PREVALENCE OF DRY EYE SYNDROME IN PATIENTS WITH TYPE 1 AND TYPE 2 DIABETES- A COMPARATIVE STUDY

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ABSTRACT

BACKGROUND

Diabetes mellitus (DM) is a major cause of various ocular complications including Keratoconjunctivitis sicca resulting in tear film deficiency, significantly hindering the performance of daily life and may lead to blindness in severe cases. The objective of our study was to understand the association between Type 1 and Type 2 diabetes mellitus (DM) and development of dry eye syndrome.

MATERIALS AND METHODS

A pair of eyes of 40 patients with Type 1 DM and 60 patients with Type 2 DM was tested for dry eye syndrome using standard scores from Schirmer test 1, 2, tear film break-up time and Rose Bengal staining. Results were statistically analysed to understand significant association.

RESULTS

Patients with both types of DM belonged to middle or older age groups. Dry eye syndrome was present in nearly half of the patients, as assessed by different techniques. Dry eye syndrome was significantly increased with progressing age and duration of DM of both types in patients. There was, however, no significant difference in prevalence of dry eyes between patients with Type 1 and Type 2 DM.

CONCLUSION

Dry eye syndrome is an important comorbidity of DM and progresses with age and duration of the disease, and needs early detection and therapeutic management.

KEYWORDS

Diabetes Mellitus, Type 1, Type 2, Dry Eye Syndrome.

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BACKGROUND

Diabetes mellitus (DM) is a global metabolic disorder affecting the overall quality of life.[1] Insulin-dependent (Type 1) DM is a chronic autoimmune disease in genetically susceptible individuals, resulting from selective loss of insulin producing β- cells in the pancreatic islets.[2] It affects children, adolescents and adults, with a global increase of about 3-4% annually,[3] and is a result of the complex interplay of several factors including environmental, nutritional and genetics.[4] Non-insulin-dependent (Type 2) DM is by far the most common type of diabetes, comprising greater than 95% of all cases.[1] Type 2 DM is caused by insulin resistance resulting from its progressive secretion defect, thereby increasing the body's demand for insulin to maintain glucose homoeostasis and resulting in obesity.[5,6] DM is associated with several complications like acute myocardial infarction, stroke, end-stage renal disease, diabetic foot ulcer and microvascular complications such as nephropathy and neuropathy.[6-8] Hence, quality of life and productive years are often severely compromised due to the complex and multiple ensuing diseases[9,10] in addition to recurrent monetary expenses.[11]

Additionally, DM is also a major cause of ocular complications including diabetic retinopathy, diabetic papillopathy, glaucoma, cataract, and ocular surface diseases such as diabetic keratopathy and dry eye syndrome.[12,13] Dry eye syndrome, also known as Keratoconjunctivitis sicca, is one of the most common ocular disorders throughout the world.[14] It is a complex disease of the anterior surface of the eye and results in tear film deficiency, significantly hindering the performance of daily life and may lead to blindness in severe cases.[12,15] It involves multifactorial manifestations involving changes in ocular surface and discomfort, irritation, fluctuating and blurred vision, increased tear osmolarity, tear film instability and visual disturbance.[12,16]

Considering the global trend in increase of both Type 1 and Type 2 DM,[17,18] and dry eye syndrome, our study was focused on understanding the prevalence of dry eye

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syndrome in patients suffering from Type 1 and Type 2 DM and comparing prevalence between the two groups. Schirmer test 1 & 2, Tear film break-up time (TFBUT) and Rose Bengal staining was used to assess the prevalence of dry eye syndrome in patients of both groups. Our results indicate that dry eye syndrome was prevalent in patients of both Type 1 and Type 2 DM and significantly increased with both age of the patients and duration of DM, although no difference in prevalence was observed between the two DM groups. Our results thus indicate the necessity of early detection and intervention of dry eye syndrome in patients with Type 1 and Type 2 DM for prevention of progression of ocular complications.

MATERIALS AND METHODS

Study Population- The study was conducted on patients afflicted with Type 1 DM (n= 40; 80 eyes) and Type 2 DM (n= 60; 120 eyes) and attending the Outpatient Department of Regional Institute of Ophthalmology, Kolkata, between the period of 2012-2014. Clearance from the Institutional research and ethical committee was obtained prior to commencement of the study. Written informed consent from all participants was also taken before the onset of observations and experiments.

Demographic Characteristics- All demographic characteristics of the patients, including age, gender, type of diabetes mellitus, duration of the disease, etc. were recorded in a specific format for statistical correlation.

