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Original Article / Çalışma - Araştırma

Symptomatology and etiology of chronic pediatric rhinosinusitis

Kronik pediatrik rinosinüzitin semptomatolojisi ve etyolojisi

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Objectives: This study aims to define symptoms and etiology and determine how to prevent chronic rhinosinusitis in children.

Patients and Methods: Between February 2003 and February 2005, 50 pediatric patients (25 girls and 25 boys; mean age 8.22 years; range 4 to 14 years) with chronic rhinosinusitis were included in the study. The patients were questioned about anterior/posterior nasal dripping, night cough, headache, nausea, vomiting and nasal obstruction for symptomatology; about school condition, smoking behavior of parents and history of asthma for etiology. Hemogram, serum biochemistry, allergy test, nasal smear, chest and lateral neck radiography and sweat test were performed.

Results: Symptomatologic examination revealed that 48% had anterior nasal dripping, 62% with postnasal dripping, 70% with headache and 90% with nasal obstruction. Evaluation of etiological factors revealed that 68% were going to school, 48% of the parents had the history of smoking, 42% with allergy test-positivity and 60% with adenoid vegetation.

Conclusion: Our study results indicated that environmental factors are important as etiological factors in rhinosinusitis. For prevention, we recommend restriction of close relationship at school, not to smoke at home and vaccination in each year with *influenza* and *S. pneumonia* vaccine.

Key Words: Etiology; pediatric; resistant; rhinosinusitis; symptom.

Amaç: Bu makalenin amacı, rinosinüzitin semptomları ve etyolojisini tanımlamak ve çocuklarda kronik rinosinüzitin nasıl önleneceğini belirlemektir.

Hastalar ve Yöntemler: Çalışmaya Şubat 2003 ve Şubat 2005 tarihleri arasında kronik rinosinüzit olan 50 pediatrik hasta (25 kız, 25 erkek; ort. yaş 8.22 yıl; aralık 4-14 yıl) dahil edildi. Hastaların semptomatoloji açısından ön ve arka burun akıntısı, gece öksürüğü, baş ağrısı, bulantı, kusma ve burun tıkanıklığı ve etyoloji açısından okul durumu, ebeveynlerin sigara alışkanlığı ve astım öyküsü sorgulandı. Hemogram, serum biyokimya, alerji testi, burun sürüntüsü, göğüs ve lateral boyun radyografi ve terleme testi yapıldı.

Bulgular: Semptomatolojik inceleme sonucunda hastaların %48'inde ön burun akıntısı, %62'sinde postnazal akıntı, %70'inde baş ağrısı ve %90'ında burun tıkanıklığı saptandı. Etyolojik faktörler değerlendirildiğinde, hastaların %68'inin okula gittiği, %48'inin ebeveynlerinin sigara içtiği, %42'sinde alerji testinin pozitif olduğu ve %60'ında adenoid hipertrofisi olduğu görüldü.

Sonuç: Çalışma bulguları, rinosinüzitte çevresel faktörlerin de etyolojik faktörler kadar önemli olduğunu gösterdi. Koruma açısından okulda yakın ilişkinin sınırlandırılması, evde sigara içilmemesi ve her yıl *influenza* ve *S. pneumonia* aşılarının yapılmasını önermekteyiz.

Anahtar Sözcükler: Etyoloji; pediatrik; dirençli; rinosinüzit; semptom.

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It is difficult to distinguish pediatric rhinitis and sinusitis clinically because they are often part of the same disease. For this reason, it is more accurate to use the term rhinosinusitis instead of sinusitis in pediatric patients. There are many studies on acute sinusitis and complications in pediatric patients; but there are few studies about chronic sinusitis.[1] The importance and frequency of chronic sinusitis in the pediatric age group has increased in recent years. The reasons for this increase include increasing use of endoscopes and computed tomography (CT) which help diagnose sinusitis more definitely and accurately, progress in the diagnosis and treatment of allergic diseases and demonstration of harmful effects of sinus infections upon chronic pulmonary diseases.[2]

The diagnosis of chronic rhinosinusitis from acute sinusitis is easy and based on prolongation of symptoms for more than 12 weeks. But it is more difficult to differentiate chronic rhinosinusitis from recurrent acute sinusitis. It is hard to recognize whether rhinosinusitis is completely healed or not between the exacerbations of recurrent acute sinusitis and many cases can be misdiagnosed as chronic sinusitis. When chronic rhinosinusitis is severe, it is appropriate to start four to six weeks broad spectrum antibiotic treatment and to obtain a post-treatment CT. It is important to maximize medical treatment to observe how much the disease resolves. Even if post-treatment CT shows complete recovery, predisposing factors such as allergic rhinitis and adenoid hypertrophy must be taken into account. Adenoidectomy must be considered when radiologically proven adenoid hypertrophy exists even if chronic rhinosinusitis is healed with medical treatment.[2] Most chronic rhinosinusitis cases heal succesfully with initial oral treatment of two to four weeks based on culture results.

