

PREVALENCE OF GLAUCOMA IN TYPE 2 DIABETES MELLITUS AND ITS RELATION TO HYPERTENSION

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ABSTRACT

BACKGROUND

Glaucoma is one of the leading global causes of irreversible blindness. Vascular risk factors like hypertension and diabetes can influence the development and progression of glaucoma. Hence, screening for glaucoma is of utmost importance in patients with hypertension and diabetes.

The aim of the study is to study the prevalence of glaucoma in type 2 diabetic patients and its relation to systemic hypertension.

MATERIALS AND METHODS

A total of 750 diabetic patients aged between 31 and 80 years attending our clinic were selected for the study. Blood pressure was graded as normal or hypertensive (systolic blood pressure >140 mmHg and/or diastolic blood pressure >90 mmHg) intraocular pressure was recorded using applanation tonometer. Glaucoma was confirmed by dilated fundus examination and perimetry (HFA). Those patients already on treatment for glaucoma and Hypertension (HT) were also included in this study.

RESULTS

The prevalence of glaucoma in 750 diabetic patients was 93 (12.4%) and prevalence of HT was 349 (46.5%). Glaucoma was significantly more in diabetic patients with HT 53 (15.2%) than patients without HT 40 (10.0%), p value 0.05%.

CONCLUSION

This study suggests that increase in blood pressure increases the intraocular pressure. Thus, subjects with HT are at increased risk of glaucoma, which necessitates adequate control of blood pressure in diabetic patients. No such relationship was seen between glycaemic control and glaucoma.

KEYWORDS

Diabetes, Glaucoma, Hypertension, Intraocular Pressure.

HOW TO CITE THIS ARTICLE: Jayalekshmi T, Poullose KP. Prevalence of glaucoma in type 2 diabetes mellitus and its relation to hypertension. J. Evid. Based Med. Healthc. 2018; 5(5), 435-438. DOI: 10.18410/jebmh/2018/88

BACKGROUND

Glaucoma is the second most common cause of irreversible blindness and visual impairment worldwide. Hypertension is an important risk factor for cardiovascular disease. Glaucoma is defined as chronic progressive optic neuropathy characterised by retinal ganglion cell death and associated visual field loss. Glaucoma is asymptomatic in its earlier stages. Although, intraocular pressure remains an important risk factor for glaucoma, other factors can also influence the disease development and progression. Several studies have implicated vascular risk factors in the pathogenesis of glaucoma. Among them, HT has become increasingly important.¹ Worldwide, the reported prevalence for primary open-angle glaucoma varies between 1.62% and 3.51%.²

Financial or Other, Competing Interest: None.

Submission 10-01-2018, Peer Review 15-01-2018,

Acceptance 24-01-2018, Published 29-01-2018.

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DOI: 10.18410/jebmh/2018/88



Several studies suggest that both HT and hypotension are associated with increased risk of primary open-angle glaucoma. Elevated blood pressure may directly damage the small vessels of optic disc and increase the risk of glaucoma.³ Excessive blood pressure lowering in glaucoma patients may cause a drop in Ocular Perfusion Pressure (OPP) and subsequent ischaemic injury causing glaucomatous cupping and visual field loss.⁴

The potential association between diabetes and primary open-angle glaucoma has been studied by many groups and most studies support a weak association between the two diseases with higher incidence of primary open-angle glaucoma in diabetic patients as compared to nondiabetic patients. In the present study, we have studied the relationship between intraocular pressure and blood pressure and the prevalence of glaucoma in diabetic patients.

MATERIALS AND METHODS

A total of 750 patients attending our diabetic clinic over 2 years were recruited for the study. Of this, 567 were males and 183 were females. The age group was between 31 and 80 years. It was a cross-sectional observational study. The study group included newly-diagnosed hypertensives and

those already on antihypertensive medications. HT was defined as systolic blood pressure >140 mmHg and/or diastolic blood pressure >90 mmHg³. Patients with history of glaucoma on treatment and newly-detected glaucoma were included in the study. Single measurement of blood pressure was taken using a mercury sphygmomanometer in the right upper arm in the sitting position by both palpatory and auscultatory method.

