Protective Antireflux Operation with Feeding Gastrostomy

Experience with Children

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Regurgitation and aspiration of feedings is a significant problem in children with impaired oral intake fed *via* gastrostomy. Using extended (18–24 hour) esophageal pH monitoring to assess gastroesophageal reflux (GER), we studied prospectively 32 children (aged 2 to 16 years) referred for feeding gastrostomy. Twenty-five patients had repeat esophageal pH monitoring after surgery. Prior to surgery, GER was documented in 23 (72%) of the 32 children. Twenty-two of the 23 children with GER before surgery had an antireflux operation performed in conjunction with the feeding gastrostomy. Gastroesophageal reflux was clinically significant in the single failed antireflux operation and in the child with GER before surgery who only had a gastrostomy performed. All nine patients without GER only had gastrostomy performed. Six of these developed GER by pH monitoring after surgery, with significant vomiting in four. Of our 11 patients remaining at risk for GER after surgery, seven (64%) had persistent vomiting with gastrostomy feedings. Thus, 91% (29 of 32) of the children were potentially at risk for GER if a gastrostomy only was performed. We believe these data support the need for a "protective" antireflux operation in children referred for feeding gastrostomy.

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CHILDREN DEVELOP DIFFICULTY in feeding for a variety of reasons. Most have an underlying neurologic problem with either an uncertain or poor prognosis. These children can literally "starve to death" without the institution of supplemental enteral or parenteral feedings. Often the surgeon is requested to place a gastrostomy tube for feedings. Although such a procedure may appear straightforward, it usually involves patients who are high risk for perioperative aspiration pneumonia because of poor swallowing and impaired pharyngeal reflexes. These pulmonary problems can be long-term and crucial in the patient's overall chance for survival.[1]

Since vomiting has been a problem reported frequently in neurologically-impaired children, some clinicians have considered gastroesophageal reflux (GER) as a cause for the vomiting.[2,3] While other complications of GER also may occur in these children,[4] the actual incidence of GER is unclear. The medical treatment of GER in children with central nervous system disorders has been difficult and for the most part unsuccessful.[5,6] In the present study we evaluate the need for an antireflux operation to protect children, having a feeding gastrostomy, from GER. Our evaluation utilizes extended (18 to 24 hour) esophageal pH monitoring to document the presence or absence of GER in these patients.

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Methods

Population and Studies

Of 35 consecutive children (two weeks to 16 years of age) referred for placement of a feeding gastrostomy because of impaired oral intake, 32 had comprehensive evaluation and are reported. There were 21 boys and 11 girls. Central nervous system disease was present in 28 patients (Table 1). Of the 32 children, 11 had repeated episodes of vomiting and 14 children suffered from recurrent aspiration pneumonia. Six children had esophagitis suspected by history. Twelve patients had no reflux-related symptoms. Informed consent was obtained from the patient's legal guardian(s) and all patients were evaluated and treated prospectively. The children with a seizure disorder were maintained on appropriate anticonvulsant medication.

Each patient was studied with a barium esophagram and upper gastrointestinal series prior to operation. None had evidence of tracheoesophageal fistula, esophageal obstruction or gastric outlet obstruction. Thirteen (41%) had reflux on barium esophogram. Esophagoscopy was performed in the six patients with suspected esophagitis.

Extended esophageal pH monitoring was performed for 18 to 24 hours in all children. The pH score obtained after the two hour postcibal (PC) period was used to document GER.[7] In addition, the mean duration of sleep reflux after the two-hour PC period (ZMD) was obtained from esophageal pH recordings and used to assess the relationship of respiratory symptoms to GER.[8] The upper limit of normal for the pH score is 64, and for the ZMD the upper limit of normal is 3.8 minutes.[9] All studies were performed while the patients were receiving their usual medication with feedings. Feedings (300 mL/square meter BSA) were given over 15 minutes through a nasogastric tube inserted into the stomach and removed after each feeding. The results of extended esophageal pH monitoring were used to determine the need for a protective antireflux operation in addition to gastrostomy.

Operative Procedures

A Stamm gastrostomy was performed in all children with placement of the tube along the greater curvature portion of the gastric corpus and fixation of the anterior gastric corpus to the posterior abdominal wall at the site of tube exit. Fifteen patients had a Nissen fundoplication;[10] six patients, a modified Thal fundoplication;[11] and one patient, a Boerema anterior gastropexy.[12]

Follow-up

Patients were evaluated in the acute period after surgery to assess the effectiveness and safety of the operative procedure. The clinical course in each child was assessed from 1 to 12 months (average of 5 months) after surgery. There were no operative deaths. Twenty-five children had repeat extended esophageal pH monitoring. The pH monitoring was performed with the same volume of feedings and medications (including the same dosage) as given during the preoperative studies. The only difference was that feedings were administered through the gastrostomy tube over 15 minutes instead of through a nasogastric tube. Testing was begun when the patient had demonstrated complete return of bowel function and gastrostomy feedings were at full volumes. No children had evidence of intestinal obstruction or paralytic ileus.

