ORIGINAL ARTICLE
INTRAOCULAR PRESSURE AND CENTRAL CORNEAL THICKNESS IN HYPERTENSIVE AND NON-HYPERTENSIVE PATIENTS

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Background: Intraocular pressure (IOP), the pressure inside the eyeball, is retained by balance between production and drainage of aqueous humour. It fluctuates with age, central corneal thickness (CCT), blood pressure, vascular disease, diabetes and myopic refractive error. This study was done to compare IOP and CCT and to correlate these parameters with age in hypertensive and non-hypertensive patients. Methodology: This study was conducted at Ophthalmology Department, Mayo Hospital, Lahore. A total of 108 subjects were included in the study and divided into two groups of 54 each. Blood pressure was checked using mercury sphygmomanometer. IOP was assessed with Goldman applanation tonometer and CCT was measured with ultrasound pachymeter. Results: Mean age of patients with hypertension was 56.37±6.7 and non-hypertensive patients were 52.35±5.92 years. IOP was significantly higher in hypertensive patients as compared to non-hypertensive patients (p<0.001). CCT was not statistically significant in hypertensive and non-hypertensive people in both right and left eyes. Conclusion: Mean IOP and CCT were significantly higher in hypertensive subjects. IOP showed weak negative and CCT showed weak positive correlation with age in hypertensive patients.

Keywords: IOP, CCT, hypertension

INTRODUCTION

The pressure inside the eye ball, intraocular pressure (IOP) is retained by balance between production and drainage of aqueous humour. Its value ranges from 11–21 mmHg. It fluctuates with age, central corneal thickness, blood pressure, vascular disease, diabetes and myopic refractive error.1 Routinely, IOP shows 24-hourly variation favouring to be higher in morning and lower in evening. It shows diurnal variation of 5 mmHg. Far sighted eyes show greater diurnal variation than near sighted eyes.2 It can be assessed with applanation, indentation and pneumatic methods. But gold standard measurement is based on Imbert-Fick principle. It can be documented with Goldmann applanation tonometer. IOP measurement is directly connected with flattening of cornea so central corneal thickness (CCT) is the key determinant of IOP. It is normally 490–560 µm thick centrally.3 It can be assessed with ultrasound or optical pachymeter. Clinically CCT measurement plays a direct role in management of 15% of patients of glaucoma.4 Main independent determinant of higher IOP is the high blood pressure.5

Hypertension risk increases with low physical activity, use of tobacco, high salt intake, and unhealthy diet. Another important risk factor for hypertension is aging.6 There exists a strong correlation between IOP, age, blood pressure and CCT.7 IOP increases with increased systolic blood pressure and with younger age.8 According to another study, IOP decreases with age.9 It was also reported in a study that there is no significant correlation of CCT with IOP, age, gender and hypertension.10 Another study observed that there is no significant association of IOP with age and body mass index.11

IOP is the only genuine risk factor in Glaucoma which can be modified. Therefore, it is significant to evaluate the characteristics that are associated with raised IOP. Several factors are associated with raised IOP, i.e., age, gender, central corneal thickness, race, blood pressure, body mass index, lens status, etc. Literature review showed that systemic blood pressure (BP) is related with IOP, however results obtained from various studies reporting associations of BP with IOP and CCT are controversial. We aimed to compare and correlate all these factors in both hypertensive and non-hypertensive population to generate new data for our population directly affecting the diagnosis and management of patients with glaucoma.

MATERIAL AND METHODS

This case control study was conducted in the Department of Ophthalmology, Mayo Hospital, Lahore, in 2017 after approval from Advance Studies and Research Board, KEMU, Lahore. Non-probability convenient sampling was done.

One hundred and eight (108) subjects were included in the study (54 in each group). Written
informed consent was taken and complete ophthalmic examination was done. Visual acuity and slit lamp examination was done to rule out anterior segment pathologies. Blood pressure was measured in sitting position with mercury sphygmomanometer and average of three readings was recorded. IOP was measured in both eyes with Goldmann applanation tonometer after applying topical proparacaine 0.5% and 2% fluorescein strips. The CCT was measured with ultrasound pachymeter.

Data was analysed using SPSS-17. Mean±SD was calculated for normally distributed quantitative variables. Pearson’s Correlation coefficient was used to observe the correlation between IOP, CCT, and age, and p<0.05 was considered as statistically significant.

RESULTS
Mean age of hypertensive patients was 56.37±6.71 years and non-hypertensive patients were aged 52.35±5.92 years. Mean IOP in right and left eye was significantly higher in hypertensive patients than non-hypertensive patients (p=0.000). The CCT in right and left eye was higher in non-hypertensive subjects but not statistically significant. (Table-1).

