ORIGINAL ARTICLE

Frequency and Associated Factors of Dry Eye among Glaucoma Patients Attending Tertiary Eye Hospital, Karachi

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Abstract

Background: Dry eye disease (DED) is a multifactorial disease of the eye. The disease is characterised by failure to produce sufficiently high amounts of tears to moisturise the ocular surface.

Objective: To determine the frequency and influencing factors of dry eye among glaucoma patients visiting the tertiary eye hospital of Karachi.

Methodology: A cross-sectional study was commenced in the glaucoma department of Al-Ibrahim Eye Hospital (AIEH), Karachi, from July to December 2023. The sample was collected through non-probability consecutive sampling. Patients underwent detailed examination, including Intraocular pressure (IOP) and Dry eye assessment. Dry eye was categorised as Severe (0-5mm wetting), moderate (>5-10mm wetting), mild (>10-15mm wetting) and normal (>15mm wetting). The data was analysed using SPSS Version 26.0.

Results: A total 75 eyes of 58 patients were included in the study. Mean age was 52.13±6.68 years. The majority of the patients were males, 52% (n=30). Frequency of dry eye was 77.3% (n=58 eyes). In multivariable regression analysis, patients with an age above 50 years have high chances of dry eye compared to those aged 16 to 30 years (aOR: 1.509, 95% CI: 0.725–2.961). Among different medications, the combination of an anhydrase inhibitor and a beta blocker has a 2.131 times higher risk of dry eyes compared to prostaglandin (aOR: 2.131, 95% CI: 0.336–8.445).

Conclusion: The Study concludes that the age, duration of glaucoma and combination of different glaucoma medications are independently associated with the occurrence of dry eye.

Keywords: *Cross-sectional studies, dry eye, glaucoma, ocular surface disease, prevalence.*

INTRODUCTION

Dry eye disease (DED) is a multifactorial disease of the eye [1]. It is caused by the failure to produce high-quality or sufficient amounts of tears to moisturise the ocular surface [2]. DED is etiologically categorised into two types: aqueous-deficient and evaporative dry eye [3]. Aqueous-deficient dry eye (ADDE) occurred due to loss of lacrimal tear production [4], and evaporative dry eye (EDE) is related to increased evaporation of the tear film in the presence of normal lacrimal secretion [5]. Burning, itching, light sensitivity, blurred vision, and eye fatigue are the common symptoms of DED that usually disturb both eyes [2].

Globally, DED affects 40 to 59% of glaucoma patients [6]. Studies reported that DED occurs frequently in patients with glaucoma [7, 8]. The prevalence of dry eye varies from region to region. It ranges from 5 to 50% [9] worldwide, and a study from the USA found a 6.8% burden of dry eye among glaucoma patients [10]. A study from Tanzania reported 79.7% prevalence of dry eye [11]. Another study from Ethiopia reported a 57% frequency of dry eye in the glaucoma group as per Schirmer's test [7]. Another study from India found 62.7% and 72% frequency of dry eye in primary open-angle glaucoma patients (POAG) and Secondary open-angle glaucoma (SOAG), respectively [12]. A study from Pakistan reported an 83.6% frequency of DED among glaucoma patients [13].

DED can become worse if the patient continues to use eye drops for an extended period. This is the reason glaucoma sufferers are twice as likely to develop DED [14]. To measure the severity of DED/OSD symptoms, structured scoring formats like ocular surface disease index (OSDI), standardised patient evaluation of eye dryness (SPEED), and dry eye questionnaire (DEQ-5) have been used [15]. Ocular and systemic drugs are one of the threats for developing DED [16].

However, it is essential to recognise the burden of DED among glaucoma patients in our population. Thus, the study not only focuses on the frequency of dry eye but also identifies the key risk factors that are involved in its development. This will help improve clinical outcomes, guiding health care interventions, early recognition of disease and prompt management for patients.

METHODOLOGY

A cross-sectional study was designed in the glaucoma department of Al-Ibrahim Eye Hospital (AIEH), Karachi, from July to December 2023. Data was collected after taking approval from the hospital's

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Received: February 12, 2025; Revised: June 03, 2025; Accepted: June 03, 2025
DOI: https://doi.org/10.37184/jlnh.2959-1805.3.25

  ISSN: 2960-2963 (Online) *Journal of Liaquat National Hospital 2025; 3(3): 182-186*

research Ethics Committee. The protocol number of this study was REC/IPIO/2023/23. Sample size was calculated through OpenEpi after depicting an 83.6% [13] frequency of dry eye among glaucoma patients. Keeping a 95% confidence interval and 8.5% desired precision. Final sample found to be 73. Non-probability consecutive sampling was done. Patients aged 16 to 65 years, using anti-glaucoma medications, and who agreed to take part in the study were included in the study. Patients with diabetes, a history of trabeculectomy and viral infection were excluded from the study.

