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Medication adherence and barriers to long-term anti-glaucoma therapy among glaucoma patients. A cross-sectional study.

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Abstract

Background

Glaucoma is a chronic optic neuropathy that requires lifelong reduction of intraocular pressure, commonly achieved through topical therapy. Suboptimal adherence to eye drops remains a major contributor to disease progression.

Objectives

To assess the level of medication adherence and to identify perceived barriers to long-term topical anti-glaucoma therapy among patients attending a tertiary care centre.

Methods

A questionnaire-based cross-sectional study was conducted on one hundred adults with diagnosed glaucoma receiving topical anti-glaucoma therapy were enrolled. Adherence was classified as good, moderate, or poor using predefined questionnaire criteria, and perceived barriers were documented using multiple-response items.

Results

A total of 100 glaucoma patients were analysed. Most participants were aged 41–60 years (46%) or >60 years (36%), and 58% were male. Primary open-angle glaucoma was the commonest diagnosis (62%). Regarding treatment exposure, 41% had been on therapy for 1–3 years, and 61% were receiving monotherapy. Based on the adherence scale, 58% demonstrated good adherence, while 27% and 15% had moderate and poor adherence, respectively. Among individuals with suboptimal adherence (n = 42), the leading immediate reasons were forgetting to instil eye drops (71.4%) and skipping doses because vision appeared normal (50.0%). The most frequently reported barriers to long-term topical therapy were forgetfulness (42%), the long-term nature of treatment (36%), medication cost (31%), and difficulty in self-administration (29%). Other barriers included fear of adverse effects (24%), low perceived need due to lack of immediate feedback (22%), inadequate knowledge regarding disease progression (19%), and limited family/social support (14%)

Conclusion

More than two-fifths of glaucoma patients reported suboptimal adherence, largely driven by behavioral and practical barriers. Targeted counselling, skill-based instillation training, and reminder-based support can strengthen persistence with therapy and improve long-term outcomes.

Recommendations

Integrate structured adherence counselling into routine visits, introduce reminder strategies, and improve affordability and accessibility of glaucoma medications.

Keywords: Glaucoma; medication adherence; eye drops; non-adherence; barriers; India
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Introduction

Glaucoma is a progressive optic neuropathy characterized by structural damage to the optic nerve head and corresponding visual field loss. It remains a leading cause of irreversible blindness worldwide [1]. Long-term lowering of intraocular pressure (IOP) is the only proven strategy to slow disease progression, and topical ocular hypotensive medications constitute the first-line treatment for many patients in routine clinical practice [2]. Unlike acute illnesses, glaucoma demands lifelong engagement with therapy, regular follow-up, and sustained behavioral commitment even when vision appears stable [3].

Medication adherence is an essential determinant of treatment effectiveness in chronic diseases. Adherence encompasses correct dosing, timing, and persistence over time, whereas non-adherence includes missed doses, incorrect technique, premature discontinuation, and inconsistent refill behaviour [4]. In glaucoma, poor adherence is particularly problematic because the disease is typically symptom-silent until advanced stages. Consequently, patients may not perceive an immediate benefit from treatment, and even brief interruptions in therapy can compromise IOP control and accelerate functional decline.

Evidence from electronically monitored and survey-based studies shows that non-adherence to topical glaucoma therapy is common and multifactorial. Forgetfulness, difficulties in instillation, low self-efficacy, complex dosing schedules, scepticism regarding benefits, and treatment cost have been repeatedly identified as key contributors [3-5]. In Indian settings, additional barriers include limited health literacy, access constraints, and dependence on family members for medication administration, which collectively influence persistence with therapy [6]. Addressing these barriers requires context-sensitive approaches that combine patient education, behavioural reinforcement, and practical support.

