

Pediatric allergic conjunctivitis and allergic rhinitis

Tong Qiao^{a,*}, Yizhen Hu^{a*}, Zhinan Wang^b

^aDepartment of Ophthalmology, the Union Hospital Affiliated to Huazhong University of Science and Technology, Wuhan 430022, Hubei Province, China;

^bDepartment of E.N.T, Wuhan Children's Hospital, Wuhan 430016, Hubei Province, China.

Received 20 February, 2008

Abstract

Objective: To assess the relationship between allergic conjunctivitis(AC) and allergic rhinitis(AR) in pediatric ophthalmology and E.N.T outpatient clinic. **Methods:** Eight hundred and ninety two patients were enrolled in survey during Mar. 2005-Jan. 2007, 407 allergic conjunctivitis cases were placed in the ophthalmology clinic group and 485 allergic rhinitis cases were from the E.N.T clinic. The comorbid disorders, histories, symptoms, signs of patients were recorded. Type 1 allergy was tested in 479 cases by a specific IgE antibody blood test. Eosinophils were detected in superficial conjunctival scrapings of the superior tarsal conjunctiva and mucosa surface scrapings of middle nasal meatus in 88 cases with both diseases. **Results:** 302(74%), 374(92%), 116(29%) in 407 cases with allergic conjunctivitis had concomitant eczema, rhinitis and asthma, respectively; 334(69%), 430(89%), 145(30%) in 485 cases with allergic rhinitis had concomitant eczema, allergic conjunctivitis and asthma, respectively. The prevalence of allergic conjunctivitis concomitant allergic rhinitis and allergic rhinitis concomitant allergic conjunctivitis had no significant difference($\chi^2=2.6$, $P > 0.05$). The prevalence of allergic conjunctivitis and allergic rhinitis concomitant eczema and asthma also had no significant difference ($\chi^2=3.08$; $\chi^2=0.21$, $P > 0.05$). The degree of severity of two kinds of disease symptoms is not parallel, in the patients with seasonal allergic conjunctivitis(SAC) and perennial allergic conjunctivitis(PAC), the clinical signs of AR were always severer($\chi^2=258.2$, $P < 0.05$) than those of AC. However, the results coincided with the cases with vernal keratoconjunctivitis(VKC)($\chi^2=66.5$, $P < 0.05$); Eosinophils were revealed in 50(57%) conjunctival scrapings and nasal mucosa scrapings($\chi^2=1.5$, $P > 0.05$), 47(53%) cases had positive results in both scrapings. The main aeroallergens were house dust mites, house dust and fungi, and the main food-allergens were fish, crab and shrimp. **Conclusion:** The two disorders were shown to share more similarities than differences, as suggested that allergic conjunctivitis should be considered in future guidelines on preventing the development of rhinitis and asthma in children.

Key words: allergy; conjunctivitis; rhinitis

INTRODUCTION

Allergic conjunctivitis is a group of diseases that are frequent in childhood^[1], and is an extremely common disorder; however, the vast majority of these are mild and self-limiting, some not requiring medical treatment at all, or being very adequately managed at the primary care level. But a small minority may be very difficult to control and may result in chronic sight-threatening complications caused by the secondary corneal being affected^[2-3]. Compared to allergic conjunctivitis, allergic

rhinitis is not a trivial illness but a major medical condition that affects the quality of life of people all over the world^[4]. patients with allergic rhinitis often present with various symptoms of conjunctivitis including sneezing, watery rhinorrhea and nasal congestion; itchy, red, watery eyes, and since the mucosa surface of conjunctiva and nasal is similar, the same allergens that trigger allergic rhinitis may be involved in the pathogenesis of allergic conjunctivitis(often using unspecific terms such as hay fever or allergic rhinoconjunctivitis^[5]). whether the extent allergic conjunctivitis is associated with allergic rhinitis has not yet been rigorously evaluated. Children with allergic rhinitis and/or con-

*Corresponding author

E-mail address: qiaojone@gmail.com

conjunctivitis suffer from many disorders including mental health, social function, and overall vision^[6]. The earlier the diagnosis and corresponding treatment, the more benefit the children will get, and have the quality of their lives enhanced^[7]. It is helpful for diagnosing the allergic conjunctivitis and rhinitis to have a clearer understanding of the relationship between the two diseases. So the objective of the present study was to assess the relationship between two diseases in pediatric ophthalmology and E.N.T outpatient clinic.

