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Correspondence to:
Md Sajidul Huq
Email: sajidul.decf@gmail.com
ORCID: 0000-0001-6780-8002

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Original Article

Clinical Profile of Glaucoma Patients: A Cross-Sectional Study at a Tertiary Eye Center in Bangladesh

Habiba Sultana[1], Khairul Islam[2], Shajeda Azizi[3], Md Sajidul Huq[4]

1 Assistant Professor, Glaucoma Department, Deep Eye Care Foundation, Rangpur, Bangladesh
2 Associate Professor, Cataract Department, Deep Eye Care Foundation, Rangpur, Bangladesh
3 Research Associate, Public Health Department, Deep Eye Care Foundation, Rangpur, Bangladesh
4 Assistant Professor, Public Health Department, Deep Eye Care Foundation, Rangpur, Bangladesh

ABSTRACT

Background: Glaucoma is a group of disorders that can lead to irreversible vision loss if untreated. It affects individuals across all ages, genders, and ethnicities, with intraocular pressure (IOP) being the only modifiable risk factor. Regional studies highlight variations in the prevalence of glaucoma subtypes, underscoring the need for population-specific data to guide effective prevention and treatment efforts. This study aimed to explore the clinical characteristics and patterns of glaucoma patients in a tertiary care setting in Bangladesh.

Methods: This was a hospital-based cross-sectional study, conducted from January to December 2023 at the Glaucoma Department of Deep Eye Care Foundation. A total of 2,172 individuals aged 20 years and above were conveniently selected as the study population. After explaining the study objectives, written informed consent was obtained from all participants. Ethical approval was obtained from the institutional review board of the Deep Eye Care Foundation. Data analysis was performed using the Statistical Package for Social Sciences (SPSS), with a *P*-value of less than 0.05 considered statistically significant.

Results: The study population predominantly consisted of middle-aged and older adults, with a slightly higher proportion of females than males. Most participants were housewives, followed by farmers. A majority resided in rural areas rather than urban, and only a negligible number reported a family history of glaucoma. More than half of the patients presented with reduced visual acuity. The average IOP was nearly similar in both eyes. Most cases showed bilateral involvement of glaucoma. The predominant types of glaucoma were primary angle-closure suspects (PACS) and primary open-angle glaucoma (POAG). The main treatment approaches included beta-blockers and laser peripheral iridotomy, while a notable proportion of patients were kept under observation.

Conclusions: Bilateral involvement and reduced visual acuity were common, with PACS and POAG being the predominant subtypes. This study offers unique insights into the demographic and clinical profile of glaucoma in rural communities, emphasizing the need for community-based screening, gender-sensitive eye care, and early detection to reduce visual disability.

Key words: Glaucoma, clinical profile, IOP, prevalence, management, glaucoma types

INTRODUCTION

Glaucoma is commonly associated with elevated intraocular pressure (IOP), though it can also occur with normal or even reduced IOP levels. Glaucoma includes a group of eye diseases that slowly damage the optic nerve, causing changes in the optic disc and permanent loss of vision, eventually leading to blindness. [1] Glaucoma is a major public health issue, ranking as the second leading cause of blindness after cataracts. It accounts for 8% of global blindness, affecting about 60.5 million people, with 8.4 million already blind from the disease. [2] The prevalence of glaucoma is approximately 1% in individuals aged 50 years and beyond throughout the world, and it tends to rise with age. [3,4] According to some studies, Glaucoma poses the greatest risk to elderly males in Bangladesh, with a prevalence of 3.2% in those aged 35 years and older. [5]

There are two main types of glaucoma: open-angle and angle-closure, each with different features and treatments. The "angle" is the space between the iris and cornea, where the trabecular meshwork is situated. Both types can be primary or secondary. Risk factors include older age, nearsightedness, family history, African-Caribbean ethnicity, and diabetes. Glaucoma can also be caused by certain medicines, such as systemic or eye-drop steroids. [6] Early detection and appropriate management of glaucoma can prevent blindness associated with the condition. [7]

Glaucoma pathogenesis is not fully understood, though elevated IOP is a key risk factor. IOP depends on the balance between aqueous humor secretion and its outflow via the trabecular meshwork and uveoscleral pathway. In open-angle glaucoma, age-related changes increase trabecular resistance, while angle-closure glaucoma results from iris blockage of drainage pathways, causing an acute IOP rise. Beyond IOP, factors like vascular dysregulation, genetics, and systemic conditions also contribute, particularly in normal-tension glaucoma. [8]

