Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2016, 5, 4:104-110

Relationship between Intra Ocular Pressure and Some Risk Factors, In Northern Iran

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ABSTRACT

High intra ocular pressure (IOP) often is related with open angle glaucoma. Although patients with high IOP are disposable to risk of open angle glaucoma, most of them never given it. In this study we evaluated association of hypertension and some other underlying causes with high IOP in population of patients referred to Amiralmomenin hospital during 2011-2012. This was a descriptive prospective study. Population was included patients with high IOP referred during 2012 to Amiralmomenin Hospital in Rasht. 180 patients with high IOP entered in the study. IOP of both eyes, systolic and diastolic blood pressure in admission were measured by expert assistant of ophthalmology and recorded. 55% of our patients were women. The mean age of them was 67.64±11.88 years. The mean systolic and diastolic blood pressure were respectively 128.66 ± 16.71 and 77.00 ± 9.02 mmHg. The re was a significant relation between gender, history of hypertension, alcohol abuse, hyperlipidemia and cardiac disease with high IOP in right eye ($p<0.05$). Although there was a meaningful relation between changes of systolic blood pressure and IOP ($p=0.005$), there was no relation between changes of diastolic pressure and IOP ($p>0.05$). Our study showed that systolic blood pressure can predict the high IOP. The results indicate a high impact of intraocular pressure on measures of blood pressure in an Iranian sample population.

Keywords: Hypertension, Intra-Ocular Pressure, Predicting Factor, Systolic Blood Pressure, Diastolic Blood Pressure

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INTRODUCTION

High intraocular pressure associated with open-angle glaucoma and open-angle glaucoma was defined in the early part of the criteria [1]. Although elevated intraocular pressure in patients with open-angle glaucoma is a risk factor for glaucoma, but most of these patients have not ever given glaucoma [1, 2]. Although high IOP is not the only risk factor for optic nerve damage in glaucoma, it seems that improvement of damage associated with optic disk examinations and or loss of visual field in high intraocular pressure [2-5]. High intraocular pressure in patients with normal pressure glaucoma is associated with optic nerve damage relatively [6]. Hence, cognition of effective factors on the level of intraocular pressure and prevention of high ocular pressure is so important. Several studies were done in evaluation of causes associated with high ocular pressure [1, 7-21]. Different studies in western population had mentioned that age and systolic blood pressure positively increases intraocular pressure [1, 7, 10-17, 21, 22]. Causes affecting the high ocular pressure are aging [1, 2, 4-9, 12, 18, 19], sex [22] African race [22], hypertension [1, 22,

23], pulse rate [20], diabetes [1, 20, 22, 23], obesity [22, 23], alcohol use [23], smoking [22], myopia [23], color-blind [23], nuclear sclerosis [23] and a family history of glaucoma [22, 23]. In addition, some epidemiological studies examined the relationship of obesity and IOP [16, 22, 24, 25] which showed that obesity was an independent risk factor for increasing IOP beside considering age, systolic blood pressure [SBP] and diastolic blood pressure [DBP] [16, 22, 24, 25]. Although there are many large population-based investigations had revealed significant associations between IOP and arterial blood pressure measurements [26, 27], there are few studies in Iran and Asia that evaluate the positive relationship between change in IOP and change in SBP. In large studies in two big cities in Iran in 1999, prevalence of hypertension in normal population more than 19 years old indicated as 18% [28] and 22% [29] which is high prevalence. Hypertension and other cardiovascular risk factors can affect many patients who have other comorbidities like ophthalmic disorders which leaded to rise of intra ocular pressure. There was no study which evaluated these factors in Iranian population. Therefore, in this study we evaluated relationship of blood pressure and some associated factors with high ocular pressure in patients referred to Amiralmomenin Hospital in 2012.

