Original Article

Study Of Specular Microscopic Findings Of Cornea In Patients With Type2 Diabetes Mellitus – A Hospital Based Study

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Abstract

Background: Corneal evaluation is an important tool in Ophthalmologists daily practice. Hyperglycemia is a metabolic condition that can have damaging effects on almost all body tissues. Ophthalmic complications of hyperglycemia are most notable in the cornea and the retina. Retinal impairment is responsible for the majority of visual impairments in diabetics; however, corneal impairment remains a major vision-hindering pathology. Diabetes mellitus has a significant effect on all layers of corneal. This study is carried out to compare the morphological characteristics of corneal endothelium in type 2 diabetic patients and age-matched healthy subjects by specular microscopy.

Objective: The aim of this study is to compare the corneal endothelial cell density, morphological features, and central corneal thickness in type 2 diabetes mellitus with age-matched, nondiabetic control subjects using noncontact Specular Microscope.

Methodology: A Hospital based, Cross Sectional Study. This includes 50 patients with type 2 DM and 50 control (nondiabetic) subjects. All participants will undergo a complete ophthalmological examination. Corneal endothelial measurements were performed using a noncontact specular microscopy and the findings of all patients will be compared. Data will be analysed using MS Exel - SPSS SOFTWARE version 2.2

Results: Among the 100 study participants 50 were diabetic and 50 were non-diabetic. The mean age among diabetic were 59.60±7.9 and the mean age among non-diabetic study participants were 57.72±6.3. The morphological changes of corneal endothelium is measured by spectral microscopy and found that the that ECD was significantly lower (2646.52 ± 349.63 vs. 2678.67 ± 351.76 cells/m^2; $p = 0.02$).The central cornea was thicker in diabetic group compared to non-diabetic group (61.80 ± 33.10 vs. 542.73 ± 34.20; $p = 0.00$). In diabetic patients the coefficient of variance was significantly increased than non-diabetic group. There is also significant change in percentage of hexagonal cells within both the groups.

Conclusion: Keratopathy is an important complication, in that respect we can suggest it should be evaluated more cautiously in diabetic patients

Introduction:

The prevalence of diabetes mellitus is at an alarming status and considered as a major non-communicable disease worldwide. India is becoming known as the "Diabetic Capital of the World" due to the rising prevalence of diabetes.[1]

India has been estimated to have 69.1 million new cases of diabetes, which is regarded to be the second-highest number of cases behind China, according to the WHO.[2]

Chronic uncontrolled hyperglycaemia leads to damage and dysfunction of several organs, particularly the heart, blood vessels, eyes, kidneys, nerves, and nervous system. One of the major causes of blindness, diabetic retinopathy (DR), affects about 40% of diabetes individuals.[3]

In an adult cornea, the endothelial count (ECC) is typically 2000–2500 cells/mm^2. A minimum of 400–500 cells/mm2 are necessary to keep the endothelium's pumping activity. With the help of an active Na/K ATPase and solute transport the corneal endothelium maintains the corneal transparency. These cells are known to decrease with age at a rate of 0.5% per year.[4]

In addition to diabetic retinopathy (DR), patients with DM also experience corneal endothelial damage. The corneal endothelium experiences ongoing metabolic stress due to chronic hyperglycemia which leads to decreased endothelial cell density (ECD), increased corneal thickness and corneal keratopathy.[5]

The central corneal thickness (CCT) can be used to evaluate corneal edema and healthy endothelial function. Specular microscopy is a non-invasive technique used to access the structure and function of the corneal endothelium using discrete focusing technology.[6]By considering the increasing incidence of type 2 diabetes in India, this study was proposed to compare the morphological characteristics of corneal endothelial cells in type 2 diabetic patients and age-matched healthy subjects by specular microscopy.

Materials and Methods:

Study design: Hospital based Cross- sectional study

Study population: Patients with type 2 diabetes and without diabetes attending OPD in Ophthalmology dept. MMCH&RI, Kanchipuram

Inclusion criteria: Patient diagnosed with type 2 diabetes, patients without diabetes, age > 35 yrs of age.

