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Original Research Article

A prospective study of endothelial cell count in diabetic and non-diabetic patients after cataract surgery

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Abstract

Introduction: To assess and compare the changes in endothelial cell count in diabetic and non-diabetic patients after routine phacoemulsification and small incision cataract surgery.

Materials and Methods: Total 130 eyes of 130 patients was taken in the study were age and sex matched. Out of which 65 eyes of 65 patients of Type 2 diabetes mellitus and 65 eyes of 65 non-diabetic patients of cataract underwent cataract surgery. Out of which 65 patient for phacoemulsification surgery and 65 patients for small incision cataract surgery were evaluated. In all the patients specular microscopy for the corneal endothelial cell count and central corneal thickness was done pre-operatively. And post operatively at one week, six weeks and 12 weeks was done. The variation in the endothelial size and shape and percentage of hexagonal cells were assessed. A Comparative analysis of endotheial cell count and percentage of endothelial cell loss between two groups was performed. Also there was comparison of endothelial cell loss between phacoemulcification and small incision cataract surgery was done.

Results: The mean pre-operative endothelial cell count in the Non-diabetic group was higher than the diabetic group ($p<0.001$). The post-operative endothelial cell count loss in both the groups were statistically significant ($p<0.001$). On comparing postoperative endothelial cell loss in non diabetics (7.09%) to diabetic group, the diabetic group had significantly higher endothelial loss (12.04 %) ($p<0.001$). The change in percentage hexagonal cells in diabetic group was significantly higher than in non diabetic group ($p<0.005$). There was no significant difference was found in endothelial cell loss in between phacoemulcification and small incision cataract surgery.

Conclusions: In diabetic patients there was higher endothelial cell loss when compared with nondiabetic patients after cataract surgery. The changes were seen even in the presence of good glycemic control.

Introduction

Type 2 diabetes is likely to be the greatest epidemic in human history. If the total number of diabetics in the world is to be collected in one country, it would be the third biggest country in the world.[1] Diabetic patients develop cataract at younger ages compared with their nondiabetic counterparts.[3,4] Although cataract surgery can restore their vision, in several recent studies it has shown that diabetic patients are more susceptible to corneal complications. For example, at baseline, diabetic patients have lower endothelial cell density with an increased coefficient of variance.[5–7] In addition, after 10 years of diabetic duration, patients may develop greater central corneal thickness (CCT).[5]

In previous studies it was shown conflicting results on whether diabetic patients have an increased risk of endothelial cell loss after cataract surgery.[8–13] The aim of this study was to investigate the association between diabetes and endothelial cell count in ,patients of cataract surgery and difference in endothelial cell count in non-diabetic patients, to offer a comprehensive analysis of etiologies explaining the increased risk of endothelial cell loss after cataract surgery among diabetic patients.

Materials and Methods

This study is a prospective study conducted at department of ophthalmology, Dr. Sushila Tiwari Government Hospital, Govt. Medical College Haldwani from April 2017 to April 2018. Approval was taken from the Institutional ethical committee, a proper informed and written consent was taken from all the participants. Total 130 eyes of 130 patients were studied out of which 65 diabetic patients and 65 non-

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diabetic patients were taken. In all the patients, non-contact specular microscopy for corneal endothelial cell count and central corneal thickness, pre-operatively and post-operatively at 1 week, 6weeks and 12weeks was done. HbA1C was used as criteria for glycemic status HbA1C <7.0% as good control. The variation in endothelial cell size and shape and percentage of hexagonal cells were assessed. Both groups underwent pre-operative blood investigations (Fasting, post-parandial blood sugar levels and HbA1C) and complete ophthalmological assessment i.e. slit lamp examination, Grading of cataract done by Lens Opacities classification System III(LOCS III), IOP measured with Goldmann's, applanation tonometer, dilated fundus examination. Cataract surgery with IOL implantation was performed by same surgeon. Group A – Patients with controlled diabetes mellitus type 2 (65 eyes of 65 patients) who underwent Cataract surgery and IOL implantation. Group B – Non diabetic patients (65 eyes of 65 patients) who underwent cataract surgery and IOL implantation.

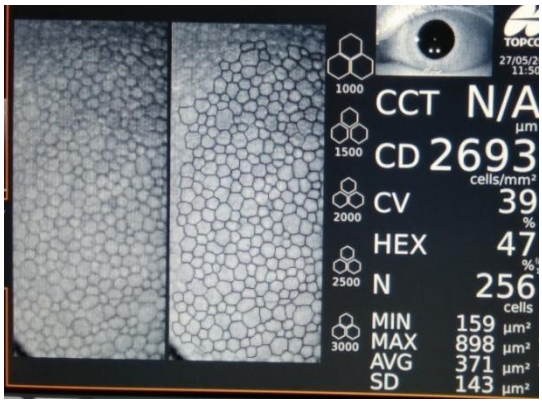

Fig. 1: Specular microscopy showing endothelial cell count (per mm^2), hexagonality (%).