Understanding local adherence patterns and barriers is vital for designing feasible, scalable interventions within busy tertiary eye care services. Therefore, this study was conducted to quantify adherence levels and identify perceived barriers among glaucoma patients receiving topical therapy at Osmania Medical College, Hyderabad. The objectives of the study were: (i) to assess the level of medication adherence among glaucoma patients on topical anti-glaucoma therapy, and (ii) to determine the patient-reported barriers associated with long-term therapy continuation.

Materials and Methods

Study design and setting

A cross-sectional study was carried out at Sarojini Devi Eye Hospital, Osmania Medical College, Hyderabad, Telangana, India. Study participants were enrolled from outpatient services during their scheduled visits between 25 August 2025 and 30 October 2025. The institution acted as a tertiary care referral hub, providing services to urban and peri-urban communities and managing cases referred from surrounding districts across the region.

Study participants and sample size

A total of 100 glaucoma patients receiving topical anti-glaucoma therapy were included. The sample size was estimated using the single population proportion formula for cross-sectional studies:

$$n = Z^2 \times p \times (1 - p) / d^2$$

where n represents the required sample size, Z is the standard normal deviate corresponding to the desired confidence level (1.96 for 95% confidence), p is the anticipated prevalence of adherence, and d is the absolute precision. In the absence of reliable local estimates, an expected prevalence of 50% was assumed to yield the maximum sample size. With a 95% confidence level and 10% absolute precision, the calculated sample size was:

$$n = (1.96)^2 \times 0.5 \times 0.5 / (0.1)^2 = 96.04$$

The value was rounded up, and a final sample size of 100 participants was included.

Adult patients (≥18 years) with a clinical diagnosis of primary open-angle glaucoma, primary angle-closure glaucoma, or secondary glaucoma who had been prescribed intraocular pressure–lowering eye drops for at least one month were eligible. Patients with severe

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cognitive impairment, acute ocular emergencies requiring immediate intervention, or inability to provide informed consent were excluded. Consecutive sampling was used to recruit eligible participants attending the glaucoma clinic during the study period.

Data collection tool and procedure

Data were collected using a structured, interviewer-assisted questionnaire comprising two components: (i) sociodemographic and clinical details (age group, sex, type of glaucoma, duration of therapy, and regimen type), and (ii) medication adherence and perceived barriers. Adherence was assessed through direct patient responses regarding missed doses and discontinuation behavior, and was categorized into good, moderate, or poor adherence. For participants reporting moderate or poor adherence, additional items captured specific non-adherence patterns such as forgetting, incorrect timing, or difficulty with instillation technique. Perceived barriers were elicited using multiple-response options informed by commonly reported determinants in prior literature [4-6].

Operational definitions

Good adherence was defined as rare or no missed doses, with consistent continuation of therapy. Moderate adherence referred to occasional missed doses without prolonged interruption. Poor adherence was defined as frequent missed doses or self-reported discontinuation of drops without medical advice. Barriers were recorded as patient-reported reasons that made long-term eye drop use difficult, and multiple responses were permitted per participant.

Bias

Several measures were implemented to minimise potential sources of bias. Selection bias was reduced by enrolling consecutive eligible glaucoma patients attending the outpatient department during the study period, according to predefined inclusion and exclusion criteria. Information bias was limited through the use of a structured, pretested questionnaire and standardised administration procedures. To reduce interviewer bias, uniform instructions were followed while collecting responses. Recall bias was minimised by focusing on recent medication-taking behaviour and by using simple, clearly phrased questions. Social desirability bias was addressed by assuring participants of confidentiality and anonymity, emphasising that responses would not influence their clinical care.

Statistical analysis

Data were entered into a spreadsheet and analyzed using standard descriptive statistics. Categorical variables were summarized as frequencies and percentages. Adherence categories, non-adherence patterns, and perceived barriers were presented as proportions. Because the primary aim was to describe adherence status and barriers, inferential tests were not applied.

Ethical considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of Osmania Medical College and associated hospital, Hyderabad, Telangana, India. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrolment. Confidentiality of patient data was strictly maintained, and participants were informed of their right to withdraw from the study at any stage without affecting their standard clinical care.