Because there are few studies about the symptomatology and etiology of chronic rhinosinusitis resistant to medical treatment in the pediatric group, we decided to write this article. This study aims to discuss physical examination findings, radiological and laboratory results, symptomatologic and etiologic factors of pediatric patients with chronic rhinosinusitis resistant to medical treatment with reference to the literature.

PATIENTS AND METHODS

Fifty pediatric patients (25 girls, 25 boys; mean age 8.22 years; range 4 to 14 years) who were seen at the department of otorinolaryngology between February 2003 and February 2005 with a diagnosis of chronic rhinosinusitis with no resolution after two months of medical treatment were evaluated in this study.

Patients who had sinusitis symptoms for over one month were initially considered for our study; those with known systemic disease were excluded. The patients took amoxicillin and clavulanic acid, oral and nasal decongestant and nonsteroid antiinflammatory drugs for one month At the end of one month, if symptoms persisted and physical examination revealed the diagnosis of rhinosinusitis, cefuroxime axetil was given for another month. After the second month, if symptoms still persisted, a coronal and axial CT was taken. If physical examination and CT still confirmed the diagnosis of rhinosinusitis then these patients were included in this study. History and symptoms of pediatric patients were obtained from the person who looks after him or her.

Patients who were resistant to medical treatment were questioned about anterior nasal dripping, postnasal dripping, night cough, headache, morning nausea and vomiting, chronic nasal obstruction and weakness for determination of symptomatology. They were also questioned about day nursery and school condition, smoking behavior of parents, and history of asthma for determination of etiology. Hemogram, serum biochemistry, total immunoglobulin E (IgE), AlaTOP allergy test, nasal smear, eosinophil cationic protein (ECP), immunoglobulin G (IgG), immunoglobulin M (IgM), immunoglobulin A (IgA), C reactive protein (CRP), chest radiogram, lateral neck graph in soft tissue density and sweat test was performed on all patients.

Radiographs were taken while the neck was in an extended position and posteroanterior thorax position. Total IgE levels were measured and the levels less than 24 ng/ml were accepted normal for eosinophil cationic protein. Results for AlaTOP allergy test were accepted as positive or negative. Sweat test results above 40 mEq/lt were accepted as positive and patients with positive results were evaluated together with the pediatric clinic.

Statistical methods

Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois, USA) for Windows 10.0 program was used for statistical analysis of the findings in this study. Data values were expressed as mean ± standard deviation, frequency and percentage. For the qualitative data comparison Chi-square test was used. Differences were considered significant when $p<0.05$.

RESULTS

Evaluation of patients according to symptomatology revealed that 48% had anterior nasal dripping, 62% had postnasal dripping, 38% had night cough, 70% had headache, 24% had morning nausea and vomiting, 90% had chronic nasal obstruction and 28% had weakness. Additionally 8% of patients had nasal itching, 6% had epistaxis, 4% had lack of appetite, 4% had snoring, 4% had sneezing, 2% had cough and 2% had nasal talking (Table 1).

Evaluation of patients according to etiological factors revealed that 68% were going to day nursery or school, 48% had parents with a history of smoking, 42% had allergy test positivity, 60% had adenoid vegetation, 2% had concha bullosa, 22% had nasal smear positivity, 4% had sweat test positivity and 24% had a history of asthma (Table 2). None of the patients had immunoglobulin deficiency. Hemogram and serum biochemistry levels were within normal limits.

Table 1. Distribution of patients according to symptomatology

Symptoms	n	%
Anterior nasal dripping	24	48.0
Postnasal dripping	31	62.0
Night cough	19	38.0
Headache	35	70.0
Morning nausea and vomiting	12	24.0
Chronic nasal obstruction	45	90.0
Weakness	14	28.0
Other symptoms		
Epistaxis	3	6.0
Lack of appetite	2	4.0
Snoring	2	4.0
Nasal itching	4	8.0
Sneezing	2	4.0
Cough	1	2.0
Nasal talking	1	2.0

