

Medical treatment of allergy in children with recurrent or chronic sinusitis

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ABSTRACT

Background: Diagnosis and treatment of chronic and recurrent sinusitis in children is of potential importance and many factors can have an influence on it. This study assessed the chronic and recurrent sinusitis and affecting factors, as well as the role of allergy in its course and treatment in children. **Materials and Methods:** A total of 106 children with the diagnosis of chronic or recurrent sinusitis, referred to specialty clinics of otolaryngology and allergy of Tabriz Children Educational-Medical centres since 2010 to 2012, were enrolled. The history and physical examination findings were recorded for all patients and allergy Prick test was done for all. Response to treatment was evaluated during the follow-up visits. **Results:** The mean age of studied patients was 6.5 ± 2.9 years. Of all the patients, 54 (50.9%) were male and 52 (49.1%) were female. Skin Prick test was positive in 69.8%. Response to treatment was seen in 86.8% of the patients while 7.5% did not have any favourable outcome. Anti-allergic treatment caused better outcomes in patients with positive Skin Prick test than those with negative results. **Conclusion:** The prevalence of allergic disease in children with chronic or recurrent sinusitis is considerable and anti-allergic treatments can result in favourable therapeutic outcomes in children with sinusitis, especially with positive skin prick test results.

Key words: Allergy, chronic sinusitis, recurrent sinusitis, upper respiratory tract infections

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INTRODUCTION

Chronic rhino sinusitis (CRS) has been the second most prevalent chronic health problem,¹ affecting 12.5% of the US population or nearly 31 million patients each year.² Sinusitis in children is one of the less-recognised clinical findings. Although many physicians believe that sinusitis can affect children of any age, but at the same time the best strategies for treatment and diagnosis in children is still controversial. High incidence of sinusitis beside the increasing microbial resistance against the old-generation antibiotics shows the need for proper diagnostic and therapeutic measures in these children.³⁻⁵

The real prevalence of sinusitis in children is unknown but it seems that in average each child is affected by the upper

respiratory tract infections for six to seven times per year and sinusitis occurs in 5-13% of them.⁶ Approximately, 6-13% of children may experience sinusitis.⁷ Also, according to the studies, incidence of sinusitis and microbial resistance is high, causing an increase in health care costs.^{8,9}

There are several predisposing factors in sinusitis including inflammatory, anatomic and immunological factors. Allergic rhinitis is the most common predisposing factor for rhino sinusitis.¹⁰⁻¹³ The incidence of allergy in children is estimated as 15-20%.⁴ Patients afflicted with allergies have a predisposition for developing sinusitis. One study determined that both disorders exist in the same patient 25-70% of the time, and another study found that 72 of 121 patients with chronic nasal symptoms and positive skin tests for allergies had positive sinus computed tomography scans showing sinusitis.¹⁴

To our knowledge, the accurate information about the prevalence of chronic or recurrent sinusitis in Northwest of Iran is not available, and considering the cold and dry climate and the increasing presence of children in kindergarten, it seems that the prevalence of viral respiratory tract infections and consequently the purulent

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sinusitis is high in this region. On the other hand, there are many controversies in diagnostic criteria and treatment of CRS, and some doctors are not fully familiar with this disease in children. Meanwhile, the mentioned problems is increasing in the simultaneous presence of sinusitis and inflammation of other parts of the upper or lower respiratory tract. So the present study was designed to conduct a survey on the chronic or recurrent sinusitis in this region to determine the risk factors and the role of allergy in response to treatment.

MATERIALS AND METHODS

This study was performed on 106 children with chronic or recurrent sinusitis presenting to Paediatric Clinic of Tabriz University of Medical Sciences or Allergy or Ear-Nose-Throat (ENT) clinics of "Tabriz Children Educational-Medical centre" since 2010 to 2012. Inclusion criteria were children or teenagers with diagnosis of chronic or recurrent sinusitis according to guidelines of American Academy of Otolaryngology, Head and Neck Surgery. Exclusion criteria were patients with concurrent head and neck problems and age more than 18 years.

The Tabriz University of Medical Sciences Ethical Committee permission was obtained before performing the study, and the informed consent was obtained from patients. Then, the patient enrolled for visit and evaluation by researchers, and information about the history and physical examination were included in the checklist. The patients were evaluated about underlying causes of allergies, cystic fibrosis, immunodeficiency and reflux, and finally, the prevalence of children with allergies has been determined.

