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Original Research Article

Assessment on the evaluation of corneal endothelial cell morphology and cell count in cataract with pseudoexfoliation

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ABSTRACT

Purpose: To assess the cell morphology & evaluate corneal endothelial cell count in patients suffering from cataract with pseudoexfoliation (PEX).

Materials and Methods: A cross-sectional study was planned and conducted in 40 eyes of patients, corneal endothelial cell density (CD), central corneal thickness (CCT) and coefficient of variation (CV) & percentage of hexagonal cells (6A) in cell size were assessed with application of specular microscope.

Results: The mean age of patients with cataract & PEX was 68.5 years. 58% were males. Lower CD was found in 40% patients of 50-59 years & 60% patients 60-69 years. Patients above 70 years had normal CD for age. 6A was low in 90% of PEX corneas. Abnormal CV was seen in 67.5% patients. CCT, CD & 6A were lower in PEX glaucoma compared to PEX.

Conclusion: Our study confirms the existence of quantitative and qualitative abnormalities in corneal endothelial cells with PEX especially when IOP is high.

1. Introduction

Cornea is the transparent part of the eye which is covering the iris and pupil and allowing light to enter inside the eye. This transparency of our cornea is mostly dependent on the stroma which is known to remain dehydrated. For this purpose, the proper metabolic functioning of the endothelium is necessary. While operating on cataract there are several factors such as distortion of cornea, contact of lens fragments or intraocular lens with the endothelium, and sometimes even the release of free radicals which could stimulate the loss of endothelial tissue which in turn could generate irreversible corneal oedema in some cases.[1]

It has been observed and studied that the morphological characteristics of the corneal endothelium & cell density could be dependent on age. It has been estimated that the endothelial cell density diminishes at a rate of 0.5% annually beginning at birth, a rate that can increase to 2% after intraocular surgery.[2]

Pseudoexfoliation syndrome is an chronic age-related systemic syndrome which targets the ocular tissues through the periodic deposition of fibrillary white flaky material from the lens, mainly on the lens capsule, ciliary body, zonules, corneal endothelium, iris and pupillary margin.[3]

PEX syndrome has been found to be associated with corneal endotheliopathy in many histopathological studies.[4] Since PEX is also associated with hypoxia of the anterior segment, it seems pertinent to acquire more knowledge of the in vivo morphology of corneal endothelial cells in addition to the existing histopathological features in order to predict problems for intraocular surgery in these eyes.

There are higher possibilities to detect these ocular changes earlier using imaging technologies which provides

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the objective and quantitative measures such as specular or confocal microscopy. Hence, this study aims to evaluate the corneal endothelial cell count and morphology of cataractous eyes with PEX in an Indian cohort to predict the susceptibility to intraoperative complications. Aims of this study were

1. To determine and evaluate the corneal endothelial cell count in patients with cataract with pseudoexfoliation.
2. To assess the corneal endothelial cell morphology in patients with cataract with pseudoexfoliation.

2. Materials and Methods

A cross-sectional study was planned and conducted in 40 eyes of 31 patients diagnosed with cataract with pseudoexfoliation. Ethical approval was taken from the committee before commencing of this study. The study period was for 3 months (July 2021 to September 2021).

Patients having cataract with pseudoexfoliation in either gender of any age group were included in this study.

Followings were excluded from the study.

1. Patients who have not given consent.
2. Patients with history of previous intraocular surgery, contact lens use, corneal trauma, diabetes mellitus or any other pathologies affecting corneal endothelium.
3. Patients with previous intraoperative surgical complications like subluxation of lens.

Patients who fulfilled the inclusion criteria were included for the study.

The objectives of the intended study was properly explained along with informed consent was taken. Sociodemographic data was collected. Detailed present and past history was taken.

All patients underwent a detailed ophthalmic assessment, including best corrected visual acuity (BCVA) measurement using Snellen's chart, intraocular pressure (IOP) measurement by non-contact tonometry, slit-lamp biomicroscopy, and fundus examination using indirect ophthalmoscope with 20D lens.

These patients were then examined for Corneal Endothelial Cell Density (CD), Central Corneal Thickness (CCT), Avg. Cell size and Percentage of hexagonality (6A) with a specular microscope.

The data collected was subjected to statistical analysis and results tabulated.

3. Results

Among 31 patients in our study, 7 patients (22.6%) belonged to the age group of 51-60 years, 12 patients (38.7%) in the age group of 61-70 years, 9 patients (29%) in the age group of 71-80 years and 3 patients (9.7%) aged above 80. The mean age of presentation was 68.5 years. 58% of our study population were males (18 patients) and 42% were females (13 patients). Right eye was involved in 13 patients (42%), left eye was involved in 10 patients (32.2%) and bilateral involvement was seen in 8 patients (25.8%).

PEX glaucoma was present in 4 eyes (10%) and absent in 36 eyes (90%) of our study.

