Gastrostomy Button: Clinical Appraisal

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Abstract

We retrospectively studied all gastrostomy buttons inserted in the Royal Children's Hospital, Brisbane between 1988 and 1995. One hundred and thirty-two patients (M = 60, F=72) and 388 buttons were analysed. Intellectual handicap and cystic fibrosis comprised the majority of patients. Thirty-three patients had gastrostomy buttons inserted primarily, whereas, 99 patients received gastrostomy buttons inserted into matured gastrostomy stoma. The average longevity of all determined buttons (n = 280) was 360.43 days (SD = 310.24). The first buttons inserted primarily (n = 25) had longer longevity than the first buttons inserted into matured gastrostomy stoma (n = 82) with statistical significance. The average longevity of subsequent buttons was significantly less than the first buttons. Valve incompetence and leakage of gastric content around the shaft were the most common causes of button removal. We concluded that the gastrostomy button is the method of choice for 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

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The gastrostomy button, a skin-level non-refluxing feeding device, was introduced by Gauderer in 1984[1]. Although the gastrostomy button was developed to avoid several problems commonly encountered with the conventional gastrostomy tube, i.e., internal or external migration, inadvertent removal, pivoting action leading to leakage, tissue reaction, discomfort and psychological problems, the experience with this appliance is limited and the spectrum of use has not been clearly defined and its utility and safety has not been clearly assessed.

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Table 1. The indications of button insertion.

	Intellectual Handicap (n = 69)	Cystic Fibrosis (n = 29)	BPD (n = 7)	Chromosome Abnormality (n = 5)	Miscel. (n = 22)	Total (n = 132)
Number of buttons*	162	55	10	17	36	280
Average longevity of buttons (days)	328.03	512.85	504.10	236.88	294.23	360.43
Statistic significance** ($p < 0.05$)		a	a	a,b,c	b,c	

* The buttons that were taken out and the longevity was known.
** a = $p < 0.05$ vs. intellectual handicap, b = $p < 0.05$ *vs* cystic fibrosis, c = $p < 0.05$ *vs* BPD.

Purpose of the study

In order to evaluate the clinical application of the gastrostomy button, we retrospectively studied all buttons for the indications, types of primary operations, longevity of the first and subsequent buttons, factors that determined the longevity of the buttons, types of buttons and the causes of the button removal.

MATERIAL AND METHOD

We retrospectively studied all buttons of patients who received button insertion in the Royal Children's Hospital between December 1988 and December 1995. One hundred and thirty-two patients (M = 60, F=72) and 388 buttons were analysed. The follow-up data were collected from medical records and questionnaires on the telephone. Because an adequate follow-up time was required, we collected the data up to 1st November 1997. The average follow-up time was 3.07 years and the maximum was 8.43 years. Although 23 patients had a follow-up time less than one year, the longevity of the gastrostomy buttons of these patients was calculated using only the gastrostomy buttons that were taken out and the definite longevity known. With regard to the longevity of all gastrostomy buttons in this study, we excluded 108 buttons that were either still in place during the last follow-up or the patients had died while they had the last buttons. These undetermined longevity buttons had an average longevity of 433.51 days.

The longevity of the gastrostomy buttons was measured and the analysis of the difference between each comparable group was carried out by Student's *t* test. The statistical significance was p value < 0.05. The probability of survival of the buttons was evaluated by the Kaplan-Meier estimation method.

RESULTS

One hundred and thirty-two patients received 388 gastrostomy buttons. The primary clinical conditions were 69 intellectual handicap, 29 cystic fibrosis, 7 bronchopulmonary dysplasia, 5 chromosome abnormalities and 22 other miscellaneous cases which included 4 severe gastrooesophageal reflux, 3 oesophageal atresia with stricture and oesophageal dysmotility, 3 metabolic disorders, 2 Mobius syndrome, 2 giant tumours at the neck and chest wall and one each for caustic oesophageal and stomach injury, Foetal Akinesia syndrome, attention deficit disorder, laryngotracheomalasia, neuronal intestinal dysplasia, Opitz Frias syndrome, surfactant deficiency syndrome and 1 unrecognised syndrome (Table 1). The functional performance

Table 2. The distribution of the gastrostomy buttons.

