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Original Article

Gender and Age Disparities in the Prevalence of Primary Open-Angle Glaucoma among Type 2 Diabetics

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ABSTRACT

Background: *Primary Open-Angle Glaucoma (POAG) is a leading cause of irreversible blindness, often with no early symptoms. This study examined age and gender differences in POAG prevalence among people with Type 2 Diabetes to support better screening in high-risk groups.* ***Methods & Materials:*** *This cross-sectional analytical study was conducted at the Department of Ophthalmology in collaboration with the Department of Endocrinology, BIRDEM General Hospital, Dhaka, from March 2022 to April 2023. The study population comprised 185 type 2 diabetic patients in total. Patients either admitted or attending OPD at the Department of Ophthalmology & Endocrinology OPD of BIRDEM General Hospital, Dhaka was included in this study. Statistical analysis was performed using SPSS version 27.0. A p-value of ≤0.05 was considered statistically significant.* ***Result:*** *The study found that the mean age of respondents was 51.6 ± 6.6 years, with a higher proportion (53.5%) in the 51-60 years age group. There was a significant difference in age between the POAG group (54.2 ± 6.06 years) and the normal group (51.03 ± 6.6 years, p = 0.013). Males were more prevalent in the POAG group (53.1%) compared to the normal group (30.7%, p = 0.031).* ***Conclusion:*** *The study finds that older age and male gender increase the risk of Primary Open-Angle Glaucoma (POAG) in people with Type 2 Diabetes, highlighting the need for targeted screening and early detection in high-risk groups.*

Keywords: *Gender and Age Disparities, Primary Open-Angle Glaucoma, Type 2 Diabetics, Blindness*

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INTRODUCTION

Glaucoma is one of the leading causes of preventable blindness globally [1]. The disease often goes unnoticed in its early stages due to the absence of symptoms, and by the time it is detected, irreversible vision loss has typically occurred [2]. Primary Open Angle Glaucoma (POAG) is a chronic and progressive optic neuropathy, primarily affecting individuals over the age of 40, where elevated intraocular pressure (IOP) and other unidentified factors contribute to optic nerve damage and the degeneration of retinal ganglion cells and their axons. Although the exact mechanisms behind retinal ganglion cell death are not fully known, elevated IOP remains the most significant risk factor. Multiple large-scale randomized clinical trials have confirmed a link between IOP levels and the onset and progression of glaucoma. In addition to the mechanical stress from increased IOP on the optic nerve head (ONH), other vascular and systemic influences have been implicated, as they may cause reduced perfusion of the ONH, potentially playing a key role in the development and progression of POAG [3]. Globally, glaucoma affects approximately 60 million people, with POAG being more prevalent than primary angle-closure glaucoma (PACG) in most populations. Its estimated prevalence among individuals aged 40 to 80 years is 3.54%, and around 3.6 million people worldwide are blind due to POAG [4]. Primary Open-Angle Glaucoma (POAG) is a progressive optic neuropathy and one of the leading causes of irreversible blindness worldwide. Its prevalence is influenced by multiple factors, including age, gender, and systemic conditions such as type 2 diabetes mellitus (T2DM). Type 2 diabetes has been identified as a significant risk factor for POAG due to mechanisms such as microvascular dysfunction, oxidative stress, and impaired autoregulation of blood flow to the optic nerve head, all of which can contribute to glaucomatous damage [5,6]. The risk of POAG increases with advancing age, which is associated with cumulative damage to the optic nerve and age-related changes in ocular structures. Studies have consistently shown a higher prevalence of POAG in older individuals, particularly those over 60 years of age [7]. In diabetic patients, this risk may be further amplified due to the chronic effects of hyperglycemia on vascular integrity and nerve function. Gender differences have also been observed in POAG prevalence, although findings remain inconsistent across populations. Some studies suggest that males have a slightly higher prevalence, possibly

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due to anatomical differences in optic nerve structure or hormonal influences, while others report no significant gender disparity or higher risk in females under certain conditions [8]. Understanding the combined impact of gender and age on POAG prevalence among individuals with T2DM is crucial for early detection and intervention. Diabetic patients represent a high-risk group where targeted screening, particularly among older adults and potentially vulnerable gender groups, can play a significant role in preventing vision loss. This study aims to explore these disparities, contributing valuable insight into the epidemiology of POAG in diabetic populations and informing future strategies for risk-based screening and management.