MATERIALS AND METHODS

Subjects

Eight hundred and ninety two patients were enrolled in the survey during Mar.2005- Jan. 2007. Children with allergic conjunctivitis or allergic rhinitis were diagnosed in the ophthalmology and E.N.T outpatient clinics of Wuhan Children's Hospital. 407 cases were allergic conjunctivitis from the ophthalmology clinic, and 485 cases were from E.N.T clinic as the allergic rhinitis group.

Eight hundred and ninety two children with the mean age of 8.5 years(3 months~17 years) were enrolled in the study. The mean age in ophthalmology group was 8.2 years(5 months~17 years) and for E.N.T, 8.7 years (3 months~17 years). 582(65%) were male, 310(35%) were female(1.9:1). The characteristics, history, symptoms, signs, laboratory findings and comorbid disorders of patients were entered into a given form.

Diagnosis

Allergic conjunctivitis was diagnosed as if the patient had characteristic symptoms and signs based on criteria set out by Buckley in 1998^[8]. And allergic rhinitis was diagnosed according to the criteria set out by allergic rhinitis impact on asthma(ARIA) in 2001^[9]. This was done to ensure accurate and consistent diagnosis of allergic conjunctivitis and rhinitis so as not to include other conditions, for example, drug allergy or preservative toxicity. All cases were diagnosed by the same ophthalmologist and otolaryngologist. The presence of a type I hypersensitivity reaction is usually considered as a defining characteristic of allergic conjunctivitis and rhinitis, distinguishing it from other immunedependent ocular and nasal surface diseases. The diagnosis of asthma and eczema were based on history and clinical examination, if necessary, with the help of related specialists. Inclusion criteria required a history of recurring symptoms over a period of at least 1 year. The degree of allergic conjunctivitis and rhinitis was classified as mild, moderate and severe, respectively, by the diagnosed criteria.

Since children seldom wear contact lens in Wuhan, allergic conjunctivitis in this study may be divided into

3 major subcategories: Seasonal allergic conjunctivitis (SAC) and perennial allergic conjunctivitis(PAC), which are commonly grouped together and are almost always mild. The other group is vernal keratoconjunctivitis (VKC) syndrome which is usually severe.

Clinical features

Allergic conjunctivitis is characterized by itching, redness, tearing and photophobia. Physical signs are injection of conjunctiva vessels, chemosis and eyelid edema. Allergic rhinitis may be perennial and intermittent according to symptoms graded by severity and their effect on patient quality of life. Patients with typical seasonal allergic rhinitis tend to have watery rhinorrhea; repetitive sneezing; itching(pruritus) of the nose, ears, and throat; and nasal congestion, whereas patients with perennial allergic rhinitis are more likely to have prominent and severe nasal congestion and postnasal drainage. Perennial allergic rhinitis may be more difficult to diagnose because its symptoms can mimic those of chronic sinusitis, recurrent upper respiratory tract infections, and vasomotor rhinitis.

Methods

Type I allergy was tested by a specific IgE antibody test in the blood(Allergy Screen,ASI,USA, offered by HOB in Beijing, PRC). Eosinophils was detected in superficial conjunctival scrapings of the superior tarsal conjunctiva, and mucosa surface scrapings of middle nasal meatus was taken in some severe cases(with parents' permission for the examination).

Statistical analysis

The chi-squared test was used for the analyses of data. The P value < 0.05 was considered statistically significant.

RESULTS

Common information

302(74%), 374(92%), 116(29%) in 407 cases with allergic conjunctivitis had concomitant eczema, rhinitis and asthma respectively; 334(69%), 430(89%), 145 (30%) in 485 cases with allergic rhinitis had concomitant eczema, allergic conjunctivitis and asthma respectively. The prevalence of allergic conjunctivitis concomitant allergic rhinitis and allergic rhinitis concomitant allergic conjunctivitis had no statistical difference($\chi^2=2.6$, $P > 0.05$), and the prevalence of allergic conjunctivitis and allergic rhinitis concomitant eczema and asthma had no significant difference ($\chi^2=3.08$; $\chi^2 = 0.21$, $P > 0.05$).

Information of patients with allergic conjunctivitis and rhinitis

796 cases had both allergic conjunctivitis and allergic rhinitis, however 738 cases(93%) in those gave a com-

plete record of the severity. Out of those, 352 were cases with PAC, 272 cases with SAC and 114 cases with VKC (Fig 1). The degree of severity of two kinds of disease symptoms was not parallel in patients with SAC and PAC. The clinical signs of AR were always severer ($\chi^2 = 258.2, P < 0.05$) than those of AC; but in verse with cases being diagnosed as VKC($\chi^2 = 66.5, P < 0.05$)(Tab 1, 2).

