

Corneal Endothelial Cell Loss after Phacoemulsification in Patients of Type 2 Diabetes

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ABSTRACT

Purpose: To assess the mean corneal endothelial cell loss after Phacoemulsification in patients of type 2 diabetes.

Study Design: Cross-sectional study.

Place and Duration of Study: Layton Rahmatullah Benevolent Trust Free Eye and Cancer Hospital for a period of six months, from May 2015 to November 2015.

Material and Methods: Three hundred and fifty-five patients were selected by non-probability convenience sampling. Patients with cataract, diagnosed at least after 6 months of diagnosis of type 2 diabetes were included in this study. Patients with any systemic disease or ocular disease other than senile cataract were excluded from the study. Endothelial cell count was measured with Specular microscopy one day before surgery. One experienced surgeon with post-graduate experience of at least five years performed all the procedures. Follow up by specular microscopy was done at 6 weeks after phacoemulsification. Statistical analysis was done using SPSS version 23.

Results: Mean age of the patients was 59.32 ± 7.60 years. There were 41.97% males and 58.03% females. Mean endothelial cell count before phacoemulsification was 2177.21 ± 591.078 and 6 weeks after surgery was 1984 ± 597.51 . Age, gender, laterality, duration of diabetes and type of cataract was not significantly related with endothelial cell loss, p -value > 0.05 . Mean endothelial cells loss was higher in patients with HbA1c > 7 as compared to those with HbA1c < 7 (p -value = 0.01).

Conclusion: Patients with poor control of diabetes have higher endothelial cell loss after phacoemulsification than patients with good control.

Key Words: Diabetes mellitus, Cataract, Corneal Endothelial Cell, Phacoemulsification.

How to Cite this Article: Mazhar SA, Zahid S, Hanif J, Arshad MA, Iqbal RN. Effect of type 2 diabetes on Corneal Endothelial Cell Loss after Phacoemulsification, Pak J Ophthalmol. 2020; **36 (1)**: 3-7.

DOI: <https://doi.org/10.36351/pjo.v36i1.908>

INTRODUCTION

In Pakistan, cataract contributes around 66.7% of the cases of blindness¹. One of the major causes of

cataract is diabetes mellitus. Corneal abnormalities are present in more than 70% of the diabetic patients and others include clinically detectable changes such as increased epithelial fragility, recurrent erosions, reduced corneal sensitivity, endothelial cell loss and predisposition to corneal edema^{2,3}.

Cataract surgery is the most commonly performed

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surgery, which is always associated with damage to corneal endothelium⁴. During phacoemulsification, endothelial cell loss depends upon many factors. Few of these are the size and site of incision, technique of phacoemulsification, hardness of the cataract, anterior chamber depth, the axial length of the eye, viscoelastic material used and skills of the surgeon^{5,6,7}.

The patients presenting in LRBT eye hospital come from both urban and rural areas of Pakistan and these patients have poor diabetic control on presentation. The purpose of the study was to observe endothelial cell loss in diabetic cataract patients after phacoemulsification in our population.

MATERIAL AND METHODS

This study was conducted for a period of six months in Layton Rahmatullah Trust Hospital after approval from the hospital ethical committee. Total of 355 patients were selected through non-probability convenience sampling. Patients of either gender with age range of 50-80 years and presenting with cataract, diagnosed at least after 6 months of diagnosis of type 2 diabetes were included in this study. Patients with hypertension, asthma, uveitis (Anterior chamber cells on Slit lamp), previous history of any neurological disease, and history of trauma to eye were excluded from this study.

Demographic information like name, age, gender, etc. was noted after taking the informed consent.

Table 1: Descriptive statistics of the patients.

