

Twenty-four-hour esophageal pH monitoring in children and adolescents with chronic and/or recurrent rhinosinusitis

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Abstract

Gastroesophageal reflux (GER) disorder was studied in children and adolescents with chronic and/or recurrent rhinosinusitis not associated with bronchial asthma. Ten children with a clinical and radiological diagnosis of chronic and/or recurrent rhinosinusitis, consecutively attended at the Pediatric Otolaryngology Outpatient Clinic, Federal University of São Paulo, were evaluated. Prolonged esophageal pH monitoring was used to investigate GER disorder. The mean age of the ten patients evaluated (eight males) was 7.4 ± 2.4 years. Two patients presented vomiting as a clinical manifestation and one patient presented retrosternal pain with a burning sensation. Twenty-four-hour esophageal pH monitoring was performed using the Sandhill apparatus. An antimony probe electrode was placed in the lower third of the esophagus, confirmed by fluoroscopy and later by a chest X-ray. The parameters analyzed by esophageal pH monitoring included: total percent time of the presence of acid esophageal pH, i.e., pH below 4 (<4.2%); total number of acid episodes (<50 episodes); number of reflux episodes longer than 5 min (3 or less), and duration of the longest reflux episode (<9.2 min). One patient (1/10, 10%) presented a 24-h esophageal pH profile compatible with GER disorder. This data suggest that an association between chronic rhinosinusitis not associated with bronchial asthma and GER disorder may exist in children and adolescents, especially in those with compatible GER disorder symptoms. In these cases, 24-h esophageal pH monitoring should be performed before indicating surgery, since the present data suggest that 10% of chronic rhinosinusitis surgeries can be eliminated.

Key words

- Sinusitis
- Chronic disease
- Gastroesophageal reflux
- Children
- Adolescents
- Esophageal pH monitoring

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Introduction

Gastroesophageal reflux (GER) consists of spontaneous return of gastric content to the esophagus (1). This phenomenon is gen-

erally considered to be physiological despite the existence of an antireflux barrier system, which includes the His angle, gastric rosette, crural diaphragm, phrenic-esophageal ligament, and lower esophageal sphincter (2).

Physiological GER should be differentiated from gastroesophageal reflux disease (GERD), which is characterized by signs and/or symptoms secondary to GER, affecting life quality and leading to esophageal tissue lesions. The main manifestations of GERD are growth deficit, infant apnea, esophagitis, bronchial asthma, aspirative pneumonia, and anemia (3). Otorhinolaryngological manifestations have also been described, such as laryngospasm, chronic cough, laryngeal stridor, laryngitis, subglottic stenosis, laryngeal granulomas, vocal chord nodules, persistent otitis media, rhinopharyngitis, choanal stenosis, adenoidal hypertrophy, nasal drainage, and chronic sinusitis (4-7). It is important to point out that respiratory and otorhinolaryngological manifestations of GERD may occur in patients without typical symptoms of the disease, i.e., regurgitation, vomiting and/or retrosternal pain with a burning sensation (5).

The etiology of the inflammatory process in the mucosa of the upper airways and the mechanisms that determine and/or maintain this process have not been elucidated (8). When acid refluxes from the stomach and makes contact with the upper respiratory mucosa, it causes irritation and edema which impair the mucociliary clearance function (5,9,10). Another possible mechanism is hyper-reactivity of the autonomous nervous system caused by reflux, with consequent edema and obstruction, similar to that observed in vasomotor rhinitis (10). The edematous nasopharynx and/or facial sinus mucosa may cause ostium sinus obstruction followed by the development of sinusitis (5,9,10).

Today, prolonged monitoring of esophageal pH is the best available method for GERD diagnosis. It not only allows the detection of reflux, but also provides the frequency and duration of acid reflux episodes, $\text{pH} < 4$, and the analysis of its relationship to meals, position and concomitance with possible symptoms attributed to GERD (1).

There is some doubt concerning the real importance of the association between otorhinolaryngological manifestations in children and GERD, with few reports on this topic. The majority of the studies refer to laryngeal disorders, mainly in adults (4,8), with few references to nasosinus disorders in children and adolescents, especially in those without bronchial asthma (5,6,9,11).

The purpose of the present study was to investigate GERD in children and adolescents with chronic and/or recurrent rhinosinusitis not associated with bronchial asthma using 24-h esophageal pH monitoring.

Patients and Methods

Thirteen children were evaluated consecutively at the Pediatric Otolaryngology Outpatient Clinic of the Federal University of São Paulo, Escola Paulista de Medicina (UNIFESP/EPM), with a clinical and radiological diagnosis of chronic and/or recurrent rhinosinusitis.

Clinical diagnosis was based on the criteria of the International Conference of Facial Sinus Disorders (11), as follows: persistence of signs and/or symptoms for at least 12 weeks or six episodes of acute sinusitis a year, with a minimal interval between episodes of at least 10 days after the end of treatment. The major signs and symptoms are nasal obstruction, rhinorrhea, headache during the crisis, pressure pain in the face, and olfactory disorder. Fever, halitosis, cough, and irritability are considered to be minor symptoms.

