

Gastrostomy tube insertion in children: The Edmonton experience

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BACKGROUND: Although gastrostomy tube insertion – whether endoscopic or open – is generally safe, procedure-related complications have been reported.

OBJECTIVE: To compare gastrostomy tube insertion-related complications between percutaneous endoscopic gastrostomy and open gastrostomy at a single pediatric centre.

METHODS: The charts of children (younger than 17 years of age at the time of tube insertion) who underwent endoscopic or open gastrostomy tube insertion from January 2005 to December 2007 at the Stollery Children's Hospital (Edmonton, Alberta) were examined.

RESULTS: A total of 298 children underwent gastrostomy tube insertion over a period of three years. After excluding patients with incomplete charts, 160 children (91 boys, mean \pm SD] age 3.18 \pm 4.73 years) were included. Eighty-five children (mean age 4.50 \pm 5.40 years) had their gastrostomy tube inserted endoscopically, while the remaining 75 (mean age 1.68 \pm 3.27 years; $P < 0.001$) underwent an open procedure. The overall rate of major complications was 10.2% for the endoscopic technique and 8.6% for the open technique ($P = 0.1$). Major infections were higher in the endoscopic technique group, while persistent gastrocutaneous fistulas after tube removal were more common in the open technique group.

CONCLUSION: Although the rate of major complications was similar between the endoscopic and open tube insertion groups, major infections were more common among children who underwent endoscopic gastrostomy. The decision for gastrostomy tube insertion was primarily based on clinical background.

Key Words: Children; Gastrostomy; PEG

Percutaneous endoscopic gastrostomy (PEG) is one of the most widely used methods for nutritional support in children. While short-term enteral nutrition can be provided via nasogastric or nasojejunal tubes, it is difficult to continue this route for long durations (1). Consequently, the invention of PEG by Gauderer (2) in 1979 has been recognized as a valuable tool.

Common indications for gastrostomy (G) tube insertion include failure of adequate intake due to impossible or chronic inadequate oral intake (eg, neurological disorders with inability to swallow or dysphagia), craniofacial abnormalities, oncological problems with malnutrition, and other clinical conditions that lead to wasting and malnutrition (eg, chronic renal failure, cystic fibrosis, metabolic problems, chronic infections such as HIV, cardiac disease, short bowel syndrome and Crohn's disease) (3-5). Other important indications include recurrent documented aspiration, the need for a route to administer medication and, rarely, for gastric drainage and decompression (1-6).

Ethically justified and comprehensive guidelines should be adhered to during the decision-making process for PEG insertion (1).

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L'insertion d'une sonde de gastrostomie chez les enfants : l'expérience d'Edmonton

HISTORIQUE : Même si l'insertion d'une sonde de gastrostomie par endoscopie ou voie ouverte est généralement sécuritaire, on observe des complications liées à cette intervention.

OBJECTIF : Comparer les complications liées à l'insertion d'une sonde de gastrostomie selon la technique de gastrostomie par endoscopie percutanée ou la gastrostomie ouverte dans un seul centre pédiatrique.

MÉTHODOLOGIE : Les chercheurs ont examiné le dossier d'enfants (de moins de 17 ans au moment de l'insertion de la sonde) qui ont subi l'insertion d'une sonde de gastrostomie par endoscopie ou par voie ouverte entre janvier 2005 et décembre 2007 au *Stollery Children's Hospital* d'Edmonton, en Alberta.

RÉSULTATS : Au total, 298 enfants ont subi l'insertion d'une sonde de gastrostomie sur une période de trois ans. Après l'exclusion des patients au dossier incomplet, 160 enfants (91 garçons, âge moyen \pm ÉT] de 3,18 \pm 4,73 ans) ont participé à l'étude. Quarante-vingt-cinq enfants (âge moyen de 4,50 \pm 5,40 ans) se sont fait insérer la sonde de gastrostomie par voie endoscopique, tandis que les 75 autres (âge moyen de 1,68 \pm 3,27 ans; $P < 0,001$) ont subi une intervention ouverte. Le taux global de complications majeures s'élevait à 10,2 % pour ce qui est de la technique endoscopique, et de 8,6 % pour ce qui est de la technique ouverte ($P = 0,1$). Les infections majeures étaient plus fréquentes dans le groupe ayant subi la technique endoscopique, tandis que les fistules gastrocutanées persistantes après le retrait de la sonde étaient plus courantes dans le groupe ayant subi la technique ouverte.

CONCLUSION : Même si le taux de complications majeures était similaire dans les groupes s'étant fait insérer une sonde par voie endoscopique et par technique ouverte, les infections majeures étaient plus courantes chez les enfants qui avaient subi une gastrostomie endoscopique. La décision de procéder à l'insertion d'une sonde de gastrostomie se fondait d'abord et avant tout sur les antécédents cliniques.

