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Research Article

A COMPARATIVE STUDY OF CORRELATION BETWEEN CENTRAL CORNEAL THICKNESS AND INTRAOCULAR PRESSURE IN PRIMARY OPEN-ANGLE GLAUCOMA WITH HEALTHY CONTROL SUBJECTS

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ABSTRACT

Objective: The objective of the study is to compare the central corneal thickness (CCT) of primary open-angle glaucoma (POAG) patients with healthy subjects.

Methods: A prospective, hospital-based, cross-sectional study conducted on total 100 consecutive subjects of age 40–60 years, 50 subjects of POAG, and 50 healthy controls presenting to the eye OPD in study period August 2021 to July 2022, at Department of Ophthalmology, Sardar Patel Medical College and Associated Group of Hospital, Bikaner, Rajasthan.

Results: Mean age was 49.56±7.17 years in Group A and 52.36±7.86 years in Group B ($p>0.05$). 40% had 6/9 vision followed by 34% had 6/6 vision in Group A and 44% had 6/9 vision followed by 40% 6/12 vision in Group B ($p<0.05$). All cases in Group A had intraocular pressure (IOP) of 10–20 mmHg and 60% had IOP of 21.1–25.0 mmHg. ($p<0.05$). Mean CCT was 545.2±38.51 µm in Group A and 519.35±40.52 µm in Group B ($p<0.05$).

Conclusion: Patients with thin corneas are more likely to develop POAG.

Keywords: Primary open-angle glaucoma, Central corneal thickness, Intraocular pressure.

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INTRODUCTION

The most prevalent kind of glaucoma, known as primary open-angle glaucoma (POAG), affects 85–90% of cases in affluent nations [1]. Basic open-angle glaucoma's basic etiology is unknown, but various risk factors have been linked to the disease's onset [2]. Age, race, a first-degree relative with a positive family history, genetic studies that have been successful in locating glaucoma genes, decreased ocular perfusion pressure, and decreased central corneal thickness (CCT) have all been identified as independent risk factors for the development of POAG [3].

Elevated intraocular pressure (IOP) is among the most significant risk factors for POAG. Measurement of IOP is one of the most important and frequently carried out tests in ophthalmology. The Goldmann Applanation Tonometer (GAT), which measures IOP, has earned this distinction. The CCT is known to have an impact on IOP measurement [4,5]. Thinner CCT was identified by the OHTS as one of the risk variables for OHT to develop into POAG, which was found to be a strong predictor of glaucoma [4]. The measurement of IOP is influenced by the CCT, with bigger corneas providing incorrectly higher readings and thinner corneas producing falsely lower results [6]. The global target of the World Health Organization in Vision 2020 is to reduce blindness prevalence to <0.5% in all countries or <1% in any community [7].

IOP is consequently primarily of relevance because of its link to glaucoma. IOP, the sole directly modifiable risk factor and acknowledged as the primary determinant in the progression of glaucoma in glaucoma patients, is known to be influenced by CCT. There are now some statistics on the mean CCT for glaucoma patients, but there are none for persons who are not glaucomatous. To accurately quantify IOP and treat patients seen in the eye clinic, this study set out to estimate the mean CCT in both POAG and non-glaucoma patients.

Early diagnosis and treatment of glaucoma patients and those with ocular hypertension who are at a high risk of developing vision loss may lessen both the personal and social financial consequences of the disease for each patient. In patients with ocular hypertension, CCT is a potent predictor of the development of glaucoma, and a thinner CCT has been linked to more advanced glaucoma. The purpose of the study is to evaluate the relationship between CCT and IOP in healthy persons and POAG patients.

Aim

The aim of the study is to compare the CCT of POAG patients with healthy subjects.

METHODS

This prospective, hospital-based, cross-sectional study was conducted on total 100 consecutive subjects of age 40–60 years, 50 subjects of POAG, and 50 healthy controls presenting to the eye OPD in study period August 2021 to July 2022, at Department of Ophthalmology, tertiary care center. POAG-diagnosed patients, age between 40 and 60-year age, and willing to participate were included in the study. Patients with angle closure on gonioscopy, those already on glaucoma treatment, patients who have undergone glaucoma surgery/refractive surgery/cataract surgery, patients with secondary causes for open-angle glaucoma, such as pseudoexfoliation (exfoliation syndrome), pigment dispersion, and traumatic angle recession, and patients not given informed consent for ophthalmic examination were excluded from the study.