The main goals of glaucoma treatment are to slow its progression and protect the quality of life. Since glaucoma can affect daily life earlier than expected, early detection and treatment are essential. [9] The validated approach to treat glaucoma is the reduction of IOP. [10] Findings from various multicenter clinical trials have shown that reducing IOP is advantageous in preventing the onset and mitigating the progression of the disease condition. [11,12]

Understanding glaucoma patterns is critical for shaping effective treatment and policy strategies. Despite glaucoma being a leading cause of irreversible blindness, hospital-based research is scarce in Bangladesh that systematically evaluates its clinical characteristics. A hospital-based approach provides access to confirmed cases, detailed diagnostic evaluations, and standardized clinical records, ensuring robust data for clinical profiling. Moreover, northern Bangladesh, with its unique demographic, socioeconomic, and healthcare access disparities, remains underrepresented in existing literature. Investigating this region is essential for understanding whether its glaucoma patterns differ from other parts of Bangladesh and global trends, thereby filling a critical knowledge gap and guiding region-specific as well as nationwide strategies. Here's a concise version. We conducted this study to assess the clinical profile of glaucoma in northern Bangladesh and compare it with findings from other regions of Bangladesh and worldwide.

MATERIALS AND METHODS

Study Design, Setting, and Population

This hospital-based cross-sectional study was conducted between January and December 2023, involving glaucoma patients at the Glaucoma Department of Deep Eye Care Foundation, Rangpur, Bangladesh.

Sample Size

A total of 2,172 patients aged 20 years and above were conveniently selected, based on expected patient flow and prevalence, to provide an adequate sample for describing clinical characteristics.

Inclusion and Exclusion Criteria

Patients aged 20 years and above with glaucoma were conveniently selected, while patients who were critically ill, unwilling to participate, or mentally unstable were excluded.

Data Collection Instrument

Data were collected using a semi-structured questionnaire, designed in English and translated into the local language for clarity, and developed after reviewing relevant literature. [13–15]

Ethical Considerations

This study has been approved by the review board of Deep Eye Care Foundation, Rangpur, Bangladesh (Ref: DECF/DICO/IRB/2023/R03). The purpose and nature of the research were explained to the participants, and Informed consent has been obtained from all individuals included in this study.

Assessment and Recruitment of Patients

The best corrected visual acuity was determined and documented. Slit lamp biomicroscopy was conducted, and the peripheral anterior chamber depth was assessed using the van Herick method. IOP was measured using a Goldmann applanation tonometer (model AT 030; Carl Zeiss Meditec) while the patient received topical anesthesia via proparacaine 0.5% and fluorescein staining of the tear film. Gonioscopy was conducted. A Sussmann lens comprising four mirrors was utilized. The angle was evaluated using the Shaffer system, and an angle is deemed occludable when the pigmented trabecular meshwork is not observable in 180° of the angle under dim illumination. Laser iridotomy was conducted in individuals with occludable angles following the acquisition of their consent. All subjects exhibiting open angles on gonioscopy demonstrated pupillary dilatation. Subjects exhibiting occludable angles demonstrated dilation following laser iridotomy. The optic nerve head was evaluated using a 90-D lens at the slit lamp. The vertical cup-to-disc ratio (VCDR) was assessed and documented. The optic disc's suspect appearance was characterized by a VCDR of 0.6, asymmetry in VCDR between the eyes, focal thinning of the neuroretinal rim, localized or diffuse defects in the retinal nerve fiber layer, and/or the presence of optic disc hemorrhage. Central corneal thickness and automated perimetry were recommended. A glaucomatous visual field defect was deemed present if the following criteria were met: Criteria for glaucoma diagnosis

include: (1) glaucoma hemifield test results that fall outside normal limits, and (2) the presence of a cluster comprising three or more non-edge, contiguous points that do not cross the horizontal meridian, exhibiting a probability of less than 5% when compared to the age-matched normal group on the pattern deviation plot, observed on two distinct occasions.

Statistical Analysis

All data were entered into MS Excel and analyzed using SPSS, with results presented as frequencies and percentages. Chi-square tests were performed to assess the association between different variables. A *P*-value less than 0.05 was considered statistically significant.

