Primary Gastrostomy Button: A Means of Long Term Enteral Feeding in Children

RAVIT RUANGTRAKOOL, M.D., F.R.C.S.T. (Surgery), Diploma in Paediatric Surgery (London)*, TAT HIN ONG, M.B., B.S., F.R.A.C.S.**

Abstract

Between June 1992 and December 1997, forty-two patients (M 19, F 23) received 94 primary gastrostomy buttons due to 22 intellectual handicap, 7 cystic fibrosis, 4 severe gastro-oesophageal reflux, 2 bronchopulmonary dysplasia, 2 tumours in the neck region and 5 miscellaneous causes. Open fundoplication concomitant with primary button, primary open button and laparoscopic fundoplication concomitant with primary button were performed in 20,15 and 7 patients respectively. The average longevity +,- standard deviation of all buttons was 388.36 +,- 360.35 days. The average longevity of the buttons of the laparoscopic fundoplication group was significantly lower than the others. The major causes of removal of Bard buttons were valve incompetence and flap damage, whereas, balloon leakage was the major cause of removal of the Mic-key button. There were merely minor stomal complications and no gastric separation and peritonitis. Because of the acceptable longevity of the buttons and minimal complications, we concluded that the primary gastrostomy button was the preferable method of long term enteral feeding in children.

Key word : Adult, Child, Stomach, Enteral Nutrition/Instrumentation, Enteral Nutrition/Adverse Effects, Follow-up Studies, Gastrostomy, Human, Silicone Elastomers, Intubation, Gastrointestinal

RUANGTRAKOOL R & ONG TH
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The gastrostomy button is well known for its many advantages over the conventional gastrostomy tube. It decreases the incidence of stoma irritation, discomfort, severe granulation, internal and external migration, inadvertent removal, pivoting reaction leading to leak around stoma, more durability and aesthetical superiority than the gastrostomy tube. Traditionally, the gastrostomy button requires firm attachment between the stomach and anterior abdominal wall which needs the interval between

* Division of Paediatric Surgery, Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

** Department of Surgery, Royal Children's Hospital, Herston Road, Herston, Brisbane, Australia.

gastrostomy and gastrostomy button to maintain this integrity for at least 3 months[1-5]. This indicates that patients who require admission while during gastrostomies are performed, suffer from complications related to the gastrostomies and need many visits to dilate the calibre of the gastrocutaneous tract until the proper gastrostomy buttons can be selected and take significant risk of the separation of the stomach from the anterior abdominal wall when the gastrostomies are changed to gastrostomy buttons[6]. We propose a new method of gastrostomy button insertion that does not require a gastrostomy tube and study the efficiency of this new method.

MATERIAL AND METHOD

We retrospectively studied all patients who had gastrostomy buttons inserted without gastrocutaneous tract as primary gastrostomy insertions in the Royal Children's Hospital, Brisbane, between June 1992 and December 1997. We collected data of the indications, methods of insertion, causes of the button removal, types of buttons, complications, longevity of the first buttons and all buttons and the factors that determined the longevity of each button from the medical records and questionnaires by telephone. The average follow-up time was 2.11 years.

The method of button insertion when the open procedure was selected whether combined with fundoplication or not, was the modified Stamm's technique for the conventional gastrostomy. After the midline or transverse incisions were done, the gastrotomy was performed at the centre of two purse-string sutures. The gastrostomy button was applied by the surgeon and inserted through the gastrotomy incision. When successful insertion was accomplished, the purse-string sutures were tied to snug the gastrotomy button. After another stab incision was performed suitable for the size of the gastrostomy button, the flange side of the button was brought through this wound and the seromuscular layer of the stomach was secured to the anterior abdominal wall by interrupted sutures.

The technique of gastrostomy button insertion concomitant with laparoscopic fundoplication was the laparoscopic assisted gastrostomy button insertion described in 1997[7]. After fundal wrap was completed, the gastrosplenic ligament was released with diathermy and the junction between the fundus and body of the stomach was mobilised laterally to the greater curvature. The skin incision was done inferiorly to the left side port and located between the costal margin and umbilicus. After the stomach was grasped by the artery forcep under vision, the peumoperitoneum was released and the stomach was drawn into the wound. The 2 purse-string with 4/0 polyglycolic sutures were performed and the button was inserted then the stomach was fixed to the wound.