Detailed clinical examination including routine blood tests in a diabetic patient were done.

The intraocular pressure was recorded using applanation tonometer. Gonioscopy and dilated fundus examination using +90D lens and indirect ophthalmoscopy were done. All subjects with high intraocular pressure (>21 mmHg) or cup-disc ratio >0.5 or asymmetry of >0.2 were further evaluated with Humphreys perimeter for field defects. Primary open-angle glaucoma was diagnosed by the presence of both characteristic visual field defects and optic nerve damage with or without intraocular pressure of >21 mmHg.⁵

Statistical Analysis of Data

Quantitative variables expressed in mean $\pm$ Standard Deviation (SD) and categorical variables expressed in percentage were used for the analysis. Association of glaucoma with selected variables was carried out using Chi-square test. SPSS 17.0 version was used for analysis. P values less than 0.05 was considered statistically significant.

RESULTS

Of the total 750 patients included in our study, prevalence of HT was 349 (46.5%) (Table 1) (Figure 1).

The age group ranged from 31 to 80 years (Table 2) (Figure 2).

Of this, 567 were males and 183 were females (Table 3) (Figure 3).

Among the 750 patients, 93 (12.4%) had glaucoma, which is high compared to other studies done in general population^{2,6} (Table 4) (Figure 4).

In our study, glaucoma was significantly more in diabetic patients with HT53 (15.2%) than patients without HT40 (10.0%) p value significant at 0.05 level (Table 5) (Figure 5).

Our study showed no significant relation between glycaemic control and incidence of glaucoma (Table 6) (Figure 6).

HT	Count	Percentage
Yes	349	46.5
No	401	53.5

Table 1. Percentage Distribution of the Sample According to HT

Age	Count	Percentage
31-40	50	6.7
41-50	219	29.2
51-60	295	39.3
61-70	158	21.1

71-80	28	3.7
Mean $\pm$ SD	53.9 $\pm$ 9.1	

Table 2. Percentage Distribution of the Sample According to Age

Sex	Count	Percentage
Male	567	75.6
Female	183	24.4

Table 3. Percentage Distribution of the Sample According to Sex

Glaucoma	Count	Percentage
Yes	93	12.4
No	657	87.6

Table 4. Percentage Distribution of the Sample According to Glaucoma

HT	Glaucoma				X ²	p
	Yes		No			
	Count	Percent	Count	Percent		
Yes	53	15.2	296	84.8	4.67*	0.031
No	40	10.0	361	90.0		

Table 5. Comparison of HT Based on Glaucoma

*: - Significant at 0.05 level.

FBS	Glaucoma				X ²	p
	Yes		No			
	Count	%	Count	%		
Normal	21	16.9	103	83.1	4.32	0.115
Moderate control	27	13.9	167	86.1		
High	45	10.4	387	89.6		

