Proportion of dry eye in type II diabetics

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Abstract

Introduction: Diabetes mellitus is a multisystem disorder, which is one of the most prevalent and important non-infectious causes of morbidity and mortality worldwide. While diabetic retinopathy (DR) and diabetic cataracts are well-known complications, dry eye syndrome (DES), also referred to as keratoconjunctivitis sicca, is also common in the diabetic population. If left untreated, severe dry eye may lead to eye inflammation, abrasion of the corneal surface, corneal ulcers, and vision loss. So, it is very important to diagnose it earlier as these devastating complications can be prevented. **Materials and Methods:** A total of 200 adult patients diagnosed with type II diabetes of either sex with an age more than 40 years were selected. Complete ophthalmological examination was done. Dry eye was diagnosed on the basis of various objective tests, and proportion of dry eye and its relation with glycemic control were studied. **Conclusion:** Patients with uncontrolled type II diabetes had a higher proportion of dry eye disease. A significant co-relation was found among the FBS levels, the HbA1c levels, age, duration of disease, and dry eye in patients with diabetes. No significant co-relation was found between the sex of the patient and dry eye in patients with diabetes. Hence, our study recommends that primary care physicians should advise their patients to get clinical evaluation for dry eye done along with diabetic retinopathy in uncontrolled diabetes.

Keywords: Diabetes mellitus, diabetic retinopathy, dry eye, Schirmer's test

Introduction

Diabetes mellitus (DM) has topped the leading health-related catastrophes the world ever witnessed.[1] By 2040, the prevalence of diabetics globally would raise to 642 million.[2] India leads the world in diabetic population and estimated to have 62.4 million people with diabetes.[3] It is predicted that by 2030, in India, DM may affect up to 79.4 million.[4] Diabetic retinopathy (DR) affects more than 93 million people worldwide.[5] However, recently in diabetic patients, ocular surface problems, especially dry eye, have been gaining attention. Various corneal components like the epithelium, endothelium, nerves, and immune cells signify specific systemic complications of diabetes. Just as diabetic retinopathy stands as a marker of more generalized microvascular disease, corneal neuropathy can act as a tool to predict peripheral and autonomic neuropathy and hence gives an opportunity for early treatment. In addition, an inflammatory component of diabetic complications has been recognized as indicated by alterations of immune cells in cornea. Furthermore, it causes both quantitative and qualitative abnormalities in tear secretion, decreased corneal sensitivity, and poor adhesion of regenerating epithelial cells. All these imply a widespread disease of the ocular surface due to diabetes including common diseases like dry eye, recurrent corneal erosions to severe complications like corneal ulcerations, superficial punctate keratopathy, and persistent epithelial defects. Close monitoring of diabetic patients as well as glycemic control is important for the prevention of dry eye syndrome. Early diagnosis of dry eye syndrome in diabetic patients is important for improving the ocular surface and quality of vision.

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Aims and objectives

Our aim was to study the proportion of dry eye in type II diabetes mellitus patients and to find the relation of glycemic control with dry eye in type II diabetic patients.

Materials and Methods

This study was conducted on 200 patients with type II diabetes mellitus visiting the ophthalmology department of a tertiary healthcare center in North India.

Study design

This was a hospital-based cross-sectional observational study.

Ethical considerations

Study protocol was approved by Institutional Ethics Committee. Written informed was taken from all the study participants.

Inclusion Criteria

All patients diagnosed as type II diabetic by a physician of either sex irrespective of duration of diabetes, age, glycemic control, and symptomatic/asymptomatic of dry eye reporting to Department of Ophthalmology were included in the study.

Exclusion criteria

Type I diabetic patients, pregnancy-induced diabetes, associated with other diseases – Sjogren's syndrome, rheumatoid arthritis, Parkinson's disease, patients who underwent ocular surgeries in the past, on medications – anti-histaminic, tricyclic anti-depressants, oral contraceptive pills, steroids, acute and chronic ocular infections, presence of ocular foreign body, trichiasis, entropion, and trachoma were excluded from the study.

Examination

Detailed history regarding diabetes such as duration of diabetes, type of treatment, overall control in the past three months based on sugar levels, HbA1c values, FBS, and PPBS levels were recorded. A detailed history regarding symptoms, occupation, drug intake, local, and systemic associations was taken. Dry eye prevalence and pattern were analyzed by following objective tests.

Slit-lamp biomicroscopic examination of both eyes was done, with stress on examination of tear film, eyelashes, anterior and posterior eyelid margins, lacrimal puncta, conjunctiva, inferior fornix, tarsal conjunctiva, bulbar conjunctiva, and cornea.

