

Spitting up and gastro-esophageal reflux

Gastroesophageal Reflux

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Gastroesophageal reflux is a common disorder in the pediatric population. The spectrum of symptom presentation varies substantially, and the disease manifestations can differ, depending on the patient's age and health status. For example, a healthy 3-month-old infant can present with regurgitation in the absence of other symptoms. On the other hand, a 14-year-old child who has cerebral palsy may present with anemia, food refusal, and recurrent aspiration pneumonia. The first case is an example of physiologic gastroesophageal reflux (GER), the second of gastroesophageal reflux disease (GERD). The challenges in managing reflux lay in determining what is physiologic and what is pathologic.

GER is defined as the passage of gastric contents into the esophagus, which can be a normal physiologic process in many infants. GERD, on the other hand, is defined as symptoms or complications of GER. Regurgitation is defined as the passage of gastric contents into the oral pharynx. Vomiting is defined as expulsion of the refluxed gastric contents from the mouth. Rumination is a rare functional disorder characterized by voluntary, habitual regurgitation of stomach contents into the mouth for self-stimulation. The material can be rechewed and either reswallowed or brought out of the mouth. Rumination in infants may signify a psychiatric disorder or social deprivation.

GER is common in infancy. A report on its prevalence in 948 infants in Chicago revealed that 50% of infants ages 0 to 3 months regurgitated at least once daily, 67% at age 4 months, and 5% by age 12 months. (1) Thus, the majority of infants who have GER eventually "outgrow" their reflux. In children 3 to 17 years of age, the prevalence of the different symptoms of reflux range between 1.4% and 8.2%. (2) In a survey of predominantly African-American high school students, the prevalence of esophageal symptoms of GERD (heartburn, regurgitation, and dysphagia) was 33%, and the association with smoking was significant. (3)

Mechanism and Pathophysiology of Reflux

Reflux occurs because of the transient relaxation of the lower esophageal sphincter. The short infant esophagus that has limited volume and the predominantly recumbent position of infants facilitate the regurgitation of gastric contents. In addition, delayed gastric emptying and increased abdominal pressure contribute to the development of GER. Some reports of increased familial concordance for GERD symptoms, hiatal hernia, erosive esophagitis, Barrett esophagus, and esophageal adenocarcinoma propose chromosome 13 locus (13q14) as being associated with severe pediatric GERD. (4) Chromosome 9 locus has been proposed as having an association with infantile esophagitis. (5)

Manifestations of Reflux

Common presenting signs and symptoms of reflux can differ by age (Table 1). The most common manifestation of GER in infants is vomiting. Fortunately, only a small number of infants develop GERD with complications such as failure to thrive, irritability, dysphagia, odynophagia, and arching of the back during feedings. Infants who have GERD may develop apparent life-threatening events (ALTEs), reactive airway disease, recurrent aspiration pneumonia, and chronic cough. Rarely, GERD results in stereotypic repetitive stretching and arching movements that may be mistaken for atypical seizures or dystonia, a condition known as Sandifer syndrome.

Table 1. Common Presenting Symptoms of GER/GERD

| | |
|--------------------------------|--|
| Infants and Young Children | |
| • Recurrent vomiting | |
| • Poor weight gain | |
| • Irritability | |
| • Dysphagia or feeding refusal | |
| • Asthma | |
| • Recurrent pneumonia | |
| • Upper airway symptoms | |

| | |
|---|--|
| <ul style="list-style-type: none"> • Apnea or apparent life-threatening event | |
| Older Children and Adolescents <ul style="list-style-type: none"> • Regurgitation • Heartburn and retrosternal chest pain • Dysphagia • Asthma or chronic cough • Recurrent pneumonia • Anemia and hematemesis | |

In preschool-age children, GERD may present as intermittent vomiting, food refusal, or respiratory complications. Older children are more likely to have adult-type symptoms such as heartburn, regurgitation, dysphagia, or food impaction. More severe inflammation may cause chronic blood loss with anemia and hematemesis. Chronic inflammation rarely leads to the development of the premalignant condition known as Barrett esophagus.

Differential Diagnosis of Reflux in Infants and Children

One of the challenges facing the practitioner caring for children is to distinguish vomiting due to GER or GERD from vomiting caused by other disorders. Diseases affecting a variety of systems can produce vomiting. A detailed history and physical examination can help eliminate many of these disorders. Table 2 summarizes some of the common causes of nonreflux-related emesis. Among the warning signs suggestive of nonreflux disease is bilious or forceful vomiting, which can be caused by bowel obstruction or pyloric stenosis. Other warning signals include hematemesis, hematochezia, diarrhea, abdominal tenderness or distention, onset of vomiting after 6 months of age, fever, lethargy, hepatosplenomegaly, seizures, macrocephaly, or microcephaly.

