COMPARISON OF THE CORNEAL ENDOTHELIAL CELL COUNT IN TYPE II DIABETIC PATIENTS WITH HEALTHY ADULTS

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ABSTRACT

Objective: To compare the mean corneal endothelial cell count in type II diabetic patients with healthy adults.

Study Design: Case control.

Place and Duration of Study: Out-patient Department of Armed Forces Institute of Ophthalmology, Rawalpindi from September 10, 2013 to March 25, 2014.

Material and Methods: A hospital-based case-control study was carried out at out-patient department of Armed Forces Institute of Ophthalmology in which 130 eyes (65 diabetic eyes and 65 controls) were included. Non-probability consecutive sampling was adopted. Relevant detailed history including information about age, gender, duration of diabetes, any other medical illness and current medical treatment being taken by patient was recorded.

Results: Data entry and analysis was done in SPSS version 10. Total 130 eyes (65 diabetic and 65 non-diabetic eyes) were included in our study according to the inclusion criteria. Mean age (years) of patient in both the groups was 59.55 ± 8.01 and 53.85 ± 10.07. Mean corneal endothelial cell count in both the groups was 2368.35 ± 389.58 and 2588.64 ± 269.84 respectively which was statistically significant (*p*-value=0.001) in both the groups.

Conclusion: The conclusion of the study was that the mean corneal endothelial cell count in type II diabetic patients was significantly less as compared to healthy adults.

Keywords: Endothelial cell count, Type II diabetes.

INTRODUCTION

Diabetes Mellitus is the most important non infective epidemic to hit the globe in the present millennium. The International Diabetes Federation estimated the global prevalence of Diabetes to be 246 million in 2007 and possibly reaching up to 380 million by 2025. This translates into approximately 5.9% of the world adult population, with 80% of cases occurring in the developing world[1]. Diabetes mellitus type II is a metabolic disorder that is characterized by high blood glucose in the context of insulin resistance and relative insulin deficiency. Type II diabetes constitutes about 90% of cases of diabetes with the other 10% primarily due to diabetes mellitus type I and gestational diabetes. Diabetic eye disease is an end-organ response to the effects of the condition on the human system. The cornea is a transparent structure protecting the anterior one-sixth of the eye ball consisting of five distinct layers[2]. Chronic hyperglycemia can affect the morphology and function of various corneal layers compromising corneal transparency[3]. Corneal endothelium is the innermost layer of hexagonal non-replicating neural crest derived tissue that is responsible for maintaining corneal deturgence throughout life by pumping excess fluid out of the stroma and keeping the corneal stroma in its usual dehydrated state[4]. Introduction of specular microscopy by Maurice in 1968 resulted in non-invasive detailed morphological analysis of the corneal endothelium at high magnification in vivo. Diabetics show significantly lower corneal endothelial cell count as compared with the normal population[5]. Corneal endothelial cell count is vital for maintaining corneal clarity. A

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large population based study published in October 2012 supported this evidence by revealing lower corneal endothelial cell counts in the Diabetic population versus normal subjects (2550 ± 326 vs 2634 ± 256 *p*=0.001)[5].

The rationale of this study is to evaluate and document the health of corneal endothelium in terms of cell count in a Pakistani diabetic population so that appropriate measures can be adopted during intraocular procedures to protect the already compromised corneal endothelium. To decide whether or not this evaluation should be made a part of protocol for eye care in a diabetic population.

MATERIAL AND METHODS

This Case-control study was carried out at the Armed Forces Institute of Ophthalmology, Rawalpindi from September 10, 2013 to March 25, 2014. Study was conducted after the approval of the Hospital Ethical Committee. Eyes of all type II diabetics (Group A)presenting to AFIO out-patient department in the above mentioned time period with ages ranging from 40-70 years and having a 5-10 years duration of diabetes were included.The diagnosis of diabetes was based on the World Health Organization (WHO) criteria which included afasting plasma glucose >7.0 mmol/l (126 mg/dl) or a 2-hour plasma glucose >11.1 mmol/l (200mg/dl). Controls (Group B) included the eyes of all non – diabetics including hospital staff and patients who presented to AFIO out-patient department for refraction in the above mentioned time period with ages ranging from 40-70 years. Patients with a previous history of active ocular infection, ocular inflammation, pseudoexfoliation syndrome, rheumatoid arthritis, contact lens wear, corneal dystrophies, dry eyes, ocular trauma, ocular surgery, glaucoma, uveitis, corneal opacities, pterygium, trichiasis, entropion or patients having pan-retinal photocoagulation were excluded from this study. Sample sizewas calculated with the help of World Health Organization (WHO) sample size calculator, following are the calculations

Level of significance:	5%
Power of test:	80%
Pooled standard deviation:	199.78
Test value of the population mean:	2562.07
Anticipated population mean:	2852.27

Sample size = n = approximately 65 eyes to be studied in each group

Total of 130 eyes (65 diabetic and 65 non-diabetic)

A total of 130 eyes (65 diabetic eyes and 65 controls) were included. Non-probability consecutive sampling was adopted.

Proper written informed consent was taken from all participants. All history taking and examinations were conducted in proper privacy. Confidentiality of the patient´s record was maintained. Relevant detailed history including information about age, gender, duration of diabetes, any other medical illness and current medical treatment being taken by patient was recorded. Slit lamp examination was conducted to rule out dry eyes, corneal opacities, uveitis, entropion and trichiasis. Goldmann applanation tonometry was carried to rule out any rise in intra ocular pressure. Specular microscopy of corneal endothelium was carried out using the non-contact Topcon SP-3000P microscope. Approximately 100 cells were counted in each image analysis. This was repeated thrice for each eye and then the mean of these readings calculated. The captured image was then be analyzed with Topcon cell count software.

