



A STUDY ON SEVERITY OF DRY EYES IN PATIENTS WITH DIABETIC FOOT SYNDROME

Ophthalmology

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ABSTRACT

Aim- The aim of the study was to correlate dry eye status with severity of diabetic foot syndrome. **Materials and Methods-** A prospective study was done involving 90 patients aged above 18 years with Type 2 Diabetes Mellitus suffering from various grades of diabetic foot syndrome. A detailed history was taken, and ocular and systemic examination was done. Dry eye status was evaluated with TBUT and Schirmer's test and graded as level 1, 2, 3 and 4 dry eyes according to Dry eyes work up (DEWS) classification. Diabetic foot syndrome was graded according to Wagner's diabetic foot ulcer classification. **Results-** Among diabetic foot syndrome patients 63% had dry eyes; 35.4% had level 1 dry eye, 25.4% had level 2 dry eye, 1.1% had level 3 dry eyes and 1.1% had level 4 dry eyes. Prevalence of dry eyes was significant in grade 3 and grade 4 diabetic foot syndrome (DFS). **Conclusion-** There was statistically significant positive correlation between the severity of dry eye and severity of diabetic foot syndrome. All patients with DFS should be evaluated for dry eye disease (DED) thus prompt treatment can be started in these individuals to prevent potential corneal complications.

KEYWORDS

Dry eyes, diabetic foot syndrome, schirmer test

INTRODUCTION

The Tear Film and Ocular Surface Society Dry Eye Workshop II defines a dry eye as follows: "Dry eye is a multifactorial disease of the ocular surface characterised 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 etiologic roles."⁽¹⁾ Dry eye disease (DED) is divided into two groups: evaporative and aqueous deficient. Diabetic pathology includes changes in microvasculature of the body including nephropathy, neuropathy and retinopathy.^[6] Hyperglycaemia and microvascular damage to the corneal nerves can block the feedback mechanism which controls secretion of tears. The reduced corneal sensitivity favours the occurrence of dry eye disease (DED) by reducing the blink rate, by decreasing the reflex-induced lacrimal secretion and increasing evaporative tear loss. Diabetic foot ulcer and dry eyes are common disabling sequel of diabetes mellitus which can be prevented.

Aim

To study correlation between dry eye status with the severity of diabetic foot syndrome (DFS).

MATERIALS AND METHODS

A prospective study was done involving 90 patients with diabetic foot syndrome attending our outpatient department in a tertiary hospital in a period of 1 year. Cases included were patients above 18 yrs age with type 2 diabetes with diabetic foot ulcer.

Cases excluded were patients who less than 18 yrs, type 1 diabetes, gestational diabetes, Contact lens users, patients who have undergone Pterygium excision, intraocular surgeries, Keratoplasty patients who have undergone refractive surgeries, on medications such as anti-glaucoma medications, patients with known Sjogren's syndrome, Rheumatoid arthritis, Hypothyroidism, lagophthalmos, mucocutaneous disorders, ocular chemical injuries in the past.

Informed written consent was taken from all the patients. Ethical clearance was obtained. A detailed history regarding age, sex, ocular symptoms, and duration of type 2 diabetes mellitus and presence of other diseases was obtained. Detailed ocular and systemic examination were done. Dry eye status was confirmed by TBUT and Schirmer's test and grading was done by DEWS II classification. (Table 1) For TBUT test a fluorescein strip, dampened with saline, is placed in the lower lid fornix. Patients are instructed to blink several times to spread the fluorescein across the cornea. After allowing the patient to refrain from

blinking, the cornea is examined under a blue cobalt filter using a slit lamp. The duration from the last blink to the appearance of the first dry spot on the corneal surface is measured in seconds and less than 10s was considered as positive for dry eyes. This test is conducted for each eye. For Schirmer Test A standard Whatman 41 paper strip is inserted at the 1/3 lateral edge of the lower eyelid without applying topical anesthesia measured in millimeters after 5mins and less than 10mm was considered as dry eyes. This procedure is repeated for each eye.

Diagnosis is established by positivity of one or more of the tests in one eye and / or both eyes and then classified according to Dry eyes Workshop (DEWS II) classification. The eye with the worse grading of any of the above test mentioned was considered for statistical purposes when different grading was seen in each eye in an individual. DFS grading was done by Wagner's diabetic foot ulcer classification. (Table 2)

The data was analysed using SPSS version 16.0. All the data was analysed using descriptive statistics and Chi square test.

