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Prevalence and Management of Dry Eye Syndrome in Patients Undergoing Topical Anti-Glaucoma Treatment

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Abstract
Glaucoma, a chronic optic neuropathy, necessitates lowering intralobular pressure (IOP) through topical anti-glaucoma medications. Despite their efficacy, these medications may induce Dry Eye Syndrome (DES), impacting ocular surface health. This study aims to investigate DES prevalence and management in patients undergoing topical anti-glaucoma treatment. Objectives include determining prevalence, evaluating symptom severity assessing management effectiveness. A cross-sectional study involved 500 glaucoma patients using Prostaglandin Analogues, Beta Blockers, Alpha Agonists, Carbonic Anhydrase Inhibitors, or Combination Therapy. Prevalence was assessed clinically, symptoms were quantified via questionnaires diagnostic tests (Schirmer, TBUT, staining) were employed. Management strategies were evaluated for efficacy. DES prevalence varied: Combination Therapy (50%) and Prostaglandin Analogues (45%) exhibited highest rates. Symptomatology highlighted burning sensation (102 cases) and foreign body sensation (82 cases). Diagnostic tests indicated poorer outcomes in Combination Therapy. Effective management included Combination Therapy (90% symptom improvement) and Punctal Plugs (80%). DES prevalence and severity vary with medication type, impacting patient symptoms and diagnostic outcomes. Effective management strategies include tailored therapies, but further research is warranted to refine treatment approaches.

INTRODUCTION

Glaucoma is a chronic, progressive optic neuropathy characterized by the degeneration of retinal ganglion cells, leading to irreversible vision loss if untreated. It is one of the leading causes of blindness worldwide, affecting millions of individuals, particularly those aged 40 and above[1]. The primary goal in the management of glaucoma is to lower intra ocular pressure (IOP), which is the most significant risk factor for the progression of the disease. Topical anti-glaucoma medications are the first line of treatment for most glaucoma patients due to their efficacy in reducing IOP and their non-invasive nature compared to surgical options[2].

Despite their benefits, these medications are not without adverse effects. One notable and increasingly recognized side effect is the development of Dry Eye Syndrome (DES). DES is a multi factorial disease of the tears and ocular surface that results in discomfort, visual disturbance tear film instability with potential damage to the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface[3,4].

The prevalence of DES in the general population is significant, with studies suggesting that it affects approximately 5-34% of adults worldwide, depending on the diagnostic criteria used. In patients with glaucoma, the prevalence is even higher, with reports indicating that DES affects between 40-60% of individuals receiving topical anti-glaucoma therapy[5]. This increased prevalence can be attributed to several factors related to the medications used, including preservatives in the eye drops, the chronic nature of glaucoma treatment the potential for these medications to disrupt the homeostasis of the ocular surface[6].

The pathophysiology of DES in patients undergoing topical anti-glaucoma treatment involves several mechanisms. Firstly, many topical anti-glaucoma medications contain preservatives such as benzalkonium chloride (BAK), which are known to have toxic effects on the ocular surface. BAK can induce apoptosis in corneal epithelial cells, disrupt the tear film cause inflammation, all of which contribute to the development of DES[7]. Secondly, the active ingredients in these medications, such as beta-blockers, prostaglandin analogs, alpha agonists carbonic anhydrase inhibitors, may also have direct and indirect effects on tear production and ocular surface health. For instance, beta-blockers can reduce tear production, while prostaglandin analogs can cause hyperemia and inflammation[8,9].

The diagnosis of DES involves a combination of patient-reported symptoms and clinical signs. Common symptoms include dryness, burning, stinging, foreign body sensation, photo phobia blurred vision. Clinical tests used to diagnose DES include the Schirmer test (which measures tear production), tear film break-up time (TFBUT, which assesses tear film stability) ocular surface staining with dyes such as fluorescein and lissamine green. Additionally, questionnaires such as the Ocular Surface Disease Index (OSDI) and the Dry Eye Questionnaire (DEQ) are frequently used to quantify the severity of symptoms and their impact on patients' quality of life[10].

The management of glaucoma-induced tear edema (DES) in patients undergoing topical anti-glaucoma treatment is a complex task that requires balancing the need to control intra ocular pressure (IOP) with the need to maintain a healthy ocular surface. Two main management strategies are: modifications to the anti-glaucoma treatment regimen and direct interventions for DES[11].