The mean endothelial cell density of our population was 2150 cells/mm. Lower endothelial cell density (CD) for age was seen in 40% patients aged 50-60 years and in 60% patients aged 60-70 years. Patients above 70 years of age had cell density within the normal range for that age. The mean cell area in our study was found to be 450.93 μm2 and SD of cell area 230 μm2. Abnormal coefficient of variation (CV) was seen in 67.5% of cases indicating a high degree of polymegathism in the PEX corneas. The percentage of hexagonality (6A) was found to be low in 90% of PEX corneas (36 eyes), indicating abnormal shape of cells (pleomorphism) in 90% of PEX corneas.

Mean central corneal thickness (CCT), CD and 6A were lower in eyes with PEX glaucoma compared to eyes with PEX alone.

Table 1: Coefficient of variation of cell density (polymegathism)

Coefficient of variation (CV)	Frequency (%)
30-35	3 (7.5%)
36-40	11 (27.5%)
41-45	11 (27.5%)
46-50	8 (20%)
51-55	6 (15%)
56-60	1 (2.5%)

Table 2: Percentage of hexagonal cells (pleomorphism)

% Hexagonality (6A)	Frequency (%)
10-20	2 (5%)
20-30	7 (17.5%)
30-40	12 (30%)
40-50	15 (37.5%)
>50	4 (10%)

4. Discussion

Pseudoexfoliation syndrome is a chronic age-related systemic syndrome which targets the ocular which targets the ocular tissues through the periodic deposition of fibrillary white flaky material from the lens, on the lens capsule, corneal endothelium, ciliary body, zonules, iris and pupillary margin.[5] PEX was first described by Lindberg in 1917. In the eye, PEX materials are deposited on the lens surface, trabecular meshwork, iris, zonula, and ciliary body.[6]

Corneal endothelial changes in PEX eyes are induced by an altered composition and increased flare intensity of the aqueous humor caused by a breakdown of the blood aqueous

