Hypertension in Primary Open Angle Glaucoma

Suprada Pokharel,[1] Dakki Sherpa,[2] Om Krishna Malla[1]

[1]Department of Ophthalmology, Kathmandu Medical College Teaching Hospital, Kathmandu, Nepal, [2]Depatment of Ophthalmology, National Academy of Medical Sciences, Kathmandu, Nepal.

ABSTRACT

Introduction: The impact of vascular factors in POAG is well known and controversial. Some reports have shown high blood pressure in POAG, some low systolic blood pressure and some described no difference in blood pressure between POAG and controls. However decreased ocular perfusion pressure was found in most of the studies. Our study aims to assess the role of hypertension in POAG .

Methods: It was cross-sectional case–control hospital based study carried out from 1st June 2012 to 1st June 2013. There were 40 cases and 100 controls included in the study. The role of hypertension were compared with those hypertensive patients with glaucoma (cases) and hypertensive patients without glaucoma (controls).

Results: Age above 50 years (odds ratio: 4.827 with 95% CI 1.862-12.517), male genders (odds ratio: 3.10 with 95% CI 1.356-7.146) and low diastolic perfusion pressure (odds ratio: 3.857 with 95% CI 1.362-11.224) showed strongly positive association with POAG. High systolic blood pressure (odds ratio: 1.476 95% CI 0.627-3.476), high diastolic blood pressure (odds ratio: 1.348 95% CI 0.587-3.096) and low systolic perfusion pressure (odds ratio: 1.8661 with 95% CI 0.649- 5.335) were weakly associated with glaucoma in our study.

Conclusions: Age above 50 years, male gender and low diastolic perfusion pressure were strong risk factor for the development of POAG.

Keywords: *diastolic blood pressure; diastolic perfusion pressure; POAG; systolic blood pressure; systolic perfusion pressure.*

INTRODUCTION

Systemic hypertension may increase the risk of primary apen angle glaucoma (POAG) by damaging the small blood vessels of the optic disc. Moreover, studies have shown BP and IOP levels are positively associated.[1-3] Some authors have described association of glaucoma with low systolic blood pressure,[4] some, low blood pressure in normal tension glaucoma and high blood pressure in POAG,[5-7] and others have reported no difference in blood pressure in glaucoma and control.[8,9] A reduced ocular perfusion pressure in POAG patients compared with normal controls was reported in a number of studies.[10,11] A low perfusion pressure impairs the perfusion of the optic nerve and causes glaucomatous loss of the visual field.

This study is carried out to detect role of hypertension and perfusion pressure in POAG and control group in our context.

Correspondence: Dr. Suprada Pokharel, Kathmandu Medical College Teaching Hospital, Kathmandu, Nepal. Email: supranp@yahoo.com.

METHODS

This was cross-sectional case–control hospital based study. Hypertension patients attending OPD of ophthalmology department of Kathmandu Medical College Teaching Hospital and OPD of Nepal Eye Hospital were evaluated for this study from 1st June 2012 to 1st June 2013. The role of hypertension was compared with those hypertensive patients with glaucoma (cases) and hypertensive patients without glaucoma (controls). Cases included in the study were diagnosed glaucoma under treatment .Controls were patients attending eye OPD for fundus evaluation or for refractive error. Cases and controls were matched for age (three or four years above and below) and for sex.

Consent from the Ethical board committee of Kathmandu Medical College Teaching Hospital was taken as per the Helsinki Declaration act before undertaking the study. Informed consent was taken from all patients and those who allowed entering in the study were only included in the study.

Visual acuity was recorded with Snellen's chart. Anterior segment and posterior segment of the eyes were examined with Heine slit lamp. Anterior chamber of all cases and controls were assessed with slit lamp. Posterior segment of the eyes were examined with 90 D lens to assess disc cupping and neuroretinal rim. Visual field was assessed in all cases. In controls, visual field was performed in individuals with cupping >0.5:1 only or when cup disc ratio (CDR) asymmetry between two eyes was >0.2:1. Automated perimetry was performed for assessing visual field. When patients were not co-operative with perimetry tests or perimetry tests revealed reliability error, then OCT (optical coherence tomography) was performed on those individuals to assess optic nerve fibres. Intraocular pressure of both cases and controls were assessed with applanation tonometry with two readings and the mean of those readings were recorded. Blood pressure was measured with a mercury sphygmomanometer two times at two-minute interval after five minutes of rest in the sitting position. Auscultatory systolic and diastolic values were taken at the time of the first and fifth Korotkoff sound, respectively. The average of the two measurements was considered for the analysis.

Inclusion criteria

Cases were the people with history of hypertension and on anti-hypertensive medications recent and old, with open angle glaucoma diagnosed on the basis of IOP, disc changes and visual field defects, who were already on glaucoma treatment, who smoked and consumed alcohol in past and had quitted those substances for at least five years.

Controls were the people with history of hypertension, recently on anti-hypertensive medications, who were old and who smoked and consumed alcohol in the past and had quitted those substances for at least five years.

Exclusion criteria

Cases and controls with diabetes, myopia, migraine, hyperlipidemia, cardiovascular diseases, who were smokers and consumed alcohol, who had undergone any ocular surgeries or laser treatment and those who did not allow consent to enter in the study.

There were 40 glaucoma patients with hypertension and 100 controls with hypertension but without glaucoma included in our study. It was non-randomised sampling study with subjects of 40 years and above. The variables for this study were age, sex, systolic BP, diastolic BP, systolic perfusion pressure, diastolic perfusion pressure, IOP and glaucoma.

Data were recorded in SPSS 17 version programme. The role of hypertension was compared with those hypertensive patients with glaucoma and hypertensive patients without glaucoma by calculating odds ratio and probability value.