Modifications to the anti-glaucoma treatment regimen include switching to preservative-free formulations, using combination therapy changing the class of medication if the medication is contributing to DES. Direct interventions for DES include artificial tears, anti-inflammatory treatments punctal plugs. Artificial tears provide temporary relief by lubricating the ocular surface and improving tear film stability. Anti-inflammatory treatments like topical cyclosporine or corticosteroids can reduce ocular surface inflammation. Punctal plugs are small devices inserted into tear ducts to reduce tear drainage and increase the retention time of natural tears on the ocular surface. Lifestyle modifications and environmental control, such as taking breaks during activities that strain the eyes, using humidifiers avoiding environments with excessive air conditioning or heating, can also help alleviate DES symptoms[1,132].

In conclusion, this study aims to bridge the gap in knowledge regarding the prevalence and management of DES in patients undergoing topical anti-glaucoma treatment. By systematically investigating the prevalence, severity effective management strategies for DES in this population, we hope to contribute to improved clinical practice and better patient care.

Aims and Objectives: To investigate the prevalence and management of Dry Eye Syndrome (DES) in patients undergoing topical anti-glaucoma treatment.

- To determine the prevalence of Dry Eye Syndrome among patients receiving various topical anti-glaucoma medications.
- To evaluate the severity and symptoms of Dry Eye Syndrome in these patients using standardized diagnostic criteria and symptom questionnaires.
- To assess the effectiveness of different management strategies for Dry Eye Syndrome in patients undergoing topical anti-glaucoma treatment.

MATERIALS AND METHODS

Study Design: This cross-sectional study was conducted to evaluate the prevalence, severity, symptoms, diagnostic test results management strategies for Dry Eye Syndrome (DES) among patients using different anti-glaucoma medications. The study comprised a total of 500 patients, each undergoing treatment with one of five categories of anti-glaucoma medications: Prostaglandin Analogues, Beta Blockers, Alpha Agonists, Carbonic Anhydrase Inhibitors, or Combination Therapy.

Study Participants: The participants were 500 patients diagnosed with glaucoma and undergoing treatment with the specified anti-glaucoma medications. Each category included 100 patients. Patients were selected from a pool of glaucoma patients attending ophthalmology clinics. Inclusion criteria included patients aged 18 and above who had been on their respective anti-glaucoma medications for at least six months. Exclusion criteria were patients with a history of ocular surgery in the past year, pre-existing ocular surface diseases, or use of systemic medications known to affect tear production.

Data Collection:

Prevalence of Dry Eye Syndrome: The prevalence of DES among the patients was determined by clinical diagnosis based on symptoms and diagnostic test results. The number of patients diagnosed with DES in each medication group was recorded prevalence was calculated as the percentage of patients with DES out of the total number of patients in each group.

Severity of Dry Eye Syndrome: The severity of DES was graded as mild, moderate, or severe based on standardized clinical criteria, including symptom severity, diagnostic test results clinical examination findings. The number of patients in each severity grade was documented for each medication group.

Symptoms of Dry Eye Syndrome: Patients reported symptoms commonly associated with DES, including burning sensation, foreign body sensation, itching, redness tearing. The frequency of each symptom was recorded for each medication group.

Diagnostic Tests: Three diagnostic tests were performed to evaluate the ocular surface and tear function in patients with DES:

- **Schirmer Test:** Measures the amount of tear production. The mean Schirmer test result (in mm) for each medication group was recorded.
- **Tear Break-Up Time (TBUT):** Assesses tear film stability. The mean TBUT (in seconds) for each medication group was documented.
- **Ocular Surface Staining:** Evaluates ocular surface damage using fluorescein staining. The mean ocular surface staining score for each medication group was recorded.

Management Strategies and Their Effectiveness: Patients with DES were managed using various treatment strategies, including artificial tears, punctal plugs, omega-3 supplements, warm compresses combination therapy. The effectiveness of these strategies was evaluated based on improvement in symptoms, TBUT Schirmer test results. The percentage improvement in each parameter was recorded for each management strategy.

Statistical Analysis: Descriptive statistics were used to summarize the data. Prevalence rates were calculated as percentages. Mean values and standard deviations were computed for continuous variables (Schirmer test, TBUT ocular surface staining). The effectiveness of management strategies was assessed by calculating the percentage improvement in symptoms, TBUT Schirmer test results before and after treatment.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Review Board (IRB) of the participating institutions. Informed consent was obtained from all participants prior to their inclusion in the study. The study was conducted in accordance with the principles of the Declaration of Helsinki.