Baseline variables including patients' age, sex and location of the patients (in urban and rural environments) were recorded. The history of exposures with environments that have allergic capability, living in places near the garden or arable land and proximity to the factories, workshops or chemical waste, exposure to pets, kindergarten attendance, history of exposure with tobacco smoke and history of the feeding with cow milk were asked and recorded. Family history of allergies including skin allergies, allergic rhinitis, asthma and eye allergies were also asked. Previous history of allergy including rhinitis, asthma, ocular allergy, eczema and wheal were recorded in allergic patients.

Also, the studied cases were assessed about: History of allergy-related disease including recurrent colds and flu or prolonged colds, long-term use of antibiotics, recurrent purulent pharyngitis, recurrent acute otitis, history of recurrent serous otitis or prolonged infections and recurrent infection croup history of chronic cough, mouth breathing, nocturnal snoring and nocturnal apnoea, history of continuous nasal congestion, purulent rhinorrhoea or postnasal pharyngeal discharge. In addition, the

information of patients were evaluated and recorded for a history of nasal itching, sneezing, halitosis, throat pruritus, nasal speech, *hot potato* voice, ear pruritus, autophony, tinnitus, otorrhoea, hearing loss, wheezing, cough following physical activity and epigastric burning.

Clinical examination of the ear, throat, nose and lungs was also performed and their positive or negative findings were recorded as the "have" or "doesn't have", respectively. Skin sensitivity test was performed for all patients and positive test cases for each patient were recorded and the total number of positive allergy tests for each patient was calculated and recorded.

Treatment modalities were antibiotic therapy, antihistamines, topical corticosteroids, systemic steroids and surgery. The surgery methods were included the insertion of ventilation tubes (VT), adenoidectomy, tonsillectomy and sinus surgery which were recorded in patients data form. Response to treatment was assessed in follow-up visits for each patient and was recorded as "Better", "Worsen" and "No change". Being better was considered as the decline in the frequency of colds and the need for antibiotics and consequently reducing the symptoms of chronic sinusitis and recurrent sinusitis.

The collected data and variables were described using descriptive statistics, frequency and percentage. Statistical analyses of data were performed by Statistical Package for the Social Sciences (SPSS)-16 software using Chi-square test, Fisher's exact test, independent T-test and Pearson's correlation coefficient. *P* values less than 0.05 were considered statistically significant.

RESULTS

The average age of patients was 6.5 ± 2.9 years (range: 6 months to 18 years). 54 (50.9%) patients was male and 52 (49.1%) were female. Eighty-three patients (78.3%) were living in cities and 22 (20.8%) were from rural areas. According to patients' history, 35 patients (33.0%) were living in vicinity of a garden or arable land. Five patients were living in the neighbourhood of factories or chemical wastes. Also, there was a history of exposure to pets in 27 patients (25.5%), attending in kindergarten for 52 patients (49.1%) and smoking in 57 (53.8%), and a history of feeding with cow milk was noted for 17 patients (16.0%).

The numbers and percentages of positive cases for family history of allergies and previous history of allergy in patients and the history of allergy-related disease and chronic cough, mouth breathing, nocturnal snoring and nocturnal apnoea are shown in Table 1.

The history of nasal obstruction was reported by 87 patients (82%) of which the obstruction was repeatedly in 77 patients

(72.6%) and permanently in 10 (9.4%). Rhinorrhoea was noted in 88 patients (83.0%), which was purulent in 32 patients (30.2%) and mucoid in 56 (52.8%). Post-nasal drip was reported by 84 patients (81.1%), which was purulent in 35 patients (33.0%) and mucoid in 51 patients (48.1%).

Table 2 shows the frequency of symptoms associated with allergy and sinusitis in studied cases.

Table 1: Family history, previous history and history of allergy-related diseases in studied patients

Variable	Frequency (%)
Familial history	59 (55.7)
Allergy	26 (24.5)
Skin allergies	17 (16.0)
Allergic rhinitis	9 (8.5)
Asthma	
Ocular allergy	25 (23.6)
Previous history	21 (19.8)
Allergy	15 (14.2)
Hay fever	1 (0.9)
Asthma	4 (3.8)
Ocular allergy	5 (4.7)
Eczema	8 (7.5)
Urticaria	
History of allergy-related diseases and disorders	91 (85.8)
Recurrent cold	
Prolonged cold	87 (82.1)
Long-term use of antibiotics	96 (90.6)
Purulent pharyngitis	34 (32.1)
Acute otitis media	26 (24.5)
Prolonged serous otitis	35 (33.0)
Recurrent croup	14 (13.2)
Chronic cough	78 (73.6)
Mouth breathing	67 (63.2)
Nocturnal snoring	61 (57.5)
Nocturnal apnoea	12 (11.3)

