International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Website: https://ijmpr.in/

Research Article

Prevalence and Clinical Profile of Glaucoma in Patients with Uveitis Attending a Tertiary Care Centre

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Received: 05-08-2025
Accepted: 20-08-2025
Published: 30-08-2025

ABSTRACT

Background: Uveitis is a major cause of preventable visual loss, with glaucoma representing one of its most serious and potentially irreversible complications. Data on the burden and pattern of uveitic glaucoma from Central India remain limited.
Objectives: To estimate the prevalence of raised intraocular pressure (IOP) and glaucoma among patients with uveitis attending a tertiary care centre, and to characterise associated clinical profiles.
Material and Methods: This hospital-based cross-sectional study included 50 eyes of patients with uveitis presenting to the School of Excellence for Eye under the Government Medical College and Hospital, Indore (India), between March 2023 and February 2025. All subjects underwent detailed history, best-corrected visual acuity assessment, slit-lamp biomicroscopy, Goldmann applanation tonometry with six-point diurnal IOP measurement, gonioscopy and dilated fundus examination. Standard automated perimetry was performed in eyes with adequate visual acuity. Uveitis was classified according to SUN/IUSG criteria, and uveitic glaucoma was defined as IOP >21 mmHg with glaucomatous optic disc and/or reproducible field defects in the absence of primary glaucoma.
Results: The mean age was 47.9 years, and 72% of patients were male. Anterior uveitis was the predominant subtype (60%), and 60% of eyes had a chronic course. Raised IOP (≥21 mmHg) was detected in 30% of eyes, while uveitic glaucoma was present in 12% (6/50). Most glaucoma cases occurred in chronic uveitis (83.3%) and anterior uveitis (83.3%); two-thirds had open-angle and one-third angle-closure configuration on gonioscopy. Cataract and macular involvement were frequent coexisting complications.
Conclusion: Uveitic glaucoma is a relatively common sequela of chronic anterior uveitis in this setting. Rigorous and sustained IOP, optic nerve and visual field surveillance is essential to mitigate irreversible vision loss.

Keywords: Uveitis; Uveitic glaucoma; Intraocular pressure; Anterior uveitis; Prevalence.

INTRODUCTION

Uveitis denotes inflammation of the uveal tract, comprising iris, ciliary body and choroid, with or without involvement of adjacent ocular structures such as retina, optic nerve, vitreous and sclera.[1] It represents a heterogeneous group of disorders that can be classified anatomically using the International Uveitis Study Group and Standardization of Uveitis Nomenclature (SUN) criteria into anterior, intermediate, posterior uveitis and panuveitis, and further described as acute, recurrent or chronic according to the clinical course.[2,3] Anterior uveitis is the most frequent pattern worldwide, typically affecting young and middle-aged adults, with a male preponderance in many series.[4–6] A wide spectrum of infectious, autoimmune, traumatic and idiopathic aetiologies has been implicated, often in association with systemic diseases such as

seronegative spondyloarthropathies, sarcoidosis and juvenile idiopathic arthritis.[7,8] Uveitis accounts for an estimated 10% of global blindness, largely due to sight-threatening complications including cataract, macular oedema and glaucoma.[9] Glaucoma secondary to uveitis, often termed uveitic glaucoma, arises through complex interactions between intraocular inflammation, structural damage to the trabecular meshwork, synechial angle closure and corticosteroid therapy.[10,11] Reported prevalence rates of elevated intraocular pressure or glaucoma in uveitic eyes range from approximately 5–20%, and are substantially higher in chronic and anterior uveitis than in acute or posterior forms.[12–14] Uveitic glaucoma is challenging to manage, frequently requiring prolonged medical therapy and, in a substantial proportion of cases, surgical intervention, with a guarded visual prognosis.[15] Robust local data on the burden and profile of glaucoma in uveitis are therefore essential to inform timely detection, risk stratification and follow-up strategies in tertiary care settings. This study aims to quantify the prevalence of glaucoma among patients with uveitis attending the School of Excellence for Eye under the Government Medical College and Hospital, Indore (India), and to emphasise the importance of early detection and optimal screening to mitigate long-term visual morbidity and the associated societal disease burden.

MATERIAL AND METHODS

This hospital-based observational study included 50 eyes of patients diagnosed with uveitis who presented to the School of Excellence for Eye under the Government Medical College and Hospital, Indore (India), over a period from March 2023 to February 2025. All examinations and data collection were performed in a dedicated uveitis–glaucoma clinic using a predefined proforma.