	First button		Subsequent button
	Gastrostomy button into matured stoma	Primary gastrostomy button	
Number of patient	99	33	107
Number of button	99	33	256
Determined button*	82	25	173
Still in place	9	8	63
Died with button	5	0	8
Loss follow-up	3	0	12

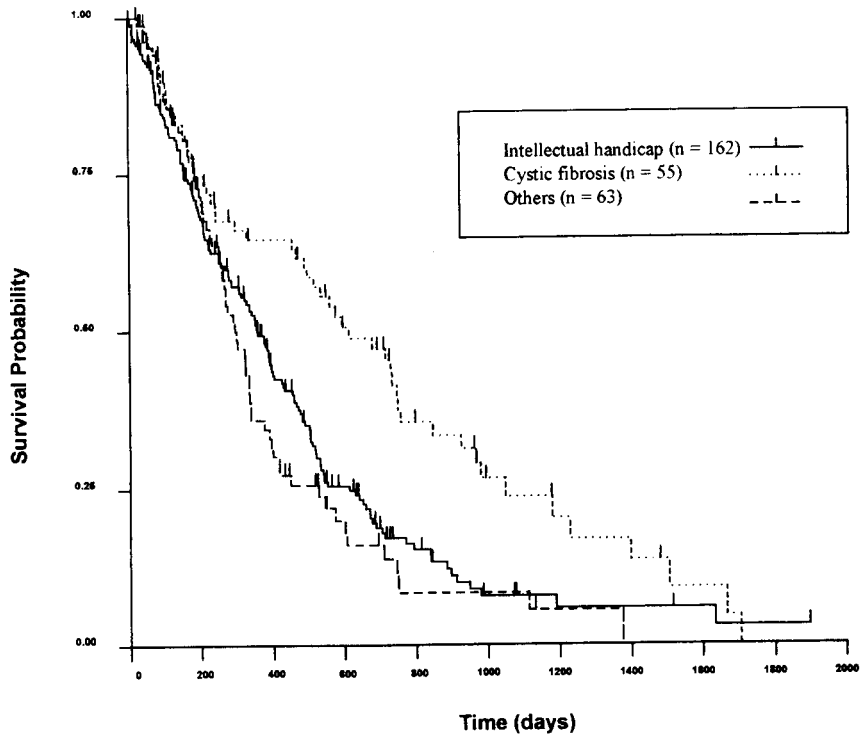
* The buttons that were taken out and the longevity was known.

curves of all buttons comparison between the indications of button insertion are revealed in graph 1.

The distribution of all gastrostomy buttons is revealed in Table 2.

Thirty-three patients received gastrostomy buttons without matured gastrostomy stoma as primary gastrostomy buttons (19 with open fundoplication, 3 with laparoscopic fundoplication and 11 without fundoplication). (Table 3).

Ninety-nine patients had gastrostomy buttons inserted into matured gastrostomy stoma. The average interval between the gastrostomy tube and



Graph 1. Functional performance curves of all buttons (n = 228) (comparison between the indications of button insertion).

Table 3. Primary gastrostomy button.

	Fundoplication+ button (n = 19)	Laparoscopic fundoplication+ button (n = 3)	Primary gastrostomy button (n = 11)	Total (n = 33)
Average age (years)	5.89	3.23	5.44	5.5
No. 1st button*	14	2	9	25
Average longevity	712.86	194.00	451.67	577.32**
(days ,- SD)	(+,- 537.42)	(+,- 12.73)	(+,- 292.00)	(+,- 462.33)
No. subsequent button*	14	1	9	26
Average longevity	289.29	400.00	253.44	272.19***
(days ,- SD)	(+,- 151.14)		(+,- 179.10)	(+,- 153.39)

* The buttons that were taken out and the longevity was known.

** $p < 0.05$ *vs* the 1st button inserted into matured gastrostomy stoma in Table 4

*** $p < 0.05$ *vs* the 1st button of total primary gastrostomy button group

gastrostomy button was 198.24 days (SD = 309.80 days). In this group, 56, 28, 12 and 3 cases received gastrostomy buttons following percutaneous endoscopic gastrostomy, open fundoplication with gastrostomy, open gastrostomy and laparoscopic fundoplication with gastrostomy respectively. (Table 4).

