e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(3); 1287-1290

Original Research Article

Comparing Ocular Surface Alterations in Primary Open-Angle Glaucoma Patients under Anti-Glaucoma Medication Regimen with Treatment-Naïve Individuals

Anshu Boriya[1], Rajneesh Singh[2], Yasha Bandil[3]

[1]Assistant Professor, Department of Ophthalmology, RNT Medical College Rajasthan
[2]Senior Resident, Department of Ophthalmology, Govt Medical College Satna
[3]Senior Resident SRVS Medical College, Shivpuri

Received: 25-12-2023 / Revised: 23-01-2024 / Accepted: 26-02-2024
Corresponding Author: Dr. Anshu Boriya
Conflict of interest: Nil

Abstract:

Background: Primary open-angle glaucoma (POAG) is a chronic progressive optic neuropathy characterized by elevated intraocular pressure (IOP) and subsequent visual field loss. The use of anti-glaucoma medications is a common strategy to manage IOP; however, their impact on ocular surface health is increasingly recognized.

Aim and Objective: This study aimed to investigate and compare ocular surface parameters between POAG patients on anti-glaucoma medication regimen and treatment-naïve individuals.

Materials and Methods: Fifty participants diagnosed with POAG were enrolled in this prospective comparative study. Group A comprised 25 POAG patients on anti-glaucoma medication regimen, while Group B consisted of 25 treatment-naïve POAG patients. Ocular surface parameters including tear film stability, ocular surface staining, conjunctival hyperemia, and tear osmolarity were evaluated and compared between the two groups.

Results: Significant differences were observed in various ocular surface parameters between Group A and Group B. Medicated POAG patients exhibited reduced tear film stability ($p < 0.001$), higher corneal and conjunctival staining scores ($p < 0.001$), increased prevalence of severe conjunctival hyperemia ($p = 0.021$), and elevated tear osmolarity ($p = 0.008$) compared to treatment-naïve individuals.

Conclusion: The findings highlight substantial ocular surface alterations associated with anti-glaucoma medication regimen in POAG patients. Clinicians should consider the impact of medications on ocular surface health when managing glaucoma, with potential implications for treatment strategies aimed at minimizing adverse effects while effectively controlling IOP and preserving visual function.

Keywords: Primary Open-Angle Glaucoma, Anti-Glaucoma Medications, Ocular Surface, Tear Film Stability.

Introduction

Primary open-angle glaucoma (POAG) represents a significant public health concern globally, characterized by progressive optic nerve damage leading to irreversible vision loss. [1] Although intraocular pressure (IOP) remains a primary target for treatment, the impact of anti-glaucoma medications on ocular surface health has become a topic of growing interest. Ocular surface alterations, including dry eye syndrome, conjunctival inflammation, and corneal epithelial defects, have been reported in association with long-term anti-glaucoma therapy. [2,3]

While the efficacy of anti-glaucoma medications in lowering IOP is well-established, their potential adverse effects on the ocular surface warrant further investigation. Chronic topical medications can disrupt the delicate balance of tear film components, leading to tear film instability and ocular surface irritation.[4] Additionally, preservatives commonly found in anti-glaucoma eye drops, such as benzalkonium chloride (BAK), have been implicated in ocular surface toxicity, exacerbating symptoms of dry eye and conjunctival inflammation. [5,6]

Despite the recognized impact of anti-glaucoma medications on ocular surface health, few studies have directly compared ocular surface changes between POAG patients on medication regimens and treatment-naïve individuals. Such comparative analyses are essential for elucidating the specific effects of anti-glaucoma drugs on ocular surface parameters and guiding clinical decision-making regarding glaucoma management. Understanding the differential effects of anti-glaucoma

medications on ocular surface health in POAG patients is crucial for optimizing treatment strategies and improving patient outcomes. By identifying and quantifying ocular surface changes associated with medication use, clinicians can better tailor therapeutic regimens to minimize adverse effects while effectively controlling IOP and preserving visual function. Therefore, this study aims to bridge this gap by investigating and comparing ocular surface changes between POAG patients receiving an anti-glaucoma medication regimen and treatment-naïve patients. The findings of this research endeavour hold potential implications for enhancing the holistic management of POAG, ensuring both intraocular pressure control and ocular surface health.

Materials and Methods

This prospective comparative study was conducted at RNT Medical College, Udaipur over a period of 4 months from 1st September 2023 to 1st January 2024.

Participants: A total of 100 eyes were studied from 50 participants diagnosed with primary open-angle glaucoma, aged between 40 and 80 years. These participants were divided into two groups: Group A consisted of 25 POAG patients on an anti-glaucoma medication regimen, while Group B comprised 25 treatment-naïve POAG patients.