DISCUSSION

The diagnosis and treatment of pediatric rhinosinusitis is still a controversial subject. There are many reasons for difficulties in diagnosis. First of all, chronic rhinosinusitis in pediatric patients is a multifactorial and complex disease. There are so many predisposing factors like allergy, immune deficiency syndromes, cystic fibrosis and immotile cilia syndrome and rhinosinusitis may result as a complication of these diseases. Secondly, we encounter many difficulties when taking the history, during physical examination and radiological studies. Pediatric patients cannot express their symptoms sufficiently. Physical examination is more difficult in pediatric patients because of the communication difficulties between patient and doctor. Conventional radiographs often give less information about ethmoid sinuses and this contributes to misdiagnosing chronic sinusitis in children.[3]

Another difficulty in diagnosis is the absence of an approved clinical classification of pediatric rhinosinusitis.[3] Purulent secretions at the middle meatus correlates with diagnosis of rhinosinusitis. Endoscopic examination is useful for diagnosis and cooperation is necessary between patient and doctor.[4-6]

In our study, we confirmed the diagnosis of rhinosinusitis with physical examination and paranasal sinus CT after two treatment protocols of four weeks each.

The treatment of sinusitis is still controversial. Intensive and long-term treatment is usually

Table 2. Distribution of patients according to etiology

Etiology	n	%
Day nursery and school condition	34	68.0
History of parents smoking at home	24	48.0
Allergy	21	42.0
Adenoid vegetation	30	60.0
Concha bullosa	1	2.0
Nasal smear positivity	11	22.0
Immunoglobulin deficiency	–	–
Sweat test positivity	2	4.0
History of asthma	12	24.0

enough for complete recovery.[7] In some patients mucosal disease still persists and surgical treatment may be necessary. Most of the studies we found in the literature were related with medical treatment of rhinosinusitis.[8]

Öztürk et al.[9] studied the predisposing factors for rhinosinusitis in 40 pediatric patients. They found that 33 patients (82.5%) complained about cough, 30 patients (75%) had nasal dripping, 35 patients (87.5%) had nasal obstruction, 17 patients (42.5%) had headache, eight patients (20%) had halitosis, five patients (12.5%) had fever and three patients (7.5%) had periorbital swelling.

Parsons and Phillips[10] stated that symptoms of pediatric chronic sinusitis patients include purulent nasal dripping 90%, chronic nasal obstruction 100%, postnasal dripping 63%, cough 71%, halitosis 67%, headache 71% and behavioral changes 63%.

When we compared our results with these studies, we found that the ratio of nasal dripping complaint was lower. We thought this finding may be related to separation of nasal dripping symptoms into anterior and posterior. Similarly we found that the ratio of cough complaint was also lower than the other studies in the literature. This situation may be explained by our asking only night cough instead of cough lasting all day.

The ratio of headache symptoms in our study was higher than most of the previous studies.[8,9] In our study the mean age of the patients was 8.4±2.7 years and it is relatively higher than other studies.[8,10] Öztürk et al.[9] found statistical significance between age and headache and determined increase in headache symptoms with increasing age. A reason for this increase might be better description of their symptoms.

Colonization of microorganisms inside adenoid tissue may trigger sinonasal symptoms because of the close relationship of adenoid tissue to the paranasal sinuses.[7,11-13] Lee and Rosenfeld[12] studied bacterial prevalence in adenoid tissue and sinonasal symptoms and found a significant relationship between them. Takahashi et al.[14] followed up children with serous otitis media and sinusitis who underwent adenoidectomy and children with same disease who hadn't had adenoidectomy for three years. They found a significant decrease of sinonasal symptoms in children who had undergone adenoidectomy. Other studies have shown that big adenoid tissue may cause rhinosinusitis with aerodynamic, bacteriological and immunologic effects.[11,15] In our study, we determined that adenoid hypertrophy caused significant obstruction in 30 patients (60%) so we thought that adenoid tissue may cause rhinosinusitis by creating obstruction. We performed adenoidectomies on 22 of 30 patients. And postoperative six-month follow-up revealed that 14 patients (63.6%) healed without further surgery. Other studies also showed that adenoidectomy is useful in pediatric chronic rhinosinusitis resistant to medical treatment and this finding correlates with our opinion.[16,17]

Adenoidectomy in recurrent and chronic rhinosinusitis treatment helps not only to eliminate an etiological factor but also removes overlapping symptoms of adenoid hypertrophy and rhinosinusitis. Adenoid surgery alone improves symptoms without any further surgery in patients who are thought to need endoscopic sinus surgery.[18] So we should not consider endoscopic sinus surgery without awaiting the effects of adenoidectomy.