Results

Participants' flow

During the study period, 100 consecutive adult glaucoma patients receiving topical anti-glaucoma therapy were assessed for eligibility at the glaucoma clinic. All patients met the predefined inclusion criteria and none fulfilled the exclusion criteria. Written informed consent was obtained from all participants prior to enrolment. All enrolled participants completed the structured questionnaire and clinical data verification. There were no withdrawals, incomplete responses, or missing data. Consequently, data from all 100 participants were included in the final statistical analysis.

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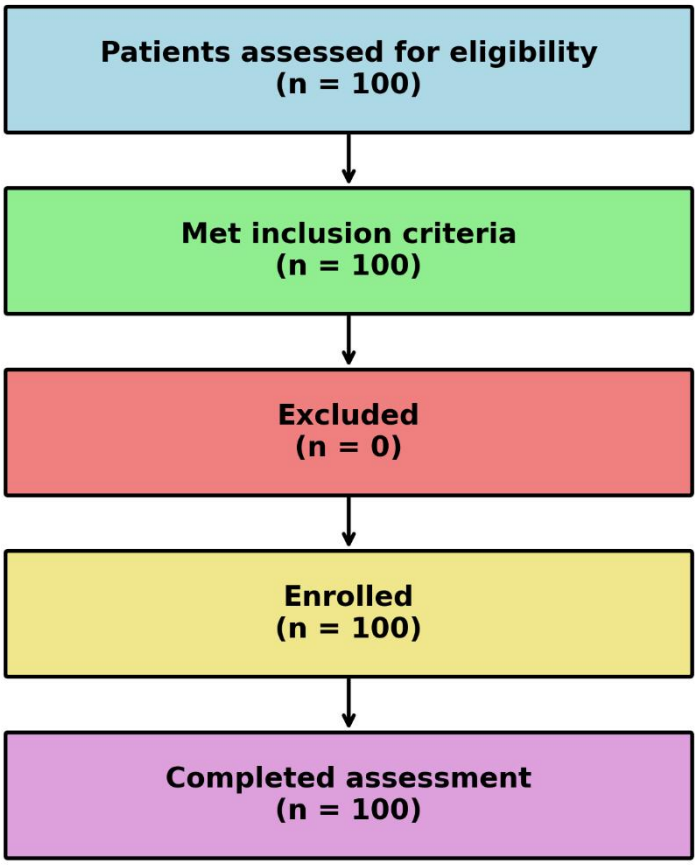

Figure 1: Participant Flow Diagram

A total of 100 glaucoma patients receiving topical anti-glaucoma therapy were included in the final analysis. All participants completed the adherence and barriers questionnaire during the study period.

The study cohort consisted predominantly of middle-aged and elderly individuals, with 46% aged 41-60 years and 36% aged >60 years. Males comprised 58% of participants. Primary open-angle glaucoma was the most common diagnosis (62%), and 41% had been on therapy for 1-3 years. Monotherapy was used by 61% of patients, while 39% were receiving combination therapy (Table 1).

Overall, 58% of participants demonstrated good adherence to topical therapy, while 27% and 15% reported moderate and poor adherence, respectively, indicating that 42% had some degree of suboptimal adherence (Table 2).

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Table 1. Sociodemographic and clinical characteristics of the study participants (N = 100)

Variable	Category	n (%)
Age group (years)	≤40	18 (18.0)
	41–60	46 (46.0)
	>60	36 (36.0)
Sex	Male	58 (58.0)
	Female	42 (42.0)
Type of glaucoma	Primary open-angle glaucoma	62 (62.0)
	Primary angle-closure glaucoma	28 (28.0)
	Secondary glaucoma	10 (10.0)
Duration of therapy	<1 year	34 (34.0)
	1–3 years	41 (41.0)
	>3 years	25 (25.0)
Treatment regimen	Monotherapy	61 (61.0)
	Combination therapy	39 (39.0)

Table 2. Level of medication adherence among glaucoma patients (N = 100)

