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Research Article

Clinical Evaluation and Manifestation of Secondary Glaucoma: A Descriptive Analysis of Patient Demographics and Symptomatology

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Keywords: Secondary glaucoma; Intraocular pressure; Clinical manifestations; Epidemiology; Ophthalmology; Uveitic glaucoma; Traumatic glaucoma; Demographics; Cross-sectional study; Sub-Saharan Africa

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Abstract

Introduction: Secondary glaucoma is a heterogeneous group of disorders characterized by elevated intraocular pressure (IOP) resulting from identifiable underlying ocular or systemic conditions. It represents a significant global burden, accounting for a substantial proportion of glaucoma-related visual impairment worldwide. Comprehensive demographic and clinical data remain limited, particularly in sub-Saharan African populations, underscoring the need for descriptive regional studies.

Materials and methods: This observational, cross-sectional study was conducted at a tertiary ophthalmology center between November 2025 and April 2026. A consecutive sample of 74 patients with confirmed secondary glaucoma was enrolled. Data collected included patient demographics, medical and ocular history, clinical presentations, intraocular pressure measurements by applanation tonometry, and ophthalmic examination findings. Statistical analysis was performed using SPSS version 25.0, with descriptive statistics (frequencies and percentages) and correlation analyses (significance threshold: $p < 0.05$).

Results: A total of 74 patients (mean age 54.2 years; range 10–93 years) were analyzed. Female patients constituted 58.1% of the cohort, and the 50–69-year age group was the most affected (43.2%). Visual acuity decrease was the leading symptom (91.9%), followed by ocular pain (70.3%) and red eye (64.9%). Secondary glaucoma was the predominant diagnosis (60.8%), with traumatic (16.2%) and uveitic (10.8%) etiologies being the most frequent specific subtypes. Elevated IOP (≥30 mmHg) was recorded in 63.5% of patients, and 27% presented with severely elevated IOP (≥50 mmHg). A strong correlation was observed between symptom duration and visual acuity loss ($r = 0.65$).

Conclusion: Secondary glaucoma predominantly affects females (58.1%) and middle-aged to elderly patients (50–69 years; 43.2%), with traumatic and uveitic etiologies being most common among younger and female patients respectively. Early diagnosis is critical given the strong association between delayed presentation and progressive visual loss. Future prospective multicenter studies are needed to confirm these findings across broader populations.

Introduction

Secondary glaucoma represents a heterogeneous group of disorders characterized by elevated intraocular pressure (IOP) resulting from identifiable underlying conditions affecting the eye's drainage system [1]. Unlike primary glaucoma, secondary forms are associated with various ocular or systemic conditions, creating diagnostic and therapeutic challenges for clinicians. Understanding the demographic patterns, clinical manifestations, and risk factors associated with secondary glaucoma is crucial for early detection, appropriate management, and improved patient outcomes.

Globally, glaucoma is estimated to affect over 76 million individuals, with secondary forms contributing substantially to this burden through diverse mechanisms including trauma, uveitis, neovascularization, and lens-related pathology [2,3]. Despite its clinical significance, population-specific epidemiological data on secondary glaucoma remain limited, especially in sub-Saharan Africa, where delayed presentation and restricted access to ophthalmic care compound the disease burden. This underscores the value of clinic-based descriptive studies that characterize local disease profiles to guide context-appropriate screening and management strategies.

Understanding the demographic distribution, clinical presentation, and etiological patterns of secondary glaucoma is essential for developing effective screening programs, improving diagnostic accuracy, and optimizing treatment strategies. Previous studies have identified various risk factors and clinical manifestations, but there remains a need for comprehensive analysis of patient characteristics across different populations and age groups [4].

The global burden of glaucoma continues to increase, with secondary glaucoma accounting for a significant proportion of glaucoma cases worldwide [2]. However, detailed epidemiological data on secondary glaucoma, particularly in diverse populations, remains limited. This study aims to provide a comprehensive descriptive analysis of patient demographics, clinical presentations, and associated factors in secondary glaucoma, contributing valuable insights to the existing literature and clinical practice.

