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RESEARCH ARTICLE
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CORNEAL ENDOTHELIAL CELL DENSITY AFTER PHACOEMULSIFICATION IN PATIENTS WITH AND WITHOUT PSEUDOEXFOLIATION SYNDROME

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Abstract

Background: Pseudoexfoliation syndrome is a systemic disease in which matrix of fibrotic material is deposited in many organs. In the eye, a basement membrane like fibrillogranular, whitish material is deposited on the cornea, Iris, lens, zonular fibres and trabecular meshwork.

Aim: To assess and compare the corneal endothelial changes in terms of endothelial count in patients with and without pseudoexfoliation syndrome after routine uneventful Phacoemulsification.

Methods: A profile of 100 patients in this hospital-based prospective, observational cohort study was studied in the Postgraduate Department of Ophthalmology, Government Medical College Srinagar over a period of one and a half year. Study group consists of patients (GROUP A, n=50) with Pseudoexfoliation and control group consists of those patients (GROUP B, n=50) without Pseudoexfoliation Syndrome who have been diagnosed of visually significant cataract by slit lamp biomicroscopy and have underwent Phacoemulsification procedure for cataract extraction by using a standard technique with the same phacoemulsification equipment at similar setting by a single surgeon. Specular microscopy was done preoperatively and at 1 week, 1month, 6 months and 1 year postoperatively. The endothelial cell density (ECD) was evaluated and compared between PEX and control group.

Results: There was significant endothelial cell loss in the patients with pseudoexfoliation syndrome than in the patients without pseudoexfoliation syndrome. In GROUP A patients with PEX, the preoperative median ECD significantly decreased from 2367.9 cells/mm2 to 2083.2 cells/mm2 postoperatively ($P<0.05$). In the control group, the preoperative median ECD decreased from 2665.4 cells/mm2 to 2545.8 cells/mm2 postoperatively at 1 year follow up. **Conclusion:** Although Cataract surgery in Pseudoexfoliation is challenging, if the surgeon is aware of the condition pre operatively and pays meticulous attention to the surgical technique during cataract surgery, the intraoperative complications can be managed and good outcome can be expected.

Keywords: Pseudoexfoliation syndrome, Cataract surgery, Ophthalmology, endothelial cell density.

Introduction

Pseudoexfoliation syndrome is the widespread intraocular and systemic formation and accumulation of an anomalous flake like fibrillar extracellular material. The prevalence of PEX syndrome increases with age and varies widely in racial and ethnic populations. (1-7) The ocular manifestation of this syndrome is the deposition of PXF material in the anterior segment of eye such as in the iris, anterior chamber angle, lens surface and zonule, which results in many complications like glaucoma, cataract, poor mydriasis and zonular instability.[1,2,8]

Cataract surgery in eyes with PXF is difficult due to zonular instability and poor mydriasis.(9-13) In addition, morphologic studies indicate that PXF material is produced and accumulates in corneal endothelial cells, leading to a progressive change in the endothelium.(14,15) Furthermore, many studies have found decreased corneal endothelial cell density(ECD). [16-19]

In the recent years, specular and electron microscopic studies have shed light on new clinical trials allowing evaluation of both quantitative and qualitative corneal endothelial cell changes to occur in eyes with pseudoexfoliation. Along with lower endothelial cell density, changes in the percentage of hexagonal cells and the coefficient of variation of cell size have been shown in the eyes with pseudoexfoliation when compared to eyes without pseudoexfoliation.

This study was designed to evaluate the corneal endothelial cell density after phacoemulsification in patients with and without Pseudoexfoliation Syndrome.