RESULTS AND DISCUSSIONS

In Table 1, the prevalence of DES varies across medications, with the highest prevalence found in patients on combination therapy (50%), followed by those on prostaglandin analogues (45%). Beta blockers, alpha agonists carbonic anhydrase inhibitors show lower prevalences of 30%, 25% 20%, respectively. The overall prevalence of DES among the 500 patients studied is 34%.

Table 2 delves into the severity of DES in affected patients, showing that combination therapy also leads to the highest number of severe cases (15), whereas carbonic anhydrase inhibitors result in the fewest severe cases (5). The majority of DES cases are of moderate severity across all medication types, with a total of 72 moderate cases. Mild DES is most common in patients on prostaglandin analogues and combination therapy, each with 15 cases, while the total number of mild cases is 58.

Table 3 outlines the symptoms reported by DES patients, with burning sensation being the most common symptom (102 cases), particularly prevalent in patients on combination therapy (30 cases). Foreign

Table 1: Prevalence of Dry Eye Syndrome Among Patients on Different Anti-Glaucoma Medications

Anti-Glaucoma Medication	Number of Patients	Number with DES	Prevalence of DES (%)
Prostaglandin Analogues	100	45	45%
Beta Blockers	100	30	30%
Alpha Agonists	100	25	25%
Carbonic Anhydrase Inhibitors	100	20	20%
Combination Therapy	100	50	50%
Total	500	170	34%

Table 2: Severity of Dry Eye Syndrome in Patients with DES

Severity Grade	Prostaglandin Analogues	Beta Blockers	Alpha Agonists	Carbonic Anhydrase Inhibitors	Combination Therapy	Total
Mild	15	10	10	8	15	58
Moderate	20	15	10	7	20	72
Severe	10	5	5	5	15	40
Total	45	30	25	20	50	170

Table 3: Symptoms of Dry Eye Syndrome Reported by Patients

Symptom	Prostaglandin Analogues	Beta Blockers	Alpha Agonists	Carbonic Anhydrase Inhibitors	Combination Therapy	Total
Burning Sensation	25	20	15	12	30	102
Foreign Body Sensation	20	15	12	10	25	82
Itching	15	10	10	8	20	63
Redness	10	8	5	5	15	43
Tearing	5	5	3	3	10	26

Table 4: Diagnostic Test Results for Dry Eye Syndrome

Diagnostic Test	Prostaglandin Analogues	Beta Blockers	Alpha Agonists	Carbonic Anhydrase Inhibitors	Combination Therapy	Total
Schirmer Test (mean mm)	8.5	9.2	10.0	10.5	7.8	9.2
Tear Break-Up Time (TBUT) (mean sec)	6.0	6.5	7.0	7.5	5.5	6.5
Ocular Surface Staining (mean score)	2.5	2.0	1.8	1.5	2.8	2.1

Table 5: Management Strategies and Their Effectiveness

Management Strategy	Number of Patients	Improvement in Symptoms (%)	Improvement in TBUT (%)	Improvement in Schirmer Test (%)
Artificial Tears	60	70%	30%	25%
Punctal Plugs	30	80%	40%	35%
Omega-3 Supplements	40	60%	25%	20%
Warm Compresses	20	50%	20%	15%
Combination Therapy	20	90%	50%	45%
Total	170	70% (average)	35% (average)	28% (average)

body sensation and itching are also frequent, with 82 and 63 cases respectively, while redness and tearing are less commonly reported, with 43 and 26 cases respectively.

Table 4 presents diagnostic test results for DES. Patients on combination therapy show the poorest results, with the lowest mean Schirmer test value (7.8 mm) and Tear Break-Up Time (TBUT) (5.5 seconds), indicating more severe dry eye. Prostaglandin analogues also show relatively poor outcomes, while carbonic anhydrase inhibitors perform the best with a mean Schirmer test of 10.5 mm and a TBUT of 7.5 seconds. Ocular surface staining scores further highlight the severity in combination therapy patients (mean score of 2.8) compared to other groups.

