



PSEUDOEXFOLIATION ; A THREAT FOR ENDOTHELIAL CELL COUNT

Ophthalmology

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ABSTRACT

Pseudoexfoliation syndrome presents with multiple challenges which requires proper preoperative planning. Our present study shows that endothelial cell density is significantly decreased with altered cell morphology in patients with Pseudoexfoliation compared to age matched control group. The central corneal thickness is decreased in patients with PXF compared to age matched control. Thus evaluating ECD & morphology is an important pre-operative measure taken in patients with PEX planning for any intra ocular procedures.

KEYWORDS

Pseudoexfoliation, Senile cataract, Endothelial cell count, Endothelial cell morphology, Central corneal thickness.

INTRODUCTION

Pseudoexfoliation which is first described by Lindberg in 1917¹, is an age relates systemic disorder with primary ocular manifestation with genetic predilection. LOXL-1[lysyl-oxidase-like] gene² is associated with this. Characteristic features include accumulation of grayish white fibro granular extracellular pseudoexfoliative material produced by abnormal basement membrane of aging epithelium. This material is deposited in trabeculum, lens capsule, iris, ciliary body of eye, corneal endothelium etc. Pseudoexfoliation has shown to be related to cataract, glaucoma, zonulopathy, lens subluxation, pseudouveitis, retinal vein occlusion and keratopathy³.

The corneal endothelium consists of a monolayer of polygonal cells, which helps in maintaining corneal transparency throughout the life. Average endothelial cell count is about 3000 cell/mm³, that decreases at the rate of 0.6% every year. When endothelial cell density reaches to 500 cells/mm³, cornea loses its transparency affecting the vision⁴. In patients with PEX qualitative and quantitative morphology changes in corneal endothelium predispose for endotheliopathy, making more vulnerable to the effects of intra ocular surgeries⁵.

Focal production of PEX exhausts corneal endothelial cells, causing secondary degeneration and corneal decompensation. This usually occurs bilaterally, asymmetric, slowly progressive corneal endotheliopathy.

Studies have shown that high CCT leads to over estimation and low CCT leads to underestimation of Intra ocular pressure. Underestimation of IOP in patients with PEX can lead to serious complications like faster progression of optic disc damage and poor visual outcome.

Pseudoexfoliation cases are associated with 5 times more likelihood of intraoperative complications like zonulopathy, poor mydriasis, subluxated or dislocated lens, difficulty in Rhexsis, shallow anterior chamber, thus making routine intraocular surgery as a challenging task⁶. Thus meticulous examination and early identification PEX pre operatively is very essential to alert surgeon to be prepared for complications.

Specular microscopy is an advanced method of examining and recording corneal endothelium cell density and morphology. Its a non invasive technique. Unlike other microscopes, instead of imaging the light transmitted through the substance, the specular microscope images the light reflected from the optical interface⁷.

Modern specular microscope can analyse size, shape and population of endothelial cells using computer assisted morphometry.

The current study aims at evaluating endothelial cell count and morphology, central corneal thickness in patients with senile cataract with and without pseudoexfoliation.

METHODS

A simple randomized observational study conducted over a pool of 100 participants, which further divided into two groups each having 50 participants of the out- patient, department of ophthalmology,

Bangalore Medical College And Research Institute, Bengaluru, Karnataka over a period of three months. After obtaining informed written consent, 50 participants of senile cataract with pseudoexfoliation & 50 participants of senile cataract without pseudoexfoliation were studied. Patients with corneal pathologies like corneal dystrophy, degeneration, previous ocular surgery, ocular trauma, traumatic, congenital, development, complicated cataract were excluded from study after thorough clinical and slit lamp examination.

Participants included in the study were subjected to specular microscopy[Tomey EM- 3000], Intraocular pressure measurement using Goldmann Applanation tonometry, Angle evaluation by Gonioscopy using Indirect 4 - mirror gonioscope, Pupil dilation with Tropicamide and phenylephrine eyedrops instilled every 10min over 30 min interval, slit lamp examination of lens capsule, pupils, corneal endothelium to look for pseudoexfoliation material.

