Original Article

Factors Associated with the Risk of Persistent Gastrostomy Site Infection Following Laparoscopic or Open Nissen Fundoplication

Hisayuki Miyagi, Shohei Honda, Masahi Minato, Tadao Okada[1], Akinobu Taketomi

Department of Gastroenterological Surgery, Graduate School of Medicine, Hokkaido University, [1]Faculty of Education, School Health Nursing, Hokkaido University of Education, Sapporo, Japan

Abstract

Background: Gastrostomy for feeding disorders or swallowing dysfunctions can be complicated by persistent gastrostomy site infection (PGSI). PGSI causes nutrient leakage, with dilated PGSI requiring gastrostomy reconstruction. The purpose of this study was to evaluate the causes, patient characteristics, and perioperative management of PGSI after Nissen fundoplication and gastrostomy for patients with gastro-oesophageal reflux. **Patients and Methods:** The records of all patients who underwent Nissen fundoplication and gastrostomy for gastro-oesophageal reflux over the past 12 years were retrieved. Risk factors were analysed, including age at surgery, gender, operative procedure, use of postoperative ventilator management, gastrostomy tube migration towards the pylorus, bacterial culture results, and length of hospital stay. PGSI as a cause of inflammation was analysed statistically. **Results:** Forty patients were identified, ranging in age from 1 to 49 years (median, 11 years) surgically. Twenty each underwent laparoscopic and open surgery, with all undergoing gastrostomy using the Stamm technique. Four patients developed PGSI. Gastrostomy tubes had migrated postoperatively to the pyloric side in three of these four patients ($P < 0.005$), increasing intragastric pressure. Three of these four patients also required positive pressure ventilation during the perioperative period ($P < 0.001$). **Conclusion:** PGSI correlates with the perioperative management of positive pressure and with increased intragastric pressure resulting from pyloric obstruction, which is caused by aberrant distribution of the gastrostomy tube to the pyloric side. **Statistical Analysis Used:** Factors in the two groups were compared statistically by Mann–Whitney U-test to determine whether PGSI caused inflammation. Statistical significance was defined as $P < 0.05$.

Keywords: Complication, gastrostomy site infection, Nissen fundoplication, Stamm procedure

Introduction

Gastrostomy is an essential surgical intervention for paediatric patients with feeding disorders or swallowing dysfunctions and who have severe motor and intellectual disabilities (SMID) or congenital oesophageal atresia. Gastrostomy procedures for paediatric patients include the Stamm, Witzel, and percutaneous endoscopic gastrostomy (PEG) procedures, which may be performed under laparotomy or laparoscopically.

Many patients with SMID experience gastro-oesophageal reflux, with gastrostomy performed in conjunction with anti-reflux surgery, such as laparoscopic Nissen fundoplication. Patients with congenital oesophageal atresia are frequently treated with radical surgery during the neonatal period, and many undergo gastrostomy under laparotomy. Gastrostomy can improve the quality of life of paediatric patients, but many patients who undergo Nissen fundoplication experience persistent gastrostomy site infection (PGSI).[1] This condition is characterised by inflammation due to leakage of gastric contents from the stomach surrounding the gastrostomy tube. This, in turn, causes erosion of the skin, making the stomach wall thinner and the orifice of the fistula larger. Some patients must undergo re-gastrostomy because of dilatation of a gastric fistula.[1]

Access this article online

Quick Response Code:

Website: www.afrjpaedsurg.org

DOI: 10.4103/ajps.AJPS_57_16

Address for correspondence: Dr. Shohei Honda, Kita 15, Nishi 7, Kita-ku, Sapporo 060-8638, Japan. E-mail: honda@med.hokudai.ac.jp

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Miyagi H, Honda S, Minato M, Okada T, Taketomi A. Factors Associated with the Risk of Persistent Gastrostomy Site Infection Following Laparoscopic or Open Nissen Fundoplication. Afr J Paediatr Surg 2017;14:21-3.

The purpose of this study was to clarify the risk factors for the occurrence of PGSI in patients who underwent Nissen fundoplication and gastrostomy.

Patients and Methods

The medical records of all patients who underwent Nissen fundoplication and gastrostomy between 2002 and 2013 in our institution were examined [Table 1]. Patients were divided into those who did and did not experience PGSI. Patient factors associated with the onset of PGSI and perioperative management were examined. Risk factors analysed included age at surgery, gender, operative procedure, use of postoperative ventilator management (yes/no), migration of the gastrostomy tube towards the pylorus (yes/no), bacterial culture results, and length of hospital stay. Factors in the two groups were compared statistically by Mann–Whitney U-test to determine if PGSI caused inflammation. Statistical significance was defined as $P < 0.05$.