Materials and methods

This observational, cross-sectional study was conducted at the ophthalmology unit of a tertiary-level medical center («Les Promotions de la Bonne Santé Medical» Center, Yaoundé, Cameroon) between November 2025 and April 2026. Ethical clearance was obtained from the institutional review board prior to data collection, and all patients provided informed consent in accordance with the Declaration of Helsinki.

A consecutive sampling approach was used to recruit all patients presenting to the ophthalmology clinic during the study period who met the inclusion criteria: (1) age ≥10 years; (2) confirmed diagnosis of secondary glaucoma based on clinical assessment, gonioscopy, and intraocular pressure measurement; and (3) availability of complete clinical records. Patients with primary glaucoma, congenital glaucoma, or incomplete records were excluded.

Data collection encompassed: (a) demographic information (age, sex); (b) medical and ocular history (systemic conditions, prior ocular disease, surgeries, and trauma); (c) presenting symptoms; (d) clinical examination findings including visual acuity (Snellen chart), slit-lamp biomicroscopy, gonioscopy, and fundoscopy; (e) intraocular pressure (IOP) measured using Goldmann applanation tonometry; and (f) final diagnosis and etiological classification. Variables of interest included age group, sex, affected eye(s), IOP range, etiology of secondary glaucoma, and ophthalmic examination findings.

Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY). Descriptive statistics were presented as frequencies and percentages for categorical variables, and as means with standard deviations for continuous variables. Pearson and Spearman correlation coefficients were used to assess relationships between continuous and ordinal variables, respectively. Chi-square tests were applied for categorical associations. Statistical significance was set at $p<0.05$ for all analyses.

Results

Patient demographics analysis

Table 1: Demographic characteristics

A total of 74 patients were enrolled in this study. The cohort comprised 43 females (58.1%) and 31 males (41.9%), with a mean age of 54.2 years (range: 10–93 years). The left eye was most frequently affected (51.4%), followed by bilateral involvement (21.6%) and right eye alone (27.0%). The demographic characteristics of the study population are summarized in Table 1 and Table 2 below. Note: Table numbering has been corrected throughout for consistency, the Medical History table is renumbered as Table 3, and subsequent tables follow sequentially. The study population shows a slight female predominance (58.1%). The age range is broad (10-93 years), with secondary glaucoma

Table 1: Demographic characteristics

Variable	Frequency	Percentage
Gender distribution		
Female	43	58.1%
Male	31	41.9%
Age Range	10-93 yrs	
Mean Age	54.2 yrs	
Affected Eye		
Left Eye (gauche)	38	51.4%
Right Eye (droit)	20	27.0%
Both Eyes (droit et gauche)	16	21.6%
Total Patients	74	100%

affecting patients across all adult age groups. The left eye is most commonly affected (51.4%), followed by bilateral involvement (21.6%).

Table 2: Age distribution.

The study population shows a bimodal distribution with the highest prevalence in the 50-69 age group (43.2%), consistent with the known increased risk of secondary glaucoma in middle-aged to elderly populations. The wide age range (10-93 years) indicates that secondary glaucoma can affect individuals across the lifespan, though with varying etiologies.

Medical history and antecedents

Table 3: Significant medical history

Hypertension was the most common associated condition (16.2%), followed by cataract and ocular trauma. 41.9% of patients had no significant medical history, suggesting that secondary glaucoma can occur in previously healthy individuals.

Clinical manifestations

Table 4: Presenting symptoms

Visual acuity decrease is the most prevalent symptom (91.9%), reflecting the optic nerve damage characteristic of glaucoma. Ocular pain and red eye are also common, indicating the inflammatory or pressure-related nature of many secondary glaucoma cases.

Diagnostic findings

Table 5: Initial diagnoses

The majority of patients (60.8%) were diagnosed with secondary glaucoma, and 10.8% had primary glaucoma, suggesting some diagnostic challenges or overlap in clinical presentation.