All demographic data and history of glaucoma medication were noted on a predesigned proforma. IOP was checked through the GAT applanation tonometer by an ophthalmologist. Dry eye was diagnosed through Schirmer's test. Wattman filter paper was placed inside the eye's lower lid to assess the number of tears [17]. The strip was taken out after five minutes, and the length of the wet strip was recorded. Classification of dry eyes was done as Severe (0-5mm wetting), moderate (>5-10mm wetting), mild (>10-15mm wetting), and normal (>15mm wetting) [18, 19].

Data was analysed by using SPSS V. 26.0. Normality of data was checked through the Shapiro-Wilk test. Mean ± S.D. was calculated for continuous variables. All categorical variables were presented in frequency and percentages. The differences between categorical groups like age groups, gender and duration of glaucoma were stratified in the classification of dry eye using chi-square [20]. To see the association of factors with dry eye, bivariate logistic regression was used. For p-value < 0.2, the variables were entered into a multiple logistic regression model [21]. P-value <0.05 was considered statistically significant.

RESULTS

A total of 75 eyes of 58 patients were included in the study. Mean age was 52.13±6.68 years (range:16-65). The majority of the patients were males, 52% (n=30). The frequency of dry eye was 77.3% (n=58 eyes). All baseline details were depicted in Table **1.**

Table 1: Baseline details of study patients.

Variables	Frequency (%)
Gender	
Male	30 (52)
Female	28 (48)
Age groups	
16 -30	9 (15.51)
31 - 50	18 (31.03)
> 50	31 (53.44)
Duration of glaucoma	
< 2 years	17 (22.66)
2 -5 years	23 (30.66)
> 5 years	35 (46.66)
Frequency of dry eye	
Normal	17 (22.66)
Mild	3 (4)
Moderate	23 (30.66)
Severe	32 (42.66)

Severity of dry eyes was commonly seen in high age groups, as 42.85% (n=9) and 47.5%(n=19) eyes belonged to age groups, 31 to 50 and above 50 years, respectively. (p<0.05). Gender wise, females were found with more severe dry eyes, 48.5%(n=17) as compared to males, 37.5% (n=15). (p>0.05). A significant association was found between the severity of dry eye and the duration of glaucoma. (p<0.05) (**Table 2).**

Among other factors, age was significantly associated with dry eye, in univariate analysis, patients with age

Table 2: Stratification of dry eyes.

Variables	Normal n(%)	Mild n(%)	Moderate n(%)	Severe n(%)	p-value
Age groups					
16 - 30	5 (35.71)	0 (0)	5 (35.71)	4 (28.57)	0.029
31 - 50	4 (19.04)	2 (9.52)	6 (28.57)	9 (42.85)	
> 50	8 (20)	1 (2.5)	12 (30)	19 (47.5)	
Gender					
Male	10 (25)	1 (2.5)	14 (35)	15 (37.5)	0.245
Female	7 (20)	2 (5.7)	9 (25.7)	17 (48.5)	
Duration of glaucoma					
< 2 years	7 (41.17)	0 (0)	4 (23.52)	6 (35.29)	0.043
2 -5 years	6 (26.08)	2 (8.69)	6 (26.08)	9 (39.13)	
> 5 years	4 (11.42%)	1 (2.85)	13 (37.14)	17 (48.57)	

Table 3: Factors associated with dry eye among glaucoma patients.

Variables	cOR(95% CI)	p-value	aOR(95% CI)	p-value
Gender				
Male	Reference		-	-
Female	1.333(0.446-3.984)	0.606	-	-
Age (years)				
16 -30	Reference		Reference	
31- 50	1.509(0.396-22.711)	0.036	2.130(0.723-4.915)	0.001
> 50	5.091(0.927-17.255)	0.025	4.223(0.611-6.322)	0.015
Duration of glaucoma				
< 2 years	Reference		Reference	
2 -5 years	2.324(0.431-5.121)	0.043	2.130(0.723-4.915)	0.001
> 5 years	4.561(0.892-7.091)	0.021	4.223(0.611-6.322)	0.015
Medication				
Prostaglandin	Reference		Reference	
Beta blocker	0.357(0.072-1.764)	0.109	0.591(0.023-2.129)	0.206
A combination of an anhydrase inhibitor and a beta blocker	2.000(0.204-9.618)	0.010	2.131(0.336-8.445)	0.001
Combination with different mono drugs	1.524(0.330-7.044)	0.015	1.861(0.441-6.431)	0.035
Other combination products	1.857(0.175-4.206)	0.022	1.601(0.151-5.122)	0.041

**CI: Confidence interval, cOR: Crude Odds ratio, aOR: Adjusted Odds ratio.*

above 50 years had high chances of dry eye as compare to 16 to 30 years, (cOR: 1.509,95% CI: 0.396–22.711, p<0.05) and for multivariable regression analysis (aOR: 2.130,95% CI: 0.723–4.915, p<0.05) Similarly, duration of glaucoma also independently linked with dry eye as patients with duration of glaucoma more than 5 years had high odds of dry eyes as compare to < 2 years of duration, (cOR: 4.561,95% CI: 0.892–7.091, p<0.05) and (aOR: 4.223,95% CI: 0.611–6.322, p<0.05). Among different medications, the combination of an anhydrase inhibitor and beta blocker had 2.131 times higher risk of dry eyes compared to prostaglandin (cOR: 2.000,95% CI: 0.204–9.618, p<0.05) and (aOR: 2.131,95% CI: 0.336–8.445, p<0.05) (**Table 3**).

