Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

A Study on Evaluation of Ocular Surface Disease in Patients with Glaucoma

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Abstract

Background: Ocular surface disease is the most common, underdiagnosed comorbidity of glaucoma. Ocular surface disease affects the quality of life of glaucoma patients apart from causing visual disturbances. Evaluation of ocular surface disease is important for complete management of glaucoma.

Aims and Objectives: This study aims to evaluate the subjective and objective measures of ocular surface disease in patients with glaucoma.

Materials and Methods: A cross-sectional study was carried out on 108 eyes of 54 glaucoma patients on topical antiglaucoma medications for >6 months at the department of ophthalmology from January 2018 to January 2019. Subjective evaluation with ocular surface disease index (OSDI) score and objective evaluation with tear breakup time (TBUT) and Schirmer test were carried in all patients.

Results: The subjective measure with OSDI score >12 was observed in 55.6% of glaucoma patients. The objective measures with TBUT <10 s and Schirmer test <10 mm in 5 min were observed, respectively, in 64.8% and 53.7% of glaucoma patients. Patients on longer duration (>15 months) of topical antiglaucoma medications and patients on multiple topical antiglaucoma drugs had higher OSDI score, lesser TBUT, and lesser Schirmer test values. OSDI score had strong positive correlation with TBUT and Schirmer test.

Conclusion: Prompt evaluation of ocular surface disease, use of fixed-drug combinations, use of preservative-free antiglaucoma eye drops, and supplementation with lubricants will improve the compliance of patients and outcome of glaucoma management.

Key words: Ocular surface disease index score, Ocular surface disease, Schirmer test, Tear Breakup time, Topical antiglaucoma medications

INTRODUCTION

Ocular surface disease impairs the quality of life apart from affecting the eyesight. Ocular surface disease often coexists with glaucoma. The glaucoma patients suffer from restricted visual fields, relentless progression of the disease despite adequate management, and financial burden due to lifelong treatment and follow-up. The quality of life of glaucoma patients becomes further impaired due to the ocular surface disease.

Access this article online

www.ijss-sn.com

Month of Submission : 02-2019
Month of Peer Review : 03-2019
Month of Acceptance : 03-2019
Month of Publishing : 04-2019

Chronic use of topical antiglaucoma drugs decreases the conjunctival goblet cell density.[1] Topical beta-blockers have been associated with increased incidence of dry eye due to reduced corneal sensitivity. Oral administration of drugs like carbonic anhydrase inhibitors can decrease the tear production. Hence, adequate evaluation of ocular surface and management of risk factors for dry eye is essential for the management of patients with glaucoma.

Aim

The aim of the study is to evaluate the ocular surface disease in patients with glaucoma.

Objectives

The objectives of this study were as follows:

1. To evaluate the subjective measures of ocular surface disease in patients with glaucoma.

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2. To evaluate the objective measures of ocular surface disease in patients with glaucoma.

MATERIALS AND METHODS

A cross-sectional study was conducted in 108 eyes of 54 glaucoma patients of age 40–80 years who attended the Outpatient Department of Ophthalmology, Thanjavur Medical College from January 2018 to January 2019.

Inclusion Criteria

The following criteria were included in the study:

1. Patients between the age of 40 and 80 years with primary open-angle glaucoma or normal tension glaucoma on topical antiglaucoma medications for at least 6 months.
2. Both males and females included.

Exclusion Criteria

The following criteria were excluded from the study:

1. Patients of age <40 years and >80 years.
2. Patients with post-trabeculectomy or another post-ocular surgery status.
3. Patients with primary angle closure glaucoma or secondary glaucoma.
4. Patients on systemic medications such as antihistamines, decongestants, and antidepressant drugs.
5. Patients with a history of systemic disorders such as diabetes, hypertension, arthritis, and thyroid disorders.

A pro forma was made with details of age, sex, occupation, address, and complaints such as burning sensation, dryness, itching, grittiness, watering, stickiness, or heaviness of eyes. Menopausal status of female patients recorded. History of medical management of glaucoma regarding the name of the eye drop, and the dose and duration of the treatment was recorded.

Subjective measure of ocular surface disease evaluated using OSDI questionnaire. After obtaining written informed consent, the questionnaire was administered in vernacular language and OSDI score calculated. The ocular surface was defined by OSDI score[2] as normal (0–12 points) or as having mild (13–22 points), moderate (23–32 points), or severe (33–100 points) disease.

