cause of swallowing disorder was neurological disease (62.3%), followed by cardiopathy (8.9%) and severe respiratory disease (8.9%). The remaining 19.8% showed a swallowing disorder related to various syndromic and genetic conditions.

No significant differences between both groups in terms of age, weight, sex, and associated comorbidities were found ($p > 0.05$; ►Table 1).

All gastrostomies were assisted by endoscopy and laparoscopy was also performed in 31.5%. Of these, 25.3% underwent antireflux surgery during the same intervention (8.2% in the P-PEG group and 17.1% in the T-PEG group).

Overall Complications

The total number of complications in our series was 33 (22,6%). Seventeen (24.2%) complications were found in the P-PEG group and 16 (21.0%) in the T-PEG group ($p > 0.05$). All complications were documented within the initial 6 months following gastrostomy placement.

The specific types of complications recorded in each group are shown in ►Table 2. The most frequent complication registered in the P-PEG group was buried bumper with 8/70 cases (11.4%), whereas in the T-PEG group was granuloma related to the T-fastener with 7/76 cases (9.2%; ►Fig. 3A). Other complications registered included infection, bleeding, device dislodgement, early button extrusion, pneumoperitoneum, prolapse, and abdominal wall necrosis (►Fig. 3B).

When comparing complications using the Clavien–Dindo classification system, it is clinically significant to note that we observed a higher incidence of severe complications in the P-PEG group, as indicated in ►Table 2. Type I and II complications were more frequent in the T-PEG group (9.2 vs. 4.3%), whereas type III and IV complications were more common in the P-PEG group (20.0 vs. 11.8%). We emphasize that although these differences were notable, they did not reach statistical significance ($p = 0.24$ and $p = 0.17$, respectively). Only one life-threatening complication (type IV) was observed in our series, diagnosed in the P-PEG group: a tube

Table 1 Demographics and surgical indications by groups

	P-PEG ($N = 70$)	T-PEG ($N = 76$)	Significant difference (p-value)
Age (years)	4.8[a] (SD = 5.1)	5.4[a] (SD = 5.5)	0.87
Weight (kg)	12.6[a] (SD = 8.6)	15.6[a] (SD = 10.3)	0.27
Sex			
Female	55.7%	47.4%	0.31
Male	44.3%	52.6%	0.31
Indication of PEG			
Neurological disease	55.7%	68.4%	0.11
Cardiopathy	11.4%	6.7%	0.30
Respiratory disease	11.4%	6.7%	0.30
Other	21.4%	18.4%	0.65

Abbreviations: PEG, percutaneous endoscopic gastrostomy; P-PEG, "pull-technique" gastrostomy; SD, standard deviation; T-PEG, T-fasteners gastrostomy technique.
Percentages are based on the number of study participants in respective groups.
[a]Values expressed in mean and SD.

dislodgement during the first tube replacement led to peritonitis, septic shock, and urgent laparotomy. There were no reported deaths related to PEG placement.

Among the complications, those intraoperative were minimal, with only one in each group. In the P-PEG group, a Clavien–Dindo type III complication was documented during gastrostomy placement: a pneumoperitoneum, necessitating laparoscopy to confirm the absence of complications. In the T-PEG group, a Clavien–Dindo Type II complication was recorded: an episode of intraoperative self-limited bleeding, which required a blood transfusion.

Table 2 Overall complications related to each type of percutaneous endoscopic gastrostomy placement according to Clavien–Dindo

Overall complications	P-PEG ($N = 70$)	T-PEG ($N = 76$)
Type I	**3 (4.3%)**	**6 (7.9%)**
Granuloma	–	3 (3.9%)
Infection	1 (1.4%)	3 (3.9%)
Bleeding	2 (2.9%)	–
Type II	–	**1 (1.3%)**
Bleeding	–	1 (1.3%)
Type III	**13 (18.6%)**	**9 (11.8%)**
Buried bumper	8 (11.4%)	–
Granuloma	–	4 (5.3%)
Device dislodgement	2 (2.9%)	1 (1.3%)
Early button extrusion	–	2 (2.6%)
Pneumoperitoneum	2 (2.9%)	–
Abdominal wall necrosis	–	1 (1.3%)
Bleeding	–	1 (1.3%)
Prolapse	1 (1.4%)	–
Type IV	**1 (1.4%)**	–
Device dislodgement	1 (1.4%)	–
Total	**17** (24.2%)	**16** (21.0%)

