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Prevalence and Severity of Dry Eye in Type 2 Diabetes Mellitus Patients

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Abstract

Purpose: This current study was done to find out the prevalence and severity of dry eyes in patients of type 2 diabetes and also to study the association of dry eyes with the stages of diabetic retinopathy.

Methods: This is a hospital based prospective cross sectional observational study involving 382 patients attending the ophthalmology OPD and in-patient department at R L Jalappa Hospital attached to Sri Devaraj Urs Medical college, Tamaka, Kolar from December 2017 to May 2019.

Results: In the present study majority of the patients (58.6%) were males. Most of the patients (30.8%) were aged more than 66 years with 46% of patients had duration of diabetes for more than five years The results of the present study showed 35.3% prevalence of dry eye syndrome among patients with type 2 diabetes mellitus. Among 135 patients with dry eye 79.2% had dry eye severity of grade 1 or 2 who were classified according to DEWS I criteria.

Conclusion: Dry eye syndrome in patient with type 2 diabetes mellitus was significantly associated with increasing age and longer duration. Also there was significant association of diabetic retinopathy noted with dry eye disease severity.

Keywords: Diabetes mellitus; Dry eye disease; Diabetic retinopathy; Schirmer's test; Tear film break up time; Dry Eye Workshop 1(DEWS 1).

Introduction

Diabetes mellitus (DM) is the most common metabolic disease worldwide and its hallmark is hyperglycaemia. According to estimates of the World Health Organization, the number of people worldwide living with DM is estimated to be 422 million by the year 2014. Changes in dietary habits, obesity and physical inactivity are responsible for spreading this epidemic into the developing countries.

Diabetes is often associated with several significant ocular conditions, such as diabetic retinopathy (DR), refractive changes, cataracts, nerve palsies, glaucoma and macular edema. However, one of the most common ocular complications associated with diabetes is dry eye. With the rising incidence of diabetes mellitus, these ocular diseases will be an ever greater worldwide health issue in the near future than it is already today.

DM has been identified as one of the leading systemic risk factors for dry eye syndrome (DES). DES causes discomforts like burning, foreign body sensation, visual disturbance due to tear film instability and corneal scaring with potential damage to the ocular surface like corneal and conjunctival epithelial alterations, persistent epithelial defects, accompanied by increased osmolality of tear film and inflammation of the ocular surface.[1]

It had been suggested that one or more of the following initial events may lead to the alterations in the tear film and ocular surface of diabetic patients: a) chronic hyperglycemia, b) corneal nerve damage and c) impairment of insulin action.

Ocular surface examination is often ignored and much importance is given to retinopathy. There have also been discrepancies in the prevalence reported in the literature, due to a lack of consensus about appropriate diagnostic criteria and differences in the parameters and research methodology applied.[2]

Hence the present study will aim to evaluate the clinical aspects of dry eye syndrome in type 2 diabetes mellitus and also the relationship with possible associated risk factors.

Objectives

1. To determine the prevalence of dry eye syndrome in type 2 diabetes mellitus patients.
2. To document the severity of Dry eye among type 2 diabetes mellitus patients.
3. To compare dry eye characteristics with diabetic retinopathy stages.

Methods

This is a cross sectional observational study conducted in the department of ophthalmology, R L Jalappa hospital and research center attached to Sri Devraj Urs medical college, Kolar, from December 2017 to May 2019 After obtaining clearance from Institutional Ethics Committee.

A total of 382 patients diagnosed with type 2 diabetes mellitus were included in this study.

Study Design: Cross sectional observational study.

Inclusion Critera

Type 2 diabetic mellitus patients.

Exclusion Criteria

Patients

1. Who has undergone ocular surgery in the past.
2. Who wear contact lens.
3. On any drugs known to produce dry eye, Topical (Betaxolol, Olapatidine, Naphazoline, Miotics or Mydriatics , Ketorolac) or Systemic (Beta blockers, anti-histaminics, Anti-psychotics).
4. With any other ocular disorder known to produce dry eye (Lid abnormalities, Vitamin A deficiency, Post Steven Johnsons, Vernal keratoconjuctivitis, Post ocular chemical burns).
5. With associated systemic diseases associated other than diabetes mellitus (RA, SLE, Thyroid disorders).

Method of Collection of Data

A. Demographic details, duration of diabetes and visual acuity by Snellen's chart will be recorded, followed by assessment of diabetic status by fasting blood sugar (FBS), post prandial blood sugar (PPBS), glycated hemoglobin (Hb1Ac).

