Gastrostomy use in children : a 3-year single centre experience

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Abstract

Aim : **Monocentric retrospective paediatric study describing indications for gastrostomy and major complications, compared to literature data as part of a quality check.**

Methods : **Records of all gastrostomy patients consulting at the UZ Ghent paediatric gastro-enterology department between January 2007-December 2009 were reviewed in December 2010 regarding indication, age and weight at tube insertion, insertion method, major complications and current gastrostomy tube type.**

Results : **178 patients were included of which 165 (93%) were placed using the endoscopic pull technique, the others were placed surgically (n = 13). Neurodevelopmental disability with oral motor dysfunction was the major indication (113, 63%). Other indications were failure to thrive due to concomitant disease (65, 37%). Median age at tube insertion was 3yr (interquartile range (IQR) 0.6-9) with median tube time of 3.9 yr (IQR 1.9-7.2).**

Immediate complications were 1 peritonitis and 1 post-insertion fever episode. Late complications (10, 5.6%) were 1 gastrocolic fistula, 1 dislocation and 8 buried bumpers after 4 yr (range 3.5-10.4) of tube insertion. The incidence of buried bumper increased significantly with increasing PEG tube time ($P < 0.01$).

Gastro-oesophageal reflux disease (GORD) led to Nissen fundoplication in 45 (25.3%) patients. The proportion of patients receiving a fundoplication remained about 20% over time but the time lapse between the 2 procedures decreased significantly.

Conclusion : **The development of buried bumper is associated to prolonged PEG tube use. In case of important GORD laparoscopic Nissen procedure and PEG placement can be performed simultaneously without increasing complication rate.** (Acta gastroenterol. belg., **2014**, 77, **8-12**).

Key words : PEG tube, gastrostomy, complications, buried bumper.

Abbreviations

NDD :	neurodevelopmental disability
GORD :	gastro-oesophageal reflux disease
PEG :	percutaneous endoscopic gastrostomy
IQR :	interquartile range
yrs :	years

Introduction

Since the description of the percutaneous endoscopic gastrostomy (PEG) by Gauderer (1) more than 25 years ago, this technique became the method of choice for the creation of a gastrostomy because of the early postoperative feeding possibility (2) and decreased operative time (3). The gastrostomy has become the preferred administration route to provide medium (more than 1-3 months) and long-term nutritional support (4) in patients with impaired feeding abilities leading to malnutrition (5). The gastrostomy tube is more comfortable and less prone to dislocation than the nasogastric tube (6). Long term enteral feeding is indicated in children with impaired oral motor skills leading to insufficient or unsafe oral intake, in patients with increased caloric requirements or in patients with metabolic diseases with the need for a constant and reliable caloric supply or a specific, less palatable diet. These patients are candidates for a gastrostomy.

PEG use improves nutrition and growth of patients (7), reduces feeding time and improves drug administration (8,9). The quality of life of the caregivers improves simultaneously (10). On the other hand, PEG remains an invasive procedure, carrying the risk for complications (5). In order to describe major complication burden, all files of gastrostomy patients consulting at a Belgian tertiary centre over a 3-year period (2007-2009) were reviewed, evaluating indications, age and weight at tube insertion, method of placement, method related major complications and tube feeding duration.

In our centre, patients are selected for PEG tube placement by a paediatric gastroenterologist if longstanding tube feeding is necessary because of insufficient or unsafe oral feeding. Parents receive information about the technique, possible complications and care after the tube placement. Patients are systematically assessed for gastro-oesophageal reflux (GOR) by history of possible reflux associated signs and symptoms. In case of suspicion of GOR a contrast study, pH-metry and endoscopy are used to confirm gastro-oesophageal reflux disease (GORD). A Nissen surgery is considered when severe GORD is diagnosed associated with a poor feeding tolerance due to repeated vomiting. Each decision for Nissen surgery is individually evaluated within the multidisciplinary team as the association Nissen-PEG makes the procedure more invasive. Issues to be taken into account are nutritional status, aetiology and prognosis of the underlying disease, as well as respiratory status.

Following informed consent by the parents, PEG procedure is performed by a two headed team under general anaesthesia using standard pull procedure with a single dose of Cephazoline at the time of tube insertion (11).