Table 2: Frequency of symptoms associated with allergy and sinusitis

Symptoms	Frequency (%)
Nasal pruritus	49 (46.2)
Sneezing	36 (34.0)
Halitosis	55 (51.9)
Pruritus throat	33 (31.1)
Nasal speech	31 (29.2)
Hot potato voice	1 (0.9)
Pruritus ears	20 (18.9)
Autophony	3 (2.8)
Tinnitus	2 (1.9)
Otorrhoea	6 (5.6)
Hearing loss	30 (28.3)
Wheezing	5 (4.7)
Cough after physical activity	38 (35.8)
Epigastric or retrosternal burning	9 (8.5)

Clinical examination revealed postnasal discharge (PND) in 20 patients, pharyngeal findings including erythema and exudate in 73 patients and pulmonary findings including wheezing in 5 patients.

Skin sensitivity test was positive in 74 patients (69.8%). This test was positive for 38 males (70.4%) and 36 females (69.2%). In patients with positive allergy test result, the average number of allergy to allergens was 4.6 3.2 with (range: 1-12). This number in male and female patients was 5.1 3.4 and 1.4 2.8 with (range: 1-12 to 1-10).

The numbers and percentages of positive cases for each allergen are shown in Table 3 and Table 4 shows the treatment modalities used in studied patients.

Treatment of chronic sinusitis or recurrent administration caused to improvement and recovery in 92 patients (86.8%). Eight patients (7.5%) did not improve significantly. None of the patients have reported a worse condition after treatment of chronic sinusitis or recurrent in comparison with the time before receiving allergy treatment.

There was a significant improvement among 48 male patients (94.1%) and 44 female patients (89.8%). Chi-square test showed no significant difference in cure rate of chronic sinusitis or recurrent after treatment of allergy in two male and female genders ($P > 0.05$).

Also Table 4 shows the response to various treatment modalities used in studied patients.

The square tests showed that taking antihistamines ($P = 0.002$) and topical corticosteroids ($P = 0.011$) for chronic or recurrent sinusitis was effective in the recession of the symptoms while antibiotics and surgery were not as effective.

Analysis by chi-square test did not revealed any significant relationship between improvement or no improvement and presence of clinical finding including ear, throat, nose and pulmonary symptoms ($P > 0.05$).

Pearson's correlation coefficient revealed a significant correlation between positive allergy test results and the age of patients ($P < 0.001$); so, the less age the patients were associated with more positive allergy cases ($r = -0.13$). In other words, there is a reverse relation between aging and positive allergy cases [Figure 1].

DISCUSSION

This study, performed on 106 children with chronic or recurrent sinusitis, showed that the skin sensitivity test was positive in 69.8% of the cases. This test was positive in 70.4% of males and 69.2% of females. Histamine test was positive in all patients. This overlap between allergy and

chronic or recurrent sinusitis in this study is compatible with findings of previous studies.¹⁵⁻¹⁷

Although anatomic variants have been suggested to predispose to obstruction of the ostiomeatal unit and development of chronic rhinosinusitis (CRS), however, recent studies in a pediatric population found no correlation between anatomic abnormalities and the extent of CRS on sinus imaging.¹⁸

Smart and Slavin,¹⁹ Pawankar and Zernotti¹⁶ and Pearlman *et al.*²⁰ suggested the relationship between asthma and risk of CRS. Ragab *et al.*²¹ have also found a

correlation of CRS and upper respiratory tract disease including asthma.

The pathophysiological correlation of CRS and allergic and inflammatory reactions is controversial. Pearlman believe that CRS is an inflammatory disease that occurs independent of IgE-related pathways²⁰ while Kirtsreesakul and Ruttanaphol²² consider a relation between allergic rhinitis and CRS as an IgE-mediated hypersensitivity. Jouaville *et al.* have also found a degree of inflammation in the pathophysiology of rhinitis revealed by study of expiratory nitric oxide, indicating a significant overlap with allergic disease including asthma and atopy.²³ The prevalence of IgE-mediated allergy to environmental allergens in patients with CRS has been estimated at 60% or nearly twofold of the general population.¹ Liou *et al.* evaluated causes and contributive factors to asthma severity in asthmatic patients and suggested that CRS was associated with more severe asthma.²⁴

