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Factors Related to Raised Intraocular Pressure: In a Tertiary Hospital in Bangladesh

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Abstract

Glaucoma, a leading cause of irreversible blindness globally, accounts for 8% of such cases. The probability of developing glaucoma appears to be elevated in individuals with systemic hypertension or diabetes mellitus. Elevated intraocular pressure (IOP) is the only modifiable risk factor associated with the development and progression of glaucoma, and both medical and surgical interventions are available for its management. This study, conducted in the Ophthalmology department of BSMMU from July 2021 to June 2022, was a hospital-based cross-sectional investigation with a sample size of 153. The majority of participants fell into the 41-50 age group, with a mean age of 37.15±17.14. 41.8% of the responders were men and 58.2% were women. Refractive errors were identified in 7.2% of cases, with primary open-angle glaucoma (POAG) diagnosed in 60% of cases, normal-tension glaucoma (NTG) in 11.1%, and angle-closure glaucoma (PACG) in 10.5%, among other types. The study also observed associations between age groups and IOP levels, with 42% of individuals aged 30-50 having IOP in the 18-22 mmHg range. Additionally, 50% of established glaucoma cases had diabetes mellitus, 30% had hypertension, and 10% had a history of steroid therapy. Together with other variables including steroid usage, diabetes, and hypertension, high IOP continues to be a substantial risk factor for the start and progression of glaucoma.

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Introduction

Elevated intraocular pressure (IOP) has been shown to be the fundamental contributory factor for glaucoma worldwide. Hypertensive patients with IOP have a greater chance of developing Open Angle Glaucoma (OAG), that is demonstrated as a prime cause of developing blindness worldwide (Langman et al, 2005). Glaucoma encompasses multiple diseases having common feature of Loss of visual function as a consequence of optic neuropathy. Despite the fact that research has discovered that elevated intraocular pressure (IOP) is an important risk indicator for the development of glaucoma, IOP levels have little effect on the disease's course. (Foster et al, 2002). Age and genetic predispositions are the main predictors for the onset and progression of glaucoma; however, due to their limited controllability, IOP is the only parameter that is affected by the treatment plan (Down et al, 2009). Studies suggest that, after cataracts, glaucoma is the second most common cause of blindness globally. It is believed that high blood pressure increases the chance of developing and worsening glaucoma. (Resnikoff et al, 2002). Factors such as age, gender, African ethnicity, high blood pressure, heart rate,

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diabetes, obesity, alcohol use, smoking, nuclear sclerosis cataract, shortsightedness , colorblindness, and glaucoma in the family can all contribute to high ocular pressure (Leske et al, 1983). Individuals with comorbid conditions such as eye illnesses that cause an increase in intraocular pressure might be impacted by hypertension and other cardiovascular risk factors. Based on research conducted in Africa, 15% of blindness cases are caused by glaucoma, and blindness rates are highest in the continent globally. Furthermore, a different study discovered that, in comparison to people from other regions, Africans have a higher prevalence of open angle glaucoma (OAG) than do Europeans (Park et al, 2009). Almost 25% of adults worldwide now suffer from systemic hypertension, and by 2025, that number is expected to rise to almost 1.5 billion people all over the world (Kearny et al, 2005). Seven percent of patients with lOP had hypertension, according to a community-based survey done in Uganda (Guwatudde et al, 2015). Furthermore, a number of population-based research have discovered a favourable association between intraocular pressure and systemic blood pressure (Leske et al, 1983). While raising 10P can be treated easily, it is still unknown how often it occurs in hypertensive patients. Due to the asymptomatic nature of Open Angle Glaucoma, most patients are not aware of their condition until irreversible consequences occur. Therefore, the aim of this study was to determine the frequency of elevated IOP in people with hypertension and the characteristics associated with it.

The aim of this research was to examine the variables associated with elevated IOP in the elderly population.

Materials and Methods

A cross-sectional hospital based study was carried out in the BSMMU Ophthalmology Department between June 2021 and July 2022 that included 153 participants as study participants. Patients those who had diagnosed as chronic glaucoma cases were included in the study.

Individuals with abnormalities in the cornea that might influence the lOP readings include those with anterior segment pathology, such as corneal opacities and ulcers, collagen disorders, such as keratoconus, endothelial-based corneal dystrophies, such as Fuchs, prior corneal surgery involving the central cornea, prior corneal trauma or injury, prior refractive surgery,/ corneal astigmatism (03.00 D), corneal edema, and severe surface disorder from contact lens wear.