Complete ophthalmic assessment with slit-lamp examination was done in all patients. Objective measure of ocular surface disease evaluated using tear film breakup time – tear breakup time (TBUT)[3] and Schirmer's[4] test results. The tear film breakup time must be measured before any eye drops are instilled and before the eyelids are manipulated in any way. Fluorescein strip moistened with sterile normal saline was applied to the inferior fornix. After several blinks, the patient was instructed not to blink further and the tear film was examined using a broad beam of the slit lamp with cobalt blue filter. The time lapse between the last blink and the appearance of the first randomly distributed dry spot on the cornea is the TBUT. Dry spots appearing in <10 s are considered abnormal.

Schirmer I test was done by placing a thin filter paper strip (5 mm wide, 35 mm long) at the junction of the middle and lateral thirds of the lower eyelids with the eyes closed without topical anesthesia to measure basic and reflex tearing. The amount of wetting of the paper strip in 5 min is measured. The aqueous production was assessed to be normal when the amount of wetting is ≥10 mm in 5 min and reduced when the amount of wetting is <10 mm in 5 min.

Statistical Analysis

The data were encoded in the excel sheet and analyzed using GraphPad Prism version 5. Data were represented as mean ± standard deviation for continuous variable (age, OSDI score, etc.,) and frequency with proportions for the categorical variable. Unpaired '*t*'-test or Mann–Whitney '*U*'-test was used to compare the means between the groups depending on the normality of the data. Fisher's exact test was used to compare the frequency between the groups. Spearman's correlation test was used to correlate the categorical variables. $P < 0.05$ was considered statistically significant.

RESULTS

Our study included 54 patients of age 40–80 years with 24 males and 30 females. The overall, male, and female mean age (in years) were 63.8 ± 10.2, 62.3 ± 10.7, and 65.1 ± 9.7, respectively [Table 1]. Among 108 eyes of 54 glaucoma patients, 88 eyes had primary open-angle glaucoma and 20 eyes had normal tension glaucoma. 50 eyes were on antiglaucoma eye drops for ≤15 months and 58 eyes were on antiglaucoma eye drops for >15 months.

The dryness of eyes was the most common complaint of the patients [Table 2]. Of 30 female patients, 25 patients belonged to postmenopausal status [Table 3]. Among 108 eyes, 62 eyes had single drug topical therapy for glaucoma and 46 eyes had two or more topical eye drops for glaucoma [Table 4].

Among 24 male patients, 13 male patients had OSDI score >12, and of 30 female patients, 17 females had OSDI score >12. Hence, of 54 patients, 30 patients (55.6%) had OSDI score >12. About 5.6% of patients had mild

Table 1: Baseline characteristics of the patients

Parameter	*n* (%)
Age distribution (in years)	
40–49	7 (13)
50–59	9 (16.7)
60–69	19 (35.2)
70–80	19 (35.2)
Gender	
Male	24 (44.4)
Female	30 (55.6)
Occupation	
Coolie	24 (44.4)
Housewife	30 (55.6)
Diagnosis	
Primary open-angle glaucoma	88 (81.5)
Normal tension glaucoma	20 (18.5)
Duration of antiglaucoma eye drops	
≤15 months	50 (46.3)
≥15 months	58 (53.7)

Table 2: Frequency distribution of complaints noted in the patients

Type of the complaints	*n* (%)
Dryness	19 (35.2)
Grittiness	9 (16.7)
Burning sensation	3 (5.6)
Itching	3 (5.6)
Watering	1 (1.9)
Others	19 (35.2)

Table 3: Frequency distribution of menopausal status of the women in the study

Menopausal status	*n* (%)
Attained menopause	25 (83.3)
Not attained menopause	5 (16.7)

dryness with OSDI score 13–22, 22.2% of patients had moderate dryness with OSDI score 23–32, and 27.8% of patients had severe dryness with OSDI score >32 [Table 5]. Among 108 eyes of 54 patients, 70 (64.8 %) eyes had TBUT <10 s. Among 108 eyes of 54 patients, 58 (53.7%) eyes had Schirmer I test measurement <10 mm [Table 5].

On comparing the dryness of eyes as per TBUT and Schirmer's test among males and females, the relative risk of dryness was 0.93 [Table 6]. Among 30 female patients, 25 patients were in postmenopausal state. The relative risk of the dryness of eyes in postmenopausal females was 1.12 [Table 7].