Analysis of response to therapy showed improvement in 86.8 % and no change in 7.5% of patients. As a treatment

Table 3 Frequency of allergens in studied patients

Allergens	Total positive cases (%)	Positive cases in boys (%)	Positive cases in girls (%)
Tress mix	38 (35.8)	19 (35.2)	19 (36.5)
Grass mix	37 (34.9)	22 (40.7)	15 (28.8)
Acacia	1 (0.9)	1 (1.9)	-
Alder pollen	6 (5.7)	4 (7.4)	2 (3.8)
Molds	6 (5.7)	4 (7.4)	2 (3.8)
Latex	1 (0.9)	-	1 (1.9)
Cat	13 (12.3)	10 (18.5)	3 (5.8)
Feather	10 (9.4)	7 (13)	3 (5.8)
Sheep wool	1 (0.9)	-	1 (1.9)
Mite 1 (d. p)	25 (23.6)	16 (29.6)	9 (17.3)
Mite 2 (d. f)	20 (18.9)	14 (25.9)	6 (11.5)
AspergillusFumigatus	11 (10.4)	8 (14.8)	3 (5.8)
Soya	1 (0.9)	-	1 (1.9)
Cocoa	18 (17.0)	9 (16.7)	9 (17.3)
Melon	22 (20.8)	12 (22.2)	10 (19.2)
Onion	4 (3.8)	1 (1.9)	3 (5.8)
Almond	26 (24.5)	12 (22.2)	14 (26.9)
Cow's milk	3 (2.8)	1 (1.9)	2 (3.8)
Egg (whole)	12 (11.3)	8 (14.8)	4 (7.7)
Orange	2 (1.9)	1 (1.9)	1 (1.9)
Kiwi	14 (13.2)	8 (14.8)	6 (11.5)
Banana	17 (16)	10 (18.5)	7 (13.5)
Apple	3 (2.8)	2 (3.7)	1 (1.9)
Walnut	2 (1.9)	-	2 (3.8)
Tomato	28 (26.4)	17 (31.3)	11 (21.2)
Wheat flour	7 (6.6)	2 (3.7)	5 (9.6)

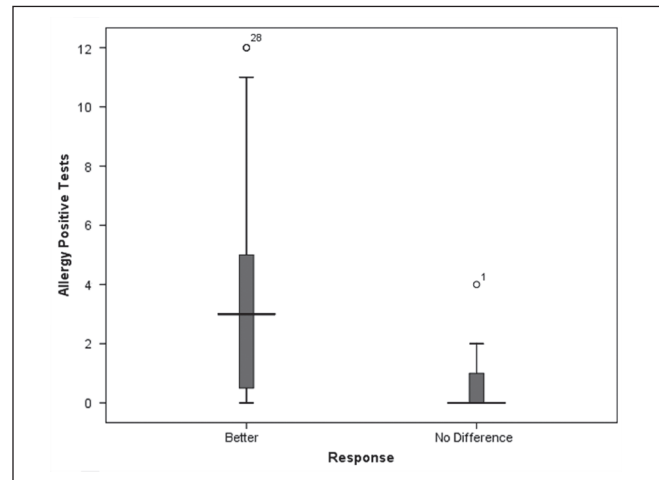


Figure: 1 Pearson's correlation coefficient indicating a significant correlation between positive allergy test results and the age of patients ($P = 0.00$, $r = -0.13$)

Table 4: Treatment modalities used in studied patients

Therapeutic	Total	Male	Female	Improvement	P
Antibiotic	104 (98.1)	54 (100)	50 (96.2)	90 (91.8)	>0.05
Antihistamines	85 (80.2)	43 (79)	42 (80.8)	77 (95.1)	<0.05
Topical corticosteroids	70 (66)	37 (68.5)	33 (63.5)	64 (97.0)	<0.05
Systemic corticosteroids	13 (12.3)	6 (11.1)	7 (13.5)	12 (92.3)	>0.05
Surgery	36 (34)	16 (29.6)	20 (38.5)	28 (87.5)	>0.05
Type of Surgery					
VTI	2 (1.9)	1 (1.9)	1 (1.9)	-	-
Adenoidectomy	33 (31.1)	15 (27.8)	18 (34.6)	-	-
Tonsillectomy	23 (21.2)	10 (18.5)	13 (25)	-	-
Sinus surgery	0 (0)	0 (0)	0 (0)	-	-

*Data was shown as Number (%); VTI – Ventilation tube insertion

method, taking antihistamines and topical corticosteroids was effective in improving the symptoms of chronic or recurrent sinusitis; while using the antibiotics, systemic corticosteroids and surgical method had no effect. These findings are compatible with findings of Lavigne *et al.* study in which sinus surgery resulted in no effect or even worsening of symptoms in some patients with CRS.²⁵ These findings suggest that anti-allergic treatment is effective in reducing symptoms in patients with chronic and recurrent sinusitis, indicating the clinical and pathophysiological overlap of chronic rhinosinusitis and allergic reactions. In addition in this study, patients did not benefit from surgical treatment, indicating the need for supplementary anti-allergic treatments.