All clinically diagnosed uveitis cases were eligible for inclusion, irrespective of anatomical subtype or aetiology, provided they met the International Uveitis Study Group and SUN Working Group criteria for intraocular inflammation.[2,3] Patients with any evidence of primary glaucoma, including a prior diagnosis of primary open-angle or primary angle-closure glaucoma, were excluded, as were eyes with other optic nerve or retinal pathologies that could independently account for visual loss.

For each participant, detailed history was obtained, including presenting complaints, duration of symptoms, past ocular history, family history of glaucoma, and relevant systemic illnesses. A general physical and systemic examination was performed to evaluate for granulomatous or systemic inflammatory disease. Best-corrected visual acuity (BCVA) was measured using a Snellen chart and subsequently categorised according to World Health Organization–based strata as normal (6/6–6/18), visual impairment (<6/18–6/60), severe visual impairment (<6/60–3/60) and blindness (<3/60 to perception of light or no light perception).

Comprehensive anterior and posterior segment evaluation was performed on a slit lamp (Takagi S12–15), documenting conjunctival congestion, corneal changes including keratic precipitates or keratouveitis, anterior chamber cells and flare, iris atrophy, nodules, synechiae, heterochromia, pupillary abnormalities, lens status, and vitreous activity. Intraocular pressure (IOP) was measured with a Goldmann applanation tonometer after instillation of 4% lignocaine and fluorescein staining, ensuring appropriate semicircular mires. To account for diurnal variation, IOP was recorded six times a day (6 a.m., 9 a.m., 12 noon, 3 p.m., 6 p.m., and 9 p.m.), and the mean of these readings was taken as the final IOP. The IOP range for each eye was also calculated; a fluctuation ≥8 mmHg between the highest and lowest readings was considered significant, even if the mean IOP was ≤22 mmHg.

Dilated fundus examination was performed in all eyes using slit-lamp biomicroscopy with a 90 D lens, direct ophthalmoscopy and binocular indirect ophthalmoscopy with a 20 D lens in a dark room. Optic disc assessment focused on vertical cup–disc ratio (C:D), asymmetry between the two eyes, neuroretinal rim configuration, vessel baring and bayoneting, disc haemorrhages, retinal nerve fibre layer defects, laminar dot sign and peripapillary atrophy; the presence of at least two characteristic glaucomatous features was taken as evidence of glaucomatous optic neuropathy. The posterior segment was also evaluated for macular oedema, retinal detachment, vascular occlusions and other pathologies, which, if responsible for visual impairment, led to exclusion from the glaucoma outcome analysis.

Gonioscopy was performed in all eyes using a Goldmann three-mirror lens under low ambient illumination, avoiding light on the pupil. After topical 4% lignocaine, coupling fluid was applied and the lens gently placed on the globe; angles were systematically examined in all four quadrants. Angle width was graded according to the Shaffer system (grades 0–4) based on the estimated angular width between the trabecular meshwork and peripheral iris and the most posterior structure visible, and averaged across quadrants to classify the drainage angle as open or occludable/closed.

Standard automated perimetry was performed with the Humphrey Field Analyzer (Carl Zeiss, model 745i) using the SITA-Standard 30-2 program in eyes with BCVA ≥6/18. Visual field testing was done with appropriate near correction, and two reliable fields at least four weeks apart were obtained whenever possible. Fields were interpreted using the Hodapp–Parrish–Anderson (HPA) classification, incorporating mean deviation and pattern deviation probability maps to categorise defects as mild, moderate or severe glaucoma, and to apply standard minimum criteria for acquired glaucomatous damage (Glaucoma Hemifield Test, cluster of depressed points, or abnormal corrected pattern standard deviation on two consecutive fields).

All patients underwent baseline laboratory investigations including haemoglobin, complete blood counts, erythrocyte sedimentation rate, and chest radiograph. Targeted tests such as Mantoux test, skin biopsy, VDRL and serum angiotensin-converting enzyme levels were performed when clinically indicated to evaluate specific aetiologies.

