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Evaluation of Glaucoma in Patients with Diabetes and Hypertension: A One-Year Observational Study

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Abstract

Background: Glaucoma is a group of eye diseases that damage the optic nerve, leading to vision loss. The elevated blood sugar levels in diabetes and high blood pressure in hypertension can both contribute to the development and progression of glaucoma. Effective management of both diabetes and hypertension can also help to reduce the risk of developing glaucoma. The aim of this study is to assess the evaluation of glaucoma in patients with diabetes and hypertension. **Material & Methods:** This cross-sectional observational study was carried out in the admitted and outpatient department (OPD) patients in the Department of Ophthalmology, Dr. Sirajul Islam Medical College and Hospital Ltd, Dhaka, Bangladesh from January 2021 to December 2022. Total 160 patients with glaucoma were included in this study. **Results:** In our study, mean (±SD) age of the study subject were 50.5±9.25 years. Majority of the patients had (27.5%) followed by 22 (13.8%) had diabetes and 14 (8.8%) had both. For the group with DM and HTN, the mean IOP was 16.25 with a 95% Confidence Interval (CI) of 13.25 to 18.43, mean HVFA was -9.12 with a 95% CI of -16.78 to -1.31 and mean CDR was 0.69 with a 95% CI of 0.55 to 0.82. For the group without DM and HTN, the mean IOP was 15.62 with a 95% CI of 14.83 to 16.35, mean HVFA was -5.01 with a 95% CI of -5.86 to -3.75 and mean CDR for this group was 0.60 with a 95% CI of 0.53 to 0.68. In the patients with DM and HTN group, there are 13 patients (13.8%) with moderate/severe VFD and 1 patient (1.1%) with mild VFD. In the patients without DM and HTN group, there are 26 patients (26.7%) with moderate/severe VFD and 54 patients (57.4%) with mild VFD. There were statistically significant differences ($p<0.05$) between the groups both moderate/severe and mild VFD. **Conclusion:** We determined that patients with HTN and DM had a greater extreme structure of glaucoma when in compared with the patients besides these risk factors. Hypertension was more common than diabetes.

Keywords:- Glaucoma, Diabetes Mellitus and Hypertension.

INTRODUCTION

Glaucoma is a chronic, progressive optic neuropathy that is caused by a group of ocular conditions resulting in raised intraocular pressure, which in turn causes damage to the optic nerve and leads to a loss of visual function.[1] But glaucoma can occur even with ordinary eye pressure. Glaucoma is the 2nd most frequent motive of blindness worldwide.[2] It is

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a foremost international issue, inflicting substantial ocular morbidity and incapacity due to its innovative nature ensuing in an irreversible visible loss.[3] Due to its chronicity, it is regularly additionally dubbed as a "silent killer" of the eye. Patients are generally asymptomatic till very superior stage, making visible loss irrecoverable with the aid of the time they current to an ophthalmologist.[4] Based on the morphology of angular iridocorneal, glaucoma is divided into the following two types: open-angle glaucoma (OAG) and angle-closed glaucoma.[5] Primary open-angle glaucoma (POAG), the most frequent glaucoma, is a chronic, progressive, and anterior optic neuropathy that is related with attribute cupping and atrophy of the optic disc, visible area loss, open angles, and no apparent causative ocular or systemic conditions.[6] POAG accounts owed for almost threequarters (74%) of all glaucoma cases.[7,8] Various estimates and meta-analysis records exhibit that estimated there were 60,500,000 people with open-angle glaucoma (OAG) and angle-closure glaucoma (ACG) in 2010.[7,9] The worldwide prevalence of diabetes among all age groups was estimated to be 2.8% in 2000 and 4.4% in 2030.[10] Some studies have found that Diabetes Mellitus is a significant risk factor for POAG.[11,12,13,14] The microvascular changes seen in diabetes make the optic nerve more susceptible to damage from intraocular pressure and also affect the retinal and optic nerve's vascular autoregulation, leading to decreased blood supply and glaucomatous optic neuropathy. A longer duration of Diabetes Mellitus was found to be associated with a higher prevalence of primary open-angle glaucoma.[11] The long-term presence of hyperglycemia along with dyslipidemia may increase the risk of neuronal damage due to oxidative stress.[15] Investigations have shown that diabetic eyes have a reduced capacity to regulate blood flow and exhibit decreased retinal blood flow.[16] Ciccone et al.[17] have explained the impact of high sugar levels or insulin resistance on pre-diabetic patients who have a strong family history of Diabetes Mellitus. Several studies have considered hypertension to be a risk factor for POAG.[18,19] Still, there is no convincing explanation for the exact mechanism by which systemic hypertension and glaucoma are related.[20] The present study was therefore conducted to assess the evaluation of glaucoma in patients with diabetes and hypertension.

