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RESEARCH ARTICLE

ANALYSIS OF PREDISPOSITION TO PRIMARY OPEN-ANGLE GLAUCOMA IN CHILDREN OF PATIENTS WITH HYPERTENSION

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Key Words
Glaucoma; Intraocular Pressure; Hypertension; Children of Patients with Hypertension

Background: Several risk factors such as systemic hypertension, obesity, and body mass index (BMI) have been associated with increased intraocular pressure (IOP). This raised IOP can lead to irreversible optic nerve damage, causing blindness.
Aims & Objective: To evaluate the effects of blood pressure (BP) and BMI on IOP and thereby analyze the predisposition to glaucoma in children of patients with hypertension.
Materials and Methods: This observational study was conducted on medical undergraduates. Students with family history of hypertension were taken as cases, and equal number of students with no family history of hypertension were taken as controls. Weight, height, BP, and IOP were recorded and compared in both the groups. Statistical analysis was done by Student t-test and Pearson correlation.
Results: Cases exhibited lower values for IOP, mean arterial pressure (MAP), and diastolic blood pressure. In cases, a positive correlation was found between both IOP and MAP and IOP and BMI, whereas in controls it was found only between IOP and BMI.
Conclusion: The results indicate that BP is an important determinant factor in regulation of IOP in children of patients with hypertension rather than those of individuals with normotension. Hence, children of patients with hypertension have to keep a check on their BPs as well as IOP to prevent the complications of early-onset ocular hypertension and thereby, glaucoma.

INTRODUCTION

Several risk factors such as systemic hypertension,[1] obesity,[2] ocular perfusion pressure, diabetes,[3] body mass index (BMI),[4] and age[5] have been associated with increased intraocular pressure (IOP). This raised IOP can lead to glaucoma, subsequently leading to irreversible optic nerve damage[6] causing blindness. Especially, open-angle glaucoma are more dangerous, as they go unnoticed in the initial stages. Thus, it is advantageous to screen people with the earlier mentioned risk factors to detect it earlier for better visual outcome.

Both IOP and blood pressure (BP) are directly associated with IOP.[4,7] But, there is a dearth of literature related to BMI, BP, and their effects on IOP in children of patients with hypertension, which could help us in predicting the future onset of ocular hypertension (glaucoma). Hence, the purpose of this study was to evaluate the effects of BP and BMI on IOP and thereby, analyze the predisposition to glaucoma in children of patients with hypertension.

MATERIALS AND METHODS

Medical undergraduates of Bagalkot participated in this observational study. Ethical clearance was obtained from the institution. Informed consent was taken from all the subjects.

Students with family history of hypertension were taken into study group (cases), and equal number of students with no family history of hypertension were taken into control group (controls). Subjects with any acute or chronic systemic illness and with any history of ocular injury/surgery were excluded from both the groups.

In both the groups, weight was recorded by a standard weighing machine, height by a stadiometer, BP by mercury sphygmomanometer, and IOP by

noncontact tonometer. BMI and mean arterial pressure (MAP) were calculated.

The recorded parameters were compared in both the groups. Statistical analysis was done by Student unpaired *t*-test and Pearson correlation using SPSS package version 14.

RESULTS

Forty-four subjects (22 cases and 22 controls) were studied and their age ranged from 17 to 20 years. For cases and controls, the mean age was 18.3 and 18.45 years, respectively; the mean height was 165.7 and 164.63 cm; and the mean weight was 63.7 and 58.68 kg.

Table 1: Comparison of IOP, BMI, and BP in Cases and Controls

	Groups	*N*	Mean	SD	*t*	*p*
Intraocular pressure (mm Hg)	Cases	22	14.22	3.25	−1.14	0.25
	Controls	22	15.22	2.93		
Body mass index (kg/m²)	Cases	22	23.3	3.59	1.55	0.12
	Controls	22	21.4	4.1		
Systolic blood pressure (mm Hg)	Cases	22	120.27	8.12	1.74	0.08
	Controls	22	115.78	9.16		
Diastolic blood pressure (mm Hg)	Cases	22	72.27	9.03	3.09	0.003*
	Controls	22	79.3	5.8		
Mean arterial pressure (mm Hg)	Cases	22	88.27	7.87	−1.52	1.34
	Controls	22	91.4	5.94		

** Statistically significant. BMI: Body mass index; DBP: Diastolic blood pressure; IOP: Intraocular pressure; MAP: Mean arterial pressure; SBP: Systolic blood pressure; SD: Standard deviation*

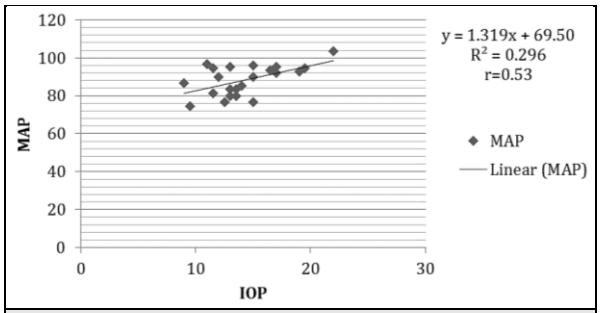

Figure 1: Correlation between IOP and BMI in cases

When IOP was compared between children with family history of hypertension (cases) and those with no history of hypertension (controls), cases exhibited lower values for IOP, MAP, and diastolic blood pressure (DBP), but not for systolic blood pressure (SBP) and BMI. These values were within normal range but not statistically significant, except the value for DBP (Table 1).

