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Adherence to Medication in Glaucoma Patients Could Improve the Visual Field

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ABSTRACT

Glaucoma is a leading cause of irreversible blindness worldwide. Medical therapy aims to reduce intraocular pressure (IOP) and prevent optic nerve damage, but its effectiveness depends on medication adherence. This study assessed medication adherence among glaucoma patients and examined its association with visual field outcomes after at least six months of medical therapy at Universitas Kristen Indonesia General Hospital in 2024. An observational analytic cross-sectional design was used. Medication adherence was measured once using the Indonesian Morisky Medication Adherence Scale-8 (MMAS-8), while visual field outcomes were evaluated retrospectively by comparing baseline and most recent 24-2 automated perimetry results from medical records. Eligible patients had received anti-glaucoma medication for ≥6 months, had at least two reliable perimetry examinations, and had not undergone glaucoma surgery. Fifty-one patients were included; 76.5% were female, with a mean age of 42.23 ± 21.4 years. Most had mild-to-moderate glaucoma, normal visual acuity, and baseline IOP within the normal range. Latanoprost was the most prescribed medication. Mean IOP decreased in both eyes after treatment, while mean deviation improved from −7.69 ± 6.88 to −6.55 ± 7.77 dB in the right eye and from −6.87 ± 5.90 to −6.63 ± 5.70 dB in the left eye. Medication adherence was significantly associated with visual field quality ($p = 0.001$). Adherent patients more frequently showed mild-to-moderate visual field loss, whereas non-adherent patients had a higher proportion of advanced loss. Higher adherence was associated with better visual field preservation, underscoring the importance of patient education and regular follow-up in glaucoma management.

Keywords
Glaucoma
Intraocular Pressure
Medication Adherence
MMAS-8
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Introduction

Glaucoma is a chronic optic neuropathy that leads to progressive and irreversible peripheral vision loss [1]. In 2023, the World Health Organization (WHO) reported that 7.7 million people were affected by glaucoma [2]–[4]. In Indonesia, based on data from the Health Information and Data Center in 2019, the prevalence of glaucoma reached 0.46%, indicating that 4 to 5 out of every 1,000 Indonesians experience this disease [5], [6]. Pharmacological therapy is the first-line treatment for glaucoma, aimed at reducing intraocular pressure to prevent further optic nerve damage. However, the effectiveness of this therapy greatly depends on patient adherence. Non-compliance with medication regimens due to forgetfulness, lack of understanding, side effects, or cost often undermines therapeutic outcomes, including the preservation of the visual field [7]–[9].

While numerous studies have established the general relationship between medication adherence and disease control in glaucoma, there is limited local evidence exploring this relationship in Indonesian clinical settings, especially regarding supporting factors such as family support, doctor-provided education and counseling, and reminder strategies. This study aims to evaluate the relationship between medication adherence and visual field outcomes in primary glaucoma patients at Universitas Kristen Indonesia General Hospital in 2024. It also explores contributing factors to adherence, with a focus on identifying barriers and potential strategies to improve treatment outcomes in this population.

Material and Methods

This study employed a cross-sectional design using retrospective data extracted from medical records. The visual field outcomes assessed at the six-month time point were not obtained through prospective longitudinal follow-up conducted as part of this study. Rather, the study analyzed clinical data already recorded as part of routine patient care, including the visual field examination performed after approximately 6 months of treatment. Data were obtained from the medical records of patients with primary glaucoma at Christian University of Indonesia General Hospital in 2024, and patients completed questionnaires to assess their medication adherence. The questionnaire used was MMAS-8 in Bahasa Indonesia. The study was conducted from January to December 2024.

The purpose of this research was to analyze the relationship between medication adherence and visual field quality in primary glaucoma patients who had received

pharmacological treatment only, and to explore the possible influence of doctor-led education as a support strategy for adherence. Patients was first time diagnosed with primary glaucoma who require the glaucoma sign included high intraocular pressure (>21mmHg), glaucomatous fundus in retina and defect of visual field of first perimetry. The examination conducted by glaucoma doctor in our clinic.

Samples were obtained with a purposive sampling method from the primary glaucoma patient population with no history of surgery or any laser treatment in eye. The patients had only undergone pharmacotherapy for 6 months, and had received a perimetry test at least twice using the same perimetry machine with 24:2 testing strategy. Patient with primary glaucoma who continue treatment with laser or surgery will be excluded, and others eye disease included infection or retinal disease were excluded.

