



## Incidence of gastroesophageal reflux disease and positive maxillary antral cultures in children with symptoms of chronic rhinosinusitis



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### ABSTRACT

**Objectives:** Studies have shown that gastroesophageal reflux disease occurs more frequently than expected in children with chronic rhinosinusitis. The objective of this study is to further understand the relationship of pediatric chronic rhinosinusitis and gastroesophageal reflux disease in children with symptoms of rhinorrhea, nasal congestion, and chronic cough.

**Methods:** A retrospective chart review of 63 children, ages 6 months to 10 years old with rhinorrhea, nasal congestion, and chronic cough. The patients underwent maxillary cultures, adenoidectomy, and distal third esophageal biopsies. Children with esophageal biopsies showing esophagitis were classified as positive for gastroesophageal reflux disease, and maxillary antral swabs growing a high density of bacteria were classified as positive for chronic rhinosinusitis.

**Results:** Six months to 5 years old children ( $n = 43$ ), 6 (14%) had simultaneous positive maxillary antral cultures and positive esophageal biopsies, 11 (26%) had positive esophageal biopsies alone, 23 (53%) had positive maxillary antral cultures alone, and 3 (7%) had neither. Six to 10 years old children ( $n = 20$ ), 9 (45%) had simultaneous positive maxillary antral cultures and positive esophageal biopsies, 1 (5%) patient had positive esophageal biopsies alone, 3 (15%) patients had positive maxillary antral cultures alone, and 7 (35%) patients had neither. Twenty-seven (42%) of the patients from the whole study had gastroesophageal reflux positive biopsies.

The younger children were statistically likely to have chronic rhinosinusitis and gastroesophageal reflux disease independently of each other ( $p = 0.0002$ ). A direct group comparison found the younger group to have independent chronic rhinosinusitis and gastroesophageal reflux disease and the older group to have simultaneous chronic rhinosinusitis and gastroesophageal reflux disease ( $p = 0.0006$ ).

**Conclusion:** In children with the presenting symptoms of rhinorrhea, nasal congestion, and chronic cough, younger children tend to have either chronic rhinosinusitis or gastroesophageal reflux disease, whereas older children tend to have a more complicated etiology of chronic rhinosinusitis and gastroesophageal reflux disease or other. In all of these patients gastroesophageal reflux disease plays an important role, as over 40% of all patients had gastroesophageal positive biopsies.

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### 1. Introduction

Chronic rhinosinusitis (CRS) has a severe impact on the health related quality of life in the pediatric population and is a challenging disease for physicians to treat [1]. Studies have demonstrated that gastroesophageal reflux disease (GERD) occurs more frequently than expected in patients with CRS [2]. The signs and symptoms of pediatric sinusitis include chronic cough,

rhinorrhea, nasal congestion, and post nasal drip. Some common pediatric symptoms of GERD include nasopharyngeal inflammation and secretions, sore throat, chronic cough, recurrent pneumonia, and chronic and/or recurrent middle ear infections [3–5]. The similarity in nasal symptoms of discharge and congestion from nasal inflammation makes an accurate diagnosis of GERD and/or CRS challenging.

CRS is one of the most common diseases in the pediatric population [6], and the diagnosis is made primarily clinically. Practice guidelines have been issued by the American Academy of Pediatrics [7], however the pathogenesis and management of this disease continues to be relatively undetermined [8]. Sinus aspiration with recovery of bacteria in high density ( $\geq 10^4$  colo-

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colony-forming units/mL) from the paranasal sinuses remains the gold standard for the diagnosis of acute or chronic bacterial sinusitis [9]. CRS in children has multiple etiologies including viral and bacterial upper airway infections, allergies, GERD, smoking irritants, cystic fibrosis, immunodeficiency, mucociliary disorders, and nasal and sinus anatomical abnormalities [10–12]. The bacteriology of CRS includes the 3 main pathogens associated with acute disease: *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*. Chronic sinusitis also includes *Staphylococcus aureus*, *Pseudomonas*, anaerobic bacteria, and fungi. Studies have shown that the role of bacterial infection as a primary cause of chronic infection has not been defined and that noninfectious factors such as GERD, allergy, may play more of a role in the chronic inflammation of the paranasal sinuses [13,14]. It is estimated that 5–13% of viral upper respiratory infections are complicated by secondary bacterial sinusitis [15], 5–10% of which do not respond to conventional antimicrobial therapy [16]. Studies have found that children in the 1–5 year old age group are found to respond more frequently to a single course of antibiotics, compared to the older children in the 4–7 year-old group that tend to have more chronic symptoms [17].