Ninety patients had gastrooesophageal reflux and 8 of them received fundoplication without either gastrostomy or gastrostomy buttons being inserted. Among the remaining 82 gastrooesophageal reflux patients, 53 fundoplication were performed later (22 together with primary gastrostomy

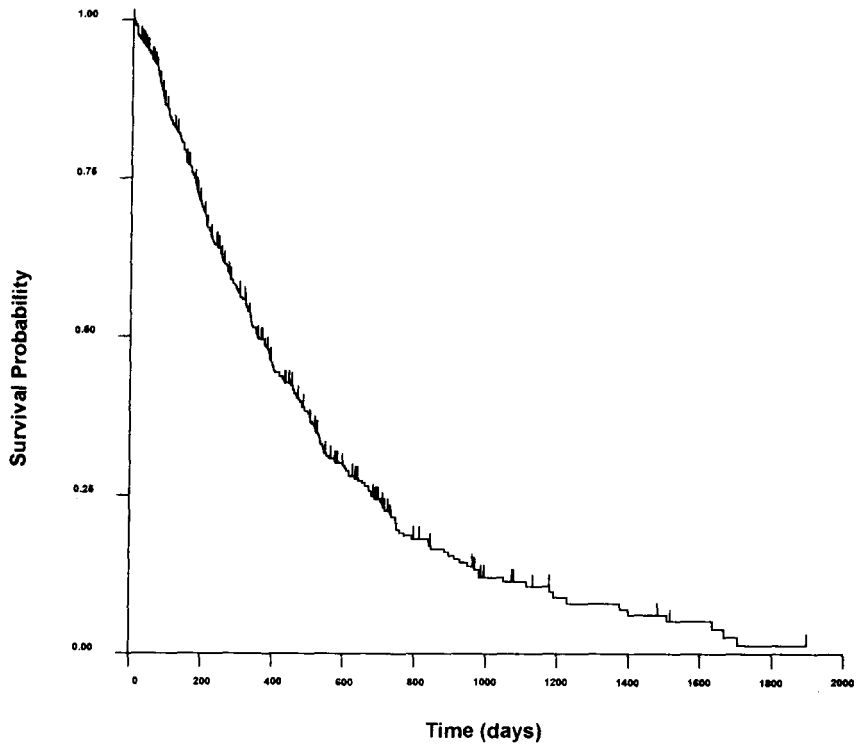
Table 4. The buttons inserted into matured gastrostomy stoma.

	Fundoplication+ gastrostomy (n = 28)	Laparoscopic fundoplication+ gastrostomy (n = 3)	Open gastrostomy (n = 12)	PEG (n= 56)	Total (n = 99)
Average age (years)	4.71	1.66	5.53	6.43	5.7
No. 1st button*	26	2	9	45	82
Average longevity (days ,- SD)	372.23 (+,- 296.53)	544.50 (+,- 289.21)	628.06 (+,- 588.56)	374.98 (+,- 282.53)	406.02** (+,- 335.56)
No. subsequent button*	60	1	18	68	147
Average longevity (days ,- SD)	332.32 (+,- 281.07)	340.00	452.92 (+,- 311.95)	255.19 (+,- 213.68)	311.46*** (+,- 261.41)

* The buttons that were taken out and the longevity was known.

** $p < 0.05$ *vs* the 1st button of the primary gastrostomy button group in Table 3.

*** $p < 0.05$ *vs* the 1st button of total post gastrostomy button group



Graph 2. Functional performance curve of all buttons (n = 280).

button insertion, 31 concomitant with formal tube gastrostomy). Among the remaining 29 patients who had gastrooesophageal reflux but did not receive any fundoplication, 6 patients (2 post PEG, 2 post open gastrostomy and 2 post open button insertion) developed severe gastrooesophageal reflux after gastrostomy buttons were inserted and needed 3 laparoscopic fundoplication, 1 open fundoplication and 2 jejunostomy buttons to correct this problem.