Among 108 eyes of 54 patients, patients gave a history of using topical antiglaucoma medications for more than 15 months in 58 eyes. The relative risk of dryness in eyes on topical antiglaucoma medications for more than 15 months was 4.16 with $P < 0.0001$ [Table 8].

Table 4: Frequency distribution of types of drug used for the management of glaucoma

Type of drugs used	*n* (%)
Timolol only	42 (38.9)
Brimonidine only	20 (18.5)
Timolol and brimonidine	40 (37)
Timolol, brimonidine, and dorzolamide	6 (5.6)

Table 5: OSDI score, TBUT, and Schirmer's test – frequency distribution of dryness

Parameter	*n* (%)
OSDI scoring (*n*=54)	
Normal (0–12)	24 (44.4)
Mild dryness (13–22)	3 (5.6)
Moderate dryness (23–32)	12 (22.2)
Severe dryness (>32)	15 (27.8)
TBUT in seconds (*n*=108 eyes)	
Normal (>10)	38 (35.2)
Dryness (≤10)	70 (64.8)
Schirmer's test in mm (*n*=108 eyes)	
Normal (>10)	50 (46.3)
Dryness (≤10)	58 (53.7)

OSDI: Ocular surface disease index questionnaire, TBUT: Tear breakup time

Comparision of mean score of OSDI, TBUT in seconds and Schirmer's test in millimeters between males and females were not statistically significant with *p* value 0.5605, 0.4606 and 0.181 respectively [Table 9].

The mean score of OSDI, TBUT in seconds, and Schirmer's test in millimeters of eyes on single topical antiglaucoma medication was 16.7, 10.3, and 15.2, respectively, and that of eyes on multiple topical antiglaucoma medications was 35.8, 5.9, and 6.3, respectively, with $P < 0.0001$ (statistically significant) [Table 9].

Similarly, the mean score of OSDI, TBUT in seconds, and Schirmer's test in millimeters of eyes on topical antiglaucoma medications for ≤15 months was 13.3, 11.6, and 18.3, respectively, and that of eyes on topical antiglaucoma medications >15 months was 34.7, 5.7, and 5.5, respectively, with $P < 0.0001$ (statistically significant) [Table 9].

The subjective assessment of ocular surface disease by OSDI score was correlated with the objective assessment of ocular surface disease by TBUT and Schirmer's test by Spearman's correlation test and was found to have a strong positive correlation [Table 10].

DISCUSSION

Our study analyzed the subjective and objective measures of ocular surface disease in 108 eyes of 54 glaucoma patients

Table 6: Comparison of dryness as per TBUT and Schirmer's test with gender

Gender	Dryness present (*n*=35)	Dryness absent (*n*=19)	Relative risk with 95% CI	*P* value
Male (*n*=24)	15	9	0.93 (0.62 to 1.3)	0.781 (not significant)
Female (*n*=30)	20	10		

TBUT: Tear breakup time

Table 7: Comparison of dryness as per TBUT and Schirmer's test with menopausal state

Menopausal state	Dryness present (*n*=20)	Dryness absent (*n*=10)	Relative risk with 95% CI	*P* value
Present (*n*=25)	17	8	1.12 (0.52–2.4)	0.99 (not significant)
Absent (*n*=5)	3	2		

TBUT: Tear breakup time

Table 8: Comparison of dryness of eyes as per TBUT and Schirmer's test with duration of antiglaucoma medications

Duration of topical antiglaucoma eye drops	Dryness present (*n*=70)	Dryness absent (*n*=38)	Relative risk with 95% CI	*P* value
≥15 months	58	0	4.16	<0.0001*
≤15 months	12	38	(2.07–8.3)	

TBUT: Tear breakup time, * indicates *P*<0.05 is considered statistically significant

Table 9: Comparison of mean score of various parameters of dryness of eyes between the various groups