Determination of Dry Eye Syndrome- Dry eye syndrome was diagnosed on the basis of ocular examination and standard diagnostic tests such as Schirmer test (1&2), Tear Film Break-up Time (TFBUT), Rose Bengal and fluorescein dye staining of ocular surface.[19] Van Bijsterveld scoring scheme was used for qualitative assessment of Rose Bengal staining.[20] McMonnies standard questionnaire was used to evaluate signs and symptoms associated with dry eye syndrome.[21]

Clinicopathological Correlation- Estimation of risk associated with demographic features such as gender was determined by Odd's ratio using univariate analysis through Fisher's exact t test. Chi square for trend was used to detect the linear variation with subsequent age of patients and duration of symptoms with prevalence of dry eye syndrome using different diagnostic tests. All statistical tests conducted were two tailed, with a Confidence Interval (CI) of 95% and probability (p) value <0.05 was considered significant. Calculations were made using software Epi Info 7 (CDC, Atlanta). Tables were created with the help of Microsoft Excel (Office 365, Microsoft Corp., USA).[22]

RESULTS

Demography of the Patients- 40 patients of Type 1 DM and 60 patients of Type 2 DM have been selected for our study. Patients affected with Type 1 and Type 2 DM mostly belonged to the age groups 40- 49 years and 50- 69 years respectively. Majority of the patients presented with 10-14 years of symptoms for both diabetic groups (Table 1). Comparative distribution of males and females was also observed for both types of DM (Table 1).

Schirmer 1 Positivity was Significantly Associated with Gender and Patient's Age

Schirmer 1 positivity (test value less than 10 mm) was present in 32.5% (13/40) patients with Type 1 DM and 35% (21/60) with Type 2 DM (Table 1). Dry eye syndrome assessed by Schirmer 1 positivity was significantly present in women and showed significant association with increasing age of the patients of both Type 1 and Type 2 DM (Table 2). Type 2 DM also showed significant trend with increasing duration of DM (Table 2). There was, however, no difference in pattern between Type 1 and Type 2 DM (data not shown).

Schirmer 2 Positivity was Significantly Associated with Patient's Age and Duration of Symptoms

Patients with Type 1 and Type 2 DM showed 20% (8/40) and 21.67% (13/60) positivity of Schirmer 2 test (test value less than 6 mm) (Table 1). Interestingly, patients with both Type 1 and Type 2 DM showed significant association of dry eye syndrome through Schirmer positivity with progressing age and duration of DM (Table 2). However, there was no significant difference of observation between Type 1 and Type 2 DM (data not shown).

Patients of Both Type 1 and Type 2 DM Showed association between age and duration of DM with TFBUT

TFBUT positivity (beak-up time less than 10 seconds) was observed in similar fraction of patients with both Type 1 and Type 2 DM (37.5%, 15/40 and 38.33%, 23/60 respectively). For both Type 1 and Type 2 DM patients, increasing age and duration of DM were significantly associated with presence of dry eye syndrome as determined by TFBUT positivity (Table 2). Similar results were observed in both Type 1 and Type 2 DM.

Rose Bengal Dye Staining, followed by Van Bijsterveld Scoring Indicated Significant Association with age and Duration of Symptoms

Dry eye syndrome was detected in 25% (10/40) and 23.33% (14/60) patients with Type 1 and Type 2 DM respectively through Rose Bengal staining, followed by Van Bijsterveld scoring (positive score ≥ 3.5) (Table 1). Positive patients showed significant trend with both enhancing age and duration of DM (Table 2) with no significant statistical difference between the two groups (data not shown).

Parameters	Type 1 DM (%)	Type 2 DM (%)
	N= 40	N= 60
Gender		
Male	23 (57.5)	28 (46.67)
Female	17 (42.5)	32 (53.33)
Age (years)		
30- 39	8 (20)	5 (8.33)
40- 49	25 (62.5)	3 (5)
50- 59	5 (12.5)	27 (45)
60- 69	2 (5)	25 (41.66)
Average age ± S.D.	43.3 ± 6.53	55.4 ± 74
Duration (years)		
10- 14	30 (75)	36 (60)
15- 19	5 (12.5)	14 (23.33)
20- 24	2 (5)	8 (13.33)
25- 30	3 (7.5)	2 (3.33)
Average duration ± S.D.	12.83 ± 4.16	14.6 ± 4.64
Schirmer 1 test		
+ve	13 (32.5)	21 (35)
-ve	27 (67.5)	39 (65)
Schirmer 2 test		
+ve	8 (20)	13 (21.67)
-ve	32 (80)	47 (78.33)
TFBUT		
+ve	15 (37.5)	23 (38.33)
-ve	25 (62.5)	37 (61.67)
Van Bijsterveld score		
+ve	10 (25)	14 (23.33)
-ve	30 (75)	46 (76.67)