After obtaining permission from the institutional research board and informed consent of study participants, detailed ocular, systemic, and family history was taken. The visual acuity (best-corrected visual acuity) was recorded, slit lamp examination was performed to rule

out any corneal/anterior segment pathology including infection and inflammation. On examination, POAG suspects were patients with open anterior chamber angles on gonioscopy, with consistently elevated IOP (>21 mmHg) associated with a glaucomatous optic disc, and glaucomatous visual field defects (Automated Perimetry–Octopus 301 Field Analyser using HFA standard analysis).

CCT was measured with ultrasonic pachymeter and average of five measurements was taken as the final reading to be used in analysis. We used ultrasound pachymetry for measuring CCT as it has the least inter and intraobserver variability as compared to optical pachymetry. IOP was measured in both eyes using calibrated GAT after anesthetizing the eye with topical proparacaine 0.5% and using 2% fluorescein strips.

Data collection and analysis

Data thus collected were entered into Microsoft Excel sheet. Statistical analyses were performed using the Epi info software (CDC, USA). Results were analyzed as tables, proportions in the case of qualitative data, and mean and standard deviation in case of quantitative data. A p<0.05 was considered to be statistically significant. For qualitative data, Chi-square test was applied and for quantitative data, students t-test was applied.

RESULTS

Maximum proportion of our study population belonged to 40–50-year age group 27 (54%) in Group A whereas 56% in 51–60-year age group in Group B. Mean age was 49.56±7.17 years in Group A and 52.36±7.86 years in Group B. (p>0.05). 52% were male in Group A and in Group B, equal distribution between male and female was observed. 58% were urban in Group A whereas in Group B, maximum 52% were urban (Table 1).

40% had 6/9 vision followed by 34% had 6/6 vision in Group A and 44% had 6/9 vision followed by 40% 6/12 vision in Group B (p<0.05) (Fig. 1).

All cases in Group A had cup–disc ratio of 0.3–0.4 whereas in Group B, maximum 40% had cup–disc ratio of 0.51–0.60 (p<0.05) (Table 2).

All cases in Group A had IOP of 10–20 mmHg. In Group B, maximum 60% had IOP of 21.1–25.0 mmHg whereas minimum 40% had 25.1–30.0. Mean age of study population was 16.0±4.0 mmHg in Group A whereas 25.0±3.0 mmHg in Group B and the difference between both groups was significant (p<0.05) (Table 3).

In Group A, maximum 62% had CCT 501–550 µm whereas minimum 2% had 601–650 µm. In Group B, maximum 60% had CCT 450–500µm whereas minimum 2% had 601–650 µm. Mean CCT of study population was 545.2±38.51 µm in Group A whereas 519.35±40.52 µm in Group B and the difference between both groups was significant (p<0.05) (Table 4).

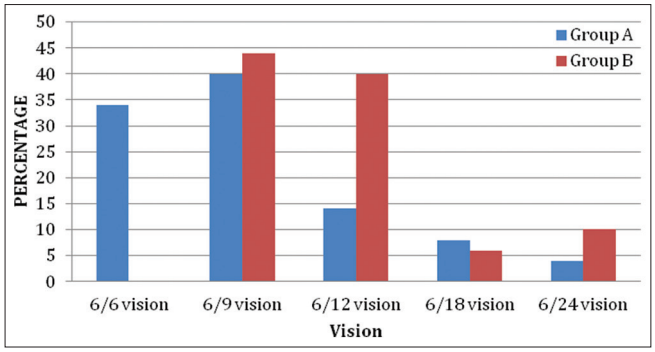

Fig. :1:. Distribution of study population according to visual acuity

DISCUSSION

In this study, maximum proportion of this study population belonged to 40–50-year age group 27 (54%) in Group A whereas 56% in 51–60-year age group in Group B. Mean age of study population was 49.56±7.17 years in Group A whereas 52.36±7.86 years in Group B and the difference between both groups was insignificant. Similarly, Mbatuegwu *et al.* [8] in their study on 422 subjects found that mean age was 40.34±14.4 years. As POAG is mainly develops after 40 years of age, that's why, the similar mean age was observed in different studies in different sociodemographic areas.