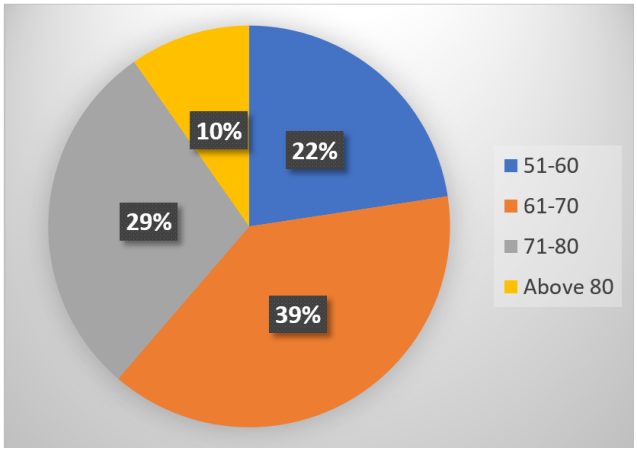

Fig. 1: Age distribution

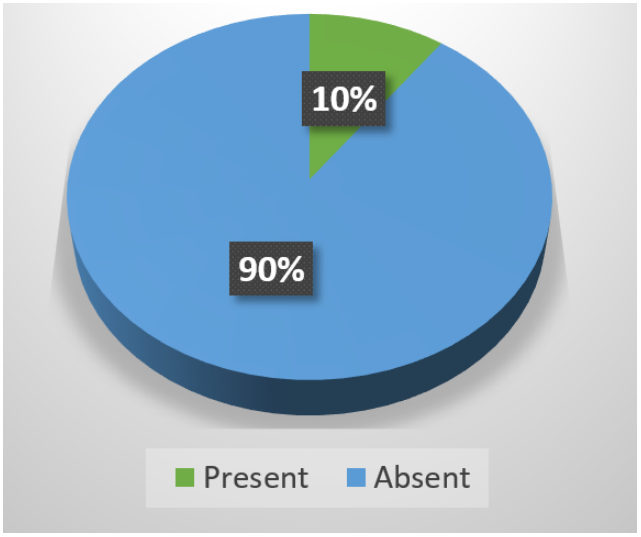

Fig. 4: PEX glaucoma

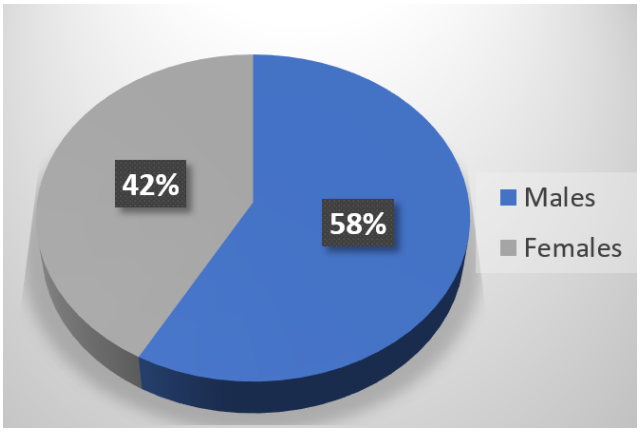

Fig. 2: Gender distribution

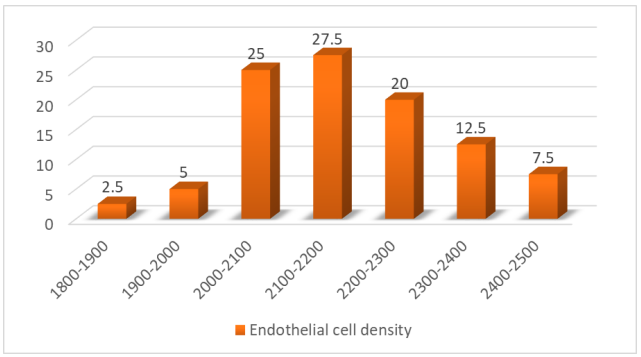

Fig. 5: Endothelial cell density

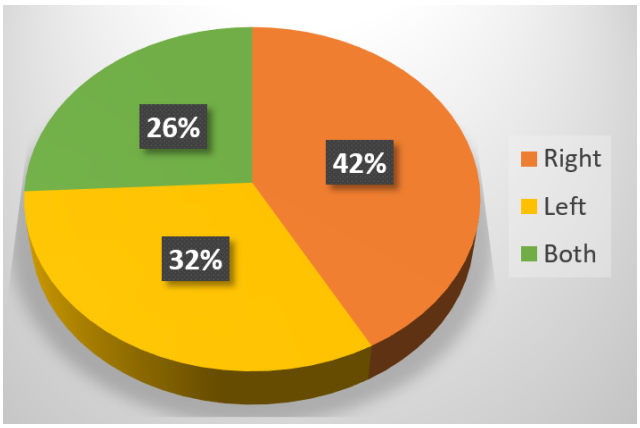

Fig. 3: Affected eye

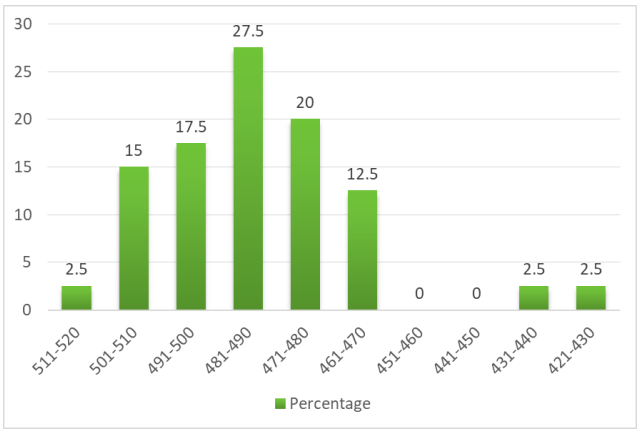

Fig. 6: Central corneal thickness

barrier and causing hypoxic changes in the cornea.[6] By electron microscopy, large clumps of typical PEX material can be found adhering to the corneal endothelium, and masses of PEX material are incorporated into the posterior Descemet membrane. These may lead to early corneal endothelial decompensation.

PEX is also a known risk factor for developing cataracts.[7] The sedimentation on cells can lead to their degeneration and, with time, produce alterations in their number and morphology. There are many studies of corneal endothelial changes in PEX eyes reporting lower endothelial cell density (CD), high coefficient of variation in cell area (CV), and a lower percentage of hexagonal cells (6A).[6]

The PEX syndrome is often found to be a cause of secondary glaucoma. The central corneal thickness (CCT) of PEX eyes in glaucoma patients was reported to be thinner than or similar to normal eyes.[6] The endothelial cell density of PEX eyes in glaucoma patients was reported lower than that of PEX eyes in patients without glaucoma or in control eyes.[6]

As patients with cataract also are at a risk for age related endothelial dysfunction, endothelial cell analysis is important for corneal function and viability assessment.

The mean age of presentation in our study was 68.5 years. 58% of our study population were males (18 patients) and 42% were females (13 patients). Right eye was involved in 13 patients (42%), left eye was involved in 10 patients (32.2%) and bilateral involvement was seen in 8 patients (25.8%).

The mean endothelial cell density of our population was 2150 cells/mm2; similar to the study by Praveen et al. where mean endothelial cell density of 2242 cells/mm2 among a similar population in India.[8] At-risk endothelial cell density (less than 2000 cells/mm2) was found in 40% patients of age 50-59 years & 60% patients aged 60-69 years; compared to the 12% reported in Japan by Ishikawa.[4]

In our study, results demonstrated that percentage of hexagonal cells was low in 90% of PEX corneas indicating high degree of pleomorphism. Abnormal CV was seen in 65% patients indicating high degree of pleomorphism and polymegathism.

However, no significant association was found between age and variability of cell size or percentage of hexagonal cells.

There was a tendency for greater cell loss and morphological abnormalities of the corneal endothelial cells and a significantly thin cornea (p-value < 0.0002) when IOP is high compared to PEX alone. This is comparable to the study done by Sarowa et al. comparing the CCT and cell density in PEX vs PEX glaucoma eyes.[9]

5. Conclusion

Our study confirms the existence of quantitative and qualitative abnormalities in corneal endothelial cells with PEX especially when IOP is high.

6. Source of Funding

None.

7. Conflict of Interest

There are no conflict of interests.

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