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Tube feeding is started 12h after tube insertion. Parents are instructed to push and turn the PEG tube on a daily basis. PEG tubes are changed for buttons or balloon gastrostomy tubes in ambulatory patients after a minimum period of 6 weeks to a maximum period of 2 years. In the neurodevelopmental disability (NDD) patients a PEG tube was often changed for a new PEG tube after 1.5-2 years when patients had general anaesthesia for another reason (dental care, botox infiltrations, orthopaedic surgery). This practice gave parents tube-security as accidental removal is unlikely with a PEG-tube. Moreover, button gastrostomy tubes have not been reimbursed by the Belgian Health insurance until 2006 hence this practice has been cheaper for the patient.

Method

All files of gastrostomy tube patients consulting at the paediatric gastro-enterology department between January (Jan.) first 2007 and 31 December (Dec.) 2009 have been reviewed in Dec. 2010, providing a patient follow up of at least 1 year. The date, method and centre of the first tube placement were recorded. Further on indication, age and weight at placement, major complications, death, decrease in proportion (tube feeding/ oral intake) or removal of the gastrostomy during the observation period, follow up time with gastrostomy as well as the need for fundoplication and time lapse between PEG and fundoplication were noted.

Major complications were defined as complications requiring a surgical or endoscopic procedure, non-prophylactic antibiotics or blood transfusion or complications leading to death. Patients were followed by their primary care physician hence records do not contain information on minor complications needing only local therapy such as granuloma or local infection at the stoma site.

Patients have been divided into 3 groups depending on the placement date : group A : tube placement before 2004, group B : Tube placement between Jan. first 2004 and 31 Dec. 2006, and group C : between Jan. first 2007 and 31 Dec. 2009. The collected data were compared between the different subgroups to evaluate eventual changes over time. Results are given as median and interquartile ranges (IQR) between brackets. Significance of differences was calculated using a Mann Whitney U test or a Kruskall Wallace test. Two-sided P-values < 0.05 were considered significant. Statistical analysis was performed with IBM-SPSS 20.

Results

From Jan. 2007 to Dec. 2009, 178 patients with a gastrostomy consulted at the centre. Of these, 6 had their gastrostomy placed at another centre. In 85 patients the tube was inserted during this 3-year observation period.

The majority was placed endoscopically (165, 92.7%). Only 13 (7.3%) received a surgical gastrostomy. The indications for a surgical gastrostomy were : 4 oesophageal atresia, 3 peritoneal dialysis, 2 hepatomegaly, 2 pharyngeal abnormalities, 1 caustic oesophageal stenosis and 1 presence of a ventriculoperitoneal drain.

The median age of the patients at the time of the survey was 7.8 year (yr) (4.5-16.8). The median time with a gastrostomy of this cohort at the time of the review was 3.9 (1.9-7.2). The median age at tube placement was 3 yr (0.6-9). When comparing the different cohorts, the patients who recently received a gastrostomy tended to be younger (n.s.) and had a lower weight ($P < 0.03$) (table 1). The minimum weight at placement decreased from 5 to 2.5 kg. Differences between the three cohorts regarding the age at placement are described in table 1 and differences regarding the indication in table 2.

NDD or muscular disease leading to swallowing disorders was the indication in 2 out of 3 patients in all 3 subgroups (113, 63.5%). The number of patients with the indication of failure to thrive as result of cystic fibrosis (16), gastroenterological disorders (15), metabolic disease (13), cardiologic disease (9), nephrological disorders (9) and oncological diseases (3) fluctuated over the years.

The type of device at the time of the survey was a PEG tube with an inner plate in 101 (56.7%) patients of which 6 were elongated with a duodenal tube. The number of consecutive PEG-type tubes a patient has had, is significantly different for NDD patients. The median number of PEG tubes in the total cohort was 1 (IQR 1-3) in contrast to 2 (1-4) in the NDD patients ($P < 0.003$). This is a consequence of the above-mentioned practice of changing a PEG-tube for another PEG-tube but also from the fact that the very young patients with a low weight receive a PEG charriere 9. It is not always possible to dilate the gastrostomy to a charriere 14 (the smallest button gastrostomy). As a consequence NDD patients are more likely to have a PEG tube (79/113 ; 69.9%) ($P < 0.001$).

Since the reimbursement of the buttons in 2007, button gastrostomy tubes (63 ; 35.4%), or balloon gastrostomy tubes (14 ; 7.9%) are systematically used after the initial PEG tube if the gastrostomy size allows it.

