

## RISK OF GLAUCOMA TREATMENT IN PATIENT WITH CATARACT

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**Abstract**

**Background:** Cataract and glaucoma frequently coexist in the elderly population, creating complex management challenges due to the potentially adverse effects of intraocular pressure-lowering medications on cataract progression. While glaucoma therapy is essential to prevent optic nerve damage, certain medications, such as beta-blockers, may inadvertently accelerate cataract formation, posing risks to visual health. This study aims to evaluate the risks associated with glaucoma therapy in patients with cataracts, focusing on cataract progression, adverse effects of glaucoma medications, and visual acuity outcomes over a 12-month period. **Materials and Methods:** A study was conducted with 100 cataract patients who required glaucoma treatment. Patients were monitored over a year, with evaluations every three months. Data collection included demographic information, comorbidities, glaucoma medication types, side effects, cataract progression, and visual acuity (LogMAR). Logistic regression analysis was used to assess the association between glaucoma medications and cataract progression. Statistical analysis was performed using SPSS version 23.0. **Result:** The study found that beta-blockers were the most commonly prescribed glaucoma medication (48%), with 24% of patients reporting adverse effects, primarily eye irritation. Cataract progression occurred in 42% of participants, with 25% requiring surgery due to vision impairment. Beta-blocker use was significantly associated with increased risk of cataract progression ( $p = 0.03$ ), and comorbidities such as hypertension and diabetes correlated with a higher incidence of side effects ( $p = 0.02$ ). Visual acuity declined significantly in patients with cataract progression (LogMAR 0.25 to 0.35,  $p < 0.01$ ). **Conclusion:** This study suggests that glaucoma medications, particularly beta-blockers, may contribute to accelerated cataract progression in patients with coexisting conditions. Additionally, patients with hypertension and diabetes are at an elevated risk of experiencing adverse effects from glaucoma treatments. Careful selection of medications and regular monitoring are recommended to optimize outcomes in these patients.

**INTRODUCTION**

Cataract and glaucoma are two of the most common age-related ocular diseases worldwide, often coexisting in the elderly population and contributing to significant visual impairment if not managed appropriately.<sup>[1]</sup> Cataracts, characterized by the clouding of the eye's natural lens, lead to gradual vision loss, while glaucoma involves progressive optic nerve damage primarily due to elevated intraocular pressure (IOP).<sup>[2]</sup> The coexistence of these conditions presents unique challenges, as the

treatment modalities for glaucoma, particularly intraocular pressure-lowering medications, may have unintended effects on cataract progression.<sup>[3]</sup>

Recent advances in pharmacologic therapy have expanded options for managing glaucoma, including prostaglandin analogs, beta-blockers, alpha agonists, and carbonic anhydrase inhibitors. Beta-blockers, for example, are frequently prescribed due to their efficacy in lowering IOP and reducing the risk of optic nerve damage.<sup>[4]</sup> However, evidence suggests that long-term use of beta-blockers and other IOP-lowering drugs may accelerate cataract development and worsen visual acuity, particularly in older

adults.<sup>[5,6]</sup> Studies have shown that beta-blockers may lead to adverse outcomes, including eye irritation and dry eye, which can compound the discomfort and visual challenges faced by cataract patients.<sup>[7]</sup>

This relationship underscores the importance of careful consideration when prescribing glaucoma medication to patients with existing cataracts. The dual burden of these conditions not only complicates treatment but also imposes a significant impact on patients' quality of life.<sup>[8]</sup> The prevalence of coexisting cataract and glaucoma, particularly among individuals with comorbid conditions like diabetes and hypertension, further complicates treatment, as these health conditions are associated with increased susceptibility to adverse effects from glaucoma medications.<sup>[9]</sup>

While numerous studies have explored the individual management of cataract and glaucoma, there remains a need for more targeted research into the risks associated with concurrent pharmacologic therapy for these conditions. Specifically, examining the impact of glaucoma medications on cataract progression, adverse side effects, and overall visual outcomes can help clinicians develop more nuanced treatment plans for affected patients.<sup>[10]</sup> Given the aging population and the rising incidence of both cataracts and glaucoma, understanding these interactions is essential to optimize patient care and mitigate the risks of vision loss. This study aims to evaluate the risks associated with glaucoma therapy in patients with cataracts, focusing on cataract progression, adverse effects of glaucoma medications, and visual acuity outcomes over a 12-month period.

## MATERIALS AND METHODS

**Study Design:** This is a prospective observational study.

**Study Setting:** The study will be conducted at an ophthalmology clinic that holds two outpatient department (OPD) sessions per week, each dedicated to cataract patients. Approximately 10 cataract patients are seen per OPD session, with an estimated 2 patients per session requiring glaucoma drops. The study will span a 12-month period, allowing for comprehensive data collection and analysis of patient outcomes.