Inclusion and Exclusion Criteria

Patient with Nucleus Grade 3 (LOCS III) or less were included in study, Age >35 years and <70 years age.

Patients with a history of intraocular surgery, serious coexistent ocular disease, corneal diseases (endothelial cell count <1500), Nucleus sclerosis Grade

IV and above, complicated cataract, uncontrolled glaucoma, congenital cataract, traumatic cataract, and chronic use of topical or systemic steroids, and those with a history of poor pupillary dilation (<5 mm) were excluded from the study. Patients with intraoperative or postoperative complications were excluded.

Cataract Surgery Technique

All procedures were performed under local anesthesia. 65 patients underwent phacoemulsification with the Alcon laureate^R world Phaco System (2.8 mm incision) using a phaco chop technique. Rest 65 patients underwent conventional Small incision cataract surgery, the intraocular lens was placed within the capsular bag in all cases. Postoperatively, all patients received the same treatment regimen consisting of a combination of an antibiotic, steroid, and nonsteroidal antiinflammatory drop (which was started next day after surgery).

Results

In our study, we compared the endothelial cell count in 65 eyes from diabetic patients (30 males and 35 females) with 65 eyes from nondiabetic patients (32 males and 33 females) underwent uncomplicated phacoemulsification and small incision cataract surgery. Preoperatively, there was no statistically significant difference in endothelial cell count (ECC) between two groups (Table 1).

Table 1: Baseline patients details

	Diabetic total no of patients (n=65),	**Non-Diabetic total no of patients(n=65)**	**P-value**
	Male (30) Female(35)	Male(32) Female(33)	
Mean Age (35-70 years)	57.1	59.9	
Pre-operative ECC(Avg.)	2983(cells/mm^2)	2944(cells/mm^2)	0.45

Diabetic patients with good glycemic control (HbA1C <7.0%) were 49, and poor glycemic control (HbA1C >7.0%) were 16. There was no significant effect of glycemic control found on endothelial cell count. (Table 2)

Table 2: Glycemic control and endothelial cell count of diabetic patients

	HbA1C < 7.0%	**HbA1C >7.0%**	**p-value**
Male	23	7	
Female	26	9	
Endothelial cell count	2984cells/mm^2	2962cells/mm^2	0.23

Phacoemulsification was performed on 65 Patients (32 diabetics and 33 Non-Diabetics), small incision cataract surgery was performed on 65 Patients (33 Diabetics and 32 Non-Diabetics) Table 3

Table 3: Patients distribution phacoemulsificaion and SICS

	Phacoemulcification		SICS	
	Diabetic patients	**Non diabetic patients**	**Diabetic patients**	**Non diabetic patients**
Male	15	16	15	16
Female	17	17	18	16
Total	**32**	**33**	**33**	**32**

Endothelial cell counts was done in both groups at post op day 7, 4 week, and post op 12 week. Comparison of endothelial cell count was done (Table 4)

Table 4: Comparison of endothelial cell counts in diabetic and non-diabetic patients underwent phacoemulcification

S. No.	Interval	Diabetic patients	Nondiabetic patients	t-test
1.	Per op	2983(cells/mm^2)	2990(cells/mm^2)	P =0.35
2.	Post op day 7	2876(cells/mm^2)	2983(cells/mm^2)	P=0.45
3.	Post op 4 week	2634(cells/mm^2)	2850(cells/mm^2)	P=0.05
4.	Post op 12 week	2534(cells/mm^2)	2778(cells/mm^2)	P=0.001

There was no significant loss of endothelial cell count in post op period on day 7 and 4 weeks, but significant endothelial cell loss was there in post op 12weeks after phacoemulsification. (Table 5)

Table 5: Comparison of endothelial cell counts in diabetic and non-diabetic patients undergoing SICS

S. No.	Interval	Diabetics patients	Non-Diabetics patients	t-test
1.	Per op	2983(cells/mm^2)	2989(cells/mm^2)	P =0.35
2.	Post op day 7	2872(cells/mm^2)	2980(cells/mm^2)	P=0.45
3.	Post op 4 week	2632(cells/mm^2)	2843(cells/mm^2)	P=0.05
4.	Post op 12 week	2530(cells/mm^2)	2772(cells/mm^2)	P=0.001

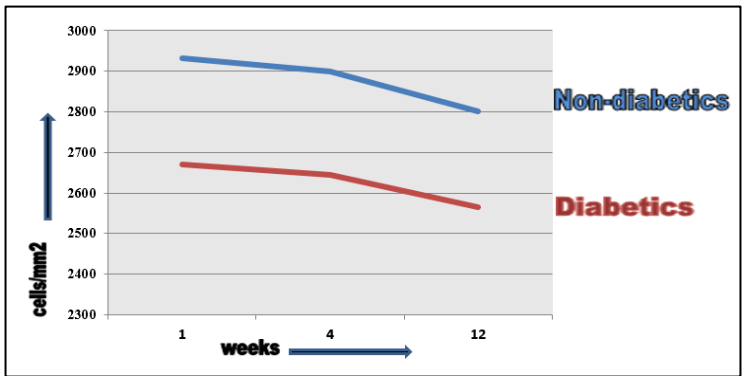

Fig. 2: Comparison of endothelial cell count in non diabetic and diabetic patients at post op 1 week, 4 week and 12 week

There was less endothelial cell loss with SICS in comparison to the phacoemulsification in diabetics and non-diabetic patients but it was statistically not significant.