METHODS & MATERIALS

This cross-sectional analytical study was conducted at the Department of Ophthalmology in collaboration with the Department of Endocrinology, BIRDEM General Hospital, Dhaka, from March 2022 to April 2023. The study population comprised 185 type 2 diabetic patients in total. Patients either admitted or attending OPD at the Department of Ophthalmology & Endocrinology OPD of BIRDEM General Hospital, Dhaka was included in this study. A consecutive type of sampling technique was applied to enroll the patients. Each patient underwent a comprehensive ocular examination, including BCVA, pupillary light reaction, ocular motility, color vision, slit lamp evaluation of the anterior segment, and IOP measurement using Goldmann applanation tonometry (Model L-5110; normal: 10–21 mmHg). Anterior chamber angle was assessed with Zeiss four-mirror gonioscopy (Model: OS4M) and considered open if Shaffer grade ≥2 with ≥270º visibility of the posterior trabecular meshwork. Fundus examination was done using a +78 D condensing lens (Model: OI-HM). Glaucoma suspects underwent additional tests: Color Fundus Photography, CCT measurement via ultrasound pachymeter, OCT of the optic nerve head and RNFL for early diagnosis, and visual field analysis using Humphrey perimetry (central 30-2) to assess functional damage. Statistical analysis was performed using SPSS version 27.0 (SPSS Inc., Chicago, IL, USA). Numerical data were expressed as mean and standard deviation (SD), while categorical data were presented as frequency and percentage. The Chi-square test was used for categorical variables, and the unpaired t-test was applied for numerical variables. A p-value of ≤0.05 was considered statistically significant. Written informed consent was obtained from all participants, and ethical approval was secured from the Institutional Review Board.

Inclusion criteria:

1. Gender: Male and female.
2. Age: 40-60 years.
3. All T2DM patients.

Exclusion criteria:

1. All patients with previous ocular surgery, ocular inflammation, or other ocular trauma.
2. All cases of secondary glaucoma, angle closure glaucoma.

RESULTS

Table – I: Distribution of sociodemographic characteristics of the respondents (*n* = 185)

Characteristics	Frequency (n)	Percentage (%)
Patient's Age (years)		
40-50	86	46.5
51-60	99	53.5
Mean ±SD (min-max)	51.6± 6.6 (40-60)	
Gender		
Male	63	34.1
Female	122	65.9

Table I shows the mean age of the respondents was 51.6±6.6, more in 51-60 years of age (53.5%). Female respondents were 65.9%, male 34.1%.

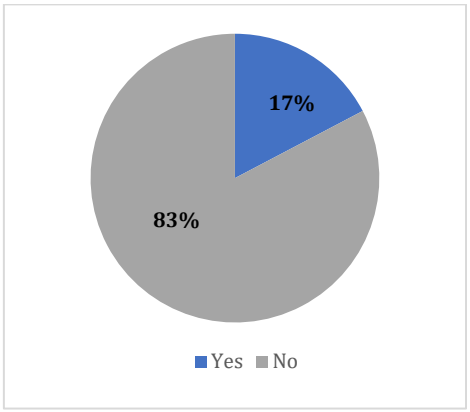

Figure – 1: Distribution of the respondents according to POAG status

Figure 1 showing among the 185 respondents, 32 (17%) had POAG.

Table – II: Distribution of ocular parameters of the respondents (*n* = 185)

Parameters	Mean ± SD
VA (Log MAR score)	0.29±0.13
IOP	14.87±3.15
CD ratio	0.46±0.14

Table II showing VA 0.29±0.13, IOP 14.87±3.15, CD ratio 0.46±0.14 of the total 185 study respondent.

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Table – III: Comparison of Age and Sex among POAG and normal respondents (*n*=185)

Characteristics	POAG (*n*=32)	Normal (*n*=153)	P value
Patient's Age (years)			
40-50	10 (31.3)	76 (49.7)	0.049 [a]
51-60	22 (68.8)	77(50.3)	
Mean ±SD	54.2±6.06	51.03±6.6	0.013
Gender			
Male	17 (53.1)	47 (30.7)	0.031 [a]
Female	15(46.9)	106(69.3)	

[a] Chi-square test

Comparison of Age and Sex among POAG and normal respondents shows a significant difference between POAG and normal respondents. The mean age of POAG is 54.2±6.06 and 51.03±6.6 in normal respondents. Among the respondents male were 17 and females were 15 in the POAG group, 47 were male and 106 were female in the normal group.

