Original Research Article

The prevalence of dry eye and diabetic retinopathy in diabetes mellitus and comparing with duration and urea, creatinine level

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Abstract

Currently, an estimated 347 million people in the world have diabetes, making it one of the most common non-communicable medical conditions worldwide. India, considered as the "diabetes capital" of the world, is home to 74 million diabetics with a prevalence of ~8.7% among the adult population. Ocular manifestations of diabetes and its complications are well known over year's. In recent years, attention has been drawn to ocular surface disorders, especially dry eye in diabetic patients. Our purpose was to correlate the dry eye and diabetic retinopathy with duration of diabetes and blood urea and serum creatinine level. Ours was a hospital based cross sectional study done from August 2013 to July 2014. Thorough fundus examination was done using indirect ophthalmoscopy, tear film and ocular surface were evaluated using Schirmer test and tear film break-up time (TBUT) and renal parameters analysed in our hospital lab. Out of 150 patients studied 61.3% of patients had diabetes of 1 to 5 years duration. 35.3% of diabetic patients had dry eye symptoms. 75% of them had poor glycemic control. 72 of them had some degrees of diabetic retinopathy with altered renal parameters. P value of the above correlation was significant. Dry eye is the most common problem encountered in patients with diabetes mellitus. Hence, all the diabetic patients should be evaluated and screened at the earliest for retinopathy changes and presence of ocular surface disorders and treated accordingly. Early treatment would prevent complications associated with ocular surface disorders and diabetic retinopathy. They should be emphasized upon on need for regular follow up and maintaining a good glycemic control.

Key Word: diabetes mellitus, dry eye, diabetic retinopathy

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INTRODUCTION

Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia associated with disturbances of carbohydrate, protein and fat metabolism due to absolute or relative deficiency in insulin action and or secretion. Diabetes is the leading cause of blindness in twenty to seventy four year age group[1]. Exact etiology of diabetic retinopathy is not known. It is believed that exposure to hyperglycemia over an extended period results in specific changes in retinal capillaries such as loss of pericytes and thickening of the basement membrane resulting in occlusion of capillaries and non-perfusion of retina and decompensation in retinal barrier function. The prevalence of diabetic retinopathy increases with the duration of diabetes and age of the patient. Dry eye is the most common problem encountered in patients with diabetes mellitus[3]. The exact mechanism for cause of dry eye in diabetes is not known[2]. Autonomic dysfunction plays a role in causing dry eye. Aldose reductase enzyme which converts glucose to sorbitol also plays a role[4]. Jin *et al* found that diabetes mellitus type 2 patients are prone to develop dysfunction of tear film. Cousen *et al* studied

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production of tears and sensation of cornea in diabetes. In addition to dry eye, tear film instability, metaplasia of conjunctiva, decreased goblet cells, decreased sensation of cornea and decreased tear film lipid layer are encountered in diabetes[5].Chronic hyperglycemia impairs inflammatory process and invasion of lids by bacteria leads on to blepharitis in diabetes patients[6]. This is cause for evaporative dry eye. The etio-pathological factors for dry eye in diabetic patients includes autonomic neuropathy, chronic hyperglycemia, insulin deficiency and chronic inflammation. Autonomic neuropathy is the key result of hyperglycemia in diabetes[7].Nerve signal pathways are damaged in autonomic neuropathy. Microvascular abnormalities and high blood sugar damage the corneal nerves and block the nerve feedback mechanism that controls secretion of tears. So lacrimal gland does not secrete tears[7]. Benetis-Del-Castillo *et al* studied relation between innervation of cornea with confocal microscopy and corneal sensations using noncontact esthesiometry in dry eye patients with diabetes[8]. Dogru stated that diabetes mellitus patients with autonomic neuropathy and uncontrolled diabetes patients exhibit abnormal Schirmer and TBUT test[9]. In diabetic patients, Schirmer test exhibits lower than normal values[10]. 55% of patients with diabetes had dry eyes symptoms and signs[11]. The Beaver Dam eye study suggested that twenty percent of diabetes mellitus patients aged between forty three and eighty six years diagnosed to have dry eyes[12]. Kaiserman and associates have told that good control of blood sugar is important for the control and prevention of dry eye syndrome among diabetic patients. Nepp and associates stated that severity of dry eye correlates with diabetic retinopathy severity[13]. In diabetes goblet cell density is reduced in patients with neuropathy[14].Schultz *et al* reported forty seven to sixty four percentage of diabetic patients having corneal abnormalities as epithelial defects, delayed healing of epithelium, corneal ulcer and kerato conjunctivitis sicca[15]. Increased duration influence the occurrence of DR and its severity was due to prolonged exposure to hyperglycemia. Duration of diabetes is an independent risk factor. Ten percent of the newly diagnosed diabetes shows DR, suggesting that these patients were not diagnosed earlier. The duration of diabetes is an important predictor of DR and its severity[16].