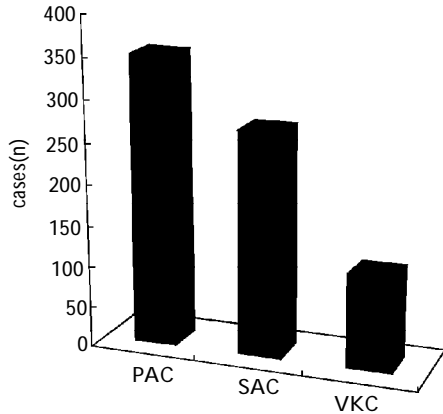


Fig 1 constitution of allergic conjunctivitis

Tab 1 severity degree of PAC, SAC and AR (n)

| Group | mild | moderate | severe |
|---------|------|----------|--------|
| PAC+SAC | 430 | 191 | 3 |
| AR | 99 | 398 | 127 |

$\chi^2 = 258.2, P < 0.05.$

Tab 2 severity degrees of VKC and AR (n)

| Group | mild | moderate | severe |
|-------|------|----------|--------|
| VKC | 24 | 68 | 22 |
| AR | 32 | 73 | 9 |

$\chi^2 = 66.5, P < 0.05.$

Results of IgE antibody test

A total of 535(67%) in 796 children were tested by a specific IgE antibody test in the blood. The positive result rate of total IgE was 99.30%(531/535). 489 cases were aero-allergen related and 423 cases food-allergen related. 450(92%) in the aero-allergen related group and 237(56%) in food-allergen related group had special IgE positive test results. The main aero-allergens were house dust mites, house dust and fungi, and the main food-allergens were fish, crab and shrimp(Fig 2, 3).

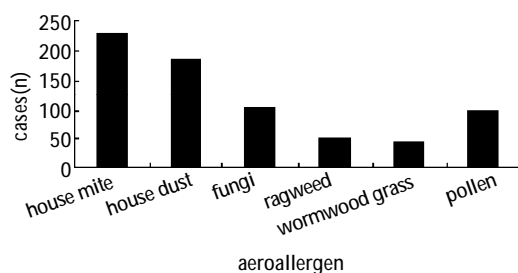


Fig 2 The result of aeroallergen attribution



Fig 3 The result of food-allergens attribution

Results of scrapings

88(11%) from 796 cases were accepted (and consented), for superficial conjunctival scrapings to be taken. These mucosa surface scrapings were obtained from the superior tarsal conjunctiva, and in middle nasal meatus. Eosinophils were revealed in 50(57%) of conjunctival scrapings and 58(66%) of the nasal mucosa scrapings($\chi^2 = 1.5, P > 0.05$), and 47(53%) cases had positive results in both scrapings.

DISCUSSION

Allergies occur frequently in all pediatric age groups, affecting up to 40% of children. Allergic rhinitis and conjunctivitis is the commonest ocular allergy syndrome among children^[10]. Pediatric ocular allergy is underdiagnosed in clinical practice and has a significant impact on the life of the children. It is vital to reach a better understanding of ocular allergic mechanisms and inflammation, which may lead to improved treatment for other allergic diseases. Although 1.9:1 of the ratio of male to female in this study was lower than 2.4:1 in Asians concluded by Singh^[11], there was a predominance of males in both allergic conjunctivitis and allergic rhinitis in children.

Traditionally, allergy investigations have focused on nasal symptoms; however, recent studies have highlighted the prevalence and significance of ocular symptoms. Evidence suggests that ocular symptoms are particularly prevalent in seasonal allergic rhinitis(SAR) sufferers^[12], and in accordance, the NHANESIII survey showed that during the summer months(May to August) in the United States, isolated ocular symptoms were more prevalent than isolated nasal symptoms. In recent years, the association of rhinitis and asthma appears to be stronger than reported previously, leading to definitions of “one airway, one disease” and “allergic rhinobronchitis.” Rhinitis and conjunctivitis, either isolated or combination, often accompany asthma and other atopic diseases^[13]. One study has shown that the prevalence of the combination of allergic conjunctivitis and allergic rhinitis was 17.6%, indicating a co-morbidity of approximately 92%^[14], as was confirmatory to our findings that allergic rhinitis was diagnosed in 92% of children with allergic conjunctivitis. Conversely, 89%

of children with allergic conjunctivitis were diagnosed with allergic rhinitis, (the prevalence of comorbid eczema and asthma of two conditions having no difference). This finding was a little different from Malo's, however they had found comorbid asthma to be more present in rhinitis(92%) than conjunctivitis (72%)^[15]. According to our findings, it can definitely be concluded that the two conditions have strong epidemiological associations.

