

Prevalence of Dry Eye and Its Association with Various Risk Factors in Rural Setup of Western Uttar Pradesh in a Tertiary Care Hospital

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Abstract

Purpose: To study the prevalence of dry eye in a hospital based population of rural setup and to evaluate its association with various risk factors. **Material and Methods:** In this cross sectional study, patients above 20 years of age were screened randomly for dry eye. An 8 points questionnaires, slit lamp examination of meibomian glands, tear film breakup time, fluorescein staining of cornea, schirmer test were used to diagnose dry eye. The diagnosis was made when three of the five parameters were positive. The role of various occupations as well as role of different exposure factors like sunlight, excessive wind, smoking, drugs, and air pollution as dry eye risk factors was accessed. **Result:** Out of 445, 45.39% patients had dry eye. Dry eye prevalence was higher in those above 70 years of age (74%). It was higher in male population (51.82%) compare to female population (37.37%), nearly equal in rural (46.04%) and urban population (44.31%) and highest among factory workers (90%). Correlation of dry eye with drugs ($P = 0.0002$), sunlight/high temperature ($P = 0.0003$) and smoking ($P = 0.03$) were significant. **Conclusion:** This is a hospital based study which provides prevalence of dry eye in rural region of western Uttar Pradesh. It is more common in old age male population and significantly higher in factory workers. Out of different modifiable risk factors most important are drugs, sunlight/high temperature and smoking.

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Keywords

Dry Eye, Fluorescein Stain, Schirmer Test, Tear Film Break up Time

1. Introduction

Dry eye is a chronic, multi-factorial condition characterized by disturbance in the tear film and the ocular surfaces. It can be caused by deficiency of any one or more of the tear film component or can be a component of systemic diseases, including Sjogren's syndrome, Lupus and Stevens—Johnson's Syndrome. Factors such as contact lens wear and adverse environmental exposures can exacerbate the symptoms of dry eye. Since we all are exposed to such adverse conditions, dry eye affects nearly everyone at one time or another.

Dry eye is the most frequent disorder in ophthalmology practice [1]. The prevalence of dry eyes varies from 10.8% to 57.1% [2]-[6]. Several factors could cause this variation. These include no standardization of the type of patients selected for the study, dry eye questionnaires, objective tests and dry eye diagnostic criteria. In literature there are various risk factors for dry eye which include air pollution, smoking, low humidity, high temperature, sunlight exposure and drugs [2] [7]-[11].

The aim of the present study was to determine the prevalence of dry eye in rural based tertiary health care center of Western Uttar Pradesh, India and evaluate the risk factors associated with it.

2. Material and Methods

This hospital based cross sectional study was conducted in the department of ophthalmology, UP Rural Institute of Medical Sciences and Research, Saifai, Etawah. The institute is 700 bedded tertiary health care centre in rural region of Western Uttar Pradesh. Total 445 patients above 20 years of age presenting with various ophthalmic problems to outdoor patient department of Ophthalmology were screened for dry eye. The patients were selected randomly and informed about the nature of study. Patients suffering from acute ocular infections, extensive corneal or conjunctival pathology, contact lens users and those who had undergone extra ocular or intra ocular surgery within six months of the screening were excluded. Initially 643 patients were chosen, out of these 198 (30.8%) patients either refused to participate or not fulfilled the inclusion criteria of the study. Total 445 cases were included in present study. Informed consent was obtained from subjects recruited for the study.

Complete general history (including history of systemic diseases, especially related to the dry eye) and ophthalmic history was taken by the ophthalmologist. He had also taken ocular and systemic examination and dry eye related questionnaires. Ocular examination included review of lid surface abnormalities and meibomian gland evaluation. Another ophthalmologist performed the objective dry eye tests thereafter. The second observer was masked to dry eye information from the questionnaires.

