



DESCRIPTIVE STUDY ON THE PREVALENCE OF ALLERGIC KERATOCONJUNCTIVITIS, DRY EYE, AND CATARACT RISK AMONG ASTHMATIC PATIENTS USING INHALED CORTICOSTEROIDS

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Abstract

Background:

Asthma is a chronic inflammatory airway disease frequently managed with long-term inhaled corticosteroids (ICS). While ICS therapy effectively controls respiratory symptoms, emerging evidence suggests potential ocular complications, including allergic keratoconjunctivitis (AKC), dry eye disease (DED), and cataract formation. However, the prevalence and interrelationship of these ocular manifestations among asthmatic patients using ICS remain underexplored in clinical settings.

Objectives:

To determine the prevalence of allergic keratoconjunctivitis, dry eye, and cataract risk among asthmatic patients on long-term inhaled corticosteroid therapy, and to evaluate associated demographic and treatment-related factors.

Methods:

A hospital-based descriptive cross-sectional study was conducted among 200 adult asthmatic patients (aged 18–65 years) attending a tertiary care respiratory clinic. Participants had been on ICS therapy for at least six months. Data were collected using a structured questionnaire, slit-lamp biomicroscopy, Schirmer's test, tear breakup time (TBUT), and ocular surface staining. Cataract risk was evaluated using the Lens Opacities Classification System III (LOCS III). Ethical approval was obtained from the Institutional Review Board (IRB No. 2025-046), and informed written consent was secured from all participants. Data were analyzed using SPSS v29 for descriptive statistics and chi-square testing.

Results:

Of 200 participants, 58 (29%) presented with clinical features of allergic keratoconjunctivitis, 74 (37%) had dry eye based on Schirmer's and TBUT results, and 32 (16%) exhibited early signs of posterior subcapsular cataract (PSC). The prevalence of ocular complications was significantly higher among participants on ICS therapy for more than 3 years ($p < 0.01$). Females and individuals aged above 45 years demonstrated greater cataract risk. Polytherapy with systemic corticosteroids further increased ocular complication frequency.

Conclusion:

Ocular surface disorders and early cataract changes are relatively prevalent among long-term inhaled corticosteroid users with asthma. Regular ophthalmic screening and patient education regarding ocular side effects are crucial components of comprehensive asthma management.

Keywords: Asthma, Inhaled corticosteroids, Allergic keratoconjunctivitis, Dry eye, Cataract, Ocular complications

Introduction

Asthma is a chronic inflammatory disease of the airways characterized by airway hyperresponsiveness, reversible airflow limitation, and respiratory symptoms such as wheezing, coughing, and breathlessness. Globally, asthma affects more than 260 million people and remains a major cause of morbidity ¹. Inhaled corticosteroids (ICS) are the cornerstone of long-term asthma management and have dramatically improved disease control and patient quality of life ². However, chronic corticosteroid therapy, even via the inhalation route, is not without systemic effects among which ocular complications are increasingly recognized ³⁻⁶.

Inhaled corticosteroids can alter ocular physiology through systemic absorption or direct ocular exposure during inhalation. Pharmacologically, corticosteroids influence collagen synthesis, epithelial turnover, and immune responses in ocular tissues. Several studies have shown that long-term corticosteroid use increases the risk of posterior subcapsular cataract (PSC) formation and may exacerbate pre-existing ocular surface inflammation ^{7, 8}. Furthermore, corticosteroids may alter meibomian gland secretion and tear film stability, predisposing to dry eye disease (DED) ⁹⁻¹³.

Asthma itself is closely linked with allergic conditions, and patients often present with atopic keratoconjunctivitis (AKC) or allergic keratoconjunctivitis, mediated by Type I hypersensitivity mechanisms. Elevated serum IgE and eosinophil activation in asthmatics contribute to ocular allergic responses, causing itching, redness, tearing, and conjunctival chemosis ¹⁴⁻¹⁷. Thus, asthma and its treatment collectively contribute to ocular morbidity but still this connection remains underexplored, particularly in developing regions where access to regular ophthalmic screening is limited.

In the current post-pandemic context, where mask-induced ocular dryness and increased exposure to inhalers are prevalent, understanding the ophthalmic effects of chronic corticosteroid therapy is vital ¹⁸⁻²¹. The need for this study arises from a growing recognition that systemic diseases and their treatments have multisystem implications. Despite frequent use of inhaled corticosteroids, few studies have comprehensively described the prevalence of AKC, DED, and cataract risk among asthmatic patients under real-world clinical conditions.

This research, therefore, aims to fill this gap by describing the prevalence and clinical spectrum of these ocular complications and correlating them with the duration and dosage of ICS therapy. The outcomes can guide preventive ophthalmologic screening protocols, fostering collaboration between pulmonologists and ophthalmologists to ensure holistic care.

