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ORIGINAL ARTICLE

Association of Central Corneal Thickness with Intraocular Pressure

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ABSTRACT

Background: Estimation of central corneal thickness is very important in the patients of glaucoma as it affects the intraocular pressure. Many studies have been done worldwide to find out the association of corneal thickness with the IOP but results are controversial. So the aim of current study was to find out the association of central corneal thickness with the intraocular pressure.

Material and Methods: A cross sectional study was conducted in the outpatient department of ophthalmology, Kosher Fazal Teaching Hospital, Lahore during January 2022 to June 2022. Topical Proparacaine 0.5% was used to anesthetize the eye while 2% flourescene was applied to stain the cornea. IOP was measured by using Goldmann applanation tonometer while CCT was measured by ultrasonic pachymeter. Data was analyzed by using Statistical Package for Social Science (SPSS) version-20. Pearson correlation was used to find out the association of IOP with CCT. p-value of less than 0.05 was considered as significant.

Results: Mean and standard deviation of age was 37.5 ± 4.9 with the range of 20 years up to 50 years. the central corneal thickness (CCT) of right eye was 531 ± 32.1 while that of left eye was 539 ± 30.9. The intraocular pressure (IOP) of right eye was 15.3 ± 2.7 and left eye was 15.9 ± 3.4. Pearson correlation coefficient found a strong significant association between central corneal thickness and intraocular pressure in both eyes with p-value ≤0.05.

Conclusion: It can be concluded that central corneal thickness is significantly associated with intraocular pressure so there is a need to modify the protocol by adding measurement of central corneal thickness before measuring intraocular pressure.

Keywords: Central corneal thickness, Intraocular pressure, Glaucoma

INTRODUCTION

Intraocular pressure (IOP) is a pressure which exerted by the fluid inside the eye. It is required to support the eye ball and maintain its optical properties [1, 2]. The normal value of IOP is 11-21 mmHg [3]. During eye examination, measurement of intraocular pressure is the key point of examination [4]. The gold standard method for measuring intraocular pressure is Goldmann applanation tonometry, commonly used worldwide [5]. The value of IOP varies with the corneal thickness, the normal range of IOP (11-21 mmHg) is at the corneal thickness of not more than 520µm [6-8].

Cornea is the part of outer most fibrous layer of the eye ball with no vascular supply. It is a curved transparent part that transmit the light rays and refract them. Just behind the cornea the aqueous humor is freely circulate in the anterior and posterior chamber of eye and maintains the IOP [9, 10]. The thickness of corneas varies from one side to the other side, it is estimated that on the vertical and horizontal plane the values are 10.6mm and 11.7mm respectively while posteriorly it is concave with thickness of 0.5-0.6mm at the center and 1.0mm at the periphery. Anteriorly the radius of curvature is 7.8mm and posteriorly it is 6.5mm. the most central part of cornea is spherical having diameter of 4mm [11, 12]. Pachymeter is used to measure the central corneal thickness (CCT), in which ultrasonic waves are used to estimate the corneal thickness at any point throughout the cornea, this procedure is termed as Pachymetry [12]. Besides pachymetry, there are some methods as well to measure CCT like optical coherence tomography (OCT) or magnetic resonance imaging (MRI) [13].

Estimation of CCT is very important in the patients of glaucoma as it affects the IOP. If the value of CCT is more than 520µm then there will be error in measuring IOP as the cornea becomes rigid with increased central corneal thickness which exerts a high power during applanation tonometry so the tonometer read this increased power as an increased IOP which is actually not increased [7]. Many studies have been done worldwide to find out the association of corneal thickness with the IOP but results are controversial. So the aim of current study was to find out the association of central corneal thickness with the intraocular pressure.

METHODOLOGY

A cross sectional study was conducted in the outpatient department of ophthalmology, Kosher Fazal Teaching Hospital, Lahore during January 2022 to June 2022. All the patients were included in the study who presented with the complaint of decreased vision with the age of 20 years to 60 years. those patients were excluded who were having any corneal disease like ulcer, abcess, degeneration, opacity, ectasia, astigmatism ≥3 diopters, surgery for refractive errors, glaucoma and also the patients who were taking either corticosteroid therapy or any drug that lowers the IOP or the patient having any systematic illness like diabetes, hypertension. Non-probability consecutive sampling technique was done.