Exclusion criteria: Patients with past history of other ocular surgeries, use of contact lenses, presence of dry eye disease; history of any ocular pathology.

Sampling size: By convenient sampling 50 patients with type 2 DM and 50 control (nondiabetic) subjects were enrolled in this study.

Study period: August 2021 –August 2022.

Data collection method: After getting informed written consent from the patients, detailed history was recorded regarding age, gender, occupation and presenting symptoms, duration, and past history and about associated systemic and ocular conditions. Patients were allocated to one of two groups (n=50 for each) namely, Group 1 (Type 2 DM), Group II (Non-diabetic). All participants will undergo a complete ophthalmological examination such as visual acquity using Snellen's chart, fundus examination by slit lamp microscopy. Corneal endothelial measurements such as central corneal thickness, endothelial cell count were performed using a non-contact specular microscopy and the findings of all patients will be were recorded in Microsoft Xcel and Statistical analysis was done by using SPSS 23 software. For the comparison of two groups, independent samples t-test and chi-square test were performed.

Results:

A total of 100 cases were divided into 2 groups with 50 cases in each group. Group 1 patients were diagnosed with type 2 diabetes mellitus and Group 2 patients were non- diabetic with normal fasting blood glucose level. In this study

group 1 consists of 27 male, 23 females with type 2 diabetes mellitus In the group 2, consists of 29 male, 21 females healthy cases and the mean age among diabetes were 59.60±7.9 and the mean age among non-diabetic study participants were 57.72±6.3. There was no significant association between groups regarding gender and age with p >0.05 was described in Table 1.

Table 1: Demographic features of study participants

	Group 1 (Diabetic) n=50	**Group 2 (Non- diabetic) n=50**
Gender (M/F)	27/23	29/21
Age	59.60±7.9	57.72±6.3

Table 2: Comparison of corneal endothelial findings among the study groups

Findings	**Group 1 (Diabetic) n=50**	**Group 2 (Non- diabetic) n=50**	**P value**
Endothelial cell density /mm^2	2646.52±349.63	2678.67±351.76	**0.02***
Central Corneal thickness (µm)	561.80±33.10	542.73±34.20	**0.00***
Hexagonal cell ratio (%)	37.19±7.2	34.72±6.16	**0.01***
Co-efficient of variation (%)	52.15±7.8	54.31±9.39	**0.00***

Table 2 represents that ECD was significantly lower (2646.52 ± 349.63 vs. 2678.67 ± 351.76 cells/m^2; $p = 0.02$).The central cornea was thicker in diabetic group compared to non-diabetic group (61.80 ± 33.10 vs. 542.73 ± 34.20; $p = 0.00$).

In diabetic patients the coefficient of variance was significantly increased than non-diabetic group. There is also significant change in percentage of hexagonal cells within both the groups which was described in Figure 1.