AIMS AND OBJECTIVES

To correlate the dry eye and diabetic retinopathy with duration of diabetes and blood urea and serum creatinine level and to evaluate the risk factors attributed to dry eye and diabetic retinopathy in diabetes mellitus patients and also to study the prevalence of dry eye and diabetic retinopathy in diabetes mellitus patients.

MATERIALS AND METHODS

It is a hospital based cross sectional study. This study was done in the period between August 2013 to July 2014. The study was done on all diabetic patients attending ophthalmology outpatient clinic. Before commencing the study Ethics committee approval was obtained from the Coimbatore medical college and government hospital. Diabetic patients attending outpatient clinic were screened for dry eye and diabetic retinopathy after obtaining consent. Detailed history was obtained including name, age, sex, presenting symptoms, duration and associated systemic disease and type of diabetes. The blood investigations such as fasting and post prandial blood sugar, urea, creatinine level were done. All patients of either sex in all age groups diagnosed to have diabetes mellitus of any duration were included. Patients with known ocular surface disorder, contact lenses usage, history of ocular surgeries in past and patients on local or systemic medications which cause dry eye are excluded. Detailed ophthalmic examination was done including best corrected visual acuity using Snellen chart and anterior segment examination using slit lamp. Symptoms of the dry eye such as redness, burning sensation, grittiness were evaluated using the questionnaire given to the patients. Condition of lid, meibomian gland and corneal surface were noted. Tear film evaluation was done by Schirmer test and tear film break up time**.** Intra ocular pressure measurement done using applanation tonometer. Detailed fundus examination was done and Diabetic retinopathy graded according to ETDRS criteria.

OBSERVATION AND RESULTS

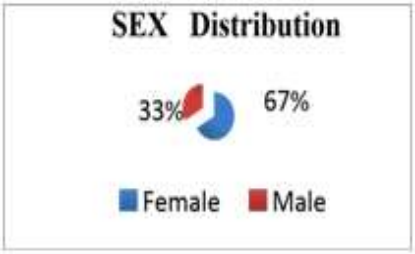

Figure 1: Sex Distribution

Among 150 patients studied, 100 patients were females and 50 patients were males.

Table 1: Duration Range

Duration	Frequency	Percent
Less than 1 year	6	4.0
1 to 5 years	92	61.3
6 to 10 years	38	25.3
11 to 20 years	14	9.3

Table 1 shows, patients diagnosed with diabetes less than 1 year duration were 4 %. Majority of population were between 1 to 5 years duration i.e., 61.3 %

Table 2: prevalence of dry eye symptoms

Dry eye Symptoms	No of patients	Percent
Absent	97	64.7
Present	53	35.3
Total	150	100.0

Table 2 shows 64.7% had no dry eye symptoms. 35.3% had dry eye symptoms.

Table 3 A and 3 B: fasting and post prandial blood sugar range

FBS(3A)	Frequency	Percent
FBS < 110	38	25.3
FBS >110	112	74.7
Total	150	100.0

PPBS (3B)	Frequency	Percent
Up to 160	37	24.7
Above 160	113	75.3
Total	150	100.0

Table 3A shows 25.3% of patients had FBS less than 110mg/dl. 74.7% had FBS more than 110mg/dl. Table 3B shows 37 patients had PPBS less than 160 mg/dl. 113 patients had PPBS more than 160 mg/dl.

Table 4A and 4B: Blood Urea And Serum Creatinine Rang

Urea(4A)	Frequency	Percent
Upto 40	127	84.7
>40	23	15.3
Total	150	100.0

Creatinine(4B)	Frequency	Percent
Upto 1	133	88.7
> 1	17	11.3
Total	150	100.0

Table 4A shows 127 patients had urea level less than 40 mg /dl. 23 patients had urea level more than 40 mg. Table 4B shows 133 patients had Creatinine level less than 1 mg/dl.17 patients had Creatinine more than 1 mg/dl.

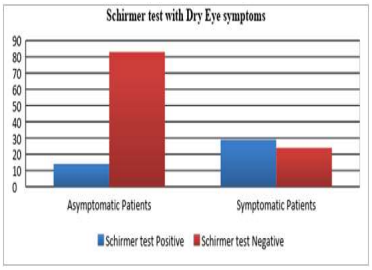

Figure 2: Schirmer Test

Among 150 patients, 43 patients were Schirmer test positive. 107 patients were negative for Schirmer test. Figure 2 shows Among 53 symptom positive patients, 29 of them Schirmer test positive and 24 of them Schirmer test negative.