A manual sphygmomanometer was used to measure each patient's blood pressure (R.P.) after admission. Blood pressure was deemed elevated or high if the systolic or diastolic readings were greater than 130 mm Hg or 80 mm Hg, respectively. Every patient had their blood sugar level measured as well. After tetracaine Hcl 0.1% was applied, the intraocular pressure (IOP) was measured using applanation tonometry. The lOP was measured in millibars (mmHg) by taking the average of three consecutive readings. The principal investigator avoided diurnal variation by taking the IOP measurements between 9 am and 12 pm. IOP readings between 10 and 21 mmHg were regarded as typical. A value of 10 mmHg or less was classified as ocular hypotension, and a value of more than 21 mmHg was considered raised IOP. The relationship between each independent variable and the dependent variable (OP) was determined through statistical analysis using SPSS version 21 software.

Table 1. Age Distribution of the Respondents

Age	N=153	Percentage
0-10	8	5.2
11-20	20	13.1
21-30	25	16.3
31-40	21	13.7
41-50	42	27.5
51-60	24	15.7
61-70	9	5.9
71-80	4	2.6
Mean ±SD	37.15±17.14	

Table 1 shows the age distribution of the respondents. Most of the respondents 42(27.5%) were in the age group 41-50 years and followed by 25(16.3%) in 21-30, 24(15.7%) in 51-60, 21(13.7%) in 31-40, 20(13.1%) in 11-20, 9(5.9%) in 61-70, 8(5.2%) in 0-10 years, 4(2.6%) in 71-80 years. The Mean ±SD age was 37.5±17,14.

Table 2. Gender Distribution of the Respondents

Gender	N=153	Percentage (%)
Male	64	41.8
Female	89	58.2

Table 2 shows Females (58.2%, N=89) are mostly prevalent than males (41.8%, N=64) in the study.

Table 3. Diagnosis

DX	N=153	Percentage (%)
Refractive Error	11	7.2
NTG	17	11.1
PACG e-Cataract	16	10.5
ONTG	3	2.0
S/P TRAB	1	0.7

Table 3 shows the diagnosis done among the study patients. Refractive Error was found in 11(7.2%) cases and followed by NTG in 17(11.1%), PACG e-Cataract in 16(10.5%), ONTG in 3(2%), (S/P) 1(0.7%)

Table 4. IOP Range

(IOP) (MHg)	N=153	Percentage (%)
8-14	21	13.7
12-20	9	5.9
14-36	7	4.6
15-16	5	3.3
16-20	19	12.4
17-18	6	3.9
18-48	27	17.6
20-22	9	5.9
21-22	6	3.9
22-36	8	5.2
24-40	8	5.2
25-23	4	2.6
26-18	3	2.0
Others	21	13.7

Table 4 shows the (IOP) (MHg) in different ranges. Most of the study patient's (IOP)(MHg) 27(17.6%) was ranged between 18-48 and followed by 21(13.7%) was 8-14, 9(5.9%) was 12-20, 7(4.6%) was 14-36, 5(3.3%) was 15-16, 19(12.4%) was 16-20, 6(3.9%) was 17-18, 9(5.9%) was 20-22, 6(3.9%) was 21-22, 8(5.2%) was 22-36, 8(5.2%) was 24-40, 4(2.6%) was 25-23, 3(2%) was 26-18 and 21(13.7%) ranged others.

Table 5. (IOP)(mmHg) range in diabetic patients in relation to age

Age Group In Years	Diabetic Patients		Most Frequent (IOP)A(MHg) Range
	N=69	Percentage (%)	
20-29	3	4.3	12-12
30-50	29	42.0	18-22
>50	37	53.6	22-36

Table 5 shows the most frequent (IOP)(mmHg) range in diabetic patients in relation to age. There were 3(4.3%) patients in 20-29 years age group with the most frequent (IOP)(mmHg) range 12-12 and followed by 29(42%) were 30-50 years with (IOP)(mmHg) range 18-22 and 37(53.6%) were >50 years with (IOP)(mmHg) range 22-36.

