



A study of correlation between TBUT and HbA1c Levels

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Abstract

Purpose: This study is done to look for the association between tear film break up time, dry eye symptoms and glycated haemoglobin (HbA1c) in patients with type 2 diabetes mellitus (T2DM).

Methods: This cross sectional observational hospital based study was conducted on 101 T2DM patients under treatment at R.L.J. Hospital and Research Centre, Kolar attached to Sri Devaraj Urs Medical College

Results: One hundred and one patients were included in the study, of which 56 (55.4%) were males and 45 (44.6%) were females. Glycosylated haemoglobin of less than 7% was observed in 11(%) patients, 82 patients had values between 7.1% to 8.9% while rest 8 patients had values of more than 9%. Of the 101 patients, 31 patients had tear break up time of 10 seconds or less. Statistical analysis revealed that glycated haemoglobin had a significant correlation with tear break up time (TBUT)

Conclusion: This study signifies the importance of good glycaemic control as a modifiable risk factor for tear film instability in patients with type 2 diabetes mellitus which can lead to dry eye.

Keywords: diabetes mellitus, tear break up time, glycosylated haemoglobin, dry eye

Introduction

Dry eye is a multifactorial disease of the tears and ocular surface, resulting in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface.

The concept of tear deficiency was first proposed in 1903 by Schirmer, who developed the famous Schirmer test, a modified version of which is still in clinical use ^[1]. Keratoconjunctivitis sicca in Sjögren syndrome was proposed by Sjögren in 1933 ^[2]. For many years, dry eye was considered to be an equivalent to keratoconjunctivitis sicca, the aqueous tear deficiency.

Diabetes mellitus can lead to dry eye through a variety of mechanisms ^[3] and studies have reported a high rate of dry eye among patients with diabetes mellitus. Prevalence of dry eye in patients with diabetes, has been reported to range between 27.7% - 54.3% ^[4]. The mechanism of dry eye in diabetes include diabetic neuropathy, metabolic dysfunction, or lacrimal gland dysfunction.

However, while several studies have found correlations between certain diabetic parameters and the risk of developing dry eye, the underlying mechanisms responsible for this is not yet fully understood ^[5]. In particular, the ocular and systemic factors affecting tear stability or short tear break up type of dry eye is not known, which is important in considering that the short tear break up type of dry eye is the most common type of dry eye in Asia ^[6].

Objectives

1. To look for the association between tear film break up time (TBUT), dry eye symptoms and HbA1c in patients with T2DM.

Methods

This retrospective observational hospital based study was conducted on 101 T2DM patients, who underwent treatment at R.L.J. Hospital and Research Centre, Kolar attached to Sri Devaraj Urs Medical College after obtaining clearance from Institutional Ethics Committee. The study period was from February 2020 to March 2020.

Study Design: Retrospective study.

Inclusion criteria

1. Type 2 diabetic mellitus patients with or without hypertension

Exclusion criteria

Patients

1. Who has undergone ocular surgery in the past.
2. Obvious ocular surface abnormalities.
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 keratoconjunctivitis, Post chemical burns).
5. Other systemic diseases associated other than diabetes mellitus (RA, SLE, Thyroid disorders).

Procedure

After obtaining informed consent, all patients fulfilling the inclusion criteria underwent a standardized interview

Regarding their demographic details, past medical history, ocular history, duration of diabetes mellitus, use of insulin and a recent HbA1c report (within one week of recruitment). The patients were then examined under slit lamp biomicroscope for eyelid abnormalities that could interfere with the normal spread of tear film, and any conjunctival disorders like pterygium.

Then the tear break-up time (TBUT) was done by instilling a drop of 2% fluorescein strip wetted with sterile water into the conjunctival sac of each eye. The time interval between the last complete blink and the appearance of a random dark spot on the cornea, under the cobalt blue filter of the slit-lamp was recorded with a stopwatch, and the mean of three timings was noted. A value of 10 seconds or less was considered as abnormal [29].