Objective

To assess the Evaluation of Glaucoma in Patients with Diabetes and Hypertension.

MATERIAL AND METHODS

This cross-sectional observational study was carried out in the admitted and outpatient department (OPD) patients in the Department of Ophthalmology, Dr. Sirajul Islam Medical College and Hospital Ltd, Dhaka, Bangladesh from January 2021 to December 2022. Total 160 patients with glaucoma were included in this study. Here, 80 patients had glaucoma as well as diabetes or hypertension or both and the rest of the 80 patients only had glaucoma. Patients with other chronic disease were excluded from this study. Consent of the patients and guardians were taken before collecting data. After collection of data, they were entered into computer and statistical analysis of the results being obtained by using windows-based computer software devised with Statistical

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Packages for Social Sciences version 22. P value of less than 0.05 was considered statistically significant.

RESULTS

Table I demonstrates the demographic characteristics of the study subjects. In our study, mean (±SD) age of the study subject were 50.5±9.25 years. Here majority of the study people (33.12%) were in the age group of 50-59 years. Majority of the study subjects (51.87%) were female in our study and 48.13% were Male. Figure 1 demonstrates the occurrence of Glaucoma in Patients with Diabetes (DM) and Hypertension (HTN) patients. Here hypertension was the most common disease (27.5%) followed by 22 (13.8%) had diabetes and 14 (8.8%) had both. For comparison, 14 patients with both DM and HTN and 80 patients without DM and HTN were assessed. Table II shows the ocular findings of patients of POAG with DM and HTN and without DM and HTN. The parameters measured are Intraocular Pressure (IOP), Humphrey Visual Field Analysis (HVFA), and Cup-Disc Ratio (CDR). For the group with DM and HTN, the mean IOP was 16.25 with a 95% Confidence Interval (CI) of 13.25 to 18.43, mean HVFA was -9.12 with a 95% CI of -16.78 to -1.31 and mean CDR was 0.69 with a 95% CI of 0.55 to 0.82. For the group without DM and HTN, the mean IOP was 15.62 with a 95% CI of 14.83 to 16.35, mean HVFA was -5.01 with a 95% CI of -5.86 to -3.75 and mean CDR for this group was 0.60 with a 95% CI of 0.53 to 0.68. Table III shows the severity of Visual Field Defect (VFD) in Patients with Diabetes and Hypertension. In the patients with DM and HTN group, there are 13 patients (13.8%) with moderate/severe VFD and 1 patient (1.1%) with mild VFD. In the patients without DM and HTN group, there are 26 patients (26.7%) with moderate/severe VFD and 54 patients (57.4%) with mild VFD. There were statistically significant differences ($p<0.05$) between the groups both moderate/severe and mild VFD.

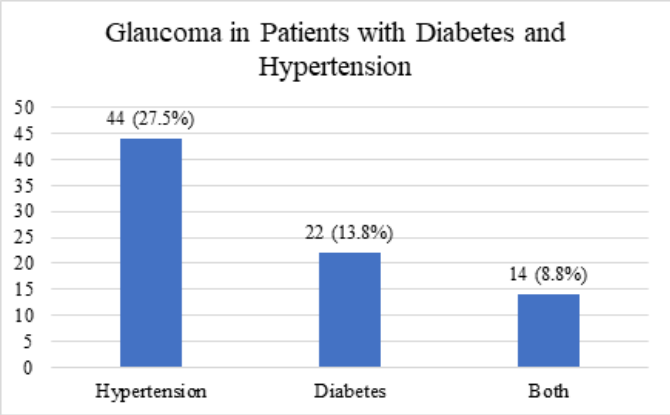

Figure 1: Occurrence of Glaucoma in Patients with Diabetes and Hypertension (N=160)

Table 1: Demographic characteristics of the study subjects (N=160).