Operational definitions

Uveitis was classified anatomically as anterior, intermediate, posterior or panuveitis according to International Uveitis Study Group and SUN Working Group criteria.[2,3] The clinical course was categorised as acute (single episode of sudden onset and limited duration), recurrent (repeated episodes separated by ≥3 months of inactivity without treatment) or chronic (persistent inflammation with relapse within <3 months after discontinuing therapy), in accordance with SUN descriptors.[3] Best-corrected visual acuity was stratified using World Health Organization thresholds: normal vision (6/6–6/18), visual impairment (<6/18–6/60), severe visual impairment (<6/60–3/60), and blindness (<3/60 to perception of light or no light perception).[16]

Ocular hypertension was operationally defined as intraocular pressure ≥21 mmHg measured by Goldmann applanation tonometry in the absence of glaucomatous optic disc changes or characteristic visual field defects. A diurnal IOP fluctuation ≥8 mmHg between maximum and minimum readings was considered clinically significant, irrespective of mean IOP.[17]

Uveitic glaucoma was defined operationally as IOP ≥21 mmHg measured by Goldmann applanation tonometry, in conjunction with glaucomatous optic nerve head changes and/or reproducible glaucomatous visual field defects on standard automated perimetry, in an eye with uveitis and no evidence of primary glaucoma.[10,18] An eye was classified as demonstrating a glaucomatous fundus if at least two of the following features were present: vertical cup–disc ratio ≥0.6, inter-eye cup–disc asymmetry ≥0.2, circumlinear vessel baring or bayoneting, optic disc haemorrhage, retinal nerve fibre layer defects, laminar dot sign, or β-zone peripapillary atrophy.[19]

On gonioscopy, anterior chamber angle configuration was graded using the Shaffer system (grades 0–4); angles with grade 3–4 (scleral spur and ciliary body band clearly visible) were considered open, whereas those with grade 0–2 (only Schwalbe's line or anterior trabecular meshwork visible, or appositional closure) were categorised as narrow or closed and at risk of angle closure.[20]

Visual fields were classified as mild, moderate or severe glaucoma according to the Hodapp–Parrish–Anderson criteria, based primarily on mean deviation values, the proportion and depth of depressed points on the pattern deviation plot and the involvement of the central 5 degrees.[21]

Statistical analysis

The prevalence of glaucoma in the uveitis cohort was calculated as the proportion of eyes fulfilling the operational definition of uveitic glaucoma among all examined uveitic eyes. Descriptive statistics, including frequencies and percentages, were used to summarise baseline characteristics, clinical patterns and complication profiles.

RESULTS

Table 1: Baseline socio-demographic characteristics of patients with uveitis

Characteristic	Category	Frequency (n = 50)	Percentage (%)
Age group (Years)	11–20	2	4
	21–30	7	14
	31–40	7	14
	41–50	10	20
	51–60	19	38
	61–70	5	10
Gender	Male	36	72
	Female	14	28

Patients were predominantly middle-aged, with nearly two-thirds aged 41–60 years and a mean age of 47.86 years. Males comprised just over two-thirds of the cohort, reflecting a marked male preponderance among uveitis cases attending this tertiary centre. (Table 1)

Table 2: Clinical pattern and baseline visual status of uveitis

Variable	Category	Frequency (n = 50)	Percentage (%)

Anatomical type	Anterior uveitis	30	60
	Intermediate uveitis	7	14
	Posterior uveitis	10	20
	Panuveitis	3	6
Course	Acute	20	40
	Chronic	30	60
BCVA (WHO strata)	6/6–6/18	29	58
	<6/18–3/60	18	36
	<3/60	1	2
	PL to no PL	2	4

Anterior uveitis was the most frequent anatomical subtype, accounting for 60% of cases, followed by posterior, intermediate and panuveitis. A chronic course predominated, and although over half of eyes maintained BCVA ≥6/18, more than one-third already had moderate visual impairment at presentation, with a small but important proportion in the blind range. Figure 1 together with Table 2 illustrates that anterior uveitis constituted the majority of presentations, with intermediate, posterior and panuveitis forming progressively smaller subsets, underscoring anterior segment disease as the principal substrate for uveitic glaucoma in this cohort.