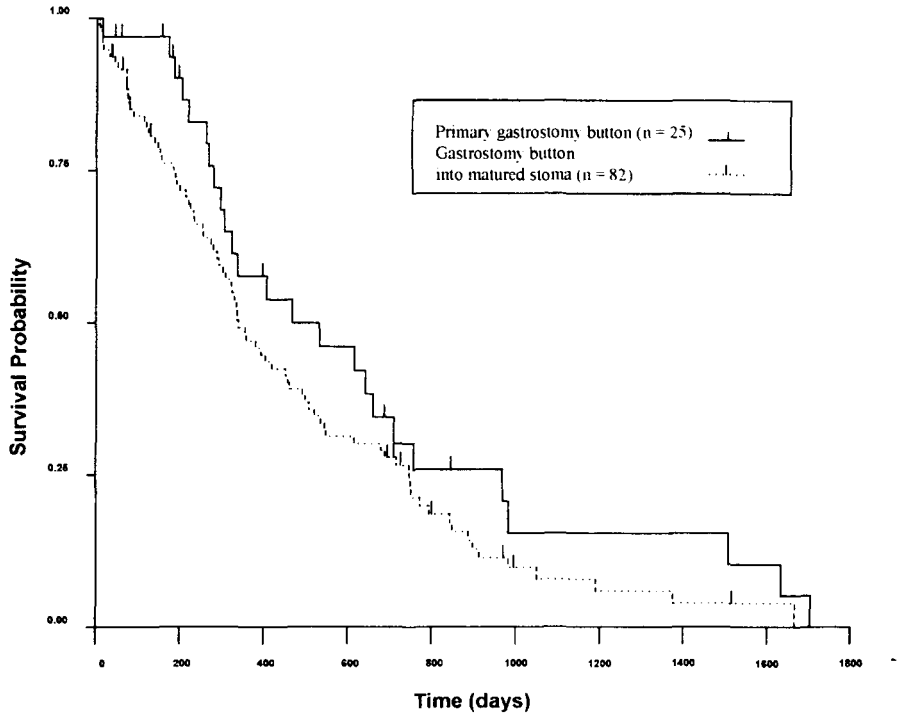
The average longevity of all determined buttons (n = 280) was 360.43 days (SD= 310.24) (Graph 2). The average longevity of the first buttons (n = 107) was 446.04 days (SD = 373.82). The first buttons inserted without matured gastrostomy stoma (n = 25) had longer longevity than the first buttons inserted into matured gastrostomy stoma (n = 82) with statistic significance (577.32 days *vs* 406.02 days : p value = 0.0443) (Graph 3).

The average longevity +,- standard deviation of the subsequent buttons (n = 173) which were inserted into the matured stoma was 305.56 +,- 248.24 days. The average longevity of subsequent gastrostomy buttons was less than the first buttons (n = 107) of either the primary gastrostomy button group or the button inserted into the matured stoma group (p value = 0.0079 and 0.0172 respectively) (Graph 4).

The six months, one year and two year functional performance rates of the first buttons of either primary gastrostomy buttons or the buttons inserted into matured stoma and the subsequent buttons are revealed in Table 5.

