



A CROSS-SECTIONAL STUDY TO DETERMINE THE RELATIONSHIP OF CENTRAL CORNEAL THICKNESS WITH THE SEVERITY OF DIABETIC RETINOPATHY AND HbA1c LEVEL IN DIABETIC PATIENTS

Ophthalmology

Dr. Rubu Yaming	Postgraduate Trainee, Ophthalmology Department, Regional Institute of Medical Sciences, Imphal
Dr. Memota Laishram	Assistant Professor, Ophthalmology Department, Regional Institute of Medical Sciences, Imphal
Dr. Lokeshwari Khundrakpam	Senior Resident, Ophthalmology Department, Regional Institute of Medical Sciences, Imphal
Dr. Preetika Singh	Postgraduate Trainee, Ophthalmology Department, Regional Institute of Medical Sciences, Imphal
Dr. Lakshita Narang	Postgraduate Trainee, Ophthalmology Department, Regional Institute of Medical Sciences, Imphal
Dr. Nameirakpam Mamota*	Associate Professor, Ophthalmology Department, Regional Institute of Medical Sciences, Imphal *Corresponding Author

ABSTRACT

Background- Diabetes mellitus (DM) is a global health problem. Prolonged abnormal glucose metabolism results in alterations in the epithelium, stroma, and endothelium of the cornea. Central corneal thickness is a crucial indicator for the functioning of the corneal endothelium pump. **Objectives:** To determine the relationship of central corneal thickness with severity of diabetic retinopathy and HbA1c level in type2 diabetes mellitus. **Methods:** A cross-sectional study was conducted in 150 T2DM patients. **Results :** The mean age was 60.56 ± 10.07 years. 34.7% are in severe NPDR followed by PDR (22.6%) and mild NPDR (18.7%). The central corneal thickness increased with severity of diabetic retinopathy progresses significantly (p value .046 and .002). Positive correlation between central corneal thickness and Hb1ac above >6.5 units. **Conclusion :** Central cornea thickness significantly increases with severity of diabetic retinopathy. Poor glycaemic control was associated with higher central corneal thickness

KEYWORDS

Central Corneal Thickness, Diabetic Retinopathy, HbA1c

INTRODUCTION

Diabetes mellitus (DM) is a global health problem. At present, there are 537 million diabetic adults in the world and overall prevalence in India stood at 9.3%.^[1] Prolonged abnormal glucose metabolism results in alterations in the epithelium, stroma, and endothelium of the cornea.^[2] Central corneal thickness is a crucial indicator for the functioning of the corneal endothelium pump.^[3] HbA1c levels reflect the average blood glucose level for the past 2-3 months.^[2] Studies in the past have indicated a potential correlation of HbA1c and the severity of Diabetic retinopathy (DR); however, there have been limited studies of a relationship between CCT with HbA1c and different grades of DR.

Objectives

To determine the relationship of central corneal thickness with severity of diabetic retinopathy and HbA1c level in type2 diabetes mellitus.

MATERIALS AND METHOD

This study is a hospital-based Cross-sectional study conducted in the Department of Ophthalmology, Regional Institute of Medical Sciences, Imphal, Manipur for a period of 26 months, i.e. April 2022 to June 2024 on 150 diabetic patients.

Inclusion Criteria

All diagnosed cases of Type 2 diabetes mellitus

Exclusion Criteria

Patients with history of ocular surgery or trauma, corneal pathologies, glaucoma and contact lens user.

All the subjects has undergone comprehensive ophthalmic examinations including refraction, slit lamp bio-microscopy, dilated funduscopy, central corneal thickness measurement and blood investigation including HbA1c and blood sugar (FBS and PPBS).

Data analysis was done using IBM SPSS version 21.0 software (IBM Corp. Armonk. NY, USA). Microsoft word and Microsoft excel were used to generate tables, pie charts.

RESULT

A total of 150 diagnosed cases of type 2 diabetes mellitus were included in the study.

The mean age was 60.56 ± 10.07 years ranges from 40 to 89 years.