Univariate and bivariate analyses were used to process data using IBM SPSS Statistics 26 software. Univariate analysis aims to determine the characteristics of glaucoma patients, while bivariate analysis aims to determine the correlation between medication adherence and visual field quality after undergoing treatment for at least 6 months using the chi-square test. The mean deviation was divided into mild (>-6 dB), moderate (-6 dB to -12 dB), advanced (<-12 to -20 dB), and severe (<-20 dB) [10], [11]. Medication adherence was measured using the Morisky Medication Adherence Scale-8 (MMAS-8) questionnaire in Indonesian which has been tested for validity and reliability was categorized into compliant (score >6) and non-compliant (<6). Medication adherence was measured using the Indonesian version of the Morisky Medication Adherence Scale-8 (MMAS-8), which has demonstrated acceptable validity (convergent validity= 0.882; sensitivity = 82.575%; and specificity = 44.915%). This research has been reviewed in advance by the ethics committee of the Institute for Research and Community Service (LPPM) UKI with number: 015/UKI.LPPM/PPM.00.00/ET.2024.

Results and Discussions

Table 1 shows the characteristics of glaucoma patients. Table 2 describes the mean deviation of perimetry and intraocular pressure. Table 3 describes the correlation between medication adherence and visual field quality. The result was significant (p = 0.001).

Table 1. Characteristics of glaucoma patients

Data	N	%
Gender		
Male	12	23.5
Female	39	76.5
Mean age	42.23 ± 21.4 years	
Visual field		
6/6-6/12	41	80.4
<6/12-6/18	7	13.7
<6/18-6/60	3	5.9

Data	N	%
<6/60-3/60	-	0
Number of glaucoma medications		
1 (one)	40	78.4
Combination	11	21.6
Medication category		
Beta-blocker	19	37.2
Prostaglandin analog	21	41.2
Combination		
Beta-blocker & prostaglandin analog	11	21.6
Acetazolamide	0	0
Brinzolamide	0	0
First visit IOP		
<10	1	1.9
10-21	38	74.6
22-30	11	21.6
>30	1	1.9

This study shows that our sample has mild to moderate glaucoma and is considered to get glaucoma medication at the first visit.

Table 2. Intraocular pressure and mean deviation at initial and after 6 months of medication

TIO (Mean)	Initial (mmHg)	6 Months (mmHg)
Right Eye	17.99 ± 5.60	16.72 ± 4.38
Left Eye	17.48 ± 5.19	16.96 ± 5.12
MD (Mean Deviation) Perimetry	Initial	Final
Right Eye	-7.69 ± 6.88	-6.55 ± 7.77
Left Eye	-6.87 ± 5.90	-6.63 ± 5.70

Table 2 shows the mean intraocular pressure of the patients and indicates that the glaucoma visual field defect is in the early stage. There was one patient with normotensive glaucoma in this study.

Table 3. Correlation between medication adherence and visual field quality

Medication adherence	Mild Moderate		Advanced Severe		P value
	N	%	N	%	
Compliant	38	74.6	4	7.8	0.001
Non-compliant	4	7.8	5	9.8	
Total	42	82.4	9	17.6	

Data indicated that female patients dominated the samples, accounting for 76.5% (39 individuals), compared with male patients at only 23.5% (12 individuals). According to Rizk, women exhibit a shallower anterior chamber depth, shorter axial length, and narrower angle width than men across all age groups. These anatomical differences contribute to the limited space in the anterior chamber, leading to impaired aqueous humor outflow [12]. Madjeji further noted that estrogen may play a potentially neuroprotective role, and estrogen deficiency in postmenopausal women is suspected to contribute to glaucoma [13]–[15]. The mean age of patients in this study was 42.23 years with a standard deviation of 21.42. This

aligns with the findings of Sari et al., who reported that glaucoma does not only occur in the elderly but can also affect children, adolescents, and young adults, a condition referred to as juvenile glaucoma.

Most patients (80.4%) had normal visual acuity, indicating that despite having glaucoma, their vision could still be preserved. These findings are consistent with the study by Purwanto T. et al., who reported that the highest prevalence in ICD-10 visual acuity classification was in the "good" category, with 29 eyes (36.7%) [16]–[19].

The majority of patients (74.6%) had intraocular pressure (IOP) within the normal range (10–21 mmHg). This result is in line with the study by Gosling, which suggested that even when IOP falls within the normal range, non-IOP-dependent mechanisms may still contribute to glaucoma progression, including vascular insufficiency of the optic nerve head, metabolic and neurodegenerative disturbances, oxidative stress, and abnormal biomechanics of the lamina cribrosa [20]–[25].