One of the reasons for recurrent sinopulmonary infections are IgA and IgG group deficiencies.[19,20] Even if IgA and IgG levels are normal, there may be IgG subgroup deficiencies and this may cause recurrent rhinosinusitis.[21] In our study none of the pediatric patients showed IgM, IgA, IgG deficiency. We could not look for subgroup deficiencies.

Most common bone anomalities seen in paranasal sinus CT scans of pediatric patients with chronic rhinosinusitis include paradoxically curved middle concha, middle concha bullosa, pneumatized uncinate, hypoplasic uncinate, hypoplastic maxillary sinus, haller cell, supraorbital or frontal cell, ager nasi cell and septal deviation.[7,22] It is suggested that paranasal sinus CT must be taken in patients nonresponsive to treatment, just after three or four weeks of medical treatment. In the study of Kazkayası et al.,[23] it is stated that CT must be taken three or five days after the medical treatment finished because of the postantibiotic effect.

Usually, the incidence of concha bullosa in children is lower than in adults and it is assumed that concha bullosae expand with increasing age.[24,25] We found 2% concha bullosa incidence in our study which is lower than the literature because we did not include adolescents in our study.

In the study of Ramadan[26] which consisted of 202 pediatric chronic rhinosinusitis patients, they stated that 27% were passively exposed to cigarette smoke. In our study we found 48% of patients passively exposed to cigarette smoke due to smoking behavior of their parents.

Physical examination of allergic rhinitis patients shows edematous concha, serous or seromusinous secretion and pale or gray-blue colored nasal mucosa.[27,28] In spite of many studies showing the relationship between allergic rhinitis and chronic sinusitis a huge percent of doctors still do not show interest in allergy tests in chronic pediatric rhinosinusitis.[28] In our study we searched allergic rhinitis with history of patient, physical examination, total IgE levels, AlaTOP allergy test, ECP and nasal smear. We detected allergic etiology in 42% of patients and this finding demonstrates the importance of allergic rhinitis as an etiological factor. Also we found 24% of patients had asthma and this shows us that chronic rhinosinusitis is more frequent in patients with asthma.

Upper respiratory tract infection is the most important risk factor for otitis media and rhinosinusitis. Cleanness of the day nursery, decrease in the number of children in each class and proximity prevention among different age groups is necessary to prevent upper respiratory tract infection in schools or day nursery.[18] We found that 68% of patients go to a school or day nursery. This high percentage makes children more prone to get any upper respiratory tract infection.

Cystic fibrosis is an epithelial autosomal recessive disease affecting exocrine glands such as sweat and salivary glands. Increased viscosity of secretions causes obstruction of gland ducts. Nasal polyposis, rhinosinusitis and lower respiratory tract infections are commonly seen in cystic fibrosis patients.[29-31] We found positive results for sweat test in two patients (4%). We followed-up these patients together with the pediatric clinic.

In conclusion, there are few studies searching for symptomatology and etiology in pediatric rhinosinusitis resistant to medical therapy. We found chronic nasal obstruction as the most common symptom followed by headache and postnasal dripping. We also found the most common etiological factor as going to day nursery or school followed by adenoid hypertrophy, passive exposure to cigarette smoking and allergy. These findings show us that the environmental factors are important as etiological factors in chronic rhinosinusitis resistant to medical treatment. For this reason we suggest restriction of close relationships at school or day nursery and not to smoke at home or nearby children. We think that it is important to vaccinate our children with *influenza* vaccine each year in October or November and with *S. pneumonia* vaccine for patients who are over two years old. Adenoid surgery alone improves symptoms without any further surgery in patients who have adenoid hypertrophy.