The data calculated the differences of longevity of each group using the Student's t test and the statistic significance was p value < 0.05. The probability of survival was estimated by the Kaplan- Meier method.

With regard to the calculation of the longevity of the button, we excluded 2 buttons the longevity of which could not be accessed and we also excluded 34 buttons which had no definite result due to the buttons still being in place during the last follow-up and the average longevity of these buttons was 298.71 days.

RESULTS

Forty-two patients (M 19, F 23) received 94 primary gastrostomy buttons and each patient received an average of 2.24 buttons. The indications of long term enteral support were 22 intellectual handicap, 7 cystic fibrosis, 4 severe gastrooesophageal reflux, 2 bronchopulmonary dysplasia, 2 giant tumours in the neck and chest region, 1 each for chromosomal abnormality, chronic renal failure, Mobius syndrome and H type oesophageal atresia. One failure to thrive patient suffered from an unrecognised syndrome.

The methods of primary gastrostomy button insertion are demonstrated in Table 1.

Thirty-five patients had gastrooesophageal reflux before gastrostomy buttons were inserted and 4 of them received merely fundoplications before gastrostomy buttons were considered. Twenty-eight patients required fundoplications concomitant with gastrostomy button insertion. Two of 7 cases who had no gastroosophageal reflux developed severe gastrooesophageal reflux after buttons were inserted. One of them needed laparoscopic fundoplication and the other received a Roux-en-Y jejunostomy button.

Three of 7 laparoscopic fundoplications required redo-fundoplications due to 2 severe recurrent gastrooesophageal reflux and one too-tight fundoplication. Two patients needed additional

Table 1. The methods of button insertion.

	Fundoplication + open button (n = 20)	Primary open button (n = 15)	Laparoscopic fundoplication + primary button (n = 7)	All (n = 42)
No. of all buttons	45	31	18	94
Average age of insertion (years)	5.67	5.28	1.96	4.91
No. of the first buttons*	14	9	5	28
Average longevity of the first buttons (days) (+,- SD)	712.86 (+,- 537.42)	451.67 (+,- 292.00)	145.80 (+,- 49.27)	527.64 (+,- 459.78)
Statistic significance			a, b**	
No. of all buttons*	28	18	12	58
Average longevity of all buttons (days) (+,- SD)	499.57 (+,- 444.11)	352.56 (+,- 256.16)	182.58 (+,- 86.88)	388.36 (+,- 360.35)
Statistic significance			a, b**	

* The buttons that were known the longevity.
** a = $p < 0.05$ *vs* fundoplication + open button, b = $p < 0.05$ *vs* primary open button

Table 2. The causes of button removal.

	Bard buttons (n = 34)	Mic-key buttons (n = 7)	All buttons (n = 50)
Valve incompetence	44.12% (15)	0% (0)	40.00% (20)
Flap damage	17.65% (6)	0% (0)	14.00% (7)
Leak around button	8.82% (3)	14.29% (1)	10.00% (5)
Balloon leakage	0% (0)	57.14% (4)	8.00% (4)
Severe granulation	8.82% (3)	0% (0)	6.00% (3)
Miscellaneous	20.59% (7)*	28.57% (2)**	22.00% (11)***

* = Two no longer need buttons, 2 too small size buttons, 1 each for infection, need another operation and external migration.
** = One each for infection and accidental pulling out.
*** = Three no longer need buttons, 2 too small size buttons, 2 infection, 1 each for accidental pulling out, severe GOR, need another operation and external migration.

operations for persistent gastrocutaneous fistula. One patient decided to convert the gastrostomy button to a gastrostomy tube due to frequent leakage around the shaft of the button.

The causes of the button removal are revealed in Table 2.