Table 1: Distribution of Duration of illness - diabetic Mellitus

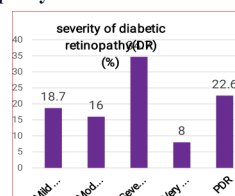
Duration of illness diabetic mellitus	Frequency	Percent	NO DR N (%)	With DR N (%)
Upto 1 year	12	8.0	11 (14.6)	1 (1.3)
>1 to 5 years	47	31.3	26 (34.6)	21 (28.0)
>5 years to 10 years	55	36.7	29 (38.7)	29 (38.7)
>10 years to 15 years	15	10.0	1 (1.3)	14 (18.6)
>15 years	21	14.0	8 (10.6)	10 (13.3)

Table 2: Comparison of Central Corneal Thickness in Relation to Duration of Type 2 DM

Duration of diabetes mellitus	Right eye corneal thickness		P value	Left eye corneal thickness		P value
	Mean	Std. Deviation		Mean	Std. Deviation	
Upto 1 year	563.33	27.586	.673	515.25	61.347	.14
>1 to 5 years	565.51	38.658		561.34	30.711	
>5 years to 10 years	562.05	34.189		563.60	34.677	
>10 years to 15 years	564.47	23.715		560.73	27.822	
>15 years	552.62	20.680		556.81	24.806	

There were invariable findings of central corneal thickness when compared with duration of diabetes.

Table 3: Distribution of Study Participants According to Severity of Diabetes Retinopathy.



In Present Study, 34.7% are in Severe NPDR Followed by PDR (22.6%) and Mild NPDR (18.7%)

Table 4: Comparison Central Corneal Thickness Among Diabetic Patients

Central corneal thickness in μm among diabetic patients	Right Eye		P value	Left Eye		P value
	Non DR (N=75)	With DR (N=75)		Non DR (N=75)	With DR (N=75)	
Mean, SD	549.52 $\pm$ 33.87	574.8 $\pm$ 26.08	.001	543.47 $\pm$ 38.19	572.11 $\pm$ 28.10	.000
Mean difference	25.280			28.640		

There is significant differences observed of central corneal thickness in between the diabetic retinopathy and non-diabetic retinopathy in both eye.

Table 5: Mean Comparison Central Corneal Thickness Among Diabetic Retinopathy Patients.

Corneal thickness in μm among diabetic retinopathy	Eye side		P value	P value	
	Right	Left		Right	Left
Mild NPDR	563.7 $\pm$ 27.0	560.2 $\pm$ 21.0	0.046	0.022	
Moderate NPDR	570.6 $\pm$ 21.1	569.9 $\pm$ 16.8			
Severe NPDR	580.1 $\pm$ 14.8	578.0 $\pm$ 12.2			
Very Severe NPDR	583.0 $\pm$ 32.1	580.4 $\pm$ 52.0			
PDR	587.8 $\pm$ 20.3	601.3 $\pm$ 9.9			

Central corneal thickness increased when severity of diabetic retinopathy progresses significantly.

Table 6: Correlation of Central Corneal Thickness with HbA1c Level

Central corneal thickness in μm	HbA1c level		Mean difference	P value
	<6.5%	$\geq$ 6.5%		
Right eye	551.73 $\pm$ 37.56	567.07 $\pm$ 29.04	- 15.33	.007
Left eye	547.88 $\pm$ 31.05	562.45 $\pm$ 37.88	- 14.57	.022

There is positive correlation and thicker central corneal thickness observed in Hb1ac above >6.5.

DISCUSSION

A total of 150 diagnosed cases of type 2 diabetes mellitus were included in the study. The mean age was 60.56 ± 10.07 years ranges from 40 to 89 years. Majority (36.7%) are having diabetic history of 5-10 years followed by 1-5 years duration (31.3%) and 14% of them chronic sufferer from diabetes. There were invariable findings of central corneal thickness when compared with duration of diabetes. In a study by Inoue K et al^[4] the mean patient age was 65.5 ± 7.5 years (mean $\pm$ standard deviation) (range, 51–78 years) and the mean duration of diabetes mellitus was 9.1 ± 8.2 years like in our study the commoner duration was 5-10 years of duration of illness.