Although PEG insertion is generally a safe procedure, complications in children have been reported with different frequencies. Major complications (1% to 17%) that may require surgical intervention include the following: major infection, peritonitis, peritoneal abscess, fasciitis and skin cellulitis, bleeding, perforation/tear of a viscus or solid organ rupture, fistula formation, disruption of the tract/detachment of the stomach wall from the skin, aspiration pneumonia and chronic gastrocutaneous fistula (7-12). Minor complications are very common (up to 50%) and include minor infections with granuloma formation, tube clogging, gastroesophageal reflux disease (GERD) or aggravation of GERD, tube dislodgement, leakage and buried bumper syndrome (7-12).

Edmonton (Alberta) is one of the few Canadian pediatric gastroenterology centres where PEG insertion is performed solely by pediatric gastroenterologists.

The aim of the present study was to review the clinical practice of the pediatric gastroenterology unit at The Stollery Children's Hospital in Edmonton, with respect to G tube insertion between January 2005 and December 2007, and to compare PEG insertion-related complications with those related to open G tube insertion.

TABLE 1
Indications for gastrostomy tube insertion

Indication	n (%)
Neurological	65 (41)
Gastrointestinal	23 (14.4)
Aspiration	29 (18)
Cardiac	8 (5.3)
Renal	8 (5.0)
Oncological	4 (2.8)
Metabolic	5 (3.4)
Other	10 (6.3)
Undiagnosed	6 (3.8)

METHODS

Patients

A retrospective chart review, examining all children (younger than 17 years of age at the time of G tube insertion) who underwent either PEG or open G tube insertion between January 2005 and December 2007, at the Stollery Children's Hospital, was performed.

Patients' demographics, underlying diagnosis/indication for G tube insertion, relevant investigations before G tube insertion, type of insertion, procedure-related complications and the need for fundoplication after insertion were examined.

Statistical analysis

Summaries (means, medians, ranges and SDs) were obtained for continuous variables, while frequency distributions are provided for categorical variables. For normally distributed data, an unpaired *t* test was used to compare continuous variables. A two-sample proportion test was used to compare complication rates between the PEG group and open G tube group. A significance level of 0.05 was used for all tests. Data were analyzed using Stata version 9.1 (Stata, USA).

Ethics

The study protocol was approved by the Health Research Ethics Board of the University of Alberta, Edmonton, Alberta.

RESULTS

The charts of 298 children were examined, 138 of which were excluded due to incomplete data or charts. Of the remaining 160 patients (91 boys, mean [\pm SD] age 3.18 \pm 4.73 years), 85 (51 boys, mean age 4.50 \pm 5.40 years) underwent endoscopic G tube insertion (ie, PEG), while the remaining 75 (40 boys, mean age 1.68 \pm 3.27 years; $P < 0.001$) underwent an open procedure. The mean weight of individuals in the PEG group at insertion was 13.5 \pm 9.6 kg and, after a mean follow-up period of 1.8 \pm 0.9 years, was 17.2 \pm 11.2 kg ($P < 0.05$). For patients in the open-insertion group, the mean weight at insertion was 8.6 \pm 8.4 kg and, after a mean follow-up period of 1.6 \pm 0.7 years, was 13.1 \pm 8.1 kg ($P < 0.05$).

During the same period, only four patients underwent radiological or laparoscopic G tube insertion. These patients were excluded from the analysis because the number was too small to draw valid conclusions.

Nissen's fundoplication was performed in 44 children for associated GERD. Of these procedures, 36 (82%) were performed at the time of initial G tube insertion (open procedure). The remaining eight patients underwent Nissen's fundoplication following G tube insertion due to either unresolved or new-onset GERD symptoms that were refractory to medical treatment.

Indications

The most common indication for G tube insertion was failure of oral intake due to chronic neurological abnormalities (41%, mostly cerebral palsy), followed by chronic aspiration in neurologically normal children (18%), gastrointestinal (GI) disease (eg, short bowel syndrome) in 14% of children, and cardiac and renal conditions (Table 1).

Preceding related investigations

The most frequently performed investigation before G tube insertion was a barium GI study (swallow/follow-through) in 37.5% of patients. Other investigations included gastric emptying scans, pH studies and upper GI endoscopies with biopsies (Table 2). Although it appears that patients undergoing concurrent fundoplication were more thoroughly investigated, the majority of patients did not undergo any preprocedure GI-related investigations. Consequently, the decision for G tube insertion was made on the basis of clinical judgement.