B. The presenting symptoms of dry eyes was obtained through a five item dry eye questionnaire (DEQ 5) of ocular symptoms relating to dry eye.[4]

C. Tear film assessment will be done and classified according to Dry Eye Workshop (DEWS) severity grading scheme. Conjunctival and corneal staining is done by flourescein stain and Shirmer's test is done using Whatman filter paper strip.

D. Diabetic retinopathy was determined through fundus examination and graded clinically using the "Early Treatment of Diabetic Retinopathy Study"(ETDRS) classification for diabetic retinopathy. (Table 1)

- Grade 0: No apparent retinopathy.
- Grade 1: Mild non-proliferative retinopathy (NPDR) –few micro aneurysms.
- Grade 2: Moderate NPDR –micro aneurysms, intra-retinal hemorrhages or venous beading.
- Grade 3: Severe NPDR – based on the 4:2:1 rule of the ETDRS, hemorrhages in all 4 quadrants, venous beading in two quadrants or intraretinal microvascular abnormalities (IRMA) in one quadrant.
- Grade 4: Proliferative diabetic retinopathy (PDR) – characterized by neovascularization of the disc or elsewhere.
- Grade 5 : Advanced diabetic eye disease-characterized by proliferative changes with dense haemorrhage, tractional retinal detachment or rubeosis iridis.

Following this, diagnostic tests namely, Meibomian gland dysfuntion grading, Schirmer's test, tear film break up time, rose Bengal test and Flouresein staining were done to rule out the diagnosis of dryeye.

Results

In our study 22 number of patients were aged between 35–45, 79 patients were between 46 to 55 years, 163 patients were between 56 to 65, 94 patients were between 66 to 75, 21 patients were between 76 to 85 and 3 patients were aged more than 86 years. In our study 58% that is 224 number patients were males and the rest 158 number of patients were females.

In our study group maximum of patients 214 were having diabetes less than 5 years, 101 patients were having diabetes since 6–10 years, 46 patients were having diabetes since 11–15 years, 13 patients were having diabetes since 16–20 years, 3 patients were having diabetes since 21 to 25 years and the rest 5 patients were having since more than 26 years.

Dry eye symptoms were assessed using the dry eye questionnaire 5. According to which patients score of 6 or more were considered as having dry eye disease. In our study of 382 patients 128 patients scored 6 or more and these patients were considered as having dry eye disease according to DEQ-5.

In our study most of the patients had visual acquity of 6/6 (69% in right eye and 69.1% in left eye) that is 0.0 according to logMAR charting of vision, 87 and 83 patients had vision 0.1 to 0.4, 17 and 23 had 0.5 to 0.8, 12 and 12 had 0.9 or above vision in right eye and left eye respectively according log MAR visual acuity charting.

In our study population 40.3% of patients had diabetic retinopathy changes in one or both the eyes. Among these 69 had mild NPDR, 47 had moderate NPDR, 21 had severe NPDR, 15 had PDR and 3 had advanced diabetic changes in right eye. Similarly in the left eye these 71 had mild NPDR , 44 had moderate NPDR, 19 had severe NPDR, 15 had PDR and 5 had advanced diabetic changes.(Table 2)

According to NEI guidlance of a score of 3 or more for corneal staining with Fluorescein stain was taken as positive for dry eye. In this study of 382 patients 104 had significant staining patterns with Fluorescein stain. In this study of 382 patients 91 had significant staining patterns with Rose Bengal stain. In our study population 32.7% that is 125 patients had meibomium gland dysfunction In our study population out of 382 patients with type 2 diabetes mellitus 135 patients had dry eye disease having a prevalence of 35.3%. (Table 3)

Out of these 135 patients with dry eye 45(33.%) patients had grade 1 dry eye disease, 62(45.8%) had grade 2 dry eye disease, 25(18.5%) had grade 3 disease and 3(2.2%) had grade 4 disease who were classified according Dry Eye Workshop 1(DEWS I) staging system. Of the 135 patients diagnosed with dry eye 41.4% were females and 58.6% were males. 135 patients diagnosed with dry eye 36 patients were having grade 2 dry in age group of 56–65. Also severe forms of dry was seen in patients aged more than 66 years of age. So there was significant association of age with severity of dye eye was noted.