Abbreviations: PEG, percutaneous endoscopic gastrostomy; P-PEG, "pull-technique" gastrostomy; T-PEG, T-fasteners gastrostomy technique.
Percentages are based on the number of study participants in respective groups.

Complications Related to First Gastrostomy Tube Replacement

As previously described, the primary difference between the two groups is the sedation requirement for the first replacement, with no need for anesthesia in the T-PEG group. Our study confirms that the P-PEG group had a significantly higher incidence of sedation requirement for the first replacement compared with the T-PEG group (97 vs. 2.6% [$p < 0.05$]). Two cases in the T-PEG group necessitated sedation for tube replacement due to the complication of early button extrusion, occurring at 1 and 4 months, respectively. In both cases, sedation was necessary to facilitate the dilation of the stoma, enabling gastrostomy replacement.

We explicitly analyzed complications related to the first tube replacement and found a higher incidence in the P-PEG

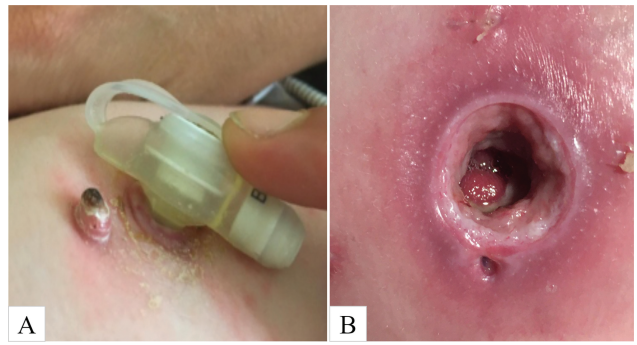

Fig. 3 Images of postoperative complications. (**A**) Granuloma related to the T-fastener in the T-PEG group. (**B**) Abdominal wall necrosis in the T-PEG group. T-PEG, T-fasteners percutaneous endoscopic gastrostomy technique.

group (7.2 vs. 1.4%; $p = 0.092$). Although the difference was not statistically significant, it is worth noting that in the T-PEG group, the only dislodgement was resolved endoscopically, while in the P-PEG group, two out of five complications resulted in peritonitis and required emergent laparotomy, as shown in ►Table 3.

Complications Treated with Urgent Surgical/Endoscopic Interventions

Patients in the P-PEG group needed more urgent interventions (either by endoscopy, laparoscopy, or laparotomy) compared with the T-PEG (18.6 vs. 6.6% [$p < 0.05$]). The most frequent cause of an urgent intervention was a buried bumper, found in eight patients in the P-PEG group and none in the T-PEG group (11.4 vs. 0% [$p < 0.05$]).

Management of Complications Treated with Urgent Interventions

In the following section, we provide a detailed account of the management of complications that necessitated urgent interventions in both groups.

In the P-PEG group, the majority of buried bumper cases (six out of eight) underwent endoscopic repositioning. The two remaining cases of buried bumper necessitated a surgical revision to extract the intragastric portion of the PEG and replace the gastrostomy.

Additional complications requiring urgent interventions in the P-PEG group included one case of pneumoperitoneum immediately after PEG placement leading to exploratory laparoscopy with no findings, two cases of gastrostomy dislodgement leading to peritonitis requiring laparotomy to clean the abdominal cavity, and one case of dislodgement without peritonitis requiring endoscopic replacement. It is noteworthy that all three previously mentioned cases of gastrostomy dislodgement occurred during the first tube replacement.

