ORIGINAL ARTICLES

COMPARISON OF CENTRAL CORNEAL THICKNESS IN PSEUDOEXFOLIATION GLAUCOMA PATIENTS WITH HEALTHY ADULTS

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ABSTRACT

Objective: To compare the central corneal thickness (CCT) in pseudoexfoliation glaucoma (PXG)patients with healthy adults.

Study Design: Cross-sectional comparative study.

Place and Duration of Study: Armed Forces Institute of Ophthalmology Rawalpindi, from Dec 2009 to Feb 2011.

Material and Methods: 30 patients having PXG (Group A) and 30 healthy adults having normal intraocular pressure (Group B) were included in the study. Intraocular pressure (IOP) in both groups was measured using gauged Goldmann applanation tonometer (GAT).Central corneal thickness (CCT) was measured with an ultrasonic pachymeter.

Results: The comparison of Mean CCT in both Groups showed that Mean CCT was significantly lesser (*p*-value <0.05) in PXG Group (519.73 µm) as compared to healthy adults Group (567.48 µm).

Conclusion: CCT in PXG patients group was found to be statistically significantly thinner as compared to healthy adults Group. CCT must be assessed in patients with pseudoexfoliation syndrome (PXF) in order to avoid the underestimation of IOP.

Keywords: Central corneal thickness (CCT), Goldmann Applanation Tonometer (GAT), Intraocular pressure (IOP), Pseudoexfoliation glaucoma (PXG), Pseudoexfoliation syndrome (PXF).

INTRODUCTION

Glaucoma is the second most common cause of irreversible blindness worldwide[1]. Early diagnosis and treatment are important factors in controlling the disease progression[2]. In Pakistan glaucoma accounts for 7.1% cases of blindness[3]. Pseudoexfoliation glaucoma (PXG) is the most common secondary open-angle glaucoma encountered by ophthalmologists worldwide[4]. Measuring intraocular pressure is the most important factor to check disease progression[5]. Goldmann applanation tonometer (GAT) is the "gold standard" for measuring IOP[6]. The normal IOP varies from 10-20 mmHg and central corneal thickness (CCT) from 490-560 µm[6] . However studies have shown that IOP alone is not an accurate test for detecting glaucoma[2]. CCT has to be considered when measuring IOP[2]. Thin corneas lead to an underestimation and thick corneas to an overestimation of IOP[6]. This underestimation of IOP can lead to missed diagnosis. Therefore evaluation of CCT in subjects with PXF is essential. No data was found on the estimation of CCT in this type of glaucoma in our country, thus mandating the need for such a study in Pakistani population.

MATERIAL AND METHODS

A cross sectional comparative study carried out at Armed Forces Institute of Ophthalmology, Rawalpindi from Dec 2009 to Feb 2011. Inclusion criteria for PXG patients (Group A) was age between 20-65 years, untreated IOP more than 22 mmHg on at least two diurnal curves, open anterior chamber angle, glaucomatous optic disc, at least three Humphrey visual field tests with glaucomatous defects and presence of typical pseudoexfoliative material at the anterior

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lens capsule and/or at the pupillary margin. Inclusion criteria for healthy adults (Group B) included age between 20-65 years, no evidence of pseudoexfoliative material at the anterior lens capsule and/or at the pupillary margin, IOP less than 21 mmHg at three different successive measurements, open angle, normal optic disc and Humphrey visual field tests and no family history of glaucoma. Subjects with ocular disease other than glaucoma, contact lens users, patients who had undergone ocular surgery or laser photocoagulation treatment and subjects with myopia or hypermetropia greater than 3D or astigmatism more than 1D that can potentially effect measurements were excluded from study. Thirty patients in PXG group (Group A) and 30 healthy adults having normal IOP (Group B) were included in study through non probability consecutive sampling. Patients were taken from outpatient department. After informed consent, all patients underwent a comprehensive ophthalmic assessment consisting of history regarding refractive errors, glaucoma, use of topical steroids, use of contact lenses, history

their Mean was noted. Prophylactic topical antibiotic was instilled into the eyes at the end of the procedure.

Central corneal thickness was measured with an ultrasonic pachymeter (Reichert IOPac USA - angled probe). The same pachymeter was used every time for all the cases. The ultrasound pachymeter was calibrated at the beginning of each day according to the manufacturer's instructions. The central corneal readings were obtained with the eye in primary position of gaze. After anaesthetizing the cornea with proparacaine hydrochloride 0.5% drops,

each subject was asked to blink before measuring central corneal thickness to avoid any error because of corneal drying. The ultrasonic probe was positioned in perpendicular position taking the center of the pupil as a reference point and five measurements were taken. The Mean of five central corneal thickness readings was used for analysis. The ultrasound probe and the specular cone were sterilized with spirit swab after use on each subject. All readings were taken in a very calm and comfortable environment. The

Table 1 : Showing descriptive statistics for age of patients.

Age (yrs)	N	Minimum	Maximum	Mean	Std. Deviation
Group A	30	40	65	58.43	5.27
Group B	30	23	64	42.90	10.06

Table-2 : Showing descriptive statistics of CCT in both groups along with comparison.

