Gastrostomy Feeding and Gastroesophageal Reflux

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Several clinical conditions require adjunctive tube feeding in order to maintain a normal nutritional state for the patient. Commonly in clinical practice, a nasogastric tube is used for this purpose, but for longer periods of time, or for indefinite use, this method of delivering enteral feeds is less acceptable than gastrostomy tube feeding [13, 43]. For much of the twentieth century, the Stamm gastrostomy, which requires open surgical laparotomy, was the most commonly accepted insertion technique. This was until 1979 when Ponsky and Gauderer introduced the percutaneous endoscopic gastrostomy (PEG) technique [18]. PEG has the advantage that it is minimally invasive, it can be performed by a gastroenterologist, it is relatively inexpensive, and, if the patient's condition precludes use of a general anesthetic, it can be performed under sedation. A PEG may also be placed with laparoscopic assistance when anatomical variants preclude the conventional PEG insertion technique [17].

Indications for Gastrostomy Tube Feeding

The range of indications for insertion of a PEG is extensive (see Table 99.1). The commonest indication for PEG insertion in pediatrics is to overcome oral-motor impairment and feeding difficulties in children with neurological impairment; the largest single group is children with cerebral palsy. Contraindications to gastrostomy tube insertion are listed in Table 99.2.

In children with neurological impairment gastrostomy, placement has been shown to significantly increase weight, reduce feeding time, and reduce both feed-related choking episodes and frequency of chest infections [27, 54, 57]. Family stress is significantly reduced [27], and quality of life of parents increases after PEG insertion to assist feeding [58]. Severe oral-motor dysfunction is a marker for the severity of degree of neurological dysfunction. Accordingly, children with severe neurological impairment who require gastrostomy feeding have a substantial long-term mortality. This is probably related more to the underlying neurological condition than it is to PEG placement [9].

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Table 99.1 Indications for insertion of a gastrostomy feeding tube

Failure of adequate nutritional intake
Oral-motor dysfunction (>50 % the commonest indication)
Craniofacial abnormalities
Head and neck trauma
Supplemental alimentation in those with increased calorie requirements
Malignancy and chemotherapy
Chronic renal failure
Cystic fibrosis
Congenital heart disease
Crohn's disease
Short bowel syndrome
Human immunodeficiency viral infection
Prolonged dependence on nasogastric tube feeding (>6 weeks)
Unsafe airway
Recurrent aspiration
Gastric drainage/decompression
Motility disorders
Short-bowel syndrome

Table 99.2 Contraindications to insertion of a gastrostomy feeding tube

Sick, unstable patient, e.g., in heart failure
Coagulopathy/bleeding disorders
Peritonitis
Severe ascites
Gastric varices
Distorted anatomy
E.g., 2° to severe kyphoscoliosis
Colonic interposition
Oesophageal obstruction
Hepatosplenomegaly
Failed diaphanoscopy

Complications of Gastrostomy Tube Feeding

Insertion of a PEG feeding tube carries with it a relatively low risk of complications. The result from Larson's series, which includes both adults and children, is typical of the published literature and revealed a procedure-related mortality of 1 %, a major complication rate of 3 %, and a minor complication rate of 13 % [35]. The commonest minor complication is infection of the gastrostomy insertion site and overgrowth of granulation tissue. Major complications are rare and include wound infection, cellulitis, oesophageal injury (probably sustained during extraction of the guide wire), abdominal wall abscesses, necrotizing fasciitis, gastrocolic fistula, colocutaneous fistula, duodenal hematoma, complicated pneumoperitoneum, gastric perforation, peritonitis, acute gastric dilatation, and gastroduodenal obstruction caused by the balloon of the gastrostomy catheter. Those patients with multisystem organ failure have an increased rate of complications and a poor response to nutritional support; for this population, the risk of PEG may outweigh its benefit [38].

Many of these complications can be avoided or reduced in likelihood by refinements to the technique of insertion [3]. A further complication and one which produces significant issues in relation to clinical management is symptomatic gastroesophageal reflux (GER) occurring after PEG insertion [27, 56].