Adherence category	Definition (questionnaire-based)	n (%)
Good adherence	Rare or no missed doses	58 (58.0)
Moderate adherence	Occasional missed doses	27 (27.0)
Poor adherence	Frequent missed or discontinued doses	15 (15.0)

Among the 42 patients with moderate or poor adherence, forgetting to instill eye drops was the most frequently reported non-adherence pattern (71.4%), followed by skipping doses because vision seemed normal (50.0%). Incorrect timing of doses (40.5%) and difficulty with drop instillation technique (33.3%) were also common, while 21.4% reported discontinuing therapy without medical advice (Table 3).

Table 3. Reported patterns of non-adherence among patients with moderate and poor adherence (n = 42)

Pattern of non-adherence	n (%)
Forgetting to instill eye drops	30 (71.4)
Skipping doses because vision seemed normal	21 (50.0)
Incorrect timing of doses	17 (40.5)
Discontinuation without medical advice	9 (21.4)
Difficulty with drop instillation technique	14 (33.3)

When asked about barriers to long-term therapy, forgetfulness was the most commonly cited barrier (42%), followed by the long-term nature of treatment (36%) and cost of medications (31%). Practical challenges such as difficulty in self-administration (29%) and fear of adverse effects (24%) were also frequently reported. A smaller proportion reported low perceived need due to no immediate feedback (22%), inadequate knowledge regarding disease progression (19%), and limited family or social support (14%) (Table 4).

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Table 4. Barriers to long-term anti-glaucoma therapy as perceived by participants (N = 100)

Barrier	n (%)
Forgetfulness	42 (42.0)
Long-term nature of treatment	36 (36.0)
Cost of medications	31 (31.0)
Difficulty in self-administration	29 (29.0)
Fear of adverse effects	24 (24.0)
Low perceived need (no immediate feedback)	22 (22.0)
Inadequate knowledge about disease progression	19 (19.0)
Poor family or social support	14 (14.0)

Discussion

This cross-sectional evaluation demonstrated that 58% of participants achieved good adherence to prescribed topical anti-glaucoma therapy, whereas 27% and 15% exhibited moderate and poor adherence, respectively. Thus, 42% of patients showed suboptimal adherence despite receiving care in a tertiary glaucoma clinic. Primary open-angle glaucoma constituted 62% of diagnoses, and 61% were on monotherapy, indicating that non-adherence occurred even in patients managed with relatively simplified regimens. These findings underscore the behavioural complexity of sustaining daily eye-drop therapy in a chronic, largely asymptomatic optic neuropathy, where disease progression may occur without perceptible visual decline [7,8].

Among individuals with moderate to poor adherence (n = 42), forgetting to instil eye drops was reported by 71.4%, and 50.0% skipped doses because vision appeared normal. When barriers were examined at the cohort level, forgetfulness was reported by 42%, the perceived long-term burden of treatment by 36%, medication cost by 31%, and difficulty in self-administration by 29%. Additional barriers included fear of adverse effects (24%), low perceived need due to lack of immediate feedback (22%), inadequate knowledge regarding disease progression (19%), and limited family or social support (14%). These quantitative patterns parallel previous barrier-focused investigations in which forgetfulness, low self-efficacy, and difficulty integrating dosing schedules into daily routines were strongly associated with non-adherence [9]. Qualitative research further demonstrates that habitual routines, caregiver involvement, and beliefs regarding the consequences of missed therapy significantly influence adherence behaviour [10–14].

Economic and treatment-burden factors were prominent in this cohort, with nearly one-third reporting cost-related concerns and over one-third perceiving long-term therapy as burdensome. In resource-constrained settings, affordability directly affects persistence and refill continuity, particularly when combination therapy is required. Indian data have highlighted improper drop instillation and non-compliance as interrelated issues, suggesting that prescription alone is insufficient without structured counselling and technique reinforcement [6,7]. The finding that 29% experienced difficulty with self-administration reinforces the need for demonstration-based teaching and periodic reassessment of instillation technique.