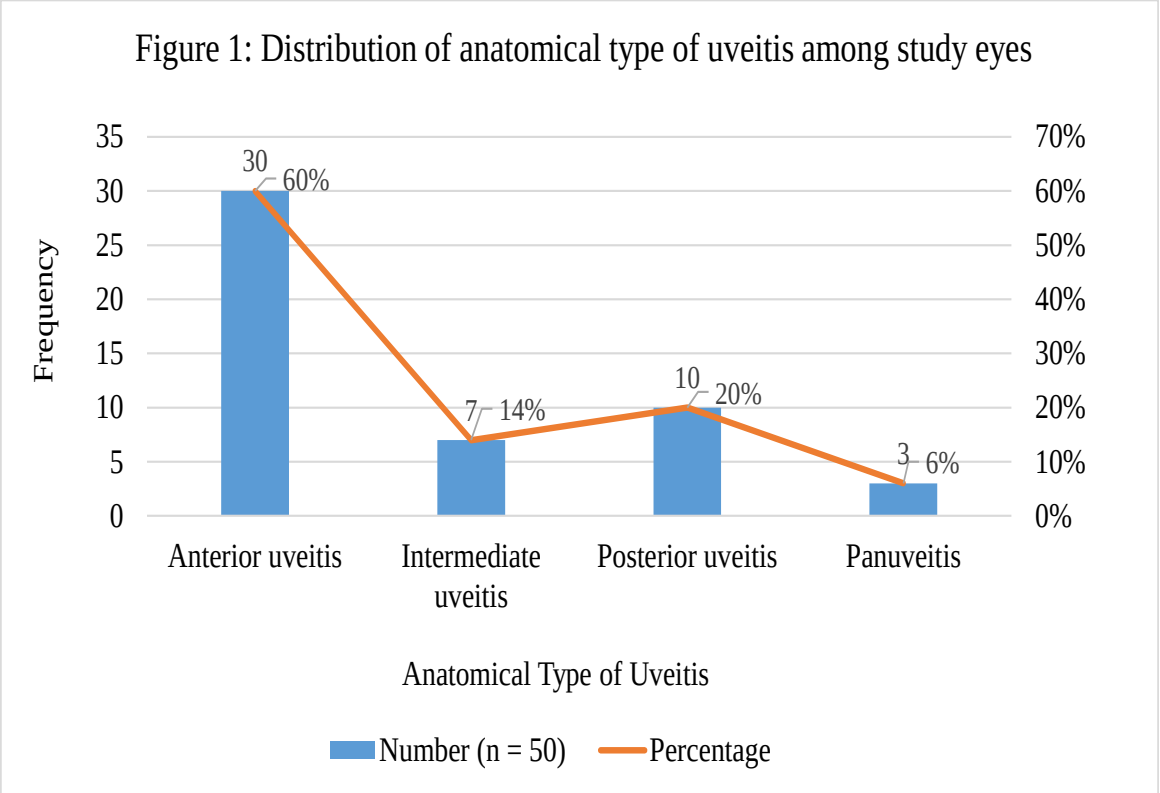

Figure 1: Distribution of anatomical type of uveitis among study eyes

Representative slit-lamp image (Figure 2) depicting chronic uveitis illustrate characteristic anterior segment inflammatory features encountered in the cohort.

