

Original Research Article

Comparison of Pseudoexfoliation Syndrome (PXF) and Pseudoexfoliation Glaucoma (PXG) by Measuring the Central Corneal Thickness Using Ultrasonic Pachymetry

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Abstract

Objective: the main objective of the study was to compare the pseudoexfoliation syndrome (PXF) and pseudoexfoliation glaucoma (PXG) by measuring the central corneal thickness using ultrasonic pachymetry. **Material and methods:** This is an observational study conducted at ophthalmology out patient department. Patients consent form was obtained before the enrolment and patients who were aged between 30 to 70 of both male and female were included into the study. Patients who were having corneal dystrophies and degenerations, previous ocular surgeries, with the history of ocular trauma and glaucoma without pseudoexfoliation were excluded from the study. **Results:** 240 patients were evaluated in this observational study. Three groups were formed among which Group I consisted of 70 patients with PXS, Group II consisted of 70 patients with PXG and Group III consisted of 70 healthy controls. The male and female ratio of the three groups are 40/30 in group I, 37/33 in group II and 39/31 in Group III. Mean age of Group I, II and III are 63.42 ± 6.54 , 65.26 ± 7.63 and 61.12 ± 7.34 years respectively. In different groups between age and sex of patients no significant difference is noticed ($p > 0.1$). To those with Group 1 and Group 3 as a comparison Group 2 have thinner corneas, the difference being statistically significant ($p < 0.05$). As compared to Group 3 patients in Group 1 had thinner corneas and the difference being statistically insignificant ($p = 0.432$). **Conclusion:** The study shows that as compared to controls (CNT) and pseudoexfoliation syndrome without glaucoma (PXS) corneas are thinner in patients with pseudoexfoliation glaucoma (PXG).

Keywords: Pseudoexfoliation syndrome, pseudoexfoliation glaucoma, central corneal thickness, Intraocular pressure, Goldmann Applanation Tonometer

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Introduction

In the elderly population leading cause of visual impairment and blindness is still cataract, despite the decreasing number of people affected [1]. For the development of nuclear sclerosis and indication for cataract surgery an independent and additional hazard is pseudoexfoliation syndrome (PXF) if age is the main risk factor for cataract progression [2,3]. PXF syndrome is a multifactorial, environmentally influenced, age related and genetically determined of the elastic fiber structure, characterized by accumulation which generally because of excessive production of an elastotic material within a multitude of intra and extraocular tissues [4]. For this reason, with ocular and systemic manifestations, PXF is a diffuse disease.

In India 3.41% is the prevalence of PEX which also increases with age, for conversion to glaucoma a significant factor is baseline ocular hypertension (OHT) [5]. Grodum et al reported that after the mean of 8.7 years follow-up as compare to control patients (27 of 98 patients, 27.6%) matched for age, sex, and intraocular pressure (IOP) without PEX glaucoma conversion rate was twice as high in patients with OHT and PEX (54 of 98 patients, 55.1%) [6]. Though various sources of error may affect the accuracy of measurements, accurate IOP measurement is an important factor in

the diagnosis and management of glaucoma. IOP readings is effected by the Central corneal thickness (CCT) [7].

For measuring IOP "gold standard" is the Goldmann applanation tonometer (GAT) [6]. From 10-20 mmHg the normal IOP varies from 490-560 μ m central corneal thickness (CCT) varies. However for detecting glaucoma IOP alone is not an accurate test as documented in various studies [7]. About 30% cases of pseudoexfoliation syndrome constitute of pseudoexfoliation glaucoma and we may overlook early glaucomatous changes. Compared to POAG, PXG has worse prognosis and a more rapid progression. Thus the main objective of the study was to compare the pseudoexfoliation syndrome (PXF) and pseudoexfoliation glaucoma (PXG) by measuring the central corneal thickness using ultrasonic pachymetry.

Materials and Method

This is an observational study conducted at ophthalmology out patient department. Patients consent form was obtained before the enrolment and patients who were aged between 30 to 70 of both male and female were included into the study. Patients who were having corneal dystrophies and degenerations, previous ocular surgeries, with the history of ocular trauma and glaucoma without pseudoexfoliation were excluded from the study. Before the initiation of the study Detailed ophthalmological examination like intraocular pressure using Goldmann applanation tonometry, slit lamp examination, gonioscopy and fundus examination, visual acuity for distant with Snellen chart and near vision with Jaeger's chart was done. 85 patients were diagnosed with pseudoexfoliation syndrome (PXS) by on anterior lens capsule after pupillary dilatation, over the pupil margin before pupillary dilatation, trabecular meshwork on gonioscopy and on corneal endothelium. 85 patients were diagnosed with pseudoexfoliation glaucoma (PXG) by pseudoexfoliative

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material over pupil margin and lens capsule, typical glaucomatous cupping and visual field defects, open angles on gonioscopy, IOP more than 22mmHg. 85 patients without any pseudoexfoliation glaucoma and pseudoexfoliation syndrome were identified as healthy controls(CNT). With an ultrasonic pachymeter for all the patients Central corneal thickness was measured. After instilled of local anesthetic drops, on the center of the cornea probe of the ultrasonic pachymeter was placed as such it aligns with the center of the pupil. Average of five consecutive readings were considered as final figure. Study related data were tabulated in an excel sheet for the proper arrangement of the data and later the statistical software like IBM Statistical Package for Social Sciences (SPSS Ver. 25) were used to calculate the statistical analysis. mean \pm standard deviation were used

to express the mean data value of continuous variables. $P < 0.05$ was considered as statistical significant.