Results

Twenty-three of the 32 children evaluated for a feeding gastrostomy had GER documented by an abnormal pH score obtained from extended esophageal pH monitoring. The presence of GER was as likely in children with other congenital disorders (3 of 4, 75%) as in children with central nervous system disorders (20 of 28, 71%).

TABLE 1. *Disorders in 32 Children Referred for Feeding Gastrostomy*

Disorder	Number
Central nervous system	
Psychmotor retardation	23
Seizures	23
Perinatal asphyxia	6
Cerebral palsy	3
Spastic quadriplegia	1
Opitz-Frias	1
Smith-Lemli-Opitz	1
Rubenstein-Taybi	1
Hydranencephaly	1
Post-traumatic encephalopathy	1
Microcephaly	1
More than one disorder	24
More than two disorders	10
Other congenital	
Pierre-Robin	1
Cleft palate	1
Cystic fibrosis	1
Prematurity and subglottic stenosis	1

Repeated episodes of aspiration were present in fourteen patients before surgery, but only seven had a prolonged ZMD suggesting that GER might be contributing to the aspiration episodes. Five of the six patients having esophagoscopy demonstrated advanced esophagitis.

A protective antireflux operation was performed in 22 of the 23 patients with preoperative GER (Table 2). Only one patient (No. 20) vomited gastrostomy feedings after antireflux surgery. He demonstrated recurrent GER 12 months following a modified Thal fundoplication and has had good control of symptoms with subsequent conversion of the antireflux procedure to a Nissen fundoplication. In the other 21 children, an antireflux procedure permitted complete gastrostomy feedings, although five children developed wretching associated with the feedings. The only perioperative complication was a lesser sac abscess in one child.

A single patient, with GER prior to surgery and subglottic stenosis requiring tracheostomy (Patient No. 23, Table 3), had a feeding gastrostomy performed without a protective antireflux operation. The follow-up in this child revealed vomiting of feedings, but follow-up was incomplete due to his sudden and unexpected death at home two months after surgery. Another child with a proven effective antireflux operation (Patient No. 9, Table 2) and complete reflief of vomiting died two months after surgery from complications related to seizures and congenital heart disease.

All nine children with no evidence of GER identified by esophageal pH monitoring had gastrostomy tube placement without a protective antireflux operation (Table 3). However, six of these patients developed GER after surgery as documented by pH monitoring. In three patients, vomiting of feedings was severe and required reoperation with creation of either a Nissen fundopli-

TABLE 2. *Symptoms and Results of Extended Esophageal pH Monitoring in Children Receiving a Feeding Gastrostomy and a Protective Antireflux Operation*

		Before Surgery					After Surgery		
Patient	Age	Symptoms*	BaS pH†	Score‡	ZMD§	Antireflux Operation	Symptoms	pH Score	ZMD
1	4 y	RS	+	89	0	Nissen	RS	31	0
2	3 y	V, E	−	141	0	Nissen	—	31	0
3	2 m	—	−	295	3.1	Nissen	—	31	0
4	5 m	RS	+	475	10.4	Nissen	rs	Not done	
5	2 w	V, RS	+	296	5.0	Boerema	rs	36	0
6	6 y	RS	−	119	0	Nissen	RS	31	0
7	4 m	V, RS	+	448	3.6	Nissen	RS	31	0
8	2 m	—	−	325	15.5	Nissen	—	31	0
9	13 m	V, RS	−	251	7.2	Nissen	rs, Died	31	0
10	18 m	—	−	81	0.3	Nissen	—	31	0
11	11 y	—	−	83	2.0	Nissen	—	31	0
12	2 w	—	+	101	1.3	Thal	—	31	0
13	10 y	V, E	+	494	4.6	Nissen	—	Not done	
14	14 y	V, E	+	868	1.7	Nissen	—	Not done	
15	4 y	RS	−	129	7.2	Thal	—	31	0
16	3 y	RS	−	100	0	Thal	RS	31	0
17	1 m	V, RS	+	559	25.7	Thal	—	31	0
18	1 m	V, RS	+	791	9.5	Nissen	RS	31	0
19	11 y	V, E	+	232	1.2	Nissen	—	Not done	
20	1 m	V, RS	+	318	3.6	Thal	V, RS	232	8.6
21	3 y	E	−	189	10.2	Nissen	—	31	0
22	2 w	RS	+	496	7.0	Thal	—	31	0

* V = vomiting; RS = aspiration pneumonia; rs = decreased frequency of aspiration pneumonia; and E = advanced esophagitis.
† Presence of reflux on barium swallow (BaS).
‡ Greater than 2-hour postcibal pH score; normal range: 31–64.
§ Mean duration of sleep reflux in minutes >2 hours postcibal; normal range: 0–3.8 minutes.

cation (Patients No. 26 and 32) or a modified Thal fundoplication (Patient No. 30) for relief of vomiting. One child with postoperative GER and hydraencephaly (Patient No. 27) died suddenly of an unknown cause one month after surgery.