Table – IV: Comparison of ocular parameters of the respondents (*n* = 185)

Characteristics	POAG (*n*=32)	Normal (*n*=153)	P value
VA (Log MAR score) Mean ± SD	0.30±0.14	0.29±0.13	0.526[c]
IOP (Intraocular pressure) Mean ± SD	18.63±3.81	14.08±2.33	<0.001[c]
CD ratio (Cup to Disc) Mean ± SD	0.72±0.09	0.41±0.09	<0.001[c]

[c] unpaired t-test

Comparison of the ocular parameter of the study population shows visual acuity in the POAG group and normal group 0.30±0.14 and 0.29±0.13 (p-value 0.526), IOP 18.63±3.81 and 14.08±2.33 in both groups, CD ratio 0.72±0.09 and 0.41±0.09 in both groups respectively which showed significant results (p-value <0.001).

DISCUSSION

Comparison of Age and Sex among POAG and normal respondents showed a significant difference. The mean age of POAG is 54.2±6.06 years and 51.03±6.6 years in normal respondents. Cross et al. showed the mean age groups were 66.1 and 63.7 respectively [9]. Motsko and Jones showed in their study that the mean age group of glaucoma patients and control (non-glaucomatous patients) were 73.6 ±7.6 and 73.5±7.6 years where there was no difference between both groups [10]. Kitsos et al. also showed in their study the mean age of similar groups was 68.0±7.35 and 67.28±10.05 years [11]. Lee et al. also showed in their study mean age in glaucomatous patients was 44.10±9.17 and non-glaucomatous patients were 40.50±8.50 [2]. In this study, Age is not statistically significant in influencing the outcome. Among the respondents, 17 were male and female were 15 in the POAG group, 47 were male and 106 were female in normal group. A study done by Lee et al. showed males were dominant in both groups (glaucomatous and non-glaucomatous patients) [2]. Motsko and Jones where females were also the majority in similar groups (61.7% and 61.7% respectively) [10]. On the contrary, Kitsos et al. found in their study male and female ratios were the same [11]. The distribution of ocular parameters of the study population shows visual acuity in the POAG group and normal group 0.30±0.14 and 0.29±0.13 (p-value 0.526), IOP 18.63±3.81 and 14.08±2.33 in both groups, CD ratio 0.72±0.09 and 0.41±0.09 in both groups respectively which showed significant results (p-value <0.001). Won et al. showed in their study that the comparison of IOP in Glaucoma (+) and Glaucoma (-) patients was 15.8±3.1 mmHg and 15.0±3.0 mm Hg [12]. Won et al showed that IOP was 15.8±3.1 in the glaucomatous group and 15.0±3.0 in non-glaucomatous patients [12]. Centanini et al showed in their study visual acuity in non-glaucomatous and open-angle glaucoma patients were 0.71±0.09 and 0.80±0.08, IOP was 19.90±4.60 and 17.06±4.20, CD ratio was 0.60±0.10 and 0.70±0.17 respectively [13]. The relationship between age and the prevalence of Primary Open-Angle Glaucoma (POAG) is well-documented, with older individuals being at greater risk. Aging is associated with structural and functional changes in the eye, including reduced ocular perfusion and increased intraocular pressure (IOP), both of which contribute to the development and progression of glaucoma. In individuals with Type 2 Diabetes, these age-related changes are often exacerbated by vascular damage and altered autoregulation of the optic nerve head, which can accelerate glaucomatous damage [14]. In diabetic individuals, both age and gender serve as important factors in the risk of POAG, with older age increasing the likelihood of developing the disease and gender-specific differences further modifying this risk. These findings underscore the need for tailored screening strategies that consider both age and gender to identify those at highest risk and ensure timely intervention [15].

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

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CONCLUSION

In conclusion, the study highlights significant age and gender disparities in the prevalence of Primary Open-Angle Glaucoma (POAG) among individuals with Type 2 Diabetes. Older age and male gender were identified as key risk factors for the condition. These findings emphasize the need for targeted screening and early detection strategies, considering both age and gender, to manage and prevent vision loss in high-risk diabetic populations.

RECOMMENDATION

It is recommended that individuals with Type 2 Diabetes, especially males and those of older age, undergo regular screening for Primary Open-Angle Glaucoma (POAG). Early detection through tailored screening programs can help identify high-risk individuals and enable timely intervention to prevent vision loss. Health professionals should prioritize glaucoma monitoring as part of routine diabetic care.

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