Most healthy infants have occasional regurgitation known as physiologic reflux. Nelson reported an incidence of gastroesophageal reflux (GER) in up to 60% of infants aged 6 months, which declined to 5% at the end of the first year of life [18]. GER at this age is due mainly to lower esophageal sphincter immaturity and a predominantly liquid diet. Reflux fades by 1 year of age as solids are introduced into the diet and the lower esophageal sphincter matures [19]. Persistent and bothersome gastroesophageal reflux in children resulting in secondary conditions such as respiratory symptoms, apnea, and failure to thrive; is considered pathologic and thus termed GERD. In children, GERD is associated with an increased risk of sinusitis, asthma, laryngitis, and bronchiectasis [20]. Studies have shown that 10% of infants suffer from GERD, and that up to 25% of asymptomatic children have GERD with 8% having nasopharyngeal reflux [21,22]. The “gold standard” for the diagnosis of GERD is the 24-h pH probe [23], and the double electrode pH probe with distal esophageal plus pharyngeal or proximal esophageal electrodes is considered the “gold standard” for diagnosis of nasopharyngeal reflux and the extraesophageal manifestations of GERD [3]. Esophageal biopsy showing histologic esophagitis is a rapid, safe and effective diagnostic test for GERD that can be done during rigid esophagoscopy [24].

Laryngopharyngeal reflux (LPR) is defined as the extraesophageal reflux of gastric contents into the larynx and hypopharynx and when the reflux reaches the nasopharynx it is termed nasopharyngeal reflux (NPR). LPR is considered a distinct entity from GERD, as patients with LPR do not have the complaints of heartburn or other esophagitis symptoms [25]. LPR is commonly associated with hoarseness, dysphagia, globus sensation, and chronic throat clearing [26,27]. The reflux of gastric contents into the pharynx is also associated with the nasal symptoms, and it has been demonstrated that NPR plays a role in refractory sinusitis [28]. Wise et al. provided evidence using pH probe testing, that patients with pathological NPR and LPR have the increased symptom of postnasal drip [29].

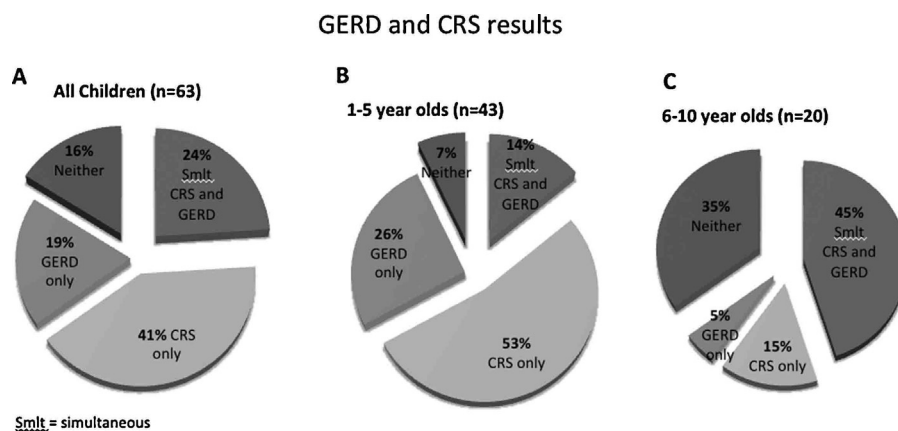
Both CRS and GERD are common diseases affecting patients, however studies demonstrate that GERD occurs more frequently than expected in patients with CRS [2]. The objective of this study was to further explore the relationship of CRS and GERD by studying the incidence of simultaneous or independent CRS and GERD, using maxillary antral cultures and esophageal biopsies as presumptive diagnostic tests, in children with symptoms of nasal rhinorrhea, congestion, and chronic cough.

## 2. Methods

The study was designed as a retrospective chart review of the medical records of 63 children ages 6 months to 10 years old at Wayne State University who presented to clinic with symptoms of nasal congestion, rhinorrhea, and cough lasting longer than 12 weeks, refractory to first line antimicrobial therapy. Approval from the institutional review board at Wayne State University was obtained before proceeding with the retrospective chart review. The following information was acquired: age, sex, presenting signs and symptoms, duration of symptoms, concurrent surgical procedures performed, maxillary sinus culture, and esophageal biopsy results. The procedures took place from September 2010 to September 2011.

The patients had been taken to the operating room to undergo adenoidectomy, bronchoscopy, esophagoscopy with biopsy, and nasal endoscopy with culture and biopsy of the osteomeatal complex. The osteomeatal complex was carefully swabbed in order to prevent contamination. During esophagoscopy a note was made of any signs of mucosal ulcerations, mucosal cobble stoning, or esophagitis. Biopsies were taken of the distal one third of the esophagus and sent for histologic assessment of esophagitis or other abnormalities.

The children were divided into two separate age groups for the purpose of analysis, the younger group was 6 months to 5 years old, and the older group was 6–10 years old. Forty-three of the patients were in the younger group, and twenty patients were in the older group. Children with an esophageal biopsy showing



**Fig. 1.** This figure shows the results of children diagnosed with GERD only, CRS only, simultaneous CRS and GERD, or neither. (A) Shows all children analyzed as one group. (B) Shows the younger age group, and (C) is the results of the older age group.

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