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A CLINICAL STUDY ON OCULAR PERFUSION PRESSURE IN NORMOTENSIVES VS HYPERTENSIVES

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ABSTRACT **Background And Objective:** Glaucomatous Optic Neuropathy can be a consequence of insufficient blood supply, increase in intraocular pressure (IOP), or other risk factors that diminish ocular perfusion pressure. To determine the ocular perfusion pressure (OPP) in normal and systemic hypertensive patients. **Materials And Methods:** One hundred and fifty patients were enrolled in this prospective and comparative study and underwent a complete ophthalmologic examination including history of previous ocular diseases, trauma or surgery, slit lamp examination, Goldmann applanation tonometry, stereoscopic fundus examination. The OPP was calculated as being the medium systemic arterial pressure (MAP) less the IOP. Only right eye values were considered for calculation **Results:** The mean age of the patients was 57.5 years (36-78), and 68.5% were women. There was a statistically significant difference in the OPP of the normal and systemic hypertensive patients ($p < 0.01$). **Conclusion:** OPP was high in hypertensives when compared to normotensives with statistically significant difference($p < 0.01$).

KEYWORDS : OPP, Hypertensives, Normotensives, Glaucoma

INTRODUCTION

Glaucoma is a multifactorial disease and its precise pathogenesis, despite extensive research, remains unknown. Intraocular pressure (IOP) is considered the main risk factor for the development and progression of glaucoma.[1,2,3,4,5,6,7]

The two main theories for pathogenesis of the glaucomatous optic neuropathy (GON) are vascular and mechanical. Both have been defended by research groups over the last 150 years. In accordance with the mechanical theory, the increase in intraocular pressure (IOP) stretches the laminar beam and causes damage to the axons of the ganglion retinal cells, while the vascular theory considers the GON a consequence of insufficient blood supply, increase in IOP, or other risk factors that diminish the ocular blood flow (OBF).

OPP may be defined as mean, systolic or diastolic OPP. Mean OPP (MOPP) can be calculated as 2/3 of the mean arterial BP – IOP; where mean arterial pressure = diastolic BP + 1/3 (systolic BP – diastolic BP). The factor 2/3 accounts for the drop in blood pressure between the brachial and ophthalmic artery when the subject is seated and the fact that the orbital arteries are further downstream. Systolic ocular perfusion pressure (SOPP) is defined as the difference between systemic systolic BP and IOP, whereas diastolic ocular perfusion pressure (DOPP) equals systemic diastolic BP – IOP. [8,9,10]DOPP is especially useful in displaying the lowest OPP values

Low systemic BP combined with an elevated IOP will reduce the perfusion pressure at the ONH, which will affect the volume of flow in eyes with an impaired autoregulatory system. Reduced flow can lead to ischaemic damage to the axons and atrophy of the retinal ganglion cells, and consequentially visual dysfunction [11,12]

MATERIALS AND METHODS

The study was performed in adherence to the guidelines of the declaration of Helsinki

One hundred and fifty patients were enrolled in this prospective and comparative study and underwent a complete ophthalmologic examination including history of previous ocular diseases, trauma or surgery, slit lamp examination, Goldmann applanation tonometry, stereoscopic fundus examination

Two measurements of IOP and AP were taken with Goldmann applanation tonometer in a seated position, with a 2-minute interval between the measurements. The patients were divided into two groups: normal and systemic hypertensive

Inclusion Criteria

Normal patients were > 35 years old with an absence of ocular or systemic diseases, no ocular surgeries, and no use of any systemic medications. Refraction could not be greater than + 6 diopters (D) spheric and 3 cylindric. They had to have a best corrected visual acuity of 20/40 or better, IOP < 21 mm Hg and cup/disk ratio < 0.4, and an absence of asymmetry.

Systemic hypertensive patients were > 35 years old with an absence of ocular pathologies and surgeries, and systolic systemic AP > 140 mm Hg and diastolic > 90 mm Hg or normal levels of systemic AP with use of antihypertensive medications. Refraction could not be greater than + 6D spheric and 3 cylindric. They had to have a best corrected visual acuity of 20/40 or better, IOP < 21 mm Hg and cup/disk ratio < 0.4, and absence of asymmetry.

The OPP was calculated as being the MAP less the IOP. Only right eye values were considered for calculations using Student's t-test

RESULTS

The mean age of the patients was 59 years (36-78), and 68.5% were women. There was a statistically significant difference in the OPP of the normal and systemic hypertensive patients ($p < 0.01$).

Previous studies consider the normal IOP to be between 10 and 20 mm Hg.[13,14] In this study, the mean IOP was 14.03mm Hg (SD 1.96) in the normotensives and 15.44mm Hg (SD 2.37) in the systemic hypertensive patients.

Our results demonstrated an OPP of 73.64 (SD 3.59) in the normal patients and 89.79 mm Hg (SD 5.44) in the systemic hypertensive patients. The difference was statistically significant ($p < 0.01$) and confirmed a higher OPP in the systemic hypertensive patients

VARIABLE	GROUP	MEAN	SD	P VALUE
AGE	NORMOTENSIVES	59.12	7.28	<0.001
	HYPERTENSIVES	59.71	8.65	
MAP	NORMOTENSIVES	87.65	3.75	<0.001
	HYPERTENSIVES	105.23	6.17	
IOP	NORMOTENSIVES	14.03	1.96	<0.001
	HYPERTENSIVES	15.44	2.37	
OPP	NORMOTENSIVES	73.64	3.59	<0.001
	HYPERTENSIVES	89.79	5.44	

DISCUSSION

The relationship between BP, OPP and OAG is multifaceted. Blood pressure is a component of OPP. Hence, it would be expected that higher BPs (theoretically related to a higher OPP) decreased the risk of OAG. Nevertheless, an increased BP could lead to a reduced blood vessel diameter, due to vasoconstriction in the short term, and in the

long-term arteriosclerosis (thickening and stiffening of the vessels walls), and therefore decreased ocular blood flow, enhancing the risk of OAG [15]

There is evidence of an abnormal association between ocular perfusion parameters and systemic blood pressure in patients with glaucoma. However, these data do refer to long-term adaptations of perfusion to the eye with blood pressure rather than a short-term increase in blood pressure.

Leske et al5 investigated the relationship between the OPP and the incidence of open angle glaucoma (OAG) and found a relative risk of 3.1 for patients with OPP < 41.0 mm Hg[5]

In The Los Angeles Latino Eye Study, the authors found a strong association between low OPP and OAG prevalence[16]

Other studies have linked glaucoma progression to abnormal decreases in BP at night. Patients have been categorized as 'nondippers' if the nocturnal decline is absent or blunted .[17] 'Extreme dippers' are defined as those showing a BP nocturnal fall greater than 15–20%. Approximately, two-thirds of healthy individuals have been characterized as physiological dippers.[18]

Studies demonstrate that not only high IOPs but also low blood pressures (including nocturnal dips) may be responsible for the association between low OPP and glaucoma

CONCLUSION

There is a statistically significant difference in the OPP between normal and systemic hypertensive patients. More studies are required to evaluate the role of the OPP in ocular pathologies, especially glaucoma. The results of this study suggest that the systemic hypertensive patients have a higher OPP in comparison to a normal patient.The balance between IOP and BP, influenced by the autoregulatory capacity of the eye, is part of what determines if an individual will develop optic nerve damage. Systemic hypertensive patients with glaucoma should be treated with caution, especially avoiding OPP reduction by systemic hypertension overtreatment

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