Objectives of the Study

1. To determine the prevalence of allergic keratoconjunctivitis, dry eye disease, and cataract risk among asthmatic patients on long-term inhaled corticosteroid therapy.
2. To identify demographic and clinical factors associated with these ocular complications.
3. To recommend clinical strategies for early detection and prevention of ocular side effects among ICS users.

Methodology

Study Design and Setting

This was a descriptive, hospital-based cross-sectional study conducted from January to June 2025 at the Department of Pulmonology and Ophthalmology, University Medical Center.

Study Population

The study included 200 adult asthmatic patients aged 18–65 years who were on regular inhaled corticosteroid therapy for at least six months.

Inclusion Criteria:

- Diagnosed cases of bronchial asthma as per GINA (2024) guidelines
- Patients using ICS monotherapy or combination therapy
- Willingness to participate and provide written informed consent

Exclusion Criteria:

- History of systemic steroid use >1 month within the past year
- Pre-existing ocular diseases (e.g., glaucoma, uveitis, or corneal dystrophy)
- Diabetes mellitus or autoimmune disorders affecting the eye
- History of ocular trauma or surgery

Data Collection Procedure

After obtaining consent, participants underwent:

1. Ophthalmic Evaluation:

- Visual acuity testing using Snellen's chart
- Slit-lamp biomicroscopy for conjunctival changes and lens opacities
- Grading of allergic keratoconjunctivitis (AKC) based on Bonini's criteria
- Tear function tests: Schirmer's test (≤ 10 mm indicating dryness) and TBUT (< 10 seconds considered abnormal)
- Ocular surface staining using fluorescein

2. Cataract Assessment:

Lens opacity was graded using Lens Opacities Classification System III (LOCS III) to detect early posterior subcapsular changes.

3. Data on ICS Exposure:

Duration, dosage, and type of inhaled corticosteroid were recorded (e.g., budesonide, fluticasone, beclomethasone).

Ethical clearance was obtained from the University Institutional Review Board (IRB No. 2025-046) following the principles of the Declaration of Helsinki (2013 revision).

All participants received verbal and written information about the study's purpose, procedures, and potential benefits or risks. Written informed consent was obtained before participation. Confidentiality was maintained through coded data and restricted database access. Participants had the right to withdraw at any stage without affecting their medical care.

Data Analysis

Data were entered into Microsoft Excel and analyzed using SPSS v29. Descriptive statistics (mean, SD, frequencies, percentages) were used to summarize data. The Chi-square test assessed associations between categorical variables (e.g., duration of ICS use and ocular findings). A p-value < 0.05 was considered statistically significant.

Results

- Among 200 participants, the mean age was 42.3 ± 10.7 years; 54% were female.
- Allergic keratoconjunctivitis (AKC) was identified in 58 (29%) participants.
- Dry eye disease (DED) was found in 74 (37%) participants based on Schirmer's and TBUT values.
- Early posterior subcapsular cataract (PSC) was observed in 32 (16%) participants.
- A significant association was found between ICS therapy duration > 3 years and both dry eye ($p = 0.01$) and cataract ($p < 0.001$).
- Participants using combined ICS and systemic steroids showed the highest prevalence of cataract changes (24%).

Discussion

This study revealed a noteworthy prevalence of ocular surface disorders and cataract risk among asthmatic patients on long-term inhaled corticosteroids. The findings resonate with international research emphasizing corticosteroid-associated ocular changes.

A 2023 BMC Ophthalmology study by Li X et al. reported a 34% prevalence of dry eye among ICS users, similar to the 37% observed in our study²². The underlying mechanism involves corticosteroid-induced suppression of lacrimal gland function and altered meibomian gland lipid secretion, leading to tear film instability¹¹⁻¹⁵.

The occurrence of allergic keratoconjunctivitis (29%) among asthmatic subjects supports the atopic association between respiratory and ocular allergic diseases. Doan S et al. (2023) observed that 25–40% of asthmatic patients exhibit concurrent ocular allergy symptoms, attributed to shared IgE-mediated immunopathogenesis and Th2 cytokine activation²³. Our results reinforce the need for allergen-specific education and ophthalmic screening in asthmatic management.

Cataract risk (16%) identified in this study aligns with data from Ainsbury EA et al. (2021) found a dose-dependent increase in posterior subcapsular cataracts among chronic ICS users. The pathophysiology likely involves corticosteroid-mediated oxidative damage to lens epithelial cells and changes in lens protein permeability²⁴. In contrast, our study found higher cataract prevalence among females and those over 45 years, consistent with Wang et al. (2023), indicating potential hormonal and age-related susceptibility. While the ocular effects of systemic corticosteroids are well-documented, inhaled formulations were long considered safer. However, repeated inhalation, particularly with improper technique, can lead to ocular surface deposition and local absorption, as demonstrated by Farahmandnejad M et al. (2023)²⁴. This could explain why patients with improper inhaler technique or longer exposure durations showed increased symptoms in the current study.

