Section: Ophthalmology

Original Research Article

ANALYTICAL STUDY ON DRY EYE EPIDEMIOLOGY, SYSTEMIC ETIOLOGY AND ASSOCIATION WITH DURATION OF SYSTEMIC ILLNESS

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Abstract

Background: Dry Eye Syndrome (DES) is a multifactorial condition affecting the tear film and ocular surface, leading to visual discomfort and Tear film instability as well as increased Tear film osmolarity and Ocular surface irritation. This study aimed to investigate the Epidemiology and Aetiology and severity of Dry Eye associated with the duration of systemic diseases. **Materials and Methods:** This was a cross-sectional Descriptive Study that included 200 patients from Coimbatore Medical College Hospital between 2019 and 2020. Chief complaints and medical histories were thoroughly documented. Comprehensive Eye examination was done for all patients. Schirmer's test, TBUT, and corneal staining were used to assess the severity of DED. The duration of Primary Sjogren's Syndrome, Rheumatoid arthritis, SLE, Thyroid disorders, Diabetes Mellitus, were evaluated. **Results:** Most subjects (73%) were female, with Systemic diseases, included Rheumatoid Arthritis (25%), SLE (24.5%), Primary Sjogren's Syndrome (20%), Thyroid disorders (15.5%), and Diabetes Mellitus (15%). Patients with TBUT < 10 seconds (60%) and positive fluorescein staining were significantly older (mean age 48.80±7.19 years) and had longer illness duration. (>10 years, $p < 0.001$). Visual acuity was significantly poorer in the groups with TBUT < 10 s and positive staining ($p < 0.001$). Severe abnormalities in the Schirmer's test are often associated with Primary Sjögren's Syndrome, SLE, Rheumatoid Arthritis, or Diabetes Mellitus. **Conclusion:** Dry Eye prevalence is greater among females with 60% of subjects having history of systemic disease. Individuals with a tear break-up time of < 10 seconds were older on average than those with a longer tear break-up time, and all had systemic illness for over 10 years. Early diagnosis and treatment are essential for preventing severe ocular damage.

INTRODUCTION

Tears and Ocular surface that leads to symptoms of visual discomfort and Tear film instability, with probable injury to the eye surface. It is also adds to increase in the Osmolarity of the Tear film and irritation of the eye surface.[1] Dry Eye denotes the diseases of the Tear film owing to reduced tear secretion and/or disproportionate tear evaporation linked with symptoms of eye discomfort.[2] Studies have shown that Dry Eye Syndrome varies about 5% and > 30% in different age categories across diverse countries and universally. The occurrence can go up to 75% in the elderly.[3] In India the prevalence was reported to be from 15% to 55% in different studies and settings.[4]

The tear film preserves a moist setting on the eye's outer surface, averting the damage and dryness of epithelial cells and lubricating the eye's surface, easing eyelid movement.[5] The instability of the tear film can be due to inadequate quantity of tear production or poor quality of tear film, which is consequent to increased evaporation of tears. Dry Eye can be categorized into two types: Aqueous Deficient and Evaporative Dry Eye Illnesses.[6]

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Reduced tear secretion can be due to autoimmune disorders such as Sjogren's Syndrome. The Evaporation deficiency is due to internal factors like lid and Conjunctival abnormalities, environment related, and nutrient deficiencies.[7]

Dry Eye Syndrome (DES) is the most common Ophthalmic condition, and unnoticed Dry Eye can augment the danger of eye infection, corneal ulcers, and Blindness. Dry Eye Syndrome (DES) is linked with reduced capability to carry out definite activities such as reading, driving, and computer-related work, which necessitates visual concentration.[8] The clinical diagnosis of Dry Eye is challenging because of the extensive variety of signs and symptoms, and uncertainty in the etiology and pathophysiology of the disease. The impact of Dry Eye on quality of life, work productivity, and cost of management makes it a concern even though some of the causes are modifiable and avoidable.[9] Diagnostic tests are needed to differentiate between Dry Eye, infection, and allergies, all of which appear similar but need to have varied treatment. Dry Eye management includes the removal of causative factors, healing of the affected eye structure, and reduction of patient distress.[10]

Aim

This study is aimed to investigate the Epidemiology, Aetiology and Severity of Dry Eye associated with Systemic diseases and its duration.

To correlate the severity of Dry Eye with the duration of primary illness.

MATERIALS AND METHODS

This cross-sectional study included 200 patients at the Coimbatore Medical College between 2019 and 2020. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

Inclusion Criteria

Patients of both sexes with Primary Sjogren's Syndrome, Systemic Lupus Erythematosus, Rheumatoid Arthritis, Thyroid disorder and Diabetes Mellitus were included in the study.

