Study of Corneal Endothelial Cell Count in Diabetes Mellitus Patients

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Abstract: *Title: Study of corneal endothelial cell count in diabetes mellitus patient. Purpose: With advent of specular microscopecorneal endothelial cell count and central corneal thickness can be assessed and early its relation with diabetic age can be ruled out. Materials and methods: This is a cross sectional study carried out on 500 patients (325 diabetics and 175 non-diabetics of age group 50 to 80 yrs, selected by non probability convenient sampling having no significant media opacity like dense cataract, significant corneal cornealopacity, vitreous hemorrhage which prevents visualization of fundus. Detailed history taking, assessment of visual acuity (unaided, best corrected), detailed anterior and posterior segment examination including ECC and CCT by specular microscope was done in all the patients. Result: Clinically incidence of decrease in ECC and increase in CCT in diabetic patients as compared to non diabetic patients. Conclusion: Corneal endothelial cell density can be decreased and the central thickness of cornea can be increased in type 2 diabetes mellitus. Corneal decompensation (based on endothelial cell count& central corneal thickness) is much more higher in patients suffering from advanced eye disease (PDR) than in patients suffering with early stages of diabetic retinopathy (NPDR).*

Keywords: Diabetic Retinopathy, Endothelial Cell Count, Central Corneal Thickness, Specular Microscope

1. Introduction

Diabetes Mellitus (DM) has topped the leading healthrelatedcatastrophes the world ever witnessed. DR is predominantly a microangiopathy in which small blood vessels are particularly vulnerable to damage from high glucose levels. Direct hyperglycemic effects on retinal cells are also likely to play a role.

Many angiogenic stimulators and inhibitors have been identified; vascular endothelial growth factor(VEGF) appears to be of particular importance in the former category. If not treated well, diabetic retinopathy leads to tractional retinal detachment, vitreous hemorrhage & neovascular glaucoma; all of which lead to significant visual loss.

The vast majorityof diabetic individuals who lose vision do so, not because of an inability to treat their disease, but rather due to a delay in seeking medical attention.If fundus examinations are initiated prior to the development of significant retinopathy and repeated periodically, and if the recommendations of the Early Treatment Diabetic Retinopathy Study (ETDRS) are followed with respect to the management of subsequent diabetic macular edema or neovascularization, the risk of severe visual loss is less than 5%.

About Specular Microscopy, it can provide a non invasive morphological analysis of the corneal endothelial cell layers from subjects enrolled in clical trials. The response and effect of stress and trauma of cataract surgery of endothelial cell could not have been so well documented ifit was not for the advent of specular microscopy.

2. Objectives

- To see if there is significant variation in the endothelial cell count in patients with Diabetes mellitus having Non proliferative and proliferative Diabetic Retinopathy as compared to patients without Diabetes mellitus.
- To see if duration of Diabetes has any effect on corneal endothelium.

3. Materials and Methods

This is a observational cross-sectional study carried out in 500 patients who had come to OPD/ were admitted in the department of Ophthalmology P.D.U., Govt. Medical college, Rajkot. The primary objective of the study was to asses and compare the endothelial cell count in diabetic patients versus non diabetic patients. All adult patients coming to the OPD and admitted in ward of G.T.Sheth Eye Hospital, PDU Medical College, Rajkot.

Total of 500 patients (325 diabetics and 175 non diabetics) who were assigned in OPD and admitted at our G.T Seth Eye Hospital during 1/1/2019 to 30/6/2020. Unwillingnes, known and diagnosed case of glaucoma, history of uveitis/ trauma, history of previos ocular surgery, cornealopacity, contact lens wearers, age related macular degeneration, and traumatic cataract (penetrating injury induced cataract) were excluded from this study.

Informed consent was obtained from all patients before examination. Ethical approval was obtained from the institutional ethics committee, P D U Medical collage Rajkot. Approval of ethics committee from institution obtained and dated on December 2018. The included patients had a casual blood glucose test performed to disclose undetected diabetes.