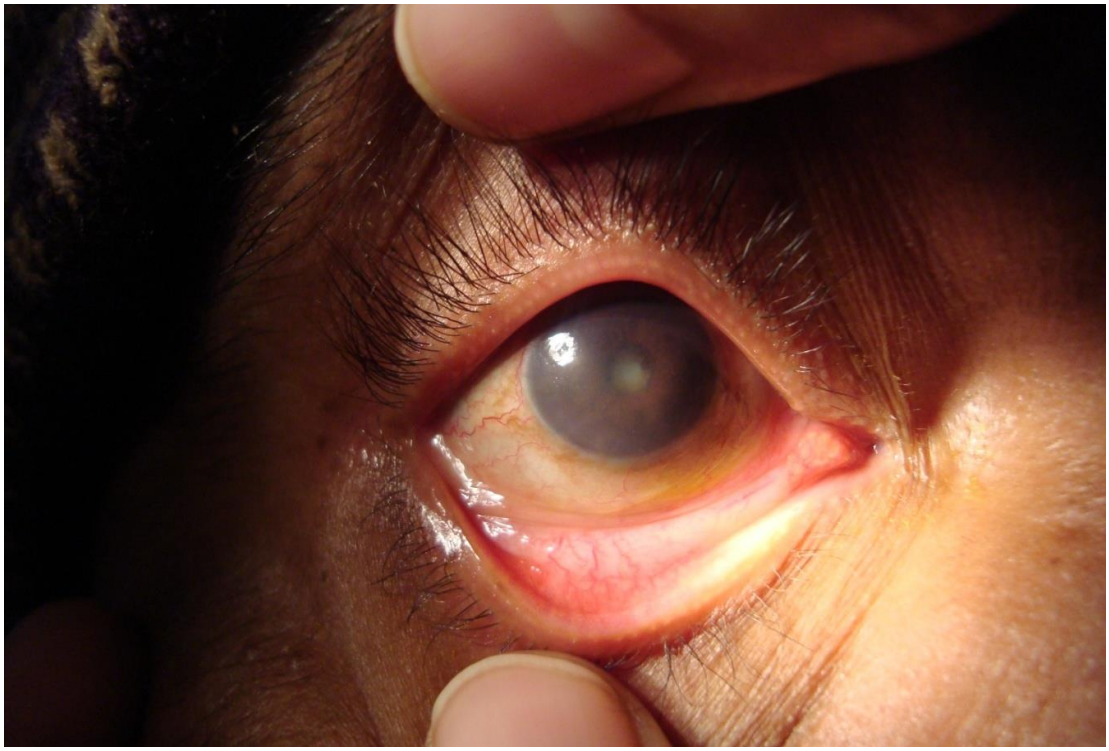

Figure 2: Chronic uveitis appearance on slit lamp examination

Table 3: Intraocular pressure profile and prevalence of raised IOP and uveitic glaucoma

Parameter	Category	Frequency (n = 50)	Percentage (%)
Goldmann IOP category (mmHg)	1–10	2	4
	11–20	33	66
	21–30	11	22
	31–40	1	2
	41–50	3	6
Raised IOP (≥21 mmHg)	Present	15	30
	Absent	35	70
Uveitic glaucoma (study definition)	Present	6	12
	Absent	44	88

One-third of uveitic eyes demonstrated ocular hypertension with IOP ≥21 mmHg, and just over one in ten fulfilled the operational criteria for uveitic glaucoma based on IOP, optic disc and field changes. Most eyes had IOP within 11–20 mmHg, but a distinct subgroup exhibited markedly elevated pressures up to 41–50 mmHg, reflecting a clinically significant burden of pressure-related risk. Table 3 and Figure 3 jointly demonstrate a stepwise gradient from the majority of uveitic eyes with IOP ≤20 mmHg, through a sizable subgroup with isolated ocular hypertension, to a smaller but clinically important fraction that had already progressed to uveitic glaucoma.

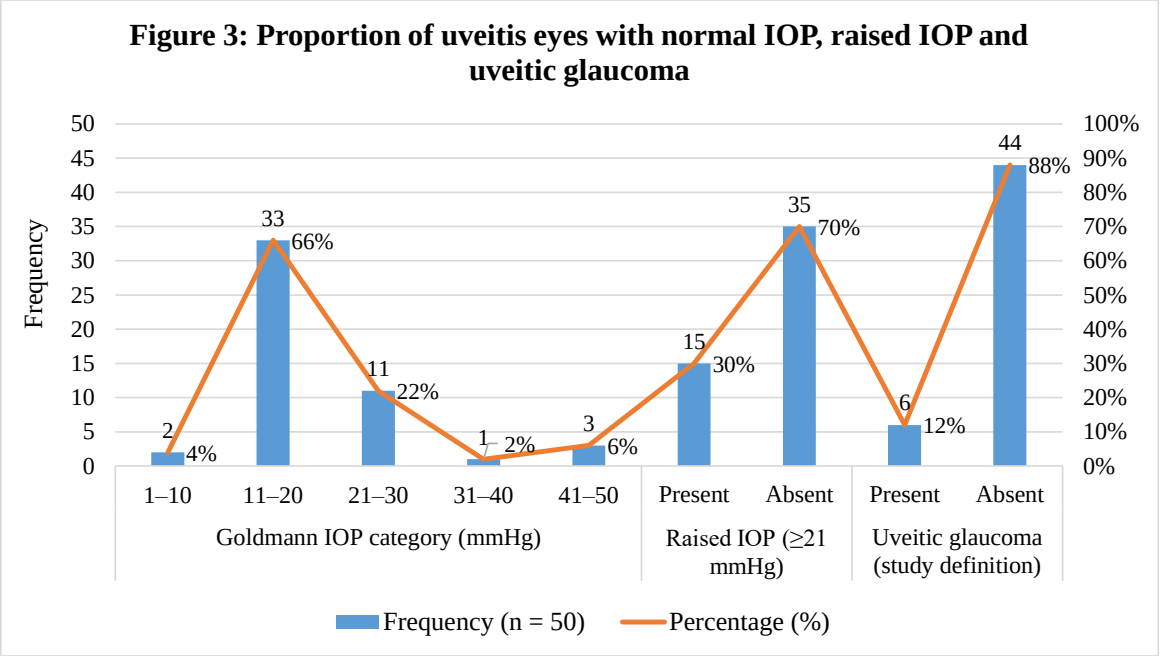

Figure 3: Proportion of uveitis eyes with normal IOP, raised IOP and uveitic glaucoma