The following inclusion criteria were utilized during the acute phase: rhinorrhea and diurnal and nocturnal cough in association with the otorhinolaryngological exam. Anterior rhinoscopy examination revealed hyperemia of anterior nasal conchae, edema with mucous-purulent secretion in the nasal cavity draining mainly through the middle meatus, and/or oroscopy revealed mucous-purulent secretion draining from rhinopharynx

through the posterior wall of the pharynx and/or a hyperemic pharynx with granules. Exclusion criteria were: neoplasias, immunodeficiency, nasosinusal polyposis, and respiratory symptom complex due to bronchial asthma and repetitive bronchopneumonia. Three patients with chronic and/or recurrent rhinosinusitis were excluded from the initial sample due to the presence of the following disorders: transient hypogammaglobulinemia, polysaccharide acid deficiency with normal serum immunoglobulin, and glucose 6-phosphate-dehydrogenase deficiency.

Radiological findings were obtained by simple X-rays of the facial sinuses as follows: frontal-nasal-plate and menton-nasal-plate. Whenever possible, the diagnosis was confirmed by computed tomography of the facial sinuses.

Twenty-four-hour esophageal pH monitoring was performed using the Sandhill apparatus. An antimony probe electrode was placed in the lower third of the esophagus and its position was confirmed by fluoroscopy and later by a chest X-ray. The probe was placed in such a way that the tip of the electrode would lie over the third vertebral body above the diaphragm throughout the respiratory cycle (12). For the exam, patients were admitted to the Pediatric Unit of São Paulo Hospital, Federal University of São Paulo, Escola Paulista de Medicina. Mealtime, changes in decubitus, the occurrence of vomiting, and any other clinical manifestations were recorded. It is important to emphasize that no physical activity or nutritional restraints were imposed on the children during hospitalization, with no changes in their daily routine. No clinical occurrence was observed during the exams.

The parameters analyzed by esophageal pH monitoring, as well as their respective normal values according to Johnson and DeMeester (13,14), presented in parentheses, included: total percent time of the presence of acid esophageal pH, i.e., pH below 4 (<4.2%); total number of acid episodes (<50

episodes); number of reflux episodes longer than 5 min (3 or less), and duration of the longest reflux episode (<9.2 min).

The Ethics Committee of the Federal University of São Paulo, Escola Paulista de Medicina, approved the study and written informed consent was obtained from the persons responsible for the patients.

Results

Of the 10 children studied, 8 were males and 2 females, ranging in age from 5 to 12 years old, with a mean age of 7.4 ± 2.4 years old.

Table 1 shows the distribution of the patients according to age, gastrointestinal symptomatology and facial sinus radiological and computed tomography findings. Patient #7 presented pain in the retrosternal region with a burning sensation, and patient #8 had undergone previous surgery for GER correction at 2 years and 3 months of age.

The results of 24-h esophageal pH monitoring (Table 2) showed that patient #7 (1/10, 10%) presented percent of time with acid esophageal pH (<4) above 4.2% and 24-h numerical pH score of all results of the test equal to 18.8, which is considered pathological according to the criterion of Johnson and DeMeester (13).

Discussion

Chronic and/or recurrent sinusitis in children results from the interaction of multiple factors, such as recurrent upper airway infections, allergy, GERD, exposure to irritant agents such as smoking and swimming, cystic fibrosis, primary or secondary immunodeficiency, mucociliary disorders, and anatomical abnormalities of the nose and nasal sinus (7).

There are few studies correlating chronic rhinosinusitis with GERD. Barbero (5) identified GERD using 24-h esophageal pH monitoring in 7 children with chronic sinusitis

Table 1. Distribution of patients according to age, gastrointestinal symptoms, radiological diagnosis, and facial sinus computed tomography.

Patient	Age (years)	Gastrointestinal symptoms at the time of the study		Diagnosis of rhinosinusitis	
		Vomiting	Retrosternal pain with burning sensation	Facial sinus X-ray	Facial sinus computed tomography
1	8	No	No	Bilateral maxillary sinus thickening (++++)	Not performed
2	6	No	No	Bilateral ethmoidal opacification with maxillary sinus thickening (++++)	Not performed
3	6	No	No	Bilateral ethmoidal and maxillary sinus opacification	Not performed
4	11	No	No	Bilateral maxillary sinus opacification	Not performed
5	5	No	No	Bilateral maxillary and ethmoidal sinus opacification	Maxillary and ethmoidal sinus thickening (++++)
6	8	No	No	Bilateral maxillary and ethmoidal sinus opacification	Ethmoidal opacification, left maxillary and sphenoidal sinus thickening (++++)
7	12	Yes	Often	Bilateral maxillary and ethmoidal sinus opacification	Not performed
8	6	Yes	No	Right maxillary opacification and left maxillary thickening (++++)	Maxillary sinus thickening (++++)
9	8	No	No	Bilateral maxillary and ethmoidal opacification	Ethmoidal and maxillary sinus thickening (++++)
10	5	No	No	Bilateral maxillary opacification	Bilateral ethmoidal opacification with maxillary sinus thickening (++++)

Table 2. Results of 24-h esophageal pH monitoring of 10 children and adolescents with chronic and/or recurrent rhinosinusitis.

