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COMPARING ENDOTHELIAL CELL COUNT AND CENTRAL CORNEAL THICKNESS IN DIABETICS AND NON-DIABETICS

Ophthalmology

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ABSTRACT

Aim: To compare the endothelial cell density and central corneal thickness in diabetic and non-diabetic patients. **Material and Methods:** A comparative study was conducted in the Department of Ophthalmology at a Tertiary Care Hospital of Central Gujarat for a period of 10 months. A total 388 patients with age greater than 40 years were enrolled; 194 were diabetic(cases) and 194 non-diabetic patients (controls). Ophthalmic examination was done, and the various endothelial cell parameters including the endothelial cell count and central corneal thickness were measured in the central area in both eyes of all patients by non-contact specular microscope. **Results:** A total of 388 patients were divided into four main age groups, which were 40–49, 50–59, 60–69, and greater than 70 years, and then the cell density in various groups was compared in cases and controls. The cell density in the age group 60-69 years in the diabetic population was 2466.626 ± 282.350 cells/mm2 while in the non-diabetic it was 2631.337 ±355.023 cells/mm2. We observed lower density in diabetics, which was statistically significant ($p \leq 0.001$). We also had a greater number of male diabetics in our study population. The mean central corneal thickness was found to be greater in diabetics (511.945 microns ±31.762) than in the non -diabetics (500.180 microns ±38.841) in our study, which too was found to be statistically significant (p value being 0.001). **Conclusion:** The study concluded that the endothelial cell density was lower in diabetic population compared to non-diabetic and the central corneal thickness was higher in diabetic patients compared to non-diabetic patients.

KEYWORDS

Central Corneal Thickness, Coefficient of Variation, Diabetes, Endothelial Cell count, Hexagonal cell

INTRODUCTION:

Diabetes constitutes 49% of world's diabetic burden, with an estimated 72 million cases in 2017, which is expected to almost double to 134 million by 2025 [1]. In India it is the fastest growing disease and affects multiple organs of body including the eye. Diabetic retinopathy is known to occur in diabetes and various studies have been carried out. But, besides diabetic retinopathy, patients with diabetes are prone to develop corneal complications like endothelial damage, recurrent corneal erosions, persistent epithelial defects, and superficial keratitis. [2-5]

Corneal endothelium that consists of a monolayer of polygonal cells, is the innermost layer of cornea and plays an important role in maintaining optical transparency of cornea. A minimal numerical density of 400-500/mm² is required to sustain the pumping activity of the endothelium. [6-9] These cells have limited capacity, to regenerate and are gradually depleted, this situation is exaggerated during the course of certain diseases like diabetes, which also leads to changes in the morphological features of the corneal endothelium.

This study was undertaken to compare the endothelial cell density and central corneal thickness of diabetic patients (cases) with the non-diabetics (controls).

MATERIALS & METHODS :

The study was carried out in the Department of Ophthalmology of a Tertiary Care Hospital of Central Gujarat from December 2017 to November 2018. It was a comparative study with a sample size of total 388 patients comprising of two study groups viz- 194 diabetic patients (cases) and 194 non-diabetic patients (controls). Clearance from the Institute's research and ethical committee was obtained.

All patients aged 40 years and above with diabetes (type1 or type2) of at least 5 years duration, whether on treatment or not were taken as cases; the controls included all patients aged 40 years & above, with FBS <110mg/dl & PP2BS<140mg/dl at presentation. Patients who had previously undergone some intraocular surgery, showed signs of uveitis, had past history of trauma, or were a known case of glaucoma, or had endothelial dystrophies or had pseudo exfoliation syndrome or any corneal pathology were excluded from the study.

After explaining the entire procedure and taking the written informed consent from the patients, they were included in the study. Fasting blood sugar and two hour post prandial blood sugar were checked. Best corrected visual acuity, intraocular pressure measurement with the help of Schiotz, detailed slit lamp examination of both eyes, endothelial cell count & central corneal thickness was measured in the central area in both eyes of all patients by non-contact specular microscope. The parameters recorded were cell density in cells/mm²,CCT or pachymetry in microns, coefficient of variation in %, hexagonal cell in %,number of cells used to calculate the result (N).