Table 1: Sociodemography of study subjects

Socio demographic	Group A		Group B		p-value
	No.	%	No.	%	
Age					
40–50 years	27	54.0	22	44.0	0.66
51–60 years	23	46.0	28	56.0	
Sex					
Male	26	52.0	25	50.0	1.000
Female	24	48.0	25	50.0	
Residence					
Rural	21	42.0	24	48.0	0.688
Urban	29	58.0	26	52.0	

Table 2: Distribution of study subjects according to cup–disc ratio

Cup–disc ratio	Group A		Group B		p-value
	No.	%	No.	%	
0.3–0.4	50	100.0	0	0.0	0.0001*
0.41–0.50	0	0.0	12	24.0	
0.51–0.60	0	0.0	20	40.0	
0.61–0.70	0	0.0	18	36.0	
0.71–0.80	0	0.0	0	0.0	
>0.80	0	0.0	0	0.0	
Total	50	100.0	50	100.0	

Table 3: Distribution of study population according to intraocular pressure

IOP (mmHg)	Group A		Group B	
	No.	%	No.	%
10–21	50	100.0	0	0.0
21.1–25	0	0.0	30	60.0
25.1–30	0	0.0	20	40.0
>30	0	0.0	0	0.0
Total	50	100.0	50	100.0
Mean±Standard deviation	16.0±4.0		25.0±3.0	
p-value	0.0001*			

Table 4: Distribution of study population according to CCT

CCT (µm)	Group A		Group B	
	No.	%	No.	%
450–500	8	16.0	30	60.0
501–550	31	62.0	13	26.0
551–600	9	18.0	6	12.0
601–650	2	4.0	1	2.0
Total	50	100.0	50	100.0
Mean±Standard deviation	545.2±38.51		519.35±40.52	
p-value	0.0001*			

CCT: Central corneal thickness

In our study, maximum 52% were male in Group A whereas minimum 48% were female. In Group B, equal distribution between male and female was observed. The difference between both groups was insignificant. Similarly, Sharma *et al*. [9] in their study observed 58 males and 42 females.

In our study, maximum 40% had 6/9 vision followed by 34% had 6/6 vision in Group A whereas minimum 4% had 6/24 vision. In Group B, maximum 44% had 6/9 vision followed by 40% had 6/12 vision whereas minimum 6% had 6/18 vision. The difference between both groups was significant ($p<0.05$). Similarly, in Jonas *et al*. [10], development or progression of glaucomatous visual field defects detected in 119 (21.0%) eyes ($p=0.19$).

In our study, all cases in Group A had cup–disc ratio of 0.3–0.4. In Group B, maximum 40% had cup–disc ratio of 0.51–0.60 followed by 36% had 0.61–0.70 whereas minimum 24% had 0.41–0.50. The difference between both groups was significant ($p<0.05$). Similarly, in Memon *et al*.'s study [11], 153 eyes of 86 patients with POAG were examined. Eighty-eight percent of patients presented with 0.7 to total cupping.

In our study, all cases in Group A had IOP of 10–20 mmHg. In Group B, maximum 60% had IOP of 21.1–25.0 mmHg whereas minimum 40% had 25.1–30.0. Mean IOP of study population was 16.0±4.0 mmHg in Group A whereas 25.0±3.0 mmHg in Group B and the difference between both groups was significant ($p<0.05$). Similarly, Mbatuegwu *et al*. [8] found that the mean measured IOP was 16.77±4.37 mmHg. Furthermore, Sharma *et al*. [9] found that the mean IOP in Indian CCT corrected group was 19.76±2.81 mmHg and in international CCT group was 21.51±2.83 mmHg. Levene's test indicated significant difference in mean IOP of 2 groups ($p=0.000$). Furthermore, Qayum [12] found similar results.

In our study, mean CCT of study population was 545.2±38.51 μm in Group A whereas 519.35±40.52 μm in Group B and the difference between both groups was significant ($p<0.05$). Similarly, in maya Natarajan *et al*. [13], a total of 50 controls and 50 POAG patients were studied. CCT between the two groups, the mean CCT in the control group was 536 μm (462–608 μm) and in the POAG group was 531 μm (476–609 μm). There was significant difference in the CCT between POAG patients and the normal controls.

CONCLUSION

We concluded that patients with thin corneas are more likely to develop POAG. Measuring CCT in glaucoma patients may help identify those patients who are at higher risk of developing severe glaucomatous sequelae thus enabling the ophthalmologist to treat their disease more aggressively.

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AUTHORS' CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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