Table 1. Demography of the Patients

		Dry Eye Syndrome Test							
	Variables	**Schirmer Test 1** N= 21	**P Value**	**Schirmer Test 2** N= 13	**P Value**	**TFBUT** N= 23	**P Value**	**Van Bijsterveld Score** n= 14	**P Value**
Type 1 DM	**Gender**								
	Male	6 (26.09)	**0.02**	4 (17.39)	0.7	7 (30.43)	0.33	5 (21.74)	**0.71**
	Female	7 (41.18)		4 (23.53)		8 (47.06)		5 (29.41)	
	Age (years)								
	30- 39	0 (0)	**0.004**	0 (0)	**0.004**	0 (0)	**0.001**	0 (0)	**0.001**
	40- 49	8 (32)		4 (16)		9 (36)		5 (20)	
	50- 59	3 (66)		2 (40)		4 (80)		3 (60)	
	60- 69	2 (100))		2 (100)		2 (100)		2 (100)	
	Duration (years)								
	10- 14	7 (22.58)	0.17	4 (12.9)	**0.03**	7 (22.58)	**0.01**	6 (19.35)	**0.04**
	15- 19	2 (40)		1 (20)		4 (80)		0 (0)	
	20- 24	2 (100)		1 (50)		2 (100)		2 (100)	
	25- 30	2 (100)		2 (100)		2 (100)		2 (100)	

		Dry Eye Syndrome Test							
	Variables	**Schirmer Test 1** N= 21	**P Value**	**Schirmer Test 2** N= 13	**P Value**	**TFBUT** N= 23	**P Value**	**Van Bijsterveld Score** N= 14	**P Value**
Type 2 DM	**Gender**								
	Male	8 (28.57)	**0.05**	6 (21.43)	1.0	9 (32.14)	**0.43**	7 (25)	**0.52**
	Female	13 (40.63)		7 (21.87)		14 (43.75)		7 (21.88)	
	Age (years)								
	30- 39	0 (0)	**0.005**	0 (0)	**0.01**	0 (0)	**< 0.001**	0 (0)	**0.007**
	40- 49	0 (0)		0 (0)		0 (0)		0 (0)	

	50- 59	7 (25.93)		3 (11.11)		7 (25.93)		3 (11.11)	
	60- 69	14 (56)		10 (40)		16 (64)		11 (44)	
	Duration (Years)								
	10- 14	9 (25)	**0.01**	3 (8.33)	**< 0.001**	10 (27.78)	**0.02**	4 (11.11)	**0.05**
	15- 19	5 (35.71)		4 (28.57)		9 (42.86)		4 (28.57)	
	20- 24	5 (62.5)		4 (50)		5 (62.5)		1 (50)	
	25- 30	2 (100)		2 (100)		2 (100)		2 (100)	

Table 2. Assessment of Dry Eye Syndrome in Patients with Type 1 vs. Type 2 Diabetes Mellitus using Different Techniques

DISCUSSION

The derogatory effects of DM are undebated, including its pervasive effects on ocular dysfunctions including dry eye syndrome. Several studies in human and mouse models of diabetes associate the prevalence of dry eye syndrome in both Type 1 and Type 2 DM among all age groups.[16,23-26] However, to the best of our knowledge, no study till date has tried to compare the prevalence of dry eye syndrome between patients of Type 1 and Type 2 diabetes, especially with focus on the Eastern-Indian population.

The age window for patients with Type 1 and Type 2 DM observed in our studies was similar to that reported by others.[27,28] Assessment of dry eye syndrome using standard diagnostic tests such as Schirmer 1, Schirmer 2 tests, TFBUT and Rose Bengal staining showed frequencies of dry eye syndrome in Type 1 and Type 2 diabetic patients that were concordant with other researchers.[29,30] However, some studies showed difference in frequencies.[31,32] probably accounting for regional variations or difference in detection methods. Similar significant increase in dry eye syndrome with progressing age and duration of Type 1 and Type 2 DM as observed by us was also reported by others.[29,30,33] However, other researchers failed to show any such correlation.[34]

There was no significant difference between dry eye syndrome prevalence between patients having Type 1 and Type 2 diabetes. This could be due to the low number of samples assessed, low prevalence of dry eye syndrome in the population studied or other confounding factors. However, further studies in larger, cross-sectional cohorts are warranted to determine the explicit correlation between Type 1 and Type 2 DM with dry eye syndrome and also to understand whether any similarity of difference in frequencies exist between the two types.

Summary

The prevalence of dry eye was seen more in female patients than male and also with increasing age. Increasing prevalence of all those tests related to dry eyes was seen with increasing duration of both type 1 and type 2 diabetes, although the associations were not statistically significant. This could be due to the low number of samples assessed, low prevalence of dry eye syndrome in the population studied or other confounding factors. However, further studies in larger, cross-sectional cohorts are warranted to determine the explicit correlation between Type 1 and Type 2 DM with dry eye syndrome and also to understand whether any similarity of difference in frequencies exist between the two types.

A number of data suggest that the prevalence of dry eye predominantly occurs in type 2 DM, but data on frequency of dry eye syndrome in patients with Type 1 DM is almost absent, probably reflecting its lower incidence. Therefore, lack of conclusive comparative data between both categories sheds light on the clinical importance of the present study.

CONCLUSION

We can say that apart from the sight threatening retinal complications, both Type I and Type 2 Diabetes mellitus, irrespective of age and sex, may cause severe form of dry eye and the sequel of which may result in serious ocular morbidity. Thus, it is mandatory to do frequent followups of the patients suffering from diabetes to diagnose and to treat them for Dry eye.

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