Specular microscopy [Tomey EM- 3000] is a non contact procedure, which utilizes central bright specular image of corneal endothelium. Upto 300 cells are counted in fixed area of 0.135 mm. An automated cell counter recognition algorithm based on contrast difference and area based counting technique are used to assess endothelial cell density. The mean cell area and the CV[co-efficient of variation] in the cell area [standard deviation divided by mean cell area] were used as an index of the extent of variation in the cell area[polymegathism]. The percentage of hexagonal cells in the area analysed was used as an index of variation in the cell shape [pleomorphism].

RESULTS

The results were recorded in Microsoft excel and analysed using SPSS software version 18. The data analysed was represented by percentage and proportion. Mean $\pm$ SD used for quantitative data and unpaired 't' test for quantitative data of two groups.

Gender distribution of 44% Male & 56% Female participants, majority of subjects in age group of 60-69 years. Among 100 participants, 74% had senile immature cataract, 18% had senile mature cataract, 8% had senile hyper mature cataract. Among them 70% participants had normal fundus, 5% had PXF glaucoma, 25% fundus not visible due to mature cataract.

71% of patients didnot have any systemic illness, among the remaining participants 17 participants had Diabetes. 10 out of 17 Diabetic participants had pseudoexfoliation.

Endothelial cell density was significantly lower in participants with pseudoexfoliation in age group of 80 and above [Table 01]. The mean ECD in patients with pseudoexfoliation is 2180 ± 404.406 cells per sq.mm and in patients without PXF is 2696 ± 124.944 cells per sq.mm showing decreased ECD in patients with PXF compared to patients without PXF which is statistically significant [$p < 0.0001$] [Table 02][Graph 01].

Mean endothelial cell area in patients with PXF is 40.90 ± 8.986 & in patients without PXF is 37.70 ± 3.986 , though statistically not significant [Graph 02]. Clinically significant polymegathism seen in patients with PXF than without PXF.

Mean hexagonal pattern of endothelium [6A] in patients with PXF is 40.20±5.440 & patients without PXF is 44.18±3.978 which is statistically significant[p<0.001][Graph 03].

Mean central corneal thickness is less in patients above 80 years and in patients with PXF than without PXF[Table 03].

Table 01:- Mean Distribution of ECD, CV%, 6A, CCT Among Patients with PXF and without PXF

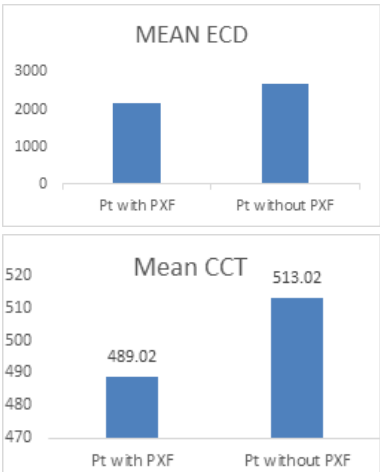
PARAMETER	MEAN [participants with PXF]	MEAN [participants without PXF]	Statistical significance
Endothelial cell density [ECD]	2180±404.406 cells per sq.mm	2696±124.944 cells per sq.mm	p<0.0001 SIGNIFICANT
Endothelial cell area [CV%]	40.90±8.986	37.70±3.986	STATISTICALLY NOT SIGNIFICANT
Hexagonal pattern of endothelium [6A]	40.20±5.440	44.18±3.978	p<0.001 SIGNIFICANT
Central corneal thickness [CCT]	489.02±25.14 2	513.02±31.42 8	p<0.001 SIGNIFICANT

Table 02:- Endothelial Cell Count in Patients with PXF and without PXF

PX					WITHOUT PXF				
AGE	N	MEAN	SD	Std error mean	N	MEAN	SD	Std error mean	
50-59	11	2159.18	468.306	141.2	17	2674.12	145.432	35.272	
60-69	22	2259.27	383.597	81.783	20	2702.45	120.432	26.929	
70-79	14	2190.14	349.299	93.354	09	2734.00	111.426	37.142	
80+	03	1631.00	218.749	126.29	04	2669.50	94.617	47.308	

