

Epidemiology of allergic conjunctivitis

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Purpose of review

To describe currently available epidemiological data on the prevalence of allergic conjunctivitis. Allergic conjunctivitis is often underdiagnosed and consequently undertreated except when it is severe and the chief complaint of a consultation in a specialty clinic. Use of healthcare resources and reduced quality of life of affected individuals justify studies on the prevalence of allergic conjunctivitis.

Recent findings

The association of allergic nasal and ocular symptoms (rhinoconjunctivitis) is common. Most children with allergic conjunctivitis have allergic rhinitis. Older population studies estimate a prevalence of 15–20% of allergic conjunctivitis, but more recent studies implicate rates as high as 40%. Ocular symptoms are common and contribute to the burden of allergic rhinitis and lower quality of life. Ocular allergies rank a very close second and at times may overcome the primary complaints of nasal congestion in rhinoconjunctivitis patients.

Summary

Little focus has been set on the impact of allergic conjunctivitis as comorbidity to asthma and rhinitis in atopic patients. Conjunctivitis symptoms are at least as severe as rhinitis symptoms in patients with 'hay fever' and some have even generated the term of conjunctivorhinitis stressing the ocular symptoms. Prevalence studies should be specifically addressed to ocular allergy symptoms.

Keywords

allergic conjunctivitis, conjunctivitis, epidemiology, rhinoconjunctivitis

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Introduction

Allergic rhinitis and conjunctivitis are systemic inflammatory conditions and often coexist. The Allergic Rhinitis and its Impact on Asthma (ARIA) initiative has established that allergic conjunctivitis is a comorbidity of asthma and rhinitis [1]. The allergic inflammatory component in ocular symptoms is less well studied as an independent entity, and much of the clinical information is commonly buried within the rhinoconjunctivitis literature. The association of allergic nasal and ocular symptoms (rhinoconjunctivitis or conjunctivorhinitis depending on which component is more severe) is common, but it is not clear if they are equal or if rhinitis is more common than conjunctivitis or if conjunctivitis is more common than rhinitis [2]; only 10% of individuals with allergic eye symptoms seek out medical attention, whereas others resort to self-diagnosis and treatment [3].

Most children with allergic conjunctivitis have allergic rhinitis and close to 50% of allergic rhinitis patients have allergic conjunctivitis usually with symptoms of watery (88%), itchy (88%), red (78%), sore (75%), swollen (72%), and stinging (65%) eyes [4]. Conjunctivitis is often under-

diagnosed among patients with allergic rhinitis and asthma. A cross-sectional study analyzed clinical data from a standardized asthma work-up protocol that included symptoms of allergic skin and respiratory conditions as well as a review of other systems. The diagnosis of conjunctivitis was registered by the attending physician in 16% of 1549 asthmatic children (mean age 4.3 years). However, 681 (44%) had at least one ocular symptom suggesting ocular allergy. Itching, lacrimation and redness were complained of by 38, 20 and 25%, respectively, of patients. House dust mites *Dermatophagoides pteronyssinus* (71.4%) and *Blomia tropicalis* (70.9%) were the most common sensitizing agents [5,6].

An epidemiologic study [7] was performed on 4991 patients consulting for the first time in Allergy services in Spain. Fifty-five percent of patients were diagnosed with allergic rhinitis, of whom 65% also had conjunctivitis and 37% asthma. The most frequently involved allergens were pollens (51%), followed by dust mites (42%). Polysensitization was found in 31% of cases.

Data on epidemiology of allergic conjunctivitis are scarce. In the US ocular allergy is estimated to affect 15–20%

of the general population [8]. Swedish adolescents have an estimated cumulative prevalence of allergic conjunctivitis of 19.1% by a written questionnaire followed by a subsequent interview [9].

The link between the upper and the lower respiratory tracts has been consistently established in the past years (united airways disease – ‘one airway – one disease’). Allergic conjunctivitis should be considered a part of this entity as the allergic inflammatory response not only impacts the respiratory tract, but is clearly tied to other mucosal surfaces especially the conjunctival surface. Little focus has been set on the impact of allergic conjunctivitis as comorbidity of asthma and rhinitis in atopic patients [10].

An international survey was conducted among patients and physicians to identify symptom perception and the impact of allergic rhinitis on health-related quality of life. A large proportion of patients in the USA had moderate or severe allergic rhinitis (62.6%). Itchy/red eyes were reported by 64% of patients with mixed forms of rhinitis and more commonly than in independent forms of seasonal or perennial allergic rhinitis [11].