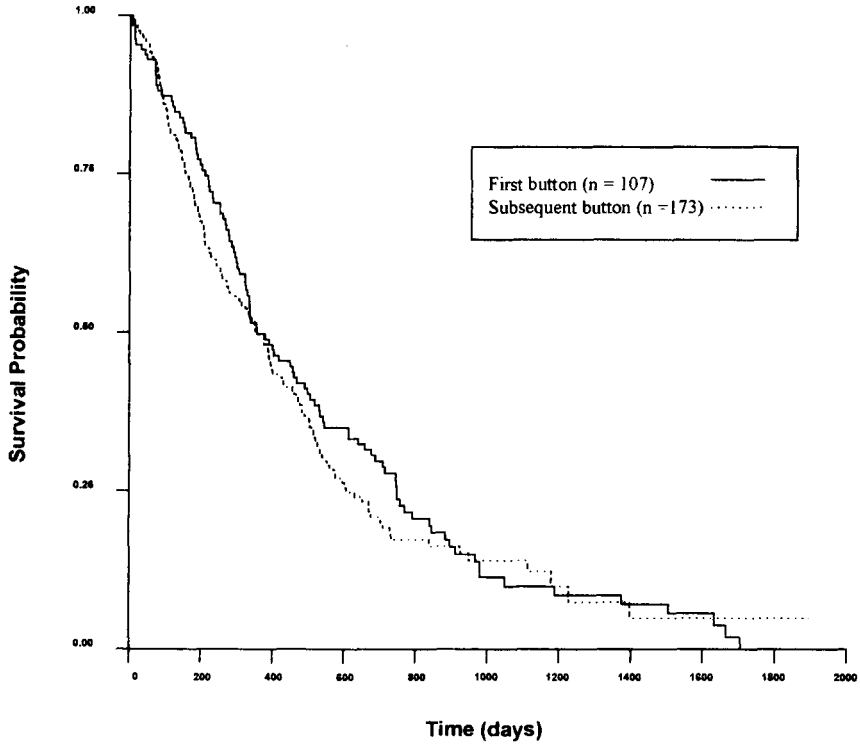
Table 5. Six month, one year and two-year functional performance rates of gastrostomy buttons.

	6 month (%)	1 year (%)	2-year (%)
The first button of primary gastrostomy button	92.00	52.00	24.00
The first button inserted into matured gastrostomy stoma	73.17	41.46	19.51
Subsequent button	60.82	34.50	5.85
All button	67.27	38.13	11.15



Graph 3. Functional performance curves of the first buttons (n = 127) (comparison between two methods of insertion).

Two hundred and fifty-six Bard buttons (Bard Interventional Products, Tewksbury, MA) (Fig. 1), 49 Mic-Key buttons (Medical Innovations Corporation, Draper, Utah) (Fig. 2) and 7 Abbott buttons were used but the longevity was recorded only in 187 Bard buttons, 34 Mic-Key buttons and 7 Abbott buttons. The average longevity of Bard, Mic-key and Abbott buttons was 378.82 days, 259.62 days and 451.43 days respectively (Bard *vs* Mic-Key, p = 0.0326; Bard *vs* Abbott, p = 0.5360 and Mic-Key *vs* Abbott, p = 0.0731) (Graph 5). Every primary gastrostomy button was a Bard button.



Graph 4. Functional performance curves of buttons (n = 280) (comparison between the first button and subsequent button).

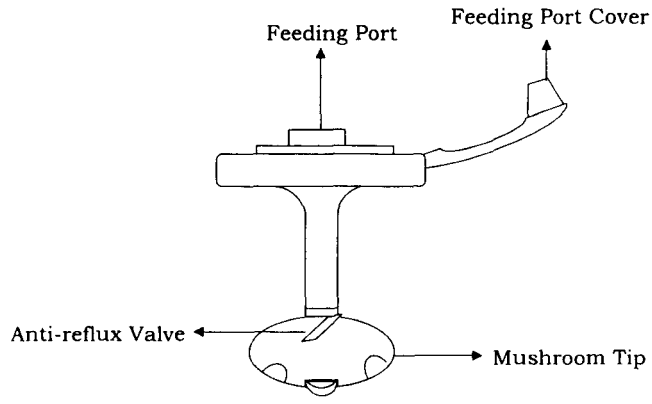


Fig. 1. Bard button.

Two hundred and eighty gastrostomy buttons were taken out. Sixteen gastrostomy buttons were removed because they were no longer need. Among 266 removed gastrostomy buttons, the causes of removal were recorded in 201 gastrostomy buttons. The causes of button removal are recorded in 135 Bard buttons and 25 Mic-key buttons respectively. The causes of button removal are revealed in Table 6.