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REFERENCES

1. Wolf G, Greistorfer K, Jebeles JA. The endoscopic endonasal surgical technique in the treatment of chronic recurring sinusitis in children. Rhinology 1995;33:97-103.
2. Manning SC. Pediatric sinusitis. Otolaryngol Clin North Am 1993;26:623-38.
3. Keleş N, Ilıcalı ÖC, Güldiken Y, Değer K. Çocuk yaş grubunda endoskopik sinüs cerrahisi; Kulak Burun Bogaz Ihtis Derg 2000;7:18-22.
4. Ferguson BJ, Mabry RL. Laboratory diagnosis. Otolaryngol Head Neck Surg 1997;117:S12-26.
5. Lusk RP, Stankiewicz JA. Pediatric rhinosinusitis. Otolaryngol Head Neck Surg 1997;117:S53-7.
6. Spector SL, Bernstein IL, Li JT, Berger WE, Kaliner MA, Schuller DE, et al. Parameters for the diagnosis and management of sinusitis. J Allergy Clin Immunol 1998;102:S107-44.
7. Parsons DS. Chronic sinusitis: a medical or surgical disease? Otolaryngol Clin North Am 1996;29:1-9.
8. Wald ER. Management of sinusitis in infants and children. Pediatr Infect Dis J 1988;7:449-52.
9. Öztürk K, Cenik Z, Özer B, Eyibilen A. Çocukluk çağı sinüzitlerinde predispozan faktörler ve water's grafisinin tanı değeri. K.B.B ve Baş Boyun Cerrahisi Derg 1999;7:168-174.
10. Parsons DS, Phillips SE. Functional endoscopic surgery in children: a retrospective analysis of results. Laryngoscope 1993;103:899-903.
11. Fukuda K, Matsune S, Ushikai M, Imamura Y, Ohyama M. A study on the relationship between adenoid vegetation and rhinosinusitis. Am J Otolaryngol 1989;10:214-6.
12. Lee D, Rosenfeld RM. Adenoid bacteriology and sinonasal symptoms in children. Otolaryngol Head Neck Surg 1997;116:301-7.
13. Linder TE, Marder HP, Munzinger J. Role of adenoids

in the pathogenesis of otitis media: a bacteriologic and immunohistochemical analysis. Ann Otol Rhinol Laryngol 1997;106:619-23.
14. Takahashi H, Fujita A, Honjo I. Effect of adenoidectomy on otitis media with effusion, tubal function, and sinusitis. Am J Otolaryngol 1989;10:208-13.
15. Haapaniemi JJ. Adenoids in school-aged children. J Laryngol Otol 1995;109:196-202.
16. Pransky SM, Low WS. Pediatric ethmoidectomy. Otolaryngol Clin North Am 1996;29:131-42.
17. Rodney PL. Functional endoscopic sinus surgery. 3rd ed. In: Cummings CW, editor. Pediatric otolaryngology head and neck surgery. St. Louis: Mosby; 1998. p. 104-15.
18. Önerci M. Çocuk sinüzitleri. In: Endoskopik sinüs cerrahisi. 2. Baskı. Ankara: Kutsan Ofset; 1999. s. 50-62.
19. Jefferis R, Kumararatne DS. Selective IgG subclass deficiency: quantification and clinical relevance. Clin Exp Immunol 1990;81:357-67.
20. DeBaets F, Kint J, Pauwels R, Leroy J. IgG subclass deficiency in children with recurrent bronchitis. Eur J Pediatr 1992;151:274-8.
21. Emiroğlu HH. Küçük A. Kösecik M. Tekrarlayan sinopulmoner enfeksiyonlu çocuklarda IgGalt grup düzeyleri. Genel Tıp Derg 1999;9;1-4.
22. Manning SC. Pediatric sinusitis. Otolaryngol Clin North Am 1993;26:623-38.
23. Kazkayası M. Karadeniz Y. Koç C. Çocukların paranazal sinüs bilgisayarlı tomografilerinde patolojik bulgular. KBB ve BBC Dergisi 2001;9:125-8.
24. Lusk RP, McAlister B, el Fouley A. Anatomic variation in pediatric chronic sinusitis: a CT study. Otolaryngol Clin North Am 1996;29:75-91.
25. Milczuk HA, Dalley RW, Wessbacher FW, Richardson MA. Nasal and paranasal sinus anomalies in children with chronic sinusitis. Laryngoscope 1993;103:247-52.
26. Ramadan HH. Surgical management of chronic sinusitis in children. Laryngoscope 2004;114:2103-9.
27. Fadal R. The medical management of rhinitis. In: English GM, editor. Otolaryngol. Vol: 2, Chapter 13. Philadelphia: JB Lippincott Company; 1998.
28. Naspitz CK. Pediatrics. In: Naspitz CK. Tinkelman DG, editors. Childhood rhinitis and sinusitis. New York: Informa Healthcare; 1990. p. 1-22.
29. Fraser RG, Peter Pare JA, Pare PD, Fraser RS, Genereux GP. In: Bralow L, editor. Diseases of the airways. Diagnosis of Diseases of the Chest. 3rd ed. Philadelphia: W.B. Saunders Company; 1990. p. 1208-19.
30. Stern RC, Doershuk CF, Drumm ML. 3849+10 kb C-->T mutation and disease severity in cystic fibrosis. Lancet 1995;346:274-6.
31. Colten RH. Cystic fibrosis. In: Braunwald E, Isselbacher KJ, Petersdorf RG, editors. Harrison's Principles of Internal Medicine 2. 11th ed. Hamburg: McGraw-Hill; 1987. p. 1085-87.