The survey was also conducted in European countries on a larger population sample but predominantly seasonal allergic rhinitis. Itchy/red eyes were among the most common current or frequent patient-reported symptoms particularly in those with mixed forms of rhinitis. However, ocular symptoms were more commonly present in patients who were diagnosed with seasonal rhinitis than in those with perennial rhinitis and 19.7% of patients reported either itchy/red eyes or watery eyes as the most troublesome symptom. Moreover, physicians tended to underestimate the incidence of ocular symptoms compared with current or frequent patient-reported incidence of symptoms. Uncontrolled ocular symptoms contribute to the burden of allergic rhinitis and lower quality of life more likely in those with persistent moderate/severe nose symptoms [12].

Patients with allergic rhinitis frequently present with symptoms of allergic conjunctivitis. However, terms such as hay fever or allergic rhinoconjunctivitis have been used and prevalence studies have not been specifically addressed to ocular allergy symptoms. Children with allergic conjunctivitis had other diagnosis in a secondary pediatric outpatient clinic: 97% had allergic rhinitis [13].

Epidemiology

The severity associated with ocular symptoms in comparison to nasal allergy symptoms has commonly been overlooked, but with recent surveys such as Allergies Across America and others ocular allergies rank a very

Key points

- Ocular symptoms are common and interfere with quality of life of allergic individuals.
- Physicians tend to underestimate the incidence of ocular symptoms compared with current or frequent patient-reported incidence of symptoms.
- The association of allergic nasal and ocular symptoms is common but little focus has been set on the impact of allergic conjunctivitis as comorbidity of asthma and rhinitis in atopic patients.
- In the International Study of Asthma and Allergies in Childhood study, allergic conjunctivitis has been reported as rhinitis associated with itchy eyes (allergic rhinoconjunctivitis) and not isolated ocular symptoms.
- There is a paucity of international data evaluating the prevalence of ocular allergies within adult populations.

close second and at times may overcome the primary complaints of nasal congestion [14].

There are large global variations in the prevalence of reported symptoms of rhinoconjunctivitis as verified by the standardized written questionnaire of the International Study of Asthma and Allergies in Childhood (ISAAC) [15]. The ISAAC phase III involved 193 404 schoolchildren aged 6–7 years from 37 countries and 304 679 adolescents aged 13–14 years from 56 countries, and demonstrated prevalence of nasal symptoms associated with itchy watery eyes of 2.2–24.2% in children and of 4.5–45.1% among adolescents. Epidemiologic studies usually address ocular symptoms as rhinoconjunctivitis, which might have underestimated cases and consequently the disease prevalence [16].

A written questionnaire previously validated for the diagnosis of allergic conjunctivitis was self-completed at school by 3120 students aged 12–19 years (mean 13.3 years). One thousand two hundred and ninety-three (41.4%) respondents had itchy eyes in the past 12 months and lacrimation was reported by 1371 (43.9%). Considering the question on having had four or more episodes of ocular pruritus in the past 12 months the prevalence of current allergic conjunctivitis was 20.7%. This question had a sensitivity of 85.4% and specificity of 85.2% [17].

A questionnaire with a subsequent interview of 396 Swedish schoolchildren aged 12–13 years estimated the cumulative prevalence of allergic conjunctivitis to be 19.1%. The prevalence of the combination of allergic conjunctivitis and allergic rhinitis was 17.6% suggesting a comorbidity of approximately 92% [9]. In a large epidemiological survey of allergic patients in Italy, 40% had symptoms possibly related to allergic conjunctival disease

[18], whereas approximately 16.2% of the Japanese population suffer from cedar pollinosis, with various manifestations such as ophthalmic, laryngo-pharyngeal and skin symptoms in addition to nasal symptoms.

In a study [19] to evaluate the impact of environment on a population with a similar genetic pool, associations between allergic diseases and CD14 and CC16 polymorphisms in Finnish versus Russian Karelian women demonstrated marginal significance for allergic eye symptoms less than 12 months suggesting that an Eastern versus a Western environment may indeed exert an effect via opposite alleles on risk of allergic diseases in adult women.

In Spain, examining primary care practices and specialists nasal and ocular symptoms were reported by 83% of patients, either currently or frequently, and 36.4% of patients reported that these symptoms were moderate or severe. Most patients (83%) reported some impact from the symptoms on their daily activities [20].

In Sweden, during the 1980s, allergic symptoms in the nose and/or eyes were reported by 29%. Of those with current symptoms 64% were allergic to pollens and/or furred animals, as judged by the history and skin tests reflecting that 36% had other causes of their allergic conjunctivitis [21]. In the course of the extended ISAAC study [22], the prevalence of allergic rhinoconjunctivitis increased from 16.5, 24.7 to 29.6% starting in 1985 and ending in 2000.