In the T-PEG group, the following complications necessitating urgent interventions were observed: one case of dislodgement without peritonitis (during the first replacement) requiring endoscopic replacement, two cases of early tube dislodgement requiring endoscopic replacement, one case of bleeding following PEG placement managed with cold saline solution by endoscopy, and one case of wall necrosis in a patient diagnosed with microcephalic primordial dwarfism, requiring surgical revision (►Fig. 3B).

Discussion

The main advantage of the T-PEG technique, also called one-step PEG, is that it directly inserts a balloon gastrostomy tube, allowing the gastrostomy replacement without the need for sedation or general anesthesia.[2,4–7] Despite the increasing popularity of the T-PEG technique, there have been only a few studies evaluating its safety in pediatric patients, as shown in ►Table 4. To date, only two studies have compared the incidence of complications between P-PEG and T-PEG in children.[2,4] However, none of these sources offer recommendations regarding the utilization of T-PEG versus P-PEG based on complications development.

The complication rates recorded in our study closely resemble those documented in the existing literature.[2,4,6,8,9] Major complications in previous T-PEG studies ranged from 1 to 16%, while in our series, it was 11.8% (►Table 4).

In our series, after comparing P-PEG and T-PEG, we did not find significant differences in the total number of complications (24.2 vs. 21.0%). Although we observed no significant differences in overall complication rates between the two groups, we did observe a higher frequency of severe complications in the P-PEG group, although these differences did not reach statistical significance. It is important to emphasize the relevance of severe adverse events classified as Clavien–Dindo III/IV complications from a patient safety perspective, as they involve invasive interventions or life-threatening events.

Furthermore, we specifically evaluated the need for an urgent endoscopy, laparoscopy, or laparotomy to solve the complication. Globally, patients in the P-PEG group needed more urgent interventions than the T-PEG.

The most frequent complication in the P-PEG group was buried bumper, whereas in the T-PEG group was granuloma related to the T-fastener. A buried bumper occurs when the external bumper of the PEG tube is tightly positioned against the abdominal wall,[13,14] and it typically requires endoscopic repositioning. On the other hand, the granuloma formation

Table 3 Complications related to the first tube replacement conducted 6 months after its placement in both groups

Complication related to the first tube replacement	P-PEG ($N = 70$)	T-PEG ($N = 76$)	Treatment
Dislodgment with peritonitis	2	–	Laparotomy
Dislodgment without peritonitis	1	1	Endoscopy
Pneumoperitoneum	1	–	Endoscopy
Undiagnosed buried bumper[a]	1	–	Surgical gastrostomy site revision
Total	**5** (7.2%)	**1** (1.4%)	–

Abbreviations: PEG, percutaneous endoscopic gastrostomy; P-PEG, "pull-technique" gastrostomy; T-PEG, T-fasteners gastrostomy technique.
Percentages are based on the number of study participants in respective groups.
[a]In this case, while removing the PEG, its intragastric part became lodged in the abdominal wall as a result of an undetected buried bumper. To extract the fragment, it was necessary to perform a surgical revision of the affected area.

Table 4 Summary of published studies on T-fasteners gastrostomy technique placement in pediatric patients

Authors	Year	Number of patients	Comparative analysis with P-PEG	Age (years)	Weight (kg)	Follow-up	Major complications related to T-PEG[a]
Moreno Montero et al[6]	2013	8	No	4.6[b] (0.7–4.6)	12.4[b] (5.5–36)	–	None
Kvello et al[8]	2010–2014	87	No	1.9[b] (0.2–16.4)	10.4[b] (5.4–33.0)	1 month	14 (16.0%)
Jacob et al[2]	2007–2010	73	Yes ($n = 55$)	4.5[c] (0.1–17)	13.6[c] (2.4–57)	3 years	–
Göthberg and Björnsson[4]	2005–2012	206	Yes ($n = 168$)	3.9[c] (± 4.7)	13.5[c] (± 9.9)	6 months	2 (1.0%)
Dahlseng et al[9]	2017–2022	82	No	2.0[b] (0.3–18.1)	9.9[b] (3.5–51.5)	3.5 months	7 (8.5%)
Our case series	2010–2021	76	Yes ($n = 70$)	5.1[b] (0.2–21.0)	14.1[c] (3.0–55.0)	1.5 years	9 (11.8%)