Results

Forty patients underwent Nissen fundoplication and gastrostomy, including thirty with severe neurological impairment and ten with spinal muscular atrophy and Hunter syndrome. Median age at surgery was 11 years (range, 1–49 years), with twenty patients each undergoing laparoscopy and laparotomy [Table 1]. Gastrostomy was always performed using the Stamm method. Of the forty patients, four developed PGSI, including three with SMID and one with spinal muscular atrophy Type I.

Three of the four patients with PGSI required positive pressure ventilation during the perioperative period ($P < 0.005$). Migration of the gastrostomy tube towards the pylorus ($P < 0.001$) was significantly correlated with the onset of PGSI [Tables 2 and 3].

All the four patients with PGSI were treated conservatively, by removal of the 14Fr gastrostomy tube and replacement with an

Table 1: Demographic characteristics of patients undergoing Nissen fundoplication and gastrostomy procedures

Total	Number
Patients	40
Gender (male:female)	25:15
Age at surgery (median), years	12.8±23.9 (11.0)
Operative procedure	
Open Nissen fundoplication and gastrostomy	20
Laparoscopic Nissen fundoplication and gastrostomy	20

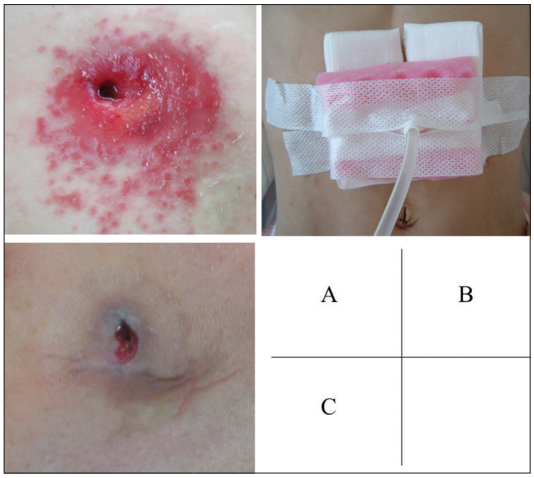


Figure 1: (A) Persistent gastrocutaneous fistula. (B) Treatment for persistent gastrocutaneous fistula. (C) After the persistent gastrocutaneous fistula is repaired, the gastrostomy button is replaced by one of the original thicknesses

Table 2: Complications of positive and negative persistent gastrocutaneous fistula at gastrostomy site

Persistent gastrocutaneous fistula	Yes	No	*P**
Patients	4	36	
Gender (male:female)	2:2	23:13	0.5909
Age at surgery (range), years	11 (6-49)	9 (0-48)	0.1549
Operative procedure (open laparoscopic)	1:3	19:17	0.2980
Perioperative positive pressure ventilation (%)	3/4 (75)	5/36 (13.8)	0.0042**
Tube migration towards the pylorus (%)	3/4 (75)	1/36 (2.7)	0.0000**
Hospital stay (range), days	23 (10-67)	15 (8-251)	0.2590

*Mann-Whitney U-test, ***P*<0.05

Table 3: Characteristics of patients with persistent gastrocutaneous fistula

Patient number	Age at surgery (years)	Gender	Underlying disease	Length of positive pressure ventilation after surgery (days)	Tube migration towards the pylorus	Bacterial culture	Hospital stay (days)
1	6	Female	SMID*	2	No	*Pseudomonas* species	10
2	36	Female	SMID*	0	Yes	*Candida albicans*	23
3	49	Male	SMID*	7	Yes	Methicillin-resistant *Staphylococcus aureus*	41
4	11	Male	Spinal muscular atrophy Type I	2	Yes	*Klebsiella oxytoca*	67

*SMID: Severe motor and intellectual disabilities

8Fr tube. After contraction of the gastric fistula and resolution of the inflammation around the fistula, the 14Fr gastrostomy tube was reinserted [Figure 1]. Only one patient, however, required enterostomy because the period of fasting was long. No recurrence has been observed.

Discussion

Among the various conditions that necessitate paediatric gastrostomy are intake disorders due to diseases caused by central nervous system dysfunction, laryngeal dysfunction, dysphagia due to abnormality or malformation of the larynx, and narrowing of the oesophagus. Because of its high risk, the PEG method is often avoided in children with severe physical and mental disabilities, including those with marked scoliosis, particularly to the right side, causing trunk deformation and positioning of the stomach above the costal arch and those in whom the colon and small intestine are always dilated because of chronic gastrointestinal motility disorder, which is often observed in children with disabilities. Rather, these children are often treated by gastrostomy, whether under direct vision by laparotomy or under laparoscopic guidance.[2,3] The PEG method has also been reported inappropriate for neonates and infants because of the fragility of tissues and smallness of the body surface area and stomach capacity.[4] Thus, in our department, the Stamm procedure, which avoids inadvertent puncture of other organs, was selected for gastrostomy in infants with severe physical or mental disability, showing marked trunk deformation, and neonates with congenital malformations such as oesophageal atresia.

