The Association of Primary Open Angle Glaucoma and Systemic Hypertension in Patients Referred to Farabi Eye Hospital

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Abstract

***Purpose*:** To investigate the association of primary open angle glaucoma (POAG) and systemic hypertension in patients referred to Farabi Eye Hospital

***Methods*:** In this case-control study in Farabi Eye Hospital. One hundred patients were selected randomly from POAG patients of glaucoma clinic, Farabi Eye Hospital. Control group consists of 100 patients, candidates for cataract surgery. History of any anti-hypertensive agent consumption was recorded for all participants. A complete set of systemic and ophthalmologic examinations, including several blood pressure measurements, was performed for each subject. Systolic blood pressure above 140 mmHg, diastolic blood pressure above 90 mmHg and/or any history of anti-hypertensive usage in each group were considered as hypertensive status.

***Results*:** Diastolic blood pressure was significantly higher in POAG patients than control group (P=0.003). Systolic blood pressure was also higher in POAG patients than control group; however, the difference was only marginally significant (P=0.07). No association between POAG and hypertension was found.

***Conclusion*:** POAG was found to have a strong positive association with diastolic blood pressure in our patients.

***Keywords*:** Primary Open Angle Glaucoma, Blood Pressure, Systemic Hypertension

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Introduction

Glaucoma is a chronic and potentially blinding disease with significant economic and social burden. A large number of studies concerning the etiology of glaucoma have been done and some risk factors for developing glaucoma have been identified. Age, sex, CCT and some other factors have a proven relationship with glaucoma but correlation of glaucoma with hypertension has not been confirmed yet. Intraocular pressure (IOP) has been found to be associated with systemic blood pressure levels in some studies.[1] A reduced ocular perfusion in primary open angle glaucoma (POAG) patients compared with normal subjects was reported in a number of studies, including large epidemiologic surveys.[2,3]

On the other hand in some situations like atherosclerosis, systemic hypertension, reduced perfusion pressure, and vasospastic syndromes (either primary or secondary), retinal vascular autoregulation is disturbed, leading to both low perfusion pressure and insufficient retinal blood supply[4-6]; possible role of these factors in the pathogenesis of glaucomatous optic neuropathy is under active investigation and further studies are mandatory.

There are increasing evidences that blood flow abnormalities are involved in the pathogenesis of glaucoma. Many clinical trials have been performed to identify this issue by using different techniques and these studies have yielded somehow paradoxical results.[7,8]

In this work we studied patients referred to Farabi Eye Hospital to determine if POAG and systemic hypertension have greater co-occurrence than in normal population.

Methods

We designed a case-control study to investigate potential correlation between systemic hypertension and POAG in Iranian patients. After approval by the Ethics Committee of Tehran University of Medical Sciences, and with adherence to the tenets of the Declaration of Helsinki, the study was performed in Farabi Eye Hospital, a tertiary eye hospital in the capital city of Tehran, Iran. Patients enrolled in group A (100 patients) were randomly selected among POAG patients in glaucoma clinic. Exclusion criteria were any previous eye surgery or laser therapy, secondary causes of glaucoma, and proliferative diabetic retinopathy. Group B (100 patients) were chosen among nonglaucomatous patients candidate for cataract surgery.

History of any anti-hypertensive agent consumption was taken from all participants; then we examined systolic and diastolic blood pressure in case and control groups. Office-based blood pressure was measured with a calibrated mercury sphygmomanometer three times at 1-min interval after 5 min of rest in the sitting position by a single, trained nurse unaware of study groups. Auscultatory systolic and diastolic values were taken. The average of three serial measurements was considered for the analysis. In both study groups, systolic blood pressure above 140 mmHg, diastolic blood pressure above 90 mmHg and/or any history of anti-hypertensive drug usage was defined as high blood pressure category. IOPs were obtained with a calibrated Goldmann applanation tonometer by one examiner, masked to systemic blood pressure.

Rate of systemic hypertension and gender was compared between study groups using χ^2 and Fisher's exact tests. Student T-test was used to compare numerical data. The statistical analysis was performed with SPSS version 11.05 (SPSS Science Inc, Chicago, IL). The statistical significance level was set at $P<0.05$ level. Predetermined study power to detect a difference of systemic blood pressure between study groups was 80% for a sample size of 100 subjects in each study arm.

Results

One hundred patients in each study group were investigated. In POAG group there were 53 males and 47 females with mean age of 62.9±13.3 years. In the control group there were 48 males and 52 females. The mean age in this group was 67.2±11.1 years. There were no significant differences in gender between the two groups.