MATERIALS AND METHODS

This was a prospective study that evaluated association of blood pressure and some associated factors with high IOP in Rasht during January till December 2012. The study population included patients with high intraocular pressure referred to Amiralmomenin Hospital in the period of study in Northern Iran, Rasht. Patients with ocular pressure of more than 21mmHg considered as ocular hypertension. 180 hospitalized patients with high intraocular pressure were enrolled in the study. Inclusion criteria for cases were age more than 20 years old, no other ocular disease associated with increased intraocular pressure and not consuming hypertension drugs. Subjects receiving medical treatment for glaucoma, hypertension and/or diabetes mellitus were excluded. Tools of gathering data was a checklist including age, sex, body mass index (BMI), history of hypertension, diabetes mellitus, rheumatologic disease, ischemic heart disease, hyperlipidemia, alcohol abuse, glaucoma, asthma, gastrointestinal disease, kidney disease, cataracts. We recorded the intraocular pressure of both eyes and systemic blood pressure during hospital admission. The examinations included tonometry, anthropometry and blood pressure measurements. All of them were performed by an expert assistance ophthalmology physician. The IOP was determined by the mean value of three successive readings of the eye with an implantation tonometer between 8 and 11 a.m. Height and weight were measured with the subjects by a lightweight hospital gown in a standing position without shoes. Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared. Blood pressure was taken in the sitting position at the right upper arm. We followed the research ethics guidelines of Guilan University of Medical Sciences and Helsinki declaration at all stages of the study. Patients were entered in the study with an informed consent. The statistical software SPSS version 18 was used for descriptive statistics (frequency, percentage, mean and standard deviation) and statistics test Kolmogorov-Smirnov find out the normal distribution of the data, Pearson correlation coefficient, Mann-Whitney U, Kruskal-Wallis H and multivariate regression using generalized linear models (Model Generalized Linear) with considering the significant $P<0.05$ were analyzed. Followed by Univariate analysis, variables with $P<0.01$ multivariate linear regression models were entered.

RESULTS

The mean age of the 189 subjects was 67.64 ± 11.88 years (range: 12–87 years) and 55% of them were female. The mean left and right IOP values were a little higher in females than in males, with a significant difference in left IOP ($P=0.043$) without in right IOP ($P=0.11$). The mean of SBP was higher in male (130.61 ± 17.16 mmHg) than female (127.07 ± 16.25 mmHg) ($P=0.157$) and DBP was higher in female (77.37 ± 8.75 mmHg) than men (76.54 ± 9.37) ($P= 0.541$). Past medical and social history of patients are showed in table 2.

In the present study there was no significant relation between age groups and left ($P=0.73$) and right intraocular pressure ($P=0.33$) and diastolic blood pressure ($P=0.73$), but there was significant correlation between systolic blood pressure ($P=0.03$) and age groups. In univariate analysis, the variables gender, history of hypertension, alcohol consumption, history of hyperlipidemia and heart disease with right intraocular pressure were associated with high intraocular pressure significantly ($P<0.005$). Sex, history of hypertension, alcohol consumption, history of glaucoma, history of rheumatologic disorders, history of diabetes mellitus and hyperthyroidism were associated with left IOP significantly ($P<0.005$) (Table 3).

In the regression analysis, alcohol consumption and hypertension were significantly associated with right IOP. So, alcohol was associated with increased right intraocular pressure (P<0007). Also hypertension was associated with increased right intraocular pressure, in which by increasing blood pressure, intraocular pressure was increased (P<0.005). Glaucoma and hypertension were significantly associated with left IOP and (P<0.005) (Table 4).

In this study, significant correlation was observed between changes in systolic blood pressure and intraocular pressure (P=0.005), while the correlation between the change in IOP was not observed with diastolic blood pressure (P>0.005). Therefore, the systolic blood pressure considered to be a marker for increased IOP.

Our results showed that systolic blood pressure (SBP) in Multivariate analysis can predict the hypertension in patients with high ocular pressure. The formula was obtained from our results was in this matter: Ocular pressure= 11+0.15× SBP. By this formula we can screen predisposing patients to control their ocular pressure.

DISCUSSION

The present study was done in an Iranian population which has not been studied yet and the results are remarkable in this respect. In this study, there was no significant correlation between age and IOP in left and right eyes, while the long-term study in Japan had shown significant reduction of IOP in healthy young and middle age persons statistically (30). In other studies, a significant inverse correlation was observed between changes in IOP with age (25, 31, 32). In contrast, in other studies, IOP increases with age (1, 33).