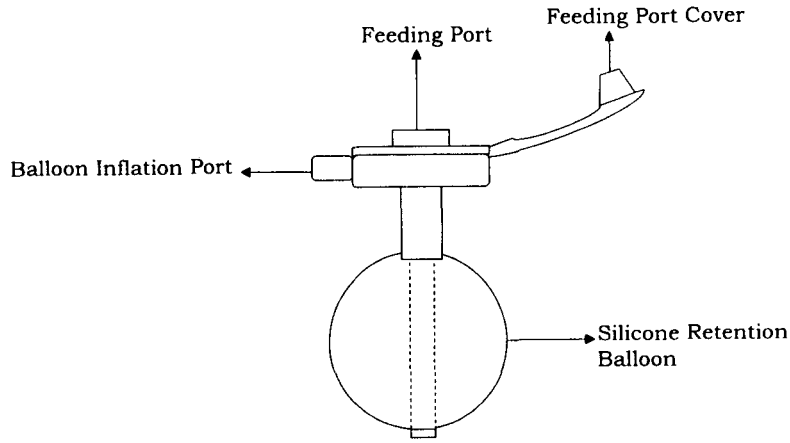
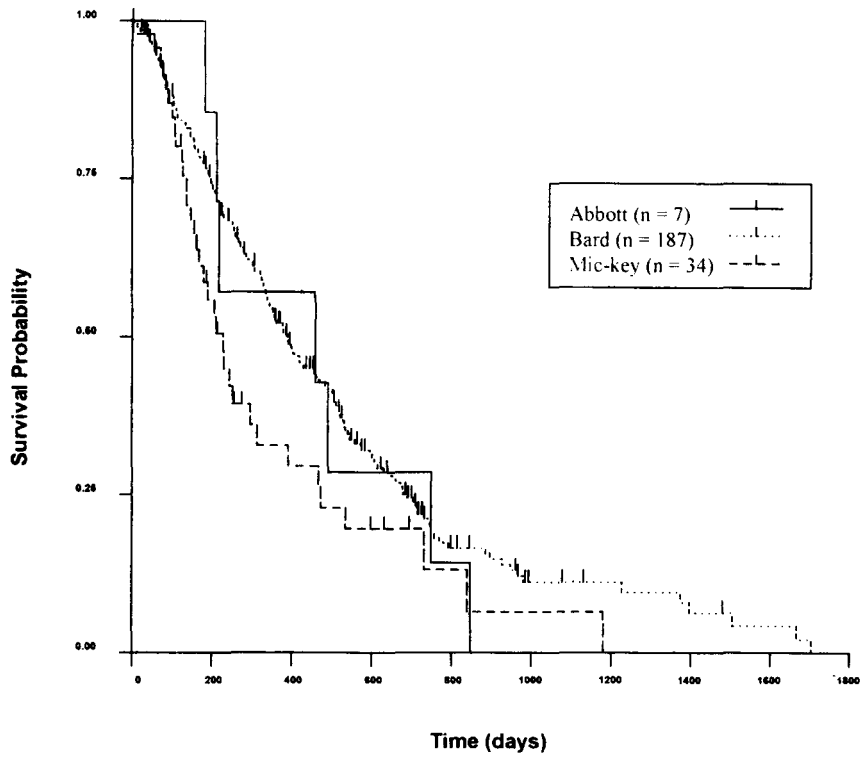


Fig. 2. Mic-Key button.



Graph 5. Functional performance curves of all buttons (n = 228) (comparison between three types of gastrostomy button).

Table 6. The causes of button removal.

Causes of button removal	Bard (n = 135)	Mic-Key (n = 25)	All (n=201)
1. Valve incompetence	37.78% (51)	4.00% (1)	32.84% (66)
2. Leak around button	19.26% (26)	12.00% (3)	19.40% (39)
3. Device damage	17.04% (23)	8.00% (2)	13.93% (28)
4. Too short	9.63% (13)	0.00% (0)	6.97% (14)
5. Balloon rupture	0.00% (0)	44.00% (11)	5.47% (11)
6. Severe granulation	2.96% (4)	12.00% (3)	4.98% (10)
7. Infection	3.70% (5)	4.00% (1)	2.99% (6)
8. Miscellaneous	9.63% (13)	16.00% (4)	13.43% (27)
Accidental pulled out	3	2	10
Severe GOR	2	1	4
Internal migration	1	1	3
Too long	1	0	3
Blockage	2	0	2
Stoma pain	1	0	1
Hematemesis	1	0	1
Gastric separation	1	0	1
External migration	1	0	1
Poor stoma location	0	0	1

One patient received colonic interposition due to caustic stricture of the oesophagus and stomach and one case had gastric transection before. Three cases needed jejunostomy button post gastrostomy button inserted and 2 patients required temporary jejunostomy for gastrooesophageal reflux. Two patients preferred change button to permanent gastrostomy until the rest of their lives.