Sixty six Bard buttons (Bard Interventional Products, Tewksbury, MA) and 14 Mic-key buttons (Medical Innovations Corporation, Milpitas, CA) were used but the longevity of only 40 Bard buttons and 9 Mickey buttons were recorded. The average longevity +,- standard deviation of the Bard buttons and Mic-key buttons were 390.00 +,- 356.08 and 263.78 +,- 153.03 days respectively and p value was 0.107.

The average longevity +,- standard deviation of the first, second, third and forth buttons were 527.64 +,- 459.78 days, 257.06 +,- 154.87 days, 234.80 +,- 110.04 days and 322.50 +,- 225.69 days respectively.

Three patients died from respiratory failure with underlying cystic fibrosis and there was no mortality directly associated with the operative technique.

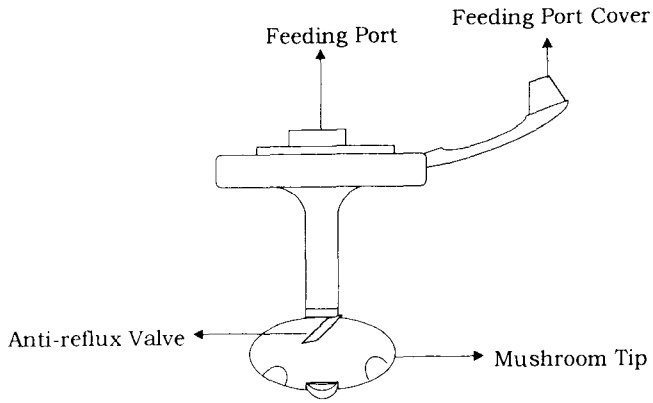
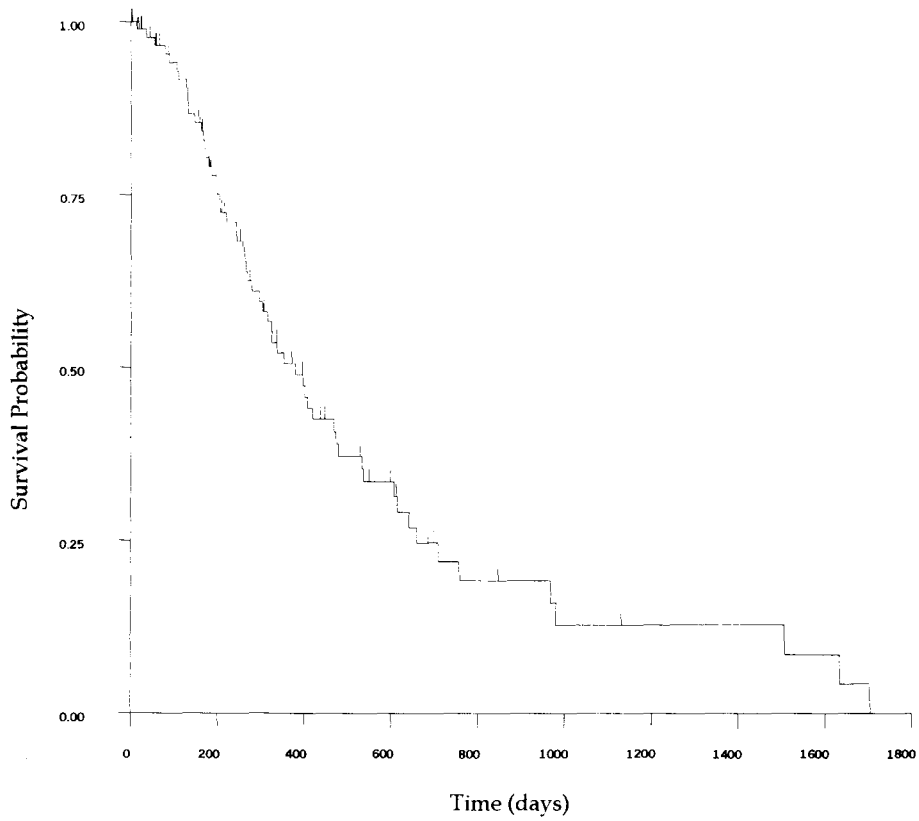


Fig. 1. Bard button.



