

Comparison of Central Corneal Thickness in Type 2 Diabetic Patients Versus Healthy Subjects

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Purpose: To compare the mean central corneal thickness in type II diabetics and non diabetics.

Study Design: Case Control Study.

Place and Duration of Study: Department of Ophthalmology, Unit II, Jinnah Hospital Lahore. The study was carried out over a period of six months from 10-07-2011 to 09-01-2012.

Material and Methods: A total of 120 patients (60 in each group) were included in this study. These patients were divided into two groups A and B. Patients with type II DM were assigned in Group A and age matched controls were assigned in Group B. CCT was measured in both groups using Alcon Ocu Scan RxP Pachymeter and average of 10 consecutive readings from each eye were recorded in micrometers.

Results: Mean age of the patients in group-A was 57.9 ± 10.4 and in group-B was 56.1 ± 11.3 years. In this study, 35 patients (58.3%) and 37 patients (61.7%) were male in group-A and B, respectively. In group-A 25 patients (41.7%) and in group-B 23 patients (38.3%) were females. When comparison was made in terms of central corneal thickness, group-A (diabetics) showed mean CCT $567.53 \pm 15.37 \mu\text{m}$ and group-B (non-diabetics) mean CCT was $532.69 \pm 9.40 \mu\text{m}$. Statistically significant difference was noted between two groups ($P < 0.001$).

Conclusion: It is concluded that diabetic patients exhibit a greater statistically significant average central corneal thickness than non-diabetics.

Key Words: Diabetes mellitus, Central corneal thickness, Pachymetry, Glaucoma.

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Diabetes mellitus is a very common disease worldwide, having a considerable impact on society, not only due to its high prevalence, but also due its complications and high morbidity and mortality related to it¹. It is clinically divided into Insulin Dependent Diabetes Mellitus (IDDM) and Non Insulin Dependent Diabetes Mellitus (NIDDM)². Common pathologies include diabetic retinopathy, maculopathy, cataract, optic neuropathy, paretic muscle disorders and diabetic keratopathy³.

Diabetic keratopathy includes corneal epitheliopathy and corneal endotheliopathy. Corneal endothelial pump dysfunction results in alterations in central corneal thickness (CCT) and endothelial cell morphology⁴.

CCT is an important indicator of corneal endothelial pump function⁵. CCT in an adult eye of caucasian population is $550 \pm 33 \mu\text{m}$ with a range of $472 - 651 \mu\text{m}$ ⁵. In one study, mean CCT of adult Pakistanis was $531 \pm 33.37 \mu\text{m}$ ⁶. DM has been shown to

affect corneal biomechanics, resulting in higher CCT values than those in healthy control subjects⁷. In one study, diabetic corneas were significantly thicker ($P = 0.019$); the mean CCT was $530.3 \pm 35.9 \mu\text{m}$ in the control group and $548.7 \pm 33.0 \mu\text{m}$ in the diabetic group⁸.

CCT is an important parameter in various diagnostic and therapeutic modalities like evaluation of corneal degeneration and dystrophies, glaucoma, ocular hypertension, refractive surgery and contact lens use⁴. There is a strong positive correlation between increased CCT and elevated intraocular pressure (IOP)⁷. Patients with both these findings are sometimes wrongly treated as cases of glaucoma. The literature suggests that diabetics have a tendency to have increased CCT as compared to non diabetics.

Some clinicians prescribe anti-glaucoma medications based on IOP readings. These medications are lifelong with considerable cost implications and side effects, therefore, it is of paramount importance to understand that these raised IOP readings are reflecting thickened corneas and not indicating a glaucomatous process. The rationale of this study is to highlight the importance of CCT measurement in diabetic patients as labeling a patient with glaucoma has significant implications on his life style.

MATERIAL AND METHODS

This was a case control study conducted in Department of Ophthalmology, Unit II, Jinnah Hospital Lahore – A tertiary care hospital. Study was carried out over a period of six months from 10-07-2011 to 09-01-2012. This study included 120 patients divided in 2 equal groups of 60 patients each. Patients were included in this study through non-probability purposive sampling. An informed consent was taken from all the participants of this study. Permission from hospital ethics committee was sought before commencement of this study. Patients with following characteristics were included; age 25 years or more, both genders, type II diabetes mellitus of 2 or more years duration, diagnosed at Jinnah Hospital Lahore with supporting medical record visiting eye department for screening of diabetic retinopathy (known diabetic or FBS > 126 mg/dl), age matched controls visiting eye department with complaints other than mentioned in excluding criteria. The following patients were excluded from the study; History of or ongoing glaucoma, history of previous

corneal (refractive surgery) or intraocular surgery (cataract extraction) and trauma, corneal ectasias (keratoconus, keratoglobus, pellucid degeneration) and past or ongoing corneal/ocular surface disease assessed on eye examination, history of contact lens wear less than 1 month before CCT evaluation, systemic connective tissue diseases i.e. rheumatoid arthritis, systemic lupus erythematosus, polyarteritis nodosa assessed on systemic examination, systemic metabolic disorders i.e. Mucopolysaccharidosis, Wilsons disease, multiple myeloma, cystinosis on systemic examination, high body mass index (BMI) of more than 27%.

