



Comparison of Single-incision Surgical Gastrostomy with other Gastrostomy Methods

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Abstract

Introduction: Many surgical methods have been defined for gastrostomy, including open surgery and endoscopic methods. There are very few reports on single-incision gastrostomy. In this study, we aimed to share our experience of single-incision surgical gastrostomy, which is less known than other methods, by comparing it with other gastrostomy methods.

Methods: Between June 2016 and June 2019, in Ümraniye E.A.H. 15, patients undergoing SIG, 14 patients undergoing Stamm gastrostomy (SG) and 11 patients undergoing percutaneous endoscopic gastrostomy (PEG) were evaluated retrospectively in this study. Age, sex, indication for operation, operation method, operation time and postoperative complications were compared.

Results: Gastric perforation was observed in one patient, and a gastrostomy tube was absent in another patient. Laparotomy and SG were performed in both patients. Two patients who underwent SIG had eventration at the incision site and granulation around the tube in six patients. Evolution was treated with local suture and granulation was treated with silver nitrate. In one patient who underwent Stamm gastrostomy, laparotomy was performed because of the development of bridged ileus. No major complication requiring laparotomy was seen in any patient who underwent SIG.

Discussion and Conclusion: SIG is easy to perform, minimally invasive, and the complication rate is lower than other methods.

Keywords: Child; gastrostomy; single-incision gastrostomy.

Gastrostomy is the most common method used in patients who require enteral nutrition due to neurological diseases, growth retardation and malignancy^[1, 2]. Recently, methods, such as laparoscopic and percutaneous endoscopic gastrostomy (PEG), have been described in addition to open surgical gastrostomy^[3-5]. There are many studies that have compared these methods. However, the results are variable and it is controversial which method is better^[6-8]. As an alternative to these methods, single-incision gastrostomy (SIG) has been described first

in adults and then in children. This method is less invasive than conventional Stamm Gastrostomy (SG) and can be performed without the need for endoscopic instruments, such as PEG and laparoscopic gastrostomy. When opening a gastrostomy through a small single-incision, the surgeon can put the tube into the stomach under direct vision. Although simple and easily applicable, few studies have been found in the English literature^[9-11]. In our clinic, we shared the cases operated by SIG and other gastrostomy methods.

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Materials and Methods

Patients who underwent SIG, PEG, and SG between June 2016 and July 2019 at Umraniye Training and Research Hospital, University of Health Science Istanbul were retrospectively analysed in this study. Age, sex, indication for operation, operation method, operation time and postoperative complications were compared.

In our hospital, the patients who need enteral nutrition are first evaluated by gastroenterology. If it is decided that it is not proper for PEG (difficulty in intervention, sedation difficulty, need for fundoplication), pediatric surgery is consulted for surgical gastrostomy. For Stamm gastrostomy, we preferred patients who needed laparotomy for brid, gastrointestinal perforation and who needed fundoplication. Other patients underwent SIG.

TIG Technique

Under general anesthesia or sedation, a mini-transverse incision (less than 2 cm) is made through the rectus muscle in the left upper quadrant. The stomach becomes visible when 20cc isotonic was introduced through a nasogastric catheter. Generally, the nasogastric probe was also palpable. 2/0 vicryl sutures are placed in the stomach corpus and double purse-string sutures are passed. Gastrostomy was performed in the middle of the purse-string sutures. The gastrostomy tube was passed and the stomach is pushed into the abdomen. The gastrostomy tube balloon was inflated. Purse-string sutures were tied. The sutures were fixed to the peritoneum. Two sutures passed through the gastric wall around the tube were sutured to the rectus muscle and fascia (Fig. 1). After 24 hours, feeding was started from gastrostomy. In the long-term follow-up of the cases, the incision scar was very small (Fig. 2).



Figure 1. SIG technique.



Figure 2. Six months after the SIG.

Results

There were a total of 40 patients and 42 operations. Patients operated by 15 SIG, 16 SG and 11 PEG methods. The age range of 15 patients who underwent SIG from three months to 12 years and the median age was five months. Demographic data of patients who underwent SIG are given in Table 1. Eleven patients underwent PEG. There were eight (72.72%) male and three (27.7%) female patients and the median age was found to be five years. There were not any patients under age two. Two of the PEG cases had myopathy, one case had cranial neoplasm and the other case had a neurological deficit. Demographic data of patients who underwent PEG are given in Table 2. Sixteen patients with SG were aged between five months and 16 years. The median age was found to be five years. In SG patients, 10 (62.5%) were male and six (37.5%) were female. Demographic data of patients who underwent SG are given in Table 3. All PEG cases were operated under sedation. All SG cases were operated under general anesthesia. The mean operative time of PEG cases was 22 minutes. Operative times of SG cases could not be reached.

