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Original Article

Study of Association of Dry Eye Disease in Allergic Conjunctivitis – An Observational Study

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ABSTRACT

Background: Allergic conjunctivitis and Dry Eye Disease are common ocular surface disorders that significantly affect visual comfort and quality of life. Both conditions share common inflammatory mechanisms and frequently coexist, resulting in overlapping clinical manifestations such as itching, redness, burning sensation, foreign body sensation, and ocular discomfort. Chronic allergic inflammation can adversely affect tear film stability and ocular surface integrity, predisposing patients to Dry Eye Disease. Despite their frequent coexistence, Dry Eye Disease remains underdiagnosed in patients with allergic conjunctivitis. Early recognition of tear film abnormalities is essential for comprehensive management and prevention of long-term ocular surface complications.

Aim: To study the association of Dry Eye Disease in patients with Allergic Conjunctivitis and to evaluate the relationship between the severity of Allergic Conjunctivitis and Dry Eye Disease.

Objectives

1. To determine the prevalence and association of Dry Eye Disease among patients with Allergic Conjunctivitis.
2. To assess the severity of Dry Eye Disease and correlate it with the severity of Allergic Conjunctivitis.

Materials and Methods: A hospital-based observational cross-sectional study was conducted among 100 patients diagnosed with Allergic Conjunctivitis attending the Ophthalmology outpatient department of a tertiary care teaching hospital. Patients fulfilling the inclusion and exclusion criteria were enrolled after obtaining informed consent. Allergic conjunctivitis was graded using the Novel Scoring System (NSS), while Dry Eye Disease was assessed using the Standard Patient Evaluation of Eye Dryness (SPEED) questionnaire, Tear Film Break-Up Time (TBUT), Schirmer's test, Tear Meniscus Height (TMH), and the Dry Eye Grading Severity Scheme (DEGSS). Statistical analysis was performed using descriptive statistics and the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results: Seasonal/perennial allergic conjunctivitis was the most common subtype (58%), followed by atopic conjunctivitis (31%) and vernal conjunctivitis (11%). Moderate allergic conjunctivitis was observed in 46% of patients, while severe disease was present in 32%. Dry Eye Disease was identified in 93% of patients, with moderate dry eye being the most common severity grade (38%). The association between the clinical subtype of allergic conjunctivitis and Dry Eye Disease severity was not statistically significant ($p = 0.137$). However, a statistically significant association was observed between the severity of Allergic Conjunctivitis and Dry Eye Disease severity ($p = 0.004$), indicating that increasing ocular surface inflammation was associated with worsening tear film dysfunction.

Conclusion: Dry Eye Disease is highly prevalent among patients with Allergic Conjunctivitis and demonstrates a significant association with the severity of

allergic ocular inflammation. Comprehensive evaluation of tear film parameters should be routinely performed in patients with allergic conjunctivitis to facilitate early diagnosis and appropriate management of Dry Eye Disease, thereby improving therapeutic outcomes and patient quality of life.

Keywords*: Allergic Conjunctivitis, Dry Eye Disease, Tear Film Dysfunction, Ocular Surface Disease, Tear Break-Up Time, Schirmer's Test.*

INTRODUCTION

Allergic conjunctivitis (AC) and Dry Eye Disease (DED) are among the most common ocular surface disorders encountered in ophthalmic practice worldwide. Both conditions significantly impair visual comfort and quality of life by producing chronic symptoms such as itching, redness, foreign body sensation, burning sensation, photophobia, and visual disturbances. Recent evidence suggests that these disorders frequently coexist and share common inflammatory pathways involving the tear film and ocular surface, making diagnosis and management particularly challenging. [1]

Globally, ocular allergy affects approximately 15–40% of the population and has shown an increasing prevalence due to urbanization, environmental pollution, and changing lifestyle patterns. Allergic conjunctivitis encompasses a spectrum of diseases including seasonal allergic conjunctivitis, perennial allergic conjunctivitis, vernal keratoconjunctivitis, and atopic keratoconjunctivitis. Although traditionally regarded as a benign and self-limiting disorder, chronic allergic inflammation can significantly alter tear film stability and contribute to the development of dry eye disease. [2] Dry Eye Disease is a multifactorial disorder characterized by tear film instability, hyperosmolarity, ocular surface inflammation, and neurosensory abnormalities. According to the Tear Film and Ocular Surface Society (TFOS) Dry Eye Workshop II report, DED is increasingly recognized as a global public health problem affecting approximately 5–50% of individuals depending on the diagnostic criteria and population studied. The socioeconomic burden of dry eye disease is considerable because of its chronic nature, frequent healthcare utilization, and detrimental impact on daily activities and workplace productivity. [3]