Exclusion Criteria

Patients with Contact lens wearers, Meibomian gland dysfunction, Corneal surgeries, Steven Johnson Syndrome, Sarcoidosis, Ectropion, and Entropion were excluded from the study.

Methods

The study was conducted among 200 patients with Systemic illnesses presented to the Ophthalmology, Rheumatology, Diabetology, and General Medicine outpatient departments during the study period. Patients of all ages and genders within the inclusion criteria were considered. The chief complaints and medical histories were thoroughly documented. Schirmer's test, TBUT, and corneal staining were performed to evaluate Dry Eye, and the severity of Dry Eye and the response to treatment were evaluated. The duration of Primary Sjogren's Syndrome, Rheumatoid Arthritis, SLE, Thyroid Disorders, Diabetes Mellitus, were assessed. Their associations with the prevalence and severity of Dry Eye were evaluated. All patients were under Physician, Rheumatologist care for their systemic illness, their diagnosis arrived after complete evaluation and appropriate laboratory investigations.

Statistical Analysis

Data analysis was performed using MS Excel and SPSS version 16. Descriptive statistics for numerical variables such as age and visual acuity were summarized using mean and standard deviation, whereas categorical variables such as sex and Schirmer's test results were presented as frequencies and percentages. Pearson's correlation, chi-square tests, and Fisher's exact test were used for inferential statistics, with a p-value < 0.05 indicating significance.

RESULTS

The result shows that the mean (SD) of age in years among the study population was 45.63 years. [Table 1]

Among these patients, 73% were females, and 27% were males. Systemic diseases included Rheumatoid Arthritis (25%), SLE (24.5%), Primary Sjogren's Syndrome (20%), Thyroid disorders (15.5%), and Diabetes Mellitus (15%). Sixty percent of the patients had a systemic disease duration exceeding 10 years, whereas 40% had a duration of < 10 years.

Among the 200 patients, 120 (60%) had a treatment duration of > 10 years and 80(40%) had a duration of < 10 years. Schirmer's test revealed that 40.5% had normal values (15 mm), 16.5% had mildly abnormal values (10-15 mm), 22% had moderately abnormal levels (5-10 mm), and 21% had severely abnormal values (< 5 mm). Sixty percent of the subjects had a tear break-up time of < 10 s and 60% had positive fluorescein staining. [Table 2]

The results showed that 51(25.5%) patients had 6/18 visual acuity in both eyes, 40 (20%) had 6/9, 38 (19%) had 6/24, 37 (18.5%) had 6/12, 22 (11%) had 6/6, and 12(6%) had 6/36 visual acuity in both eyes. [Table 3]

Patients with a TBUT of <10 seconds were significantly older (48.80±7.19 years) than those with a TBUT of >10 seconds (40.86±7.06) years ($p < 0.001$). The sex distribution was higher in females, with no significant difference ($p=0.77$). All patients with a duration of illness > 10 years had a TBUT < 10 s, whereas those with a TBUT > 10 s had an illness duration of < 10 years ($p < 0.001$).

Systemic illness diseases, such as Rheumatoid Arthritis, SLE, Thyroid disorders, and Diabetes Mellitus, showed significant differences ($p = 0.03$). Primary Sjogren's Syndrome was more common in the TBUT < 10 s group (24.2% vs. 13.8%) ($p = 0.03$). The results showed that increased duration, and type of systemic illness were associated with decreased Tear Break-up time.

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Among the patients with tear break-up time < 10 s, 46(38.3%) had 6/18 visual acuity, 35(29.2%) had 6/24, 25(20.8%) had 6/12, and 11(9.2%) had 6/36 visual acuity. There were significant differences in visual acuity with tear breakup time ($p < 0.001$). [Table 4]

The mean ages of the mildly, moderately, and severely abnormal groups were 49.76±7.46, 48.18±6.81, and 49.10 ±7.08, respectively. Among the patients with duration of systemic illness >10 years, 33 (27.5%), 44 (36.7%), and 42 (35%) belonged to mildly, moderately, and severely abnormal.14 (33.3%) of patients with severely abnormal Schirmer's test had Primary Sjogren's syndrome and SLE, 9 (21.4%) had Rheumatoid arthritis and 5(11.9%) had Diabetes mellitus.