Table 4: Raised IOP and uveitic glaucoma by disease course and anatomical type

Outcome	Subgroup	Eyes with outcome	Denominator	Percentage (%)
Raised IOP (≥21 mmHg)	Acute uveitis	1	20	5
	Chronic uveitis	14	30	46.7
Uveitic glaucoma	Acute uveitis	1	20	5
	Chronic uveitis	5	30	16.7
Uveitic glaucoma	Anterior uveitis	5	30	16.7 (83.3% of glaucoma cases)
	Posterior uveitis	1	10	10 (16.7% of glaucoma cases)
	Intermediate / panuveitis	0	10	0

Raised IOP and uveitic glaucoma were predominantly associated with chronic inflammation, with nearly half of chronic uveitis eyes showing ocular hypertension and about one-sixth developing glaucoma, compared with only 5% in acute uveitis. The vast majority of glaucoma cases arose in anterior uveitis, highlighting this anatomical subset and chronic course as key risk strata for targeted screening. (Table 4)

Table 5: Angle configuration, fundus and visual field findings

Parameter	Category	Frequency	Percentage (%)
Angle status in uveitic glaucoma eyes (n = 6)	Open angle	4	66.7
	Closed angle	2	33.3
Fundus findings in all uveitis eyes (n = 50)	Glaucomatous optic disc	6	12
	Optic atrophy	2	4
	Macular oedema	3	6
	Normal fundus	39	78

Automated perimetry (n = 50)	Normal fields	20	40
	Glaucomatous defects	2	4
	Not performed (BCVA <6/18)	28	56

Among eyes with uveitic glaucoma, two-thirds had an open-angle configuration and one-third had angle closure, indicating both mechanisms operate in this population. Glaucomatous discs were documented in 12% of all uveitic eyes, and although reliable visual fields could be obtained in fewer than half of patients, glaucomatous defects were already demonstrable in a subset, underscoring the structural and functional impact of pressure elevation. (Table 5)
Clinical images (Figures 4–5) of Fuchs' heterochromic iridocyclitis with secondary glaucoma and complicated cataract exemplify specific uveitic entities associated with elevated IOP.

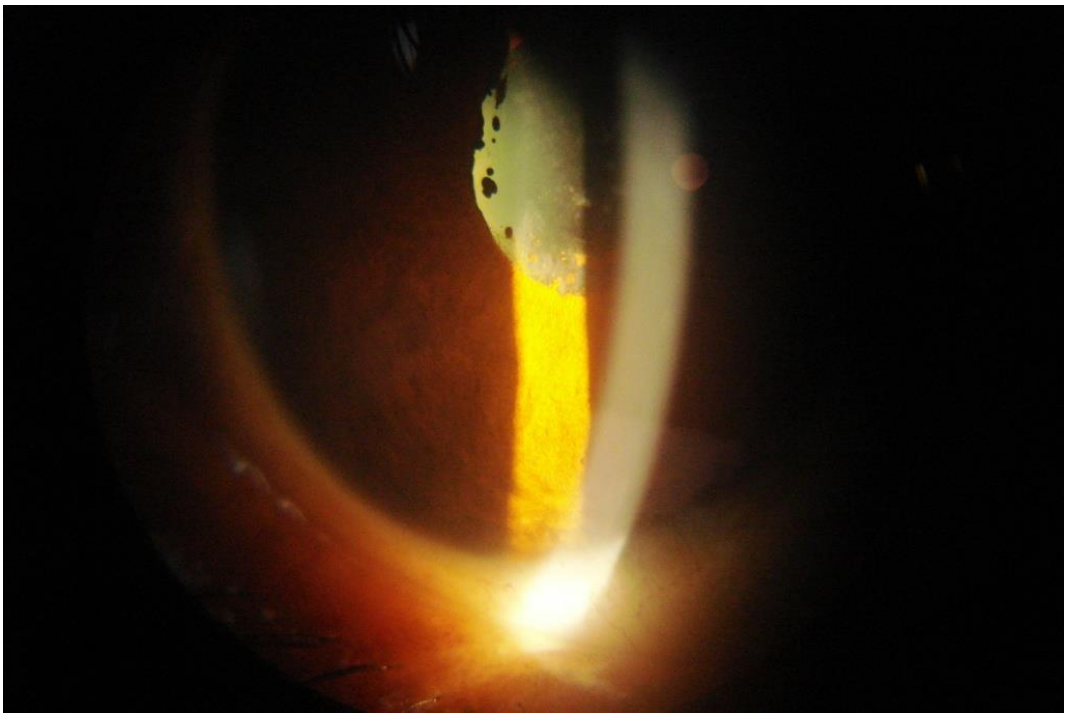

Figure 4: Fuchs' heterochromic iridocyclitis with secondary glaucoma and complicated cataract