Latanoprost was the most commonly used therapy, with 21 patients (41.2%) receiving it. This finding is consistent with the study by Koushik et al., which noted that Latanoprost, a prostaglandin F2-alpha analog, works by lowering IOP, increasing aqueous humor outflow, and improving uveoscleral outflow. Prostaglandins are often used as first-line treatment for glaucoma due to their efficacy in reducing IOP, once-daily dosing, and favorable safety profile [26]–[29].

In this study, after six months of treatment, a reduction in mean IOP was observed in both the right eye (OD) and left eye (OS). IOP decreased from 17.99 mmHg to 16.72 mmHg in OD, and from 17.48 mmHg to 16.96 mmHg in OS, demonstrating the effectiveness of therapy in controlling IOP. The reduction amounted to 1.27 mmHg in OD and 0.52 mmHg in OS. This successful reduction reflects the effectiveness of the medications used, particularly Timolol and Latanoprost. Furthermore, the improvement in Mean Deviation (MD) from –7.69 to –6.55 in OD and from –6.87 to –6.63 in OS indicates a significant enhancement in visual function.

Patients who adhered to treatment showed good visual field quality, accounting for 38 patients (74.6%). This reflects the crucial role of adherence in maintaining and improving visual field quality. Conversely, non-adherent patients experienced poorer visual field quality, with 5 patients (9.8%). This suggests that non-adherence may result in more severe optic nerve damage, worsening visual field quality, and a higher risk of blindness [30]. This finding is consistent with the study by Alvarado et al., which demonstrated that adherence to glaucoma therapy significantly reduces IOP and improves visual field quality [31]–[33].

According to Kvarnstrom et al., several factors contribute to non-adherence, including: lack of patient knowledge about treatment regimens, busy schedules leading to missed doses, changes in dosing routines, poor awareness of the importance of taking prescribed medication,

misconceptions about treatment, low health literacy (especially when written instructions are not in the patient's native language), comorbidities, physical disabilities limiting medication use, underestimation of disease severity, lack of information about the disease and its treatment, patients' desire for self-control sometimes leading to the use of non-prescription alternatives, poor access to healthcare services, weak patient-provider relationships, concealment of disease from others, strong religious beliefs prioritizing rituals over medication, and financial difficulties in purchasing medication [34]. In this study, the majority of factors contributing to non-adherence were related to patients' busy schedules, which often caused them to forget taking their medication [27], [35].

This study has several limitations. Being cross-sectional in design, it can only describe associations at a single point in time. Medication adherence was assessed using a self-reported questionnaire (MMAS-8), which may be subject to recall and social desirability bias. Visual field testing is also influenced by external factors such as patient fatigue, level of understanding of instructions, and inherent test variability, all of which may result in false positives or false negatives. In addition, factors such as baseline disease severity, type of medication, and systemic comorbidities were not controlled [36]. The educational support provided by physicians, although recognized as a potential contributing factor, was neither standardized nor quantitatively assessed. Finally, the limited sample size and single-center setting restrict the generalizability of the findings to the broader glaucoma population.

Nevertheless, this study has notable strengths. It focuses on a real-world clinical population of primary glaucoma patients receiving pharmacologic therapy only, with consistent perimetry testing over a defined treatment period. Moreover, it highlights the potential importance of physician-patient communication and education in improving medication adherence—an aspect often overlooked in glaucoma management research.

Future studies should employ a prospective longitudinal design with a larger, multicenter sample to better establish the temporal relationship between medication adherence and glaucoma progression. Objective measures of adherence, such as electronic medication monitoring or pharmacy refill records, should be incorporated alongside validated self-report questionnaires to improve measurement accuracy. Additionally, multivariable analyses controlling for potential confounding factors including baseline glaucoma severity, intraocular pressure, disease duration, treatment regimen, and systemic comorbidities are recommended. From a clinical perspective, structured patient education and adherence-promoting interventions should be implemented and evaluated to determine their effectiveness in improving long-term medication adherence and preserving visual function in patients with glaucoma.

Conclusion

This study found a significant association between medication adherence and visual field quality among primary glaucoma patients who had received pharmacological treatment for at least six months. Patients with higher medication adherence were more likely to demonstrate better perimetric outcomes, as reflected by less negative mean deviation values. Although most adherent patients had received education and counseling from their treating ophthalmologists, the cross-sectional design does not allow conclusions regarding the causal effect of adherence or educational interventions on visual field outcomes. These findings highlight the potential value of promoting medication adherence in routine glaucoma care. Further prospective longitudinal studies are needed to clarify the temporal relationship between medication adherence, patient education, and visual field progression, as well as to identify educational strategies that are most effective in supporting long-term adherence.

Conflict of Interest

The authors declare no conflict of interest.

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