Table 5: Schirmer Test and Duration Of Diabetes

Schirmer test	Less than 1 year	1 to 5 years	6 to 10 years	11 to 20 years
Positive	0	10	22	11
negative	6	82	16	3

Table 5 shows among 43 Schirmer test positive patients, 10 patients had 1 to 5 years of diabetes. 22 of them were 6 to 10 years of diabetes. 11 of them were 10 to 20 years of diabetes. The P value of above comparison was significant.

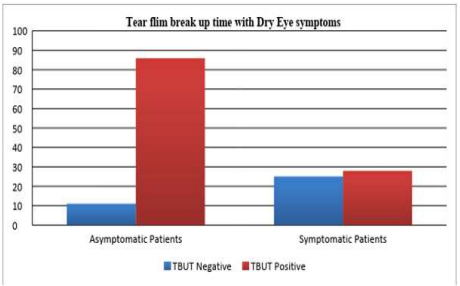

Figure 3: Tear Film Breakup Time

Among 53 dry eye symptom positive patients, Only 25 of them were TBUT positive in symptomatic patients. 28 of them TBUT test negative. The p value of the below chart is < 0.01.

Table 6: Tbut And Duration Of Diabetes Mellitus

Duration	Less than 1 year	1 to 5 years	6 to 10 years	11 to 20 years
positive	0	5	20	11
negative	6	87	18	3

Table 6 shows among 36 TBUT test positive patients, 5 of them were in 1 to 5 years duration of diabetes,20 of the were in 6 to 10 years duration and 11 of them were in 11 to 20 years duration of diabetes

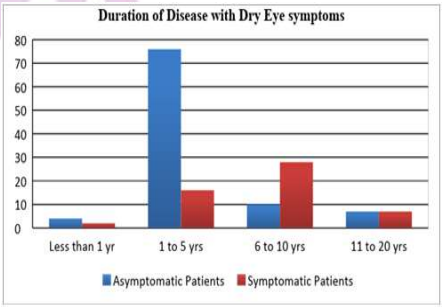

Figure 4: Duration Range and Dry Eye

Among 53 dry eye symptom positive patients.2 of them had diabetes of less than 1 year duration,.16 of them of 1 to 5 years duration, 28 of them of 5 to 10 years duration and 7 of them of 10 to 20 years duration. The p value of the above chart is < 0.01which is highly significant.

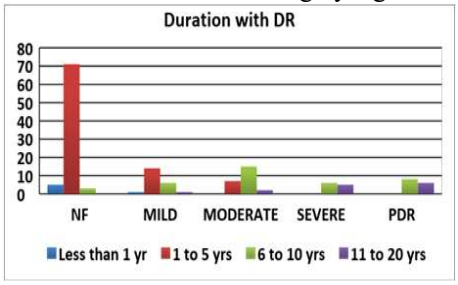

Figure 5: Duration Range And DR

92 patients were in 1 to 5 years duration. Among 92 patients,71 of them had normal fundus, 14 of them mild NPDR and 7 of them had moderate NPDR. The p value of the above chart is significant

Table 7: Schirmer Test And Dr

Schirmers Test	Normal Fundus	Mild NPDR	Moderate NPDR	Severe NPDR	PDR
Positive	3	8	14	7	11
Negative	76	14	10	4	3

The p value of the above table is <0.01, significant. 43 patients are Schirmers test positive. Among 43 patients 3 of them normal fundus, 8 of them mild NPDR, 14 of them moderate NPDR, 7 of them severe NPDR, 11 of them had PDR.

Table 8: Tbut And Dr

Tbut	Normal Fundus	Mild NPDR	Moderate NPDR	Severe NPDR	PDR
Positive	0	4	12	7	13
Negative	79	18	12	4	1

The p value of above table is <0.01 which is significant. 36patients were TBUT positive. Among 36 patients ,4 patients had mild NPDR, 12 patients had moderate NPDR, 7 patients had severe NPDR and 13 of them had PDR

Table 9: Fbs Range With Dr

FBS	Normal Fundus	Mild NPDR	Moderate NPDR	Severe NPDR	PDR
Upto 110	29	3	4	0	2
Above 110	50	19	20	11	12

The p value of the above table is <0.01, significant.112patients had FBS more than 110 mg/dl. Among 112 patients 50 of them had normal fundus , 19 of them had mild NPDR, 20 of them had moderate NPDR, 11 of them had severe NPDR and 12 0f them had PDR

Table 10: Ppbs Range With Dr

PPBS	NORMAL FUNDUS	MILD NPDR	MODERATE NPDR	SEVERE NPDR	PDR
upto 160	33	1	2	1	0
above 160	46	21	22	10	14

The p value of the above table is <0.01, significant.113 patients had PPBS more than 160 mg/dl.46 of them had normal fundus, 21 of them had mild NPDR, 22 of them moderate NPDR, 10 of them had severe NPDR and 14 of them had PD

Table 11: Dry Eye and Sex Predilection

dry eye symptoms	female	male
Negative	58	39
Positive	42	11

The p value of table no. 11 is <0.01, significant. Among 53 symptomatic patients 42 were females.