Immediate major complications have been noted in 2 patients (1%). One patient has developed peritonitis immediately after tube placement. Important scoliosis made trans-illumination difficult in this patient. He was successfully treated with intravenous antibiotics. The same patient, however, developed also a gastrocolic fistula necessitating surgery. Another patient with a ventriculoperitoneal drain has been treated with intravenous antibiotics for 1 week because of fever within the first day after PEG insertion without clinical sign of peritonitis. Late complications were observed in 10 (5.6%) patients : the gastrocolic fistula (see above), a tube dislocation necessitating surgery and 8 cases of buried bumpers (4.5%). A buried bumper occurred only in NDD patients with a PEG tube and after a median tube time of 4 yr (IQR : 3.8- 8.25 ; Range 3.5-10.4), despite the instruction of daily mobilisation of the tube. Surgical

Table 1. — **Different aspects of gastrostomy patients and subgroups according to the year of gastrostomy placement**

	Total Group n = 178	**Group A** (< 2004) [1] n = 49	**Group B** (2004-2006) [2] n = 44	**Group C** (2007-2009) [3] n = 85	***Significance***
Age (yrs) at tube placement **Weight** (kg) at placement	3 (0.6-9) 10 (6.4-19.7)	5 (0-17) 10.5 (8-17.5)	3.25 (0-37) 13.5 (7.6-27.5)	1.66 (0-26) 9 (5.2-15)	*n.s.* ***P < 0.03***
Time with gastrostoma (yrs)	3.9 (0.9-7.2)	9.7 (2.4-26.8)	5.2 (2.3-6.7)	2.3 (0.5-4)	
Indications [4] : NDD & muscular disease Cystic Fibrosis Gastrointestinal disease Cardiologic disease Nephrologic disease Oncologic disease Metabolic disease	 113 (63.5%) 16 (9%) 15 (8.5%) 9 (5%) 9 (5%) 3 (2%) 13 (7%)	 32 (66%) 6 (12%) 4 (8%) 1 (2%) 1 (2%) 0 (0%) 5 (10%)	 28 (64%) 6 (13.5%) 2 (4.5%) 0 (0%) 4 (9%) 1 (2%) 3 (7%)	 53 (62%) 4 (5%) 9 (%) 8 (9.5%) 4 (5%) 2 (2%) 5 (6%)	
Tube type : PEG tube Button Balloon gastrostomy	 101 (56.7%) 63 (35.4%) 14 (7.9%)	 28 (57.1%) 19 (38.8%) 2 (4.1%)	 16 (36.4%) 24 (54.5%) 4 (9.1%)	 57 (67.1%) 20 (23.5%) 8 (9.4%)	
Tube removal : number Time between placement & removal (yrs)	28 (15.7%) 2.4 (1.3-4.1)	6 (12.2%) 6.3 (4.5-8.3)	7 (15.9%) 4.1 (3.3-4.3)	15 (17.6%) 1.4 (0.8-1.9)	
Death : number Time between placement & death (yrs)	20 (11.2%) 1.8 (0.6-7.8)	6 (12.2%) 8.4 (7.8-8.6)	2 (4.5%) 2.6 (2.2-8)	12 (141.2%) 0.7 (0.3-1.2)	
Nissen : total number Time (yrs) PEG-Nissen Simultaneous procedures	45 (25.3%) 0 (0-1.1) 21	10 (20.4%) 3.3 (1.5-4) 1	16 (36.4%) 0 (0-0.2) 8	19 (22.4%) 0 (0-0) 12	*n.s.* ***P < 0.001*** ***P < 0.001***
Buried bumper number **Time** with tube until bumper (yrs)	8 (4.5%) 4 (3.8-8.3)	5 (10.2%) 6.9 (3.8-9.8)	3 (6.8%) 3.9 (3.6-4.1)	0 (0%)	***P < 0.01***
Number of PEG tubes in 1 patient	1 (1-3)	4 (1-7)	2 (1-3)	1 (1-2)	***P < 0.01***
Proton Pump Inhibitor use	64 (36%)	19 (38%)	18 (40%)	27 (32%)	

Significance of differences between the subgroups were calculated with chi-square or Kruskall Wallis test. Tied P values are indicated in the last column. Results are given as Median and interquartile ranges between brackets. There is a significant decrease in weight at placement over the years as well as significant more simultaneous Nissen procedures.