Table 6. (IOP)(mmHg) range in HTN patients in relation to age

Age Group In Years	HTN Patients		Most Frequent (IOP)A(MHg) Range
	N=59	Percentage (%)	
20-29	1	1.7	10--12
30-50	22	37.3	18-20
>50	36	61	20-40

The most common (IOP)A(mmHg) range in HTN patients according to age is shown in Table VI. In the age group of 20–29 years, the most common (IOP)A(mmHg) range was found in 1 patient (1.7%), followed by 22 patients (37.3%) who were 30–50 years old and had a (IOP)A(mmHg) range of 18–20 and 36 patients (61%), who were older than 50 years old and had a range of 20–40.

Table 7. (IOP)(mmHg) range in Cardiac patients in relation to age

Age Group In Years	Cardiac Patients		Most Frequent (IOP)A(MHg) Range
	N=63	Percentage (%)	
20-29	1	1.6	10-10
30-50	25	39.7	18-18
>50	37	58.7	20-36

The most common (IOP)(mmHg) range for cardiac patients according to age is shown in Table 7. One patient (1.6%) in the 20–29 age group had the most common (IOP) (mmHg) range of 10–10, followed by 25 (39.7%) in the 30–50 age group with the range of 18–18 and 37 (58.7%) in the >50 age group with the range of 20–36.

Discussion

Research had shown that high IOP was a reliable indicator of when POAG will manifest, and that treating high IOP patients with topical ocular hypotensive medicine might postpone or avoid POAG from developing (Gordon et al, 2002). Numerous research investigations have indicated that the prevalence of glaucoma rises with age (Song et el, 2011). The majority of total respondents (27.5%) belonged to the 41-50 age group, next after, 5.2% in the 0-10, 13.1% in the 11–20, 16.3% in the 21-30, 13.7% in the 31-40, 15.7% in the 51-60, 5.9% in the 61-70, and 2.6% in the 71-80 age group. 37.15+17.14 was the mean ±SD age [Tabel 1]. According to Table 2, the majority of responders were 64 (41.8%) men and 89 (58.2%) women. In another research, comparable results were seen, with 42.25% of men and 57.75% of women (Hedner et al, 2005). 7.2% of cases had refractive errors, followed by NTG e-ps at 11.1%, PACG c-Cataract at 10.5%, NTG at 2%, and (B E) at 0.7%. Most of the study patient's (IOP)(mmHg) 17.6% was ranged between 18-48 and followed by 13.7% was 8-14, 5.9% was 12-20, 4.6% was 14-36, 3.3% was 15-16, 12.4% was 16-20, 3.9% was 17-18, 5.9% was 20-22, 3.9% was 21-22, 5.2% was 22-36, 5.2% was 24-40, 2.6% was 25-23, 2% was 26-18 and 13.7% ranged others [table 4]. This study demonstrated a statistically significant link between patients with diabetes, high blood pressure, and heart problems with elevated IOP. Diabetic patients with the highest frequency (IOP) (mmHg) range of 12-12 were 4.3% of those in the 20-29 age group; these patients were followed by 42% in the 30- 50 age group with the range 18-22 and 53.6% in the >50 age group with the range 22-36. [Table 5]. Table VI shows that the most common (IOP) (mmHg) range for 1.7% of HTN patients in the 20-29 age group was 10-12. This was followed by 37.3% of patients in the 30-50 age group with an IOP (mmHg) range of 18-20, and 61% of patients over 50 years old with an IOP (mmHg) range of 20-40. 1.6% of cardiac patients in the 20-29 age group had the most frequent (IOP)(mmHg) range of 10-10, followed by 39.7% of patients in the 30-50 age group with the range of 18-18 and 58.7% of patients in the >50 age group with the range of 20-36 [Table 7].

Conclusions

IOP is the major risk factor for development of Glaucoma. Different systemic diseases can affect ocular pressure. HTN, DM and several cardiac abnormalities can raise IOP that may lead to glaucoma. So, IOP should be measured in such type of systematic diseases to treat early glaucoma.

Conflict of interest

Authors have no conflict of interest to disclose.

Statement of author's credit

M. S. Ahmed: Formulated the research goals, designed the methodology, done data curation and prepared and edited manuscript. S. M. Noman: collected and analysed data and participated in conception of the study. Q.S. Mahnur: Participated in data collection and analysis, designed computer analysis and drafted manuscript.

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