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Original Research Article

Comparision of central corneal thickness in pseudoexfoliation syndrome and pseudoexfoliation glaucoma

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ABSTRACT

Introduction: To measure the central corneal thickness(CCT) in patients with Pseudoexfoliation Syndrome without glaucoma (PXS) and Pseudoexfoliation Syndrome with glaucoma(PXG) using ultrasonic pachymetry and compare the two.
Materials and Methods: The study was conducted on 210 patients. 70 patients were with pseudoexfoliation syndrome, 70 were pseudoexfoliation glaucoma and 70 were healthy individuals. Central corneal thickness was measured using ultrasonic pachymetry.
Results: Central corneal thickness is significantly thinner in patients with PXG (515±22.94μm) than in patients with PXS (525±21.22μm) and control group (528±23.35μm) with p value < 0.05.
Conclusion: The study shows that corneas are thinner in patients with pseudoexfolaition glaucoma (PXG) as compared to pseudoexfoliation syndrome without glaucoma (PXS) and controls (CNT).

1. Introduction

Pseudoexfoliation syndrome is a microfibrillopathy, with strong genetic component. Single nucleotide polymorphism (SNP) of lysyl oxidase 1 gene (LOXL1) located on chromosome 15 is responsible for pseudoexfoliation syndrome and glaucoma.[1] It is characterized by the production and accumulation of extracellular fibrillary material in different tissues of the body. Characteristic whitish flake material is deposited over several ocular structures including corneal endothelium, pupillary margin, anterior lens capsule, zonules, ciliary body, trabecular meshwork. It is the most common identifiable cause for secondary open angle glaucoma.[2] Other systemic conditions associated with PXF are cardiovascular disease, cerebrovascular disease, sensorineural hearing loss, Alzheimers disease.[3]

The goldstandard for the measurement of intraocular pressure is Goldmann applanation tonometer . Thinner corneas underestimate the IOP and thicker corneas overestimate the IOP, thus a correction factor must be added to the measured IOP, when CCT deviates from the mean.[4–7] In case of deviatio n of CCT from the mean of 520μ, 0.7mmHg should be added for every 10μ.[7] Thus it can lead to underestimation of IOP in cases of pseudoexfoliation syndrome with thin corneas. Pseudoexfoliation glaucoma constitute about 30% cases of pseudoexfoliation syndrome and we may overlook early glaucomatous changes. PXG has a more rapid progression and worse prognosis compared to POAG.

The study aims to measure the CCT in patients with pseudoexfoliation syndrome(PXS) and pseudoexfoliation glaucoma(PXG) using ultrasonic pachymetry and compare the two.

2. Materials and Methods

This is a cross-sectional comparative study conducted over a period of 12 months from April 2018 to April 2019, on 210 patients attending the Department of Ophthalmology, Narayana Medical College, Nellore. The study was

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conducted after obtaining clearance from instituted ethical committee. Patients with age between 35-65 years, of either sex were included in the study. Patients with the history of ocular trauma, previous surgeries, corneal degenerations and dystrophies and glaucoma without pseudoexfoliation were excluded from the study.

Informed consent was taken from all the patients included in the study. Detailed ophthalmological examination was done, including visual acuity for distant with Snellen chart and near vision with Jaeger's chart, slit lamp examination, intraocular pressure using Goldmann applanation tonometry, gonioscopy and fundus examination.

Patients were divided into 3 groups. 70 patients with pseudoexfoliation syndrome(PXS) ; diagnosed by the presence of pseudoexfoliative material over the pupil margin before pupillary dilatation, on anterior lens capsule after pupillary dilatation, on corneal endothelium and on trabecular meshwork on gonioscopy. 70 patients with pseudoexfoliation glaucoma (PXG); diagnosed by the presence of pseudoexfoliative material over pupil margin and lens capsule, IOP more than 22mmHg, open angles on gonioscopy, typical glaucomatous cupping and visual field defects. 70 were age and sex matched healthy controls(CNT) without pseudoexfoliation syndrome and pseudoexfoliation glaucoma.

Central corneal thickness was measured for all the patients with an ultrasonic pachymeter (Pachette 2 model DGH 550). Patients were seated comfortably, local anestheticdrops were instilled in the eye. In primary gaze, the probe of the ultrasonic pachymeter was placed on the center of the cornea as such it aligns with the center of the pupil. Five consecutive readings were recorded and the average was considered as the final value.

Data has been entered into Microsoft Excel and statistical analysis was done using IBM Statistical Package for Social Sciences (SPSS Ver. 25). For continuous variables, the data values are expressed as mean $\pm$ standard deviation. To test the mean difference between three groups, ANOVA with Tukey 's post hoc test was used, $P < 0.05$ is considered significant.

3. Results

The study was conducted on 210 patients. Patients were divided into 3 groups. Group 1 consisted of 70 patients with PXS, Group 2 consisted of 70 patients with PXG and Group 3 consisted of 70 healthy controls. Group 1 had 40 males and 30 females, group 2 had 37 males and 33 females, group 3 had 39 males and 31 females. Mean age of group 1 is 63.23 $\pm$ 6.54 years, group 2 is 65.46 $\pm$ 7.63 years, group 3 is 61.42 $\pm$ 7.34 years. No significant difference is noticed between age and sex of patients in different groups. ($p > 0.1$)

Central corneal thickness of patients in Group 1 is 525 $\pm$ 21.22 μm, Group 2 is 515 $\pm$ 22.94 μm, Group 3 is 528$\pm$ 23.35 μm. Patients in Group 2 have thinner corneas compared to those with Group 1 and Group 3, the difference being statistically significant ($p<0.05$). Patients in Group 1 had thinner corneas compared to Group 3, the difference being statistically insignificant ($p=0.432$).