Complications

A total of 35% of patients (56 of 160) experienced one or more complication(s) either during or after G tube insertion, 18.8% (30 of 160) experienced a major complication, while 24.4% (39 of 160) experienced a minor complication. The most common major complications were chronic gastrocutaneous fistula (after G tube removal), major infections (defined as infections that required intravenous antibiotics) and aspiration pneumonia. Major infections included cellulitis, peritonitis, and skin or peritoneal abscess (Figure 1A). Minor infections, tube dislodgement and leakage, on the other hand, were the most frequent minor complications (Figure 1B). Although complication rates varied between the two modes of insertion, the difference was not statistically significant. The rate of major complications was 20.0% (17 of 85) in the PEG group and 17.3% (13 of 75) in the open technique group ($P = 0.1$). Despite the intravenous administration of one dose of intraoperative antibiotics, the most frequent major complication in the PEG group was infection, mainly cellulitis and peritonitis (presumably due to intraperitoneal leakage of gastric contents). In the open G tube group, the most common complication was persistent gastrocutaneous fistula after removal of the G tube.

A small difference in the rate of complications appeared within the group of patients who underwent open G tube insertion when comparing those who underwent concurrent fundoplication and those who did not (Figure 2). The percentage of children with major complications in the fundoplication group was 19.4% (seven of 36), compared with 15.3% (six of 39) in children who did not undergo associated fundoplication at the time of open G tube insertion. The proportion of minor complications also appeared to be higher in the fundoplication group (33.3% [12 of 36]) than in the group who did not undergo the procedure (20.5% [eight of 39]). However, neither of these differences were statistically significant ($P = 0.1$). No mortality related to G tube insertion (endoscopic or open) was reported.

DISCUSSION

The G tube has been a valuable tool in nutritional rehabilitation. It has been used for several indications in pediatric and adult populations (1,7-12). In the pediatric population, the most common indication is nutritional support for patients with chronic neurological problems – mainly cerebral palsy (1,8), which was the main indication for G tube insertion in our cohort. The second most common indication was chronic aspiration. Providing fluids through a G tube to these patients was a safe alternative to the oral route. These children did not have a generalized neurological insult to explain their aspiration problems; however, aspiration was an isolated finding in otherwise neurologically healthy children. The majority of these children were referred from pediatric pulmonologists because they experienced persistent chest problems secondary to aspiration. Aspiration was diagnosed in these children after an assessment with a feeding therapist. The same indication for G tube insertion was reported in other centres, but with variable frequencies (1,6,9).

PEG tube insertion is generally a safe procedure (1); however, variable incidence rates of complications have been reported. This procedure should not lead to mortalities per se; however, death has been reported due to comorbid conditions (11). Generally speaking, it is recommended not to place PEG tubes during periods of severe disease (eg, acute heart failure) or severe immunosuppression (1,6). Death has been reported post-PEG insertion when it is attempted during these periods (11). No deaths related to G tube insertion were documented in our series.

TABLE 2
Investigations performed in gastrostomy patients before gastrostomy tube insertion

Variable	Study				
	Barium	pH	Gastric emptying	Endoscopy	No investigation
Endoscopic insertion	35.3	18.8	12.9	8.2	54.1
Open insertion with concurrent fundoplication	50.0	22.2	27.8	5.5	41.7
Open insertion without fundoplication at time of insertion	30.8	2.6	10.3	2.6	59.0
Primary diagnosis of aspiration	65.5	34.5	20.7	10.3	24.1
Primary diagnosis unknown (undiagnosed)	50.0	16.7	16.7	16.7	16.7
Overall	37.5	15.6	15.6	6.3	52.5