RESULTS

In our study mean age was 57.9 ± 6.985 years and mean duration of type 2 DM was 9.12 ± 4.667 years. Out of 90 patients, 68 (75%) were males and 22 (25%) were females. 63% of the patients had DED.

Out of the patients with DED, 35.4% had level 1 dry eye, 25.4% had level 2, 1.1% had level 3 dry eyes and 1.1% had level 4 dry eyes. Amongst the patients with DFS, grade 4 had the highest prevalence of dry eyes followed by grade 3. Amongst Grade 3 DFS, 12.2% (11) had level 1 dry eyes, 8.8% (8) had level 2 dry eyes and 1.1% (1) had level 3 dry eyes. Among grade 4 DFS patients 12.3% (11) had level 1 dry eyes, 11.1% (10) had level 2 and 1.1% (1) had level 4 dry eyes. (Table 1) A significant correlation was noted between severity of diabetic foot syndrome ($p < 0.001$) and level 1 and level 2 dry eyes. Level 3 and 4 did not show any significant correlation. (Table 3) Thus, prevalence of dry eye was found to increase with the increase in the severity of diabetic foot syndrome.

Table 1-Dry Eye Workshop Classification (dews II)

Dry eye severity	Level 1	Level 2	Level 3	Level 4
Discomfort, severity and frequency	Mild and /or	Moderate episodic with stress	Severe and frequent	Severe and disabling
Discomfort, severity and frequency	episodic; environmental stress			
Visual symptoms	None or episodic	Activity limiting	Annoying, chronic	Constant and/or

	mild fatigue	episodes	and/or constant, limiting activity	possibly disabling
Conjunctival injection	None to mild	None to mild	+/-	+/++
Corneal staining (severity/ location)	None to mild	Variable	Marked central	N/A
Corneal/tear signs	None to mild	Mild debris, decreased meniscus	Filamentary keratitis, mucus clumping, tear debris	Filamentary keratitis, mucus clumping, o tear debris, ulceration
Lid/meibomian glands	MGD variably present	MGD variably present	MGD frequent	Trichiasis keratinization,
Tear film break-up time (seconds)	Variable	≤10	≤5	Immediate
Schirmer score (measures tear secretion) (mm/5 minutes)	Variable	≤10	≤5	≤2

Table-2 Wegner's Diabetic Foot Ulcer Classification

GRADE	LESION
Grade 0	Intact skin
Grade 1	Superficial ulcer
Grade 2	Deep ulcer
Grade 3	Ulcer with bone involvement
Grade 4	Forefoot gangrene
Grade 5	Extensive gangrene involving full feet

Table 3-correlation Of Severity Diabetic Foot Syndrome And Level Of Dry Eyes

DRY EYES SEVERITY	DFU GRADING				TOTAL	P value
	GRADE 1	GRADE 2	GRADE 3	GRADE 4		
LEVEL 1	6.6%(6)	4.3%(4)	12.2%(11)	12.3%(11)	35.4%(33)	<0.001
LEVEL 2	2.2%(2)	3.3%(3)	8.8%(8)	11.1%(10)	25.4%(23)	<0.001
LEVEL 3	0	0	1.1%(1)	0	1.1%(1)	0.3
LEVEL 4	0	0	0	1.1%(1)	1.1%(1)	0.3

DISCUSSION

The prevalence of diabetes is growing rapidly with resultant complications assuming epidemic proportions. Our study co-relates with Vishwanathan et al⁽²⁾ in the outcome that majority of diabetic foot syndrome patients were male. In our study 75% (68) of the patients were males. Forbes et al observed prolonged duration of diabetes was associated with increased frequency of complications.⁽³⁾

Peripheral artery disease is an essential factor of foot ulcers in nearly 50% of patients with diabetes among them, atherosclerosis is the main cause of peripheral vascular disease.⁽⁷⁾ It is speculated that it could be result of increased oxidative stress and endothelial damage at later stages of diabetes.⁽⁴⁾ Peripheral neuropathy, a chronic complication of diabetes, is one of the most crucial factors causing diabetic foot ulcers.⁽¹¹⁾

According to Seifart and Stremmel, diabetic patients had an increased rate of dry eye due to decreased corneal sensitivity, neuropathy involving innervations of lacrimal gland and loss of goblet cells.⁽⁵⁾

Presence of dry eyes in diabetic subjects was believed to be due to several factors. Dry eyes can result from either interruption of the tearing reflex pathways or from any process that affects the secretion of the tear film. In diabetes, it is possible that damage to the microvasculature of the lacrimal gland together with autonomic neuropathy contributes to the impairment of the gland.