Data entry and analysis was done in SPSS version 10. Mean ± Standard Deviation were calculated for the mean corneal endothelial cell count in both the groups. Mean ± Standard Deviation were calculated for the age (years) of the patients in both the groups. Frequency and percentages were calculated for gender. Independent sample t-tests were used to compare the mean corneal endothelial cell count between diabetic and control groups. Effect of modifiers like age, gender and duration of diabetes was controlled by stratification. The *p*-value of <0.05 was taken as significant.

RESULTS

Total 130 eyes (65 diabetic and 65 non-diabetic eyes) were included in our study according to the inclusion criteria. Descriptive statistics of age (years.) of patient was calculated in terms of mean and standard deviation. Mean age (years.) in both the groups was 59.55 ± 8.01 and 53.85 ± 10.07 as shown in table-1. Frequency and percentages were calculated for distribution of gender. In our study majority of the patients were males. The frequency and percentages of male patients in both the groups was 38 (58.5) and 57 (87.7) respectively, whereas frequency and percentages of female patients in both the groups was 27 (41.5) and 08 (12.3) respectively, as shown in table-2.

The outcome of the study was mean corneal endothelial cell count which was compared with diabetic eyes group and healthy eyes. Mean corneal endothelial cell count in both the groups was 2368.35 ± 389.58 and 2588.64 ± 269.84 respectively as shown in table-3. Independent samples t-test was used to compare mean endothelial cell count which was statistically significant (*p*-value=0.001) in both the groups, which showed that mean corneal endothelial cell count in type 2 diabetic patients was less as compared to healthy adults.

Table-1: Descriptive Statistics of Age (years.) of patient in both the groups.

Groups	n	Mean age (years.) of patients
Group A (Diabetic eyes)	65	59.55
Group B (Control eyes)	65	53.85

Table-2: Distribution of Patient's gender in both the groups.

Gender	Group B (Control eyes) n (%)	Group B (Control eyes) n (%)
Male	38 (58.5)	27 (87.7)
Female	27 (41.5)	8 (12.3)
Total	65 (100)	65 (100)

Table-3: Comparison of mean corneal endothelial cell count in both the groups.

Groups	n	Mean	Std. Deviation	*p*- value
Group A (diabetic eyes)	65	2368.35	389.58	0.000269
Group B (control eyes)	65	2588.64	269.84	0.000282

DISCUSSION

Diabetes mellitus is a global problem with the greatest frequency in developing countries. It has been postulated that there is a need for global surveillance programs for primary, secondary, and tertiary prevention of diabetes and its complications. Also, it has been shown that blinding complications such as diabetic retinopathy can be significantly reduced by early intervention with laser treatment[6]. Effective treatment therefore has to be initiated at an early stage before the patient is aware of any symptoms. This can be achieved only by systematic screening. This will include identifying those with a family history of diabetes, assessment of visual acuity, and examination of the anterior segment of the eye in all clinics and by all medical practitioners, including general practitioners and primary eye caretakers. Many of the complications of diabetes mellitus may be delayed or prevented by prompt and effective treatment and education[7].

The corneal endothelium plays an important role in the maintenance of the corneal transparency. The evaluation of the density and thickness of this layer is important in a wide range of disorders such as contact-lens-related complications, glaucoma, dry eye, and diabetes mellitus.The outcome of various intraocular surgeries including cataract, keratoplasty, vitrectomy, and refractive surgeries also rely on the status of the cornea[8]. Diabetes causes changes in the corneal endothelial cell morphology. The corneal endothelium is known to demonstrate pleomorphism and polymegathism[9]. There is a

significant correlation of the endothelial cell density and the duration of the disease, suggesting a cumulative effect of diabetes. These factors were also correlated with age[10]. It is possible that morphologic changes with aging may be responsible for the decreased density and increased thickness of the cornea, as a significant correlation was also observed in the controls. Larsson et al also observed changes in the diabetic cornea, which were similar to that induced by aging[11].

In our study, the age (years.) of patient in terms of mean and standard deviation in both the diabetic and the non-diabetic groups were 59.55 ± 8.01 and 53.85 ± 10.07. Similarly in a study by Adeotiet al[6] the mean ± standard deviation in age of diabetic and non-diabetic groups patients were 57.51 ± 10.90 and 54.83 ± 9.47 respectively.

In a study by Pareket al[11] the frequency and percentage of male patients with type 2 diabetes were 55 (60.8) and female patients were 34 (39.2). And the non-diabetic male patients were 70 (70) and female patients were 30 (30). In our study, the frequency and percentages of male patients in both the diabetic and the non-diabetic groups were 38 (58.5) and 57 (87.7) respectively, whereas frequency and percentages of female patients in both the groups was 27 (41.5) and 08 (12.3) respectively.

The outcome of our study was mean corneal endothelial cell count (ECC) which was compared between diabetic and non-diabetic eyes. Mean ± Standard deviation of corneal endothelial cell count in both the groups were 2368.35 ± 389.58 and 2588.64 ± 269.84 respectively. Similarly, Parekh et al[11] in their study showed that the mean ± standard deviation of ECC in diabetic group was 2562.07 ± 35.98 and in non-diabetic group it was 2852.27 ± 280.243. However considering that the mean deviation of age between diabetic and non-diabetic groups in our study wasapproximately 5.7 years compared with 4.2 years. in their study.

CONCLUSION

In conclusion,the mean corneal endothelial cell count in type 2 diabetic patients was significantly less as compared to healthy adults. The study further suggests to conduct more studies, so that if proven then this evaluation should be made a part of the protocol for eye care in a diabetic population in Pakistan.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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