The patients with diabetes had a fasting blood sugar level and post parandial blood sugar level test performed to reveal glycemiccontrol. Then, assessments of corneal endothelial cell count and central corneal thickness were done using non-contact specular microscopy

Medical/Surgical Devices
Snellen's Visual Acuity Chart placed at 6 meters,
Non Contact Tonometer.
Slit-Lamp Bio-microscope, along with 90 D lens
Direct Ophthalmoscope & Binocular Indirect Ophthalmoscope along with 20 D lens.
Specular microscope

4. Result and Analysis

Association between Diabetes and Age
The bar graph below depicts the means of Age (Years) in the 2 different groups.
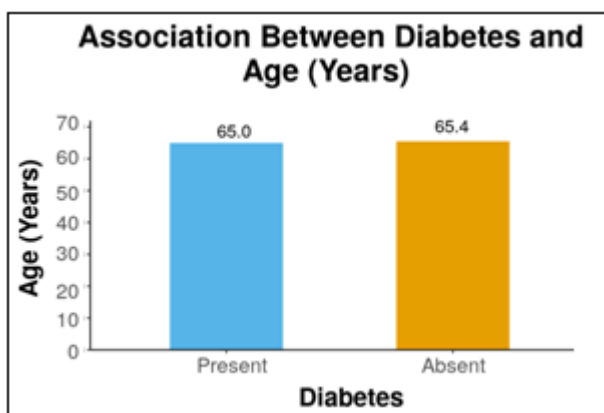
Fisher's exact test was used to explore the association between 'Diabetes' and 'Age' as more than 20% of the total number of cells had an expected count of less than 5.

There was no significant difference between the various groups in terms of distribution of Age ($\chi2 = 1.981$, $p = 0.987$).
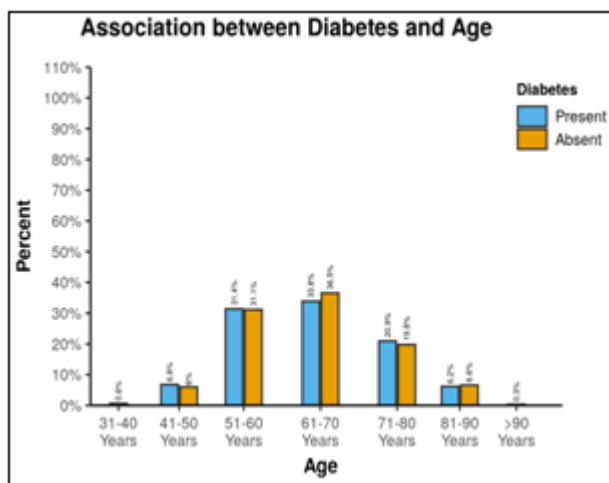

Association between Diabetes and Diabetic Retinopathy
There was no significant difference between the various groups in terms of distribution of Diabetic Retinopathy.
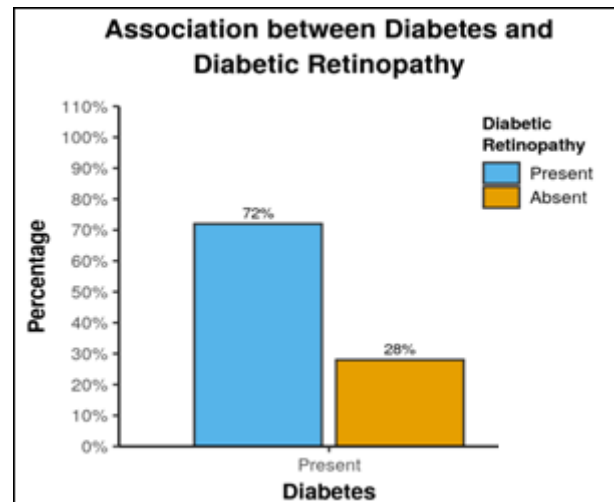
Association between Diabetes and Severity of Diabetic Retinopathy
There was no significant difference between the various groups in terms of distribution of Severity of Diabetic Retinopathy
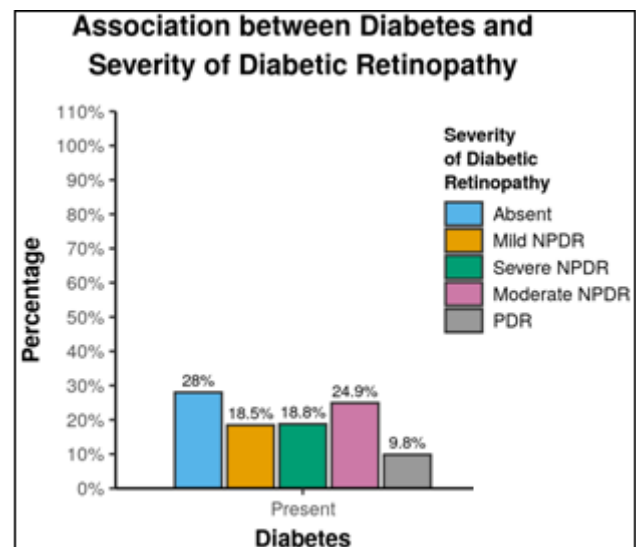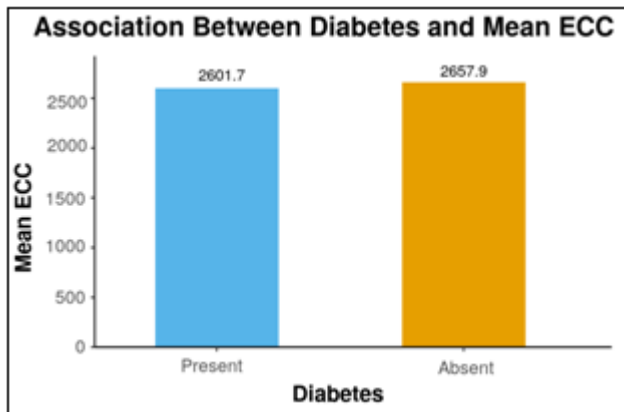