Table 5 evaluates management strategies and their effectiveness in improving DES symptoms and diagnostic test results. Combination therapy, involving multiple management strategies, is the most effective, showing a 90% improvement in symptoms, a 50% improvement in TBUT a 45% improvement in the Schirmer test. Punctal plugs are also notably effective, with an 80% improvement in symptoms and a 35% improvement in the Schirmer test. Artificial tears, omega-3 supplements warm compresses show varying degrees of effectiveness, with overall average improvements of 70% in symptoms, 35% in TBUT 28% in the Schirmer test.

The prevalence and management of Dry Eye Syndrome (DES) in patients undergoing topical anti-glaucoma treatment is a critical concern, as highlighted by our study. Our findings reveal significant variations in DES prevalence and severity across different anti-glaucoma medications, which align with and expand upon previous research in this domain.

Prevalence of DES: Our study found that the overall prevalence of DES among patients on anti-glaucoma medications is 34%, with combination therapy and prostaglandin analogues showing the highest prevalence rates of 50% and 45%, respectively. These findings are consistent with earlier studies that identified a high incidence of DES in patients using prostaglandin analogues and combination therapies. For instance, Leung[2]. reported a 40% prevalence of DES among patients on prostaglandin analogues, attributing it to the preservative benzalkonium chloride (BAK), which is known to exacerbate ocular surface disease . Similarly, a study by Fechtner[14]. (2011) indicated that combination therapies often contain higher concentrations of preservatives, increasing the risk of DES.

Severity of DES: The severity of DES in our study varies across medication types, with combination therapy leading to the highest number of severe cases (15 out of 50 patients). This is followed by prostaglandin analogues, which also show a significant number of severe cases. In comparison, carbonic anhydrase inhibitors exhibit the fewest severe cases. Previous studies support these findings, suggesting that combination therapies and prostaglandin analogues are more likely to result in severe DES due to their preservative content and frequent dosing requirements . However, our study adds nuance by quantifying the severity distribution, showing a predominance of moderate cases across all medication types, a detail less emphasized in earlier research[15,16].

Symptoms of DES: The most commonly reported symptoms in our study were burning sensation (102 cases) and foreign body sensation (82 cases). These symptoms were particularly prevalent among patients on combination therapy. This symptom profile is in line with reports by Baudouin[15], who identified burning and foreign body sensations as predominant symptoms in DES patients on preserved anti-glaucoma medications . Our data further elucidate the symptom distribution across different medication types, underscoring the impact of combination therapies.

Diagnostic Test Results: Diagnostic tests in our study reveal that patients on combination therapy have the poorest outcomes, with the lowest mean Schirmer test value (7.8 mm) and Tear Break-Up Time (TBUT) (5.5 seconds). These results mirror those found in studies by Hommer[17] and Kuppens[18]. who reported similar findings in patients on combination therapies and prostaglandin analogues . Our study adds value by comparing these results across multiple medication types, highlighting the relative efficacy of carbonic anhydrase inhibitors, which show the best diagnostic outcomes.

Management Strategies: The effectiveness of various management strategies in our study shows that combination therapy is the most effective, with a 90% improvement in symptoms. Punctal plugs also demonstrate high efficacy, consistent with findings by Yellepeddi. (2008), who noted significant symptom relief and improved tear metrics with punctalplugs. Our study corroborates the effectiveness of artificial tears, omega-3 supplements warm compresses, while providing comparative data on their relative efficacy, an aspect not thoroughly explored in earlier research.

Limitations: This study has several limitations. Firstly, it is observational and cross-sectional, which restricts the ability to establish causal relationships between anti-glaucoma medications and the development of dry eye syndrome (DES). Additionally, the study relies on patient self-reporting for symptom data, which can introduce reporting bias. The relatively small sample size for each medication group (100 patients per group) may limit the generalizability of the findings. Moreover, the study does not account for potential confounding factors such as the duration of medication use, the presence of other ocular surface diseases, or the impact of environmental factors on DES prevalence and severity.

CONCLUSION

The prevalence and severity of DES in patients undergoing topical anti-glaucoma treatment vary significantly depending on the medication type, with combination therapy and prostaglandin analogues being associated with the highest prevalence and severity. The most common symptoms reported include burning sensation, foreign body sensation itching. Diagnostic tests such as the Schirmer test and Tear Break-Up Time (TBUT) corroborate these findings, highlighting the more severe dry eye conditions in patients on combination therapy. Among the management strategies, combination therapy of DES treatments proves to be the most effective, followed by punctal plugs and artificial tears. Despite these insights, further research is necessary to better understand the underlying mechanisms and to develop more targeted interventions for managing DES in patients on anti-glaucoma medications.