Among those with severely abnormal Schirmer's test results, 17 (40.5%) had 6/18 visual acuity, 11 (26.2%) had 6/12, 9 (21.4%) had 6/24, and 5 (11.9%) had 6/36, which was significant ($p<0.001$). [Table 5]

Patients with positive fluorescein staining were significantly older (48.80±7.19 years) than those with negative staining (40.86±7.06 years, $p < 0.001$). The sex distribution was higher in females, with no significant difference ($p=0.77$).

All patients with a duration of illness > 10 years had positive staining, while those with a duration of illness < 10 years had negative staining ($p < 0.001$). Primary Sjogren's syndrome was more common in the positive staining group (24.2% vs. 1.8%, $p = 0.03$).

Among the subjects with positive fluorescein staining, 46(38.3%) had 6/18 visual acuity, 35(29.2%) had 6/24, 25(20.8%) had 6/12, and 11(9.2%) had 6/36 visual acuity. There were significant differences in visual acuity based on fluorescein staining ($p < 0.001$). [Table 6]

Table 1: Age Distribution among subjects

Features	In years
Mean	45.63
Median	45.00
Mode	49
Standard deviation (SD)	8.120
Minimum	30
Maximum	71

Table 2: Demographic and clinical characteristics of study participants

		Frequency (%)
Gender	Female	146 (73%)
	Male	54 (27%)
Systemic disease	Rheumatoid Arthritis	50 (25%)
	SLE	49 (24.5%)
	Primary Sjogren's Syndrome	40 (20%)
	Thyroid disorder	31 (15.5%)
	Diabetes Mellitus	30 (15 %)
Duration of Systemic diseases (years)	>10	120 (60%)
	<10	80 (40%)
Duration of treatment (years)	> 10	120 (60%)
	< 10	80 (40%)
Schirmer's test (mm)	Normal > 15	81 (40.5%)
	Mildly abnormal 10-15	33 (16.5%)
	Moderately abnormal 5-10	44 (22%)
	Severely abnormal < 5	42 (21%)
Tear break-up time (seconds)	< 10	120 (60%)
	> 10	80 (40%)
Fluorescein staining	Positive	120 (60%)
	Negative	80 (40%)

Table 3: Visual acuity of the right and left eyes among the population

Visual acuity	Frequency (%)	
	Right eye	Left eye
6/6	22 (11%)	22 (11%)
6/9	40 (20%)	40 (20%)
6/12	37 (18.5%)	37 (18.5%)
6/18	51 (25.5%)	51(25.5%)
6/24	38 (19%)	38 (19%)
6/36	12 (6%)	12 (6%)

Table 4: Association of clinical parameters between Tear Break-Up time

		Tear break-up time		P-value
		< 10 seconds	> 10 seconds	
Age in years (mean)		48.80±7.19	40.86±7.06	< 0.001
Gender	Male	31 (5.4%)	33 (42.6%)	0.77
	Female	89 (61%)	57 (39%)	

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Duration of illness (years)	< 10	0	80 (100%)	< 0.001
	> 10	120 (100%)	0	
Systemic illness	Primary Sjogren's	29 (24.2%)	11 (13.8%)	0.03
	Rheumatoid Arthritis	30 (25%)	20 (25%)	
	SLE	30 (25%)	19 (23.8%)	
	Thyroid disorder	11 (9.2%)	20 (25%)	
	Diabetes Mellitus	20 (16.7%)	10 (12.5%)	
Visual acuity	6/6	1 (0.8%)	21 (26.2%)	< 0.001
	6/9	2 (1.7%)	38 (47.5%)	
	6/12	25 (20.8%)	12 (15%)	
	6/18	46 (38.3%)	5 (6.2%)	
	6/24	35 (29.2%)	3 (3.8%)	
	6/36	11 (9.2%)	1 (1.2%)	