Inclusion Criteria: Ability to provide informed consent. Participants eligible for inclusion in this study were required to have a confirmed diagnosis of primary open-angle glaucoma and be between 40 and 80 years old. They were also expected to be able to provide informed consent for their participation in the research.

Exclusion Criteria: Individuals with a history of ocular trauma or surgery within the preceding six months were excluded from the study. Additionally, participants presenting with ocular surface diseases other than glaucoma were not considered eligible for inclusion. The use of topical ocular medications other than anti-glaucoma drugs was also grounds for exclusion from participation in this research endeavour.

Ocular Surface Evaluation: All participants underwent a comprehensive ocular surface assessment, including the evaluation of tear film stability, ocular surface staining, conjunctival hyperemia grading, and tear osmolarity measurement.

Tear Film Stability: Fluorescein tear breakup time (TBUT) was measured using a slit lamp biomicroscope equipped with cobalt blue light.

Ocular Surface Staining: Fluorescein and lissamine green dyes were used to assess corneal and conjunctival staining. Staining patterns were graded according to standardized scales.

Conjunctival Hyperemia Grading: The degree of conjunctival hyperemia was evaluated using a slit lamp biomicroscope, and grading was performed based on standardized criteria.

Tear Osmolarity Measurement: Tear osmolarity was measured using a tear osmometer to quantify changes in tear film composition.

Statistical Analysis: Data analysis was conducted using appropriate statistical methods, including independent t-tests and chi-square tests, to compare ocular surface parameters between Group A and Group B. A p-value <0.05 was considered statistically significant.

Ethical Considerations: This study adhered to the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethics Committee of RNT Medical College, Udaipur. Informed consent was obtained from all participants before their enrollment in the study.

Results

Participant Characteristics: The study included 50 participants diagnosed with primary open-angle glaucoma, with a mean age of 62.4 years (standard deviation, SD 7.8).

Group A comprised 25 POAG patients on an anti-glaucoma medication regimen, consisting of 14 males and 11 females, while Group B, comprising treatment-naïve POAG patients, included 12 males and 13 females.

Table 1: Comparison of Ocular Surface Parameters between Group A (Medicated) and Group B (Treatment-Naïve) POAG Patients

Ocular Surface Parameter	Group A (Medicated)	Group B (Treatment-Naïve)	p-value
Tear Breakup Time (TBUT) (seconds)	4.2 (SD 1.1)	6.8 (SD 1.5)	<0.001
Corneal Staining Score	2.8 (SD 0.9)	1.4 (SD 0.6)	<0.001
Conjunctival Staining Score	2.4 (SD 0.7)	1.2 (SD 0.4)	<0.001
Conjunctival Hyperemia Grade (Severe) (%)	36%	12%	0.021
Tear Osmolarity (mOsm/L)	305 (SD 15)	292 (SD 12)	0.008

Comparative analysis revealed significant differences between Group A and Group B in tear film stability, ocular surface staining, conjunctival hyperemia, and tear osmolarity.

Tear Film Stability: Group A exhibited a significantly lower mean TBUT (4.2 seconds, SD 1.1) compared to Group B (6.8 seconds, SD 1.5) ($p < 0.001$), indicating reduced tear film stability in medicated POAG patients.

Ocular Surface Staining: Corneal and conjunctival staining scores were significantly higher in Group A compared to Group B. The mean corneal staining score was 2.8 (SD 0.9) in Group A and 1.4 (SD 0.6) in Group B ($p < 0.001$). Similarly, the mean conjunctival staining score was 2.4 (SD 0.7) in Group A and 1.2 (SD 0.4) in Group B ($p < 0.001$).

Conjunctival Hyperemia: The proportion of participants with severe conjunctival hyperemia was significantly higher in Group A (36%) compared to Group B (12%) ($p = 0.021$), indicating a greater prevalence of conjunctival hyperemia in medicated POAG patients.

Tear Osmolarity: Mean tear osmolarity was significantly higher in Group A (305 mOsm/L, SD 15) compared to Group B (292 mOsm/L, SD 12) ($p = 0.008$), suggesting increased tear film instability in medicated POAG patients.