Twelve patients died from respiratory failure due to aspiration pneumonia and chronic lung diseases underlying cystic fibrosis and 3 cases died from the end stage of neurodegenerative disorder and 1 patient expired from intractable cardiac failure with underlying congenital heart anomaly. No patient died directly from the complications of the operative procedure.

DISCUSSION

The gastrostomy button is a non-refluxing device which has many advantages over the gastrostomy. It offers a less obtrusive procedure, aesthetical superiority to permanent tube devices and quality of life improvement. It decreases the incidence of dislodgment and avoids problems related to gastrostomy tubes such as stoma irritation, leakage, discomfort, granulation tissue and internal migration as well as eliminating the need of frequent tube changes and hospital visits[1-6]. Internal and external migrations of gastrostomy buttons have been described but these incidences are rare[7,8].

The gastrostomy button traditionally is inserted after the tract of gastrostomy matures and the gastrocutaneous fistula tract supported by adhesion between the stomach and the abdominal wall is required[2-4,9-12]. There is a tendency to increase the use of gastrostomy button as a primary procedure without matured gastrostomy stoma. The primary gastrostomy button has many advantages over the gastrostomy button inserted into matured stoma. It eliminates the gastrostomy procedure and several complications commonly seen with gastrostomy tubes, i.e., inadvertent removal, internal and external migrations, pivoting action leading to leakage, discomfort, etc. The patients do not require many hospital visits to dilate and calibrate the diameter of the gastrocutaneous tract and take the unnecessary risk of gastric separation and peritonitis associated with interval gastrostomy insertion[13,14]. In our series, 33 patients had gastrostomy buttons inserted as the primary procedure. The first buttons inserted primarily as primary gastrostomy buttons (n = 25) had longer longevity than the first buttons inserted into matured gastrostomy stoma (n = 82) with statistical significance (577.32 days *vs* 406.02 days: p value = 0.0443).

The methods of insertion of primary gastrostomy button have been modified by many techniques due to the difficulty to insert the flange of the gastrostomy button without damaging the stomach. Some modifications were adapted either from the "pulled technique"[13,14] or "pushed technique"[15-17] of Percutaneous Endoscopic Gastrostomy. Laparoscopy aided gastrostomy button insertion has also been proposed[18,19].

The majority (52.3%) of patients who had gastrostomy buttons inserted comprised intellectual handicap (n=69). The study revealed that patients who had major respiratory problems such as cystic fibrosis (n =29) and bronchopulmonary dysplasia (n = 7) had a better survival rate of gastrostomy buttons than intellectually handicapped patients (328.03 days *vs* 512.85 and 504.10 days respectively). This implies that the prolonged increase of abdominal pressure does not decrease the longevity of the buttons although button malfunction from severe coughing due to excessive intraabdominal pressure has been reported[20].

In 1988, Gauderer reported that the average longevity of the button was 8.9 months[3] but in a later study[4], he suggested that the average longevity was approximately 1 year. In our series, the average longevity of all buttons was 360.43 days which is not so different from Gauderer's series.

The open gastrostomy, PEG as well as the gastrostomy button are well recognised as these procedures increase clinical and radiological gastrooesophageal reflux[21-24]. In our series, 6 from 29 patients who had gastrooesophageal reflux but did not receive fundoplication, developed severe gastrooesophageal reflux after gastrostomy buttons were inserted. This indicates that the clinical evaluation of gastrooesophageal reflux before the procedure is necessary. The clinical judgement deciding whether the concomitant fundoplication should be performed or not, is still being debated. Isch JA. suggested that the concomitant fundoplication should be omitted if clinical reflux has not been demonstrated even if radiological gastrooesophageal reflux is still presented[21].