Thus, 91% (29 of 32) of the children were at risk for the complications of GER following the placement of a gastrostomy, including six children who did not have GER before surgery. Seven of the 11 patients remaining at risk for GER after surgery had serious problems with gastrostomy feedings as manifested by vomiting, and in two of these patients there was reflux-related aspiration pneumonia.

Discussion

Children with feeding difficulties provide a continuing challenge to the pediatrician and surgeon. They often have congenital or acquired central nervous system disorders that interfere with normal swallowing. For

TABLE 3. *Symptoms and Results of Extended Esophageal pH Monitoring in Children Receiving a Feeding Gastrostomy without Antireflux Operation*

		Before Surgery				After Surgery		
Patient	Age	Symptoms*	BaS†	pH Score‡	ZMD§	Symptoms	pH Score	ZMD
23	5 m	RS	−	147	1.6	V, RS, Died	Not done	
24	10 y	—	−	43	1.3	—	46	0
25	1 m	—	−	31	0	—	Not done	
26	6 y	V	−	58	0	V, RS	219	10.6
27	2 m	—	−	60	1.1	V, Died	289	5.9
28	16 y	—	−	50	0.3	—	158	2.1
29	2 y	—	−	51	0	V, RS	Not done	
30	3 y	—	−	34	0	V	269	0.8
31	10 m	—	−	38	1.5	—	83	1.0
32	1 m	RS	+	31	0	V, RS	279	3.1

* V = vomiting and RS = aspiration pneumonia.
† Presence of reflux on barium swallow (BaS).
‡ More than 2-hour postcibal pH score; normal range: 31–64.
§ Mean duration of sleep reflux in minutes >2-hour postcibal; normal range: 0–3.8 minutes.

children needing feeding gastrostomy, the present series documents a high incidence of GER as identified by the most accurate method, extended esophageal pH monitoring. An unexpected finding was the creation of frequent and significant GER by gastrostomy tube placement in patients who did not have GER previously. The mechanism for this change is unclear, but it may involve an anatomic distortion of the gastroesophageal junction by anterior fixation of the stomach to the abdominal wall (unpublished observations). Whether this GER persists long-term is unknown. Nevertheless, GER following gastrostomy alone presented a serious management problem for most of our patients in the acute period immediately following surgery.

As stated previously, recurrent aspiration pneumonia is a frequent problem in the child with a severe central nervous system disorder.[6] This complication probably results from an abnormal swallowing mechanism which is inadequate for oral feedings. If related to GER, aspiration can persist and become life-threatening even in the absence of oral feedings. The association between GER and aspiration pneumonia can be established before surgery from a combination of clinical symptoms and the presence of GER with a prolonged ZMD. We had six such patients. In each there was termination or reduction in the frequency of aspiration when GER was controlled with an antireflux operation.

In our experience, the complications of GER in children with feeding difficulties have been severe and potentially life-threatening. We feel, with the high incidence of GER in these children, the risks of a protective antireflux operation with gastrostomy are acceptable when compared to the risks of uncontrolled GER with a gastrostomy alone. Unless a gastrostomy can be performed without creating GER, an antireflux operation seems indicated to protect these patients with feeding difficulties from the adverse effects of GER.

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Discussion

DR. HIRAM C. POLK, JR. (Louisville, Kentucky): I suppose I am speaking as the only nonunion member of the pediatric surgical community to comment on this paper. Conceptually, this is a gigantic step. You have got to decide whether it is a step forward or backward, because this really is a proposal that all children having operations for feeding gastrostomy should have a major intra-abdominal operation added to that (that is, gastroesophageal reflux). I doubt that you could have found a more negative basis to my reading of this manuscript, because that represents a huge change.

On the other hand, you have heard Bill Tunell tell us that this is an example in which virtually all of these children—most before, and certainly all after—had real troubles with reflux, and that several of these could be indicated in the cause of death of the patient. These are a desperately ill collection of kids. When you look at the manuscript, at the list of indications, most of them have very serious, and probably not very reversible, neurological diseases.

On the other hand, the authors, have made a very good case for the indications for doing this on virtually all gastrostomies, and you have to compliment the Oklahoma group, because perhaps more than other people in this discipline, they have really been careful about documenting the adverse as well as the good effects of antireflux operations in the pediatric population.

It is hard to imagine that one will now want to apply this uniformly, but I think the data as I heard it and the manuscript as I read it says it ought to be the exceptional child who should undergo a feeding gastrostomy *without* an antireflux operation. If we buy this, it is going to be incumbent on the Oklahoma group to continue to inform us what the complication rate is of an added major operation to what has always been thought to be a pretty simple proposition (that is, a gastrostomy).

The obvious other question would be: Could this better be attacked by a feeding jejunostomy, or some other sort, that would protect the patient better, perhaps with a less complicated procedure, from gastroesophageal reflux?

Over time, this will be a big discussion. We may have heard a first here today, and we will be interested to see how this sorts out.