DISCUSSION

In this study 150 patients with type 2 diabetes mellitus were examined for dry eye and diabetic retinopathy manifestations and above manifestations are correlated with age, duration, control of diabetes and urea, creatinine level. Among 150 patients ,100 patients were females and 50 were males. 61.3% of patients diabetes of between 1 to 5 years duration.35.3% of diabetic patients had dry eye symptoms. Our study showed that 75% of them were not in good glycemic control. Binder A *et al* study showed that 55% of patients with diabetes had dry eye signs and symptoms at least at some of the time. Among 53 symptomatic patients, 29 were Schirmer test positive and 24 of them were Schirmer negative. 14 of the asymptomatic patients showed Schirmer test positive. Schirmer test is useful screening test for diagnosing hyposecretion, but not for an adequate determination of tear production. Its sensitivity is between 10% and 30%. Among symptom positive patients (53), TBUT is positive in 25 patients. The p value of above comparison is significant. Mannavit published prevalence of dry eye in diabetic patients utilising either Schirmers test or TBUT. In our study 42 females are dry eye symptom positive and only 11 males are symptom positive. p value is significant. Prevalence of dry eye is higher among advancing age, female sex, poor glycemic control, patients with diabetic retinopathy and high urea, creatinine level. In our study higher grades of diabetic retinopathy is associated with higher incidence of dry eye symptoms and the p value of the test is significant. Among 150 patients,23 patients had urea level more than 40 mg/dl. In 23 patients only 2 of them had normal fundus. 1 patient had mild NPDR. 7 of them had moderate NPDR. 5 of them had severe NPDR. 8 of them had PDR.P value of the above test is significant. With regard to serum Creatinine level, 17 of them had more than 1mg/dl. Only one patient had normal fundus. Remaining patients with elevated creatinine level had some degree of DR. p value of the above correlation is significant. 38 patients among 150 patients had fasting blood sugar less than 110mg/dl. Remaining patients(112) had more than 110 mg/dl. 50 patients had normal fundus in more than 110 FBS group. 72 of them had some degrees of diabetic retinopathy, Microvascular complications develop in nearly all patients with type 1 diabetes and in more than 77% of those with type 2 diabetes who survives for over 20 years with the disease. Vision threatening retinopathy is rare in type 1 diabetes in the first 3 to 5 years of diabetes or before puberty. After 2 decades nearly all patients with type 1 DM develop retinopathy. 21% of type 2 diabetes patients have retinopathy at the time of first diagnosis of diabetes. UKPDS demonstrated that improved blood glucose control reduced the risk of developing retinopathy, nephropathy and possibly reducing neuropathy. Moss and associates also reported a high incidence of dry eye

among females 16 .7% compared to males 11.4%, but in our study p value of gender correlation with diabetic retinopathy is not significant.

CONCLUSION

Dry eyes are more prevalent in diabetic individuals. The ocular surface disease in diabetic individuals was confirmed by Schirmer test and tear film breakup time. Early detection of dry eye and diabetic retinopathy prevents vision threatening complications like formation of corneal opacity, diabetic macular edema, tractional retinal detachment and vitreous haemorrhage. Dry eye syndrome is a definite entity, that occurs in diabetic patients, more so, when the duration of diabetes is longer, poor glycemic control, high urea, creatinine level are associated with DR, irrespective of severity. Hence it is mandatory to look for ocular surface abnormality in diabetic patients, as it can interfere with vision further. Schirmer test and TBUT test are easy to perform and easily available. They can be routinely done in all diabetic patients, in order to diagnose dry eye in early stage, so that prompt treatment can be initiated. As dry eye symptoms and DR have a correlation, it is important to rule out DR in symptomatic dry eye patients and vice versa. Since poor glycemic control and elevated urea, Creatinine levels have been associated with increased incidence of dry eye, it is important to look for the same, even in asymptomatic patients with altered biochemical parameters. Apart from ophthalmoscopy, Schirmer test and TBUT should be compulsorily done in all diabetic patients.

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