Furthermore, the two diseases have the same pathophysiology, and the mucosa of conjunctival and nasal is the common site for allergic responses as allergic conditions usually involving exposed body surfaces. This response involves an over-sensitivity(either acquired or innate) to an external allergen which results in a hypersensitivity reaction. Type I immediate hypersensitivity reactions primarily involve the mast cell and the basophil and tend to be IgE mediated. High total IgE levels have been measured in the serum of patients with allergic conjunctivitis and allergic rhinitis, and the two diseases also shared the same allergen in this study. House dust mites, house dust and fungi were the main allergens like many findings in these allergic diseases before^[16-17]. In addition, the findings that the main food-allergens are fish, crab and shrimp. Previous research has neglected to reveal food-allergens in allergic conjunctivitis and rhinitis. However, this kind of data is still rare especially in children under 2 years old. So further studies are still necessary to emphasize on this part.

Among inflammatory cells, eosinophils represents a common clue in upper and lower airway inflammation^[18], and it should be noted that just small percentage of patients underwent the scrapings examination. Naturally we believe the study would have been more conclusive, if we had tested a significant quantity of patients. The positive rate of the presence of eosinophils in conjunctival scraping and nasal scrapings was not high because of an accumulation of eosinophils in the deeper conjunctiva and nasal mucosa. However, the outcomes could still verify the same inflammatory procedure in allergic conjunctiva as that in nasal mucosa.

Although the two conditions had the same character, the degree of severity of the two is not parallel, as indicates that when one disease appears in a patient, another should be checked up very carefully to assure two conditions get corresponding treatment.

Because all the allergic diseases share common inflammatory mediators, it may explain why treating any kind of allergic disease may improve comorbid condition.

As inflammation and its relationship to remodeling for allergic rhinitis and asthma are becoming better

understood, the importance of anti-inflammatory treatment is increasingly accepted. The World Allergy Organization, in conjunction with the World Health Organization, has published Guidelines for the Prevention of Allergy and Allergic Asthma^[19-20]. The guidelines recommend treating upper airway disease, such as AR, to prevent the development of asthma. One study supports the use of nasal rinsing with hypertonic saline in the pediatric patient with seasonal allergic rhinoconjunctivitis^[21]. This treatment proved to be tolerable, inexpensive and effective. Intranasal corticosteroids(INS) are highly effective for treating nasal symptoms of AR, however, they may also be effective for the treatment of ocular symptoms. Currently, the mechanism by which intranasal treatments act on ocular symptoms is not known. Potential mechanisms include improved drainage of ocular secretions resulting from a reduction of edema and inflammation around the lower end of the nasolacrimal duct, and a decrease in neuronal reflex activity. It is well established that allergen challenges to one side of the nasal cavity lead to nasal secretion in the contralateral cavity via a neurologic reflex.^[22-24] Nasal challenges have also produced ocular itching in 90% of patients in one study^[22] suggesting that ocular symptoms may be induced by a nasal-ocular reflex.

Given the similarity that exists between the patterns of inflammation seen in allergic rhinitis and allergic conjunctivitis, patients may best benefit from an approach that considers treating the entire airway rather than only a part. Ocular surface disease in childhood-onset adult AKC patients was characterized by greater ocular surface epithelial damage. Prolonged inflammation may be important in the evolution and progression of ocular surface disease in patients with longstanding active AKC^[25], which urges us to prevent and treat allergic diseases in childhood earlier. The findings have indicated that allergic conjunctivitis should be considered in future guidelines on prevention the development of rhinitis and asthma, especially in childhood.

References

- [1] Zepeda OB, Rosas VMA, Ito Tsuchiya FM, del Río NBE, Sienna MJ. *Rev Alerg Mex. Allergic conjunctivitis in children* 2007;54: 41-53.
- [2] Ziskind A. Allergic conjunctivitis. *Current Allergy and Clinical Immunology* 2006;119:55-9.
- [3] Tanaka M, Dogru M, Takano Y, Miyake-Kashima M, Asano-Kato N, Fukagawa K, et al. The relation of conjunctival and corneal findings in severe ocular allergies. *Cornea* 2004 ;23:464-7.
- [4] Adams PF, Hendershot GE, Marano MA. Current estimates from the national health interview survey, 1996. *Centers for Disease Control and Prevention/National centre for Health Statistics* 1999; 10:200.