Gastroesophageal Reflux

Gastroesophageal reflux (GER) is common in children with cerebral palsy, the largest group in whom a gastrostomy feeding tube is inserted, and occurs in 19–75 % of such cases [21, 48, 53, 59]. Central nervous system dysfunction is the prime cause of this high incidence of GER in children with cerebral palsy. Additional contributory factors include hiatus hernia, adoption of a prolonged supine position, and increased intra-abdominal pressure secondary to spasticity, scoliosis, or seizures [22, 24]. As a result of neuromuscular incoordination in the foregut, the anti-reflux function of the lower esophageal sphincter mechanism and esophageal motility are significantly impaired. Gastric dysmotility and delayed gastric emptying may also predispose toward GER in children with neurological impairment [2, 4, 8, 42], although

this relationship has not been demonstrated in all studies [6, 30, 41, 52].

Insertion of a Stamm gastrostomy has been shown to reduce lower esophageal sphincter (LES) pressure and predispose to GER [7, 32]. Studies following PEG insertion have shown both an increase in LOS pressure [29], and no effect on basal LES pressure unless rapid bolus feeds are delivered via the tube [10].

Similarly, some authors have found no relationship between PEG insertion and GER [37, 47, 49, 56], whereas others have [20, 27]. The reported postoperative prevalence of GER as a complication of PEG insertion varies from 13 % to 28 % [26, 28, 33, 56]. It may be that the site of insertion of the gastrostomy tube has an influence on the development of postoperative GER, and some endoscopists have found that tube placement in the antrum or lesser curve is associated with less subsequent reflux [47, 50].

Given the uncertainty about whether PEG insertion will exacerbate GER in the individual patient, especially those with foregut dysmotility, it would seem prudent to establish whether or not GER exists preoperatively [19]. Unfortunately, no test has been shown reliably to predict which patients will develop clinically significant GER post-PEG insertion. Despite normal clinical history and preoperative radiological and lower esophageal pH studies, GER can become apparent in neurologically impaired children after gastrostomy tube placement [5]. Much of the evidence in the literature is conflicting as a result of relatively small studies in selected cases, but the larger studies have shown no significant difference in GER symptoms or median reflux index on 24-h lower esophageal pH monitoring before and after PEG insertion [33, 37, 47]. Even preoperative histological evidence of esophagitis is poorly predictive of subsequent significant GER [12, 26]. In practice a pragmatic attitude should be adopted which takes into account the extent of clinical symptoms of GER (vomiting, aspiration, etc.) prior to PEG insertion and then selects those patients with significant clinical symptoms for investigation by prolonged lower esophageal pH monitoring and barium or water-soluble contrast studies to determine the need for a surgical anti-reflux procedure or jejunostomy [19].

Surgical Anti-reflux Procedures

The notion of a "prophylactic" anti-reflux procedure following gastrostomy insertion especially in children with neurological impairment was advocated by some [31]. The consensus' view now, however, is that such an approach is not advisable [14, 23, 33, 34, 45, 51, 56, 61, 62]. A major reason for this view is that fundoplication is associated with a higher morbidity and mortality rates in neurologically impaired children, when compared with neurologically normal children [36, 40, 44, 46].

Postoperative morbidity rates of up to 50 % and reoperation rates of up to 20 % and mortality rates up to 50 % are quoted following standard Nissen fundoplication [1, 40]. Major complications can occur both intra- and postoperatively including hepatic vein laceration, bowel perforation, tension pneumothorax, paraesophageal hernia, and small bowel obstruction [44]. Children with neurological impairment have more than twice the complication rate, three times the morbidity rate, and four times the anti-reflux reoperation rate than non-neurologically impaired children [15, 44]. In one study, for instance, more than 30 % of children with neurological impairment had major complications or died within 30 days of surgery, and 25 % had documented operative failure [39]. In another report, nearly one half of neurologically impaired children had documented recurrent GER after surgery [40]. Recurrent GER often leads to a second operation, but these repeats have a failure rate of around 30 % [11, 55, 60].

No single symptom is reliably predictive of recurrent GER so it is necessary to have a high index of suspicion for the development of recurrent GER after anti-reflux procedure in neurologically impaired children and to have a low threshold for proceeding to upper GI contrast study and lower esophageal pH study or endoscopy to investigate this possibility [39].

Medical Management of Gastroesophageal Reflux

The advent of proton-pump inhibitors (PPI) for use in children has had a very significant impact on the treatment of GER. Just as increasing experience of the complications following fundoplication has been shown to raise the threshold for performing this operation in children with neurological impairment [51] so has the efficacy of PPI as medical treatment been associated with a dramatic decrease in the number of surgical antireflux procedures performed in children [25].

In conjunction with PPI therapy, strategies to control reflux include a change from bolus to continuous pump feeding [10] and use of whey-predominant enteral milk formulae which have been shown to be associated with faster gastric emptying and less reflux [16].

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