**Participants:** The study aims to enroll 100 participants over a 12-month period. Based on patient flow and the frequency of glaucoma medication prescriptions, approximately 50 participants are expected within the first six months, reaching a total of 90-100 by the end of the year.

### Inclusion Criteria

- Patients diagnosed with cataracts and undergoing evaluation in the cataract OPD.
- Patients aged 40 years and above.
- Patients who require glaucoma drops as part of their treatment regimen.

### Exclusion Criteria

- Patients with a history of ocular surgery within the past year.
- Patients with severe systemic diseases (e.g., advanced diabetes) affecting ocular health.
- Patients unwilling or unable to provide informed consent.
- Patients with complex ocular conditions contraindicating the use of glaucoma medications.

**Bias:** To minimize selection bias, consecutive eligible patients from each OPD session will be considered for the study. Observer bias will be reduced by training clinicians involved in the assessment and standardizing protocols for data collection.

**Data Collection:** Data will be collected on demographic characteristics, relevant medical history, cataract stage, glaucoma status, prescribed glaucoma medications, and any adverse effects or complications. Baseline data will be collected at the time of recruitment, with follow-up assessments every three months.

**Procedure:** Eligible patients visiting the cataract OPD and requiring glaucoma treatment will be approached for participation. After obtaining informed consent, baseline data will be collected. Participants will then be monitored through scheduled follow-ups every three months to document the response to glaucoma treatment and any emerging side effects.

**Sample Size Calculation:** Given the clinic's patient flow and the approximate rate of glaucoma drop prescriptions, an estimated 50 patients can be enrolled in six months, with a total of 90-100 over one year. This sample size will be sufficient to detect trends in glaucoma treatment-related risks in cataract patients.

**Statistical Analysis:** For data analysis, SPSS version 23.0 will be utilised. We will use descriptive statistics to summarise clinical and demographic characteristics. The groups will be compared using the t-test and chi-square test. Using logistic regression, factors connected to complications will be assessed. Statistical significance will be established when the p-value is less than 0.05.

## RESULTS

A total of 100 cataract patients requiring glaucoma treatment were enrolled in this study. The mean age of the participants was 65.3 years (SD = 9.2), with 52% male and 48% female patients. The majority (63%) had hypertension, and 28% had diabetes, conditions which were noted due to their potential impact on eye health.

Patients were prescribed various types of glaucoma medications, with beta-blockers being the most common (48%), followed by prostaglandin analogs (35%), and carbonic anhydrase inhibitors (17%). Adverse reactions were recorded in 24% of the participants, with the most common side effect being

eye irritation (12%), followed by dryness (7%) and blurred vision (5%).

During the study, 42% of participants showed signs of cataract progression over the 12-month follow-up period. Of these, 25% required cataract surgery due to significant visual impairment. The remaining 17% were monitored but did not yet meet the criteria for surgical intervention. A significant correlation was found between the use of beta-blockers and cataract progression ( $p = 0.03$ ).

Logistic regression analysis was performed to evaluate factors associated with complications.

Patients using beta-blockers had a 1.8 times higher risk of cataract progression compared to those on other medications (95% CI: 1.1-3.2,  $p = 0.03$ ). Additionally, participants with hypertension and diabetes had a higher incidence of side effects ( $p = 0.02$ ).

Visual acuity was assessed at baseline and at each follow-up visit. The mean visual acuity (LogMAR) worsened from  $0.25 \pm 0.10$  at baseline to  $0.35 \pm 0.15$  after 12 months in patients with cataract progression. In those without progression, the mean visual acuity remained stable at  $0.26 \pm 0.12$  ( $p < 0.01$ ), as shown.

**Table 1: Demographic and Baseline Characteristics of Participants (n=100).**

Demographic Variable	Frequency (n=100)	Percentage (%)
Age (Mean $\pm$ SD)	65.3 $\pm$ 9.2	
Gender		
- Male	52	52%
- Female	48	48%
Comorbidities		
- Hypertension	63	63%
- Diabetes	28	28%

**Table 2: Distribution of Glaucoma Medications and Observed Side Effects**

Medication Type	Frequency (n=100)	Percentage (%)
Beta-blockers	48	48%
Prostaglandin analogs	35	35%
Carbonic anhydrase inhibitors	17	17%
Side Effects Observed		
- Eye Irritation	12	12%
- Dryness	7	7%
- Blurred Vision	5	5%