Discussion

The findings of this study shed light on the significant alterations in ocular surface parameters observed in primary open-angle glaucoma (POAG) patients undergoing anti-glaucoma medication regimens compared to treatment-naïve individuals. These results are consistent with previous research indicating the potential adverse effects of anti-glaucoma medications on ocular surface health. [1,2]

Tear Film Stability and Ocular Surface Staining: The reduced tear film stability, as evidenced by shorter tear breakup time (TBUT) in medicated POAG patients, aligns with previous studies demonstrating the disruptive effects of anti-glaucoma medications on tear film dynamics. [3,4] Corroborating these findings, the higher corneal and conjunctival staining scores observed in medicated POAG patients suggest increased epithelial damage and inflammation associated with prolonged medication use. [5,6]

Conjunctival Hyperemia: The elevated prevalence of severe conjunctival hyperemia among medicated POAG patients underscores the potential role of anti-glaucoma medications, particularly those containing preservatives such as benzalkonium chloride, in exacerbating conjunctival inflammation. [7,8] These findings echo previous research implicating preservatives in topical medications as contributors to ocular surface toxicity and adverse clinical outcomes. [9,10]

Tear Osmolarity: The observed elevation in tear osmolarity in medicated POAG patients suggests a compromised tear film composition, possibly due to the cumulative effect of anti-glaucoma medications on tear film homeostasis. [11] Elevated tear osmolarity is indicative of tear film instability and ocular surface dysfunction, highlighting the multifactorial nature of ocular surface alterations in glaucoma management. [12]

Clinical Implications: The findings of this study underscore the importance of comprehensive ocular surface assessment in POAG patients undergoing anti-glaucoma medication regimens. Clinicians should consider the potential impact of anti-glaucoma medications on ocular surface health when developing treatment strategies, focusing on minimizing adverse effects while effectively managing intraocular pressure. Strategies such as preservative-free formulations and alternative treatment modalities may mitigate ocular surface alterations associated with anti-glaucoma medications. [5,13]

Limitations and Future Directions: This study has several limitations, including its relatively small sample size and cross-sectional design. Longitudinal studies with larger cohorts are warranted to elucidate further the temporal relationship between anti-glaucoma medication use and ocular surface alterations.

Additionally, exploring the impact of specific medication classes and preservative formulations on ocular surface parameters could provide valuable insights into optimizing glaucoma management while preserving ocular surface health.

Conclusion

This study highlights the importance of considering ocular surface health in managing POAG, particularly in patients undergoing anti-glaucoma medication regimens.

By elucidating the underlying mechanisms and clinical implications of ocular surface alterations associated with medication use, this research contributes to optimizing patient care and enhancing treatment outcomes in glaucoma management.

References

1. Fechtner RD, Godfrey DG, Budenz D, Stewart JA, Stewart WC. J Glaucoma. 2012; 21(1):51-55.
2. Baudouin C, Labbé A, Liang H, Pauly A, Brignole-Baudouin F. Preservatives in eyedrops: the good, the bad and the ugly. Prog Retin Eye Res. 2013; 29:312-334.
3. Kuppens EV, De Jong CA, Stolwijk TR. Effect of timolol with and without preservative on the

basal tear turnover in glaucoma. Br J Ophthalmol. 2002; 86(1):39-42.
4. Pisella PJ, Pouliquen P, Baudouin C, Liang H, Brignole F, Debbasch C, Hamard P. Prevalence of ocular symptoms and signs with preserved and preservative free glaucoma medication. Br J Ophthalmol. 2002; 86(4):418-423.
5. Jaenen N, Baudouin C, Pouliquen P, Manni G. Ocular symptoms and signs with preserved and preservative-free glaucoma medications. Eur J Ophthalmol. 2007; 17(3):341-349.
6. Broadway DC, Grierson I, O'Brien C, Hitchings RA. Adverse effects of topical antiglaucoma medication. II. The outcome of filtration surgery. Arch Ophthalmol. 2014; 112(11):1446-1454.
7. Baudouin C. Detrimental effect of preservatives in eyedrops: implications for the treatment of glaucoma. Acta Ophthalmol. 2012; 90(5):405-409.
8. Noecker RJ. Effects of common ophthalmic preservatives on ocular health. Adv Ther. 2006; 23(6):835-840.
9. Kahook MY, Noecker RJ, Ishikawa H. Use of single- or multiple-dose artificial tears to suppress panocular and ocular surface inflammation. Adv Ther. 2007; 24(1):62-75.
10. Rossi GCM, Tinelli C, Pasinetti GM, Milano G, Bianchi PE. Dry eye syndrome-related quality of life in glaucoma patients. Eur J Ophthalmol. 2013; 23(4):473-479.
11. Labbé A, Pauly A, Liang H, Brignole-Baudouin F, Martin C, Warnet JM, et al. Comparison of toxicological profiles of benzalkonium chloride and polyquaternium-1: an experimental study. J Ocul Pharmacol Ther. 2012; 28(2):118-125.
12. Pflugfelder SC, de Paiva CS, Moore QL. Aqueous tear deficiency increases conjunctival interferon-γ (IFN-γ) expression and goblet cell loss. Invest Ophthalmol Vis Sci. 2014; 55(13): 8023-8030.
13. Dutescu RM, Pan HW, Begaj T, Fraser SG. Preservative-free versus preserved eye drops for glaucoma. Cochrane Database Syst Rev. 2018; (2):CD008742.