Methods:

This prospective, observational cohort study that was conducted in the Postgraduate Department of Ophthalmology, Government Medical College Srinagar. The study was undertaken after obtaining clearance from the institutional ethical committee. The study was conducted over a period of one and a half year. Study group include patients with and without Pseudoexfoliation Syndrome who have been diagnosed of visually significant cataract by slit lamp biomicroscopy and have to undergo Phacoemulsification procedure for cataract extraction by a single surgeon using a standard technique with the same phacoemulsification equipment at similar setting. In this study, we excluded patients with pupillary diameter <5mm in either groups, NS 3 and NS 4 cataracts, patients with pre-existing corneal disease or other ocular comorbidities, previous intraocular surgery or trauma, Glaucoma, Preoperative Endothelial count of < 1500 cells/mm square.

Clinical Examination includes

1. Visual Acuity testing for distant and near objects by using snellen's chart for distant and near respectively
2. Refraction
3. External ocular examination
4. Slit Lamp Biomicroscopy

Corneal Endothelial cell changes was studied using specular microscopy for measurement of Corneal Endothelial Cell Density.

Look for the following evidences:

- Measurement of pupillary size before and after dilatation
- Type of cataract (nuclear, posterior subcapsular cataract, cortical Cataract)
- . Tonometry
- . Fundus Examination
- . Biometry

Statistical analysis

All data was analyzed using the SAS software package (release 6.12, SAS Institute Inc.). Age and IOP were used as continuous variables. Statistics were performed using the Student *t* test and the Mann-Whitney U test was used to compare differences between the eyes. Pearson's chi-square 2-sided test was used to test the frequencies of lens opacities in the paired eyes. Analyses by subjects

were also performed with logistic regression. The 95% confidence intervals of the prevalence were estimated and p< 0.05 was selected to denote statistical significance of differences.

Results:

Data for 50 patients in the PEX group [Group A] and 50 patients in the non-PEX group [Group B] were analyzed. The mean age was 55.68±6.61 years in the PEX group and 55.84±7.98 years in the control group (p=0.083). There were 22 women and 28 men in the PEX group and 21 women and 29 men in the non-PEX group (p=0.760). There was no statistically significant difference in age and sex between the groups (Table 1).

Table 1: Demographic profile of the study population

Variables	Group A	Group B	P Value
Age	55.68±6.61	55.84±7.98	0.083
Sex M/F	28/22	29/21	0.760

IOP was higher in the group A before and after pupil dilatation as compared to group B (Table 2).

Table 2: IOP before and after pupil dilatation

Parameter	**IOP (mmhg) [95%Cl]**		
Dilation	**Group A**	**Group B**	**P Value**
Before	**18.8 [17.68-20.22]**	**16.8 [15.98-17.21]**	**<0.01**
After	**18.9 [18.47-20.80]**	**16.3 15.68-17.51]**	**<0.01**

The prevalence of the cataract was detected in 57.0% of cases in the Group A compared to 39.5% in the Group B (p = 0.002). Nuclear cataract was more often represented in the Group A but was not statistically significant (p = 0.14). Patients with Pseudoexfoliation with cataract were significantly younger compared to patients without it and the median age was 55 and 60 years, respectively (p<0,001). In logistic regression analysis, adjusted to age, subjects with PXS have 1.5-fold risk of having cataract compared to the non- PXS group (p = 0.003); both age and PXS have a significant influence on cataract formation (Table 3).

Table 3: Regression analyses of formation of cataract, by PXS and age

Cataract	**Odds ration**	**SD**	**P Value**	**[95%Cl]**
EXS	**2.03**	**0.48**	**<0.01**	**1.28-3.21**
Age (Cataract)				
EXS	**1.56**	**0.41**	**0.09**	**0.96-2.63**
50-59	**1.0 (Ref)**			
60-69	**2.86**	**1.23**	**0.01**	**1.23-6.64**
70-80	**11.46**	**4.75**	**<0.01**	**5.08-25.85**
≥80	**29.70**	**5.37**	**<0.01**	**10.78-81.90**

The operative eyes with EXS differed significantly from non-EXS in the predominant type of lens opacity (Table 4).