Sixty type II diabetic patients and 60 age matched controls meeting the above mentioned criteria were referred from out-patient department (OPD) for pachymetry. These patients were divided into two groups A and B. Patients with type II DM were assigned to Group A and age matched controls assigned to Group B.

CCT was measured after instillation of local anaesthetic in both groups using Alcon Ocu Scan RxP Pachymeter and average of 10 consecutive readings from each eye were recorded in micrometers by the researcher. Also, the mean of the readings were recorded for that patient. Single dose of broad spectrum antibiotic was instilled immediately after the procedure. Information was recorded using a pre-designed proforma.

Data were analyzed by computer software SPSS version 10.0. Quantitative variables like age, CCT and duration of diabetes were presented as mean and standard deviation. Qualitative variables such as gender were presented as percentages and frequencies. Mean CCT of each eye was calculated separately. Comparison of CCT between the two groups was done using t-test. P value (one tailed) of < 0.05 was considered as significant.

RESULTS

Age distribution of the patients is described in Table 1. Mean age of the patients in group-A was 57.9 ± 10.4 and in group – B was 56.1 ± 11.3 years (Table 1). The gender distribution is given in Table 2.

When comparison was made in terms of CCT, group – A (diabetics) showed mean CCT $567.53 \pm 15.37 \mu\text{m}$ and group-B (non-diabetics) mean CCT was $532.69 \pm 9.40 \mu\text{m}$. Statistically significant difference was noted between two groups ($P < 0.001$) (Table 3).

Table 1: Distribution of patients by age (n = 120).

Age (Year)	Group - A (Diabetics)		Group - B (Non-Diabetics)	
	No.	%	No.	%
30 - 50	17	28.3	22	36.7
51 - 70	35	58.3	31	51.7
71 - 85	08	13.4	07	11.6
Total	60	100.0	60	100.0
Mean ± SD	57.9 ± 10.4		56.1 ± 11.3	

Table 2: Distribution of patients by gender (n = 120).

Gender	Group - A (Diabetics)		Group - B (Non-Diabetics)	
	No.	%	No.	%
Male	35	58.3	37	61.7
Female	25	41.7	23	38.3
Total	60	100.0	60	100.0

Table 3: Comparison of central corneal thickness (n = 120).

Group	Mean	Standard Deviation
Group - A (Diabetic)	567.53	15.37
Group - B (Non-Diabetic)	532.69	09.40
t value	14.97	
p value	p < 0.001	

DISCUSSION

Diabetes is a common disease. The current worldwide prevalence is estimated to be approximately 250×10^6 , and it is expected to reach 380×10^6 by 2025^{9,10}. Approximately 13 % of people are effected by diabetes mellitus world wide¹¹.

Occasionally, Diabetes mellitus is diagnosed after its onset and many symptoms may go unnoticed¹². It is

estimated that nearly 50% of diabetics are undiagnosed at the moment¹⁰. Therefore it is imperative that early diagnosis of diabetes is made so that end organ damage can be avoided and morbidity and mortality of this disease is reduced¹.

One of the most common ocular morbidity associated with diabetes is diabetic retinopathy. Other problems associated with diabetes are cataract and glaucoma. It is estimated that diabetic retinopathy is second most common cause of blindness in working age group^{10,12}.

Diabetic keratopathy mostly involves the corneal epithelium and endothelium that may manifest as punctate epithelial erosions and decreased pumping ability of endothelial cells. Clinically, this may manifest as altered corneal transparency and fluctuating vision^{13,14}.

In the current study, mean CCT in diabetic patients was $567.53 \pm 15.37 \mu\text{m}$ while in non-diabetic patients, it was noted to be $532.69 \pm 9.40 \mu\text{m}$. A statistically significant difference between two groups was observed with p value of $p < 0.001$. Similar data has been reported by Herse, Lam and Douthwaite^{15,16}.

It has been implicated that hyperglycaemia is the main reason for altering biomechanics of cornea. That may result in changes in corneal endothelial morphology and thus varying central corneal thickness¹⁷. Sonmez et al suggested that hyperglycaemia is responsible for inducing refractive changes in cornea which have been manifested in altered keratometric readings¹⁸. In another study, it was shown that different stages of hypoxia effected corneal endothelial permeability as well¹⁹. This emphasizes the need of assessing corneal endothelial function before performing intraocular and corneal surgery in patients with long term diabetics²⁰.

It has also been reported that variations in central corneal thickness may be one of the earliest clinical signs in diabetic eye disease²¹. El-Agamy stated long term history of diabetes mellitus is associated with changes in corneal morphology and central corneal thickness²².

CONCLUSION

Thus we conclude from this study that diabetes mellitus is correlated with increasing central corneal thickness. Further studies are needed to assess the relationship of diabetes and its effect on corneal endothelium and its association with corneal

thickness. This may influence our protocols regarding intraocular surgery in diabetics.

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