Patient	Time of acid esophageal pH <4 (%)	Total number of acid episodes (%)	Number of episodes longer than 5 min	Duration of the longest episode (min)	Score according to Johnson and DeMeester (13)
1	0.19	8	0	1.0	1.45
2	0.00	0	0	0.0	0.33
3	1.00	28	0	1.0	3.40
4	0.16	7	0	0.5	1.24
5	3.19	62	1	7.0	12.56
6	0.86	19	0	4.2	4.45
7	4.62	15	1	7.9	18.80
8	2.04	37	0	2.9	5.37
9	0.00	21	0	0.0	1.90
10	0.01	2	0	0.1	0.57

Patient #7 is the positive patient.

who did not respond favorably to surgical treatment of the sinusopathy. These patients recovered from their otolaryngological symptoms after the institution of treatment for GERD. With this background, 22 children with chronic sinusitis and indication for sinusopathy surgery were assigned to 24-h esophageal pH monitoring and abnormal results were observed in 16 (72.7%) of them (5). One third of the patients presented recurrent chronic abdominal pain, flatulence, hiccups, and thoracic pain. After the institution of anti-reflux therapy, total remission of the symptoms was observed in 10 patients and partial improvement in 3 patients. Barbero (5) concluded that there is an association between rhinosinusitis and GERD in children and that GERD should be considered before surgical treatment for sinusitis is indicated. Bothwell et al. (15) observed an important reduction in the number of children suffering from chronic sinusitis who required surgical treatment for sinusopathy after GERD treatment (11). Halstead (6) reported that 6 (55%) of 11 patients with chronic rhinosinusitis and otitis had a favorable response to the anti-reflux medication, and 5 of these patients (45%) presented abnormal results of 24-h esophageal pH monitoring. Phipps et al. (9), studying 30 children with chronic sinusitis, found the presence of pathological reflux in the distal esophagus in 19 (63%) of them. Fifteen (79%) of these 19 patients showed a favorable response to the clinical treatment of GERD.

In the present study, GERD was identified in 1 (10%) of the 10 patients with chronic rhinosinusitis, therefore, in a smaller proportion of patients than reported in previous studies (5,6,9,11). It should be mentioned that a well-established diagnosis of chronic and/or recurrent rhinosinusitis in children is not very frequent, especially when children with bronchial asthma are excluded from the samples studied. One of the exclusion criteria used in the present study was the presence of a respiratory symptom complex,

which could be one of the characteristics explaining the lower frequency of altered pH monitoring in our patients, since this exclusion criterion was not adopted in the literature. Regarding the symptoms related to GERD, the only patient with altered pH monitoring presented vomiting and a retrosternal burning sensation. Only another patient with normal esophageal pH monitoring reported a symptom related to GERD, i.e., repetitive vomiting.

Some issues should be discussed regarding esophageal pH monitoring. First, regarding to the location of the electrode, the European Society for Pediatric Gastroenterology and Nutrition Working Group on GER recommended the use of fluoroscopy for electrode placement (12). The tip of the electrode should be positioned over the third vertebral body above the diaphragm (16). The second issue is where the probe electrode should be placed for evaluation of GERD and otorhinolaryngological disorders: in the distal esophagus only, in the distal and proximal esophagus, or in the distal esophagus and pharynx (9,17-20). Phipps et al. (9), using two electrodes placed in the distal esophagus and nasopharynx, concluded that the use of a single electrode placed in the distal esophagus is sufficient to indicate GERD treatment. Little et al. (20) could not define at what point the frequency and/or duration of pharyngeal reflux becomes pathologic. A recent editorial in the *Journal of Pediatric Gastroenterology and Nutrition* alerted that caution must be exercised in the interpretation of results of pharyngeal pH monitoring (21). There is also another difficulty related to the correct placement of double electrodes using a single catheter because the length of the esophagus varies according to age and height. Maldonado et al. (22) improved a triple-electrode bifurcated adjustable pH probe to identify true hypopharyngeal acid reflux episodes in adults.

Considering the difficulties in the correct

placement of each double probe using a single catheter, and the lack of data about pharyngeal reflux in pediatric patients, we performed the present study using a distal esophageal pH probe.

The results of the present investigation suggest that there may be an association between chronic rhinosinusitis and GERD

in children and adolescents, especially those presenting typical GERD symptoms. In these cases, 24-h esophageal pH monitoring should be suggested before surgery is indicated. However, further studies involving larger samples are necessary to confirm the real dimension of the association between GERD and chronic and/or recurrent rhinosinusitis.

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