In our study, grade 3 and 4 diabetic foot syndrome subjects had a significantly higher frequency of dry eye symptoms. A study by Najafi et al⁽⁸⁾ who found a significant correlation between dry eye disease and diabetes mellitus. According to Hom and Deland, 52.9% of patients with either diabetes or borderline diabetes had self-reported clinically

relevant dry eyes.⁽⁹⁾ Manaviat et al. stated that there is a correlation between diabetes and dry eyes.⁽¹⁰⁾ Limited studies have explored the correlation among DFS and DED with the study showing no correlation between the two entities.⁽¹²⁾

Diabetic foot syndrome and dry eyes can be controlled if detected and managed well. As noted in view of association between dry eyes and diabetic foot syndrome better screening protocols and incorporating both conditions will help alleviate them more efficiently.

We can conclude that diabetic foot syndrome patients have significant prevalence of dry eye. Very limited studies have studied effects of diabetic foot syndrome and dry eyes among the south indian population. However, we need a larger cohort and a longer follow up to study effects of dry eyes amongst DFS patients.

CONCLUSION

India is the home to one of the highest numbers of diabetes patients, amongst whom DFS is prevalent due to uncontrolled glycemic levels. This study proves that there exists a significant association between diabetic foot syndrome and dry eye, which increases with the severity of the DFS. Early diagnosis and timely treatment of dry eye and its control can improve the quality of life and prevent potential corneal complications. Close monitoring of diabetic patients and good blood sugar regulation is important for prevention of dry eye. The association of dry eyes with DFU will further compound and deteriorate the quality of life thus it is important for timely evaluation. It mandates interdepartmental co-ordination in detection and efficient management of diabetic foot ulcer and dry eyes.

Conflict of Interest: None.

REFERENCES

- Craig JP, Nichols KK, Akpek EK, Caffery B, Dua HS et al. TFOS DEWS II Definition and Classification Report. *Ocul Surf*. 2017 Jul;15(3):276-283
- Viswanathan V, Madhavan S, Rajasekar S, Chamukuttan S, Ambady R. Urban-rural differences in the prevalence of foot complications in South-Indian diabetic patients. *Diabetes Care*. 2006;29:701-3
- Forbes JM, Cooper ME. Mechanisms of diabetic complications. *Physiol Rev*. 2013;93:137-88
- Kesarwani D, Rizvi SW, Khan AA, Amitava AK, Vasenwala SM, Siddiqui Z. Tear film and ocular surface dysfunction in diabetes mellitus in an Indian population. *Indian J Ophthalmol*. 2017;65:301-304.
- Seifart U, Stremmel I. Trockeneye und Diabetes mellitus. *Ophthalmologe*. 1994;91:235-9.
- Alavi A, Sibbald RG, Mayer D, Goodman L, Botros M, Armstrong DG, et al. Diabetic foot ulcers: Part I. Pathophysiology and prevention. *J Am Acad Dermatol*. 2014;70:1.e1-8
- Dinh TL, Veves A. A review of the mechanisms implicated in the pathogenesis of the diabetic foot. *Int J Low Extrem Wounds*. 2005;4(3):154-159.
- Najafi L, Malek M, Valojerdi AE, et al. Dry eye and its correlation to diabetes microvascular complications in people with type 2 diabetes mellitus. *J Diabetes Complications*. 2013;27(5):459-462.
- Hom M, De Land P. Self-reported dry eyes and diabetic history. *Optometry*. 2006;77(11):554-558.
- Manaviat MR, Rashidi M, Afkhami-Ardekani M, Shoja MR. Prevalence of dry eye syndrome and diabetic retinopathy in type 2 diabetic patients. *BMC Ophthalmol*. 2008;8:10.
- Erdoğan A, Düzgün AP, Erdoğan K, Özkan MB, Coşkun F. Efficacy of Hyperbaric Oxygen Therapy in Diabetic Foot Ulcers Based on Wagner Classification. *J Foot Ankle Surg*. 2018;57(6):1115-1119
- Gülce Gökçöz Özişik, Hasan Basri Çakmak, Murat Kendirci, Osman Dağ. Comparison of Dry Eye Findings in Diabetes Mellitus Patients with and without Diabetic Foot. *Sakarya Med J*. 2023;13(4):499-506