

Effect of Diabetes Mellitus on Corneal Endothelial Cell Count

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ABSTRACT

Objective: To determine corneal endothelial cell count in type 2 diabetes mellitus patients.

Study Design: Observational study

Place and Duration of Study: This study was conducted at the Ophthalmology Department, Jinnah Postgraduate Medical Centre, and Karachi from 1st April 2018 to 30th September, 2018.

Materials and Methods: 78 patients of either gender aged between 40 to 60 years who were diagnosed type 2 diabetics and didn't have any other ocular disease were included in the study. 78 non-diabetic control subjects were also recruited. Patient demographics were documented and corneal endothelial cell count was determined using specular microscopy. Data was analyzed using SPSS version 17.

Results: 156 eyes (78 diabetics and 78 controls) were studied. Mean corneal endothelial cell count was found to be 2051 ± 19.039 cells/mm² and 2580 ± 260.3 cells/mm² in both groups respectively. No association of age and duration of diabetes with corneal endothelial cell count were found.

Conclusion: The corneal endothelial cell count in type 2 diabetics is significantly lower in comparison to healthy subjects.

Key Words: diabetes mellitus, specular microscopy, corneal endothelial cell count

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INTRODUCTION

Diabetes mellitus has become a major public health concern globally. International diabetes federation estimated the global prevalence of diabetes to be 246 million in 2007 and it is expected to reach to 380 million by 2025¹. Pakistan too houses 7 million diabetics and this is expected to rise to 14.4 million by 2040 making Pakistan the 8th highest country in terms of burden of diabetes mellitus². Diabetic changes manifest in eye in a multitude of ways including diabetic retinopathy, corneal dysfunction, cataract, glaucoma, ischemic optic neuropathy and maculopathy, among others^{3,4}. Changes in cornea that have been linked to diabetes mellitus include decreased corneal endothelial cell count and hexagonality, increased central corneal thickness, pleomorphism, polymegethism, decreased corneal sensitivity and higher corneal autofluorescence⁵. Variable results have been documented while comparing corneal endothelial cell counts of diabetics with non-diabetics.

Lee et al⁶ and several other authors^{7,8} have reported significantly lower corneal endothelial cell density in diabetics whereas Hugod et al⁹ and a few other authors^{10,11} have documented that there is no significant difference in corneal endothelial morphology in diabetics and normal subjects. An inverse relation between duration of diabetes and corneal endothelial density has been shown by Lee et al⁶ whereas Choo et al¹² have reported absence of any effect of duration of diabetes on corneal morphology. Limited local studies on this topic^{2,13}, have documented decreased endothelial cell counts in diabetics with cell density decreasing with increasing duration of diabetes. Our study aims to evaluate the effect of diabetes on corneal endothelial cell count and the correlation of same with duration of diabetes, thereby adding to the limited local literature available.

MATERIALS AND METHODS

This observational study was carried out at Department of Ophthalmology, Jinnah Postgraduate Medical Centre, and Karachi from 1st April, 2018 to 30th September, 2018 after approval from ethical review board of the hospital. Patients aged between 40 and 60 years of either gender who were diagnosed type 2 diabetic were recruited in the study through non probability consecutive sampling. A control group of non-diabetics was taken. An informed consent was taken from all participants. Patients with previous history of ocular surgery/ trauma/ laser, glaucoma, corneal disease and dry eye syndrome were excluded.

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Sample size was calculated to be 78 for each group considering mean corneal endothelial density to be 2562.1 ± 36 cells/mm², confidence level 95% and margin of error 8%. All patients were interviewed for their demographics. Complete ophthalmic examination including visual acuity, slit lamp examination and IOP measurement was done. Corneal endothelial cell count for each patient was evaluated using specular microscopy done by the same examiner between 9 and 11 am. An average of three readings taken from central cornea was taken.

The collected data was entered and analyzed in SPSS version 17. Mean and standard deviation of quantitative variables like age, duration of diabetes and corneal cell density was calculated. Frequency and percentage were calculated for qualitative variables like gender. Stratification with respect to age, gender and duration of diabetes was done. Post stratification t-test was applied. The results were considered significant at $p \leq 0.05$.