* exclude 2 buttons which their longevity can not be accessed.

Graph 1. Kaplan-Meier estimation curve of all gastrostomy buttons (n = 92)*.

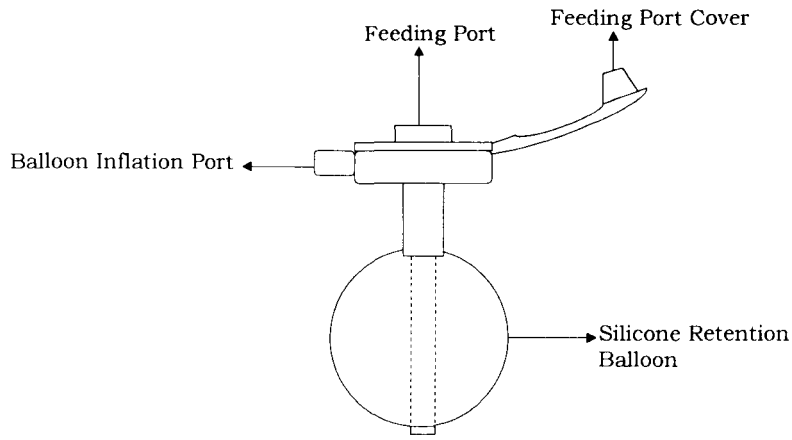
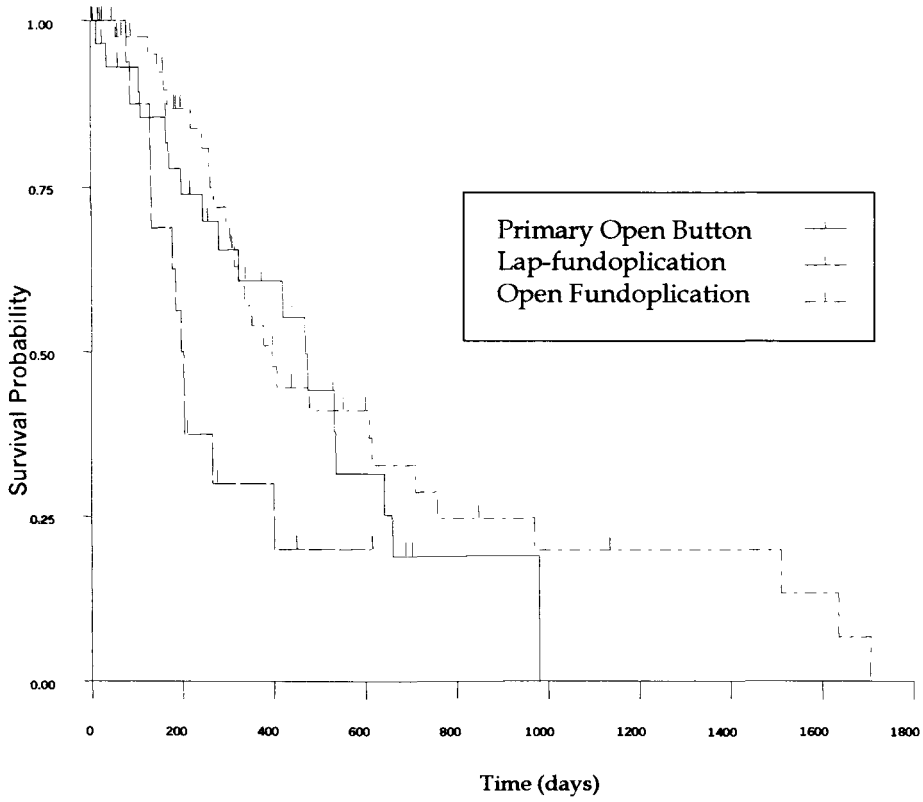
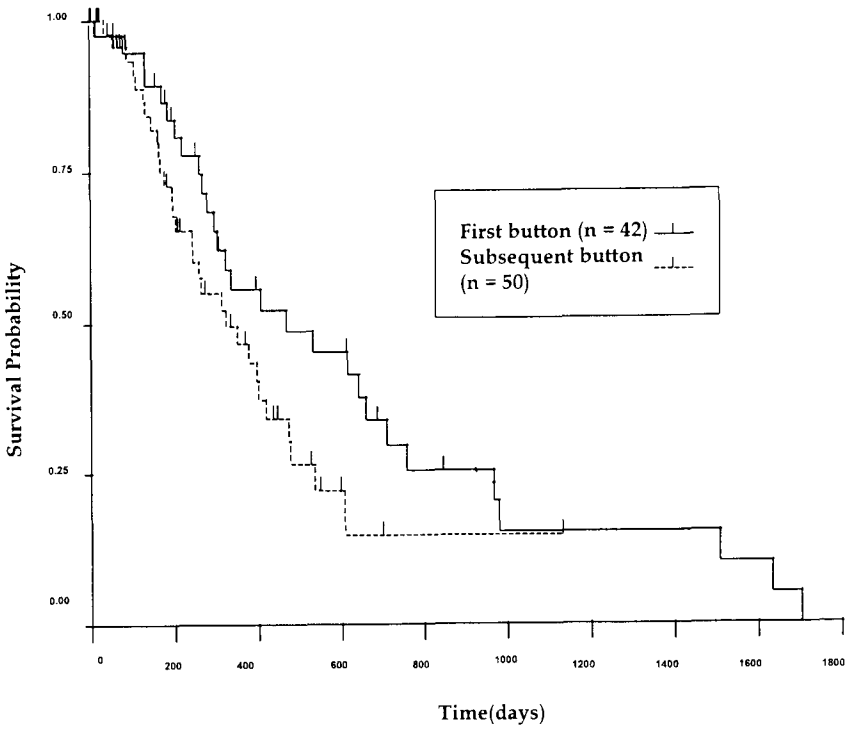