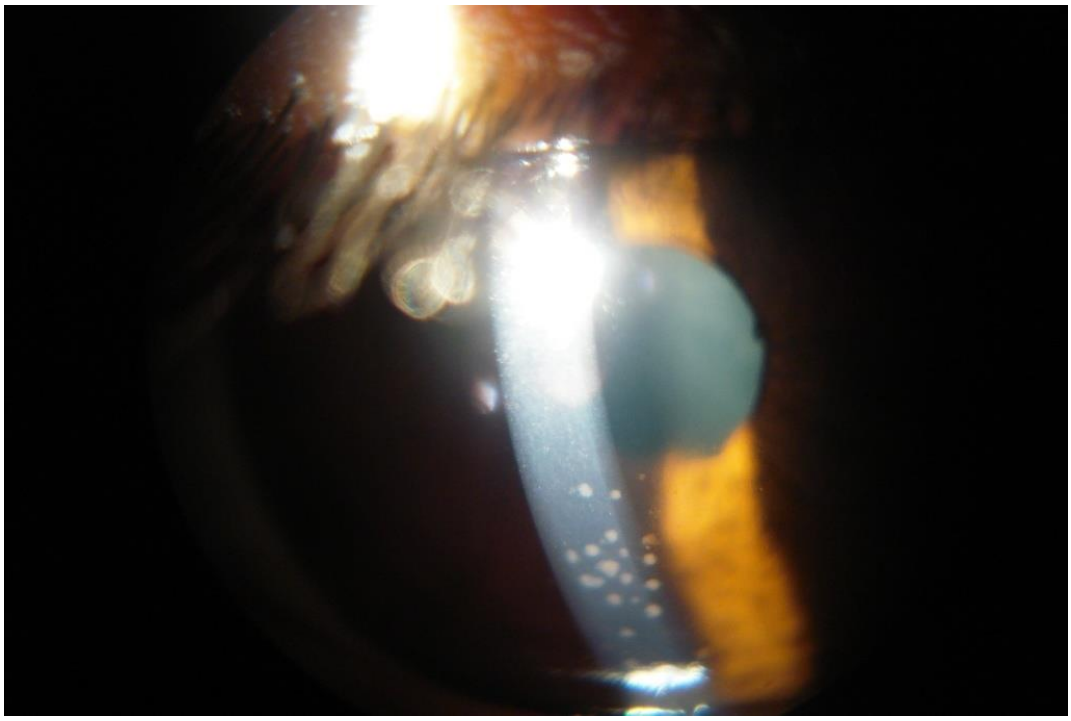

Figure 5: Fuchs' heterochromic iridocyclitis demonstrating iris heterochromia, secondary glaucoma and complicated cataract

Table 6: Ocular complications in uveitis

Complication	Frequency (n = 50)	Percentage (%)
Cataract	8	16
Glaucoma	6	12
Hypotony	2	4
Vitreous haemorrhage	2	4
Macular oedema	3	6
Retinal detachment	1	2
Optic atrophy	2	4
None (no complication)	26	52

Just under half of uveitic eyes had at least one structural complication, with cataract and glaucoma being the most frequent, followed by macular and optic nerve-related sequelae. Glaucoma thus emerges as a major component of the overall complication profile, reinforcing its contribution to long-term visual morbidity in uveitis. (Table 6)

DISCUSSION

In this hospital-based cohort, uveitic glaucoma was identified in 12% of eyes, while 30% demonstrated ocular hypertension, underscoring uveitis as an important substrate for pressure-related optic nerve damage in a tertiary care setting. This frequency lies within the broad range of 5–20% reported for uveitic glaucoma in inflammatory eye disease series, although direct comparisons are limited by differences in case mix, follow-up duration and case definitions.[10] The predominance of glaucoma in chronic rather than acute uveitis (16.7% versus 5%) in the present study is consistent with the concept that prolonged or recurrent intraocular inflammation and cumulative steroid exposure potentiate structural trabecular damage and sustained IOP elevation.

