Comparing the morphometric properties of Pseudoexfoliation without Glaucoma versus Pseudoexfoliation with Glaucoma: An analytical study in Sub Himalayan region

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Abstract: Background: Secondary chronic open angle glaucoma associated with PEX or pseudoexfoliative glaucoma (PEXG) accounts for approximately 25% of all glaucoma and represents the most common identifiable cause of glaucoma. The aim of this study was to compare the corneal endothelial morphology and hexagonal cell ratio percentage between eyes having PEX without glaucomatous changes in comparison with patients suffering from pseudo exfoliative syndrome with glaucoma. Methodology: The present cross-sectional analytical study was conducted in the Department of Ophthalmology, Indira Gandhi Medical College, Shimla among the selected patients of pseudo exfoliation with glaucoma from July 2018 through June 2019 i.e. one year. The morphometric properties were measured by using non-contact specular microscopy (Topcon SP-1P Version 1.41) P value <0.05 was considered to be statistically significant. Results: Mean Endothelial cell density (ECD) respectively in PEX and PEXG was 2586.33±505.156 cells/mm² and 2248.50±479.91 cells/mm² (p<0.001) whereas the Mean Hexagonal Ratio (HR) was found to be 29.74 ± 9.15 % and 32.41 ± 16.44 % respectively (p=0.499).Conclusion: This research shows that in eyes with PEX syndrome, both with and without glaucoma, ECD was statistically significantly lower than in the PEX with glaucoma, which may increase the risk of corneal decompensation after intraocular surgeries.

Keywords: Comparing the morphometric without Glaucoma versus Pseudoexfoliation

INTRODUCTION

 Secondary chronic open angle glaucoma associated with PEX or pseudoexfoliative glaucoma (PEXG) accounts for approximately 25% of all glaucoma and represents the most common identifiable cause of glaucoma (Aboobakar, I. F., & Allingham, R. R. 2014; & Ritch, R. et al 2003). Compared to primary open angle glaucoma (POAG), pseudoexfoliative glaucoma (PEXG) is more severe, carries with it a higher risk of blindness, and is associated with higher mean/maximum intraocular pressures (IOPs) at diagnosis, with a wider range of fluctuations in IOP (Philip, S. S. et al 2012).

The corneal endothelium is a single layer of hexagonal cells that do not have the ability to regenerate. The normal density of corneal endothelial cells in adults is approximately 2500 cells/mm² and it is reduced by about 0.6% a year (Bourne, W. M., & McLaren, J. W. 2004). Corneal endothelial cell density (ECD) is an important factor in the evaluation of corneal health. Reduction in ECD indicates an attenuation of the corneal endothelium and may proceed to corneal edema, loss of visual acuity and painful bullous keratopathy. Counting ECD accurately and in a reproducible manner plays an important role in this evaluation. Several studies have shown the influence of PEX on the cornea, specifically the corneal endothelial cell density [ECD], with multiple studies showing decreased ECDs of patients with PEX and PEXG compare to control patients (Shi, Y. et al 2019; Kheirkhah, A. et al 2015; & Yu, Z. Y. et al 2019). About 30–50% of retinal ganglion cells may be lost before any visual fields changes are detected due to the deposition of PEX material. Some studies have reported the presence of difference in RNFL thickness measurement between the eyes with the PEX (Kozobolis, V. P. et al 2010; Taliantizis, S. et al 2009; Lim, S. H. et al 2020; Yüksel, N. et al 2007; Novak Lauš, K. et al 2017; & Pawar, N. et al 2017).

There are some studies of corneal endothelial changes in eyes having PEX syndrome reporting lower endothelial cell density and a lower percentage of hexagonal cells.14
However, there are few studies reporting any significant changes in endothelial cell density or the percentage of hexagonal cells in eyes having PEX in comparison to those having PEXG. As there is a paucity of such literature from the northern part of India, the aim of this study was to compare the corneal endothelial morphology and hexagonal cell ratio percentage between eyes having PEX without glaucomatous changes by using non-contact specular microscopy (Topcon SP-1P Version 1.41) in comparison with patients suffering from pseudo exfoliative syndrome with glaucoma.

**METHODOLOGY**

The present cross-sectional analytical study was conducted in the Department of Ophthalmology, Indira Gandhi Medical College, Shimla among the selected patients of pseudo exfoliation with glaucoma from July 2018 through June 2019 i.e. one year. All consecutive patients presenting to ophthalmology OPD and diagnosed with pseudo exfoliation with glaucoma and were willing to participate were included in the study till the completion of sample size. The rest who did not fulfil our inclusion criteria were excluded from our study. The patients were divided into 2 groups i.e PEX without glaucoma and PEX with Glaucoma. Diagnosis of pseudo exfoliation syndrome was made by the appearance of a white, dandruff like material on pupillary margin of iris, classical pattern of 3 zones or “Bulls Eye” pattern due to deposition of pseudoexfoliative material on the anterior capsule of lens, gonioscopy, fundus examination, and specular Microscopy. Specular microscopy was performed using a non-contact specular microscope. The data was entered and cleaned using Microsoft Excel Spreadsheet 2007. The data was analyzed using SPSS v22. The data was checked for normalcy. The quantitative variables were expressed as mean and standard deviation whereas the qualitative variables were expressed as frequencies and proportions. A p-value < 0.05 was considered to be statistically significant. Prior permission was taken from ethical committee of Indira Gandhi Medical College, Shimla to go ahead with the study.