RESULTS

From January 2023 to December 2023, we recruited 2,172 patients. Nearly half of the participants (46.4%) were aged 40 to 59 years, with a mean age of 48.6 ± 16.1 years. Females comprised 54.1% of respondents, nearly half of whom were housewives (46.4%). Most participants (69%) lived in rural areas, while only 0.5% reported a family history of glaucoma (**Table 1**).

More than half of the patients had visual acuity worse than 6/18 in both eyes (55.1% in the right and 56.6% in the left; **Figure 1**). The majority of the glaucoma patients presented with normal IOP between 11 to 21 mm of Hg (79% in the right and 78.3% in the left). The mean IOP measured was 19.32 mmHg (±8.28) for the right eye (R/E) and 19.39 mmHg (±8.39) for the left eye (L/E; **Figure 2**). Optic disc assessment showed that about half of the patients had a cup-to-disc ratio (CDR) between 0.61 and 0.90 (52% right, 51.6% left), with mean CDR values of 0.67 in the right and 0.67 in the left eye (**Figure 3**). The vast majority of glaucoma patients in our study had primary glaucoma (90.5%), followed by secondary glaucoma (9.5%; **Figure 4**).

Table 1: Descriptive statistics of measured variables among glaucoma participants.

Characteristics	*n* (%)
Age, years	
Less than 18 years	88 (4.1)
18–39 years	454 (20.9)
40–59 years	1007 (46.4)
60–79 years	586 (27)
80 years and above	37 (1.7)
Mean ± SD	48.59 ± 16.11
Gender	
Female	1175 (54.1)
Male	997 (45.9)
Occupation	
Housewife	1007 (46.4)
Farmer	377 (17.4)
Service	255 (11.7)
Student	228 (10.5)
Retired/unemployed	124 (5.7)
Business	118 (5.4)
Day labor	30 (1.4)
Residence	
Rural	1499 (69)
Urban	673 (31)
Family history of glaucoma	
Present	11 (0.5)
Absent	2161 (99.5)

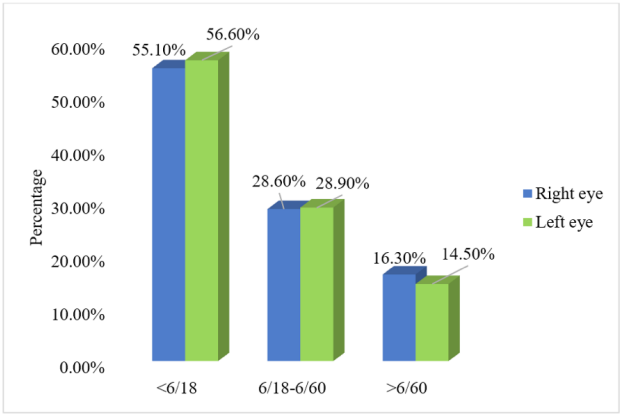

Figure 1: Distribution of visual acuity among the study participants.

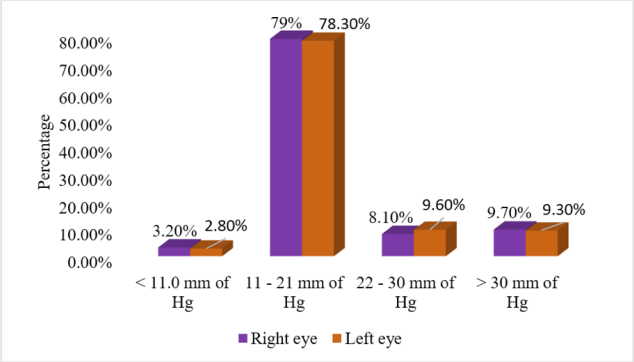

Figure 2: Distribution of intraocular pressure among the study participants.

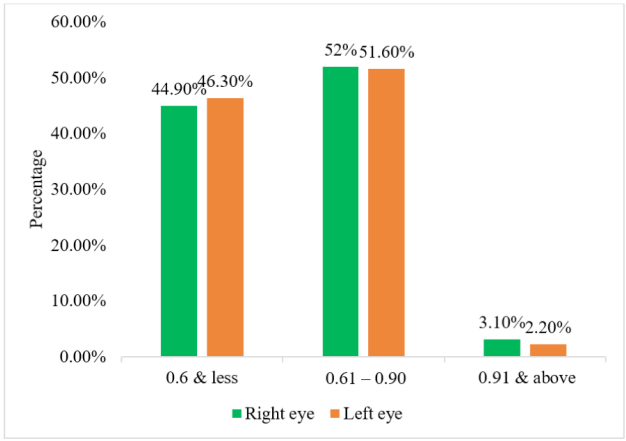

Figure 3: Distribution of cup-to-disc ratio among the study participants.