Evidence from interventional studies indicates that measurable improvements in adherence can be achieved when modifiable barriers are addressed. Reminder-based strategies and automated dosing supports have demonstrated statistically significant gains in electronically monitored adherence rates [3,8]. Multifaceted educational interventions combining counselling, reinforcement, and behavioural prompts have further improved persistence and correct drop administration [9,11]. Randomised evaluations of reminder calls and structured follow-up have shown superior adherence compared with usual care [10]. These data collectively suggest that clinic-level strategies such as regimen simplification, reminder tools, and structured patient communication may improve long-term therapeutic engagement.

Beyond patient-level determinants, systemic factors warrant consideration. High outpatient volume, limited consultation time, and fragmented follow-up pathways may compromise reinforcement of adherence messages. Incorporating brief adherence screening into routine documentation, delegating drop-technique training to nursing personnel, and encouraging low-cost reminder mechanisms (alarms, calendars, caregiver prompts) represent pragmatic approaches within tertiary centres. Patients who discontinue therapy because symptoms are

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absent require targeted education emphasising that glaucomatous optic neuropathy progresses silently and that sustained intraocular pressure control remains protective over time [7,8].

Generalizability

The findings reflect adherence behaviour among glaucoma patients receiving care at a tertiary teaching hospital in Hyderabad and are most applicable to similar outpatient settings where topical therapy is the mainstay of treatment. Because the sample was clinic-based and assessed using self-reported responses over a short enrolment period, adherence estimates primarily represent patients who attend follow-up and engage with services. Wider community-based surveys across varied socioeconomic strata can strengthen external validity.

Conclusion

In this questionnaire-based cross-sectional study of 100 glaucoma patients on topical therapy, good adherence was observed in just over half of participants, while 42% reported moderate or poor adherence. Forgetfulness and dose skipping during low perceived necessity in a symptom-silent disease were the most common non-adherence patterns, and the dominant barriers related to behavioural factors, treatment burden, cost, and difficulties in self-administration. Routine adherence assessment, patient-centred counselling, and practical instillation training should be integrated into every follow-up visit. Low-cost reminder strategies and simplified regimens can support long-term persistence and safeguard visual outcomes.

Limitations

This single-centre cross-sectional study relied on self-reported adherence, which introduces recall and social desirability bias. The short recruitment window restricted assessment of seasonal or long-term variations in persistence. Adherence was not validated using pharmacy refill data or electronic monitoring, and clinical outcomes such as IOP control and visual field status were not correlated with adherence categories. The questionnaire did not quantify barrier severity, caregiver dependence, or the frequency of missed doses over extended time periods.

Recommendations

Ophthalmology clinics should implement brief adherence screening at each visit and document missed doses, technique issues, and affordability concerns. Patient education must emphasise the silent progression of glaucoma and the preventive role of consistent therapy. Demonstration and return-demonstration of drop instillation should be provided, especially for older adults and those on combination therapy. Reminder-based strategies such as mobile alarms, dosing charts, and caregiver prompts should be encouraged. Where possible, fixed-dose combinations and cost-reduction measures, including generic substitutions and hospital pharmacy support, should be offered to improve persistence.

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Abbreviations

IOP - Intraocular pressure

POAG - Primary open-angle glaucoma

PACG - Primary angle-closure glaucoma

OMC - Osmania Medical College

OPD - Outpatient department

Source of funding

Study has no funding

Conflict of interest

Author declares no cconflict of interest.

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Author contributions

AF-Concept and design of the study, results interpretation, review of literature and preparing first draft of manuscript. Statistical analysis and interpretation, revision of manuscript. **KF** -Concept and design of the study, results interpretation, review of literature and preparing first draft of manuscript, revision of manuscript. **GSS** -Review of literature and preparing first draft of manuscript. Statistical analysis and interpretation.

Data availability

Data available on request

Author Biography

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Original Article

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