The prevalence and severity of symptoms of self-reported hay fever were assessed in 509 symptomatic Swiss patients not currently receiving treatment who consulted their physicians during the 1994 pollen season. Conjunctivitis was diagnosed in 93.3% of cases (in 8% isolated), rhinitis in 92% (isolated in 6.7%). 24.2% suffered from current asthma symptoms. When the main symptomatology of hay fever (excluding asthma) was taken into account (the diagnosis with the severest symptomatology), 22.4% of patients suffered predominantly from conjunctivitis, 24.6% from rhinitis and 53% from both. Onset of symptoms typically occurred between March and May and lasted on average 2.7 ± 1.8 months. Severe symptoms were most common in the rhinitis group and least common in the rhinoconjunctivitis group. Conjunctivitis was more common than rhinitis in younger patients, whilst asthma prevalence increased with age (so-called 'Etagenwechsel'). Conjunctivitis symptoms were at least as severe as rhinitis symptoms in approximately 70% of patients with hay fever [23].

Even in developing countries where allergy has a low prevalence in the ISAAC study, allergic conjunctivitis has

been reported as high as 20% of the population [24]. This was similar for 3058 randomly selected Nigerian children aged 13–14 years that demonstrated the cumulative prevalence rates of wheezing, rhinitis other than common cold, and symptoms of eczema were 16.4, 54.1 and 26.1%, respectively. However, rhinitis associated with itchy eyes (allergic rhinoconjunctivitis) was reported by 39.2% of the school children, that is 80% of those patients reported to have rhinitis [25].

The ISAAC study missed the opportunity to assess the prevalence of isolated conjunctivitis symptoms. If validated questions for ocular symptoms had been included, it could have facilitated the identification of the prevalence of conjunctivitis and its relationship with other allergic diseases [10].

In France, a study [26] assessing the ARIA Allergic Rhinitis survey noted ocular symptoms were present in 52% of allergic rhinitis patients.

In a study [27] from Oxfordshire, UK, itching was more common than redness that was more common than tearing.

The overall prevalence of allergic diseases in Turkish children was 27.4% and the prevalence of rhinitis 11%, asthma 10.2%, and conjunctivitis 7.1%, and skin diseases 6.3% [28] (Table 1).

The ISAAC has shown that the prevalence of rhinitis with itchy-watery eyes (rhinoconjunctivitis) varied across centers from 0.8 to 14.9% in 6–7-year-olds and from 1.4 to 39% in 13–14-year-olds [29]. However, it is not clear whether the prevalence of rhinitis and conjunctivitis was similar or if one symptom was more common than the other. There is a paucity of international data evaluating the prevalence of ocular allergies within adult populations; however, the incidence of nasal allergy has been determined to be 24–29, 28–34, 13–23, 12–18 and 13–17% in UK, France, Germany, Spain and Italy, respectively [30] (ECRHS 1996), and 14% in USA [31]. A recent analysis of National Health and Nutrition Examination Survey (NHANES) III data has shown that ocular symptoms, defined as 'episodes of watery, itchy eyes' affected 40% of the adult population of the USA during a 12-month period, and prevalence of ocular symptoms did not change significantly with age [32]. The survey showed that cat exposure triggered ocular, nasal, or ocular and nasal symptoms in about a fifth of sufferers, whereas tobacco smoke was a trigger for approximately a third of sufferers in each category [33]. This finding was consistent across all regions of the country [32].

Traditionally, allergy investigations have focused on nasal symptoms; however, recent studies have highlighted

Table 1 Prevalence of individual ocular symptoms in studies of different allergic diseases and in epidemiologic survey specific for allergic conjunctivitis

Author	Year	Site	N	Age	Condition	Itching (%)	Redness (%)	Lacrimation (%)
Bielory [4] ^a	2000	USA	2500	>18	Allergic Rhinitis Survey	88	78	88
Neto <i>et al.</i> [5 [•]]	2010	Brazil	1549	0–14 years	Asthma	38.4	25	19.9
Canonica <i>et al.</i> [12]	2007	Europe	1482	>12 years	SAR	71 ^b	–	67
					PAR	49 ^b		43
Geraldini <i>et al.</i> [17]	2010	Brazil	3120	12–19 years	Survey ^c	41.4	–	43.9
Schatz [11]	2007	USA	447	>12 years	SAR	64 ^b	–	43
					PAR	52 ^b		42

PAR, perennial allergic rhinitis; SAR: seasonal allergic rhinitis.

^a Originally published in Allergies in America Executive Summary, 2006; <http://www.myallergiesinamerica.com>.

^b Itchy/red eyes.