Table 5: Association of clinical parameters between Schirmer's test

		Schirmer's test				P value
		Normal	Mildly abnormal	Moderately abnormal	Severely abnormal	
Age in years (mean)		40.75±7.08	49.76±7.46	48.18±6.81	49.1±7.08	< 0.001a*
Gender	Male	23 (42.6%)	13 (24.1%)	7 (13%)	11 (20.4%)	0.14b
	Female	58 (39.7%)	20 (13.7%)	37 (5.3%)	31 (21.1%)	
Duration of illness (years)	< 10	80 (100%)	-	-	-	< 0.001b*
	> 10	1 (0.8%)	33 (27.5%)	44 (36.7%)	42 (35%)	
Systemic illness	Primary Sjogren's	11 (13.6%)	5 (15.2%)	10 (22.7%)	14 (33.3%)	< 0.001c*
	Rheumatoid arthritis	20 (24.7%)	6 (18.2%)	15 (34.1%)	9 (21.4%)	
	SLE	20 (24.7%)	5 (15.2%)	10 (22.7%)	14 (33.3%)	
	Thyroid disorder	20 (24.7%)	6 (18.2%)	5 (11.4%)	0	
	Diabetes mellitus	10 (12.3%)	11 (33.3%)	4 (9.1%)	5 (11.9%)	
Visual acuity	6/6	22 (27.2%)	0	0	0	< 0.001c*
	6/9	38 (46.9%)	1(3%)	1 (2.3%)	0	
	6/12	12 (14.8%)	3 (9.1%)	11 (25%)	11 (26.2%)	
	6/18	5 (6.2%)	13 (39.4%)	16 (36.4%)	17 (40.5%)	
	6/24	3 (3.7%)	12 (36.4%)	14 (31.8%)	9 (21.4%)	
	6/36	1 (1.2%)	4 (12.1%)	2 (4.5%)	5 (11.9%)	

a- One-way ANOVA test, b- Chi square test, c- Fischer's exact test
***- p value <0.05 is significant**

Table 6: Association of clinical parameters between fluorescein staining

		Fluorescein staining		P-value
		Negative	Positive	
Age in years (mean)		40.86±7.06	48.80±7.19	<0.001a*
Gender	Male	23 (42.6%)	31 (57.4%)	0.77b
	Female	57 (39%)	89 (61%)	
Duration of illness	< 10 years	80 (100%)	0	<0.001b*
	> 10 years	0	120 (100%)	
Systemic illness	Primary Sjogren's	11 (1.8%)	29 (24.2%)	0.03b*
	Rheumatoid arthritis	20 (25%)	30 (25%)	
	SLE	19 (23.8%)	30 (25%)	
	Thyroid disorder	20 (25%)	11 (9.2%)	
	Diabetes mellitus	10 (12.5%)	20 (16.7%)	
Visual acuity	6/9	1 (0.8%)	21 (26.2%)	< 0.001a*
	6/9	2 (1.7%)	38 (47.5%)	
	6/12	25 (20.8%)	12 (15%)	
	6/18	46 (38.3%)	5 (6.2%)	
	6/24	35 (29.2%)	3 (3.8%)	
	6/36	11 (9.2%)	1 (1.2%)	

DISCUSSION

The main aim of the study was to analyse Dry Eye Epidemiology, Systemic Etiology and association with duration of Systemic illness.

The study assessed Dry Eye among subjects who had Systemic illness, not among the general population so the prevalence cannot be generalised to all subjects. Local Ocular causes of Dry Eye like topical medications, Environmental factors and smoking were not assessed.

The study emphasis the use of readily available Schirmer's Strip, Fluorescein Staining, TBUT for Dry Eye assessment. Further evaluation of Dry Eye by Tear Osmolarity ,Impression Cytology, Fluoro Photometry and Tear protein immune –assay was not done in this study for initiating treatment, further

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reiterating the importance of basic Dry Eye tests can be universally done for Dry Eye diagnosis.

Mean age of the study population was 45.63 years And hence early screening for Dry Eye has to be initiated once the diagnosis of the Systemic illness has been made.

Gender distribution showed 73% were females Systemic illness distribution among the study population highest was Rheumatoid Arthritis with 25%.

Longer the duration of Systemic illness higher the incidence of Dry Eyes and hence a periodic review is important.

60% of the study population had Positive Fluorescein Staining.

21% had severely low values of <5mm on Schirmer's test.

The TBUT distribution among the study population showed 60% had <10seconds time making, the above three tests basic for diaganosing the severity of Dry Eye

The main aim of the study was to analyse Dry Eye.

CONCLUSION

A study of 200 subjects with systemic illness revealed a high prevalence of dry eye: 60% based on tear break-up time and fluorescein staining and 59.5% based on Schirmer's test. Rheumatoid arthritis (25%), SLE (24.5%), primary Sjogren's syndrome (20%), thyroid disorders (15.5%), and diabetes mellitus (15%) were the main conditions. Subjects with a tear break-up time of < 10 s had a higher mean age (48.80 years) than those with a longer tear break-up time (40.86 years), and 100% of those with < 10 s break-up time had systemic illness for over 10 years.

In conclusion, Early diagnosis, periodic review and timely therapy in patients with Systemic illness with Dry Eye manifestation will help avert complications, which may be severe with a longer duration, and may lead to severe ocular surface damage.

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