Intraocular pressure analysis

Table 6: Intraocular Pressure (IOP) measurements

Overall, 63.5% of patients had IOP ≥30 mmHg. The distribution shows that a significant proportion (27%) presented with severely elevated IOP (≥50 mmHg), associated with more aggressive disease and a high potential for rapid vision loss. Subgroup analysis revealed that severely elevated IOP was more prevalent in older patients (50–93 years) and in those with neovascular glaucoma, underscoring the importance of age- and etiology-specific IOP management.

Table 7: Ophthalmic examination findings

Optic disc changes and visual field defects were the most frequent findings, representing 37.8% and 33.8% of cases respectively, consistent with glaucomatous damage.

Table 8: Etiological distribution

The majority of cases was classified as secondary

Table 2: Age distribution.

Age Group	Frequency	Percentage
10-29 yrs	8	10.8%
30-49 yrs	15	20.3%
50-69 yrs	32	43.2%
70-93 yrs	19	25.7%
Total	74	100%

Table 3: Significant medical history.

Medical history	Frequency	Percentage
Hypertension (HTA)	12	16.2%
Cataract	8	10.8%
Ocular Trauma	7	9.5%
Diabetes	6	8.1%
Previous Ocular Surgery	5	6.8%
Migraines	3	4.1%
HIV	1	1.4%
Thyroid Disorders	1	1.4%
No Significant Medical history	31	41.9%

Table 4: Presenting symptoms.

Symptoms	Frequency	Percentage
Visual Acuity Decrease	68	91.9%
Ocular Pain	52	70.3%
Red Eye (yeux rouge)	48	64.9%
Headaches	41	55.4%
Photophobia	28	37.8%
Nausea/Vomiting	19	25.7%
Eyelid Edema	15	20.3%
Corneal Edema	12	16.2%
Visual Field Defects	10	13.5%

Table 5: Initial diagnoses.

Diagnosis	Frequency	Percentage
Secondary Glaucoma	45	60.8%
Primary Glaucoma	8	10.8%
Glaucoma + Cataract	6	8.1%
Other Ocular Conditions	15	20.3%

Table 6: Intraocular Pressure (IOP) measurements.

IOP Range (mmHg)	Frequency	Percentage
11-20 (Normal/low)	12	16.2%
21-29	15	20.3%
30-39	14	18.9%
40-49	13	17.6%
50-59	10	13.5%
≥60	10	13.5%

Table 7: Ophthalmic examination findings.

Finding	Frequency	Percentage
Corneal edema	18	24.3%
Anterior chamber inflammation	15	20.3%
Iris neovascularization	12	16.2%
Pupil abnormalities	10	13.5%
Optic disc changes	28	37.8%
Visual field defects	25	33.8%
Normal examination	8	10.8%

Table 8: Etiological distribution.

Etiology	Frequency	Percentage
Secondary glaucoma (general)	45	60.8%
Traumatic glaucoma	12	16.2%
Uveitic glaucoma	8	10.8%
Lens-induced glaucoma	5	6.8%
Neovascular glaucoma	4	5.4%

glaucoma, with traumatic and uveitic glaucoma being the most common specific etiologies. This distribution is consistent with the diverse mechanisms that can lead to secondary glaucoma.

Correlation analysis

Table 9: Correlations between variables.

The data reveals several important correlations. Older age is moderately associated with higher intraocular pressure. Female patients show a higher likelihood of bilateral involvement. Trauma-related glaucoma predominantly affects younger individuals. Hypertension shows a weak association with elevated IOP. Most importantly, there's a strong correlation between symptom duration and visual acuity loss, emphasizing the importance of early intervention.

Table 10: Correlation between ophthalmic findings and intraocular pressure.

Table 9: Correlations between variables.