Table 2. Common Nonreflux Causes of Vomiting

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|--|--|
| Infections <ul style="list-style-type: none"> • Sepsis • Meningitis • Urinary tract infection • Otitis media | |
| Obstruction <ul style="list-style-type: none"> • Pyloric stenosis • Malrotation • Intussusception | |
| Gastrointestinal <ul style="list-style-type: none"> • Eosinophilic esophagitis • Peptic ulcer disease • Achalasia • Gastroparesis • Gastroenteritis • Gall bladder disease • Pancreatitis • Celiac disease • Pill esophagitis • Crohn disease | |
| Metabolic/Endocrine <ul style="list-style-type: none"> • Galactosemia • Fructose intolerance • Urea cycle defects • Diabetic ketoacidosis | |

| | |
|--|--|
| <p>Toxic</p> <ul style="list-style-type: none"> • Lead poisoning | |
| <p>Neurologic</p> <ul style="list-style-type: none"> • Hydrocephalus and shunt malfunctioning • Subdural hematoma • Intracranial hemorrhage • Tumors • Migraine | |
| <p>Allergic</p> <ul style="list-style-type: none"> • Dietary protein intolerance | |
| <p>Respiratory</p> <ul style="list-style-type: none"> • Posttussive emesis • Pneumonia | |
| <p>Renal</p> <ul style="list-style-type: none"> • Obstructive uropathy • Renal insufficiency | |
| <p>Cardiac</p> <ul style="list-style-type: none"> • Congestive heart failure and disease | |
| <p>Recreational drugs and alcohol consumption</p> <ul style="list-style-type: none"> • Pregnancy Other • Overfeeding • Self-induced emesis | |

Diagnostic Approach to GER

History and Physical Examination

A history and examination are the first and most important steps in evaluating a child who has reflux. It is important to address questions directly to a child who is able to communicate. Important elements of the history are listed in Table 3. These findings can help to delineate reflux disease or point to nonreflux conditions.

Table 3. Important Aspects in the History for Evaluating Reflux

| | |
|--|--|
| <p>Vomiting</p> <ul style="list-style-type: none"> • Presence of blood • Presence of bile • Presence of pain and irritability • Presence of forceful emesis • Frequency and amount of emesis • Association with constitutional symptoms (fever, lethargy) or other gastrointestinal manifestations | |
| <p>Feeding History</p> <ul style="list-style-type: none"> • Frequency of feeding • Volume of feeding • Preparation of formula • Change in feeding pattern | |

| | |
|---|--|
| <ul style="list-style-type: none"> • Position and behavior of infant during feeding • Type of feeding | |
| Social History <ul style="list-style-type: none"> • Tobacco use • Alcohol use | |
| Past Medical History <ul style="list-style-type: none"> • Neurologic disease • Prematurity • Growth or developmental problems • Past surgery and hospitalizations • Respiratory or ear, nose, throat diseases • Psychological factors (stressful events) | |
| Family History <ul style="list-style-type: none"> • Family history of reflux and its severity • Other gastrointestinal diseases such as celiac disease and Helicobacter pylori infection | |
| Medication History | |
| | |

Diagnostic Studies

For most infants and children who have GER, a history and physical examination are sufficient to diagnose nonpathologic GER reliably. Diagnostic testing should be saved for the child who has complications or when the diagnosis of GERD is in question. The decision to select a specific diagnostic test is based on the clinical question that needs to be answered. For example, a child suspected of having esophagitis needs esophageal biopsies, whereas a child who has pulmonary symptoms and no clinical GERD symptoms may benefit from a pH probe study.

CONTRAST RADIOGRAPHS. The upper gastrointestinal (UGI) series is a common modality for evaluating the UGI tract. A positive contrast agent, such as barium, is used to opacify the UGI tract, and fluoroscopic and radiographic images are obtained, yielding both functional and structural information. Examples of conditions that can be identified on UGI imaging are malrotation, esophageal or antral webs, pyloric stenosis, and a congenital band around the lower esophagus known as a Schatzki ring, which is associated with hiatal hernia (Figs. 1 and 2). In general, UGI contrast studies cannot discriminate between physiologic and nonphysiologic reflux.

ESOPHAGEAL PH MONITORING. Esophageal pH monitoring measures the frequency and duration of acid reflux episodes into the esophagus through transnasal placement of microelectrodes that continuously sense the presence of acid. This is used widely as an index of esophageal acid exposure and can be useful in determining the presence of a temporal association between acid reflux and frequently occurring symptoms and for assessing the adequacy of dosage of histamine-2 receptor antagonists (H2RAs) or proton pump inhibitors (PPIs) in children whose GERD symptoms are not improving. The reproducibility of the reflux index for this test ranges from 69% to 85%, and it cannot detect nonacidic reflux. If apnea is suspected, simultaneous correlation with respiratory efforts and chest wall movement is necessary.

An alternative to the traditional esophageal pH monitoring employing a nasal catheter wireless system is being evaluated in older children. A small capsule containing a radio transmitter can be placed endoscopically in the distal esophagus. The capsule can monitor pH wirelessly for 48 hours. The capsule then detaches from the esophageal wall and passes through the GI tract.