REFERENCES

1. Baudouin, C., J.P. Renard, J.P. Nordmann, P. Denis and Y. Lachkar et al., 2012. Prevalence and risk factors for ocular surface disease among patients treated over the long term for glaucoma or ocular hypertension. Eur. J. Ophthalmol., 23: 47-54.
2. Leung, E.W., F.A. Medeiros and R.N. Weinreb, 2008. Prevalence of ocular surface disease in glaucoma patients. J. Glaucoma, 17: 350-355.
3. Michael, A.L., B. Christophe, B. Jules, D. Murat and N.F. Gary,et al 2007. The definition and classification of dry eye disease: report of the Definition and Classification Subcommittee of the International Dry Eye WorkShop. Ocul. Surf., 5: 75-92.
4. Craig, J.P., K.K. Nichols, E.K. Akpek, B. Caffery and H.S. Dua et al., 2017. Tfos dews ii definition and classification report. Ocular. Surf., 15: 276-283.
5. Noecker, R., 2001. Effects of common ophthalmic preservatives on ocular health. Adv. Ther., 18: 205-215.

6. Schaumberg, D.A., D.A. Sullivan, J.E. Buring and M.R. Dana, 2003. Prevalence of dry eye syndrome among us women. Am. J. Ophthalmol., 136: 318-326.
7. van Setten, G., M. Labetoulle, C. Baudouin and M. Rolando, 2016. Evidence of seasonality and effects of psychrometry in dry eye disease. Acta Ophthalm., 94: 499-506.
8. Zhang, X., S. Vadoothker, W.M. Munir and O. Saeedi, 2019. Ocular surface disease and glaucoma medications: A clinical approach. Eye and amp; Contact Lens: Sci. and amp., Clin. Pract., 45: 11-18.
9. Zhou, X., X. Zhang, D. Zhou, Y. zhao and X. Duan, 2022. A narrative review of ocular surface disease related to anti-glaucomatous medications. Ophth. Ther., 11: 1681-1704.
10. Tapply, I. and D.C. Broadway, 2021. Improving adherence to topical medication in patients with glaucoma. Pati. Prefer. Adherence., 15: 1477-1489.
11. Fineide, F., N. Lagali, M.Y. Adil, R. Arita, M. Kolko, J. Vehof and T.P. Utheim, 2022. Topical glaucoma medications-clinical implications for the ocular surface. Ocu. Surf., 26: 19-49.
12. Kim, K.E., C.K. Lee, J. Shin, Y. Kim and S. Rho, 2023. Comparisons of efficacy and safety between preserved and preservative-free brimonidine tartrate in glaucoma and ocular hypertension: A parallel-grouped, randomized trial. Sci. Rep., Vol. 13, No. 1 .10.1038/s41598-023-31726-1.
13. Fechtner, R.D., D.G. Godfrey, D. Budenz, J.A. Stewart, W.C. Stewart and M.C. Jasek, 2010. Prevalence of ocular surface complaints in patients with glaucoma using topical intraocular pressure-lowering medications. Cornea, 29: 618-621.
14. Baudouin, C., A. Labbé, H. Liang, A. Pauly and F. Brignole-Baudouin, 2010. Preservatives in eyedrops: The good, the bad and the ugly. Prog. Retinal Eye Res., 29: 312-334.
15. Baudouin, C., 2009. The ocular surface in glaucoma. Cornea, 28: 14-19.
16. Hedengran, A. and M. Kolko, 2023. The molecular aspect of anti-glaucomatous eye drops - are we harming our patients? Mol. Aspects Med., Vol. 93 .10.1016/j.mam.2023.101195.
17. Kuppens, E.V., T.R. Stolwijk, K.R. De and B.J.A. Van, 1992. Basal tear turnover and topical timolol in glaucoma patients and healthy controls by fluorophotometry. Inve. Ophth. Vis. Sci., 33: 3442-3448.
18. Yellepeddi, V.K., R. Sheshala, H. McMillan, C. Gujral, D. Jones and T.R.R. Singh, 2015. Punctal plug: A medical device to treat dry eye syndrome and for sustained drug delivery to the eye. Dr Disco Today., 20: 884-889.