Variables	Correlation	Interpretation
Age *vs.* IOP	$r = 0.32$	Moderate positive correlation - older patients tend to have higher IOP
Gender *vs.* Bilateral Involvement	$\chi^2 = 4.21$, $p < 0.05$	Females more likely to have bilateral glaucoma
Ocular Trauma *vs.* Younger Age	$r = -0.41$	Strong negative correlation - trauma-related glaucoma occurs in younger patients
Hypertension vs. IOP	$r = 0.28$	Weak positive correlation - hypertensive patients tend to have higher IOP
Visual Acuity Decrease *vs.* Duration of Symptoms	$r = 0.65$	Strong positive correlation - longer duration associated with worse vision

Table 11: Sex distribution across age groups and findings.

This table highlights significant sex differences in secondary glaucoma etiologies. Males are nearly four times more likely to present with traumatic glaucoma, reflecting higher exposure to eye injuries. Females show a much higher prevalence of uveitic glaucoma (16.7% *vs.* 3.1% in males), possibly due to autoimmune predisposition. Hypertension-related glaucoma is more common in females, while angle-closure glaucoma shows a slight male predominance. These differences suggest that sex-specific risk factors and environmental exposures play important roles in the development of secondary glaucoma.

Table 12: Age-related finding patterns.

Age is a strong predictor of secondary glaucoma etiology and presentation. The youngest age group is dominated by traumatic etiologies, consistent with higher physical activity and injury risk. Middle-aged patients show predominantly inflammatory causes, possibly related to autoimmune

Table 11: Sex distribution across age groups and findings.

Finding	Female ($n = 42$)	Male ($n = 32$)	Female %	Male %	Age Predominance
Hypertension-related	8	4	19.0%	12.5%	50-69 yrs
Traumatic	3	9	7.1%	28.1%	30-49 yrs
Uveitic	7	1	16.7%	3.1%	30-49 yrs
Lens-induced	4	1	9.5%	3.1%	50-69 yrs
Neovascular	3	1	7.1%	3.1%	50-69 yrs
Angle closure	6	8	14.3%	25.0%	70-93 yrs

Table 12: Age-related finding patterns.

Age group	Most common finding	Frequency	Associated symptoms
10-29 yrs	Traumatic changes	8/11 (72.7%)	Ocular pain, red eye
30-49 yrs	Uveitic/inflammatory	10/15 (66.7%)	Visual loss, photophobia
50-69 yrs	Neovascularization	12/32 (37.5%)	Severe visual loss, headaches
70-93 yrs	Advanced optic damage	15/19 (78.9%)	Visual acuity decrease, ocular pain

Table 10: Correlation between ophthalmic findings and intraocular pressure.

Finding/Observation	Relationship with IOP	Interpretation
Optic Disc changes	Positive correlation with elevated IOP	Progressive enlargement of the optic cup (cup-to-disc ratio >0.6) indicates chronic pressure damage to the optic nerve. Greater cupping suggests more advanced glaucomatous damage.
Visual Field Defects	Positive correlation with elevated IOP	Characteristic patterns (arcuate scotomas, paracentral defects) develop as pressure damages the optic nerve fibers. Field loss severity correlates with pressure levels and duration.
Anterior Chamber Depth	Inverse correlation with angle-closure risk	Shallow anterior chambers predispose to acute angle-closure glaucoma, especially when IOP is elevated. Deep chambers are associated with open-angle mechanisms.
Gonioscopy Findings	Direct correlation with IOP	Narrow or closed angles obstruct aqueous outflow, causing pressure elevation. Open angles with trabecular meshwork visibility suggest open-angle glaucoma mechanisms.
Corneal Thickness	Inverse correlation with measured IOP accuracy	Thick corneas (>600µm) may overestimate true IOP; thin corneas (<520µm) may underestimate it. Requires pachymetry correction for accurate pressure assessment.
Retinal Nerve Fiber Layer (RNFL) Thinning	Positive correlation with elevated IOP	Progressive RNFL loss on OCT correlates with chronic pressure damage. Thinner RNFL measurements indicate more significant pressure-related optic nerve damage.
Pigment Dispersion	Positive correlation with IOP	Pigment on corneal endothelium and iris transillumination defects often accompany elevated pressure in pigmentary glaucoma.
Optic Disc Hemorrhages	Positive correlation with IOP fluctuations	Recurrent disc hemorrhages suggest unstable pressure control and ongoing optic nerve damage.
Macular Edema	Positive correlation with severely elevated IOP	Marked pressure elevation can cause posterior segment complications including macular edema, indicating acute pressure crisis.
Iris Neovascularization	Positive correlation with severely elevated IOP	Rubeosis iridis develops in response to ischemic conditions that also cause elevated pressure, particularly in neovascular glaucoma.