DISCUSSION

DED is one of the most common complications of glaucoma. The patients using glaucoma medication showed more recurrent symptoms of DED than participants not using glaucoma medication [22]. Although topical anti-glaucoma drugs are always considered the basic management of glaucoma [23], their long-term use may influence the visual surface [16]. However, the study focused not only on the frequency of dry eye among glaucoma patients but also on its influencing factors.

A study from Nepal reported 72% [8] frequency of dry eye among glaucomatous eyes. Another study from Romania reported 63% [24] burden of dry eye. Another study from India [12] showed a 62.7% prevalence of dry eye in primary open-angle glaucoma (POAG) patients and 72% in secondary open-angle glaucoma (SOAG). Another study from Pakistan reported 83.6% [13] burden of dry eye among glaucoma patients. The present study reported a 77.3% frequency of dry eye among glaucomatous eyes.

There are multiple factors which can be associated with the prevalence of dry eye. Monjane *et al*. [11] showed that females have high odds of dry eye compared to males (OR: 1.13, 95% CI: 0.67–1.82, p>0.05). Likewise, in our study, female has 1.333 times higher risk of dry eyes compared to males (OR: 1.33, 95% CI: 0.446–3.984, p>0.05). Similarly, age above 50 years has a higher risk of dry eye than below 50 years (OR: 1.62, 95% CI: 0.68–3.54, p<0.05) [11]. This finding also resembles the present study's results, as patients above 50 years of age have 4.223 times the odds of having dry

eye compared to those below 50 years (OR: 4.223, 95% CI: 0.611–6.322, p<0.05).

Likewise, in our study, females had 1.333 times higher risk of dry eyes compared to males (OR: 1.33, 95% CI: 0.446–3.984, p>0.05). Whereas the duration of glaucoma is found to be independently linked with the prevalence of dry eye. A study [11] found patients having glaucoma for 2 to 5 years had 1.52 times higher chances of dry eye compared to those with less than a year duration. (OR: 1.520, 95% CI: 1.350–1.880, p<0.05). While our study reported the risk of 2.130 times higher for the same duration (OR: 2.130, 95% CI: 0.723–4.915, p<0.05).

Maximum use of glaucoma medications increased the risk of dry eyes [25]. Chen *et al*. [26] reported that the Odds of DED with two medications are 1.23, while for three and four medications, the risk increased to 1.63 and 2.60, respectively. Another study from Tanzania [11] reported that use of more than two glaucoma medications has a 2.55 times higher risk of dry eyes than single medication (OR: 2.550, 95% CI: 1.890–3.360, p<0.05). These findings resemble the present study's results; our study showed that a combination of an anhydrase inhibitor and a beta blocker has a 2.131 times higher risk of dry eyes compared to prostaglandin (OR: 2.131, 95% CI: 0.336–8.445, p<0.05).

LIMITATIONS

The findings in this study could not be generalised as it is a single-centre study. Due to limited resources and time constraints, we did not check the other factors that can be associated with DED, like visual acuity and contrast sensitivity. Only a Schirmer test was used to ascertain the prevalence of DED.

CONCLUSION

The study concludes that the frequency of DED is 77.3%. Factors that are directly linked with the occurrence of dry eye are age, duration of glaucoma and glaucoma medications. Moreover, combination drugs like an anhydrase inhibitor and a beta blocker have been found to be a high-risk factor for dry eye compared to single medications.

RECOMMENDATIONS

Evaluation for dry eye must be done together with daily assessments of visual acuity. As a result, eye care practitioners must act promptly to protect patients from dry eye symptoms by recommending high-quality lubricants such as Systane, Vismed, *etc*. Dry eye must be evaluated in adults over the age of 50 during each hospital visit or screening, as it affects older people frequently.

ETHICAL APPROVAL

Ethical approval was obtained from the Institutional Review Committee of Al–Ibrahim Eye Hospital, Karachi (REF No. REC/IPIO/2023/23). All procedures performed in studies involving human participants were following the ethical standards of the institutional and/ or national research committee and the Helsinki Declaration.

CONSENT FOR PUBLICATION

Written informed consent was taken from the participants.

AVAILABILITY OF DATA

The data set may be acquired from the corresponding author upon a reasonable request.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest..

ACKNOWLEDGEMENT

We want to acknowledge all the staff of the glaucoma department in Al Ibrahim Eye Hospital for facilitating us during this project.

AUTHORS' CONTRIBUTION

MN: Design the study, write up of methodology and final review of the manuscript.

MAM: Data collection and discussion writing.

TM: Result write up, statistical analysis and final review of manuscript.

SJ: Write up of introduction.

IP: Data collection and literature search.

S: Literature search and editing of a manuscript.

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