The ocular surface is maintained by an integrated lacrimal functional unit comprising the lacrimal glands, conjunctiva, cornea, meibomian glands, eyelids, and sensory neural pathways. Any disruption in this functional unit may result in tear film instability and ocular surface inflammation. In patients with allergic conjunctivitis, persistent inflammatory mediators such as histamine, cytokines, eosinophilic proteins, and immunoglobulin E contribute to conjunctival epithelial damage and alterations in mucin secretion, thereby predisposing individuals to dry eye disease.[4] Several studies have demonstrated a significant overlap between allergic conjunctivitis and dry eye disease. Patients with ocular allergy frequently exhibit reduced tear breakup time, decreased tear meniscus height, abnormal Schirmer's test values, and increased ocular surface staining. Chronic rubbing of the eyes, use of topical antihistamines containing preservatives, and prolonged ocular inflammation further exacerbate tear film dysfunction. Consequently, dry eye disease in allergic conjunctivitis often remains underdiagnosed because the symptoms of both disorders substantially overlap.[5] The coexistence of allergic conjunctivitis and dry eye disease presents an important clinical challenge. Failure to recognize the presence of dry eye may result in persistent symptoms despite adequate anti-allergic therapy. Similarly, treatment directed solely toward dry eye without addressing underlying allergic inflammation may provide only temporary relief. Therefore, comprehensive evaluation of tear film parameters in patients presenting with allergic conjunctivitis is essential for optimal management and prevention of long-term ocular surface complications. [6] In the Indian context, allergic conjunctivitis represents one of the most frequently encountered ophthalmic complaints, particularly among children and young adults living in tropical climates. Environmental allergens, increasing pollution levels, and climatic variations contribute substantially to its prevalence. India also bears a considerable burden of dry eye disease, with studies reporting prevalence rates ranging from 18% to over 30% in various populations. Despite the significant burden of both disorders, limited Indian literature has specifically explored their association and the severity of dry eye manifestations among patients with allergic conjunctivitis. [7]

Given the overlapping symptomatology, common inflammatory mechanisms, and potential impact on treatment outcomes, evaluating the association between allergic conjunctivitis and dry eye disease assumes considerable clinical significance. Early identification and simultaneous management of both conditions may improve patient satisfaction, reduce chronic ocular discomfort, and enhance long-term ocular surface health. The present study has therefore been undertaken to assess the association of dry eye disease in patients with allergic conjunctivitis and to determine whether the severity of allergic conjunctivitis correlates with the severity of dry eye disease.

AIM

To study the association of Dry Eye Disease in patients with Allergic Conjunctivitis and to evaluate the correlation between the severity of Dry Eye Disease and Allergic Conjunctivitis.

OBJECTIVES

Primary Objective

1. To determine the prevalence and association of Dry Eye Disease among patients diagnosed with Allergic Conjunctivitis.

Secondary Objectives

1. To assess the severity of Dry Eye Disease in patients with Allergic Conjunctivitis using standardized dry eye assessment tools.
2. To correlate the severity of Dry Eye Disease with the severity of Allergic Conjunctivitis.

MATERIALS AND METHODS

Study Design

- Hospital-based observational cross-sectional study.

Study Setting

- Department of Ophthalmology, tertiary care teaching hospital.

Study Duration

- 18 months.

Study Population

- Patients diagnosed with Allergic Conjunctivitis attending the Ophthalmology Outpatient Department.

Sample Size

- 100 patients with Allergic Conjunctivitis.

Sampling Technique

- Consecutive sampling of eligible patients fulfilling the inclusion and exclusion criteria.

Inclusion Criteria

- Patients diagnosed clinically with Allergic Conjunctivitis.
- Patients of either gender.
- Patients willing to participate and provide written informed consent.
- Patients aged 5 years and above.

Exclusion Criteria

- Patients with Sjögren's syndrome.
- Patients with active ocular infections.
- Patients with autoimmune disorders affecting the ocular surface.
- Patients who have undergone ocular surgery within the preceding six months.
- Contact lens users.
- Patients receiving long-term topical medications known to affect tear film stability.
- Patients unwilling to participate in the study.

Study Procedure

After obtaining approval from the Institutional Ethics Committee and written informed consent, all eligible participants will undergo a detailed ophthalmic evaluation.
The following information will be recorded:

- Demographic details (age, gender, occupation).
- History of ocular symptoms.
- Duration of allergic symptoms.
- Type of allergic conjunctivitis.