RESULTS

156 eyes (78 type 2 diabetics and 78 normal subjects) were evaluated. Demographic details of both groups are given in table 1. Mean age of diabetic group was 50.87 ± 7.74 years whereas that of control group was 52.34 ± 8.37 years. Range of age group for both groups was 40 to 60 years. 60.3% subjects were males and 39.7% females in the diabetic group whereas the corresponding values for control group were 58.9% and 41.02%.

Table No1: Demographic profile

Parameter	Diabetic (n=78)	Control (n=78)
Age	50.87 ± 7.74	52.34 ± 8.37
Gender		
Male	47 (60.3%)	46 (58.9%)
Female	31 (39.7%)	32 (41.02%)
Duration of DM		
<10 yrs.	55 (70.5%)	-
>10 yrs.	23 (29.4%)	-

Mean corneal endothelial cell count (CCC) in diabetic group was found to be 2051.05 ± 19.039 cells/mm² while in the control group it came out to be 2580 ± 260.3 cells/mm². On analysis of association of age with corneal cell count it was observed that in patients with age of less than 50 years mean CCC was 2050.42 ± 21.622 cells/mm² while in patients with age of 50 and above mean CCC was 2051.93 ± 17.252 cells/mm² ($p = 0.735$). On analysis of association of duration of diabetes with corneal cell count it was observed that in patients with diabetes for less than 10 years mean CCC was 2049.93 ± 19.020 cells/mm² while in patients with DM ≥ 10 years mean CCC was 2053.74 ± 19.234 cells/mm².

DISCUSSION

Normal corneal endothelial structure and function is vital for maintaining corneal transparency. Corneal endothelial density has implications in several conditions including dry eye, diabetic keratopathy and glaucoma¹³. Abnormal endothelial cell density also means greater susceptibility to surgical stress and hence affects the final outcome of procedures like cataract extraction, refractive surgery and keratoplasty. Raised blood sugar level affects the cornea in 70% of diabetics through different mechanisms including excessive sorbitol accumulation in corneal endothelium and accumulation of advanced glycation end products in basement membrane or descemet membrane².

In our study, mean corneal endothelial cell count was found to be significantly lower in the diabetic group as compared to the control group (2051.05 cells/mm² versus 2580 cells/mm²); Similar results were documented previously in several studies. Qamar et al² and Batool et al¹³ studied Pakistani population and reported significantly lesser CED in diabetics in comparison to non-diabetic controls. Internationally Sudhir ET al¹⁴, Lee lawongtawun ET al¹¹ and several other studies also reported decreased CED in diabetics. In contrast to previous studies that documented decreased CED with age¹⁵⁻¹⁷, our study didn't show any such association (p -value 0.735). There is a probability that this was because the age group taken in our study was just 40 to 60 years whereas in other studies a larger range of age was studied.

Likewise in our study no association between duration of diabetes and CED was noted (p -value 0.424). Similar results were reported by Modis ET al⁸ and Ashish ET al¹⁸. On the contrary, lower CED with greater than 10 years of diabetes was reported by Qamar ET al², Lee ET al⁶, Briggs ET al¹⁹ and Gupta et al²⁰.

CONCLUSION

This study concludes that corneal endothelial density is lower in type 2 diabetics. Therefore evaluation of corneal endothelial status should be routinely carried out in diabetics in order to better manage their ocular comorbidities.