In this study, sex, history of hypertension, alcohol consumption, history of high cholesterol and cardiac disease were associated significantly with intraocular pressure in the right eye (P<0.005). Gender, hypertension, alcohol consumption, glaucoma, rheumatologic disease, diabetes mellitus and hyperthyroidism associated significantly with intraocular pressure in the left eye (P<0.005). In this study, sex, hypertension, alcohol consumption, high cholesterol and cardiac disease associated with intraocular pressure in the right eye significantly (P<0.005). Gender, hypertension, alcohol consumption, glaucoma, rheumatologic disease, diabetes mellitus and hyperthyroidism associated with intraocular pressure in the left eye significantly (P<0.005).

We showed significant relationship between gender and IOP in both eyes and the mean of IOP was higher in male than female. Inversely, in an another large population Iranian study there was no significant relationship (34).

Table 1- Distribution of demographic and clinical characteristics of patients

Characteristics	Male	Female	Total
Age			
< 40 years	0	5, 5.1%	5, 2.8%
41-60 years	18, 22.2%	19, 19.2%	37, 20.6%
>61 years	63, 77.8%	75, 75.8%	138, 76.7%
Mean Age (years)	67.86 ± 9.77	67.45 ± 13.41	67.64 ± 11.88
Mean Right IOP (mmHg)	15.70 ± 3.4 0	16.52 ± 3.29	16.16±3.53
Mean Left IOP (mmHg)	15.84 ± 3.15	17.02 ± 4.14	16.49 ± 3.76
Mean SBP (mmHg)	130.61 ± 17.16	127.07 ± 16.25	128.66 ± 16.71
Mean DBP (mmHg)	76.54 ± 9.37	77.37 ± 8.75	77.00 ± 9.02
Mean BMI (kg/m^2)	28.70 ± 4.00	29.23 ± 4.47	28.99 ± 4.26

IOP= Intra Ocular Pressure; SBP= Systolic Blood Pressure; DBP= Diastolic Blood Pressure; BMI= Body Mass Index. Values are given as n, percentages or mean± standard deviation.

Table 2- Gender distribution and past medical history of patients

Factors	Frequency (Percent)
Gender	Male: 81 (45%) Female: 99 (55%)
Cardiac disease	25 (13.9%)
Hyperlipidemia	27 (15%)
Hypertension	99 (55%)
Smoking	18 (10%)
Alcohol	2 (1.1%)
Cataract	72 (40%)
Renal disease	3 (1.7%)
Glaucoma	37 (20.6%)
Rheumatologic disease	2 (1.1%)
Gastrointestinal disease	2 (1.1%)
Hyperthyroidism	2 (1.1%)
Asthma	4 (2.2%)
Diabetes Mellitus	37 (20.6%)

Table 3- Comparison of mean of OD (Right IOP) and OS (Left IOP) based on clinical and demographic factors

Factors		Right IOP (OD) (Mean ± SD) mmHg	P-Value	Left IOP (OS) (Mean ± SD) mmHg	P-Value
Gender	Male	16.5 ± 3.2	0.03	17.0 ± 4.1	0.04
	Female	15.7 ± 3.4		15.8 ± 3.1	
Cardiac disease	Yes	17.4 ± 3.9	0.04	16.3 ± 3.8	0.87
	No	15.9 ± 3.2		16.5 ± 3.5	
Hyperlipidemia	Yes	17.0 ± 4.4	0.064	17.1 ± 4.0	0.393
	No	15.9 ± 3.1		16.3 ± 3.7	
Hypertension	Yes	16.8 ± 3.2	0.005	17.3 ± 4.0	0.005
	No	15.2 ± 3.2		15.5 ± 3.2	
Smoking	Yes	16.4 ± 3.1	0.706	16.6 ± 3.9	0.879
	No	16.1 ± 3.3		16.4 ± 3.7	
Alcohol	Yes	23.0 ± 1.4	0.004	21.0 ± 4.2	0.089
	No	16.0 ± 3.2		16.4 ± 3.7	
Renal disease	Yes	16.3 ± 2.5	0.90	16.3 ± 1.5	0.80
	No	16.1 ± 3.3		16.4 ± 3.7	
Glaucoma	Yes	16.0 ± 2.0	0.90	24.7 ± 8.5	0.005
	No	16.1 ± 3.3		16.2 ± 3.3	
Rheumatologic disease	Yes	14.0 ± 0.0	0.005	24.5 ± 9.1	0.002
	No	16.1 ± 3.3		16.3 ± 3.6	
Gastrointestinal disease	Yes	14.0 ± 0.1	0.52	16.0 ± 0.1	0.68
	No	16.1 ± 3.3		16.4 ± 3.7	
Hyperthyroidism	Yes	19.5 ± 3.5	0.15	21.0 ± 5.6	0.08
	No	16.1 ± 3.3		16.4 ± 3.7	
Asthma	Yes	17.2 ± 1.7	0.50	17.2 ± 3.0	0.68
	No	16.1 ± 3.3		16.4 ± 3.7	
Diabetes Mellitus	Yes	16.6 ± 3.4	0.334	17.1 ± 3.5	0.005
	No	16.1 ± 3.3		16.3 ± 3.8	