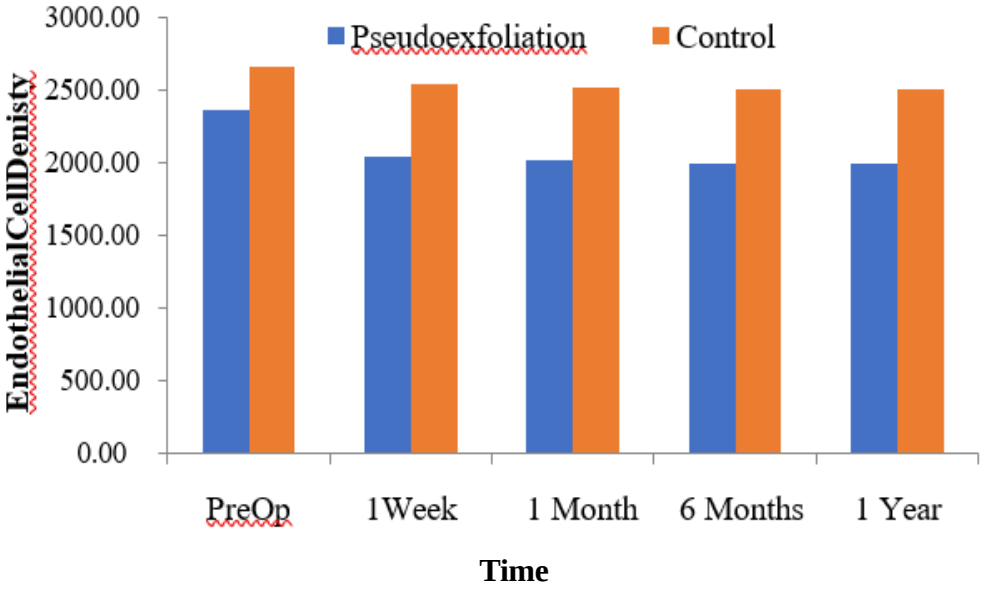
Table 4: Cataract type in the operative eyes

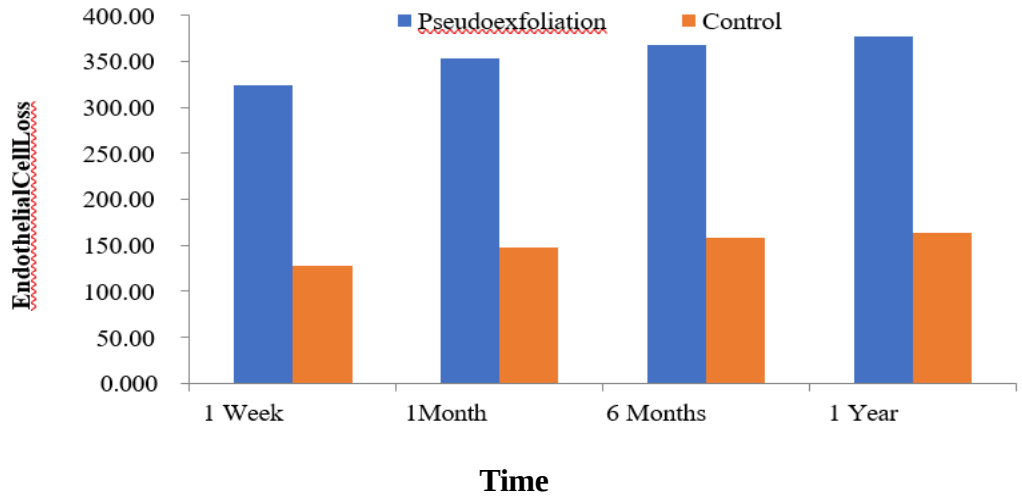
Type of cataract in operative eye	**Group A (%)**	**Group B (%)**	**P value**
Nuclear	**57.6%**	**36.8%**	**<0.001**
cortical	**7.6%**	**17.0%**	
subcapsular	**7.6%**	**20.3%**	
mixed	**27.2%**	**25.9%**	