Hexagonal cell count was also done in diabetic and non diabetic group. Comparison was done in both the groups. There was significant difference in hexagonal cell percentage was faoun in diabetic patients (Table 6)

Table 6: Comparison of hexagonal cell count in patients undergoing phacoemulcification (%)

S.No.	Interval	diabetic	Non-diabetic	t-test
1.	Pre -OP	56.5 +/- 4.2(%)	61.4+/- 5.2(%)	P=0.70
2.	Post op day 7	52.9+/-4.6(%)	58.2+/- 6.5(%)	P=0.02
3.	Post op 4 weeks	51.4+/-5.2(%)	57.9+/- 6.1(%)	P=0.45
4.	Post op 12 weeks	49.5+/-5.3(%)	57.8+/-6.4(%)	P=0.01

The mean pre-operative endothelial count in the Non-diabetic group was higher than the diabetic group (p<0.40). The post-operative endothelial count loss in both the groups were statistically significant (one-way ANOVA p<0.001). On comparing postoperative endothelial loss in non diabetics (7.09%) to diabetic group, the diabetic group had significantly higher endothelial loss (12.04% p<0.001). The change in percentage hexagonal cells in diabetic group was significantly higher than in non diabetic group (p < 0.005).

Both groups showed decrease % of hexagonal cells in post operative 3 month period.

In our study we did not include hard cataracts (nucleur sclerosis Gd>IV.LOCS III).

Because it requires higher energy for phacomulcification and both the groups has no significance difference in distribution of nucleus density.

Discussion

Type 2 diabetes is likely to be the greatest epidemic in human history. If the total number of diabetics in the world is to be collected in one country, it would be the third biggest country in the world.[1] In recent years, the prevalence of diabetes, as well as prediabetes, has significantly increased in India. A recent Indian Council of Medical Research sponsored study suggests the widespread seriousness of this condition across rural and urban areas with some areas showing prevalence as high as 13%.[2]

Diabetic patients develop cataract at younger ages compared with their nondiabetic counterparts.[3,4] Although cataract surgery can restore their vision, several recent studies have shown that diabetic patients may be more susceptible to corneal complications. For example, at baseline, diabetic patients have lower endothelial cell density with an increased coefficient of variance.[5–7] In addition, after 10 years of diabetic duration, patients may develop greater central corneal thickness (CCT).[5]

In Previous studies it was shown conflicting results on whether diabetic patients have an increased risk of endothelial cell loss after phacoemulsification cataract surgery.[8–13] The aim of this study was to investigate the association between diabetes and endothelial cell count in, patients of cataract surgery and difference in endothelial cell count in non-diabetic patients, to offer a comprehensive analysis of etiologies explaining the increased risk of endothelial cell loss after cataract surgery among diabetic patients.

Increased ECL in diabetic patients may be associated with increased vulnerability of endothelial cells in diabetic patients or it may be due to increased trauma during the cataract surgery. Potential theories for increased vulnerability include a lower initial endothelial cell count,[5–7] an underlying corneal neuropathy translating into a more generalized weakness of the cornea,[11] or overall ischemia making the eye more susceptible to the damaging impact of surgery.[17]

Over a decade ago, ophthalmologists began to notice increased ECL among diabetic patients after phacoemulsification. Langwinska-Wośko et al[14] reported in 2004 a significant discrepancy of 14% loss in diabetic versus 9% loss in nondiabetic patients. The initial finding was echoed by Hugod et al[15] but

contradicted by Al-Sharkawy et al,[16] who found the same percentage of ECL around 8% after phacoemulsification. In our study on comparing postoperative endothelial loss in non diabetics (7.09%) to diabetic group, the diabetic group had significantly higher endothelial loss (15.06% p<0.001). The change in percentage hexagon cells in diabetic group was significantly higher than in non diabetic group (p = 0.005).

Kohlhaas et al[18] reported no further postoperative loss of endothelial cells after 4 weeks, which suggests that wound healing is complete by this time. This postulate accords well with the findings of Cheng et al[19] and Amon et al[20] who also observed preoperative corneal thickness values to be restored within a similar period of time.

Conclusion

Our study has found that patients in diabetic group shows significantly higher endothelial cell loss after cataract surgery as compared to Non- diabetic group.

These changes were seen even in the presence of good glycemic control. In our study corneal endothelium of the diabetic patient showed more damage after phacoemulsification surgery as compared to SICS, But it was stastically not significant. So this warrants more careful approach during intraocular surgery in diabetic patients to prevent endothelial cell damage.

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Conflict of Interest: None.

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