Characteristics		Number of people	Percentage
Age (Years)	<20	6	3.75
	20-29	12	7.5
	30-39	26	16.25
	40-49	35	21.87
	50-59	53	33.12
	≥60	28	17.5
	Mean± SD	50.5±9.25	

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Sex	Male	77	48.13
	Female	83	51.87

Table 2: Ocular findings of patients of POAG with DM and HTN and without DM and HTN (N=94).

Parameters		**Mean**	**95% CI**
Patients with DM and HTN	Intraocular pressure (IOP)	16.25	13.25 to 18.43
	Humphrey visual field analysis (HVFA)	-9.12	-16.78 to -1.31
	Cup-disc ratio (CDR)	0.69	0.55 to 0.82
Patients without DM and HTN	Intraocular pressure (IOP)	15.62	14.83 to 16.35
	Humphrey visual field analysis (HVFA)	-5.01	−5.86 to −3.75
	Cup-disc ratio (CDR)	0.60	0.53 to 0.68

Table 3: Severity of Visual Field Defect (VFD) in Patients with Diabetes and Hypertension (N=94).

VFD	**Patients with DM and HTN (n=14)**		**Patients without DM and HTN (n=80)**		**P value**
	N	**%**	**n**	**%**	
Moderate/Severe	13	13.8	26	27.7	0.0307
Mild	1	1.1	54	57.4	< 0.0001

DISCUSSION

Glaucoma is the most typical cause of total blindness worldwide. According to study conducted by the WHO, glaucoma is thought to have caused the blindness of 3.2 million people globally.[21] Despite the evaluation of a number of risk factors for the emergence of POAG, research in this area is still ongoing.[22] Additionally, several research discovered that DM may be a risk factor for POAG.[11,12,19] The connection between DM and POAG is still debatable, though.[23] It has long been assumed that among vascular variables, systemic HTN may raise IOP primarily through ciliary body overproduction or impeded aqueous humor outflow.[24] However, there is still disagreement and uncertainty about this connection. While some research point to systemic HTN as a risk factor for glaucoma, others show that low systemic BP is more hazardous and poses a significant risk for the onset and progression of glaucoma.[25,26] The current study was conducted to assess the evaluation of glaucoma in patients with diabetes and hypertension. In our study, mean (±SD) age of the study subject were 50.5±9.25 years. The prevalence of glaucoma among individuals of 50-59 years old was highest (33.12%). In the study of Varma R et al.[27] among the 3939 participants, mean age was 54.7 ± 10.5 years which is similar to our study. Majority of the study subjects (51.87%) were female in our study and 48.13% were Male which is similar to other studies.[28,29] In our study, hypertension was the most common disease (27.5%) followed by 22 (13.8%) had diabetes and 14 (8.8%) had both. This was comparable with the study of Garg et al,[30] where HTN was seen in 35.1% of their participants. For the group with DM and HTN, the mean Intraocular Pressure (IOP) was 16.25 with a 95% Confidence Interval (CI) of 13.25 to 18.43, mean Humphrey Visual Field Analysis

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(HVFA), was -9.12 with a 95% CI of -16.78 to -1.31 and mean Cup-Disc Ratio (CDR) was 0.69 with a 95% CI of 0.55 to 0.82. For the group without DM and HTN, the mean IOP was 15.62 with a 95% CI of 14.83 to 16.35, mean HVFA was -5.01 with a 95% CI of -5.86 to -3.75 and mean CDR for this group was 0.60 with a 95% CI of 0.53 to 0.68. In the patients with DM and HTN group, there are 13 patients (13.8%) with moderate/severe VFD and 1 patient (1.1%) with mild VFD. In the patients without DM and HTN group, there are 26 patients (26.7%) with moderate/severe VFD and 54 patients (57.4%) with mild VFD. There were statistically significant differences ($p<0.05$) between the groups both moderate/severe and mild VFD. In a study conducted by Khatri A et al,[28] they found that the mean IOP in patients with both DM and HTN was 16.0 (95% CI: 13.9 to 18.0, $p<0.05$), mean VFD of −9.08 (95% CI: −16.9 to −1.27 $p<0.05$), and mean CDR of 0.68 (95% CI: 0.571 to 0.785, $p<0.05$). In comparison, the patient without DM and HTN had a mean IOP of 15.7 (95% CI: 14.9 to 16.5, $p<0.05$), mean VFD of −4.85 (95% CI: −5.83 to −3.86, $p<0.05$), and mean CDR of 0.61 (95% CI: 0.58 to 0.65, $p<0.05$). The comparison shows that the participants with DM and HTN have higher chances of having severe VFD compared with the participants without DM (OR 19.9, 95% CI: 2.52 to 156.8, $p=0.0046$). Their findings are in line with our study. In another study of Mitchell P et al,[31] IOP was consistently slightly higher in people with diabetes.