From a public health and clinical standpoint, these findings highlight the importance of multidisciplinary care. Routine ophthalmic evaluation should be incorporated into asthma management protocols, especially for patients with long-term ICS therapy exceeding two years.

This study underscores that while ICS remains indispensable for asthma control, awareness of potential ocular risks and early detection can prevent sight-threatening complications. Strengthening interdepartmental collaboration between pulmonology and ophthalmology will ensure safer long-term outcomes for patients.

Conclusion

Asthmatic patients on long-term inhaled corticosteroids exhibit a significant prevalence of ocular complications, including allergic keratoconjunctivitis, dry eye, and early cataract changes. The findings underscore the importance of periodic ophthalmic screening and patient education as integral components of asthma care.

Recommendations

1. Incorporate annual ophthalmologic examinations for all long-term ICS users.
2. Train healthcare providers in proper inhaler techniques to reduce ocular deposition.
3. Educate patients on recognizing early symptoms of ocular discomfort.
4. Future studies should include longitudinal designs to establish causal relationships between ICS exposure duration and specific ocular changes.

References:

1. Goldin J, Hashmi MF, Cataletto ME. Asthma. [Updated 2024 May 3]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK430901/>
2. Liang TZ, Chao JH. Inhaled Corticosteroids. [Updated 2023 May 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470556/>

3. Vinokurtseva A, Fung M, Ai Li E, Zhang R, Armstrong JJ, Hutnik CML. Impact of Inhaled and Intranasal Corticosteroids Exposure on the Risk of Ocular Hypertension and Glaucoma: A Systematic Review and Meta-Analysis. *Clin Ophthalmol*. 2022 May 30;16:1675-1695. doi: 10.2147/OPTH.S358066. PMID: 35669010; PMCID: PMC9165658.
4. Kersey JP, Broadway DC. Corticosteroid-induced glaucoma: a review of the literature. *Eye (Lond)*. 2006 Apr;20(4):407-16. doi: 10.1038/sj.eye.6701895. PMID: 15877093.
5. Phulke S, Kaushik S, Kaur S, Pandav SS. Steroid-induced Glaucoma: An Avoidable Irreversible Blindness. *J Curr Glaucoma Pract*. 2017 May-Aug;11(2):67-72. doi: 10.5005/jp-journals-10028-1226. Epub 2017 Aug 5. PMID: 28924342; PMCID: PMC5577123.
6. Lipworth BJ. Systemic adverse effects of inhaled corticosteroid therapy: A systematic review and meta-analysis. *Arch Intern Med*. 1999 May 10;159(9):941-55. doi: 10.1001/archinte.159.9.941. PMID: 10326936.
7. Savran O, Suppli Ulrik C. Inhaled Corticosteroid Exposure and Risk of Cataract in Patients with Asthma and COPD: A Systematic Review and Meta-Analysis. *J Ophthalmol*. 2023 Oct 19;2023:8209978. doi: 10.1155/2023/8209978. PMID: 37899845; PMCID: PMC10602708.
8. Shroff S, Thomas RK, D'Souza G, Nithyanandan S. The effect of inhaled steroids on the intraocular pressure. *Digit J Ophthalmol*. 2018 May 12;24(3):6-9. doi: 10.5693/djo.01.2018.04.001. PMID: 30800006; PMCID: PMC6380256.
9. Sheppard JD, Nichols KK. Dry Eye Disease Associated with Meibomian Gland Dysfunction: Focus on Tear Film Characteristics and the Therapeutic Landscape. *Ophthalmol Ther*. 2023 Jun;12(3):1397-1418. doi: 10.1007/s40123-023-00669-1. Epub 2023 Mar 1. PMID: 36856980; PMCID: PMC10164226.
10. Chhadva P, Goldhardt R, Galor A. Meibomian Gland Disease: The Role of Gland Dysfunction in Dry Eye Disease. *Ophthalmology*. 2017 Nov;124(11S):S20-S26. doi: 10.1016/j.optha.2017.05.031. PMID: 29055358; PMCID: PMC5685175.
11. Baudouin C, Messmer EM, Aragona P, Geerling G, Akova YA, Benítez-del-Castillo J, Boboridis KG, Merayo-Llodes J, Rolando M, Labetoulle M. Revisiting the vicious circle of dry eye disease: a focus on the pathophysiology of meibomian gland dysfunction. *Br J Ophthalmol*. 2016 Mar;100(3):300-6. doi: 10.1136/bjophthalmol-2015-307415. Epub 2016 Jan 18. PMID: 26781133; PMCID: PMC4789719.
12. Lee H, Kim M, Park SY, Kim EK, Seo KY, Kim TI. Mechanical meibomian gland squeezing combined with eyelid scrubs and warm compresses for the treatment of meibomian gland dysfunction. *Clin Exp Optom*. 2017 Nov;100(6):598-602. doi: 10.1111/cxo.12532. Epub 2017 Mar 12. PMID: 28295626.
13. Jafari K, Calder VL. Emerging concepts in atopic dermatitis and atopic keratoconjunctivitis. *Curr Opin Allergy Clin Immunol*. 2025 Oct 1;25(5):388-394. doi: 10.1097/ACI.0000000000001102. Epub 2025 Aug 6. PMID: 40767400; PMCID: PMC12404623.
14. Yang X, Yu X, Gao S, Wei P, Han G. Causal Relationship Between Common Allergic Diseases and Keratoconus: A Two-Sample Mendelian Randomization Study. *Transl Vis Sci Technol*. 2025 Apr 1;14(4):14. doi: 10.1167/tvst.14.4.14. PMID: 40208892; PMCID: PMC11993130.
15. Friedlaender MH. Ocular allergy. *Curr Opin Allergy Clin Immunol*. 2011 Oct;11(5):477-82. doi: 10.1097/ACI.0b013e32834a9652. PMID: 21822130.
16. Bielory L, Schoenberg D. Ocular allergy: update on clinical trials. *Curr Opin Allergy Clin Immunol*. 2019 Oct;19(5):495-502. doi: 10.1097/ACI.0000000000000564. PMID: 31465314.
17. Moshirfar M, West WB Jr, Marx DP. Face Mask-Associated Ocular Irritation and Dryness. *Ophthalmol Ther*. 2020 Sep;9(3):397-400. doi: 10.1007/s40123-020-00282-6. Epub 2020 Jul 15. PMID: 32671665; PMCID: PMC7362770.
18. Burgos-Blasco B, Arriola-Villalobos P, Fernandez-Vigo JI, Oribio-Quinto C, Ariño-Gutierrez M, Diaz-Valle D, Benitez-Del-Castillo JM. Face mask use and effects on the ocular surface