Patients will undergo:

1. Best corrected visual acuity assessment.
2. Slit lamp examination of the anterior segment.
3. Grading of Allergic Conjunctivitis using the Novel Scoring System (NSS).
4. Evaluation for Dry Eye Disease using the Standard Patient Evaluation of Eye Dryness (SPEED) questionnaire.
5. Tear Film Break-Up Time (TBUT).
6. Schirmer's Test.

7. Tear Meniscus Height (TMH) assessment.
8. Dry Eye grading using the Dry Eye Grading Severity Scheme (DEGSS).

Statistical Analysis

Data will be entered in Microsoft Excel and analysed using SPSS software (Version 25.0). Continuous variables will be expressed as mean ± standard deviation. Categorical variables will be expressed as frequencies and percentages. Chi-square test will be used to determine associations between categorical variables. Student's t-test or ANOVA will be applied for comparison of continuous variables wherever appropriate. A p-value of <0.05 will be considered statistically significant.

RESULTS

A total of 100 patients with allergic conjunctival disease were evaluated for the presence and severity of Dry Eye Disease. Allergic conjunctivitis was classified according to the clinical type and graded using the Novel Scoring System. Dry Eye Disease was assessed using the SPEED questionnaire, Tear Film Break-Up Time, Schirmer's test, Tear Meniscus Height, and the Dry Eye Grading Severity Scheme. Categorical variables were analysed using the Chi-square test. A p value of <0.05 was considered statistically significant.

Table 1. Distribution of Patients According to the Type of Allergic Conjunctivitis (n = 100)

Type of allergic conjunctivitis	Frequency (n)	Percentage (%)
Seasonal/perennial allergic conjunctivitis	58	58.0
Atopic conjunctivitis	31	31.0
Vernal conjunctivitis	11	11.0
Total	**100**	**100.0**

Interpretation:

Among the 100 patients included in the study, seasonal or perennial allergic conjunctivitis was the most common clinical type, accounting for 58% of cases. Atopic conjunctivitis was observed in 31% of patients, whereas vernal conjunctivitis accounted for 11%. Thus, uncomplicated allergic conjunctivitis constituted the predominant form of allergic conjunctival disease in the study population.

Table 2. Severity of Allergic Conjunctivitis Based on the Novel Scoring System (n = 100)

Severity of allergic conjunctivitis	Frequency (n)	Percentage (%)
Mild	22	22.0
Moderate	46	46.0
Severe	32	32.0
Total	**100**	**100.0**

Interpretation:

Based on the Novel Scoring System, moderate allergic conjunctivitis was the most frequently observed grade, affecting 46% of patients. Severe allergic conjunctivitis was present in 32%, while 22% had mild disease. Overall, more than three-fourths of the patients had moderate-to-severe allergic conjunctivitis, indicating a considerable burden of active ocular surface inflammation in the study population.

Table 3. Distribution of Dry Eye Disease Among Patients with Allergic Conjunctivitis (n = 100)

Dry eye grading	Frequency (n)	Percentage (%)
No dry eye	7	7.0
Mild dry eye	21	21.0
Moderate dry eye	38	38.0
Severe dry eye	26	26.0
Very severe dry eye	8	8.0
Total	**100**	**100.0**

Interpretation:

Dry Eye Disease was detected in 93% of patients with allergic conjunctivitis, while only 7% had no evidence of dry eye. Moderate dry eye was the most common severity grade, observed in 38% of patients, followed by severe dry eye in 26%, mild dry eye in 21%, and very severe dry eye in 8%. These findings demonstrate a high burden of tear-film dysfunction among patients with allergic conjunctival disease.

Table 4. Association Between the Clinical Type of Allergic Conjunctivitis and Severity of Dry Eye Disease (n = 100)

Dry eye severity	Seasonal/perennial allergic conjunctivitis	Atopic conjunctivitis	Vernal conjunctivitis	Total
No dry eye	6	1	0	7
Mild	16	3	2	21
Moderate	22	13	3	38
Severe	12	9	5	26
Very severe	2	5	1	8
Total	**58**	**31**	**11**	**100**

p value: 0.137

Interpretation:

Among patients with seasonal or perennial allergic conjunctivitis, moderate dry eye was the most common grade, occurring in 22 patients. In atopic conjunctivitis, moderate and severe dry eye were observed in 13 and 9 patients, respectively, while 5 patients had very severe dry eye. All patients with vernal conjunctivitis had some degree of dry eye. However, the association between the clinical type of allergic conjunctivitis and the severity of Dry Eye Disease was not statistically significant (**p = 0.137**). Therefore, the severity of dry eye did not appear to depend significantly on the clinical subtype of allergic conjunctivitis.