Parameter	OSDI score	TBUT in seconds	Schirmer's test in mm
Gender			
Male (*n*=24)	22.5±13.5	8.7±3.7	12.1±7.6
Female (*n*=30)	26.6±17.3	8.2±3.9	10.9±8.6
P value	0.5605 (NS)	0.4606 (NS)	0.181 (NS)
Number of topical antiglaucoma medications			
1 drug (*n*=60)	16.7±11.01	10.3±3.6	15.2±7.9
>1 drug (*n*=48)	35.8±14.7	5.9±2.5	6.3±5.2
P value	<0.0001*	<0.0001*	<0.0001*
Duration of topical antiglaucoma medications			
≤15 months (*n*=50)	13.3±7.5	11.6±3.3	18.3±6.7
>15 months (*n*=58)	34.7±14.2	5.7±1.5	5.5±3.2
P value	<0.0001*	<0.0001**	<0.0001*

Data are expressed as mean±SD. * indicates *P*<0.05 is considered statistically significant when groups were compared using Mann–Whitney *U*-test. ** indicates *P*<0.05 is statistically significant when groups were compared using unpaired "t" test, OSDI: Ocular surface disease index questionnaire, TBUT: Tear breakup time

Table 10: Correlation of subjective assessment of OSDI with objective assessment of ocular surface disease (Schirmer's test and TBUT) of eyes on topical antiglaucoma medications

Correlation of OSDI with	Correlation statistic			Interpretation
	P value	Spearman rho value	95% CI of rho value	
TBUT	<0.0001*	0.82	0.7–0.89	Strong positive correlation
Schirmer's test	<0.0001*	0.89	0.8–0.93	Strong positive correlation
Both TBUT and Schirmer's test	<0.0001*	0.83	0.71–0.89	Strong positive correlation

TBUT: Tear breakup time, OSDI: Ocular surface disease index questionnaire, * indicates *P*<0.05 is considered statistically significant

on topical antiglaucoma medications for >6 months. The prevalence of dry eye by OSDI score, TBUT, and Schirmer' test in patients on topical antiglaucoma medications was 55.6%, 64.8%, and 53.7%, respectively, similar to the study of Zemba *et al.*,[5]and other studies.[6-8] In our study, there were no gender difference and menopausal status of females among the prevalence of dry eye.

The relative risk of dry eye in patients receiving topical antiglaucoma medications for >15 months is 4.16 with $P < 0.0001$ as compared to the eyes with topical antiglaucoma medication ≤15 months. Hence, the longer duration of topical antiglaucoma medication is associated with increased prevalence of ocular surface disease.[9-11]

The mean scores of OSDI, TBUT, and Schirmer's test of eyes on single antiglaucoma eye drop were 16.7 ± 11.01, 10.3 ± 3.6, and 15.2 ± 7.9, respectively. The mean scores of OSDI, TBUT, and Schirmer's test of eyes on multiple antiglaucoma eye drops were 35.8 ± 14.7, 5.9 ± 2.5, and 5.5 ± 3.2, respectively. Hence, the eyes on multiple antiglaucoma eye drops had higher OSDI score and lower TBUT and Schirmer values with higher prevalence of ocular surface disease.[12-14]

In our study, the subjective evaluation with OSDI score was found to have strong positive correlation with objective evaluation by TBUT and Schirmer' test similar to other studies.[15]

CONCLUSION

The visual impairment due to glaucoma can be prevented by early screening and proper management. Often, the compliance of the patient for the topical antiglaucoma eye drops plays a major role in consistent reduction of the intraocular pressure and preservation of vision. Ocular surface health plays an important role in the compliance of patients for topical medications. The ocular adverse effects of long-term use of topical timolol eye drops include burning sensation, tear film alterations, and corneal anesthesia. The preservatives in the topical antiglaucoma eye drops also adversely affect the ocular surface.[16]

The ocular surface disease adversely affects the quality of life of glaucoma patients.[17] Hence, the use of fixed combination eye drops to reduce the dosage and preservative-free antiglaucoma medications improves the ocular surface health and adherence of patients to topical therapy. As ocular surface disease coexists with glaucoma, awareness and prompt management of dry eye will improve the compliance of patients and outcome of glaucoma management.[18-20]

Hence, early detection and management of ocular surface disease in glaucoma patients on topical medications will improve the quality of life of patients and results in better outcome of glaucoma management in the community.

ACKNOWLEDGMENT

We acknowledge Dr. L. Mageshwaran for his support in statistical analysis.

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How to cite this article: Thirunavukkarasu A, Karunakaran R. A Study on Evaluation of Ocular Surface Disease in Patients with Glaucoma. Int J Sci Stud 2019;7(1):48-52.

Source of Support: Nil, **Conflict of Interest:** None declared.