RESULTS

Fifteen (37.5%) glaucoma cases were in age group 51-60 years age group and 62.5% (25) were males. Forty six percent of control group was in 40-50 years age group and 65% were females.

Majority 22 (55%) of glaucoma cases had high tension, 17 (42.5%) were normal tension and one (2.5%) were ocular hypertension.

While calculating Odds ratio, age above 50 years have four times more risk to develop glaucoma than controls in our study which was statistically significant .

Table 1. Age and gender distribution of glaucoma cases and controls.

Case	Age group	Female n (%)	Male n (%)	Total n (%)
	40-50	1 (6.7)	5 (20)	6 (15)
	51-60	8 (53.3)	7 (28)	15 (37.5)
	61-70	5 (33.3)	9 (36)	14 (35)
	71-80	1 (6.7)	4 (16)	5 (12.5)
Total		15 (100)	25 (100)	40 (100)
Control	40-50	33 (50.8)	13 (37.1)	46 (46)
	51-60	17 (26.2)	7 (20)	24 (24)
	61-70	11 (16.9)	9 (25.7)	20 (20)
	71-80	4 (6.2)	6 (17.1)	10 (10)
Total		65 (100)	35 (100)	100 100)

Male genders have three times more risk for developing glaucoma than controls in this study and had strong positive association.

Low diastolic perfusion pressure was found to be significantly associated with glaucoma.

Table 2. Risk factors and odds ratio in POAG compared with controls.

Risk factors	Odds ratio	95% Confidence interval Lower limit	Upper limit
Age > 50yrs: = < 50 yrs	4.827	1.862	12.571
Male:Female	3.100	1.356	7.146
Systolic blood pressure > 140: < = 140 mmHg	1.476	0.627	3.476
Diastolic blood pressure > 90: < = 90 mmHg	1.348	0.587	3.096
Systolic perfusion pressure < = 140: > 140 mmHg	1.861	0.649	5.335
Diastolic perfusion pressure < = 60: > 60 mmHg	3.857	1.362	11.224
Intraocular pressure > 21: < = 21 mmHg	Fischer's Exact test p-value < 0.001		

High systolic blood pressure and high diastolic blood pressure were weakly associated in our study. Low systolic perfusion pressure was also weakly associated with POAG.

Intraocular pressure was significantly higher (> 21 mmHg) in glaucoma patients than in controls. Fischer's Exact test was calculated for this risk factor as there were no controls with IOP > 21 mmHg.

High systolic (odds ratio: 1.59 with 95% CI 0.323-7.848) and high diastolic blood pressure (odds ratio: 1.714 with 95% CI 0.348-8.44) was not significantly associated with IOP > 21 mmHg and < = 21 mmHg though there was weak positive association.

DISCUSSION

In our study, age above 50 years (odds ratio: 4.827 with 95% CI 1.862-12.517) and males gender (odds ratio: 3.10 with 95% CI 1.356-7.146) showed significantly positive association for the development of POAG as in other reports published.[12,13]

Systolic and diastolic blood pressure was not significantly associated with IOP > 21 mmHg and < = 21 mmHg though there was weak positive association.

However, population based Beaver-Dam study showed that intraocular pressures were significantly correlated with systolic and diastolic blood pressures at both baseline and follow up. Decreased systolic or diastolic blood pressures of more than 10 mm Hg over five years were significantly associated with decreased IOP in this study.[1] In other study done in Japan revealed that age was significantly negatively correlated with IOP while higher mean blood pressure was significantly correlated with higher IOP.[2]

Our study result with no significant association between IOP and blood pressure could be because of our small sample size. Other reason could be because this was cross-sectional study. However there still was a risk of high systolic and high diastolic blood pressure with IOP > 21 mmHg.

No statistically significant odds ratio was found with high systolic (odds ratio: 1.476 95% CI 0.627-3.476) and high diastolic blood pressure (odds ratio: 1.348 95% CI 0.587-3.096) though weak positive association was observed in POAG when compared with controls. The findings were similar as observed in other population based studies.[1,5] However, cross sectional Latino population based study reported that high systolic blood pressure and low diastolic blood pressure were associated with higher prevalence of POAG.[15] The controversial report might be due to ethnic group variation about the role of hypertension and glaucoma which needs further study.

Low systolic perfusion pressure was weakly associated with POAG though not statistically significant in our study. Low diastolic perfusion pressure (odds ratio: 3.857 with 95% CI 1.362- 11.224) on the other hand showed significant positive risk factor for POAG which was similar to other population based studies[1,2,5] Several studies both hospital and population based has revealed that lower systolic and diastolic perfusion pressure increases the occurrence of POAG including NTG,[1,2,16] which was similar to our study findings.

In a similar hospital based study like ours low blood pressure was found in both progression of POAG glaucoma and normal tension glaucoma.[16] The study revealed statistically significant low systolic blood pressure in glaucoma cases than in controls. The diastolic blood pressure was not statistically different in those two groups.

Though our study was not population based and it may not represent all Nepalese population or all

population with POAG but this study does show role of blood pressure and perfusion pressure in cases with glaucoma. The statistically insignificant positive association between blood pressure, systolic perfusion pressure and glaucoma in our study might be due to small sample size.

We do recommend further population based study in Nepal to further assess the prevalence and incidence of POAG and to assess the impact of hypertension in glaucoma.

CONCLUSIONS

Age above 50 years, male gender and low diastolic perfusion pressure were strong risk factor for the development of POAG in our study. High systolic, high diastolic blood and low systolic perfusion pressure was also observed as risk factor for POAG but was statistically insignificant.

We recommend screening of every hypertensive patient for glaucoma and control of hypertension but not aggressive control leading to systemic hypotension and low perfusion pressure which was the statistically significant risk factor seen in our study for glaucomatous damage.

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