Statistical analysis

All the data obtained was entered into excel sheets from which descriptive and inferential analysis was done. After compiling the data, the mean, SD, and CI were calculated. The compiled data was analyzed using the Independent "t" test and parameters were compared between the two populations.

RESULTS:

Gender Distribution

In our study out of 388 patients examined, 220 were males and 168 were females with M:F ratio being 1:30.

Age Distribution

All patients of the age 40 years and above were randomly chosen for the study. Out of the 194 diabetic patients there were 33 patients (17.01%) of 40-49 years of age, as against 40 (20.61%) patients in the non- diabetic population. Maximum proportion of the patients fell in the age group 60-69 years in both diabetic and non - diabetic populations. The least number of patients were found in the age group 70 and above in the non- diabetic population and in the age group 40-49 years in the diabetic population. (Figure 1 - A& B)

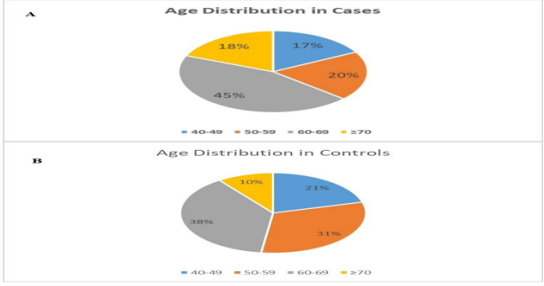

Figure 1 : Age Distribution amongst Cases and Controls

Distribution According To Duration Of Diabetes

Out of 194 diabetic patients 144(74.22%) patients were diabetic for less than 10 years and 50 patients (25.77%) were having diabetes for 10 or more years. (Table-1)

Table 1: Distribution According To Duration Of Diabetes

DURATION OF DIABETES	CASES (n = 194)	
	Number	%
< 10 Years	144	74.22%
10 Years	50	25.77%
Total	194	100%

Distribution Of Endothelial Cell Parameters In Population

In our study the mean cell density of 194 patients with diabetes was found to be 2583.603cells/mm2 (±295.017) and among 194 non diabetic patients, mean cell density was found to be 2665.752 cells/mm² (±310.767). The difference between cell density between the populations (82 cells) was found to be statistically significant with p value 0.007.

The mean corneal thickness in diabetic population was 511.945 microns (±31.762) and the mean for non-diabetic group was 500.180 microns (±38.841). Hence the corneal thickness in diabetics was found to be greater which was statistically significant with p value 0.001.

In our study mean coefficient of variation (CV) in diabetic population was 32.713% (±3.419) and in the non - diabetic population it was found to be 32.443%(±3.574). The difference between the two groups was not found to be statistically significant (p value 0.446).

Our study found the mean hexagonal cell % in diabetic population to be 49.451% (±9.059) and in the non - diabetic population it was 48.340% (±11.705). This difference between the populations was not statistically significant with p value being 0.296.(Table – 2)

Table 2: Distribution Of Endothelial Cell Parameters In Population

	CASES (n=194)			CONTROLS (n=194)			
PARAMETER	MEAN	SD	CI	MEAN	SD	CI	P
CELL DENSITY (cells/mm2)	2583.603	295.017	41.776	2665.752	310.767	44.006	0.007
CENTRAL CORNEAL THICKNESS (micron)	511.945	31.762	4.497	500.180	38.841	5.5001	0.001
COEFFICIENT OF VARIATION (%)	32.713	3.419	0.484	32.443	3.574	0.5061	0.446
% OF HEXAGONAL CELLS	49.451	9.059	1.282	48.340	11.705	1.657	0.296

SD- Standard deviation CI- Confidence interval

Age- Wise Distribution Of Endothelial Cell Parameters In Study Population:

Cell Density-

The total 388 patients in our study were divided into four main age groups, which were 40-49, 50-59, 60-69 and ≥70 years and then the cell density in various groups were compared in cases and controls.

Although each group had a different sample size, the cell density in the age group 60-69 years diabetic population was 2466.626 cells/mm² (±282.350) while in the same age group the mean cell density of nondiabetic population was found to be (2631.337 cells/mm2 ± 355.023) and the difference was statistically significant with a p value 0.001.