Most studies like present cross-sectional study show that the diabetic eye had an increase central corneal thickness (CCT) (RE- 574 ± 26.08 , LE- 572 ± 28.10) as compared to non-diabetic eyes (RE- 549.52 ± 33 , LE- 543.47 ± 38). This difference was statistically significant. Lee J et al^[5] reported the similar findings that mean CCT of diabetic eyes was significantly thicker than non-diabetic controls in sample size of 81 diabetic and concluded that it is due to increased hydration of cornea and endothelial dysfunction.

Central corneal thickness was significantly increased with the severity of diabetic retinopathy in both eyes. Jha A et al^[6] found that as the grade of diabetic retinopathy worsens, CCT increases. Durukan I et al^[7] concluded invariably that CCT measurements were similar across subgroups in the proliferative DR group, contrary to our study.

Our study finding shows that poor glycaemic control ($\text{HbA1c} > 6.5\%$) were associated thicker mean central corneal thickness (CCT) as compared to those diabetic patients who had $\text{HbA1c} < 6.5\%$ and compared using independent t test. Most of these results have been published in the literature in past but without any uniform consistency. Although, Choo M et al^[8] (2010) showed different conclusion then our study as their study did not show any correlation to the CCT with HbA1c level, and severity of diabetic retinopathy (DR). Other studies drawn similar finding as our study like study by Lee J et al^[5], Su et al^[9] and Wiemer.^[10]

CONCLUSIONS

The findings from this study concluded that the central corneal thickness was found higher in diabetic retinopathy (DR) group as compared to no diabetic retinopathy (DR) group and significant increase in central corneal thickness (CCT) as the severity of diabetic retinopathy progresses. There was positive correlation found between central corneal thickness with Hb1Ac level with significant P-value and statistically insignificant correlation of central corneal thickness with duration of diabetic mellitus.

Therefore, this concludes that measurement of central corneal thickness in diabetic patients may become an important tool to assess the health of cornea and identifying those at high risk of developing further severe complication like diabetic retinopathy (DR), glaucoma, keratoconus, dystrophies, corneal edema.

REFERENCES

- 1) Makkar B, Tanmay S, Deepak M, Singh M.K. Changes in the Central Corneal Thickness in Diabetes Mellitus Patients with age and Gender Matched Healthy Controls in North Indian Population. *Annals of International medical and Dental Research*. 2018 June;4(4):7-9.
- 2) Choudhary SN, Gupta C, Nagar KV. A study of correlation between glycemic control (HbA1C level) and central corneal thickness in diabetic patients. *International J of scientific research*. 2021 feb 1;10(2):41-42.
- 3) Dabas R, Sethi S, Aggarwal R, Lamba Sonika, Bhattacharjee A, Tandon A. Central Corneal Thickness (CCT) in Diabetic Subjects and its Correlation with Disease Duration and Severity. *Annals of International medical and Dental Research*. 2017 july;3(5):04-06.
- 4) Inoue K, Kato S, Inoue Y, Amano S, Oshika T. The corneal endothelium and thickness in type II diabetes mellitus. *Jpn J Ophthalmol*. 2002;46:65–9.
- 5) Lee J, Oum B, Choi H, Lee J, Cho B. Differences in corneal thickness and corneal endothelium related to duration in diabetes. *Eye*. 2006;20:315–8.
- 6) Jha A, Verma, A. & Alagorie, A.R. Association of severity of diabetic retinopathy with corneal endothelial and thickness changes in patients with diabetes mellitus. *Eye*. 2022; 36:1202–1208.
- 7) Durukan I. Corneal endothelial changes in type 2 diabetes mellitus relative to diabetic retinopathy. *Clin Exp Optom*. 2020;103:474–8.
- 8) Choo M, Prakash K, Samsudin A, Soong T, Ramli N, Kadir A. Corneal changes in type II diabetes mellitus in Malaysia. *Int J Ophthalmol*. 2010;3:234–6.
- 9) Su DH, Wong TY, Wong WL, Saw SM, Tan DT, Shen SY, et al. Diabetes, hyperglycemia, and central corneal thickness: the Singapore Malay Eye Study. *Ophthalmology*. 2008;115:964–8.
- 10) Wiemer NG, Dubbelman M, Kostense PJ, Ringens PJ, Polak BC L. The influence of chronic diabetes mellitus on the thickness and the shape of the anterior and posterior surface of the cornea. *Cornea*. 2007;26:1165–70.