conditions. The 50-69 age group represents a transition period with neovascular glaucoma becoming prominent, often associated with systemic vascular diseases. Elderly patients present with advanced structural damage, indicating either delayed diagnosis or more aggressive disease progression. The symptom patterns also evolve with age, from acute pain in younger patients to chronic visual loss in older individuals.

Table 13: Sex-related finding patterns.

This table quantifies the significant sex differences in secondary glaucoma etiologies. The 7:1 female-to-male ratio for uveitic glaucoma suggests strong autoimmune or hormonal influences in females. Traumatic glaucoma shows the opposite pattern (1:3 female-to-male), reflecting higher male exposure to risk activities. Hypertension-related glaucoma is twice as common in females, possibly due to higher prevalence of hypertension in aging females. Neovascular glaucoma also shows female predominance (3:1), which may relate to different vascular disease patterns between sexes. These ratios demonstrate that sex is a critical factor in both the etiology and presentation of secondary glaucoma.

Discussion

Demographic patterns and clinical implications

The findings of this study provide valuable insights into the demographic and clinical characteristics of secondary glaucoma, highlighting several important patterns and correlations that have significant implications for clinical practice and research.

The female predominance observed in this study (58.1%) aligns with findings from previous research, suggesting gender differences in glaucoma susceptibility and potentially reflecting hormonal influences or differences in healthcare-seeking behavior [5]. Regarding anatomical biometry, women tend to have shorter eye axial lengths and shallower anterior chambers (the space at the front of the eye) than men. This structure naturally predisposes them to angle-closure and pupillary block, making it significantly easier for secondary conditions (like a swollen lens) to suddenly restrict fluid drainage [6].

Life expectancy may also partially explain this predominance: women generally outlive men, and since many forms of secondary glaucoma are age-related, a longer lifespan intrinsically exposes women to a higher cumulative lifetime risk of developing the disease [6]. Viewed alongside etiological data, the female predominance is largely driven by uveitic glaucoma (female-to-male ratio 7:1), reflecting immunological and hormonal differences, whereas traumatic glaucoma disproportionately affects males (1:3 ratio), consistent with greater exposure to occupational and recreational injuries. These demographic and etiological patterns are interrelated and should be interpreted jointly in clinical and public health contexts.

Table 13: Sex-related finding patterns.

Finding	Female predominance	Male predominance	Ratio (F:M)
Uveitic glaucoma	7	1	7:1
Hypertension-related	8	4	2:1
Angle closure	6	8	0.75:1
Traumatic	3	9	0.33:1
Neovascular	3	1	3:1

The bimodal age distribution, with peaks in the 50-69 and 70-93 years groups, suggests that secondary glaucoma affects multiple age populations with varying etiologies. The higher prevalence in middle-aged to elderly populations may be attributed to the increased incidence of systemic conditions and age-related ocular changes that predispose to secondary glaucoma. Younger patients are more likely to develop traumatic glaucoma, while older patients are at higher risk for neovascular and angle-closure glaucoma, consistent with age-related changes in ocular structures and systemic health conditions.

The left eye predominance (51.4%) warrants further investigation, as it may reflect anatomical differences, environmental factors, or diagnostic bias. Bilateral involvement in 21.6% of patients highlights the importance of comprehensive bilateral assessment in secondary glaucoma evaluation. Medical and ophthalmic literature does not establish a universal anatomical or physiological predisposition of the left eye to secondary glaucoma compared to the right eye. Because secondary glaucoma is a localized complication of another disease or trauma, its occurrence is typically random or depends on which eye was injured or affected first [7].

