

# Relation of Systemic Blood Pressure and Its Effect on Intraocular Pressure

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## Abstract

**Introduction:** Hypertension is a condition characterized by elevated blood pressure (BP) in the arteries. Hypertension affects 16-37% of the population worldwide. Long-term hypertensive patients may develop complications such as stroke, heart failure, kidney disease, and peripheral vascular disease.

**Aim:** To correlate changes in systemic BP and its effect on intraocular pressure.

**Methods:** A total of 100 hypertensive patients and 100 normotensive individuals were included in this study between the age group of 35 and 60 years. BP and intraocular pressure were recorded. Data were compared between both the groups.

**Results:** There was a significant correlation between changes in systemic BP and intraocular pressure (IOP). Independent *t*-test showed a significant rise in IOP with an increase in systemic BP.

**Conclusion:** Increased BP is associated with a significant rise in IOP.

**Key words:** Intraocular pressure, Hypertension, Systemic blood pressure

## INTRODUCTION

Hypertension is a condition characterized by elevated blood pressure (BP) in the arteries. Normal BP varies between 100 and 140 mmHg systolic and 60-90 mmHg diastolic.<sup>1</sup> High BP is when the resting BP is above 140/90 mmHg.<sup>2</sup> Hypertension affects 16-37% of the population worldwide. Long-term hypertensive patients may develop complications such as stroke, heart failure, kidney disease, and peripheral vascular disease.<sup>3</sup> It can also affect the retinal arterioles leading to blindness subsequently. Intraocular pressure (IOP) is found to be associated with systemic BP levels. The purpose of this study is to correlate these changes in

IOP with an increase in systemic BP and compare it with IOP in normotensive patients.

## METHODS

This study included 200 patients between the age group of 35 and 60 years. The patients were divided into two groups: 100 normotensive individuals in Group 1 and 100 hypertensive patients in Group 2. A detailed history was taken. General examination was done and vitals recorded. All the patients were made to rest for 30 min after which BP was recorded in the supine position. Patients with systolic BP of  $\geq 150$  mmHg and/or diastolic BP of  $\geq 100$  mmHg were included in the hypertensive group.

IOP was recorded for all the patients and individuals using Goldmann appplanation tonometer. Fundus examination was done to rule out retinopathy. Data were analyzed and compared between both the groups *P* value calculated using one-way ANOVA test.

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Analyses were done for calculating mean, standard deviation, minimum and maximum IOP in normotensive, and hypertensive groups.

## RESULTS

The mean age of male individuals was 53.6, and that of female was 49.3 years. Minimum and maximum IOP values in each group along with their mean and standard deviation are depicted in Table 1.

Two sample independent *t*-test showed significant values are suggesting hypertension correlating with an increase in IOP, respectively,  $P = 0.00005$ .

## DISCUSSION

According to various studies, a positive correlation was noted between intraocular pressure and BP.<sup>4</sup> Beaver Dam study showed that an increase of systolic BP  $\geq 10$  mmHg from baseline leads to 0.44 mmHg rise in IOP and a decrease of systolic BP  $\leq 10$  mmHg from baseline leads to 0.59 mmHg decrease in IOP over a 5-year interval.<sup>5</sup> Similarly, diastolic BP was associated with 0.19 mmHg in IOP over a 9-year follow-up.<sup>6</sup>

It is believed that hypertension has an indirect effect on IOP based on sympathetic tone of hypertensive individuals.<sup>7</sup> This can influence IOP by affecting the episcleral venous pressure which helps in regulation of aqueous outflow across the trabecular meshwork into the Schlemm's canal.<sup>8</sup>

According to Wong *et al.*, IOP increased with age to the sixth decade, after which a decrease in IOP was seen with the further increase in age.<sup>9</sup> In our study, we selected patients between the age group of 35 and 60 years. IOP was measured and the minimum IOP in normotensive individuals was found to be 6 mmHg and that of hypertensive patients was 8 mmHg. The maximum IOP in normotensive individuals was 26 mmHg, and that of hypertensive patients was 36 mmHg. The mean value and standard deviation of Group 1 individuals were 14.64 and 4.00, respectively, whereas in Group 2 it was 18.04 and 6.02.

*P* value was significant (0.00005) suggesting correlation between increase in IOP with an increase in systemic BP.

**Table 1: Mean and SD for Groups 1 and 2 including minimum and maximum IOP values**

Groups	Minimum IOP value (mmHg)	Maximum IOP value (mmHg)	Mean $\pm$ SD
Group 1 (normotensive)	6	26	14.64 $\pm$ 4.00
Group 2 (hypertensive)	8	36	18.04 $\pm$ 6.02

IOP: Intraocular pressure, SD: Standard deviation

The increase in IOP can lead to optic neuropathy further leading to deterioration of vision which is irreversible.<sup>10</sup> Hence, hypertension being a modifiable risk factor for increase in IOP should be controlled and maintained at optimal level to prevent its effect on vision.

## CONCLUSION

There is a strong correlation between increase in BP and IOP. Hence, every physician should target toward maintaining adequate systemic BP levels in every hypertension patients.

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