Objective: To determine the role of antireflux surgery in the treatment of gastroesophageal reflux–induced otolaryngologic disease (GEROD).

Design: A retrospective medical record analysis was performed. Patient demographics, otolaryngologic disease secondary to gastroesophageal reflux (GER), method of GER diagnosis, medical treatment used before antireflux surgery, and response to surgical intervention were considered.

Setting: Tertiary care children’s hospital.

Patients: Among patients undergoing antireflux surgery between January 1, 1996, and December 31, 1999, children with GEROD were included in the study.

Interventions: Children with GEROD who failed medical therapy underwent antireflux surgery.

Main Outcome Measures: The demographics of patients requiring antireflux surgery for treatment of their otolaryngologic disease and their clinical response to surgery were reviewed.

Results: Fourteen (17%) of 82 children, ranging in age from 48 days to 3 years (mean age, 9.7 months), who underwent antireflux surgery for GER at our institution between 1996 and 1999 were diagnosed as having GEROD. Twelve (86%) of the 14 patients were found to have upper airway abnormalities, including subglottic edema, fixed subglottic stenosis, reflex apnea, and recurrent croup. Two patients (14%) had severe chronic sinusitis and otitis media. Nine (64%) of the 14 had normal neurologic function for their age vs 5 (36%) who had neurologic impairment. After antireflux surgery, all 14 patients with GEROD had complete resolution of clinical symptoms.

Conclusions: Gastroesophageal reflux has an important role in the cause of numerous otolaryngologic disorders. Although medical management should remain the mainstay of GER therapy, antireflux surgery provided definitive and successful treatment of potentially life-threatening manifestations of GEROD.


Otolaryngologic manifestations of gastroesophageal reflux (GER) in children are increasingly recognized and defined in the literature. The exposure of the upper aerodigestive tract to gastric secretions results in numerous pathologic conditions. Chronic rhinosinusitis, recurrent otitis media, chronic cough, and airway abnormalities, such as subglottic stenosis, recurrent croup, laryngomalacia, and reflex apnea, may be caused or exacerbated by GER.

Most GER of early childhood is functional, with only a small percentage resulting in secondary pathologic conditions. Children with pathologic GER and GER-induced otolaryngologic disease (GEROD) generally have an excellent response to medical therapy. A few require surgical intervention in the form of antireflux surgery. We describe a group of patients with GEROD requiring surgical intervention.

RESULTS

Fourteen (17%) of 82 children who underwent antireflux surgery for GER had GEROD. There were 8 boys and 6 girls, with a mean age at surgery of 9.7 months (age range, 48 days to 3 years). Twelve (86%) of the 14 had upper airway abnormalities, including 1 or more of the following: fixed subglottic stenosis, subglottic edema, reflex apnea, and recurrent croup. Two (14%) had severe chronic sinusitis and otitis media thought to be secondary to GER.

Nine (64%) of the 14 had normal neurologic function for their age vs 5 (36%) who had neurologic impairment. In the neurologically impaired group, 5 had
PATIENTS AND METHODS

PATIENTS

A retrospective medical record review was performed. All patients undergoing antireflux surgery for medically refractory GER between January 1, 1996, and December 31, 1999, at the Children’s Hospital of New Orleans, La, were included. Manifestations of GER resulting in antireflux surgery were analyzed. Those patients with an otolaryngologic disorder as a primary manifestation were designated as having GEROD. Excluded were those whose otolaryngologic disease was believed to be an incidental finding.

PREOPERATIVE EVALUATION

Prior workup and treatment of the patients’ GER and the otolaryngologic disorder were reviewed. All patients had GER diagnosed by barium sulfate swallow test, pH probe, esophagoscope with biopsy, or bronchoscopy with cytologic evaluation for lipid-laden macrophages. Antireflux surgery was chosen after failed medical therapy (ineffective course of an H2 receptor blocker, proton pump inhibitor therapy, or a prokinetic agent) or if medical therapy was bypassed because of life-threatening GER symptoms.

SURGICAL TECHNIQUE

Antireflux surgery in the form of Nissen fundoplication was performed via standard laparotomy or, more recently, laparoscopy.