- [5] Tan TN, Lim DL, Lee BW, Van BHP. Prevalence of allergy-related symptoms in Singaporean children in the second year of life. *Pediatr Allergy Immunol* 2005; 16:151-6.
- [6] Leonard BC H, Katelaris, Susan L, Robert MN. Treating the Ocular Component of Allergic Rhinoconjunctivitis and Related Eye Disorders. *Med Gen Med* 2007; 9: 35.
- [7] Bielory L, Friedlaender MH. Allergic conjunctivitis. *Immunol Allergy Clin North Am* 2008;28:43-58.
- [8] Buckley RJ. Allergic eye disease-a clinical challenge. *Clin Exp Allergy* 1998;28(Suppl6):39-43.
- [9] Bousquet J, van Cauwenberge P, Khaltaev N. Allergic rhinitis and its impact on asthma. *J Allergy Clin Immunol* 2001;108: S147-334.
- [10] Abelson MB, Granet D. Ocular allergy in pediatric practice. *Curr Allergy Asthma Rep* 2006 ;6:306-11.
- [11] Singh A J, Loh R S K, Bradbury J A . Demographic study of paediatric allergic conjunctivitis within a multiethnic patient population. *Br J Ophthalmol* 2003;87:1195.
- [12] Kosrirukvongs P, Visitsunthorn N, Vichyanond P, Bunnag C. Allergic conjunctivitis. *Asian Pac J Allergy Immunol* 2001;19:237-44.
- [13] Busse WW, Holgate ST. Asthma and rhinitis. Oxford:Blackwell Scientific Publications, 1995.
- [14] Hesselmar B, Aberg B, Eriksson B, Aberg N. Allergic rhinoconjunctivitis, eczema, and sensitization in two areas with differing climates. *Pediatr Allergy Immunol* 2001;12: 208-15.
- [15] Malo JL, Lemiere C, Desjardins A, Cartier A. Prevalence and intensity of rhinoconjunctivitis in subjects with occupational asthma. *Eur Respir J* 1997;10:1513-5.
- [16] Dykewicz MS, Fineman S, Skoner DP, Nicklas R, Lee R, Blessing-Moore J, et al. Diagnosis and management of rhinitis: complete guidelines of the Joint Task Force on Practice Parameters in Allergy, Asthma and Immunology. *Ann Allergy Asthma Immunol* 1998;81: 478-518.
- [17] Boulay ME, Boulet LP. The relationships between atopy, rhinitis and asthma: pathophysiological considerations. *Curr Opin Allergy Clin Immunol* 2003;3:51-5.
- [18] Juliusson S, Pipkorn U, Karlsson G, Enerback L. Mast cells and eosinophils in the allergic mucosal response to allergen challenge: changes in distribution and signs of activation in relation to symptoms. *J Allergy Clin Immunol* 1992;90:898-909.
- [19] World Health Organization. *Prevention of Allergy and Allergic Asthma*. Geneva:WHO, 2003, (WHO/NMH/MNC/CRA/03.2).
- [20] Mhrshahi S, Webb K, Almqvist C, Kemp AS. Adherence to allergy prevention recommendations in children with a family history of asthma. *Pediatr Allergy Immunol* 2008; [Epub ahead of print].
- [21] Garavello W, Di Berardino F, Romagnoli M, Sambataro G, Gaini RM. Nasal rinsing with hypertonic solution: an adjunctive treatment for pediatric seasonal allergic rhinoconjunctivitis. *Int Arch Allergy Immunol* 2005 ;137:310-4.
- [22] Sheahan P, Walsh RM, Walsh MA, Costello RW. Induction of nasal hyper-responsiveness by allergen challenge in allergic rhinitis: the role of afferent and efferent nerves. *Clin Exp Allergy* 2005;35: 45-41.
- [23] Blais MS. Evolving paradigm in the management of allergic rhinitis-associated ocular symptoms: role of intranasal corticosteroids. *Curr Med Res Opin* 2008;[Epub ahead of print].
- [24] Naclerio R. Intranasal corticosteroids reduce ocular symptoms associated with allergic rhinitis. *Otolaryngol Head Neck Surg* 2008; 138:129-39.
- [25] Onguchi T, Dogru M, Okada N, Kato NA, Tanaka M, Takano Y, et al. The impact of the onset time of atopic keratoconjunctivitis on the tear function and ocular surface findings. *Am J Ophthalmol* 2006; 141:569-71.