The questions regarding dry eye symptoms consisted of eight items (Annexure I). Six of the symptoms were the same as those used by Schein *et al.* [12]. Two more symptoms (sticky eye and tearing) were added because they were included in the questionnaires of other dry eye studies [13]-[16]. When a respondent indicated the presence of symptom often or all the time then it was recorded. The dry eye test were included the tear film break up time (BUT), fluorescein staining of the cornea, slit lamp examination of meibomian glands and the schirmer test. The tear film break up time test was performed before the other dry eye test, to avoid any untoward interference. Fluorescein staining of cornea was observed by slit lamp with a cobalt blue filter and was graded 0 (no staining), 1 (mild staining with a few disseminated stains and limited to less than one third of the cornea), 2 (moderate staining with a severity between grade 1 and 3) or 3 (severe staining with confluent stains and occupying half or more of the cornea) [13]. The condition of the meibomian gland was determined by observing the lid margin with a slit lamp. Because there is no universal grading system of meibomian gland dysfunction, we defined meibomian gland disease as the presence of meibomian gland orifice plugging or lid margin telangiectasia. The presence of lid margin telangiectasia was recorded and any meibomian gland obstruction was graded. We defined grade 0 as no obstruction; grade-1: was plugged with translucent serous secretion when the lid margin was compressed; grade-2: plugged with viscous or waxy white secretion when the lid margin was compressed; and grade-3: plugged with no secretion when the lid margin was compressed. The schirmer test was

performed last so that ocular irritation by the test strip would not interfere with other examination results. One minute after instillation of a drop of 0.5% paracaine, any visible fluid in the inferior fornix or lid margin was gently dried with a cotton swab. A Whatman filter paper 41 was then placed temporally in each lower fornix and left in place for 5 minutes. The patient was allowed to either blink normally or to close his or her eyes. After 5 minutes, the strip was removed and the amount of wetting (in mm) was recorded from the pre-calibrated strip.

3. Diagnosis and Statistical Analysis

Positive dry eye symptom was defined as having one or more symptoms often (at least once a week) or all the times. Positive signs were if one or both eyes revealed tear film break up time less than 10 seconds [17], a Schirmer test score less than 5 min [18] a fluorescein score more than 1 [18], or the existence of meibomian gland disease which was diagnosed when telangiectasia at the lid margin or plugging of the gland orifices was present (\geq grade 1).

If three or more than three of the above five were positive, the subject was deemed to be suffering from dry eye.

Data were analyzed by using Chi-Square, Z test and strength of association was determined by the odds ratio and significance of Fisher's exact test. P value less than 0.05 was considered statistically significant.

4. Results

Table 1 shows the base line characteristics of the study group. Out of 445 randomly selected subjects for the

Table 1. Baseline characteristics (n = 445).

	Frequency	Percent
Age group		
20 - 29	64	14.4
30 - 39	63	14.2
40 - 49	69	15.5
50 - 59	75	16.9
60 - 69	102	22.9
70 - 79	60	13.5
80 - 89	11	2.5
90 - 99	1	0.2
Sex		
Male	247	55.5
Female	198	44.5
Place of residence		
Rural	278	62.5
Urban	167	37.5
Occupation		
Farmers/labouersrs	77	17.3
Others with high exposure	65	14.6
Home makers/students	137	30.8
Factory workers	10	2.25
Office workers	34	7.64
Others with low exposures	122	27.4

study, 247 (55.50%) were male and 198 (44.49%) were female. 278 (62.47%) from rural background while 167 (37.52%) from urban region. Occupationally most of them were home makers/students (30.78%).

Dry eye was present in 202 (45.39%) of the study subjects (**Table 2**). The prevalence of dry eye was increased with increasing age. The prevalence was significantly higher in age group 70 years and above compared to all other age groups. Male (51.82%) had significantly higher prevalence of dry eye than female (37.37%) ($Z = 3.085$, $P < 0.05$).

This study was done in rural based tertiary health care center, but the adjoining urban and sub-urban areas lacking such good ophthalmic facilities. So, we got cases from both rural and urban population.