In cases, regression analysis showed a positive correlation between IOP and MAP (Figure 1), IOP and DBP, and IOP and BMI (Figure 2). On the other hand, in controls, positive correlation was found only between IOP and BMI (Figure 3), not between IOP and MAP (Figure 4) or IOP and DBP.

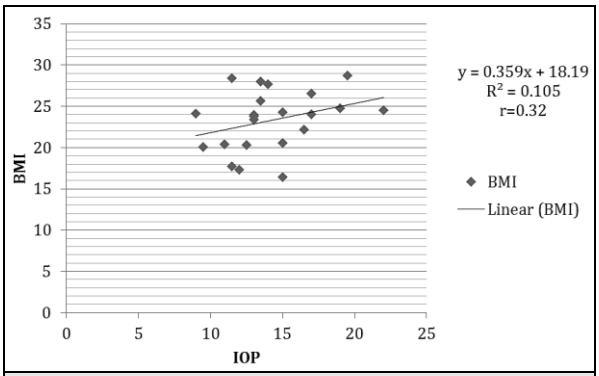

Figure 2: Correlation between IOP and MAP in cases

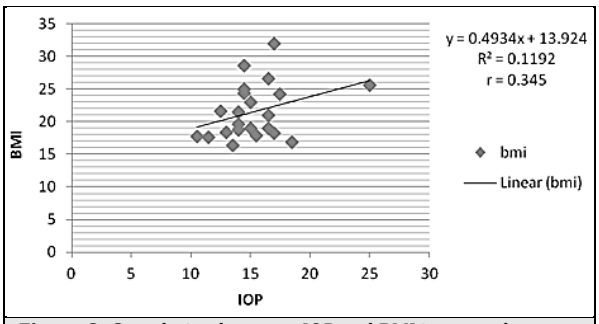

Figure 3: Correlation between IOP and BMI in controls

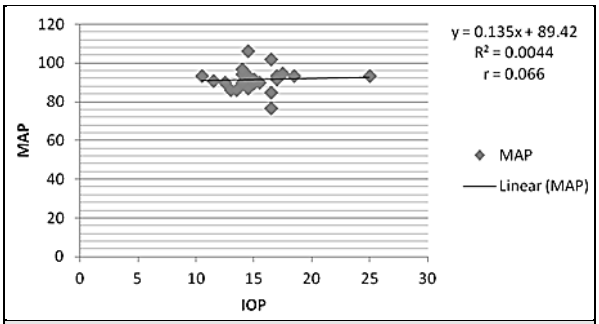

Figure 4: Correlation between IOP and MAP in controls

DISCUSSION

The results of this study indicate that cases showed lower values for IOP, MAP, and DBP. They also showed positive correlation between IOP and MAP, IOP and DBP, and IOP and BMI.

In a cross-sectional population-based study, the mean IOP of both eyes was found to increase linearly with the increase in SBP.[8] In a 5-year follow-up study of SBP and IOP, significant direct correlation between changes in SBP and IOP was observed.[9] In a study on 9 normal subjects and 10 subjects with autonomic failure, analysis of covariance indicated a strong association between MAP and IOP overall.[10] A large decrease in MAP was also correlated with a

large decrease in IOP.[11] Comparison of the differences in BPs for cases of elevated IOP and matched controls suggested that the SBP values were higher in cases than in controls. Changes in IOP were positively correlated with changes in SBP and DBP over both 1- and 2-year periods.[12] The findings of this study were similar to these above-mentioned studies.

Schulzer and Drance[13] observed that DBP was not correlated with IOP, which was contradictory to the findings of this study. In this study, a positive association between IOP and BMI was found in both the groups. It indicates that BMI acts as an independent equal risk factor in both the groups.

Though the values for IOP, MAP, and DBP were less in cases than in controls, significant association was found between IOP and MAP. This association indicates that BP is an important determinant factor in regulation of IOP in children of patients with hypertension rather than in children of individuals with normotension. It also would suggest that MAP and DBP act as risk factors for ocular hypertension in children of patients with hypertension.

The limitations of this work include a smaller sample size, and study of the results in relation to paternal or maternal (and also of grandparents) effect on hypertension status, so that the inheritance of hypertension and also of raised IOP can be studied.

CONCLUSION

The results of this study show that children of patients with hypertension may be more prone for raised IOP in future due to strong correlation between IOP and BP in them. Hence, children of patients with hypertension have to keep a check on their BPs as well as IOP to prevent the complications of early onset ocular hypertension and thereby glaucoma.

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