Limitations of The Study

In our study, there was small sample size and absence of control for comparison. Study population was selected from one center in Dhaka city, so may not represent wider population. The study was conducted at a short period of time.

CONCLUSIONS

We determined that patients with HTN and DM had a greater extreme structure of glaucoma when in compared with the patients besides these risk factors. Hypertension was more common than diabetes. Patients with these risk elements may want to signify “high-risk patients” and need to be recognized and be defined about the condition. A well documentation of the preceding investigation is an ought to analyze the rate of development and modification in the therapy may additionally be required accordingly.

REFERENCES

1. Congdon N, O'Colmain B, Klaver CC, Klein R, Muñoz B, Friedman DS, et al. Causes and prevalence of visual impairment among adults in the United States. Arch Ophthalmol. 2004;122(4):477-85. doi: 10.1001/archopht.122.4.477.
2. Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, Pokharel GP, et al. Global data on visual impairment in the year 2002. Bull World Health Organ. 2004;82(11):844-51.
3. Goldberg I, Graham SL, Healey PR. Primary open-angle glaucoma. Med J Aust. 2002;177(10):535-6.
4. Palimkar A, Khandekar R, Venkataraman V. Prevalence and distribution of glaucoma in central India (Glaucoma Survey 2001). Indian J Ophthalmol. 2008;56(1):57-62. doi: 10.4103/0301-4738.37597.
5. Kwon YH, Fingert JH, Kuehn MH. Primary open-angle glaucoma. N Engl J Med. 2009;360:1113–24.
6. Thylefors B, Négrel AD. The global impact of glaucoma. Bull World Health Organ. 1994;72(3):323-6.
7. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. Br J

Annals of International Medical and Dental Research
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Page no- 120-126 | Section- Research Article (Ophthalmology)