**RESULTS**

There were 46 study participants of whom there were 24 males and 22 females. The mean age of patients with Pseudoexfoliation without Glaucoma and Pseudoexfoliation with Glaucoma was 68.43±9.88 years, and 66.52 ± 8.38 years respectively. (Figure 1)

The visual activity was in the range from 6/6 to FC 2/60 in the left eye as well as in the right eye. An intra ocular pressure (IOP) of less than 10 mm Hg was found in more than three-fourth of the participants while the rest had an IOP ranging from 10-20 mm, and none had an IOP of more than 21 mm Hg in the left eye, whereas an IOP of <10 mm Hg was found to be in nearly 68% of the patients, while one-third of the patients had an IOP ranging between 10-20 mg Hg whereas the rest had an IOP of >21 mm Hg in the right eye. Vertical cup disc between 0.3 -0.4 was found in 39 patients while a cup disc between 0.5 and 0.6 was found to be among the rest of the study participants (Table 1).
Table 1: Comparison of characteristics of the PEX and PEXG groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pseudo-exfoliation without Glaucoma (n,%</th>
<th>Pseudo-exfoliation with Glaucoma (n,%</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years (Mean ±SD)</td>
<td>68.43± 9.88</td>
<td>66.52±8.38</td>
<td>0.81</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>24</td>
<td>32</td>
<td>0.023</td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Intra Ocular pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Eye</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10</td>
<td>11</td>
<td>3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>10-20</td>
<td>35</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>21-25</td>
<td>0</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Right Eye</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10</td>
<td>13</td>
<td>4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>10-20</td>
<td>31</td>
<td>27</td>
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</tr>
<tr>
<td>21-25</td>
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</tbody>
</table>

Non-Contact Specular Microscope (Topcon SP-1P Version 1.41) was used to evaluate the following morphometric parameters in the corneal endothelial cells and it was found that the Mean Endothelial cell density (ECD) respectively in PEX and PEXG was 2586.33±505.156 cells/mm² and 2248.50±479.91 cells/mm² whereas the Mean Hexagonal Ratio (HR) was found to be 29.74 ± 9.15 % and 32.41 ± 16.44 % respectively. There was a significant difference in the endothelial cell density in the patients having pseudo-exfoliation without glaucoma as compared to the patients having pseudo-exfoliation with glaucoma. There was, however, no significant difference in the Hexagonal ratio between the two groups (Table 2).

**DISCUSSION**

Mean Endothelial cell density (ECD) (cells/mm²) in the patients of PEX as compared to PEXG were 2586.33±505.156 and 2248.50±479.909 respectively. In our study the difference between the mean ECD between the two groups was found to be statistically significant. The PEXG group had significantly lower mean endothelial cell densities compared with the PEX group (p<0.05).

Research presented by Inoue et al Seitz et al and Wang et al shows that the cell density of the endothelium of the PEX group (without considering glaucoma) was lower than that of the control group. Through further analysis the authors found that patients with PEX syndrome and secondary glaucoma have a lower endothelial cell density than people with PEX syndrome without glaucoma (Inoue, K. et al 2003; & Seitz, B. et al 1995).

Wali et al studied endothelial cell density of groups of patients with PEX syndrome with glaucoma and PEX without glaucoma. Their observations were consistent with the results of this study and the research published by Wang et al and Seitz et al All researchers noticed that patients with PEX glaucoma have lower endothelial cell density than those with PEX syndrome without glaucoma but these results never reached statistical significance unlike our study (Wali, U. K. et al 2008).

Mean Hexagonal Ratio (HEX)(%) in patients of PEX and PEXG was 29.74±9.15 and 32.41±16.44 respectively. In our study, the difference between the mean Hexagonal Ratio (HR) between the two groups was found to be non-significant. This finding was contrary to study done by Yu¨ ksel N et al (2007).

Most of the results of our study were similar to various other studies. However, there were some differences that may be due variation in age, ethnicity, sample size, gender and using different machines for measuring endothelial cell density and Hexagonal cell ratio.

**CONCLUSION**

This research shows that in eyes with PEX syndrome, both with and without glaucoma, ECD was statistically significantly lower than in the PEX with glaucoma, which may increase the risk of corneal decompensation after intraocular surgeries. No statistically significant difference was found between Hexagonal Cell Ratio in the group of patients with PEX syndrome and the PEXG group.

**REFERENCES**