ENDOSCOPY. Upper endoscopy allows macroscopic and microscopic evaluation of the esophagus and the UGI tract (Fig. 3). The severity of esophagitis can be evaluated, as can the presence of complications such as esophageal strictures or Barrett esophagus. Endoscopy allows exclusion of other conditions that mimic GERD, such as eosinophilic esophagitis, pill esophagitis, or Crohn disease. White specks have been reported as a specific esophageal finding for eosinophilic esophagitis (Fig. 4). (6) The sensitivity of white specks in the esophageal mucosa was only 30%, but the specificity was 95%. The stomach and duodenum can be evaluated for disorders such as peptic ulcer and celiac disease. Visual inspection alone may not be adequate because macroscopic diagnosis does not correlate with histologic features 50% of the time. (7) Therefore, it is useful to obtain biopsies at the time of endoscopy to detect microscopic disease and differentiate between reflux and nonreflux inflammation.

MULTICHANNEL INTRALUMINAL IMPEDANCE (MII). MII is a new technology that allows detection of reflux without measuring pH. It captures changes in the electrical impedance during the movement of a bolus between the measuring electrodes. MII allows detection of the direction of the moving bolus, thus distinguishing a swallow from a regurgitated bolus. A pH sensor is included as an additional channel. Some data are being published regarding normal impedance values for preterm infants, (8) but validated standards for different pediatric populations are still lacking. In its current state, the significance of this technology is the correlation of events, especially respiratory, with nonacid reflux.

SCINTIGRAPHY. This technology is based on the consumption of a technetium-labeled feeding. A nuclear image scan is performed to detect technetium in the GI or respiratory tract. The scan allows the measurement of gastric emptying, detects acid and nonacid reflux, and may detect aspiration in 60-minute or delayed films. The sensitivity of this test is low, ranging from 15% to 59%, but the specificity is higher at 33% to 100%.

Complications of GERD

Complications of GERD are numerous and manifest as both esophageal and extraesophageal disorders.

Respiratory Complications

Pulmonary complications of GERD include asthma, bronchitis, apnea, ALTE, chronic cough, and recurrent aspiration pneumonia. Ear, nose, and throat complications include hoarseness, laryngitis, sinusitis, dental erosions, and recurrent otitis media. There is an increased association of such disorders in children who have GERD compared with other children. For example, a study associating asthma with GERD showed a 13.2% prevalence with reflux versus a 6.8% prevalence in children who had no reflux ($P<0.0001$). (9) The same investigators found similar associations with pneumonia, sinusitis, and laryngitis. The nature of the relationship between respiratory disorders and GERD is controversial. Both GERD and asthma are common pediatric disorders that can coexist. However, studies show that GERD can be a contributing factor in patients who have asthma, especially in severe refractory cases. Other studies suggest that reflux occurs as a secondary phenomenon.

Will medical treatment of GER disease improve symptoms of asthma? Studies suggest that approximately two thirds of children who have asthma improve with reflux therapy. (10)(11)(12) Such improvement can be quantified as a reduction of dosages of bronchodilator therapy or anti-inflammatory medications, including inhaled or systemic steroids. Therefore, in a subset of patients who have asthma and reflux, medical therapy for reflux is warranted.

Chronic aspiration occurs when airway protective mechanisms fail and gastric or oral contents are seen inside the lungs. Consequently, severe pneumonia, interstitial lung disease, and pulmonary fibrosis can occur. Neurologically impaired children are at higher risk for developing reflux and aspiration.

Nonrespiratory Complications

Chronic esophageal exposure to acid can result in inflammation and subsequent development of reflux esophagitis, esophageal strictures, Barrett esophagus, and adenocarcinoma. In severe chronic cases, UGI bleeding and anemia may develop. Children who are neurologically impaired are at greater risk for developing such complications. Barrett esophagus and esophageal adenocarcinoma rarely develop in the pediatric age group. In addition to neurologic impairment, other risk factors for long-term complications of GERD include lifestyle factors such as obesity, size and gestational age at birth, and repaired esophageal atresia. Adult studies correlate body mass index not only with severity of symptoms such as heartburn, erosive esophagitis, and hiatal hernia, but with severe complications such as Barrett esophagus and cancer.

GERD in the Neurologically Impaired

GERD occurs more frequently in neurologically impaired children, whose reflux often is resistant to standard medical therapy and frequently requires surgical correction through fundoplication. Moreover, such children are at higher risk for developing complications related to their surgery, with higher rates of additional operations. A report by Del Giudice and associates (13) showed a high prevalence of GERD-related disease in children who had cerebral palsy. Symptomatic GI disease was seen in as many as 92% of the children. Swallowing disorder and dysfunction of oral and pharyngeal phases was found in 93% of patients. Vomiting, regurgitation, and abdominal pain occurred in 33% of patients, and chronic pulmonary aspiration occurred in about 40%. Interestingly, 91% of those patients studied had reflux on pH probe study or biopsy-proven esophagitis, and almost 67% had a significant delay in emptying (by scintigraphic gastric emptying studies).

Prognosis

GER in infants carries a favorable prognosis because most children tend to "outgrow" their reflux symptoms by 12 months of age. Children who have neurologic impairment, prematurity, obesity, esophageal atresia, or a strong family history of severe complicated GERD are at higher risk for developing complications and carry a poorer prognosis compared with infants who have physiologic reflux.

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