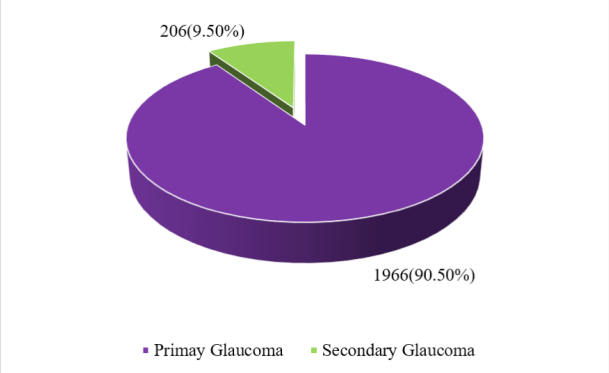

Figure 4: Different types of glaucoma.

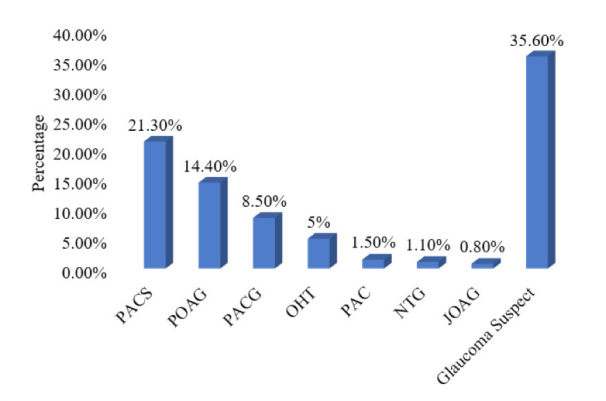

Figure 5: Types of primary glaucoma. PACS: primary angle-closure suspects; POAG: primary open-angle glaucoma; PACG: primary angle-closure glaucoma; OHT: ocular hypertension; PAC: primary angle closure; NTG: normal tension glaucoma; JOAG: juvenile open-angle glaucoma.

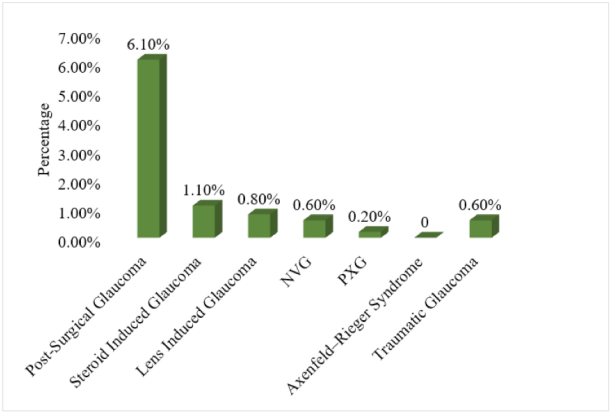

Figure 6: Types of secondary glaucoma. NVG: neovascular glaucoma; PXG: pseudoexfoliative glaucoma.

The most common types of glaucoma identified were primary angle-closure suspects (PACS), affecting 463 patients (21.3%), followed by primary open-angle glaucoma (POAG) in 313 patients (14.4%; **Figure 5**). For secondary glaucoma, post-surgical glaucoma was the most prevalent, observed in 133 patients (6.1%), followed by steroid-induced glaucoma in 24 patients (1.1%; **Figure 6**).

The majority of participants, 525 (24.2%), were primarily treated with beta-blockers, followed by 354 (16.3%) who received laser peripheral iridotomy (Laser PI; **Table 2**). **Table 3** compares the sociodemographic characteristics of patients with primary and secondary glaucoma. Most participants in both groups were aged 40 to 59 years, showing a significant association between age and glaucoma type (P = 0.031). Primary glaucoma was more common among both males (44.9%) and females (55.1%; P = 0.004). With respect to residence, primary glaucoma also predominated in both urban and rural areas, revealing a significant association with place of residence (P < 0.001; **Table 3**). Comparison of our study results with those reported in previous Bangladeshi studies is shown in **Table 4**.