	Mean	Std. Deviation	Range	Minimum	Maximum
Age	59.32	7.6	30	50	80
Duration of type 2 DM	6.51	4.72	42	2	44
HbA1C %	6.47	0.94	3.8	4.9	8.7
Duration of Cataract	2.29	0.92	4	1	5
Endothelial count (p <0.001)	Pre-operative	2177.21	591.078	2242	3263
	After 6 weeks Cell Loss	1984.03	597.51	2320	3048
		193.18	60.07	422	532

Table 2: Relation of endothelial cell loss with different factors.

	n	Mean	p-value
Age Groups (years)	50-64	274	195.78 ± 63.20
	65-80	81	184.42 ± 47.30
Gender	Male	149	187.57 ± 63.88
	Female	206	197.25 ± 56.98
Side of cataract eye	Right	104	199.53 ± 61.65
	Left	251	190.56 ± 59.33
Duration of type 2 DM (years)	≤ 5 years	202	196.15 ± 61.94
	> 5 years	153	57.48 ± 189.27
Duration of cataract (years)	≤ 2 years	233	192.811 ± 63.55
	> 2 years	122	193.91 ± 53.03
HbA1c%	≤ 7	248	187.79 ± 50.99
	> 7	107	205.67 ± 75.95

HbA1c was recorded. Preoperative endothelial cell count was measured one day before surgery. Specular microscopy was used to measure endothelial cell count. To avoid bias one experienced surgeon with post-graduate experience of at least five years performed all the procedures. Follow up by specular microscopy was done at 6 weeks after phacoemulsification. All the data was collected on a proforma and analyzed in SPSS version 23.0. Quantitative variables like age, pre/post endothelial cell count, endothelial cell loss, duration of diabetes mellitus, HbA1c and duration of cataract was in the form of mean and standard deviation. Qualitative variables i.e. gender were presented as numbers and percentages. Effect modifiers, like gender, age, duration of Diabetes, cataract and HbA1c were controlled with the help of stratification. Post-stratification T-Test was used. A p-value of ≤ 0.05 was considered significant.

RESULTS

There were 149 (41.97%) male and 206 (58.03%) female patients. Mean age was 59.32 ± 7.60 years, the minimum age was 50 and the maximum age was 80 years. Two hundred and seventy four (77.18%) patients were 50-64 years old and 81 (22.82%) patients were 65-80 years of age. For details refer to tables 1 and 2.

The endothelial loss was significant 6 weeks after surgery, p-value < 0.001. When data were stratified over the duration of type 2 diabetes and duration of cataract, we found no significant difference in endothelial cell loss, p-value > 0.05. Mean endothelial cells loss was significantly high in patients with HbA1c > 7% as compared to those whose HbA1c was < 7% i.e. 205.67 ± 75.95 (9.45%) and 187.79 ± 50.99 (8.63%) respectively, p-value = 0.01.

DISCUSSION

Previous studies in other parts of the world have

shown results comparable to our study. In a similar study, that included 153 diabetic patients undergoing manual small incision cataract surgery (SICS) were assessed for the endothelial cell loss and change in central corneal thickness (CCT). The results showed that patients undergoing manual small incision cataract surgery in diabetic patients had a less functional reserve. A steady drop in the endothelial density was noticed, with the mean endothelial loss at 6 weeks and 3 months being 9.26 ± 9.55 and 19.24 ± 11.57 , respectively, in patients with diabetes. In patients with diabetes, it was seen that the CCT increased initially till the second postoperative week, followed by a reduction of CCT in the subsequent follow-up (sixth week) and a further reduction in the last follow-up (3 months). In diabetic patients, the change in CCT between the second and sixth weeks was significantly high^{6,7}.

In a study by Hugod et al. the corneal thickness and cell count were measured before surgery, and three months after surgery⁸. A significant decrease in hexagonal cells percentage was observed. The mean decrease in endothelial cell density at three months in the diabetic group was 154 cells per square millimeter (6.2%). Results revealed that diabetic patients have more corneal damage and endothelial cells loss.

In recent years, the surgical equipment has been improved, new viscoelastic agents, and techniques have been introduced⁹. Reshma et al¹⁰ conducted a study at 152 eyes and the mean endothelial cells loss after phacoemulsification was 10-15% at the end of 6 months. In a study by Kaur et al¹¹ that included 100 patients, mean endothelial cell loss was 19.53% at the end of 42 days. These results are comparable to our study i.e. 8.87% in 335 patients. Similar results were noted by Gogate¹² at the end of 6 weeks, Thakur¹³ at the end of one month and Akram¹⁴ at the end of three months.