Rose Bengal staining

Rose Bengal staining of the conjunctiva was performed by using sterile Rose Bengal paper strip, on the slit lamp using red-free filter to see any staining of conjunctiva or cornea. Grading was done by dividing the ocular surface into three zones: nasal bulbar conjunctiva, cornea, and temporal bulbar conjunctiva, each graded 0-3 (0, none; 3, confluent staining). Scores more than three were considered abnormal and indicative of dry eye.

Schirmer's test I was done using 5 mm × 35 mm Whatman's filter paper #41 without prior instillation of topical anesthetic drops. Schirmer's strip was folded 5 mm from one end and was inserted at the junction of the outer 1/3 and inner 2/3 of lower lid margin. The patients were allowed to blink as necessary. The strip was removed after 5 minutes and amount of wetting was measured from the fold. A reading of less than 10 mm was regarded abnormal and indicative of dry eye.

Schirmer's test II Topical anesthetic was instilled into the conjunctiva and after 5 minutes, the excess fluid was dried with a filter paper. Schirmer's strip was used as in Schirmer 1. A reading of less than 6 mm wetting was regarded as abnormal.

Fluorescein tear film breakup time. Tear film breakup time was measured after instilling fluorescein dye into the inferior conjunctival fornix of patients and allowing blinking several times before stopping. The tear film was examined with a broad beam of cobalt blue light for the appearance of black spots or lines representing areas of dryness. The interval between the last blink and the appearance of first dry spot around the cornea was taken as breakup time. A breakup time of less than 10 seconds was considered abnormal.

Statistical analysis

Data collected were entered into MS Excel and were analyzed statistically. Mean and standard deviation were calculated for continuous variables. Categorical variables were compared using the Chi-square test. P value <0.05 was considered as statistically significant.

Observation and Results

This study was conducted on 200 patients with type II diabetes mellitus visiting the ophthalmology department of a tertiary healthcare center in North India. The occurrence of dry eye in these patients was assessed with the help of various objective and subjective tests. Following observations were made.

Demographic data

All the patients in this study belonged to age group of 40 to 89 years. Youngest patient was 40 years old, and oldest patient was 88 years old. The study included a sample size of 200, which included 123 males and 77 females.

Rose Bengal staining score

Rose Bengal staining score valued 0-3 in 152 cases, 3-6 in 45 cases, and 6-9 in 3 cases for right eye. For left eye, it was valued at 0-3 for 155 patients, 3-6 for 40 patients, and 6-9 for 5 patients. [Figure 1a]

Tear film break-up test was conducted and a value of 0-5 seconds was found in 24 patients (12%) in right eye and 27 patients (13.5%) in left eye. A value of 6-9 seconds was found in 36 patients (18%) in right eye and in 37 patients (18.5%) in left eye. A value of

more than 10 seconds was found in 140 patients (70%) in right eye and 136 patients (68%) in left eye. [Figure 1b]

Schirmer 1 test was conducted on all patients in this study. A value <5 mm was found in 3% of patients in right eye and 4% of patients in left eye. A value of 5-9 mm was found in 15 patients (7.5%) in right eye and 25 patients (12.5%) in left eye. A value of 10-14 mm was found in 35 patients (17.5%) in right eye and in 20 patients (10%) in left eye. Schirmer 1 test value of 15-19 mm was found in 21 patients (10.5%) in right eye and in 29 patients (14.5%) in left eye. A value of 20-24 mm was found in 40 patients (20%) in right eye and in 37 patients (18.5%) in left eye. A value of 25-29 mm was found in 35 patients (17.5%) in right eye and in 47 patients (23.5%) in left eye. A value of 30-35 mm was found in 48 patients (24%) in right eye and in 34 patients (17%) in left eye. [Figure 1c]

Schirmer 2 test was conducted on all the patients in this study. A value of <6 mm was found in 24 patients (12%) in right eye and in 19 (9.5%) patients in left eye. A value of >6 mm was found in 176 patients (88%) in right eye and in 181 patients (90.5%) in left eye. [Figure 1d]

Duration of diabetes and dry eye

A significant association was found between the duration of diabetes and the presence of dry eye. Out of 67 patients with diabetes of less than 5 years, the total patients with dry eye were 5, i.e., 7.46%. In 77 patients with diabetic history of 5-10 years, dry eye was found in 19 patients, i.e., 24.6%. In 40 patients with diabetic history of 10-15 years, dry eye was found in 25 patients, i.e., 62.5%. In 16 cases with diabetes of more than 15 years, dry eye was found in 14 cases, i.e., 87.5%. Out of a total of 200 patients with diabetes, dry eye was found in 63 patients, i.e., 31.5%. *P* value was found to be <0.001 and statistically significant. [Figure 2a]