The average longevity of subsequent gastrostomy buttons was less than the first buttons with statistical significance. The reasons for this might be awareness of the parents. With the first button, the care-taker did not realise the problems which happen to the button requiring button changing and had a tendency to postpone medical help.

Bard buttons (n = 256) which are the most frequently used buttons in this series had a statically significant longer survival than Mic-Key buttons (n=49), (378.82 days *vs* 259.62 days) respectively. These two types of gastrostomy button have their own advantages as well as disadvantages. Although the Bard button has a longer survival period, it has the disadvantage of pain during insertion and removal due to the mushroom dome of the button not allowing it to collapse sufficiently to go to the stoma without pain and it has the high incidence of valve incompetence due to material fatigue, shaft deformability and encrustation of the tubing[2,3,25]. Although the Mic-Key button has an advantage of easy insertion, the major limitation is balloon rupture or balloon leakage which is the main cause of button removal (44%). Haas-Beckert[25] observed the leakage of Mic-Key and found that the leakage site was from the valve for balloon inflation instead of the balloon itself.

Two reports have described three fatal complications of blind replacements related to excessively long gastrocutaneous tracks that caused 2 deaths due to intraabdominal leakage after gastric separation from the anterior abdominal wall and 1 death due to air embolism after the button was inserted through the liver[26,27]. Some authors have recommended verifying the placement of every button device endoscopically or fluoroscopically [2,6,26-28]. With regard to gastric separation, in our series which did not routinely perform endoscopic removal of the buttons except the type of button which dictated endoscopic removal or the patients needed gastroduodenoscopy examination for another reason, there was only one gastric separation from anterior abdominal walls after the gastrostomy button was inserted following PEG performed 56 days before and conservative management easily solved this problem. In the largest reported series, Gauderer reported 3 gastric separations from anterior abdominal walls in 545 button insertions[4]. There were no other major complications related to replacement of the button although the majority of the patients have not been proved endoscopically or fluoroscopically. We recommend that routine endoscopic or fluoroscopic checking after changing the button is an unnecessary and complicated office procedure[3,29].

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ข้อควรคำนึงในการใช้กระดุมกระเพาะอาหาร

รวิศ เรืองตระกูล, พ.บ., Tat Hin Ong, พ.บ.***

ผู้เขียนได้ทำการศึกษาย้อนหลังการใช้ Gastrostomy button ณ โรงพยาบาล Royal Children's Hospital กรุง Brisbane ระหว่างปี พ.ศ. 2531 ถึง พ.ศ. 2538 การศึกษาได้วิเคราะห์ข้อมูลจากผู้ป่วย 132 ราย (เป็นชาย 60 ราย และเป็นหญิง 72 ราย) และจาก 388 Button ผู้ป่วยพิการทางสติปัญญาและผู้ป่วย Cystic fibrosis เป็นผู้ป่วยส่วนใหญ่ในการศึกษานี้ ผู้ป่วย 33 ราย ได้รับการผ่าตัดใส่ Gastrostomy button โดยไม่ได้รับการผ่าตัด Gastrostomy มาก่อน ในขณะที่ผู้ป่วยอีก 99 ราย ได้รับการใส่ Gastrostomy button ในรูเปิดของ Gastrostomy เดิม ค่าเฉลี่ยอายุการใช้งานของ Button ทั้งหมด (n = 280) มีค่าเท่ากับ 360.43 วัน (SD = 310.24) Button อันแรกที่ผ่าตัดใส่แบบ Primary (n = 25) มีอายุการใช้งานนานกว่า Button อันแรกที่ใส่ในรูเปิดของ Gastrostomy (n = 82) อย่างมีนัยสำคัญ ค่าเฉลี่ยอายุการใช้งานของ Button อันถัดมามีค่าน้อยกว่า Button อันแรกอย่างมีนัยสำคัญ การรั่วของลิ้นและการรั่วของน้ำย่อยกระเพาะอาหารออกมารอบ Button เป็นสาเหตุสำคัญในการเอา Button ออก ผู้เขียนขอสรุปว่า Gastrostomy button เป็นวิธีการที่เหมาะสมในการให้อาหารเป็นระยะเวลานานในผู้ป่วยเด็ก

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

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