Ophthalmol. 2006;90(3):262-7. doi: 10.1136/bjo.2005.081224.
8. Bourne RR. Worldwide glaucoma through the looking glass. Br J Ophthalmol. 2006;90(3):253-4. doi: 10.1136/bjo.2005.083527.
9. Tham YC, Li X, Wong TY, Quigley HA, Aung T, Cheng CY. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. Ophthalmology. 2014;121(11):2081-90. doi: 10.1016/j.ophtha.2014.05.013.
10. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004;27(5):1047-53. doi: 10.2337/diacare.27.5.1047.
11. Chopra V, Varma R, Francis BA, Wu J, Torres M, Azen SP. Type 2 diabetes mellitus and the risk of open-angle glaucoma the Los Angeles Latino Eye Study. Ophthalmology. 2008;115(2):227-232.e1. doi: 10.1016/j.ophtha.2007.04.049.
12. Pasquale LR, Kang JH, Manson JE, Willett WC, Rosner BA, Hankinson SE. Prospective study of type 2 diabetes mellitus and risk of primary open-angle glaucoma in women. Ophthalmology. 2006;113(7):1081-6. doi: 10.1016/j.ophtha.2006.01.066.
13. Wilson MR, Hertzmark E, Walker AM, Childs-Shaw K, Epstein DL. A case-control study of risk factors in open angle glaucoma. Arch Ophthalmol. 1987;105(8):1066-71. doi: 10.1001/archopht.1987.01060080068030.
14. Klein BE, Klein R, Jensen SC. Open-angle glaucoma and older-onset diabetes. The Beaver Dam Eye Study. Ophthalmology. 1994;101(7):1173-7. doi: 10.1016/s0161-6420(94)31191-2.
15. Mitchell P, Smith W, Chey T, Healey PR. Open-angle glaucoma and diabetes: the Blue Mountains eye study, Australia. Ophthalmology. 1997;104(4):712-8. doi: 10.1016/s0161-6420(97)30247-4.
16. Kong GY, Van Bergen NJ, Trounce IA, Crowston JG. Mitochondrial dysfunction and glaucoma. J Glaucoma. 2009;18(2):93–100.
17. Clermont AC, Bursell SE. Retinal blood flow in diabetes. Microcirculation. 2007;14(1):49–61.
18. Ciccone MM, Scicchitano P, Cameli M. Endothelial function in pre-diabetes, diabetes and diabetic cardiomyopathy: a review. J Diabetes Metab. 2014;5:364.
19. Dielemans I, de Jong PT, Stolk R, Vingerling JR, Grobbee DE, Hofman A. Primary open-angle glaucoma, intraocular pressure, and diabetes mellitus in the general elderly population. The Rotterdam Study. Ophthalmology. 1996;103(8):1271-5. doi: 10.1016/s0161-6420(96)30511-3.
20. Dielemans I, Vingerling JR, Wolfs RC, Hofman A, Grobbee DE, de Jong PT. The prevalence of primary open-angle glaucoma in a population-based study in the Netherlands: the Rotterdam Study. Ophthalmology. 1994;101(11):1851-5.
21. Dielemans I, Vingerling JR, Algra D, Hofman A, Grobbee DE, de Jong PT. Primary open-angle glaucoma, intraocular pressure, and systemic blood pressure in the general elderly population. The Rotterdam Study. Ophthalmology. 1995;102(1):54-60. doi: 10.1016/s0161-6420(95)31054-8.
22. Rivera JL, Bell NP, Feldman RM. Risk factors for primary open angle glaucoma progression: what we know and what we need to know. Curr Opin Ophthalmol. 2008;19(2):102-6. doi: 10.1097/ICU.0b013e3282f493b3.
23. Tielsch JM, Katz J, Quigley HA, Javitt JC, Sommer A. Diabetes, intraocular pressure, and primary open-angle glaucoma in the Baltimore Eye Survey. Ophthalmology. 1995;102(1):48-53. doi: 10.1016/s0161-6420(95)31055-x.
24. Caprioli J, Coleman AL; Blood Flow in Glaucoma Discussion. Blood pressure, perfusion pressure, and glaucoma. Am J Ophthalmol. 2010;149(5):704-12. doi: 10.1016/j.ajo.2010.01.018.
25. Bonomi L, Marchini G, Marraffa M, Bernardi P, Morbio R, Varotto A. Vascular risk factors for primary open angle glaucoma: the Egna–Neumarkt Study. Ophthalmology. 2000;107(7):1287–1293.
26. Orzalesi N, Rossetti L, Omboni S. Vascular risk factors in glaucoma: the results of a national survey. Graefes Arch Clin Exp Ophthalmol. 2007;245(6):795-802. doi: 10.1007/s00417-006-0457-5.
27. Varma R, Wang D, Wu C, Francis BA, Nguyen BB, Chopra V, et al. Four-year incidence of open-angle glaucoma and ocular hypertension: the Los Angeles Latino Eye Study. Am J Ophthalmol. 2012;154(2):315-325.e1. doi: 10.1016/j.ajo.2012.02.014.
28. Khatri A, Shrestha JK, Thapa M, Khatri BK, Kharel M. Severity of primary open-angle glaucoma in patients with hypertension and diabetes. Diabetes Metab

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
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Page no- 120-126 | Section- Research Article (Ophthalmology)

Syndr Obes. 2018;11:209-215. doi: 10.2147/DMSO.S160978.
29. Tielsch JM, Katz J, Quigley HA, Javitt JC, Sommer A. Diabetes, intraocular pressure, and primary open-angle glaucoma in the Baltimore Eye Survey. Ophthalmology. 1995;102(1):48-53. doi: 10.1016/s0161-6420(95)31055-x.
30. Garg P, Singh L, Malhotra R, Lisa M. A study on systemic risk factors for primary open angle glaucoma. Int J Life Sci Pharma Rev. 2014;4(2):ISSN 2250-0480.
31. Mitchell P, Smith W, Chey T, Healey PR. Open-angle glaucoma and diabetes: the Blue Mountains eye study, Australia. Ophthalmology. 1997;104(4):712-8.

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