Author's Contribution:

Concept & Design of Study: Rabia Chaudhry
 Drafting: Imran Ali, Naresh Kumar
 Data Analysis: Nasar Qamar Khan, Wejai Kumar, Kanwal Advani
 Revisiting Critically: Rabia Chaudhry, Imran Ali
 Final Approval of version: Rabia Chaudhry

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Choo MM, Prakash k, Samsudin A, Soong T, Ramli N, Kadir AJ. Corneal changes in type II diabetes mellitus in Malaysia. *Int J Ophthalmol* 2010;3(3):234.
2. Qamar-ul-Islam, Mehboob MA, Amin ZA. Comparison of corneal morphological characteristics between diabetic and non-diabetic population. *Pak J Med Sci* 2017;33(6):1307-1311.
3. Nagaraj G, Desai AS, Jayaram N. Corneal thickness and endothelial cell density in diabetic and nondiabetic patients: a hospital based comparative study. *Int J Adv Med* 2018;5(3): 694-699.
4. Luty GA. Effects of diabetes on the eye. *Invest Ophthalmol Vis Sci* 2013;54.
5. Islam Q. Effect of diabetes mellitus on central corneal thickness – A comparative study. *Pak J Ophthalmol* 2017;33(3):126-31.
6. Lee JS, Oum BS, Choi HY, Lee JE, Cho BM. Differences in corneal thickness and corneal endothelium related to duration in Diabetes. *Eye* 2006; 20:315–318.
7. Shenoy R, Khandekar R, Bialasiewicz A, Al Muniri A. Corneal endothelium in patients with diabetes mellitus: a historical cohort study. *Eur J Ophthalmol* 2009;19(3):369-75.
8. Mó L Jr, Szalai E, Kertész K, Kemény-Beke A, Kettesy B, Berta A. Evaluation of the corneal endothelium in patients with diabetes mellitus type I and II. *Histol histopathol* 2010; 25(12):1531-7.
9. Hugod M, Storr-Paulsen A, Norregaard JC, Nicolini J, Larsen AB, Thulesen J. Corneal endothelial cell changes associated with cataract surgery in patients with type II diabetes mellitus. *Cornea* 2011; 30:749–753.
10. Storr-Paulsen A, Singh A, Jeppesen H, Norregaard JC, Thulesen J. Corneal endothelial morphology and central thickness in patients with type II diabetes mellitus. *Acta Ophthalmol* 2014; 92(2): 158-60.
11. Leelawongtawun W, Surakiatchanukul B, Kampitak K, Leelawongtawun R. Study of Corneal Endothelial Cells Related to Duration in Diabetes. *J Med Assoc Thai* 2016; 99(4):182-8.
12. Choo MM, Prakash K, Samsudin A, Soong T, Ramli N, Kadir AJ. Corneal changes in type 2 diabetes mellitus in Malaysia. *Intl J Ophthalmol* 2010; 3(3):234–236.
13. Rizvi BZ, Zafar O. Comparison of the corneal endothelial cell count in type 2 diabetic patients with healthy adults. *Pak Armed Forces Med J* 2016; 66(4):494-97.
14. Sudhir RR, 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): 1119-22.
15. Sanchis-Gimeno JA, Lleó-Pérez A, Alonso L, Rahhal MS, Martínez SF. Corneal endothelial cell density decreases with age in emmetropic eyes. *Histol Histopathol* 2005;20(2):423-7.
16. Galgauskas S, Norvydaite D, Krasauskaite D, Stech S, Asoklis RS. Age-related changes in corneal thickness and endothelial characteristics. *Clin Interv Aging* 2013;8:1445-450.
17. Qamar-ul Islam, Saeed MK, Mehboob MA. Age related changes in corneal morphological characteristics of healthy Pakistani eyes. *Saudi J Ophthalmol* 2017;31(2):86-90.
18. Ashish B, Sanghavi K, Satani D. Corneal endothelial evaluation in relation with diabetes. *Int J Int Med Res* 2016; 3(4):41–44.
19. Briggs S, Osuagwu UL, AlHarthi EM. Manifestations of type 2 diabetes in corneal endothelial cell density, corneal thickness and intraocular pressure. *J Biomed Res* 2016;30(1): 46-51.
20. Gupta M, Pandey AN, Tyagi R. A study of corneal changes – endothelial cell density (ECD) and central corneal thickness (CCT) in Type -2 DM in relation to Hba1c levels and compare it with healthy individuals. *Ind J Clin Exp Ophthalmol* 2016;2(2):123–127.