DISCUSSION

Our study aimed to evaluate the clinical profile of glaucoma patients. The mean age presentation was 48.59 (±16.11) years in our study. This result was not in concordance with other studies. [18,19] In our study, the proportion of glaucoma cases increased with age, particularly beyond 40 years. This was also observed in other studies from Nepal [20], India [21], and Nigeria. [7] Advancing age is considered a significant risk factor for developing glaucoma. [15]

In our study, slightly more than half of the participants were female, most of whom were housewives. In some studies, male predominance was seen. [5] Additionally, some studies showed female-predominant results, which were similar to our study findings. [22] The variation in gender distribution may be attributed to differences in study criteria, as well as regional and ethnic diversity across various groups. Middle-aged females were the predominant group affected by glaucoma, likely due to hormonal changes around menopause and greater healthcare-seeking behavior.

Table 2: Management of glaucoma participants.

Management	*n* (%)
1 AGM	
• Alpha 2 agonist	8 (0.37)
• Beta blocker	525 (24.17)
• Carbonic anhydrase inhibitor	14 (0.64)
• Prostaglandin analogue	29 (1.34)
2 AGMs (beta blocker + carbonic anhydrase)	301 (13.86)
3 AGMS	289 (13.31)
• Only trabeculectomy	114 (5.25)
• Trab + 1AGM	16 (0.74)
• Trab + 2AGMs	2 (0.09)
• Laser PI	354 (16.30)
• Laser PI+1AGM	39 (1.80)
• Observation	481(22.15)

AGM: anti-glaucoma medication; TRAB: trabeculectomy; Laser PI: laser peripheral iridotomy.

Table 3: Association of different types of glaucoma with sociodemographic characteristics.

Sociodemographic characteristics	Types of glaucoma		*P*-value*
	Primary glaucoma *n* (%)	Secondary glaucoma *n* (%)	
Age, years			
<18	75 (3.8)	13 (6.3)	0.031
18–39	407 (20.7)	47 (22.8)	
40–59	928 (47.2)	79 (38.3)	
60–79	526 (26.8)	60 (29.1)	
80 and above	30 (1.5)	7 (3.4)	
Gender			
Male	883 (44.9)	114 (55.3)	0.004
Female	1083 (55.1)	92 (44.7)	
Resident			
Urban	640(32.6)	33(16)	<0.001
Rural	1326(67.4)	173(84)	

*The chi-square test was applied to assess the statistical significance (*P*-value).

Table 4: Summary table presenting a comparison between our findings and those of previous studies conducted in Bangladesh.

Name of the findings	Present study	Mannaf et al. [5]	Islam et al. [14]	Mukta and Noman [16]	Rahman et.al. [17]
Mean age, years	48.59	-	-	52.6	67
Gender (M/F,%)	45.9/54.1	3.9/2.5	-	36/64	52/48
Resident (urban/rural, %)	31/69	3.6/3.1	-	-	-
Most common glaucoma type	Glaucoma suspect	POAG	PACG	PACG	POAG
Prevalence of glaucoma suspect	35.6%	10%	-	-	-
Prevalence of POAG	14.4%	78.4%	32%	16%	75%
Prevalence of PACG	8.5%	16.2%	45%	62%	-
Prevalence of PACS	21.3%	-	-	8%	-
Prevalence of secondary glaucoma	9.5%	5.5%	-	-	-
Prevalence of LIG	0.8%	19%	12%	-	-
Prevalence of NTG	1.1%	83.3%	6%	-	-
Prevalence of NVG	0.6%	24%	1%	8%	-
Prevalence of juvenile glaucoma	0.8%	-	2%	-	-
Mean IOP (mm Hg)	R/E = 19.32 L/E = 19.39	-	R/E = 26.29 L/E = 26.37	Moderate to severe (30–70)	R/E = 15 L/E = 15
C:D ratio	R/E = 0.669 L/E = 0.665	-		0.9:1 (>40%)	R/E = 0.34 L/E = 0.34
Visual acuity	**<6/18 =** R/E = 55.1% L/E = 56.6% **6/18-6/60 =** R/E = 28.6% L/E = 28.9% **>6/60** R/E = 16.3% L/E = 14.5%	-	Normal = 47% Visual impairment = 30% Severe = 14% Blind = 5%	Unaided: unaided (log mar) R/E = 0.3–0.8 (49%) L/E = 0.3–0.8 (52%) Aided (log mar) R/E = 0.0 log unit (50%) L/E = 0.0 log unit (405%)	-
Family history of glaucoma	Present = 0.5% Absent = 99.5%	-	-	Positive = 34% Negative = 64%	-

PACG: primary angle-closure glaucoma; POAG: primary open-angle glaucoma; PACS: primary angle closure suspect; LIG: lens-induced glaucoma; NTG: normal tension glaucoma; NVG: neovascular glaucoma; IOP: intraocular pressure; CDR: cup to disc ratio.

