Tear Film Break Up Time in Non Insulin Dependent (Type 2) Diabetes Mellitus Patients

Dr.Swapnagandha Sudhir Halikar	Dr. Saurabh Chaudhari
Associate professor, Smt.Kashibai Navale Medical College, Narhe, Pune-411041	PG student (2nd year) , Smt.Kashibai Navale Medical College, Narhe, Pune-411041

ABSTRACT *Background: The tear film of diabetic patients has been reported to be unstable. Number of tests are available for investigation of dry eye but Tear film Break up time is an easier and effective test to diagnose dry eye. Purpose of this study is to measure TBUT in patients with diabetes for early diagnosis of dry eye.*

Methods: We studied total of 100 patients including 46 non-insulin dependant diabetic patients and 54 normal patients. Basic demographic data regarding age, gender and occupation of the patients were recorded. From the patients' medical records, the type of diabetes, duration of diabetes, type of medication, blood glucose levels were noted. Tear film breakup time was performed in every patient and readings were noted. Statistical analysis of readings was done.

Result: We enrolled 24 female and 76 males in this study, 46 being diabetic and 54 were non-diabetic controls. The mean duration of diabetes was 8.10±3.6 years. The mean for fasting blood glucose was 143.4±27.6 mg/dl, and for HbA1C was 7.24%±1.09%. We found TBUT was significantly shorter in the diabetic group (8.42 ± 1.41 sec) than in the control group (11.65 ± 1.12 sec) (P < 0.001)

Conclusion: Tear film break up time is significantly reduced in diabetic patients compared to normal patients. Tear film break up time can be used to diagnose dry eye in diabetic patients early.

Introduction:

Diabetes mellitus, particularly type 2 is a major public health concern worldwide. Diabetes mellitus leads to micro vascular complications and altered basement membranes, which are partly responsible for ocular complications. India leads the world with largest number of diabetic subjects earning the dubious distinction of the "diabetes capital of the world". It was estimated to have 31.7 million people having diabetes in the year 2000 which is projected to be 79.4 million by year 2030[1].

Patients with type 2 DM tend to develop tear film dysfunction which is related to severity of diabetic retinopathy. Poor metabolic control and proliferative diabetic retinopathy are the high risk factors for tear film dysfunction.[2] The impact of rapid urbanization, industrialization and rapid lifestyle changes has led to an increasing trend in prevalence of diabetes and its associated complications such as neuropathy, nephropathy, vascular diseases (cardiac, cerebral and peripheral}, retinopathy[3] and dry eye syndrome.

Dry eye, an ocular surface disorder is very common among general population with 28% of the adults having dry eye syndrome[4]. Early diagnosis and timely treatment can avoid complications as secondary microbial infection and corneal ulceration can be avoided[5]. Many patients suffering from diabetes mellitus which is a systemic disease often complain of burning and foreign body sensation which is the symptom of dry eye syndrome.[7] The tear film of diabetic patients has been reported to be unstable[6]. Diabetes mellitus affects eye in many ways such as diabetic retinopathy, neovascular glaucoma, cataract, refractive errors[8] and dry eye syndrome.[7] It is significant feature of diabetes mellitus[9], in which accumulation of sorbitol by the action of aldose reductase on excess glucose contributes to the alteration in epithelium and endothelium and corneal hypoasthaesia[10].

Many patients suffering from diabetes mellitus which is a systemic disease often complain of burning and foreign body sensation which are the symptoms of dry eye syndrome[9]. Number of tests are available for investigation of dry eye but Tear film Break up time is an easier and effective test to diagnose dry eye. Purpose of this study is to measure TBUT in patients with diabetes for early diagnosis of dry eye.

DESIGN
A case control study

INCLUSION CRITERIA
All the patients diagnosed having type 2 diabetes mellitus attending the outdoor patients department of ophthalmology and medicine were included in the study. Approximate sample size of the study was 100 Diabetic and non-diabetic patients (control)

EXCLUSION CRITERIA
Patients with type 1 diabetes mellitus, ocular surface abnormalities, topical medications, contact lens wearers, previous ocular surgeries and secondary ocular and systemic diseases were excluded from the study.

METHODOLOGY
Data collection
Informed written consent was obtained from the patients. The study was performed in accordance with the guidelines of Declaration of Helsinki. Basic demographic data regarding age, gender and occupation of the patients were recorded. From the patients' medical records, the type of diabetes, duration of diabetes, type of medication, blood glucose levels were noted.

EYE EXAMINATION
Detailed eye examination including visual acuity, recording

of intra ocular pressure, slit lamp examination to rule out ocular surface abnormalities and Fundoscopic examination to check the presence of diabetic retinopathy were carried out.