Comparison of the 2 Subgroups of the Variable Diabetes in Terms of Mean ECC
The variable Mean ECC was not normally distributed in the 2 subgroups of the variable Diabetes. Thus, non-parametric tests (Wilcoxon-Mann-Whitney U Test) were used to make group comparisons.

There was no significant difference between the groups in terms of Mean ECC (W = 25247.500, p = 0.206).

The bar graph below depicts the means of Mean ECC in the 2 different groups.

Comparison of the 2 Subgroups of the Variable Diabetes in Terms of Mean CCT

There was a significant difference between the 2 groups in terms of Mean CCT (W = 22633.500, p = 0.003), with median. Mean CCT being higher in diabetic group.

The graph below depicts the means of Mean CCT in the 2 different groups.
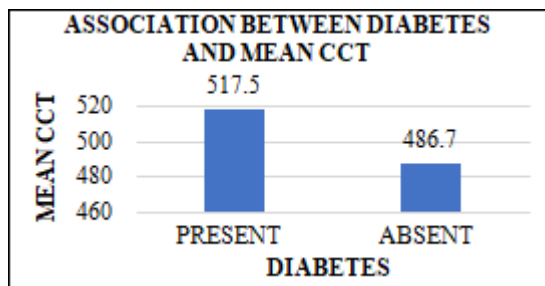
5. Discussion

Endothelial cell density

In our study, we found that the corneal endothelial cell measured in the diabetic group and the healthy age-group matched control group was not significant contrary to study by Dhasmana et al. A recent study conducted in southern India with a large study sample showed that the mean endothelial cell density was significantly lower across all age groups in patients with type 2 diabetes mellitus compared with controls. Despite the decrease in endothelial count in the diabetic group none of the patients developed corneal decompensation.

Central corneal thickness

According to our results, diabetic patients showed significant differences compared with normal persons in terms of the central corneal thickness. These findings were similar to studies by Busted et al. and Lee et al. Diabetes has reduced activity of Na+ - K+ ATPase of the corneal endothelium and this causes the morphological and functional changes of diabetic corneas. It is thought that in diabetic's aldose reductase causes intracellular accumulation of polyol, which acts as an osmotic agent leads to swelling of the endothelial cells. The recovery of cornea in diabetics takes longer compared to normal controls. In our study, We evaluate the differences in corneal morphology in 500 patients with diabetes compared with normal controls. An age and sex randomized sample was selected which has

provided us with results which potray the characteristics of entire population. In this study we evaluate corneal endothelial cell count in diabetes mellitus patients, So we take 325 patients who have diabetes and 175 patients who are non diabetic. Then, We made two groups based on diabetes present and diabetes absent, and further we divided 325 patients with mild NPDR, moderate NPDR, severe NPDR, PDR and no retinopathy. We use specular microscope for evaluation of endothelial cell count and central corneal thickness. We see that corneal endothelial cell count decrease among the patients who have diabetes with duration of diabetes compared to normal. And also central corneal thickness also increased in patients with diabetes as compared with normal. There was significant difference between the groups of diabetic patients in term of mean ECC count and mean CCT count.

6. Conclusion

1) Corneal endothelial cell density can be decreased and the central thickness of cornea can be increased in type 2 diabetes mellitus.
2) Corneal decompensation (based on **endothelial cell count& central corneal thickness**) is much more higher in patients suffering from advanced eye disease (PDR) than inpatients suffering with early stages of diabetic retinopathy (NPDR).
3) So, it goes to say that in patients with diabetic retinopathy, any intraocular surgery should be planned with a compromised cornea in mind.

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