For right eye negative weak correlation was seen between IOP and age of patients in hypertensive patients while in non-hypertensive patients positive week correlation was seen between IOP and age, i.e., (R): r (HTN)= -0.204, p = 0.140, r (N-HTN)= 0.271, p=0.048.

For left eye negative weak correlation was seen in hypertensive and in non-hypertensive patients no significant correlation was seen between IOP and age, i.e., (L): r (HTN)= -0.291, p = 0.033, r (N-HTN)= 0.001, p = 0.992.

Among hypertensive patients no statistically significant correlation was seen between CCT and age in right and left eye. Among non-hypertensive individuals weak negative correlation was seen between CCT and age in right and left eye, i.e., (R): r (HTN)= 0.025, p = 0.857, and (L): r (HTN)= 0.087, p=0.533. (R): r (N-HTN)= -0.303, p = 0.026 and (L): r (N-HTN)= -0.267, p = 0.051.

In right eye correlation between CCT and IOP in hypertensive and non-hypertensive individuals was statistically not significant. (R): r (HTN)= -0.064, p = 0.648, r (N-HTN)= 0.006, p = 0.965.

Similarly in left eye a linear weak negative and significant correlation was seen between CCT and IOP in hypertensive patients while in non-hypertensive patients’ correlation between CCT and IOP was very weak and statistically not significant. (L): r (HTN)= -0.286, p = 0.036, r (N-HTN)= 0.010, p = 0.943.

DISCUSSION
Intraocular pressure is linked with glaucoma, and in a number of studies it has been found that corneal thickness is significantly associated with IOP. Yet, a number of authors have claimed that a linear correlation does not exist between IOP and CCT. Studies have also reported altering values of CCT in different racial groups.

Gelaw et al and Iyamu et al found no significant association between these two parameters. Several factors including age, gender, refractive error, diurnal variations, genetic influence, and diseases like diabetes mellitus have been shown to affect CCT. Some studies reported positive correlation among blood pressure and IOP. Klein et al in their study showed that there was a significant correlation between IOP and both systolic and diastolic BP. Among both hypertensives and normotensives the correlation was not statistically significant; CCT was also very weakly correlated with age of hypertensive patients. Though, controversial results have also been reported for CCT and IOP in association with age of patients.

A study from Karachi found very weak correlation between CCT and IOP in healthy adults. An Indian study compared IOP differences in postmenopausal hypertensive and normotensive women. They observed statistically significant correlation between IOP and BP in hypertensive postmenopausal women.

Ebeigbe et al, in their study reported that mean IOP of women who were postmenopausal and hypertensive was significantly higher when compared with normotensive postmenopausal women. A study from Pakistan concluded that CCT is an important predictor of IOP and there was a statistically significant link/association between CCT and IOP when measured in normal healthy subjects. On the other hand a very weak but significant correlation was seen among IOP and CCT.

Wong et al reported that characteristics of study population such as age, central corneal thickness and SBP are important determinants of IOP in persons aged 40 to 80 years with central corneal thickness being more important determinant in younger persons. The divergent effects of age-related changes in systolic BP and CCT work together to lead to a moderately flat profile of intraocular pressure with age, probably through a slight reversed U-shaped association.

Table-1: Age, IOP and CCT in hypertensive and non-hypertensive patients

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Hypertensives</th>
<th>Non-hypertensives</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>56.37±6.71</td>
<td>52.35±5.92</td>
<td></td>
</tr>
<tr>
<td>IOP (Right eye)</td>
<td>17.38±3.99</td>
<td>14.05±3.98</td>
<td>0.000</td>
</tr>
<tr>
<td>IOP (Left eye)</td>
<td>18.77±6.86</td>
<td>15.09±3.84</td>
<td>0.000</td>
</tr>
<tr>
<td>CCT (Right eye)</td>
<td>525.90±30.16</td>
<td>529.57±42.51</td>
<td>0.606</td>
</tr>
<tr>
<td>CCT (Left eye)</td>
<td>526.42±28.84</td>
<td>533.38±37.93</td>
<td>0.285</td>
</tr>
</tbody>
</table>
A longitudinal study by Fukuoka et al analysed the intraocular pressure changes in young and middle-aged, healthy subjects. In middle-aged subjects a reduction in IOP over a 10 year period was observed. Nomura et al, and Shioute et al reported a descending tendency of IOP with increasing age. A decrease of 1 mm Hg in men and 0.5 mm Hg in women between the third and eighth decade was reported and a decrease of 1 mm Hg in all subjects between the same two decades was seen. In contrast, the Egna-Neumarkt and Barbados Eye studies found that as age increases IOP also increase, showing that the effect of age on IOP is strong and persistent.

CONCLUSION

Mean IOP and CCT were significantly higher in hypertensive subjects. Measurement of central corneal thickness is advisable when the clinical findings do not correlate with IOP. Hypertensives need to be monitored over time for their progression to Open Angle Glaucoma.

REFERENCES


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