Group A had a tube placed before 2004, Group B had a tube placement between 2004 and 2006 and group C between 2007 and 2009.

Abbreviations : yrs : years, kg : kilogram, NDD : neurodevelopmental delay, CF : cystic fibrosis, PEG : percutaneous endoscopic gastrostomy.

intervention was necessary in 6/8 in the other cases the bumper was endoscopically removed. This observation together with the reimbursement of the button tube stimulated a change in hospital practice.

During the observation period 20 (11.2%) patients died of non-gastrostomy related causes. Fourteen patients with NDD died of complicated pulmonary failure, 3 had incurable brain tumours, 1 inoperable cardiac patient, 1 cystic fibrosis patient with end stage lung disease and 1 patient died of decompensated metabolic disease.

It has been possible to remove the gastrostomy in 28 (16%) non-NDD patients after a median tube time of 2.3 yrs (0.6-4.1).

GORD led to laparoscopic Nissen fundoplication in 45 (25.3%) patients. These were mainly patients with NDD (35/45, 77.8%). In the different cohorts the percentage in need of GORD surgery remained about 20%, however, the time lapse between the 2 procedures decreased significantly ($P < 0.0001$). Simultaneous performance of a laparoscopic Nissen fundoplication with an endoscopic gastrostomy placement increased from 1 (9%) in group A to 12 (63%) in group C.

Acid suppressive drugs were used in 76 patients (42.7%) of which 64 received proton pump inhibitors and 12 H_2-blockers. Of the 42 patients who received a Nissen fundoplication 16/45 (35.5%) still needed proton pump inhibitors after surgery for the treatment of persisting oesophagitis.

Discussion

PEG became the preferred method of gastrostomy placement, being less invasive than surgery. Only a minority will receive a surgical gastrostomy as a result of a contraindication for PEG or an anatomic impossibility to perform an endoscopic procedure (12). The experience with the technique is increasing hence the contraindications are changing over time. As also observed by Daveluy *et al.* (13), there was a significant decrease in weight and a decreasing trend in age at PEG insertion, indicating more experience and confidence with the technique. Further on, a ventriculo-peritoneal shunt or peritoneal dialysis is no longer considered a strict contraindication (5). As has been reported earlier (14, 15), the main

Table 2. — **Clinical aspects of the patients and the PEG use according ton the gastrostomy indication**

		Total N = 178	Cardiologic disease N = 9 (5%)	Cystic fibrosis N = 16 (9%)	Gastro-intestinal N = 15 (8.5%)	Metabolic disease N = 13 (7%)	NDD N = 113 (63.5%)	Nefrologic disease N = 9 (5%)	Oncologic disease N = 3 (2%)
Age / weight at placement	weight (kg)	10 (6.4-19.7)	5 (4.3 -6.4)	39.7 (24.9-44.1)	6.6 (5.2-8)	9.4 (5.6-13.5)	10 (7.2-19)	8.2 (5.9-12)	12.3 (10.6-24.3)
	age (yrs)	3 (0.6-9)	0.5 (0.5-0.7)	15 (11-21.5)	0.6 (0.3-1.9)	1.7 (0.6-3.3)	3.4 (0.1-9.1)	1.3 (0.4-2)	3.5 (1.6-7.9)
Time with stoma	yrs	3.9 (0.9-7.2)	1.4 (0.7-1.8)	5.4 (2.9-8.6)	2.6 (0.9-4.1)	4.9 (2.3 -9.1)	4.1 (2.5-7.5)	3.4 (1.9-4.6)	0.75 (0.3-1.7)
Tube type number (%)	PEG	101 (56.7%)	5 (55.6%)	0	3 (20%)	6 (46.1%)	81 (71.7%)	4 (44.4%)	2 (66.7%)
	button	63 (35.4%)	2 (22.2%)	16 (100%)	11 (73.3%)	6 (46.1%)	22 (19.5%)	5 (55.6%)	1 (33.3%)
	balloon	14 (7.9%)	2 (22.2%)	0	1 (6.7%)	1 (6.7%)	10 (8.8%)	0	0
Time to removal	number	28 (15.7%)	5 (55.6%)	3 (18.8%)	9 (60%)	1 (7.7%)	6 (5.3%)	4 (44.4%)	0
	time (yrs)	2.4 (1.3-4.1)	0.8 (0.6-1.4)	1.6 (1.3-5.1)	2.4 (1.3-3.5)	8.4	3.4 (1.6-4.1)	3.9 (2.7-4.5)	
Time between **PEG & Nissen**	number	45	1	0	2	2	39	1	0
	time (yrs)	0 (0-1.1)	0		0.8 (0-1.5)	2 (0-4)	0 (0 -1)	0	
Buried bumper Number, time with	number **P < .001**	8	0	0	0	0	**8**	0	0
	time (yrs) **P < .001**	4 (3.8-8.3)					**4 (3.8-8.3)**		
consecutive PEG tubes	number **P < .001**	1 (1-3)	1 (1-2)	1 (1-1)	1 (1 -1)	1 (1-2)	**2 (1-4)**	1 (1-2)	1 (1-1)
PPI	number	64 (36%)	0	3 (18.8%)	3 (20%)	4 (30.8%)	50 (44.2%)	2 (22.2%)	2 (66.6%)