Central Corneal Thickness

In a similar manner the central corneal thickness of the population was compared among different age groups in the cases and controls, and it was found that the mean thickness of diabetic patients in the age group 60-69 years was 510.046 (±25.54) while in the same age group non diabetic patients had a mean CCT of 498.108 microns (±42.454), with a p value of 0.029.

The mean value of CCT among diabetics in age group 70 and above was 513.666 microns (±30.757) while in the non - diabetics of the same age group mean CCT was 471.631 microns (±26.954) which showed a statistically higher value in the diabetic compared to non diabetic population with a p value of 0.000006156 which was highly significant.

Coefficient Of Variation (cv)

When the coefficient of variation was compared in different age groups of diabetic with non diabetic population it was found that CV in age group 70 and above was 31.083% (±3.431) compared to mean CV in non - diabetic population being 34.947% (±3.593), which was statistically significant with p value 0.0002. In the other age groups no significant difference was noted.

Percentage Of Hexagonal Cells

When the percentage of hexagonal cells were compared in different age groups of diabetic and non diabetic population there was no statistical difference noted. (Table-3)

Table 3: Age -wise Distribution Of Endothelial Cells Parameters In The Study Population

Age-Group (yrs)	Cases (n=194)				Controls(n=194)			
	CD (Mean + SD)	CCT (Mean + SD)	CV (Mean + SD)	% of Hexago-nal cell (Mean + SD)	CD (Mean + SD)	CCT (Mean +SD)	CV (Mean + SD)	% of Hexagonal cell (Mean + SD)
40-49	2751.72(±285.32)	521.32 (+34.17)	32.13 (±2.35)	50.81 (±5.37)	2699 (±216.02)	500.180(±33.40)	31.55 (±2.96)	48.9 (±8.79)
50-59	2726.55(±196.37)	506.605(±41.51)	33.42 (±1.85)	44.22 (±8.50)	2761.50(±285.84)	507.85(±37.03)	32.52 (±3.27)	48.88 (+13.59)
60-69	2466.62 (±282.38)	510.04 (±25.54)	33.29 (±4.01)	49.36 (±8.87)	2631.337 (±355.02)	498.108(±42.45)	32.216(±3.86)	47.24 (±12.24)
>70	2561.29 (±292.38)	513.66 (±30.75)	31.08 (± 3.43)	53.91 (±10.15)	2422.36(±223. 47)	471.63(±26.92)	34.947(±3.59)	49.68 (±8.25)

DISCUSSION:

The corneal endothelial layer is responsible for the corneal transparency. Diabetes also affects the corneal layer particularly the endothelium. It is essential to note the changes caused by diabetes on endothelial layer in order to prognosticate diabetic patients prior to any intraocular surgery and to monitor endothelial cell count regularly as measure of health of their cornea to avoid further consequences.

In our study sample, the size was 388 patients in total, with 194 cases(diabetics) and 194 controls(non-diabetics). Our study was a comparative study where the mean age of diabetics was 60.025 years, while the mean age of the control population was 56.06 years. The study by Sumit et al. [10] which was a case control study had a sample size of 270 diabetics and 270 non-diabetics , however showed the mean age as 56.57 years for the diabetics and 54.21 years for the non-diabetics, but their sample size was more than that of our study.

The percentage of diabetic males in our study was 63.92%, with females at 36.08%, as compared to their study which had 58.5% males and females at 41.5%. Hence, in both studies there was a preponderance of males in cases as against controls, suggesting that diabetes is more common in males than females.

In our study, we evaluated a total of four parameters, namely cell density, central corneal thickness, coefficient of variation, and % of hexagonal cells in diabetics and non-diabetics. Our study showed that endothelial cell count was lower in diabetics as compared to non-diabetics .The mean cell density amongst our diabetic population was 2583.60 cells / mm2(±295.017) and in non-diabetics it was 2665.752 cells /mm2 (310.767); p value being 0.007 .This finding of our study is in agreement with Sahin et al study[11] and Yicheng et al study[12] who also reported a significantly lower cell density in diabetics ,it was

2491.98 cells/mm2 in diabetics compared to 2629.68 cells/mm2 in control group and 2492.82 cells/mm2 in diabetics and 2628.00 cells/mm2 in controls respectively.