CCT (μm)	N	Minimum	Maximum	Mean	Std Deviation	Std. Error Mean	p-value
Group A	60	451	552	519.73	24.15	3.11	< 0.001
Group B	60	512	618	567.48	26.35	3.40	

of refractive surgery or laser. Best corrected visual acuity was obtained followed by slit lamp examination. After anesthetizing the eye with topical proparacaine 0.5% and using the fluorescein strips 2%, IOP in both eyes was measured using gauged Goldmann applanation tonometer. The same Goldmann applanation tonometer was used every time for IOP measurement. All readings were taken between 0900-1200 hrs to eliminate the effect of diurnal variation[2]. Three consecutive readings were taken and

central corneal thickness and tonometric values (IOP) were recorded on a proforma containing the patient's identity and all the necessary details required for the study. Measurement of IOP and CCT was done by the same person for all the cases to eliminate bias. Data had been analyzed in the SPSS version 19. Descriptive statistics were used to describe the results. Independent sample t-test was applied to compare the Mean difference of CCT between Group A and group B. p-value of < 0.05 was taken as significant.

RESULTS

The Mean age of patients in Group 'A' was 58.43 years (SD=5.27) with an age range of 40 to 65 years, whereas in Group 'B' the Mean age was 42.90 years (SD=10.06) years with an age range of 23 to 64 years (table-1). There were 17(56.67%) male and 13(43.33%) female patients in Group 'A', whereas 16 (53.33%) male and 14 (46.67%) female healthy adults in Group 'B'. Mean CCT in Group 'A' was 519.73 µm (SD=24.15) with CCT range of 451 to 552 µm, whereas the Mean CCT in Group 'B' was 567.48 µm (SD= 26.35) with CCT range of 512 to 618 µm (Table-2). The overall Mean IOP in Group 'A' was 26.63 mmHg (SD=3.40) with an IOP range of 22 to 36 mmHg and the overall Mean IOP in Group 'B' was 14.93 mmHg (SD= 2.45) with an IOP range of 10 to 20 mmHg.

The comparison of mean CCT in both Groups showed that Mean CCT in Group 'A' (519.73µm) was significantly lesser (*p*-value <0.05) compared to Group 'B' (567.48 µm) as given in table-2.

DISCUSSION

It is a known fact that central corneal thickness affects IOP measurement using Goldmann applanation tonometry[7]. The effect of central corneal thickness on measuring IOP was first described by Goldmann[7]. He found out that when a force of 10 grams is applied to the tonometer tip which has a diameter of 3.06 mm, it is equal to an intraocular pressure of 10 mm Hg. But this fact is only true if central corneal thickness is taken to be 520 µm and causes an over or under estimation of IOP with varied central corneal thickness among population[8]. Whitacre et al found out a corrective factor of 0.18 to 0.23 mm Hg for every 10 µm variation in CCT[9]. The Rotterdam study also concluded the same results (corrective factor of 0.19 mm Hg per 10 µm difference in CCT)[10].

In our study ultrasonic pachymetry was employed to measure the central corneal thickness in subjects. Corneal anaesthesia is required to do ultrasonic pachymetry[11]. Readings obtained with ultrasound pachymetry have been found to have good reproducibility in previous studies[12,13]. Five consecutive measurements were taken at the center of the cornea of eye and their mean was taken for analysis as proposed by Colin et al in their study to obtain the accurate central corneal thickness[14]. There is diurnal variation in corneal thickness[15]. Harper et al also observed that central corneal thickness varies during the day[16]. However it does not appear to vary significantly during working hours[17]. Similarly IOP also shows diurnal variation as discussed previously[2]. To avoid the effects of diurnal variation, the measurements in our study were taken between 0900-1200 hrs.

Our study, like some previous studies[18-20] has shown that CCT in PXG patients is thinner compared to the control Group. Aghaian and colleagues[18] concluded the same results using an ultrasonic pachymeter whereas Bechmann and colleagues[19] concluded the same results using optical coherence tomography.The main sufferers here are those patients who have thin corneas and their IOP measurements taken by GAT are in higher teens. These patients can be easily diagnosed as having PXG if the CCT corrective factor is incorporated into IOP measurements because this will take the IOP reading out of normal limits and helps in the timely diagnosis of the disease at an earlier stage. People with undiagnosed PXG and thinner corneas owing to under estimation of IOP presents a challenge regarding diagnosis of the disease because one of the most important diagnostic factors in the development of glaucoma i.e. IOP becomes questionable when CCT corrective factor is not incorporated into IOP readings and because of this disease tends to progress unchecked leading to extensive irreversible glaucomatous damage.

CONCLUSION

Concluding our study shows that CCT in PXG patients was statistically significantly thinner as compared to the CCT of healthy adults group. CCT must be assessed in patients with PXF in order to avoid underestimation of IOP. The aim is timely diagnosis of the disease

at an initial stage and to start anti glaucoma therapy, thereby preventing considerable irreversible visual damage.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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