Table 3 shows factory workers (90%) followed by others with high exposures (61.54%) and farmers/labourers (57.14%) were suffered from dry eye more commonly. Office workers, shopkeepers, students and homemakers were less affected by dry eye.

All the exposure factors in **Table 4** had higher risk for dry eye. Subject exposed to sunlight/high temperature ($P < 0.05$) smoking ($P < 0.05$) and drugs ($P < 0.05$) were at higher risk of developing dry eye. [Commonly used

Table 2. Prevalence of dry eye according age group, sex and place.

	No. of subjects	Dry eyes	Prevalence (%)	P value*	95% CI
Age group (years)					
20 - 29	64	26	40.63	$P < 0.05$	29.45 - 52.87
30 - 39	63	19	30.16	$P < 0.05$	20.18 - 42.42
40 - 49	69	20	28.99	$P < 0.05$	19.56 - 40.63
50 - 59	75	37	49.33	$P < 0.05$	38.33 - 60.40
60 - 69	102	47	46.08	$P < 0.05$	36.72 - 55.72
70 - 79	60	42	70.00	$P < 0.05$	57.43 - 80.16
≥ 80	12	11	90.91	$P < 0.05$	60.09 - 99.77
Total	445	202	45.39		
Sex					
Male	247	128	51.82	$P < 0.05$	45.61 - 57.98
Female	198	74	37.37	$P < 0.05$	30.93 - 44.30
Place					
Rural	278	128	46.04	$P < 0.05$	40.28 - 51.92
Urban	167	74	44.31	$P < 0.05$	36.99 - 51.89

*Significant was calculated with Chi-Square Test and significant if P-value < 0.05 .

Table 3. Prevalence of dry eye in various occupational groups.

Occupational group	No. of subjects	Dry eyes	Prevalence (%)	P value*	95% CI
Farmers/labouersrs	77	44	57.14	$P < 0.05$	46.01 - 67.60
Others with high exposure [#]	65	40	61.54	$P < 0.05$	49.37 - 72.42
Home makers/students	137	52	37.96	$P < 0.05$	30.26 - 46.31
Factory workers	10	9	90.00	$P < 0.05$	57.40 - 99.99
Office workers	57	11	19.30	$P < 0.05$	10.96 - 31.51
Others with low exposure [§]	99	46	46.46	$P < 0.05$	36.96 - 56.24

[#]High exposure (computer operators, drivers, salesmen, field workers, cooks), [§]low exposures (teachers, retired persons, priests), * significant was calculated with Chi-Square Test and significant if P-value < 0.05 .

Table 4. Strength of association of drugs and environmental exposure factors with dry eyes.

Exposure factors	Non exposed group		Exposed group		Odds ratio	P value
	Total subject	Dry eyes	Total subject	Dry eyes		
Excessive wind	420	189	25	13	1.3241	0.539
Sunlight/high temp	316	126	129	76	2.1623	0.0003***
Air pollution	417	191	28	11	0.7656	0.5602
Smoking	383	166	62	36	1.81	0.03*
Drugs	414	178	31	24	4.55	0.0002***

Fisher's Exact Test was applied to get the significant and *significant if p-value < 0.05, ***highly significant if P < 0.0001, temp = temperature.

drugs were chlorpheniramine eye drops, antibiotic-corticosteroid eye drops, antiglaucoma eye drops, analgesics, bronchodilators, antihypertensive, antihistaminics and tranquilizers].

The most commonly presenting symptom in dry eye subjects was gritty sensation (25.4%) followed by watering of eye (23%) and red eye (17.8%) (**Table 5**).

5. Discussion

Dry eye is a major tear deficiency disorder that affects the millions of people worldwide. It is a distressing problem which is often overlooked and under diagnosed. Clinically dry eye can be divided into three stages. In the first stage the patient has symptoms but no signs are present, in the second stage the symptom of first stage along with reversible signs such as small corneal erosions and superficial ulcers, mucous secretion and hyperemia of nasal and temporal bulbar conjunctiva are present. In third stage patient has symptoms and signs of first and second stage along with irreversible signs such as corneal opacity and ulceration which can be lead to sight threatening corneal complications [19].