One of SIG case was operated under sedation and local anesthesia and other SIG cases under general anesthesia. The mean operative time was 50 min in patients who underwent SIG, but there were cases that underwent the second operation. The patients who had PEG, one had gastric

Table 1. Demographic data of the SIG patients

| No | Age | Gender | Indication | Operation time (minutes) | Complication | Feeding time |
|----|------|--------|----------------------------------------|--------------------------|------------------|--------------|
| 1 | 9 m | M | Cerebral palsy+PEM* | 50 | | 24 h |
| 2 | 11 m | F | Cerebral palsy+PEM | 40 | Granulation | 24 h |
| 3 | 5 m | M | Swallowing dysfunction+atony | 25 | Granulation | 24 h |
| 4 | 3 m | M | Hypotonia | 120** | Granulation | 24 h |
| 5 | 4 m | M | Hypoxic-ischemic encephalopathy | 50 | Granulation | 24 h |
| 6 | 3 m | F | Cleft palate and lip | 35 | | 24 h |
| 7 | 3 m | F | Multiple anomalies +PEM | 30 | | 24 h |
| 8 | 5 m | F | Hypotonia | 45 | Wound dehiscence | 24 h |
| 9 | 12 y | F | Cerebral palsy+PEM | 60 | | 24 h |
| 10 | 8 y | F | Cerebral palsy+PEM | 40 | Wound dehiscence | 24 h |
| 11 | 16 m | F | Cerebral palsy+PEM | 30 | Granulation | 24 h |
| 12 | 5 y | M | West syndrome | 35 | | 24 h |
| 13 | 8 y | M | Cerebral palsy+PEM | 50 | Granulation | 24 h |
| 14 | 5 m | F | Meningomyelocele+Arnoldchiari syndrome | 40 | | 24 h |
| 15 | 5 m | M | Multiple anomalies+PEM | 100** | | 24 h |

*PEM: Protein-energy malnutrition; **Tracheostomy in the same session to the patient 4, the operation time is long because Tracheostomy in the same session to the fourth patient and inguinal hernia repair was made in the 15th patient.

Table 2. Demographic data of the PEG patients

| No | Age | Gender | Indication | Operation time | Complication | Feeding time |
|----|------|--------|--------------------|----------------|---------------------|--------------|
| 1 | 11 y | M | Cerebral palsy+PEM | 25 | | 24 h |
| 2 | 14 y | M | Cerebral palsy+PEM | 30 | Granulation | 24 h |
| 3 | 8 y | F | Cerebral palsy+PEM | 15 | | 24 h |
| 4 | 5 y | M | Cranial neoplasm | 20 | | 24 h |
| 5 | 2 y | M | Cerebral palsy+PEM | 20 | Gastric perforation | 24 h |
| 6 | 5 y | F | Cerebral palsy+PEM | 15 | | 24 h |
| 7 | 4 y | M | West syndrome | 20 | Tube migration | 24 h |
| 8 | 15 y | M | Encephalitis | 25 | | 24 h |
| 9 | 3 y | M | Leigh syndrome | 30 | | 24 h |
| 10 | 17 y | M | Muscular dystrophy | 25 | Granulation | 24 h |
| 11 | 3 y | F | Cerebral palsy+PEM | 20 | | 24 h |

Table 3. Demographic data of the SG patients

| No | Age | Gender | Indication | Operation | Complication |
|----|------|--------|----------------------------------------|---------------------------|--------------|
| 1 | 17 y | F | Cerebral palsy+PEM | SG+ Nissen fundoplication | Granulation |
| 2 | 2 y | F | Sandhoff disease | SG+ Nissen fundoplication | |
| 3 | 4 y | M | West Syndrome+Tube migration | SG | |
| 4 | 5 y | F | Multiple anomalies+PEM | SG+ Nissen fundoplication | |
| 5 | 16 y | M | MMR*+GER**+Paraplegia | SG+ Nissen fundoplication | Granulation |
| 6 | 2 y | M | Cerebral palsy+PEM | SG+ Nissen fundoplication | |
| 7 | 5 y | M | Cerebral palsy+PEM | SG+ Nissen fundoplication | |
| 8 | 2 m | M | Multiple anomalies+PEM | SG+ Nissen fundoplication | Granulation |
| 9 | 10 m | M | Cerebral palsy+PEM | SG+ Nissen fundoplication | |
| 10 | 11 y | F | Cerebral palsy+PEM | SG+ Nissen fundoplication | Granulation |
| 11 | 6 m | M | Prematurity+PEM | SG | Granulation |
| 12 | 10 y | M | Neuronal Ceroid Lipofuscinosis | SG | |
| 13 | 17 y | F | Cerebral palsy+PEM | SG | Brid ileus |
| 14 | 15 y | M | Encephalitis | SG | |
| 15 | 5 y | F | Glutaric aciduria type 1 | SG+ Nissen fundoplication | |
| 16 | 2 y | M | Cerebral palsy+PEM+gastric perforation | SG | |