Significance of differences between the subgroups are calculated with fisher exact or Kruskall Wallis test. Tied P values are indicated in the last column. Results are given as Median and interquartile ranges between brackets. Patients with neurodevelopmental delay were more likely to have consecutive PEG tubes. They were the only patient group developing buried bumper.

Abbreviations : yrs : years, kg : kilogram, NDD : neurodevelopmental delay, CF : cystic fibrosis, PEG : percutaneous endoscopic gastrostomy, PPI : proton pump inhibitor.

indication for PEG insertion remains oral motor dysfunction associated with NDD.

The ultimate goal of nutritional support is normalising oral intake and nutritional status (16). This has been possible in 16% of this population leading to removal of the tube.

Literature is not clear whether PEG insertion increases the risk for GORD (17- 19). As patients with NDD are a major part of the population in need for a PEG tube, GORD is often a concomitant disease (20). Systematic clinical assessment followed by investigations on indication, as was done in this cohort, remains the best way to evaluate whether Nissen is indicated (21). Up to now there are no strict criteria to guide the decision for Nissen surgery. Several parameters should be taken into account : nutritional status, aetiology and prognosis of the underlying disease, as well as respiratory status. Only when severe GERD associated with impaired pulmonary function is present, or when GERD is not controlled by medical treatment, Nissen fundoplication associated with gastrostomy should be considered. However, this pragmatic approach has not yet been evaluated.

Laparoscopic antireflux procedures and PEG placement can be performed during the same anaesthesia (22). The Nissen procedure has a proven effect on emesis and hematemesis in NDD patients, however, the effect on the respiratory problems in these patients is not yet clear (23). The experience with the techniques in our centre led to an increased clinical awareness of the possible need for a Nissen procedure at the time of PEG insertion. The proportion of patients receiving a laparoscopic Nissen fundoplication, however, did not change over time but more patients received these procedures simultaneously.

The frequency of PEG complications reported depends on experience, technique used and whether minor complications are included in the report (20,24,25). The observed 6.7% (12/178) major complication rate in this cohort is comparable to the 3-12% reported in literature (11,26). The number (8/178, 4.5%) of patients developing a buried bumper is, however, higher than the reported 2.4% (26). This complication was only observed in NDD patients with longstanding (> 4 years) PEG tube despite daily mobilisation of the tube (27) and was probably a consequence of the PEG for PEG changes

often performed in this patient cohort. It is impossible to determine the influence of proton pump inhibitors, associated with mucosal hyperplasia (28), in this complication as almost all NDD patients take them. The observed decline in this complication could be the result of a shorter observation period but also due to changed hospital practice. Reimbursement for button gastrostomies by the Belgian Health insurance changed since Dec. 2006 ; hence PEG tubes are changed into low profile balloon devices after a maximum of 2 years. Keeping this observation in mind, the PEG tube with internal plate should be changed into a balloon type tube.

Conclusion

Gastrostomy tubes are increasingly used for children with nutritional problems of which neurodevelopmental delay accounts for 60% of the indications. Complications are limited in experienced hands. Awareness of concomitant GORD has led to an increased number of patients receiving a simultaneous laparoscopic Nissen procedure. Limiting the PEG tube (with inner plate) time will probably reduce the occurrence of buried bumper.

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