^c Questionnaire for ocular symptoms.

the prevalence and significance of ocular symptoms. The NHANES III survey showed that during the summer months (May–August) in USA, isolated ocular symptoms were more prevalent than isolated nasal symptoms [34^{••},35–38]. Furthermore, an investigation of hay fever sufferers showed that ocular symptoms were experienced alone (8%) or in combination with nasal symptoms (85.3%) more often than nasal symptoms without conjunctivitis (6.7%) [23]. This study also concluded that ocular symptoms were as severe or more severe than nasal symptoms in approximately 70% of patients [23].

Ocular symptoms are not only common, but also distressing for sufferers. Over 50% of nasal allergy sufferers stated that watering and red/itching eyes were moderately to extremely bothersome in the recent Allergies in America survey [31], and for 15% of sufferers the ocular component of the allergic hypersensitive reactions was the most bothersome symptom. Similarly, seasonal allergic conjunctivitis (SAC) sufferers have been shown to have a significantly reduced quality-of-life score as determined by the Rhinoconjunctivitis Quality Of Life Questionnaire (RQLQ) [3], and also score significantly lower than controls in several domains of the Visual Functioning Questionnaire 25 (VQF-25), including mental health, social function and overall vision [3,27].

As healthcare becomes more global, symptoms and descriptions may cloud the specific diagnosis of ocular allergy as it is commonly buried in the literature as rhinoconjunctivitis, it may also be reflected in a cultural language barrier such as the Chinese term ‘Hot Qi’ which is often used by parents in Hong Kong to describe symptoms in their children and in a recent survey appears to suggest inflammatory process such infection or allergy [39].

Although atopic dermatitis in infants and children generally reflects ‘atopic state’, many children outgrow atopic dermatitis only to develop other atopic disorder such as allergic rhinoconjunctivitis and/or asthma. In one study [40] monitoring the natural history of atopic dermatitis, as

atopic dermatitis disappeared in almost two-thirds of the cases (60.5%; $n = 124$), asthma (34%; $n = 70$) and rhinoconjunctivitis appeared (58%; $n = 118$) [40].

Interestingly, in a study [41] assessing the prevalence of ocular and nasal symptoms in occupational and work-related asthma, ocular symptoms of itching, redness and lacrimation were more common in those occupational asthma patients exposed to higher-molecular-weight antigens.

In a study [42[•]] performed in Portugal from the vantage point of ophthalmology departments, in which a total of 220 were enrolled, 25% had more than five episodes of ocular allergy in the past year, with 60% having year-round episodes. Associated comorbidities included allergic rhinitis in 46%, asthma 16% with significant impairment of their overall quality of life during an acute episode (45.6% ≥ 6 in a 10-point severity scale). The study noted that only 19% had an appointment with an ophthalmologist as a first action and most (56%) started with self-treatment measures and only 37% had a previous allergy diagnostic evaluation.

The NHANES III performed in the USA from 1988 to 1994 used the questionnaire regarding ocular and nasal allergy symptoms in relation to skin prick testing. The sample size was 20 010 with 1285 (6.4%) reporting ocular symptoms; 3294 (16.5%) reporting nasal symptoms; 5944 (29.7%) reporting both ocular and nasal symptoms; and 9487 (47.4%) were asymptomatic. Forty percentage of the population reported at least one occurrence of ocular symptoms in the past 12 months. Those 50 years and older had a higher frequency of isolated ocular symptoms that is believed to increase with dry eye syndrome symptoms. There is an increase in the frequency of symptoms in those younger than 50 years in the populations of patients with ocular and nasal symptoms combined and isolated nasal symptoms suggesting the higher likelihood of allergy symptoms. Ocular symptoms were noted to be more frequent than nasal symptoms in relation to animals, household dust, and pollen [34^{••}].

In several studies examining the impact of intranasal steroids on ocular symptoms a more detailed meta-analysis appears to reflect that SAR symptoms may be more intense than perennial allergic rhinitis (PAR) as determined by baseline total ocular symptom scores, although PAR symptoms are longer in duration [43].

One of the major problems associated in the provision of a 'current opinion' evaluating the epidemiology of ocular disorders from the various studies is the lack of clinical 'criteria' for the variety of ocular disorders [44]. Thus, one of our concerns is the lack of standardized criteria that are essential not only for objective assessment in clinical trials, but also for clinical studies on causative aspects of ocular allergy. In general, it does appear that perennial symptoms may be milder (but more prolonged) than SAR symptoms. However, despite such criteria it is clear that the epidemiology of ocular allergy is rampant and the expanding knowledge base will further advance our understanding of the treatment of anterior surface inflammatory disorders that is shared amongst various specialties including primary care, ophthalmologists, optometrists and allergists with the more holistic approach being provided by the allergist.

Acknowledgements

Conflicts of interest

None declared.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

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- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 000–000).

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