The demographic and anatomical profile of uveitis in this series closely parallels prior Indian referral-centre data. Anterior uveitis accounted for 60% of cases, followed by posterior, intermediate and panuveitis, with a clear male preponderance and peak incidence in the 40–60-year age group. These observations align with the patterns described by **Singh et al. (2004)** and **Das et al. (2009)**, who reported anterior uveitis as the leading subtype in North and North-East India.[4,22] Similarly, **Rathinam et al. (2007)** documented idiopathic and HLA-B27–associated anterior uveitis as dominant entities across diverse ecological settings, supporting the generalisability of the present baseline pattern.[23]

The strong association between chronic disease course and raised IOP in this study (46.7% of chronic versus 5% of acute uveitis eyes) replicates the risk gradient reported by **Herbert et al. (2004)**, who noted significantly higher rates of ocular hypertension in chronic intraocular inflammation, with active inflammation, steroid use, age and disease duration as independent correlates.[24] The present findings therefore reinforce the need for closer longitudinal IOP surveillance in patients with chronic or long-standing uveitis, even when the anterior chamber appears clinically quiet.

With respect to anatomical type, 83% of eyes with uveitic glaucoma in this series had anterior uveitis and 17% had posterior uveitis, a distribution comparable to that of **Merayo-Lloves et al. (1999)**, who found secondary glaucoma most frequently in anterior uveitis, followed by posterior uveitis and pars planitis.[25] The predominance of open-angle configuration on gonioscopy (two-thirds of glaucomatous eyes) also mirrors their observation that the majority of uveitis-associated glaucomas are open-angle in mechanism. Together, these data suggest that anterior segment inflammation with chronic course is the principal phenotype at risk for pressure-related optic neuropathy, while angle-closure mechanisms, though less frequent, remain clinically relevant in eyes with extensive synechiae.

The 12% glaucoma prevalence observed here is slightly lower than the 18.3% secondary glaucoma rate reported by **Tetsuya et al. (2002)** in a large Japanese series and close to the incidence figures from **Neri et al. (2004)**, who documented glaucoma development in 6.5–11.1% of chronic uveitis eyes over 1–5 years of follow-up.[18,26] Differences may reflect shorter observation in the present cross-sectional snapshot, the exclusion of primary glaucomas, and possible under-ascertainment of early functional loss given that reliable automated perimetry could only be performed in eyes with preserved visual acuity. In contrast, **Panek et al. (1990)** reported secondary glaucoma rates of 12% in acute and 26% in chronic uveitis, emphasising the management challenge posed by anterior segment inflammation, which is echoed by the present finding that all glaucomatous eyes showed disc changes and a subset already had visual field defects.[27]

Structural complications were frequent in this cohort; cataract (28%), macular involvement (20%) and glaucoma (12%) emerged as the leading causes of visual morbidity. This pattern parallels the work of **Prieto-del-Cura et al. (2009)** and

Stanković et al. (2009), who highlighted cataract, cystoid macular oedema and glaucoma/ocular hypertension as the principal sequelae driving vision loss in uveitis.[28,29] In the present study, over one-third of eyes already had BCVA worse than 6/18 at presentation, and two eyes had no light perception secondary to optic atrophy from uncontrolled uveitic glaucoma, illustrating the cumulative and often irreversible impact of delayed detection.

Taken together, these results confirm that uveitic glaucoma in this population is neither rare nor benign. The close concordance with international and Indian data on the influence of chronicity, anterior location and synechiae on IOP elevation supports current recommendations for aggressive control of inflammation, judicious steroid use and systematic IOP, optic disc and field monitoring in all uveitis patients, with particular vigilance in those with chronic anterior disease.[4,24,25] At the same time, the modest sample size and hospital-based design underscore the need for larger, population-based studies to define the true community burden and to refine risk-stratified screening algorithms in this region.

CONCLUSION

In this tertiary-care cohort, uveitic glaucoma affected 12% of uveitic eyes and was strongly associated with chronic anterior disease, open-angle configuration and concurrent sight-threatening complications such as cataract and macular involvement. Early, systematic surveillance of IOP, optic nerve and visual fields in uveitis patients is essential to prevent irreversible vision loss and reduce the long-term burden of glaucoma in this population.

Relevance of the Study

The study provides region-specific data on the prevalence and profile of uveitic glaucoma in Central India and highlights a high-risk phenotype (chronic anterior uveitis) requiring intensified screening and follow-up. These findings can inform local clinical protocols and contribute baseline data for future population-based surveys.

Authors' Contribution

The author conceived the study, recruited and examined all patients, performed data collection and analysis, and prepared the manuscript based on the original thesis work.

Ethical Consideration

The study adhered to the tenets of the Declaration of Helsinki; institutional ethics committee approval was obtained and written informed consent was taken from all participants prior to enrolment.

Financial Support and Sponsorship

No specific grant from funding agencies in the public, commercial or not-for-profit sectors was received for this study.

Conflicts of Interest

The author declares no conflicts of interest related to this work.

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