Table 5. Association Between the Severity of Allergic Conjunctivitis and Severity of Dry Eye Disease (n = 100)

Dry eye severity	Mild allergic conjunctivitis	Moderate allergic conjunctivitis	Severe allergic conjunctivitis	Total
No dry eye	5	2	0	7
Mild dry eye	7	11	3	21
Moderate dry eye	9	18	11	38
Severe dry eye	1	14	11	26
Very severe dry eye	0	1	7	8
Total	**22**	**46**	**32**	**100**

p value: 0.004

Interpretation:

A progressive increase in Dry Eye Disease severity was observed with increasing severity of allergic conjunctivitis. Among patients with mild allergic conjunctivitis, 5 had no dry eye and only one had severe dry eye. In the moderate allergic conjunctivitis group, 14 patients had severe dry eye and one had very severe dry eye. In contrast, all patients with severe allergic conjunctivitis had Dry Eye Disease; 11 had moderate dry eye, 11 had severe dry eye, and 7 had very severe dry eye. The association between the severity of allergic conjunctivitis and the severity of Dry Eye Disease was statistically significant (**p = 0.004**). This indicates that increasing allergic conjunctival inflammation was significantly associated with worsening dry eye severity.

DISCUSSION

The present study evaluated the association between Dry Eye Disease (DED) and Allergic Conjunctivitis (AC) among 100 patients attending the Ophthalmology outpatient department. The findings demonstrated a high prevalence of Dry Eye Disease among patients with allergic conjunctivitis and established a significant relationship between the severity of allergic conjunctivitis and dry eye severity. These observations further support the concept that ocular surface inflammation and tear film dysfunction are closely interrelated in allergic eye disease.

Distribution of Types of Allergic Conjunctivitis

In the present study, seasonal/perennial allergic conjunctivitis constituted the majority of cases (58%), followed by atopic conjunctivitis (31%) and vernal conjunctivitis (11%). Seasonal allergic conjunctivitis is widely reported as the most common form of ocular allergy worldwide because of its association with environmental allergens such as pollen, dust mites, and airborne pollutants. The predominance of seasonal and perennial forms observed in our study is consistent with previous epidemiological studies demonstrating that these subtypes account for approximately 70–90% of allergic conjunctival disorders encountered in routine clinical practice.[8]

Leonardi et al. reported that seasonal allergic conjunctivitis constitutes nearly 90% of ocular allergic diseases worldwide and represents the most frequently diagnosed allergic ocular disorder. Similarly, Rosario and Bielory reported that seasonal and perennial allergic conjunctivitis account for the majority of allergic eye diseases seen in ophthalmology clinics, particularly in tropical and subtropical countries where allergen exposure is prolonged.[9] The predominance of seasonal and perennial allergic conjunctivitis in our study is therefore in agreement with international literature and reflects the environmental and climatic factors contributing to ocular allergy.

Severity of Allergic Conjunctivitis
The present study found that moderate allergic conjunctivitis was the most common severity grade (46%), followed by severe disease (32%) and mild disease (22%). These findings suggest that a significant proportion of patients seek ophthalmic consultation only after experiencing persistent or worsening symptoms.

Kawakami et al. reported that patients with chronic allergic conjunctivitis often demonstrate moderate-to-severe ocular surface inflammation due to repeated allergen exposure and delayed presentation to healthcare facilities. Their study highlighted that chronic inflammatory changes significantly affect conjunctival goblet cell function and tear film stability.[10] Similarly, Leonardi et al. observed that moderate and severe forms of allergic conjunctivitis are associated with increased inflammatory mediator release, epithelial disruption, and ocular surface damage that predispose patients to tear film abnormalities.[11]

The predominance of moderate allergic conjunctivitis observed in our study may be attributable to delayed healthcare-seeking behaviour and chronic allergen exposure, particularly in tropical settings such as India where perennial allergens are prevalent throughout the year.

Prevalence and Severity of Dry Eye Disease in Allergic Conjunctivitis
In the present study, Dry Eye Disease was identified in 93% of patients with allergic conjunctivitis. Moderate dry eye was the most common severity grade (38%), followed by severe dry eye (26%), mild dry eye (21%), and very severe dry eye (8%).