Of the 135 patients diagnosed with dry eye there was linear relationship noted between duration of the disease and the severity of dry eye. 11 and 3 patients having diabetes for more than 15 years were having grade 3 and 4 dry eye respectively. There was significant association of dry eye severity with the duration of diabetes. (Table 7)

In this study out of the 45 patients with grade 1 dry eye 27 had no diabetic retinopathy changes and rest 18 had mild to moderate NPDR changes in their left eye. In 62 patients with grade 2 dry eye 6 had no changes, 50 had NPDR changes, 5 had PDR changes and 1 patient had advanced diabetic changes in left eye. Out of 16 patients with grade 3 dry eye 14 had NPDR changes, 9 had PDR changes and 2 had advanced diabetic changes in left eye. The rest 3 patients who had grade 4 dry eye had PDR changes in 1 patient and advanced diabetic changes in 2 patients. The diabetic retinopathy stage and dry eye severity in left eye showed statistical significance with chi square value of 366.8 and P value less than 0.001.(Table 4,6)

In this study out of the 45 patients with grade 1 dry eye 26 had no diabetic retinopathy changes and rest 19 had mild to moderate NPDR changes in their right eye. In 62 patients with grade 2 dry eye 7 had no changes, 48 had NPDR changes, 6 had PDR changes and 1 patient had advanced diabetic changes in right eye. Out of 16 patients with grade 3 dry eye 17 had NPDR changes and 8 had PDR changes in right eye.(Table 5) The rest 3 patients who had grade 4 dry eye had PDR changes in 1 patient and advanced diabetic changes in 2 patients. The diabetic retinopathy stage and dry eye severity in right eye showed statistical significance with chi square value of 346.3 and P value less than 0.001.

Table 1: Dry Eye Severity Grading Scheme.

Dry eye severity level	1	2	3	4
Discomfort, severity and frequency	Mild and/or episodic occurs under environment stress	Moderate episodic or chronic, stress or no stress	Severe frequent or constant without stress	Severe and/or disabling and constant
Visual symptoms	None or episodic mild fatigue	Annoying and/ or activity limiting episodic	Annoying, chronic and/ or limiting activity	Constant and/or possibly disabling
Conjunctival injection	None to mild	None to mild	+/-	+/++
Conjunctival staining	None to mild	Variable	Moderate to marked	Marked
Corneal staining	None to mild	Variable	Marked/central	Severe punctuate erosions
Corneal /tear signs	None to mild	Mild debris	Filamentary keratitis, mucus clumping	Filamentary keratitis, mucus clumping, ulcerations
Lid/meibomian gland	MGD variably present	MGD variably present	Frequent	Trichiasis, kertinization, symblepharon.
Tear break-up time (TBUT)	Variable	<10 seconds	<5 seconds	Immediate
Schimmer score	Variable	<10mm/5min	<5mm/5min	<2mm/5min

Table 2: Diabetic Retinopathy grading.

Diabetic Retinopathy grading	Right		Left	
	Frequency	Percent	Frequency	Percent
No Diabetic retinopathy	227	59.4	228	59.7
Mild NPDR	69	18.1	71	18.6
Moderate NPDR	47	12.3	44	11.5
Severe NPDR	21	5.5	19	5.0
PDR	15	3.9	15	3.9
Advanced diabetic eye	3	.8	5	1.3
Total	382	100.0	382	100.0

Table 3: Schirmers test.

Schirmers test in seconds	Frequency	Percent
0–5	25	6.5
6–10	57	14.9
11–15	27	7.1
16 and above	273	71.5
Total	382	100.0

Table 4: TBUT test.

TBUT test in seconds	Frequency	Percent
0–5	26	6.8
6–10	59	15.4
11–15	16	4.2
16–20	75	19.6
20 and above	206	53.9
Total	382	100.0

Table 5: Dry eye grading.

Dry eye grading	Frequency	Percent
Grade 0	247	64.7
Grade 1	45	11.8
Grade 2	62	16.2
Grade 3	25	6.5
Grade 4	3	0.8
Total	382	100.0

Table 6: Dry eye severity association with retinopathy in the left eye.

Dry eye severity		DR in left eye					
		0	1	2	3	4	5
DED	Grade 0	195	40	11	1	0	0
	Grade 1	27	12	6	0	0	0
	Grade 2	6	19	20	11	5	1
	Grade 3	0	0	7	7	9	2
	Grade 4	0	0	0	0	1	2
Total		228	71	44	19	15	5

Table 7: Dry eye severity association with retinopathy in right eye.