Systolic blood pressure was examined in both groups. In POAG group mean systolic blood pressure was 137.3±24.7 mmHg. In control group the mean systolic blood pressure was 131.6±19.9 mmHg. The difference was not statistically significant (P=0.076) (Table 1 and Figure 1).

In POAG patients mean diastolic blood pressure was 84.1±13.2 mmHg (range:

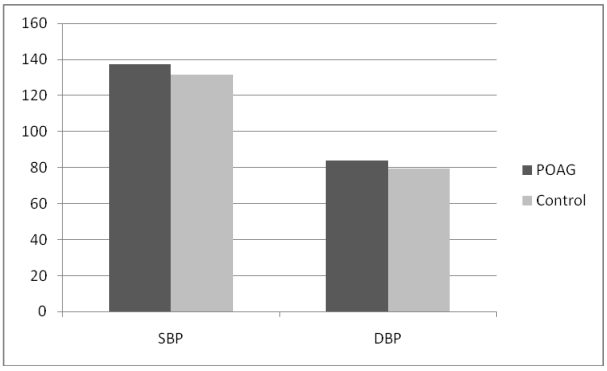
50-130) and in control patients it was 79.4±8.0 mmHg (range: 60-100). The difference was statistically highly significant (P=0.003) (Table 1 and Figure 1).

Mean IOP in glaucomatous eyes was 18.65 mmHg (range: 4-53) in the right eye and 16.71 mmHg (range: 4-34) in the left eye.

Table 1. Blood pressure comparison between primary open angle glaucoma patients (n=100) and control group (n=100)

Blood pressure	Group	Mean±SD	Range	P
Systolic	POAG	137.3±24.7	110-240	0.076
	Control	131.6±19.9	90-220	
Diastolic	POAG	84.1±13.2	50-130	0.003
	Control	79.4±8.0	60-100	

POAG: Primary open angle glaucoma
SD: Standard deviation



POAG: Primary open angle glaucoma
SBP: Systolic blood pressure
DBP: Diastolic blood pressure

Figure 1. Blood pressure distribution in primary open angle glaucoma patients (n=100) and control group (n=100).

Discussion

The study was aimed to investigate possible correlation between POAG and systemic blood pressure. The high IOP was considered as a major risk factor for having POAG, together with age and myopia. The tendency for glaucoma and hypertension to co-exist is plausible. The hypothesis of this co-existence is based on mechanisms related to sodium handling (modulation of sodium transport at receptors in ciliary and renal tubular epithelia), and agrees with the findings of others.

In two previous studies, the Rotterdam Study[11] and the Egna-Neumarkt study,[1] a significant association between POAG and hypertension was found, while in the Baltimore Eye Survey a weak correlation was reported[3] and in the Barbados Study no association was found.[2] In a report of the "Blue Mountains Eye Study",[10] systemic arterial hypertension was found to be significantly associated with an increased risk of POAG, independent of the effect of blood pressure on IOP. Two pathophysiological mechanisms supposed to have role in hypertensive damage to the optic nerve:[7] first, a hypertensive microvascular damage with resulting ischemic damage to the anterior optic nerve structures; second, dysfunction of autoregulatory mechanisms of posterior ciliary perfusion to the optic nerve head, already found impaired in some POAG patients.[12,13] Furthermore, antihypertensive agents induce blood pressure falls, particularly at night,[14,15] which further decrease the amount of blood flow to the optic nerve and consequently result in additional ischemic damage.[16]

There are several limitations in our study. There were several factors not included in the present analysis but reported to be associated with the development of POAG, such as systemic drugs[10,17] and other ocular diseases. Information about some of the factors investigated was not defined thoroughly. Diagnosis of diabetes mellitus, smoking, and antihypertensive drugs based merely on participants' answers in questionnaire. It is desirable that we design some studies in which systemic and ophthalmologic parameters are more deliberately selected and estimated.

Conclusion

In conclusion we found that POAG has a strong positive correlation with diastolic blood pressure in our patients. This study may provide basic information for further studies about association between POAG and hypertension in Iranian descent.

POAG had no association with systemic hypertension (as defined in our study) (P=0.053), and also no correlation between mean systolic blood pressure and POAG was found. Mean systolic blood pressure in POAG

group was 137.3 mmHg and in control group was 131.6 mmHg (P=0.076). POAG showed positive correlation with diastolic blood pressure. Mean diastolic blood pressure in POAG group was 84.09 mmHg and it was 79.39 mmHg in control group (P=0.003). Both IOP and systolic blood pressure increased significantly with increasing age.

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