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A STUDY OF TWENTY FOUR HOUR INTRAOCULAR PRESSURE AND BLOOD PRESSURE PATTERN ASSOCIATED WITH EARLY GLAUCOMATOUS CHANGES.

Ophthalmology

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ABSTRACT

Purpose: To observe the diurnal variation of intraocular pressure with blood pressure in patients with early glaucomatous changes. Material and methods: This study wasconducted on 128 patients over a period of 1 year, they weredivided into two,age and sex matched groups, out of which 64 patients were in control group with healthy disc and 64 patients were with early glaucomatous disc changes.IOP and blood pressure was measured for a period of 24 hours at the interval of 2 hours. Mean diurnal IOP, MOPP and blood pressure were compared with each group.**Results:** Mean diurnal IOP was significantly higher in the glaucomatous disc patients.Mean nocturnal IOP was higher than mean diurnal IOP. Early morning hours, the IOP increased in the patients having glaucomatous disc changes. There was a diurnal decrease in mean blood pressure. **Conclusion:** There was high diurnal IOP, the diurnal-to-nocturnal change of IOP is less, and the IOP pattern around normal awakening time is different in eyes with early glaucomatous changes.Circadian fluctuation of ocular perfusion pressure may be a contributing factor in the pathogenesis of glaucomatous optic neuropathy.

KEYWORDS

Intraocular pressure(IOP) , Applanation tonometry, Mean Ocular perfusion pressure(MOPP) , Blood pressure.

INTRODUCTION:

Glaucoma is defined as heterogeneous group of disorders which manifests as chronic progressive optic neuropathy characterized by specific morphological changes at optic nerve head and retinal nerve fiber layer with resultant loss of retinal ganglion cells which results in loss of visual field. It has been proved that 20-40% of ganglion cells are lost before visual field defects develop in patients of glaucoma on standard automated perimetry. As IOP is considered a major risk factor for glaucoma, an undetected IOP spike could be the missing link that has not been taken into account.[1] various investigators have shown that IOP in early morning hours is increased associated with fall in blood pressure.[2, 3] Phasing during routine office hours only would miss this. Thus diurnal variation measurement in intra ocular pressure with blood pressure in important. Variation more than 8 mm hg is significant. In this study the diurnal variation of intraocular pressure with blood pressure was assessed, also the mean ocular perfusion and relation with early glaucomatous changes was studied.

MATERIAL AND METHODS:

This prospective case-control study was conducted on 128 patients over a period of 1 year, at outpatient Department of ophthalmology, at Dr. Sushila Tiwari memorial hospital and Government medical college, Haldwani. They were divided into two, age and sex matched groups, out of which 64 patients were in control group with healthy disc and 64 patients were with early glaucomatous disc changes. IOP and blood pressure was measured for a period of 24 hours at the interval of 2 hours. Mean diurnal IOP and blood pressure were compared with each group. Patient already diagnosed with glaucoma , Ocular hypertensive, Patients suffering from hypertension were excluded from the study. Patients were admitted in the ward. Informed written consent was taken from patient. Goldman applanation tonometer was used for the intraocular pressure measurement. The first measurement of IOP and blood pressure was done between 08:00–10:00 hours. Further measurements were taken periodically 2hourly till next 24 hours. The final measurement was taken in early morning (between 06:00–08:00 hours). The readings were taken by the same person to prevent inter-observer bias. Nocturnal BP reduction was calculated as [(diurnal average BP − nocturnal lowest BP)/diurnal average BP] × 100.

RESULTS: Mean diurnal IOP was significantly higher in the glaucomatous patients .Mean nocturnal IOP was higher than mean diurnal IOP.This diurnal-to-nocturnal increase in IOP was significantly low. Early morning hours, the IOP increased in the both groups. But in the glaucomatous group this morning spike was significant. There was a diurnal decrease in mean blood pressure in both groups. The diurnal variation of IOP was 6.6+/- 0.6 mmHg in the glaucoma group, which was significantly higher than the control group (3.5+/- 0.3 mmHg; p <0.05). The decrease in the mean blood pressure between diurnal and nocturnal period was significant in the glaucoma group. (4 mmHg) ,(Table 1, 2) ,(Figure 1, 2). It was associated with nocturnal dip in the IOP. There was no significant decrease seen in the mean blood pressure in control group. Mean arterial BP (MAP) was calculated as DBP 1⁄3 (SBP DBP). MOPP was defined as 2⁄3 (MAP IOP), systolic perfusion pressure (SPP) as SBP IOP, and diastolic perfusion pressure (DPP) as DBP IOP. MOPP in glaucomatous group was 49.1+/- 2 mmHg and in non-glaucomatous group was 57.4 +/- 3, there was significant co-relation was found in MOPP and glaucoma. (p <.05) (Table 3)

Table 1. Diurnal and Nocturnal Mean IOP and difference in both the groups.

	Diurnal period (6 am- 6 pm)	Nocturnal period (6pm- 6am)	Mean difference
	IOP (mmHg)		
Glaucoma group(n=64)	18.3 +/- 0.5	24.9 +/- 0.1	6.6+/- 0.6
Non-Glaucoma group(n=64)	15.3 +/- 0.4	18.8 +/- 0.7	3.5 +/- 0.3

Table 2. Diurnal and nocturnal mean Blood pressure in both the groups.