*Mental motor retardation; ** Gastroesophageal reflux.

perforation, one other's gastrostomy tube was not in the stomach. Laparotomy and Stamm gastrostomy were performed in both patients. Granulation tissue was observed in three cases of patients who had PEG. Dehiscence was seen in two and granulation around the tube was observed in six cases who had SIG. Dehiscence was treated with local suture and granulation was treated with silver nitrate. In one patient who underwent Stamm gastrostomy, laparotomy was performed because of the development of brid ileus. Granulation tissue developed around the tube in five patients. Laparotomy was not needed in any patient who underwent SIG. In the PEG and SIG techniques, cases are fed after 24 hours. It is fed at least 48 hours after the SG technique. No mortality was observed in any of the methods.

Discussion

Open surgery Gastrostomy was defined in the 19th century, and PEG was defined in the 20th century. PEG method not only shortened the operation time but also saved patients from wide incisions in open surgery. However, major complications, such as intestinal perforation, bleeding, peritonitis and tube migration, may be seen in PEG cases. In addition, PEG cannot be performed if there is one of the following reasons: head and neck tumors, esophageal tumors, previous surgery, hepatomegaly and acid. PEG may not be applied due to technical reasons, economic reasons and lack of experienced staff. The recently described SIG is an alternative in cases where PEG cannot be performed, and SIG procedure saves the patients from open surgery's long surgery time, postoperative pain and a large incision^[12-14].

Although PEG is easy to perform and short operation time is advantageous, there is insufficient data in children under one year of age. Therefore, gastroenterologists often do not prefer PEG in children under one year of age^[15-18]. Studies advocate that physicians prefer PEG for overweight and older children^[19-21]. Similar to other gastroenterologists, gastroenterologists in our hospital do not choose percutaneous intervention in patients under one year of age because of insufficient data and lack of experience.

PEG complications in children range from 5% to 75%, while major complications range from 0.5% to 17%. In a study with 40 infants ranging in age from five months to 10 months, only one patient had an esophageal rupture with a major complication rate of 2.5%. This study argues that PEG can be safely performed in infants when performed by experienced individuals. In the same study, PEG could not be

performed in one patient because of the upper esophageal sphincter could not be passed^[21].

In most of the studies, PEG and laparoscopic gastrostomy (LG) were compared. There are few studies that evaluate open gastrostomies. Major complications are more common in patients undergoing PEG than LG and open surgery^[7, 19-23]. In a study evaluated by Liu et al.,^[8] in all three methods, open surgery was associated with fewer complications than LG and PEG. Open surgery seems safer than PEG. In our study, in support of these studies, no major complications were seen in SG and SIG cases, whereas major complications (gastric perforation, displacement of the tube) were observed in two of the 11 PEG cases.

Zorron et al., who conducted the first study on SIG, argued that SIG could be performed easily with sedation and local anesthesia, especially in the absence of endoscopic and laparoscopic instruments^[9, 10]. Aziz and Nor, who studied with a pediatric patient group of eight cases, also argued that SIG is a simple and reliable method^[11]. SIG provides the advantages of classical Stamm gastrostomy and is far from the complications of endoscopic methods. When major complications of endoscopic methods (such as displacement of the tube, gastrocolic fistula) and wide wound complications of open surgery are considered, SIG may be an advantage over other methods. When SIG performed in selected pediatric patients, both cost and operation time will be reduced. However, this study has several limitations. This study was a retrospective, single-center study and limited by small sample size.

Conclusion

SIG may be an alternative to other methods due to its easy application and low complication rate in pediatric patients. SIG may be preferred aesthetically, in the technical failure of PEG, especially in patients under one year of age where endoscopic methods are more difficult to perform. SIG can be used in selected cases. However, larger studies are needed to be an alternative.

Ethics Committee Approval: The Ethics Committee of Health Sciences University Ümraniye Training and Research Hospital provided the ethics committee approval for this study (17.04.2019-B.10.1.TKH.4.34.H.GP.01/82).

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