Endothelial Cell Density

Time	Groups		Mean
	Pseudoexfoliation	Control	
Pre Op	$2367.96^{b}\pm57.37$	$2665.42^{a}\pm61.79$	$2516.69^{A}\pm62.97$
1 Week	$2043.9^{c}\pm69.49$	$2536.9^{ab}\pm63.84$	$2290.4^{B}\pm75.06$
1 Month	$2014.92^{c}\pm58.5$	$2518.14^{ab}\pm63.76$	$2266.53^{B}\pm69.55$
6 Months	$1999.48^{c}\pm58.61$	$2507.18^{ab}\pm63.8$	$2253.33^{B}\pm69.87$
1 Year	$1990.08^{c}\pm58.56$	$2501.58^{ab}\pm63.75$	$2245.83^{B}\pm69.82$
Mean	$2083.27^{\boldsymbol{B}}\pm63.5$	$2545.84^{\boldsymbol{A}}\pm63.69$	

Values are Mean±SD, Means with superscripts in lower case letters compares the interaction effect ($p\leq0.05$). Means with superscripts corresponding to last row in upper italic bold case letters compares the main effect of two groups ($p\leq0.05$). Means with superscripts corresponding to last column in upper case letters compares the main effect of different time periods ($p\leq0.05$). The two way repeated measure ANOVA was employed to determine the statistically significant differences. Tukey HSD post hoc test was used to compare the means ($p\leq0.05$).





The Endothelial cell loss was more in the Pseudoexfoliation group as compared to the control group.

DISCUSSION

Pseudoexfoliation syndrome is a degenerative systemic pathology of the extracellular matrix characterized by an accumulation of fibrillar material in the anterior segment of the eye as well as in other organs. By electron microscopy, large clumps of typical pseudoexfoliative material can be found adhering to the corneal endothelium which influence endothelial pump mechanism, and masses of pseudoexfoliation material are incorporated into the posterior Descemet membrane. These may lead to early corneal endothelial decompensation. [20]

In this study, it was seen that preoperatively the ECD was less in the Pseudoexfoliation group as compared to the control group. These findings suggest that corneal endothelial cells are essentially deteriorated and are more vulnerable to cataract surgery as compared to healthy endothelial cells. This agrees with the study done by Quiroga et al,[18], Demircan et al,. [21]

In the patients with Pseudoexfoliation, the preoperative mean ECD decreased from 2367.9 cells/mmsquare to 2083.2 cells/mmsquare . In the control group, the preoperative mean ECD decreased from 2665.4 cells/mmsquare to 2545.8 cells/mmsquare at 1 year follow up. There was statistically significant decrease of ECD between the two groups preoperatively. The percentage of Endothelial cell loss was significantly greater in eyes with Pseudoexfoliation than in eyes without Pseudoexfoliation, despite the similarities in nuclear firmness and operative factors. However, there was statistically insignificant difference in the Endothelial cell loss between the two groups postoperatively at 1 month, 6 months and at 1 year. This is consistent with the study done by Fahmy et al [22] and Pardasani R. [23]

The two way repeated measure ANNOVA was employed to determine the statistically significant differences. Tukey HSD post hoc test was used to compare the means(p & lt;0.05).

Patients with Pseudoexfoliation syndrome have higher risk of complications during and after cataract surgery. This could be attributed to poor pupillary dilation, zonular weakness which may lead to lens dislocation and vitreous loss. To prevent severe endothelial injury during cataract surgery in eyes with PXF, accurate preoperative assessments of corneal endothelial status and zonular instability are required. In addition, Kuchle et al [24] reported that an Anterior chamber depth of less than 2.5 mm is a risk factor for zonular instability. Furthermore, poor mydriasis may also be associated with zonular weakness. Accordingly, the preoperative measurement of ACD and pupil diameter after full dilation is recommended in eyes with PXF. When the ACD is shallow and mydriasis is poor, pupil enlarging devices or a capsule supporting devices.

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