Fig. 2. Mickey button.



* exclude 2 buttons which their longevity can not be accessed.

Graph 2. Kaplan-Meier estimation curves of all gastrostomy buttons (n=92)* compare between three methods of gastrostomy button insertion.



* exclude 2 buttons which their longevity can not be accessed.

Graph 3. Kaplan-Meier estimation curves of all gastrostomy buttons (n = 92)* compare between the first button and the subsequent button.

DISCUSSION

Traditionally, gastrostomy button insertion requires firm attachment between the stomach and anterior abdominal wall which indicates that the patients need the gastrostomy procedure and wait for a minimum of 3 months before the gastrostomy button can be inserted safely[1-5]. This practice encounters problems directly related to the gastrostomy procedure itself, several problems are commonly seen with gastrostomy tubes, i.e., internal and external migration, inadvertent removal, pivoting action leading to leakage, tissue reaction and discomfort. Moreover, the patients require many hospital visits to dilate and calibre the diameter of the gastrocutaneous tract before the gastrostomy button can be inserted and take the risk of gastric separation and peritonitis associated with interval gastrostomy button insertion. Even when the recommendation of the interval time for the adhesion between the stomach and anterior abdominal wall was a minimum of 3 months or longer if the patient was malnourished or on steroids, the separation still occurred in 4 of the 643 insertions[5]. Therefore, primary gastrostomy button is desirable because it can eliminate all these problems[6,8] including the complication of gastric separation and peritonitis[6].

In this study, the average longevity of the first buttons was 527.64 days which was longer statistically insignificantly than the average longevity of all buttons which was 388.36 days. The average longevity of all gastrostomy buttons in this primary gastrostomy button series was comparative to the result of the series reported by Gauderer which revealed the average longevity of all buttons inserted after matured gastrocutaneous tract as 8.9

months[2]. In our series, the buttons which were inserted concomitant with laparoscopic fundoplication had an average longevity lower than the other groups in both the first button and all button categories with statistical significance. The method of gastrostomy button insertion concomitant with laparoscopic fundoplication required some modifications and the techniques were further scrutinised to improve the outcome.