In our study, the mean central corneal thickness in diabetics was high as compared to non-diabetics suggesting that central corneal thickness was higher in diabetics compared to the non-diabetics; while in Sumit et al's study [10] this difference was not found to be statistically significant ; in diabetics they found it to be 541.37 microns and in non-diabetics the same was found to be 539.38 microns. They concluded that the central corneal thickness values in diabetics and non-diabetics were not different, hence disregarding any major effect of diabetics on it, unlike our study which found this to be of statistical significance. In Sahin et al study[11] and also in Yicheng et al study[12], the central corneal thickness was not statistically significant unlike in our study. This could be due to a difference in sample size of the two studies, the sample size in their study being comparatively small consisting of 57 cases and 45 controls as against ours having a sample size of 388. (In Yichen et al study there were 14 diabetics and 20 controls).

CONCLUSION AND SUMMARY:

Diabetes is one of the most common non communicable diseases to affect individuals in the developing nations.

The disease has an adverse effect on multiple organs of the body including the eye.

From observations of our study, we concluded that the mean cell density was significantly lower but the central corneal thickness was higher in diabetic patients compared to the control group.

To summarize the above findings, we found that the mean value of endothelial cell density was lower in the diabetic population compared to the non- diabetic population but the difference was statistically significant (p value 0.001) only in the age group 60-69 years of age.

Strengths And Limitations Of Our Study:
Our study had a fairly large sample size of 388 patients, though they were not age and sex matched.

Conflict Of Interest: None

Financial Support And Sponsorship: Nil

REFERENCES:

1. Report November Indian Council for Medical Research, Institute for Health Metrics and Evaluation, and the Public Health Foundation of India, an advocacy November 2018.
2. Shih KC, Lam KS, Tong L . A systematic review on the impact of diabetes mellitus on the ocular surface. Nutrition and Diabetes 2017;7(3): e251.
3. Thomas N, Jeyaraman K, Asha HS, Velevan J .A practical guide to diabetes mellitus. Jaypee Brothers Medical Pub2012; 2:13-27.
4. Saini JS, Khandalavla B (1995) Corneal epithelial fragility in diabetes mellitus. Canadian Journal of Ophthalmology .1995 Apri1; 30(3): 142-146.
5. Herse PR .A review of manifestations of diabetes mellitus in the anterior eye and cornea. Americal Journal of Optometry and Physiological Optics.1988; 65(3): 224-230.
6. Choo M, Prakash K, Samsudin A, Soong T, Ramli N, et al.Corneal changes in type II diabetes mellitus in Malaysia.2010; Int J Ophthalmol 3: 234-236.
7. Sudhir R, Raman R, Sharma T. Changes in the corneal endothelial cell density and morphology in patients with type 2 diabetes mellitus: a population-based study, Sankara Nethralaya Diabetic Retinopathy and Molecular Genetics Study (SN-DREAMS, Report 23) Cornea. 2012;31(10):1119-1122. [PubMed]
8. Store-Paulsen A, Singh A, Jeppesen H, Norregaard J, Thulesen J. Corneal endothelial morphology and central thickness in patients with type II diabetes mellitus. Acta Ophthalmol. 2013;92(2):158- 160.
9. Browning DJ (2010) Diabetic retinopathy: Evidence-based management. Springer, New York.
10. Sumit, Shashi Ahuja, Chanaveerappa Bammigatti, and Praveen Kumar.Corneal Endothelial Changes in Patients of Type 2 Diabetes Mellitus Using Specular Microscopy. Ecronicon EC Ophthalmology 2017;100-107.
11. Sahin A, Bayer A , Go " khan O"zge et al. Corneal biomechanical changes in diabetes mellitus and their influence on intraocular pressure measurements . Invest ophthalmol VisSci 2009; 50: 4597-4604
12. Yicheng Chen; Susan Huang; Gowtam Jonna; Prabjot Channa. Corneal endothelial cell changes in Diabetes Mellitus , IOVS (Investigative Ophthalmology and Visual Science) 2014; 613-644