IOP= Intra Ocular Pressure

Table 4- Estimation of regression coefficient of intra ocular pressure based on demographic and clinical factors

IOP	Factor	B Coefficient	Standard Error (S.E)	Confidence Interval (95%)		P-Value
				Minimum	Maximum	
Left	Hypertension	- 0.194	0.545	- 2.543	- 0.389	0.005
	Glaucoma	- 0.316	1.780	- 1.299	- 4.629	0.005
Right	Hypertension	- 0.214	0.502	- 2.435	- 0.452	0.005
	Alcohol	- 0.203	1.867	- 8.772	- 1.398	0.007

IOP= Intra Ocular Pressure

Alcohol was directly associated with increased right intraocular pressure (P<0.007). Glaucoma and hypertension were significantly associated with left intraocular pressure and was increased by rising in left intraocular pressure (P<0.005). Despite of several studies have reported an association between blood pressure and elevated IOP, the true relationship is still not well recognized. In several studies, systolic blood pressure was the most relevant determinant of IOP in all patients [13, 16, 22, 35]. Also, in this study, significant correlation was observed between changes of

systolic blood pressure and intraocular pressure (P=0.005), while the relationship between diastolic blood pressure and IOP changes were not seen (P>0.005). Therefore, an increase in systolic blood pressure can be considered as an indicator of high IOP. Systemic blood pressure in this study was also significantly associated with high IOP in the right eye. Increase in systemic blood pressure probably can affect changes in IOP by sympathetic tone, atherosclerotic changes and high level of renin-angiotensin, indirectly [24, 36].All these factors can affect the pressure of epi-scleral venous which regulate the watery humor through the Schlemm's canal. Then it leads to effects on intraocular pressure [37].In reporting the relationship between blood pressure and IOP, most studies have consistently shown a strong influence of blood pressure on IOP [31, 32, 38-40]. Increased blood pressure has been thought to elevate IOP by not only elevating ciliary artery pressure and consequently inducing an increase in production of aqueous humor, but also increased serum corticoids and sympathetic tone [41]. In contrast with previous studies we did not have any relationship between BMI or obesity with high IOP in our population.

Findings from this study indicated that systolic blood pressure and systemic blood pressure effectively and positively, can be associated with high intraocular pressure. Changes were not affected by age. The results indicated a high impact on intraocular pressure measures blood pressure in an Iranian sample population. Also we recommended a formula in which patients with risk factors of high ocular pressure can screen by it to control their ocular pressure. To getting more information, doing a long-term longitudinal study to assess the indicators presented in this study, as well as more advanced causes and using the lens thickness for better determination of association with the increase in intraocular pressure is suggested. Our study limitation was that we performed this study as a cross sectional method in a center and the number of patients was low and we just evaluated the patients with high IOP. It is recommended to do this study in multicenter and different parts of Iran in a large population and normal subjects.

Acknowledgments
Authors of the paper thank Amiralmomenin Hospital personnel and scientific & research club of student Basij of Guilan University of Medical Sciences for their assistance in collecting data.

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