Measurement of the Tear Film break up time is accomplished by moistening a fluorescein strip with a balanced salt solution or similar ocular irrigation solution and lightly touching the strip against the inferior tarsal conjunctiva. The patient is requested to blink several times to distribute the dye through the tear film. The patient stares straight ahead without blinking while the cornea is observed through the biomicroscope using the broad tangential illumination with the cobalt blue filter. The time between a complete blink and the appearance of the first defect in the fluorescein film is measured in seconds. The first defect appears as random dark spot in fluorescein film. In performing the test, the examiner should take care not to use a fluorescein solution with anaesthetic because the anaesthetic can hasten tear break up. The normal tear film break up time is 10 seconds or longer.

A number of variables can influence the tear film break up time. Same procedure was repeated in the other eye in same environmental conditions.

STATISTICAL ANALYSIS

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS, SPSS Inc., Chicago, IL, USA) version 18.0.

Results:

There were no significant differences in age or sex between the diabetic and normal control groups. In the diabetic group (46 patients), the duration of diabetes was more than 10 years in 31 patients (67.3%). After complete examination in medicine department, 10 patients (21.7%) found to be having diabetic neuropathy.

After complete ophthalmological examination of diabetic patients, 13 eyes (14.1%) had no Diabetic Retinopathy, 44 eyes (47.8%) had Non-Proliferative Diabetic Retinopathy, and 35 eyes (38%) had Proliferative Diabetic Retinopathy, range of TBUT in these patients was 8-16 sec, 7-10 sec, 2-6 sec respectively.

The data from 24 female and 76 males were used for the final analysis.

The mean duration of diabetes was 8.10 ± 3.6 years. The mean for fasting blood glucose was 143.4 ± 27.6 mg/dl, and for HbA1C was $7.24\% \pm 1.09\%$.

Among diabetic patients, Oral hypoglycemic drugs (OGLDs) were used by 76.4% of the study subjects, while 23.6% were on insulin.

The TBUT in study groups as follows-
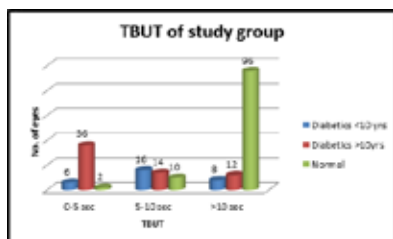
We found tear film break up time is 8.42 sec with standard deviation was 1.41 sec in diabetic group while in non-diabetic control group it was 11.65 sec with standard deviation was 1.12 sec.

We applied Students T test, we got p value which was less than 0.001.

Tear film BUT was significantly shorter in the diabetic group (8.42 ± 1.41 sec) than in the control group (11.65 ± 1.12 sec) (P < 0.001)

We got significant differences between tear film break up time of two groups.

Various differences in tear film break up time is as follows

	Tear film Break Up Time (sec)	
Age (years)	<50	11.21 ± 2.12
	>50	8.98 ± 3.32
Sex	Male	10.07 ± 1.62
	Female	11.63 ± 2.83
Duration of diabetes	<10 years	9.01 ± 1.09
	>10 years	7.92 ± 1.63
Diabetic Neuropathy	Yes	6.89 ± 2.39
	No	11.76 ± 2.17

Discussion:

Several clinical and experimental studies have reported structural, metabolic, and functional abnormalities in the conjunctiva and cornea of diabetic patients and have suggested that these abnormalities may be responsible for the clinical corneal manifestations of diabetes[12-14]. The tear film has also been reported to be unstable[15] and to have a higher osmolarity in diabetes (unpublished data; Aragona P, et al. Invest Ophthalmol Vis Sci 1999;40(Suppl):S542).

Though tear osmolarity is the standard test to diagnose status of tear film, it is not widely available to every place. With the help of just a cheap fluorescein strip, status of tear film can be known with fair acuracy.

Our study is comparable with other studies. Dogru et al[16] reported that TBUT was decreased, especially in diabetes with poor metabolic control and peripheral neuropathy. Nepp et al[17] and Ozemir et al[18] reported that abnormal tear function tests were associated with poorer metabolic glucose control.

Dry eye can be diagnosed with cheap and easily available fluroscein strip by tear film break up time test.

Conclusion:

Tear film break up time is significantly reduced in diabetic patients compared to normal patients. Tear film break up time can be used to diagnose dry eye in diabetic patients early.

Limitations

In the present study, we included only tear film break up time. We did not include other parameters like corneal sensitivity, Schirmer test, conjunctival impression cytology, tear osmolarity.

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