HbA1c and dry eye

Out of 127 patients with HbA1c value <6.5, only 25 patients (19.7%) were diagnosed with dry eye, and out of 73 patients with HbA1c value >6.5, 38 patients (52%) were diagnosed with dry eye. *P* value was found to be <0.001 and statistically significant. [Figure 2b]

Age and dry eye

Out of 30 patients with age 40-50 years, dry eye was not diagnosed in any patient. Out of 54 patients with age 51-60 years, dry eye was diagnosed in two patients (3.7%). In 92 patients with age group 61-70 years, dry eye was found in 45 patients (48.91%). Out of 21 patients in age group 71-80 years, dry eye was found in 14 patients (66.67%). Out of three patients with age more than 80 years, dry eye was found in 2 patients, i.e., 66.67%. *P* value was found to be <0.001 and statistically significant.[Figure 2c]

FBS and dry eye

Out of 72 patients with FBS 80-110 mg/dl, only eight patients (11%) were diagnosed with dry eye disease. Out of 51 patients with FBS 11-140 mg/dl, 12 patients (23.5%) were diagnosed with dry eye. Out of 48 patients with FBs 141-170 mg/dl, 20 patients (41.6%) were diagnosed with dry eye. Out of 19 patients with FBS 171-200 mg/dl, 14 patients (73.6%) were diagnosed with dry eye. Out of 10 patients with FBS >200 mg/dl, nine patients (90%) were diagnosed with dry eye. Out of total 200 patients in this study, 63 were diagnosed with dry eye, and in these patients, mean FBS was found to be 156.37. In 137 patients with no dry eye disease, mean FBS was found to be 125.47. *P* value was found to be 0.001 and statistically significant. [Figure 2d]

Out of total 123 male patients in this study, 39 patients, i.e., 31.7%, were having dry eye, and out of 77 female patients, 24 patients, i.e., 31.1%, were diagnosed with dry eye disease.
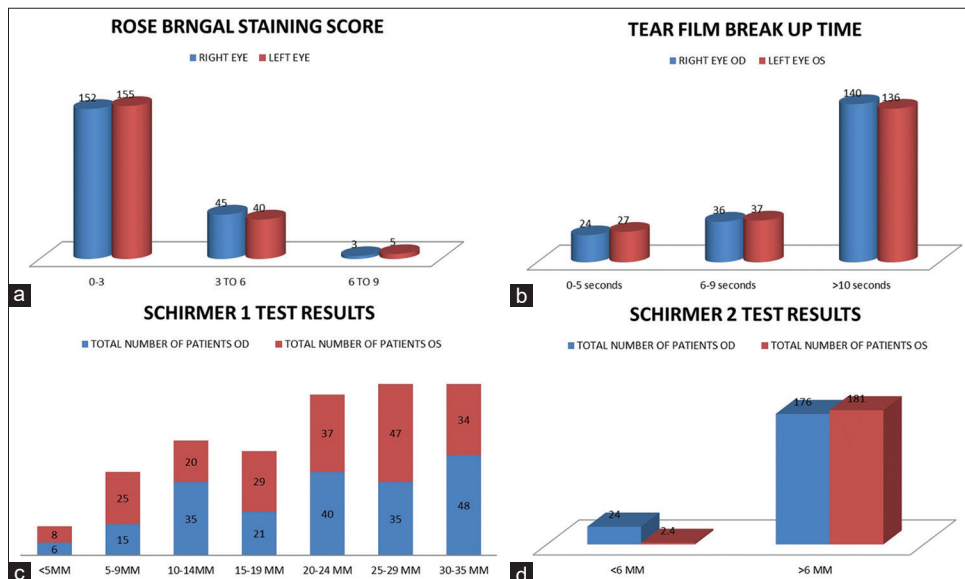