The previous studies show that prevalence of dry eye varies from 10.8% to 57.1% [6]. The different eye diagnostic criteria and different cut off values of objective dry eye tests are the main cause of such vast disparity in dry eye prevalence. In present study prevalence of dry eye is 45.39% which is slightly higher but fall within this range.

In our study, dry eye prevalence increased progressively with age which is consistent with the finding in other dry eye studies [5] [7] [20]. According to Mc Carty *et al.* as the age increases the tear secretion decreases [13]. This may be one of the explanations of this finding.

Most studies report a higher prevalence of dry eye in female than male [2] [6] [7] [21]-[23]. But in our study male (51.82%) had more prevalence of dry eye than female (37.37%). In present study most of the patients come from rural background. Since traditionally male are more active in outside work, so they are more exposed to different exposure factors such as sunlight, high temperature, excessive wind. This might be the cause of high prevalence of dry eye in male population in this study. We noted the higher dry eye prevalence in urban residence than in rural (but statistically not significant) which correlates with report from Japan [2].

Exposure to drugs, sunlight/high temperature and smoking were significantly related to dry eye (P values 0.0002, 0.0003 and 0.03) respectively. Smoking, air pollution and drugs have been suggested as risk factors in various studies [2] [7] [11]. Smoking predisposes the eye to tear film instability by its direct irritant action on the eye and represent modifiable risk factors in dry eye causation. A drug too may disrupt one or more component of the tear film causing it to become unstable.

In the study performed in Australia by Mc Carty *et al.* reported that most of the patients presented with the symptoms of foreign body sensation, discomfort, itching, tearing and photophobia [13]. Most of our patients with dry eye presented with gritty/sandy sensation (25.4%) followed by watering of eyes (23%) and red eyes (17.8%).

6. Conclusion

This study of Western Uttar Pradesh rural based tertiary health care center provided the prevalence of dry eye and its correlation with different risk factors in adjoining area. The prevalence of dry eye is relatively higher in

Table 5. Symptoms among the dry eye cases.

Symptoms	Dry eye case				Total	%
	Yes	%	No	%		
Burning sensation	16	4.83	4	2.6	20	4.12
Red rye	59	17.8	32	20.8	91	18.8
Watering eye	76	23	74	48.1	150	30.9
Crust on eye lashes	9	2.72	1	0.65	10	2.06
Dry eye feeling	50	15.1	10	6.49	60	12.4
Gritty/sandy sensation	84	25.4	22	14.3	106	21.9
Stuck shut eye in morning	6	1.81	1	0.65	7	1.44
Dry eye sensation	10	3.02	0	0	10	2.06
Sticky sensation	21	6.34	10	6.49	31	6.39
Total	331	100%	154	100%	485	100%

this region which is more common in male population. One interested thing about this study was very high prevalence of dry eye in factory workers (90%). In this region most factories are bangle based, exposing the worker to dry hot atmosphere with high temperature. This may be the explanation for such high prevalence rate of dry eye in factory workers.

7. Limitations

The main limitation of the present study is that it is a hospital based study.

The documented risk factors of dry eye such as arthritis, caffeine use, thyroid disease, gout, total to high density lipoprotein cholesterol ratio, diabetes and multivitamins were not investigated in this study.

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Annexure I

Dry Eye Questionnaire

(Allowable responses: never, rarely, sometimes, often, or all the time.)

1. Do your eyes ever feel dry?
2. Do your eyes ever have a burning sensation?
3. Do your eyes ever feel sticky?
4. Do your eyes ever feel watering?
5. Do your eyes ever red?
6. Do your eyes ever get stuck in the morning?
7. Do your eyes ever feel a gritty sensation?
8. Do you notice much crusting or discharge on your lashes?