Preliminary reports of primary percutaneous gastrostomy button in adults and children have appeared recently[8-12].The modifications from the standard Percutaneous Endoscopic Gastrostomy applied either "push" or "pull" techniques. The push techniques were described by using either a "One- Step Button"[9-11] or a "Medicina" button[12] whereas the pull technique named "Surgitek One-Step Gastrostomy Tube"[8] was adapted from the standard "pull" PEG. The disadvantages of the gastrostomy button insertion methods modified from PEG were the development of gastro-colonic fistula[10] and colo-cutaneous fistula[8] presuming these had occurred at the time of the initial placement. These complications can be reduced by either open direct gastrostomy button or laparoscopic gastrostomy button insertion[13] or laparoscopy aided gastrostomy button[7] or laparoscopy-guided percutaneous button gastrostomy[14] whether the procedures were carried out concomitantly with fundoplication or not. The technique of gastrostomy button insertion concomitant with laparoscopic fundoplication in our series was laparoscopic aided gastrostomy button insertion which used the laparoscopic instrument delivering the stomach into the small wound and the modification of Stamm's gastrostomy was applied outside the abdominal cavity. The adaptation of this technique which applied the laparoscopic technique with percutaneous gastrostomy button insertion will be discussed. After the stomach was grasped by laparoscopic instruments, the 2 purse-string sutures were performed under laparoscopic control. The stomach was fixed to the abdominal wall by two through and through 2/0 polyglycolic sutures which penetrated the skin, anterior abdominal walls and the seromuscular layer of the stomach. The stomach was punctured by a needle and the Seldinger technique was applied. After the guide wire was inserted through the needle, the dilators were used and the Mic-key button was inserted percutaneously. The through and through stabilising sutures which maintained the stomach adhering to the abdominal wall were left for 2 weeks before integrity of the gastrocutaneous tract was sustained safely.

Previous attempts of primary button insertion have been limited by the difficulty in bringing the gastrostomy button's flanges through the abdominal walls. In the modified PEG technique for gastrostomy button insertion, the feeding button enclosed in the peel-away plastic shroud which had the rip cord following the line to open the shroud and release the button[6-10]. This peel-away plastic shroud alleviated this problem as well as the use of balloon gastrostomy button which was easily inserted through the abdominal incision[12].

The use of stoma measuring device was recommended even though the accuracy of this device is still being debated[5,15,16]. One report that omitted this use, but only relied on the correlation between the weight of the patients and the length of the buttons, had experienced external migration of the buttons in 4 of 13 patients[9]. Most of the primary gastrostomy button sets which were modifications of PEG had these devices placed over the guide wire by either the "push" or "pull" technique which is different from the stoma measuring device of the standard gastrostomy button and could not be compared[6,8,10]. External migration of the buttons inserted primarily was speculated to occur only in small diameter buttons which had inadequate diameter of the dome to bust against the luminal surface of the stomach[9] and a tight fit and excessive traction should be avoided[8,9].

The most frequent cause of button removal in our series was the leakage through the shaft secondary to valve incompetence which composed of 40 per cent of our series corresponding to 74.2 per cent of Gauderer series which comprised of gastrostomy buttons inserted after matured gastrocutaneous tract[2]. This problem was related to three factors: encrustation, material fatigue and shaft deformability and would be decreased by flushing the device after use. The stoma complications in our series were only minor stoma infection easily resolved with oral antibiotic and minor stoma granulation which responded to silver nitrate application. There was no serious gastric separation and leakage of the stomach content into the peritoneal cavity.

Two reports have described three fatal cases of blind replacements related to excessive long gastrocutaneous fistula tracks[15,16]. In two

cases, the tips of the buttons opened into the peritoneal cavity, while the other penetrated the liver parenchyma, leading to air embolism when flushed. Even when the recommendation to verify the placement of the button endoscopically or fluoroscopically was proposed[4], most series including ours still recommend changing the button device as a simple office procedure performed blindly without the need of endoscopic or fluoroscopic guidance [2,5,17].