Results

101 patients were included in the study, of which 56 (55.4%) were males and 45 (44.6%) were females. The age of the patients ranged from 39 years to 80 years, with a mean age of 61.2 ± 9.1 years. The mean age for the males was 63.5 ± 11.3 years, and 58.7 ± 9.4 years for the females. All the patients in the study had type 2 diabetes mellitus and the duration ranging between 1 to 23 years with a mean duration of 7.4 ± 5.6 years.

Glycosylated haemoglobin of less than 7% was observed in 11(%) patients, 82 patients had values between 7.1% to 8.9% while rest 8 patients had values of more than 9%. The mean value for HbA1c was 7.1%.

Of the 101 patients, 31 patients had tear break up time of 10 seconds or less.

Pearson's correlation analysis revealed that glycated haemoglobin ($r = 0.26$ $P = 0.001$) and duration of diabetes ($r = 0.68$ $P = 0.001$) had a significant correlation with tear break up time (TBUT). Figure 1 shows the scatterplot illustrating the relationship between HbA1c and TBUT.

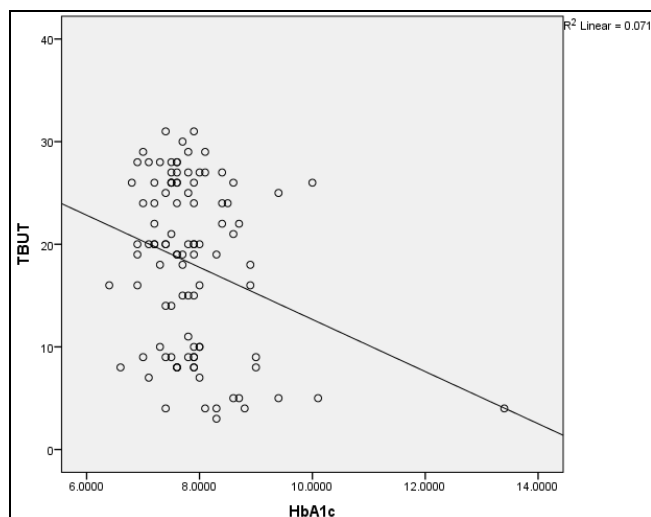


Fig 1

Discussion

Up to 30% of our patients with type 2 diabetes mellitus had tear film instability. This is in contrast to the general population with only 7% suffering from dry eye syndrome, as shown in previous study subjects using similar definitions [7]. More importantly, analysis of the systemic risk factors revealed a significant inverse correlation between serum

HbA1c level and tear break-up time, indicating that poor glycaemic control is independently associated with an unstable tear film, after adjusting for possible confounders. A significant positive correlation was also found between HbA1c and duration of diabetes, illustrating that patients with high HbA1c levels are more likely to experience dry eye symptoms. Collectively, our results suggest that poor glycaemic control is an important contributing factor to tear film instability – a finding that is in accordance with the current understanding of the pathophysiological impact of diabetes on the ocular surface [8]. This highlighted the link between systemic risk factors, dry eye symptoms and ocular tear film metrics. Our findings on the associations of HbA1c with signs and symptoms of DES are in agreement with published studies in other populations [9, 10].

In an ophthalmic specialist outpatient clinic-based study on 40 patients with T2DM, Bal *et al.* observed a significant decrease in TBUT and Schirmer's test values with higher HbA1c levels on univariate analysis, suggesting that poor glycaemic control may result in tear film dysfunction [9]. Moreover, Kaiserman *et al.* found that the frequency of artificial teardrop use in patients with T2DM increases proportionately in correlation to HbA1c level, which reflects the possible role of glycaemic control on disease severity [11]. The association between HbA1c and DES carries important clinical implications. First, while topical lubricating eyedrops remain the cornerstone for dry eye treatment, optimization of glycaemic control should also be an important consideration for achieving symptom relief in patients with T2DM and dry eye [10, 11]. Furthermore, in addition to the current practice of addressing DES only when patients complain of dry eye symptoms, regular ocular assessments for dry eye should be implemented in the routine follow-up appointments in patients with poor glycaemic control.

Conclusion

This study signifies the importance of good glycaemic control as a modifiable risk factor for tear film instability in patients with type 2 diabetes mellitus which can lead to dry eye.

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