Abbreviations: PEG, percutaneous endoscopic gastrostomy; P-PEG, "pull-technique" gastrostomy; T-PEG, T-fasteners gastrostomy technique.
[a]Major complications are defined as Clavien–Dindo types III and IV.
[b]Values expressed in median and (range).
[c]Values expressed in mean and (range).

around the T-fastener results from a local inflammatory reaction to a foreign body.[9] Initially, we attempted surgical removal of the granulomas, but we found that this approach was not always effective, as the T-fasteners often are difficult to locate. Therefore, we now prefer to use topical silver nitrate, which can help to dissolve the granulomas. Additionally, spontaneous ejection of the T-fasteners and resolution of the granulomas are common over time.[4]

Our study did not identify any other T-fastener-related complications, such as bleeding or subcutaneous migration.[7] However, the optimal timing for removing T-fasteners remains unclear. In our practice, we have found that allowing the T-fasteners to fall out spontaneously, typically within a few weeks of placement, is a safe and effective approach. In a retrospective study involving 350 patients who underwent immediate removal of T-fasteners following gastrostomy, it was found that the immediate removal of T-fasteners did not correlate with an increased complication rate.[15] However, it is important to note that the previous study has a relatively short follow-up period of 1 month. Although there is no consensus on the ideal timing for removing the T-fasteners, several pediatric series routinely remove the sutures 3 to 4 weeks after the procedure.[4,8,9] We consider this timeframe to be a reasonable period for removing the T-fasteners.

Regarding first tube replacement, almost all P-PEG required sedation, whereas most T-PEG were replaced as an outpatient procedure without sedation. Also, we found more complications related to the first replacement in the P-PEG group. Although this difference did not reach statistical significance, P-PEG complications during first tube replacement were more severe and required more urgent laparotomies, while T-PEG complications were solved endoscopically. This underscores the importance of conducting follow-up until at least the first tube replacement, as complications can occur. It is important to consider that most referenced articles do not include the first tube replacement in their follow-up period, a factor that warrants consideration when interpreting their findings.[4,6,8,9]

Some authors have reported favorable outcomes with laparoscopic gastrostomy using transcutaneous U-Stitch fixation.[16] In our series, laparoscopy was employed in selected cases, to ensure greater intraoperative safety. All PEG procedures were conducted using an endoscopic percutaneous approach, regardless of whether laparoscopy was employed simultaneously. While laparoscopic gastrostomy using U-Stitch fixation is described with good results, it is not our center's preferred technique due to its perceived time-consuming aspect.

It is important to mention that initially, the authors utilized P-PEG for PEG placement between 2010 and 2016. However, from 2016 onward, they shifted their preference to T-PEG as the primary technique. Despite the new implementation of T-PEG in 2016, we observed that T-PEG was associated with fewer complications requiring urgent interventions compared with P-PEG. The fact that we encountered fewer complications with a new technique suggests that the learning curve for T-PEG is notably brief. However, it is crucial to highlight the importance of following the correct technique, ideally performed by a skilled surgical team.

This study presents some limitations. First, as a retrospective study, it is subject to recall bias, where participants may remember past events inaccurately, leading to potential inaccuracies in the data analysis. Second, neonatal patients weighing less than 3 kg were excluded from the study due to the potential risks associated with using the T-fastener technique in this population. Specifically, the narrow abdominal surface of these patients may not allow for the placement of three anchors, and the use of a long dilator could potentially injure the posterior wall of the stomach.[4] Lastly, this study lacks analysis of overall patient outcomes beyond complications, such as recovery times or the impact

on patient quality of life, which could be interesting for future investigations. However, despite these limitations, our study provides valuable information on the complications of these two widely used procedures.