Figure 1: (a) Rose Bengal Staining score (b) Tear film break-up time (c) Schirmer 1 test results (d) Schirmer 2 test results
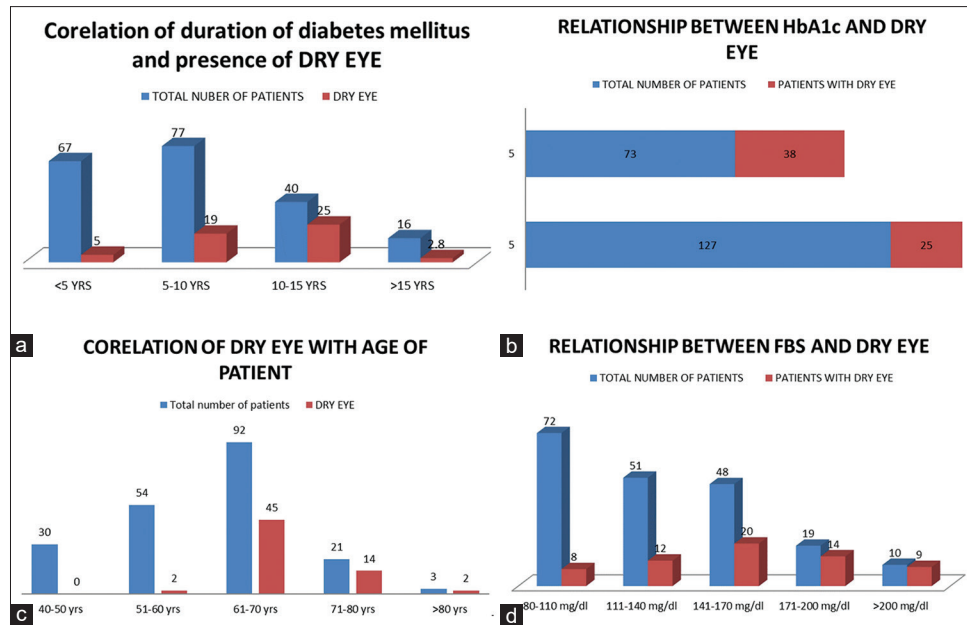
Figure 2: (a) Correlation of duration of diabetes mellitus and presence of dry eye disease (b) Relationship between HbA1c and dry eye (c) Correlation of dry eye with age of patient (d) Relationship between FBS and dry eye

Discussion

Dry eye disease definition and classification in the DEWS II report, the following definition of DED is provided: "A multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles."[6]

Dry eye produces discomfort and reduced vision when the tear film becomes chronically unstable and repeatedly breaks up into dry spots between blinks, exposing the corneal and conjunctival epithelium to evaporation (Parsons, *et al.*, 2007).[7] There are many risk factors of the dry eye disease like old age, female gender, collagen vascular disease, postmenopausal estrogen treatment, refractive surgery of cornea, androgen insufficiency, irradiation, vitamin A deficiency, and medications like antihistamines, selective serotonin reuptake inhibitors, tricyclic anti-depressants, diuretics, beta-blockers, and diabetes mellitus. NICE observed in 2012 that diabetes mellitus (DM) is one of the leading systemic risk factors for DES.

The reported prevalence of DES in diabetics is 15–33% in those over 65 years of age and increases with age and is 50% more common in women than in men.[8] These findings are like the results observed in our study.

Our study found the proportion of DES in diabetics to be 31.5% and increases with age.

Seifart U *et al.* reported that the incidence of dry eye is correlated with the level of glycated hemoglobin. The higher the level of glycated hemoglobin, the higher the incidence of dry eye.[9] Our study also found a similar pattern, and a significant statistical correlation was found between glycated hemoglobin and dry eye disease.

The Beaver Dam Eye Study reported that approximately 20% of dry eyes occurred in individuals with type II diabetes aged between 43 and 86 years. Hom and De Land reported that 53% of patients with either diabetes or borderline diabetes had self-reported, clinically relevant dry eyes.[10]

Manaviat MR. *et al.* found that 54% of patients with diabetes had DES and there was a significant correlation between DES and the duration of diabetes.[11] In our study, a similar finding was observed and 31.5% of patients with diabetes were diagnosed with dry eye and a statistically significant correlation was found between dry eye and duration of diabetes.

Currently, diabetes is identified in eye clinics in an advanced stage, only after visible signs of diabetic retinopathy. Recent ophthalmic research has identified multiple subclinical and clinical changes that occur in the anterior segment of the eye with metabolic diseases. Patients with diabetes have increased Meibomian gland dysfunction, blepharitis, and reduced tear production, resulting in increased rates of dry eye disease and discomfort. Early detection of metabolic disease may allow primary care providers to be more proactive in recommending referral and intervention in order to reduce the risk of blindness and other diabetes-related morbidity. Continued research is needed to better understand the time course of changes to the anterior segment and what can be done to better detect and diagnose patients with diabetes or undiagnosed diabetes and provide improved care for these patients.

Conclusion

Patients with uncontrolled type II diabetes have higher proportion of dry eye disease as compared to the patients with controlled diabetes mellitus in our study. A significant co-relation was found between the FBS levels and dry eye disease in our study. Significant association was noted between dry eye disease and the duration of diabetes. Significant correlation was found between HbA1c levels and dry eye disease in patients with diabetes in our study. A significant co-relation was found between the age and dry eye disease in patients with diabetes in our study. Hence, our study insists that clinical evaluation for dry eye should be an integral part of patients with uncontrolled diabetes.

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Conflicts of interest

There are no conflicts of interest.

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