Complications may occur during the management of gastrostomy, regardless of whether PEG or the Stamm procedure is used. Patients may develop peritonitis because of the leakage of contents from the gastrostomy, catheter removal, catheter perforation, gastric ulcer, pyloric stenosis, hernia, wound infection, wound open, or difficulties closing a stomach fistula.[5-9] Complications of paediatric gastrostomy were reported in 40 (16.7%) of 240 patients, with 24 (10%) showing leakage from the gastric fistula, 7 (2.9%) showing wound infection and wound opening, and 5 (2.1%) showing intraperitoneal gastric fluid leakage.[7] Another study reported that 19 (15.8%) of 280 patients experienced complications.[8]

Peri-gastric fistula inflammation due to the leakage of stomach contents from the gastric fistula is one of the most common complications of gastrostomy. This leakage and inflammation may cause tissue destruction and skin erosion, as well as destroying subcutaneous fat and making the layer between the skin and stomach thinner. Subsequently, puncture holes gradually increase in size, even the catheter is changed to a larger size, organisation is weakened, and the pores become bigger, forming a labial gastric fistula after loss of the gastric mucosa. Postoperative convulsions and hypertonia infants with severe physical and mental disability may become obstacles to wound and fistula resolution and the risk of complications is high, making postoperative drug treatment essential.[1]

Increases in abdominal pressure accompanying respiratory disease, heart disease, aspiration, and tension could cause leakage from the gastrostomy. The Stamm procedure recommends that the gastrostomy tube should be inserted through an independent site.[1] In children, however, direct insertion of the gastrostomy tube through the laparotomy site can minimize the wound. However, once the gastric mucosa becomes exposed and a labial fistula forms, re-gastrostomy may be required.

Re-gastrostomy not only increases the size of the laparotomy incision, but also the surgical invasion itself will become more marked because of adhesions in the abdominal cavity. To prevent complications, care should be taken in performing gastrostomy in infants, keeping in mind that gastrostomy for infants is never a minor operation.

PGF is treated at our institution by temporarily placing a small tube in the fistula to relieve the area around the gastrostomy site, inserting a feeding tube through the nose, and after healing of the gastrocutaneous fistula, reverting to the previous-sized gastrostomy button. This method has yielded favourable outcomes without recurrence.

Conclusion

Risk factors for PGF after Nissen fundoplication included an increase in the internal pressure of the stomach caused by positive pressure ventilation during the perioperative period and pyloric obstruction caused by migration of the gastrostomy tube towards the pylorus. Treatment of PGF included relieving the fistula and allowing inflammation around the fistula to subside, followed by reinsertion of a 14Fr gastrostomy tube.

PGF following Nissen fundoplication may be prevented by paying attention to the site and depth of insertion of the gastrostomy tube and the size of its balloon, as well as to respiratory management during the perioperative period.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Owari M, Usui N, Soh H, Tazuke Y, Kamiyama M, Fukuzawa M. The causes for leakage of gastric juice through a gastrostomy site which required remake of gastrostomy. J JSPN 2011;26:765-9.
2. Mathus-Vliegen EM, Koning H, Taminiau JA, Moorman-Voestermans CG. Percutaneous endoscopic gastrostomy and gastrojejunostomy in psychomotor retarded subjects: A follow-up covering 106 patient years. J Pediatr Gastroenterol Nutr 2001;33:488-94.
3. Saitua F, Acuña R, Herrera P. Percutaneous endoscopic gastrostomy: The technique of choice? J Pediatr Surg 2003;38:1512-5.
4. Gauderer MW. Percutaneous endoscopic gastrostomy: A 10-year experience with 220 children. J Pediatr Surg 1991;26:288-92.
5. Hopens T, Schwesinger WH. Complications of tube gastrostomy: Radiologic manifestations. South Med J 1983;76:9-11.
6. Vade A, Jafri SZ, Agha FP, Vidyasagar MS, Coran AG. Radiologic evaluation of gastrostomy complications. AJR Am J Roentgenol 1983;141:325-30.
7. Haws EB, Sieber WK, Kiesewetter WB. Complications of tube gastrostomy in infants and children 15-year review of 240 cases. Ann Surg 1966;164:284-90.
8. Currarino G, Votteler T. Prolapse of the gastrostomy catheter in children. Am J Roentgenol Radium Ther Nucl Med 1975;123:737-41.
9. Goodman LR, Wittenberg J, Messer R. Duodenal obstruction – An unusual complication of a gastrostomy feeding catheter. Br J Radiol 1971;44:883-4.