POSTOPERATIVE EVALUATION

The response to surgical intervention was evaluated through medical record review and, in some instances, telephone interviews.

known causes: cerebral palsy (3 patients), Down syndrome (1 patient), and chromosomal inversion and seizures (1 patient). There was a history of premature birth in 7 of the 14 children. In the group with upper airway abnormalities, 6 children had a history of previous intubation and 3 did not. Three children with upper airway abnormalities had incomplete medical records with regard to previous intubation status. Surgical intervention included laparoscopic Nissen fundoplication in 11 patients (79%) and open fundoplication in 3 (21%). One child underwent a second open procedure after the initial fundoplication failed 2 years postoperatively. The development of stridor and worsening reactive airway disease heralded the recurrence of GER.

After surgery, the patients with chronic sinusitis and otitis media had complete resolution of symptoms. Airway symptoms in all patients resolved, including 3 patients who subsequently underwent successful laryngotracheal reconstruction. One child with upper airway obstruction secondary to subglottic edema and a subglottic cyst had complete resolution of stridor after antireflux surgery alone. She eventually underwent uneventful marsupialization of the subglottic cyst (Table).

COMMENT

Gastroesophageal reflux is a common diagnosis in young children. It is generally nonpathologic and is believed to occur in approximately 67% of children aged 4 months, with resolution in most by 10 to 12 months. Although most children “outgrow” this functional reflux, a small number have pathologic sequelae that may include failure to thrive, hematocritia with anemia, esophagitis, or recurrent aspiration with pneumonia. It has been postulated that more than 40% of children with GER have respiratory manifestations. The prevalence of lower airway symptoms in GER and the obvious anatomic continuity make otolaryngologic pathologic conditions almost an anticipated finding. This laryngopharyngeal reflux passes through the lower and upper esophageal sphincter, spilling into the upper airway. Otolaryngologic manifestations caused or exacerbated by GER may include chronic sinusitis, recurrent otitis media, or airway abnormalities, such as subglottic stenosis, stridor, recurrent croup, laryngomalacia, and reflex apnea.

Conservative nonsurgical management is generally successful in the treatment of GER and its sequelae. In most patients, thickening the dietary formula and appropriate positioning of the child will be curative. Medical therapy usually consists of gastric acid inhibition, using an antacid, H2 receptor blocker, a proton pump inhibitor, or a prokinetic agent. Halstead7 demonstrated a 35% reduction in need for airway surgery for subglottic stenosis in patients receiving aggressive therapy for GER. Although medical therapy is usually successful, there are certain instances of failure. In a review of patients with GEROD referred for pH probe tests, Bouchard et al8 found that nearly 20% of patients had unresolved GEROD even after aggressive medical therapy.

Esophageal pH monitoring is considered the gold standard for the diagnosis of GER. Upper gastrointestinal studies using ingested contrast material are also commonly performed, which are specific but less sensitive. Other forms of documentation may include formal esophagoscopy, bronchoalveolar lavage showing lipid-laden macrophages, or a gastric emptying study. There has been controversy in the literature with regard to actual standards for pH studies, especially in infants. Walner et al9 found that an esophageal pH less than 4.0 for longer than 10% of the study translated to high risk, and for 5% to 10%, marginal risk, for reflux-associated airway symptoms in children with subglottic stenosis. Bouchard et al8 reported that, among patients referred for a pH probe study for possible GEROD, 41% had positive findings. Patients with upper airway abnormalities were more likely (>50%) to have positive test results than were those with sinusitis or otitis media. Recently, there has been interest in double-probe pH monitoring, which allows simultaneous monitoring of the esophageal and pharyngeal pH, because some studies demonstrate significant underestimation of laryngopharyngeal reflux with single-probe pH monitoring.
The mechanism is postulated to be 2-fold: (1) the apparent life-threatening events indicated that 53% had additional obstruction in the upper airway rather than a laryngeal chemoreflex induced by aspiration of gastric juice.15 Another manifestation of GER is the apparent life-threatening event and demonstrated massive GER on upper gastrointestinal studies using ingested contrast material. Several of the other patients, although without the formal diagnosis of an apparent life-threatening event, had similar symptoms.