Table 6. Comparison of FBS Based on Glaucoma

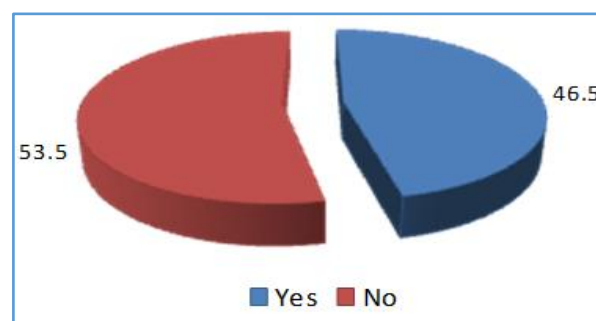


Figure 1. Percentage Distribution of the Sample According to HT

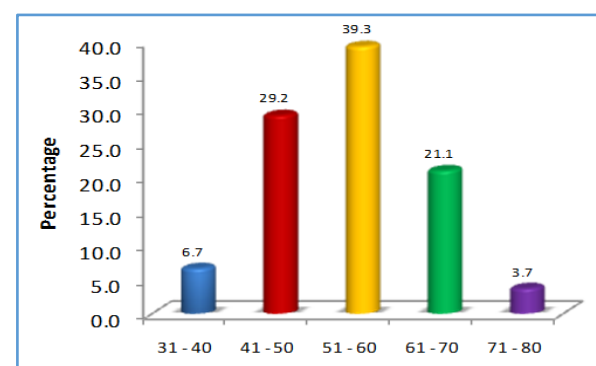


Figure 2. Percentage Distribution of the Sample According to Age

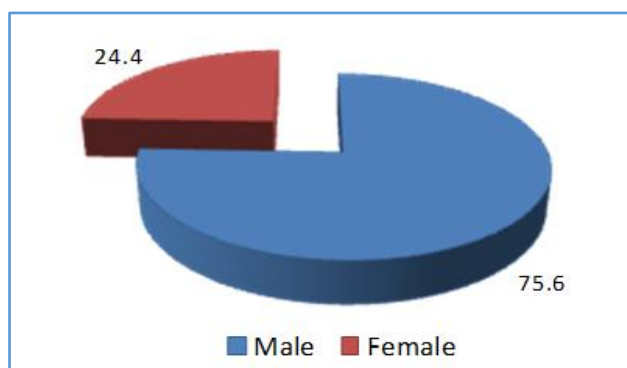


Figure 3. Percentage Distribution of the Sample According to Sex

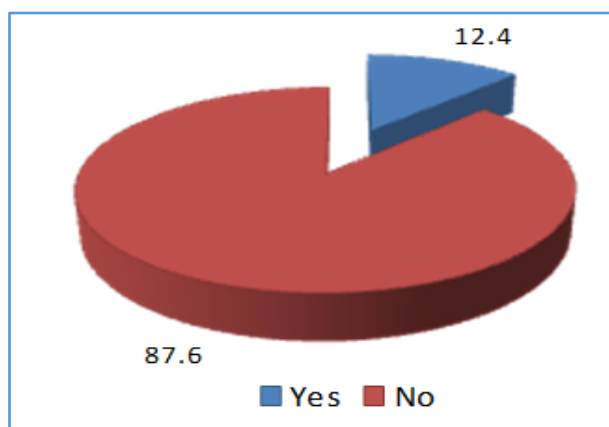


Figure 4. Percentage Distribution of the Sample According to Glaucoma

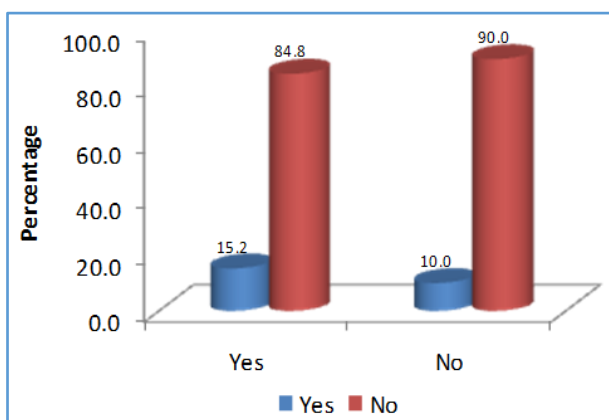


Figure 5. Comparison of HT Based on Glaucoma

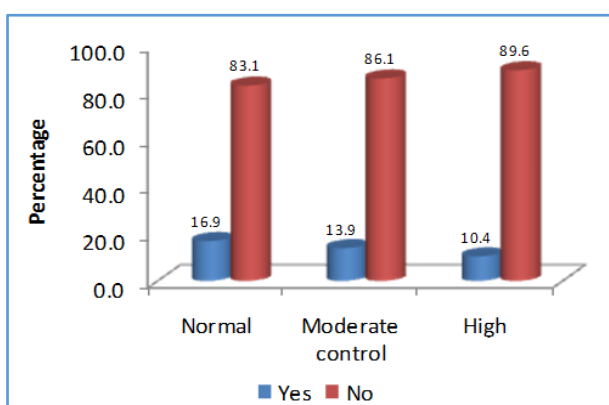


Figure 6. Comparison of FBS Based on Glaucoma

DISCUSSION

Association between HT and primary open-angle glaucoma has been evaluated in various population-based studies that yield contradictory results. In the Blue Mountain eye study, significant association was seen between HT and primary open-angle glaucoma.³ Association was strongest in those with poorly-controlled HT (5.4%) as compared to those with normal blood pressure (1.9%). Hypertension and diabetes could increase the risk of primary open-angle glaucoma indirectly through their association with high intraocular pressure. They could also increase the risk of primary open-angle glaucoma directly through small vessel disease. Vascular-related factors could affect blood pressure - intraocular pressure relationship needed for optic disc perfusion. In another study, subjects on antihypertensive medications were found more likely to have glaucoma. It may be related to bedtime dosing of antihypertensive medications, which cause a drop in nocturnal blood pressure and subsequent reduction in optic nerve head perfusion.³ Recent data suggests common mechanisms related to altered sodium transport in the epithelium of distal nephron (in HT) and ciliary epithelium (in glaucoma).⁷ Increased filtration of aqueous fluid in the ciliary body due to increased perfusion pressure in the ciliary arteries maybe the most likely explanation for the direct relationship between intraocular pressure and systemic pressure. Studies show important relation between intraocular pressure and capillary perfusion pressure in the optic nerve head. Primary open-angle glaucoma is more prevalent in those with lower perfusion pressures.^{2,8} Higher ocular perfusion pressure offers relative protection from glaucomatous damage in young patients, but is a risk factor in older patients.