Conclusion

In our experience, P-PEG is associated with more severe complications, particularly during the first button replacement. Compared with T-PEG, P-PEG is associated with a higher incidence of sedation requirements and a greater need for urgent endoscopic and surgical interventions to treat complications. Therefore, based on our findings, we advocate for the use of T-PEG in pediatric patients. P-PEG may be preferred in neonatal patients, while T-PEG could be favored in the remaining pediatric population. Further research is warranted to investigate the long-term outcomes of both P-PEG and T-PEG.

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Conflict of Interest
None declared.

References

1 Balogh B, Kovács T, Saxena AK. Complications in children with percutaneous endoscopic gastrostomy (PEG) placement. World J Pediatr 2019;15(01):12–16
2 Jacob A, Delesalle D, Coopman S, et al. Safety of the one-step percutaneous endoscopic gastrostomy button in children. J Pediatr 2015;166(06):1526–1528
3 Gauderer MW, Ponsky JL, Izant RJ Jr. Gastrostomy without laparotomy: a percutaneous endoscopic technique. J Pediatr Surg 1980;15(06):872–875
4 Göthberg G, Björnsson S. One-step insertion of low-profile gastrostomy in pediatric patients vs pull percutaneous endoscopic gastrostomy: retrospective analysis of outcomes. JPEN J Parenter Enteral Nutr 2016;40(03):423–430
5 Miller RE, Winkler WP, Kotler DP. The Russell percutaneous endoscopic gastrostomy: key technical steps. Gastrointest Endosc 1988;34(04):339–342
6 Moreno Montero A, Barceló Cañellas C, Bregante Ucedo JI, García Baglietto A, Marhuenda Irastorza C. [One-step low profile percutaneous endoscopic gastrostomy: our experience in children]. Cir Pediáatr 2014;27(04):196–200
7 McSweeney ME, Smithers CJ. Advances in pediatric gastrostomy placement. Gastrointest Endosc Clin N Am 2016;26(01):169–185
8 Kvello M, Knatten CK, Perminow G, et al. Initial experience with percutaneous endoscopic gastrostomy with T-fastener fixation in pediatric patients. Endosc Int Open 2018;6(02):E179–E185
9 Dahlseng MO, Skari H, Perminow G, et al. Reduced complication rate after implementation of a detailed treatment protocol for percutaneous endoscopic gastrostomy with T-fastener fixation in pediatric patients: a prospective study. J Pediatr Surg 2022;57(10):396–401
10 Conlon SJ, Janik TA, Janik JS, Hendrickson RJ, Landholm AE. Gastrostomy revision: incidence and indications. J Pediatr Surg 2004;39(09):1390–1395
11 Vall d'Hebron University Hospital. Surgical Antibiotic Prophylaxis in Pediatric Patients. Unit of Infectious Pathology and Pediatric Immunodeficiencies. Catalan Health Institute; 2022
12 Clavien PA, Barkun J, de Oliveira ML, et al. The Clavien-Dindo classification of surgical complications: five-year experience. Ann Surg 2009;250(02):187–196
13 Cyrany J, Rejchrt S, Kopacova M, Bures J. Buried bumper syndrome: a complication of percutaneous endoscopic gastrostomy. World J Gastroenterol 2016;22(02):618–627
14 Bennell J. Buried bumper syndrome: do we have enough evidence? Br J Community Nurs 2018;23(Sup7):S28–S30
15 Sanogo ML, Cooper K, Johnson TD, Shields J. Removal of T-fasteners immediately after percutaneous gastrostomy tube placement: experience in 488 patients. AJR Am J Roentgenol 2018;211(05):1144–1147
16 Aprahamian CJ, Morgan TL, Harmon CM, Georgeson KE, Barnhart DC. U-stitch laparoscopic gastrostomy technique has a low rate of complications and allows primary button placement: experience with 461 pediatric procedures. J Laparoendosc Adv Surg Tech A 2006;16(06):643–649