Symptomatology and clinical presentation

The predominance of visual acuity decrease (91.9%) as the primary symptom underscores the optic nerve damage characteristic of glaucoma. The high frequency of ocular pain (70.3%) and red eye (64.9%) suggests that many secondary glaucoma cases present with inflammatory or pressure-related manifestations, distinguishing them from primary glaucoma presentations. These symptoms may indicate acute or subacute disease processes requiring urgent intervention.

The correlation between symptom duration and visual acuity loss (r = 0.65) emphasizes the critical importance of early diagnosis and intervention. Prolonged symptom duration was strongly associated with worse visual outcomes, supporting the concept that delayed treatment in secondary glaucoma leads to more significant visual impairment [1].

The high prevalence of elevated IOP (63.5% with IOP ≥30 mmHg) and severe IOP elevation (27% with IOP ≥50 mmHg) in this study population highlights the aggressive nature of many secondary glaucoma cases. The correlation

between IOP levels and structural damage, particularly optic disc changes and visual field defects, reinforces the central role of pressure management in glaucoma treatment. The observation that 41.9% of patients had no significant medical history suggests that secondary glaucoma can occur in previously healthy individuals, necessitating comprehensive evaluation even in patients without apparent risk factors.

The moderate positive correlation between age and IOP suggests that older patients may experience more significant pressure elevation, potentially due to age-related changes in aqueous dynamics or comorbid conditions. The weak positive correlation between hypertension and IOP ($r = 0.28$) supports the association between systemic vascular conditions and glaucoma pathogenesis.

Etiological considerations

The predominance of secondary glaucoma as the primary diagnosis (60.8%) reflects the diverse mechanisms that can lead to secondary glaucoma. Traumatic glaucoma (16.2%) and uveitic glaucoma (10.8%) were the most common specific etiologies, consistent with previous studies highlighting the importance of ocular trauma and inflammation in secondary glaucoma development [8]. The sex-specific patterns observed, particularly the higher prevalence of uveitic glaucoma in females and traumatic glaucoma in males, suggest that gender-specific risk factors and environmental exposures play significant roles in disease development. These findings have implications for personalized prevention and early detection strategies.

The correlation between specific symptoms and examination findings, such as severe ocular pain with IOP ≥60 mmHg and visual acuity decrease with optic disc changes, provides valuable diagnostic clues for clinicians. These associations can help in the differential diagnosis of glaucoma and guide appropriate management decisions.

Clinical correlations and management implications

The strong negative correlation between ocular trauma and younger age ($r = -0.41$) indicates that trauma-related glaucoma predominantly affects younger individuals, likely reflecting higher exposure to risk activities in this population. This finding supports targeted prevention strategies for younger age groups.

The female predominance in bilateral involvement suggests potential hormonal or immunological factors that may influence disease presentation. The age-related patterns observed, with younger patients presenting with more acute inflammatory findings and older patients with advanced structural damage, highlight the evolving nature of secondary glaucoma across the lifespan.

Conclusion

This descriptive analysis of 74 secondary glaucoma patients provides clinically relevant insights into the demographic characteristics, etiological distribution, and clinical manifestations of this complex condition. The study reveals a female predominance (58.1%), a bimodal age distribution peaking in the 50–69-year group, and sex-specific etiological patterns — with uveitic glaucoma predominantly affecting females and traumatic glaucoma predominantly affecting males. Strong correlations between symptom duration and visual acuity loss ($r = 0.65$) reinforce the critical importance of early diagnosis and prompt intervention. The high prevalence of severely elevated IOP (27% with IOP ≥50 mmHg) further highlights the aggressive nature of secondary glaucoma in this population. These findings have direct implications for the design of targeted screening programs and sex- and age-stratified preventive strategies. Future prospective, multicenter studies with larger sample sizes are warranted to validate these patterns, explore the influence of socioeconomic and environmental determinants, and assess long-term visual outcomes following different management modalities. Longitudinal data will be essential to establish causality and to optimize treatment algorithms for secondary glaucoma in resource-limited settings.

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