Notably, only a small number of participants reported a family history of glaucoma, while the majority had no known familial connection to the condition in the present study. This finding aligns with a study conducted in Nepal. [15]

The most prevalent glaucoma subtype in this study was PACS, followed by POAG, emphasizing the need for regular screening for both angle-closure and open-angle forms. These findings were compared with those reported in

previous studies. The most common glaucoma types were primary angle closure glaucoma, followed by secondary glaucoma and POAG. [14,22–25] The results of this study were not comparable to the Bhaktapur Glaucoma Study. [18] Ezinne et al. documented POAG as the most common, followed by primary angle-closure glaucoma (PACG). [26,27] POAG was the predominant form among patients, followed by secondary glaucoma. [28] The prevalence of POAG and PACG varies across different Asian populations, with these discrepancies potentially linked to differences in glaucoma definitions, as well as geographical and genetic factors. Secondary glaucoma presented unique challenges, with post-surgical glaucoma being the most prevalent, followed by cases related to steroid use, highlighting the need for awareness of specific risk factors.

In our study, a significant association was revealed between different types of glaucoma with different socio-demographic factors. Similar results were found in some studies. [5,29]

The majority of patients in the present study had visual acuity worse than 6/18 in both eyes, followed by a moderate visual impairment range. A study was reported by Manhas et al. in India, where most patients had vision within the moderate impairment range. [28] Rashid, Rather, and Singh conducted a study in the Kashmir Valley. They found that nearly all of the patients presented with reduced visual acuity, which was the most common symptom. [30]

The mean IOP in the present study was within the normal range for most patients. Previous studies reported varying IOP levels, with some patients exhibiting moderately to markedly elevated pressures, highlighting potential risks for ocular complications. [14,15,28,30,31]

Regarding optic disc changes, a considerable number showed a high CDR, suggesting potential optic nerve damage. At the same time, a large group had ratios within a safer range, indicating a mix of normal and at-risk optic nerve health among these patients. The majority of patients exhibited moderate CDRs, aligning with trends reported in previous studies. [28,30]

In our study, the majority of participants were primarily treated with beta-blockers, followed by those who underwent laser peripheral iridotomy. For most participants, beta-blockers were the primary treatment. [27] Additionally, a smaller group of patients received laser iridotomy for PACG. [30]

This study is limited by its cross-sectional design, which precludes assessment of disease progression or causal relationships. Being hospital-based, the findings may not fully represent the general population. It may introduce selection and information biases, while measurement variability and unmeasured confounders could have influenced the results. The low reporting of family history may underestimate the contribution of hereditary factors in glaucoma.

This highlights the need for targeted screening policies focusing on high-risk groups. More broadly, strengthening national policies for glaucoma screening, especially in rural areas, public awareness campaigns, routine IOP monitoring, and improved access through telemedicine, mobile clinics, and subsidized medications can enhance early detection, timely treatment, and reduce the overall burden of glaucoma.

CONCLUSIONS

The study highlights significant demographic and clinical characteristics of glaucoma patients, providing valuable insights into the prevalence and types of glaucoma, as well as the treatment patterns within this population. Most patients had a visual acuity below 6/18, had bilateral involvement of glaucoma, and IOP was generally within the normal range, though a notable subset exhibited elevated IOP levels. PACS and POAG were the most prevalent types of glaucoma. Despite the high number of patients without a family history of glaucoma, the findings underscore the need for effective screening, especially in rural areas, where most participants resided. The primary treatment included beta-blockers and laser interventions, with some patients under observation, suggesting a range of management approaches tailored to individual patient needs. Future studies should focus on enhancing glaucoma awareness, improving screening efforts, and evaluating long-term treatment outcomes in diverse populations.

AUTHORS' CONTRIBUTION

Each author has made a substantial contribution to the present work in one or more areas, including conception, study design, conduct, data collection, analysis, and interpretation. All authors have given final approval of the version to be published, agreed on the journal to which the article has been submitted, and agree to be accountable for all aspects of the work.

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CONFLICT OF INTEREST

None.

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