An informed consent was taken from the patients before starting the study. A self-designed proforma was used consisting of demographic variables like age, gender and CCT measurement and IOP readings. Topical Proparacaine 0.5% was used to anesthetize the eye while 2% flourescene was applied to stain the cornea. IOP was measured by using Goldmann applanation tonometer while CCT was measured by ultrasonic pachymeter. Topical Proparacaine 0.5% was used to anesthetize the eye then fixed the eye on the distant object and probe was placed centrally over the cornea, five readings were noted with a gap of three minutes and mean of them was finally noted for analysis.

Data was analyzed by using Statistical Package for Social Science (SPSS) version-20. Qualitative variable like gender was presented in frequency and percentage while mean with standard deviation (SD) were used for numerical variables including age, CCT and IOP. Pearson correlation was used to find out the association of IOP with CCT. p-value of less than 0.05 was considered as significant at the confidence interval (CI) of 95%.

RESULTS

About 600 patient's data was analyzed for the study. Almost equal number of males and females were included in the study, the males were 52% while females were 48%. Mean and standard deviation of age was 37.5 ± 4.9 with the range of 20 years up to 50 years. the central corneal thickness (CCT) of right eye was 531 ± 32.1 while that of left eye was 539 ± 30.9, having range of 468 µm

to 587 µm and 473 µm to 591 µm respectively. The intraocular pressure (IOP) of right eye was 15.3 ± 2.7 and left eye was 15.9 ± 3.4 with the range of 9 mmHg to 22 mmHg and 10 mmHg to 21 mmHg respectively as presented in Table 1.

Pearson correlation coefficient was calculated and it found a strong significant association between central corneal thickness and intraocular pressure in both eyes with p-value ≤0.05 as mentioned in Table 1.

Table 1: Characteristics of study participants

Variables	Mean ± SD	p-value
Age	37.5 ± 4.9	0.782
Right eye		
CCT (µm)	531 ± 32.1	0.007
IOP (mmHg)	15.3 ± 2.7	
Left eye		
CCT (µm)	539 ± 30.9	0.001
IOP (mmHg)	15.9 ± 3.4	

DISCUSSION

Intraocular pressure is an important factor in ocular hypertension and glaucoma which needs proper follow-up visits. Dueker et.al. was the first to establish the relation of CCT with ocular hypertension in the patients of glaucoma [14]. After that, Brand et.al, performed a cross sectional study in 1301 patients of ocular hypertension, to find out the association of CCT with race. He reported that Caucasians had higher value of CCT than African-Americans that was 573 µm and 555 µm respectively. During the measurement of IOP by applanation tonometry, he noticed the association of CCT with IOP. So he concluded that CCT is the major factor in increasing the IOP which leads to glaucoma, resulting in visual loss. The study limitation was that those patients were included who already had IOP more than 24mmHg, instead of screening the IOP and CCT measurement in normal individual [15].

Current study found a strong significant association between CCT and IOP. One of the study done by La Rosa compared the cases of glaucoma with the control healthy population and found that central corneal thickness was significantly associated with the glaucoma but in this study IOP might be misinterpreted because of the thinner CCT of African-Americans. La Rosa In his study emphasized that CCT measurement should be the mandatory step when measuring IOP or in suspected glaucoma cases [16]. Some of the studies oppose this finding and reported that there is no need of measuring CCT in glaucoma patient as it has a poor correlation [3, 17, 18].

There is a lack of research data to include pachymetry for CCT measurements in patients who presented with raised IOP. The American academy of ophthalmology, changed the protocol by adding CCT measurement by pachymetry in suspected and confirmed cases of glaucoma with raised IOP [19].

CONCLUSION

It can be concluded that central corneal thickness is significantly associated with intraocular pressure so there is a need to modify the protocol by adding measurement of central corneal thickness before measuring intraocular pressure.

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