These findings are comparable with the observations of Hom et al., who evaluated 194 patients presenting with ocular itching and found that 57.7% had clinically significant dry eye symptoms in addition to ocular allergy. Their study emphasized the substantial overlap between allergic conjunctivitis and Dry Eye Disease and recommended routine tear film evaluation in patients with ocular allergy.[12]

Mimura et al. reported that approximately 70% of patients with chronic allergic conjunctivitis exhibited abnormal tear film parameters, including reduced Tear Break-Up Time and Schirmer's test values. The authors proposed that chronic conjunctival inflammation and goblet cell dysfunction contribute significantly to the development of tear film instability.[13]

In another study, Fujishima et al. demonstrated that patients with allergic conjunctivitis frequently exhibit decreased tear secretion and increased tear osmolarity, leading to symptoms consistent with Dry Eye Disease. They further reported that inflammatory mediators released during allergic reactions contribute substantially to ocular surface damage and tear film dysfunction.[14]

The remarkably high prevalence of Dry Eye Disease observed in our study supports the concept that allergic conjunctivitis should not be viewed as an isolated inflammatory condition but rather as an ocular surface disorder frequently associated with tear film abnormalities.

Association Between Types of Allergic Conjunctivitis and Dry Eye Disease
The present study demonstrated that although all forms of allergic conjunctivitis exhibited varying degrees of Dry Eye Disease, the association between the clinical subtype of allergic conjunctivitis and dry eye severity was not statistically significant ($p = 0.137$).

Similar findings have been reported by Villani et al., who observed that tear film abnormalities occur across various clinical forms of allergic conjunctivitis and are not necessarily dependent upon the specific subtype of ocular allergy. Instead, they found that the degree of ocular surface inflammation plays a more significant role in determining tear film dysfunction than the clinical classification itself.[15]

The absence of statistical significance in our study suggests that Dry Eye Disease may develop irrespective of the clinical subtype of allergic conjunctivitis. Therefore, clinicians should routinely evaluate tear film parameters in all patients presenting with allergic conjunctivitis, irrespective of the specific diagnosis.

Association Between Severity of Allergic Conjunctivitis and Severity of Dry Eye Disease
One of the most significant findings of the present study was the statistically significant association between the severity of allergic conjunctivitis and Dry Eye Disease severity ($p = 0.004$). Patients with severe allergic conjunctivitis demonstrated significantly higher proportions of severe and very severe Dry Eye Disease. This finding is biologically plausible because increasing ocular surface inflammation results in conjunctival epithelial damage, goblet cell dysfunction, mucin deficiency, and tear film instability. Chronic inflammatory cytokines released during allergic responses further contribute to ocular surface damage and tear hyperosmolarity.

Toda et al. demonstrated that patients with allergic conjunctivitis exhibiting severe papillary reactions had significantly reduced Tear Break-Up Time values and increased symptoms of dry eye. Their findings suggested that chronic allergic inflammation substantially contributes to tear film dysfunction and ocular surface instability.[16] The results of our study are consistent with these observations and reinforce the hypothesis that the severity of allergic conjunctivitis directly influences the severity of Dry Eye Disease. Consequently, failure to diagnose and treat concomitant Dry Eye Disease may contribute to persistent symptoms, reduced treatment satisfaction, and poor long-term ocular surface outcomes.

The present findings emphasize the importance of comprehensive ocular surface assessment in patients with allergic conjunctivitis. Management strategies should incorporate evaluation and treatment of Dry Eye Disease alongside anti-allergic therapy to achieve optimal clinical outcomes and improve patient quality of life.

CONCLUSION

The present study demonstrated a strong association between Allergic Conjunctivitis and Dry Eye Disease, highlighting the importance of evaluating tear film abnormalities in patients presenting with ocular allergy. Dry Eye Disease was highly prevalent among patients with allergic conjunctivitis, with the majority exhibiting moderate-to-severe dry eye manifestations. Although the clinical subtype of allergic conjunctivitis did not show a statistically significant association with Dry Eye Disease severity, a significant positive correlation was observed between the severity of allergic conjunctivitis and the severity of Dry Eye Disease. Patients with severe allergic conjunctivitis were more likely to have severe forms of tear film dysfunction and ocular surface compromise. These findings emphasize that allergic conjunctivitis should be approached as an ocular surface disorder that frequently coexists with Dry Eye Disease. Routine screening for dry eye in all patients with allergic conjunctivitis and timely initiation of appropriate tear film management may improve clinical outcomes, reduce persistent symptoms, and enhance the overall quality of life of affected individuals.

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