Laryngopharyngeal reflux is the instigator of the inflammatory insult leading to GEROD. This is seen in radiologic oral contrast studies demonstrating GER to the oropharynx and nasopharynx. In rhinosinusitis, the gastric acid begins the cycle of sinonasal edema and ostiomeatal complex obstruction. Bothwell et al11 documented that the aggressive treatment of GER in children with chronic sinusitis resulted in avoidance of sinus surgery in most patients. In their study, 4 (13%) of 30 patients failed medical therapy and ultimately required antireflux surgery.

The otolaryngologic literature more commonly addresses upper airway disease related to GER rather than rhinologic or otologic disease. This is also reflected in our series. The mechanism involved is believed to be direct trauma of the gastric juices on the airway, leading to inflammation and eventual chondritis and subglottic stenosis. This is exacerbated in the intubated patient, in whom the endotracheal tube may cause the initial subglottic injury.12 This may explain the high number of patients in our series with a history of intubation, premature birth, or both. These children may have had their initial insult while intubated, which progressed as their upper airways continued to be bathed in gastric acid. Nelson et al13 described 7 infants with stridor and GER and reported that 3 ultimately required a fundoplication. Two of the 3 patients had premature births with a history of intubation, and the other child had been intubated for 1 month.

Another manifestation of GER is the apparent life-threatening event in which an infant is found lifeless, bradycardic, or cyanotic.14 This is thought to be a functional obstruction in the upper airway rather than a structural obstruction. A recent review of 30 children with apparent life-threatening events indicated that 53% had GER.14 The mechanism is postulated to be 2-fold: (1) the laryngeal chemoreflex induced by aspiration of gastric acid14 and (2) sensory stimulation of the distal esophagus without laryngeal aspiration.16 One of our patients had the formal diagnosis of an apparent life-threatening event and demonstrated massive GER on upper gastrointestinal surgery. The clinical resolution of our patients after antireflux surgery is evidence that surgery is a safe and effective treatment for complicated cases of GER. When there is a potentially life-threatening pathologic condition, mechanical and physiological elimination of GER via fundoplication can be critical. The great strides in minimally invasive laparoscopic techniques have transformed a formally morbid procedure into one with small punctate incisions with far less morbidity.

Why certain subsets of patients with GEROD fail medical therapy and require surgical intervention is unknown. The presence of significant upper airway abnormalities in most of our patients may have lowered the threshold for proceeding with surgical intervention when medical therapy failed. The presence of upper airway obstruction may require a trade-off of one surgery (tracheotomy) for another (antireflux surgery). Several of our patients with severe subglottic stenosis (with tracheotomies) required antireflux surgery before laryngotracheal reconstruction. A few years after successful reconstruction, 1 child manifested failure of the fundoplication, with new onset of stridor.

Although most of our patients had normal neurologic function, many had a history of premature birth, intubation, or both. As postulated previously, these patients may have had an early upper airway insult that continued to progress in the presence of sustained GER. In addition, 10 children were younger than 1 year. Theoretically, GER is most prevalent in this age group, the lower esophageal sphincter is least functional, and the airway is narrowest.

The dogma that GER is a medical disease often results in hesitation on the part of the gastroenterologist and otolaryngologist to proceed with antireflux surgery. The clinical resolution of our patients after antireflux surgery is evidence that surgery is a safe and effective treatment for complicated cases of GER. When there is a potentially life-threatening pathologic condition, mechanical and physiological elimination of GER via fundoplication can be critical. The great strides in minimally invasive laparoscopic techniques have transformed a formally morbid procedure into one with small punctate incisions with far less morbidity.

A significantly higher percentage of children (64% vs 36%) undergoing antireflux surgery for GEROD had normal neurologic function. This is in contrast to many...
reports in the surgical literature, in which most children receiving antireflux surgery had neurologic impairment. The reason for this discrepancy and the actual incidence of GEROD in children with normal neurologic function deserve further investigation.

CONCLUSIONS

Gastroesophageal reflux has an often overlooked, but important, role in the cause of numerous otolaryngologic disorders. Although medical management is, and should remain, the mainstay of GER therapy, antireflux surgery provided definitive and successful treatment of potentially life-threatening manifestations of GEROD.

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