^{3,9} Patients at both extremes of blood pressure spectrum show an increased prevalence of glaucoma.^{10,11} The incidence is more for high-tension glaucoma.¹² Recent studies have also demonstrated that the effects on the visual field due to elevation of intraocular pressure was related to diastolic ophthalmic artery pressure. Systemic hypertension showed a modest positive association with elevated intraocular pressure.¹²

In our study, glaucoma was more in diabetic patients with HT. Connection between diabetes and simple glaucoma was observed in 1924 by Grafe. Becker, in 1971 found that simple glaucoma is more common in diabetes. This may be due to a common genetic background. Further studies have shown somewhat conflicting results. Diabetes cause microvascular damage and may affect vascular auto regulation of retina and optic nerve.² This maybe an added factor in our study, which showed higher incidence of glaucoma (12.4%) compared to general population. It maybe because the study was done in diabetic patients. Research shows that diabetes and HT increased the risk of primary open-angle glaucoma.^{13,14} Several reports have demonstrated a greater frequency of primary open-angle glaucoma in diabetics as compared to nondiabetics.^{15,16} Armstrong et al reported a prevalence of primary open-angle glaucoma of 4.1% in diabetic patients compared with 1.4% in the controls.¹⁷

A drawback of this study is that blood pressure and intraocular pressure are both influenced by diurnal variations. Therefore, having a single blood pressure or intraocular pressure reading may not be representative of an individual's true blood pressure or intraocular pressure status.³

CONCLUSION

The findings of the present study suggest that intraocular pressure increases with rise in blood pressure and subjects with HT are at increased risk for genesis of glaucoma, which necessitates adequate blood pressure control in diabetic patients. Systemic HT and glaucoma tend to be associated and common mechanisms related to sodium handling are responsible. Screening for glaucoma is of utmost importance in patients with diabetes and hypertension and it can reduce the prevalence of glaucoma, which has been recognised as a major cause of blindness worldwide.

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