**Table 3: Cataract Progression and Surgical Intervention Requirements**

Outcome	Frequency (n=100)	Percentage (%)
Cataract progression observed	42	42%
- Required cataract surgery	25	25%
- Monitoring only	17	17%

**Table 4: Logistic Regression Analysis for Cataract Progression Risk Factors**

Variable	Odds Ratio	95% CI	p-value
Beta-blocker use	1.8	1.1 - 3.2	0.03
Prostaglandin analogs	0.9	0.6 - 1.5	0.28
Hypertension	1.5	1.1 - 2.3	0.04
Diabetes	1.4	1.0 - 2.1	0.02

**Table 5: Visual Acuity Outcomes in Patients With and Without Cataract Progression**

Group	Baseline LogMAR	12-month LogMAR	p-value
Cataract progression	0.25 $\pm$ 0.10	0.35 $\pm$ 0.15	<0.01
No cataract progression	0.26 $\pm$ 0.12	0.26 $\pm$ 0.12	0.92

## DISCUSSION

The study enrolled 100 cataract patients requiring glaucoma treatment and monitored them over a 12-month period to evaluate the effects of glaucoma therapy on cataract progression and related complications. The average age of participants was 65.3 years, with a nearly even gender distribution. Comorbid conditions such as hypertension (63%) and diabetes (28%) were common among participants, factors which can influence ocular health outcomes. These baseline characteristics highlight that many patients needing glaucoma therapy are also managing

other health issues that may impact their response to treatment.

Beta-blockers were the most frequently prescribed glaucoma medication, accounting for 48% of prescriptions, followed by prostaglandin analogs (35%) and carbonic anhydrase inhibitors (17%). Adverse effects were reported by 24% of participants, with eye irritation (12%) being the most prevalent side effect. The high incidence of adverse reactions suggests that while beta-blockers are commonly prescribed, they may not be well-tolerated by all patients, underscoring the need for careful selection and monitoring of medication regimens in this population.

Over the course of the study, 42% of participants experienced cataract progression, with 25% of these cases requiring surgery due to significant vision impairment. The remaining cases were monitored for further changes. Notably, the use of beta-blockers was significantly associated with cataract progression ( $p = 0.03$ ), indicating that this class of glaucoma medication may contribute to an accelerated progression in cataract patients. Logistic regression analysis also revealed that comorbidities such as hypertension and diabetes were associated with a higher incidence of side effects, suggesting these conditions may further complicate treatment outcomes in patients undergoing glaucoma therapy. Visual acuity analysis showed that patients with cataract progression experienced a significant decline in visual function (from a LogMAR of 0.25 at baseline to 0.35 after 12 months), while those without progression maintained stable visual acuity. This finding indicates that cataract progression has a substantial impact on vision quality, a critical consideration for patients already managing glaucoma.

Recent research has revealed a variety of risks associated with glaucoma development in patients undergoing cataract surgery, particularly in pediatric and high-risk adult populations. Studies emphasize that children undergoing cataract surgery are at an increased risk of developing glaucoma, often due to age at surgery, ocular conditions, and surgical history. For instance, in a recent study by Vilares-Morgado et al. (2023), younger age at surgery and specific anterior segment abnormalities, such as microcornea, were identified as significant predictors for glaucoma following pediatric cataract surgery. The study noted that glaucoma frequently necessitates further surgical intervention, underscoring the importance of early identification of at-risk patients.<sup>[11]</sup> Similarly, Kim et al. (2019) examined the long-term risks associated with congenital cataract surgery, identifying a cumulative glaucoma risk of approximately 32% within ten years post-surgery. This study indicated that shorter axial lengths, often associated with congenital cataracts, contributed to elevated glaucoma risks. The authors recommended sustained monitoring to mitigate potential glaucoma development in these high-risk pediatric cases.<sup>[12]</sup> In adult patients, particularly those with glaucoma comorbid with cataracts, recent advancements in Minimally Invasive Glaucoma Surgery (MIGS) have shown promising results. Fingeret and Dickerson (2018) reported that

combining MIGS with cataract surgery can provide effective intraocular pressure (IOP) reduction while also minimizing the need for glaucoma medications, which is crucial in patients with poor adherence to medical regimens. This approach not only reduces treatment burdens but also enhances safety, making it a preferred strategy in glaucoma-cataract management.<sup>[13]</sup>

## CONCLUSION

These results suggest that beta-blocker glaucoma therapy in cataract patients is associated with a higher risk of cataract progression and side effects, particularly in those with hypertension or diabetes. Clinicians may need to consider alternative treatments or closer monitoring for patients at higher risk, as well as provide guidance on managing potential side effects to support better long-term outcomes in this population.

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