	Diurnal period (6am-6pm)	Nocturnal period (6pm-6am)	Mean difference
	Mean blood pressure(mmHg)		
Glaucoma group(n=64)	98+/- 2	94+/- 3	-4+/-1
Non-Glaucoma Group(n=64)	106+/-3	104+/-4	-4 +/1

Table 3.Association between MOPP and Glaucoma vs. Non-Glaucoma

	Mean IOP(mmHg)	MOPP (mmHg)	p-value
Glaucoma(n=64)	21.6+/- 4	49.1 +/- 2	0.04
Non-Glaucoma(n=64)	17.1 +/- 2	57.4 +/- 3	

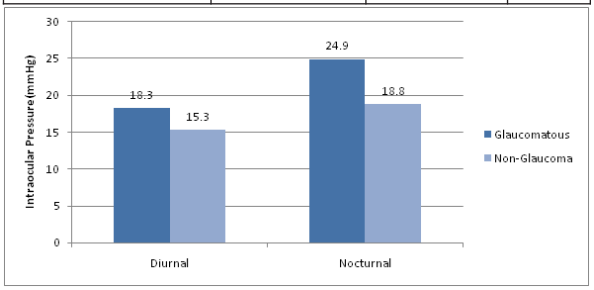

Figure 1. Mean Diurnal and Nocturnal IOP in both Glaucoma and non- glaucoma group.

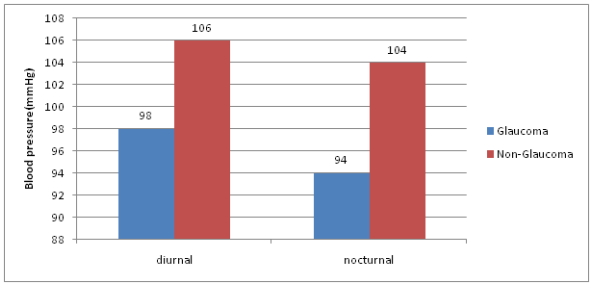

Figure 2. Mean Diurnal and Nocturnal Blood pressure in both Glaucoma and non- glaucoma group.

DISCUSSION:

The study demonstrates that, the lOP peak seen in early morning. Review of previous studies of the diurnal variation in lops shows considerable variation when compared to the current study. Similar study done by Liu et al[4] shows similar results but had increase in intraocular pressure just before sleep. Brown et al[5] mentioned that melatonin could be involved in the process, but as they point out, the fact that the lOP increases also with sleep, when the melatonin level is presumably low, tends to cast doubts on this explanation. The lOP is expected to be low at night based on the fact that aqueous production is decreased during sleep. Patients with Cushing's syndrome have been reported to have increased diurnal variations of intraocular pressure and conversely, patients with adrenal or pituitary insufficiency have shown decreased diurnal variations of intraocular pressure. Linner[6] stated that this was due to a lack of variation in aqueous flow Previous studies constantly find that lower diastolic perfusion pressure (DBP – IOP) is a risk factor in glaucoma. Choi et al[7] concluded that marked circadian MOPP fluctuation was associated with nocturnal BP reduction. Circadian MOPP fluctuation may be a risk factor for the development of NTG. Role of vascular phenomenon n development of glaucoma is also postulated in various studies.[8-11] Poor and unstable ocular perfusion causes ischemic injury to the optic nerve tissues and ganglion cells axons. Studies supporting vascular concept in glaucomatous optic neuropathy with arterial hypertension, hypotension and other vascular diseases.[8-11] Perfusion pressure is calculated as, Mean Blood pressure – Intraocular pressure, is an important factor for determining ocular blood flow.[11] Baltimore eye survey (Tielsch et al 1995) [12] showed a sixfold increase in prevalence of Open angle glaucoma, in patients with DOPP of less than 30 mmHg, compared to DOPP higher than 50 mmHg. Other studies like the Egna-Neumarkt study[13], Proyecto VER[14], the Barbados eye study[15] showed similar co-relations between MOPP and glaucoma. However Rotterdam eye study did not found any relation between OPP and incident OAG after adjustment of baseline IOP[16].

CONCLUSION:

IOP is a major modifiable factor in progression of glaucoma. Diurnal IOP changes have impact on glaucoma progression which usually missed in office hours readings. IOP and ocular perfusion pressure is more so depends upon systolic and diastolic blood pressure. In this study there was significant reduction in nocturnal blood pressure alone may adversely affect ocular perfusion pressure. It also suggests that glaucoma pathogenesis can happen in patients in whom ocular perfusion pressure is normal during daytime. The nocturnal changes in hemodynamic associated with development of early glaucomatous changes. There was high diurnal IOP, the diurnal-to-nocturnal change of IOP is less, and the IOP pattern around normal awakening time is different in eyes with early glaucomatous changes. Circadian fluctuation of ocular perfusion pressure may be a contributing factor in the pathogenesis of glaucomatous optic neuropathy.

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