In our study, mean endothelial loss in patients with age, 50-64 years was 184.42 ± 47.30 (8.47%) and in patients of 65-80 years was 195.78 ± 63.20 (8.99%). Reshma et al¹⁰ stated in their study that mean endothelial cell loss was greater in patients having age > 75 years. Hwang et al¹⁵ also stated that the degree of mean endothelial cell loss after phacoemulsification increased with the advancing age.

Mean endothelial cell loss in male and female patients in our study was 9.28% and 8.83% respectively and no significant difference was found. These results are in accordance with George et al¹⁶ and

Maggon et al¹⁷ i.e. there was no significant difference in mean endothelial cell loss in either gender.

Diabetes affects both the corneal thickness and the morphology of the endothelial cells. Hyperglycaemia in these patients causes metabolic stress, which can lead to lower endothelial cell density and greater pleomorphism and polymegethism. These endothelial changes, because of the disease, may lead to a high-risk cornea, particularly in hard cataract^{18,19}.

In another study, decrease in the endothelial cell density at 3 months in the diabetic group was 154 cells per square millimeter (6.2%) and it was compared with the control group that had 42 cells per square millimeter (1.4%)⁸. The difference between the diabetic group and the control group in cell loss was statistically significant ($p=0.04$). Another study described that the mean pre-operative endothelial count was higher in the control group when compared to the diabetic group ($p < 0.001$) and the post-operative mean endothelial cell loss was higher in the diabetic group (14.19%) ($p < 0.001$) as compared to the control group (8.05%)²⁰.

Work done in 2003 by Spaide RF showed that there was a steady decline in the endothelial density, with the mean endothelial loss in patients with diabetes at 6 weeks and at 3 months being 9.26 ± 9.55 and 19.24 ± 11.57 , respectively⁶. The change in CCT between the second and sixth weeks was significantly high in the diabetic group ($P = 0.045$). In a study by Siribunkum et al, it was noted that corneas of the diabetic patients had more polymegethism and pleomorphism. This suggested that corneal changes should be evaluated and confirmed before intraocular surgery in chronic diabetic patients¹⁸. Mean endothelial cells loss was significantly high in patients with HbA1c > 7% as compared to those whose HbA1c was < 7% i.e. 205.67 ± 75.95 (9.45%) and 187.79 ± 50.99 (8.63%). Hugod M et al⁸ and Akram et al¹⁴ also reported similar kind of statistics i.e. the patients with diabetes with greater HbA1c or blood sugar had higher cell loss than the patients with lower HbA1c or non-diabetics. The literature shows that the corneal endothelium is more vulnerable in diabetic patients with delayed repair after surgery and greater endothelial cell loss.

Patients in our part of the world have poor control of diabetes, due to which our diabetic patients may have more loss of corneal endothelial cells after phacoemulsification. On the basis of the results of present study, more precautionary measures or

techniques can be used to minimize endothelial cell loss in diabetic patients after phacoemulsification.

The limitations in our study are that we did not include the non-diabetic patients as a control group and we did not compare our results with the grades of cataract.

CONCLUSION

Patients with poor control of diabetes have higher endothelial cell loss after phacoemulsification than patients with good control.

Ethical Approval

The study was approved by the Institutional review board/Ethical review board.

Conflict of Interest

Authors declared no conflict of interest

Authors' Designation and Contribution

Syed Abdullah Mazhar; Assistant Professor: *Research planning, Manuscript writing.*

Sehar Zahid; Postgraduate resident: *Literature search, Manuscript writing*

Junaid Hanif; Consultant Ophthalmologist: *Manuscript drafting, Data collection.*

Muhammad Asharib Arshad; Final Year MBBS student: *Data collection, Final manuscript review.*

Rana Naveed Iqbal; Assistant Professor: *Data analysis, Final manuscript review.*

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