Table 03:- CCT in Patients with PXF and without PXF

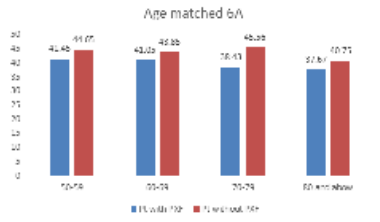
PX					WITHOUT PXF				
AGE	N	MEAN	SD	Std error mean	N	MEAN	SD	Std error mean	
50-59	11	489.82	30.163	7.315	17	507.45	32.831	9.899	
60-69	22	489.60	26.873	6.009	20	514.09	31.277	6.668	
70-79	14	489.89	14.937	4.979	09	511.71	34.354	9.182	
80+	03	480.75	14.315	7.157	04	532	11.533	6.658	



Graph 01:- Mean Endothelial Cell Density and CCT In Cataract Patients With And Without PXF.



Graph 02:- Age Matched CV% in Cataract Patients with and without PXF



Graph 03:- Age Matched 6a in Cataract Patients with and without PXF



Figure 01:- Diffuse Illumination Slit Lamp Examination Showing Lens Capsule Pseudoexfoliation

DISCUSSION

The corneal endothelium is a monolayer of cells that maintains corneal transparency. These cells can not regenerate, instead they enlarge to compensate post injury, thus reducing its functional capacity.

pseudoexfoliation syndrome is a systemic disorder which is a result of abnormal metabolic changes in the cell leading to accumulation of fibrillary material in anterior segment of eye and other organs. Risk of endothelial decompensation is more in patients with pseudoexfoliation.

Specular microscope is used in our study to compare endothelial cell density in patients with PXF and in control group without PXF.

In our study major of subjects were in age group of 60-69 years, minimum being 50 and maximum being 86. These results are consistent with the studies presented by G D. Sturrock, et al⁸. The ECD was significantly low in patients with PXF in age group of 80 and above. This shows significant reduction of endothelial cell count as the age increases.

74% patients had senile immature cataract, 17% patients had diabetes mellitus among 100 patients. The patients with diabetes had low ECD compared to patients without diabetes, results are consistent with studies presented by Modis L Jr et al⁹. These results are statistically significant.

Among 100 patients, central corneal thickness obtained from specular microscopy shown that 50% of cases have mean corneal thickness 513 micrometer. 50% of the cases have mean central corneal thickness as low as 489 micro meter. These results are consistent with studies presented by Kitsos et al¹⁰. Where they used ultrasonic pachymeter for the assessment of CCT. Our study finding is consistent with findings given by another study conducted by Acar et al¹¹.

In our study senile cataract patients with pseudoexfoliation has significantly low endothelial cell count, which is comparable to many other studies such as Zheng et al¹², Quiroga et al¹³, Koviulas et al. These studies have shown that pseudoexfoliation significantly influences cell density of corneal endothelium, main reason is PXF material that settles on the endothelium, penetrating into Descemet's membrane and breaking the connections between individual hexagonal cells, resulting in accelerated apoptosis of the cells.

ECD of less than 800 cells results in corneal decompensation, and loss of corneal transparency.[Table 04]

The present study shows decrease in endothelial cell density, Co-

efficient of variation, central corneal thickness, altered morphology in the form of polymegathism and pleomorphism in cataract patient with pseudoexfoliation compared to patients with patients without PXF. These results are comparable with studies done earlier.

CONCLUSION

Our study results shows, decrease in ECD, CCT with polymegathism and pleomorphism in patients with pseudoexfoliation. Significant low CCT underestimates the IOP readings which leads to overlooking of early glaucomatous changes.

Thus proper pre operative analysis of ECD & its morphology in cataract patients with and without PEX helps to choose appropriate surgical strategies and to reduce the complication in majority cases.

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