In summary, the placement of the gastrostomy button in one stage is a safe, feasible and preferable method and the complication rates and the longevity of the buttons are comparative to the gastrostomy buttons inserted with matured gastrocutaneous tracts[8].

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กระดุมกระเพาะอาหารปฐมภูมิ: หนทางหนึ่งในการให้สารอาหารแก่ผู้ป่วยเด็กในระยะยาว

รวิศ เรืองตระกูล, พ.บ., ว.ว. (ศัลยศาสตร์), Diploma in Paediatric Surgery,*
*Tat Hin Ong, M.B., B.S., F.R.A.C.S.***

ผู้เขียนได้ทำการศึกษาผู้ป่วย 42 ราย (เป็นชาย 19 ราย และเป็นหญิง 23 ราย) ที่ได้รับการผ่าตัดใส่ gastrostomy button รวมทั้งสิ้น 94 button โดยไม่ได้รับการผ่าตัด gastrostomy มาก่อน ระหว่างเดือนมิถุนายน 2535 ถึงเดือนธันวาคม 2540 ข้อบ่งชี้ในการผ่าตัดคือ พิการทางสมองและสติปัญญา 22 ราย, cystic fibrosis 7 ราย, ภาวะ gastroesophageal reflux อย่างรุนแรง 4 ราย, โรค bronchopulmonary dysplasia 2 ราย, เนื้องอกบริเวณคอ 2 ราย และสาเหตุอื่น ๆ อีก 5 ราย, 20 รายได้รับการผ่าตัด open fundoplication พร้อมกันกับการใส่ button, 15 ราย ได้รับการผ่าตัดใส่ button แต่เพียงอย่างเดียว และผู้ป่วยอีก 7 ราย ได้รับการผ่าตัด laparoscopic fundoplication พร้อมกันกับการใส่ button ค่าเฉลี่ยอายุการใช้งานของ gastrostomy button คือ 388.36 วัน และ standard deviation มีค่าเท่ากับ 360.35 วัน กลุ่มผู้ป่วยที่ได้รับการผ่าตัด laparoscopic fundoplication พร้อมกันกับการใส่ button มีค่าเฉลี่ยอายุการใช้งานของ gastrostomy button ต่ำที่สุด

สาเหตุสำคัญในการเอา bard button ออก ก็คือ ภาวะลิ้นของ button รั่ว และการชำรุดของฝาปิด button ในขณะที่การแตกรั่วของลูกโป่งเป็นสาเหตุสำคัญในการเอา Mickey button ออก ในการศึกษานี้ไม่มีการแยกออกของกระเพาะอาหารกับผนังหน้าท้อง และมีปัญหา stoma เพียงเล็กน้อยเท่านั้น เนื่องจากการผ่าตัดใส่ gastrostomy button โดยไม่ได้รับการผ่าตัด gastrostomy มาก่อน มีอายุการใช้งานของอุปกรณ์เป็นที่น่าพอใจ และมีผลแทรกซ้อนเพียงเล็กน้อย ผู้เขียนจึงขอสรุปว่าการผ่าตัดใส่ gastrostomy button โดยวิธีนี้สมควรยึดเป็นมาตรฐานในการให้อาหารผู้ป่วยเด็กในระยะยาวต่อไป

คำสำคัญ : เด็ก, ทารก, ผู้ใหญ่, กระเพาะอาหาร, การให้อาหาร, การให้สารอาหาร, โภชนาการ, อุปกรณ์ให้สารอาหาร, เครื่องมือให้สารอาหาร, ผลแทรกซ้อน, การติดตามผล, ท่ออาหาร, กาสตรอสโตมี, ซิลิโคน, ลำไส้, มนุษย์

รวิศ เรืองตระกูล, Tat Hin Ong
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* สาขาวิชากุมารศัลยศาสตร์, ภาควิชาศัลยศาสตร์, คณะแพทยศาสตร์ศิริราชพยาบาล, มหาวิทยาลัยมหิดล, กรุงเทพ ฯ 10700
** ภาควิชาศัลยศาสตร์, โรงพยาบาล Royal Children's Hospital, Brisbane, ประเทศออสเตรเลีย