Dry eye severity		DR in right eye					
		0	1	2	3	4	5
DED	Grade 0	194	38	14	1	0	0
	Grade 1	26	13	6	0	0	0
	Grade 2	7	18	19	11	6	1
	Grade 3	0	0	8	9	8	0
	Grade 4	0	0	0	0	1	2
Total		227	69	47	21	15	3

Discussion

In this study majority were males 58%, the youngest patient being 38 years and oldest is 90 with most of them 42.7% aged more than 56 to 65 years and about 29% were aged more than 66 years. The duration of diabetes was mostly less than 5 years in 56% of patients, with 26% patients having 6–10 years and 4% had diabetes for more 16 years. Of these patients 40.3% had diabetic retinopathy which was classified according to ETDRS classification. Majority of the patients had mild to moderate non proliferative diabetic retinopathy changes while 5 patients had advanced diabetic retinopathy in one or both eyes who were having diabetes for more than 10 years.

In the present study dry eye was diagnosed based on validated DEQ-5 questionnaire, schirmers test, tear beakup time , meibomium gland disease , corneal and conjunctival staining by fluorescein and Rose Bengal respectively. In our study population dry eye prevalence was 35.3%, 135 patients had some grade of dry eye which was according to prevalence reported in other studies on diabetic patients.

Seifart et al[5] reported a prevalence of 57% in type 1 diabetics and 70% in type 2 diabetics, Study by Manviet et al[7] reported prevalence of 54.3%, Nepp et al[6] reported prevalence of 43%, Maruthi et al of 35%. So it can be noted that the dry eye prevalence varies from 14% to 70% in different studies though these were higher numbers when compared to dry eye prevalence in general population. This disparity may due variation in study group selected or questionnaires used for symptoms assessment which are not universal. Further there is deficiency of proper guidlance of different dry eye diagnostic criteria employed and different cut-off values for the objective dry eye tests .Various age related changes in lacrimal system occur, including tear chemistry of the tear film. Certain aspects of tear physiology change with age, such as reflex secretion by the lacrimal gland, tear volume, and tear film stability, whereas others remain more or less unchanged, such as basal tear production. The reflex secretion of tears, as measured by Schirmer's I method (without anaesthesia), decreases significantly with increasing age as already was observed by Schirmer in 1903 and by many others thereafter. The tear evaporation rate has not been found to be correlated with age. The evaporation is primarily controlled by the lipid layer of the tear film and lipid layer thickness appears to be constant for different age groups.[8] In this study 46.66% patients with dry eye syndrome had age between 56 to 65 years and 33.33% were aged more than 66 years suggesting statistically significant association of increased age as a risk factor for dry eye syndrome. In a cohort study on 3722 subjects were aged 48 to 91 years (65 ± 10 years) and 43% male. The overall prevalence of dry eye was 14.4%. Prevalence varied from 8.4% in subjects younger than 60 years to 19.0% in those older than 80 years.[9] The higher incidence of dry eyes in this age group could be partly attributed to ageing. In the present study population 90% of the patients with duration of diabetes for more than 15 years, 73.9% of patients of duration 11 to 15 years, 55.4% of duration 6 to 10 years and 12.1% of duration less than 5 year had dry eye syndrome. As the duration of the diabetes increased prevalence of dry eye increased and was found to be statistically significant. In a study[7] from Iran prevalence of dry eye syndrome was significantly higher in patients with longer duration of diabetes. In type II diabetic patients, most of the long term complications of diabetes are well known to correlate with duration, dry eyes could also be a part of this. The reason for this being the slow microangiopathy and neuropathy of the diabetic disease process causing lacrimal gland dysfunction and reduced corneal sensitivity. In this study the diabetic retinopathy stage and dry eye severity showed statistical significance with chi square value of 366.8 and P value less than 0.001. Of the 3 cases of advanced diabetic eye one had grade 2 and two had grade 4 dry eye. Earlier study by Saito et al,[10] reported decrease in corneal sensation, but not that in tear secretion, was correlated with the stage of diabetic retinopathy. However, study by Nepp and associates[6] showed correlation between the severity of retinopathy with the severity of dry eyes. Further studies needs to be done to clarify association between these two. In a study[7] from Iran there was significant association between sex and grades of DR. Lower grades of DR was more common in women and higher grades of DR was more common in men, such a relation was found in another study by Rema et al.

Conclusion

In our study the prevalence of dye eye disease among type 2 diabetes mellitus patients was 35.3%. Among these patients with dry eye 79.2% had dry eye severity of grade 1 or 2 according to DEWS I criteria classification.

Dry eye disease in type 2 diabetes mellitus patients

was significantly associated with the diabetic retinopathy changes in our study population with severe forms of dry eye being present in patients having proliferative retinopathy and advanced diabetic eye disease.

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