Data presented as %

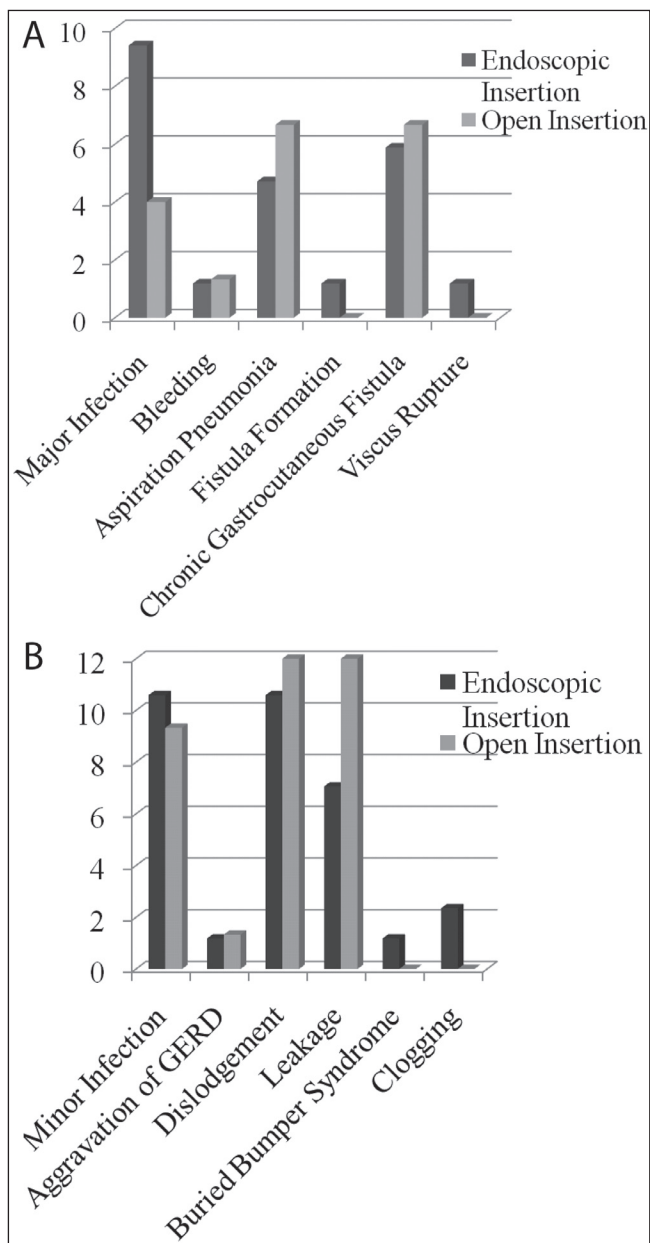


Figure 1 Percentage of children with major (A) and minor (B) complications of endoscopic and open gastrostomy tube insertion. GERD Gastroesophageal reflux disease

Major complications have been reported with variable incidence in different published pediatric series (1,7-12). The major and minor complications in our series were consistent with those in previously published studies.

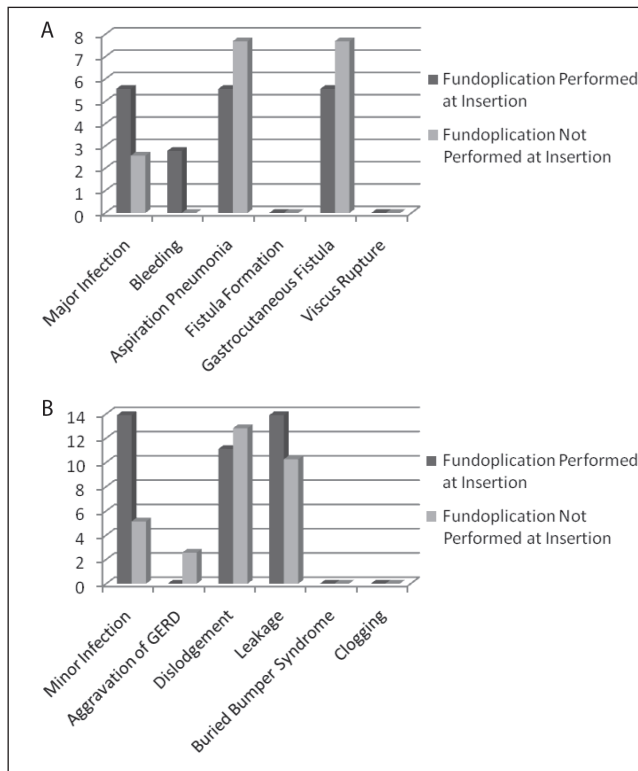


Figure 2 Percentage of children with major (A) and minor (B) complications following open gastrostomy tube insertion with or without fundoplication. GERD Gastroesophageal reflux disease

There was no statistically significant difference between complication rates in patients who underwent PEG insertion versus those who underwent open G tube insertion. This finding has been reproducible in several other studies. Following the introduction of the PEG technique, the initial rate of complications was higher in patients who underwent PEG compared with those who underwent open G tube insertion (13). However, after adjusting for variation due to issues related to the 'learning curve', the complications rates of the two techniques were similar, with substantially lower costs and shorter durations of hospitalization for patients who underwent tube insertion using the PEG technique (14-16).

Limitations of the present study include its retrospective design, which may have introduced several inherent biases including patient heterogeneity. Many patients have been lost to follow-up. The number of patients with different complications were too small to examine any predictive factors for individual complications. Comparison of PEG and open G tube insertion did not include a cost analysis. However, apart from procedure-related costs, hospital stays, in general, are longer in patients who undergo open G tube insertion than in those who undergo PEG.

CONCLUSIONS

The G tube is a valuable tool for nutritional support in children, especially in those with chronic neurological problems. Although the rate of major complications was similar between PEG and open G tube insertion groups, major infections were more common among children with PEG. The decision for G tube insertion was primarily based on clinical background and not on a certain subset of investigations.

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