Result

240 patients were evaluated in this observational study. Three groups were formed among which Group I consisted of 70 patients with PXS, Group II consisted of 70 patients with PXG and Group III consisted of 70 healthy controls. The male and female ratio of the three groups are 40/30 in group I, 37/33 in group II and 39/31 in Group III. Mean age of Group I, II and III are 63.42 ± 6.54 , 65.26 ± 7.63 and 61.12 ± 7.34 years respectively (Table 1). In different groups between age and sex of patients no significant difference is noticed ($p > 0.1$) (Table1).

Table 1: Age and gender distribution

Group	Number	Males	Females	Mean Age(yrs)
Group 1 (PXF)	70	40	30	63.42 ± 6.54
Group 2 (PXG)	70	47	33	65.26 ± 7.63
Group 3 (CNT)	70	39	31	61.12 ± 7.34

Central corneal thickness (CCT) of Group I, II and III were 524 ± 20.41 , 516 ± 21.72 and 527 ± 22.86 μm respectively (Table 2).

Table 2: Central corneal thickness

Group	Number	CCT (μm)	F value	Overall P value	IOP(mmHg)	Overall P value
Group 1 (PXF)	70	524 ± 20.41	7.314	0.002	15.6 ± 1.8	0.0001
Group 2 (PXG)	70	516 ± 21.72			23.7 ± 4.7	
Group 3 (CNT)	70	527 ± 22.86			29.5 ± 7.6	

To those with Group 1 and Group 3 as a comparison Group 2 have thinner corneas, the difference being statistically significant ($p < 0.05$) (table 3). As compared to Group 3 patients in Group 1 had thinner

corneas and the difference being statistically insignificant ($p = 0.432$) (Table3).

Table 3: Comparison of CCT among three groups

Groups	P value
Group 1 vs Group 2 (PXS vs PXG)	< 0.05
Group 1 vs Group 3 (PXS vs CNT)	0.432
Group 2 vs Group 3 (PXG vs CNT)	< 0.05

Discussion:

Characteristic changes of the lens, iris, ciliary body, corneal endothelium, trabecular meshwork zonules and structures of blood-aqueous barrier may lead because of local production and deposition of pseudoexfoliative fibers [8-10]. Most significant risk factors for surgical complications were mainly because of significant risk factor like poor pupillary dilation, zonular weakness and pathological manifestations of pseudoexfoliation. According to our study, compared to pseudoexfoliation syndrome and controls, in patients with pseudoexfoliative glaucoma the corneas are significantly thinner. Than that of controls thinner corneas were seen in pseudoexfoliation syndrome patients with no statistical significance. In past several studies and researchers were concluded with similar results. Kitsos and colleagues [11] conducted a study by using ultrasound pachymetry to evaluate the CCT in patients with pseudoexfoliation glaucoma or pseudoexfoliation syndrome. In our study Central corneal thickness (CCT) of Group I, II and III were 524 ± 20.41 , 516 ± 21.72 and 527 ± 22.86 μm respectively. Inoue and colleagues [12] concluded in a study compared to controls (547 ± 28 μm , with $p = 0.03$) corneas are thinner in PXS (529 ± 31 μm) among patients with pseudoexfoliation syndrome, pseudoexfoliation glaucoma and controls. Between the cases of PXS with and without glaucoma, no significant difference was found. In normal individuals and pseudoexfoliation glaucoma central corneal thickness was measured in the study conducted by Shah and colleagues [13]. The study concluded that compared to the normal individuals (553.9 μm) cornea is thinner in pseudoexfoliation glaucoma patients (530.7 μm), with $P < 0.001$.

CCT in different types of glaucoma using OCT were evaluated by Bechmann et al [14]. The study concluded that compared to healthy individuals (530 ± 32 μm) patients with pseudoexfoliation glaucoma have thinner corneas (493 ± 33 μm) with $p < 0.0001$. By using OCT in different types of glaucoma CCT was measured in a study conducted by Sobothka et al [15]. This study concluded that compared to normal individuals (524 ± 25 μm) CCT was less in pseudoexfoliation glaucoma (507 ± 25 μm) but was not statistically significant. Among glaucomatous eyes and normals the relation between CCT and IOP were evaluated by a study done by Yagci et al [16], where CCT was measured using ultrasound pachymetry. This study reveals compared to normals (533.96 ± 29.25 μm) CCT was lower in pseudoexfoliation glaucoma cases (526.28 ± 31.73 μm), the difference being statistically significant. The current study also concluded with the result that those with Group 1 and Group 3 as a comparison Group 2 have thinner corneas, the difference being statistically significant ($p < 0.05$). As compared to Group 3 patients in Group 1 had thinner corneas and the difference being statistically insignificant ($p = 0.432$). CCT in PXG patients is thinner compared to the control Group as concluded in this current study which were also in line with the previous few studies [17-19]. Few researcher were using an ultrasonic pachymeter where as others were using optical coherence tomography. The small sample size and observational method were the main limitation of this study. But the sample size were enough to draw a statistical conclusion. This study also demand a need of randomised trial with proper randomisation to further strong establishment of the conclusion observed in this study.

Conclusion

The study shows that as compare to controls (CNT) and pseudoexfoliation syndrome without glaucoma (PXS) corneas are thinner in patients with pseudoexfoliation glaucoma (PXG). Thus in pseudoexfoliation syndrome patients the intraocular pressure measurement should be correlated with CCT, overlooking glaucoma may because of as underestimation of intraocular pressure in such patients, which has poor prognosis and rapid progression.

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