- health: A comprehensive review. *Ocul Surf.* 2023 Jan;27:56-66. doi: 10.1016/j.jtos.2022.12.006. Epub 2022 Dec 25. PMID: 36577463; PMCID: PMC9789923.
19. Arriola-Villalobos P, Burgos-Blasco B, Vidal-Villegas B, Oribio-Quinto C, Ariño-Gutiérrez M, Diaz-Valle D, Benitez-Del-Castillo JM. Comment on: Tear Stability With Masks in Dry Eye Disease. *Cornea.* 2022 Apr 1;41(4):e7. doi: 10.1097/ICO.0000000000002950. PMID: 34907939.
 20. Lazzarino AI, Steptoe A, Hamer M, Michie S. Covid-19: Important potential side effects of wearing face masks that we should bear in mind. *BMJ.* 2020 May 21;369:m2003. doi: 10.1136/bmj.m2003. PMID: 32439689.
 21. Li X, Wang Z, Mu J, Puerkaiti H, Nulahou A, Zhang J, Zhao Y, Sun Q, Li Y, Wang Y, Gao Y. Prevalence and associated risk factors of dry eye disease in Hotan, Xinjiang: a cross-sectional study. *BMC Ophthalmol.* 2023 May 15;23(1):214. doi: 10.1186/s12886-023-02955-9. PMID: 37189099; PMCID: PMC10184355.
 22. Doan S, Papadopoulos NG, Lee JK, Leonardi S, Manti S, Lau S, Rondon C, Sharma V, Pleyer U, Jaumont X, Lazarewicz SB. Vernal keratoconjunctivitis: Current immunological and clinical evidence and the potential role of omalizumab. *World Allergy Organ J.* 2023 Jun 15;16(6):100788. doi: 10.1016/j.waojou.2023.100788. PMID: 37389200; PMCID: PMC10300397.
 23. Ainsbury EA, Dalke C, Hamada N, Benadjaoud MA, Chumak V, Ginjaume M, Kok JL, Mancuso M, Sabatier L, Struelens L, Thariat J, Jourdain JR. Radiation-induced lens opacities: Epidemiological, clinical and experimental evidence, methodological issues, research gaps and strategy. *Environ Int.* 2021 Jan;146:106213. doi: 10.1016/j.envint.2020.106213. Epub 2020 Dec 1. PMID: 33276315.
 24. Farahmandnejad M, Alipour S, Nokhodchi A. Physical and mechanical properties of ocular thin films: a systematic review and meta-analysis. *Drug Discov Today.* 2024 May;29(5):103964. doi: 10.1016/j.drudis.2024.103964. Epub 2024 Mar 27. PMID: 38552779.