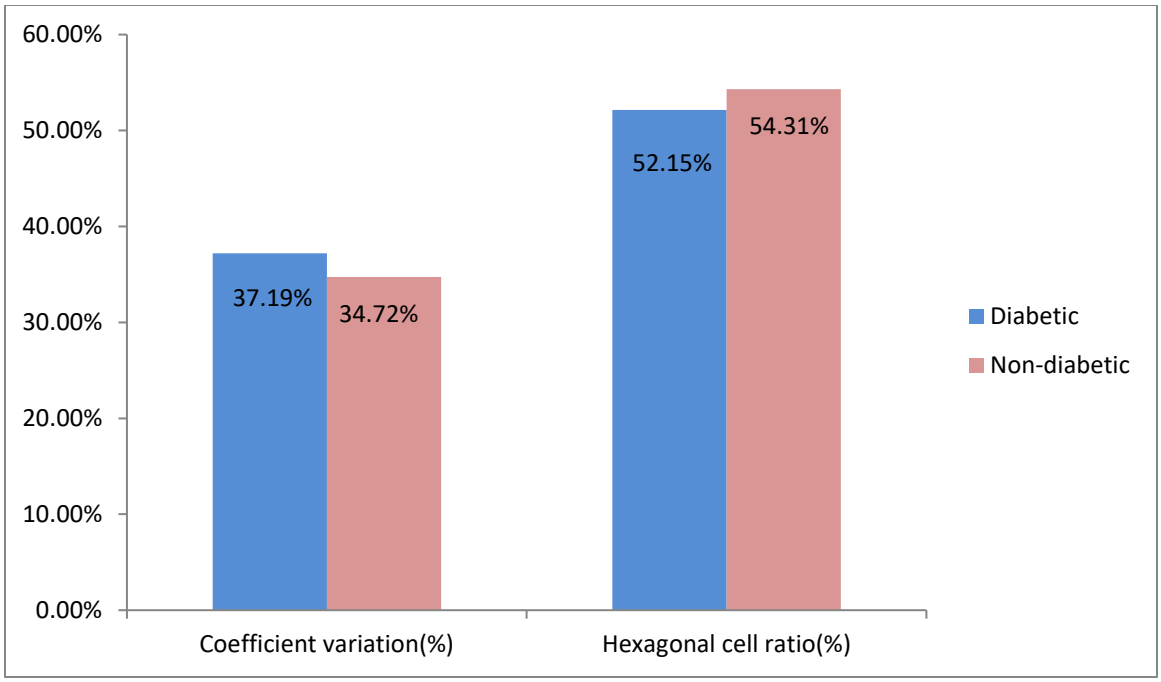

Figure 1: Comparison of Coefficient variation(%) and Hexagonal cell ration among study groups

Discussion:

In most of the diabetes patients cornea may appear as healthy, but because of metabolic stress it undergoes changes in its morphological features which also affects its function later on. In our study report there is change in endothelial cell count, central corneal thickness, coefficient of variance and hexagonal cell ratio which was studied through non-contact spectral microscopy.

This was similar to a study conducted by Inoue et al[7] stated that there is increase in CCT in diabetic patients with significant value P<0.05. He also stated that there is significant decrease in endothelial cells among diabetic patients.

Another study conducted by Choo et al[8] stated that the average size of endothelial cells and coefficient of variation (CV) of cell area were all significantly higher in diabetics. Hexagonality was significantly lower in diabetics (41.1%±19.6%) compared to non-diabetics (45.2%±20.6%) which is similar to our study report.

Several studies like Lee et al, sudhir et al, Storr Paulsen et al[9, 10,] also stated that the diabetic subjects had thicker corneas, less cell density and hexagonality, and more irregular cell size of the corneal endothelium than non- diabetic patients ($P < 0.05$). Central corneal thickness and the coefficient of variation for cell size were significantly higher for diabetes which is similar to our study report.

Similar report is also seen in a meta-analysis done by Zhang et al with 16 cross-sectional studies and 2 case control studies stated that diabetes mellitus could reduce ECD (SMD = − 0.352, 95% CI -0.538, − 0.166) and the hexagonal cell ratio(SMD = − 0.145, 95% CI -0.217, − 0.074), in addition to increasing CV (SMD = 0.195, 95% CI 0.123, 0.268) than non- diabetics.

Another study conducted by Siribunkum et al showed that the diabetic corneas had an increased coefficient of variation of endothelial cell area, a decreased percentage of hexagonal endothelial cell and an increased corneal thickness compared with the non –diabetics but in his study there were not statistically significant which is in contrast to our study report.

Conclusion:

Diabetes mellitus could cause a detrimental effect on corneal endothelium health. Diabetes mellitus contributed to the instability of corneal endothelium during the analysis. Keratopathy is an important complication, in that respect we can suggest it should be evaluated more cautiously in diabetic patients. Therefore, further studies with a large sample size are recommended to verify the extent of corneal damage caused by type 2 DM.

Conflict of interest: None

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Ethical committee approval: This study got approved by the Institutional ethical committee.

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