4. Discussion

Acccording to our study, the corneas are significantly thinner in patients with pseudoexfoliative glaucoma compared to pseudoexfoliation syndrome and controls. Pseudoexfoliation syndrome patients have thinner corneas than that of controls with no statistical significance.

Similar results are shown by several studies. Kitsos[8] and colleagues conducted a study to evaluate the CCT in patients with pseudoexfoliation syndrome, pseudoexfoliation glaucoma using ultrasound pachymetry. They concluded that the corneas are significantly thinner in patients with pseudoexfoliation glaucoma (526$\pm$34.30 μm) compared to individuals with pseudoexfolaition syndrome (550.64$\pm$39 μm) and controls (547.36$\pm$33.1 μm) $p<0.05$.

In another study conducted by Inoue and colleagues,[9] patients with pseudoexfoliation syndrome, pseudoexfoliation glaucoma and controls were included and central corneal thickness was measured in all the cases. The study concluded that the corneas are thinner in PXS (529$\pm$31μ m)compared to controls(547$\pm$28μ m) with p = 0.03. No significant difference was found between the cases of PXS with and without glaucoma.

In the study conducted by Shah[10] and colleagues, the central corneal thickness was measured in normal individuals and pseudoexfoliation glaucoma. The study concluded that the cornea is thinner in pseudoexfoliation glaucoma patients (530.7μm) compared to the normal individuals(553.9μm), with $P<0.001$.

Bechmann[11] and colleagues conducted a stud y to evaluate the CCT in different types of glaucoma using OCT. The study concluded that patients with pseudoexfolia tion glaucoma havethinner corneas(493$\pm$33 μm) compared to healthy individuals(530$\pm$ 32μm) with $p< 0.0001$. Another study conducted by Sobothka[12] and colleagues where CCT was measured using OCT in different types of glaucoma, concluded that the CCT was less in pseudoexfoliation glaucoma (507$\pm$25 μm) compared to normal individuals (524$\pm$25 μm), but was not statistically significant. Yagci[13] and colleagues conducted a study to evaluate the relation between CCT and IOP among glaucomatous eyes and normals, where CCT was measured using ultrasound pachymetry. CCT was lower in pseudoexfoliation glaucoma cases(526.28$\pm$31.73 μm) compared to normals (533.96$\pm$29.25 μm), the difference being statistically in significant. In another study conducted by Aghaian[13] and colleagues comparing CCT using ultrasonic pachymetry

Table 1: Age and gender distribution

Group	Number	Males	Females	Mean Age(yrs)
Group 1 (PXS)	70	40	30	63.23 ± 6.54
Group 2 (PXG)	70	37	33	65.46 ± 7.63
Group 3 (CNT)	70	39	31	61.42 ± 7.34

Table 2: Central corneal thickness

Group	Number of cases	CCT (μm)	F value	Overall P value
Group 1 (PXS)	70	525 ± 21.22		
Group 2 (PXG)	70	515 ± 22.94	6.439	0.002
Group 3 (CNT)	70	528 ± 23.35		

Table 3: Comparision of CCT among three groups

Groups	P value
Group 1 vs Group 2 (PXS vs PXG)	0.008*
Group 1 vs Group 3 (PXS vs CNT)	0.432
Group 2 vs Group 3 (PXG vs CNT)	0.001*

*Statistically Significant Difference (p value $<$ 0.05)

among glaucoma patients, concluded that patients with PXG have significantly thinner corneas compared to healthy individuals.

Hepsen et al,[14] concluded that the corneas are thinner in pseudoexfoliation syndrome patients (546.6± 39.6μm) compared to normals (542.9±32.2μm). the difference was not statistically significant p=0.56. Similar results have been presented by Arnarsson et al.[15] As per this study, the central corneal thickness in patients with pseudoexfoliation syndrome is 533±32μm and in controls is 527±42μm. Thus CCT is greater in PXS patients compared to controls, the difference being statistically in significant, p=0.232. As per study conducted by Acar[16] and colleagues, central corneal thickness is lower in pseudoexfoliation syndrome (540.8±30.2 μm) than in controls (551.5±28.3μm). Statistical significance was not achieved p=0.315

The study conducted by Zheng[17] and colleagues to measure cell density in different layers of cornea in eyes with pseudoexfolaition syndrome, observed the presence ofpseudo exfoliative deposits in the corneal stroma and reduced number of stromal keratocytes in eyes with pseudoexfoliation syndrome compared to those without pseudoexfoliation syndrome. They concluded that the presence of pseudoexfoliative material is responsible for inducing a poptosis of stromal keratocytes, leading to weakening of extracellular matrix; thus resulting in corneal thinning.

5. Conclusion

The study concludes that the patients with pseudoexfolaition glaucoma have thinner corneas compared to those with pseudoexfoliation syndrome and healthy individuals. Thus the intraocular pressure measurement in pseudoexfoliation syndrome patients should be correlated with central corneal thickness, as underestimation of intraocular pressure in such patients may lead to overlooking glaucoma, that has rapid progression and poor prognosis.

6. Source of funding

None.

7. Conflicts of interest

None.

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