The present study showed that Anti- allergic treatment is more effective in patients with chronic or recurrent sinusitis in whom the skin allergy test is positive (including both positive test result and number of positive results). These findings which are compatible with Lavigne *et al.* study²⁵ is showing the importance of anti- allergic therapy in the treatment of children with chronic or recurrent sinusitis.

The theory of “united allergic airway” connects allergic rhinitis (AR), CRS and asthma are viewed as arising from a common atopic entity.¹⁴ The aggregation of research suggests that AR, asthma and chronic rhinosinusitis are linked by the united allergic airway, a notion that encompasses commonalities in pathophysiology, epidemiology and treatment.¹⁴

However, despite the common thought, considering the overlap between allergic reactions and rhinosinusitis, Gelincik *et al.* suggested that allergic and non-allergic rhinitis may predispose the patient similarly to the CRS. According their findings, allergic and non-allergic rhinitis are similar in symptoms of rhinosinusitis, including pharyngeal secretions, dental pain, diagnostic grading, except for purulent nasal discharge which is more in allergic rhinitis.²⁶ It must be mentioned that the findings of this research and other studies^{15,17,20,21,27} which indicate an overlap between allergic diseases and chronic rhinosinusitis do not have a conflict and in conclusion, inflammatory reactions in upper and lower respiratory tract are pathologically related with the chronic and recurrent sinusitis, and this correlation is confirmed by clinical findings. However, the overlap of upper and lower respiratory tract allergic disease with the chronic and recurrent sinusitis is of greater importance because successful treatment of allergic diseases in children with chronic or recurrent sinusitis, increases the therapeutic response and reduces the treatment cost.

Epidemiological evidence suggests a strong relationship between AR and asthma.²⁸ AR and asthma, rather than being considered two distinct diseases, can be unified by the concept of a “united airway” where allergic

symptoms of the upper and lower airways can be thought of as manifestations of a common atopic entity.²⁹ Both diseases, which are IgE mediated, can be triggered by similar allergens.³⁰ In addition to the epidemiological evidence, several clinical reports point to a common pathophysiological relationship between AR and asthma.³¹

The overlap between allergic and non-allergic rhinitis with chronic sinusitis has been described by other studies²² and as the Gelincik showed more nasal purulence in allergic patients,²⁶ Kirtsreesakul and Ruttanaphol²² showed more abnormal findings in sinus radiography of patients with allergic rhinitis, in comparison with non-allergic rhinosinusitis patients. Also, it has shown more endoscopic findings in patients with chronic non-allergic rhinosinusitis than allergic rhinosinusitis patients. It can be concluded that because patients with chronic allergic rhinosinusitis have more purulent nasal secretions than non-allergic rhinosinusitis patients,²⁶ probably the pyogenic pathogens are more colonised in para-nasal sinuses of these patients causing destructive effects and consequently more radiographic findings in their sinuses.²²

According to previous studies, because of the relation between cold and allergic reactions, treatment of allergy, reduces the frequency of catching cold and the need for antibiotics and is effective on treatment of chronic or recurrent sinusitis.³²⁻³⁸ This relationship is also confirmed by the present study.

CONCLUSION

Allergic diseases in children with chronic or recurrent sinusitis are remarkably common and are associated with a large number of positive skin allergy tests. Treatment of allergic disease in children with chronic or recurrent sinusitis improve the patients’ condition. This improvement reduces the frequency of catching colds sinusitis and the need for antibiotics. Also the symptoms of sinusitis are reduced by reducing the frequency of colds. This may be because of probable effect of cold viruses on provoking allergic sinusitis. The response to therapy is higher in patients with positive allergy test. Aging reduces the allergic reaction and the positive allergy skin test. Age is one of the major effective factors in the treatment of allergies and subsequently in the treatment of recurrent and chronic sinusitis in children.

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