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VISUAL OUTCOMES OF CATARACT SURGERY IN LENS-INDUCED GLAUCOMA: EXPERIENCE FROM A TERTIARY CARE CENTRE IN NORTHEAST INDIA

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ABSTRACT

Background: In many developing nations, lens-induced glaucoma continues to be a major contributor to preventable blindness, particularly in rural populations where delayed cataract surgery is common. The condition arises from advanced cataracts, with phacolytic and phacomorphic variants leading to irreversible damage to the optic nerve if not treated promptly. Gaining insight into the demographic characteristics and clinical patterns of patients is crucial for enhancing treatment outcomes.

Aim: This study aimed to evaluate the postoperative visual outcomes in patients with lens-induced glaucoma following cataract surgery.

Methodology: The investigation employed a prospective observational design, involving 40 patients with lens-induced glaucoma at a tertiary hospital. Detailed demographic data, cataract type, glaucoma subtype, duration of symptoms, and laterality were recorded. All patients underwent cataract extraction, and postoperative best corrected visual acuity (BCVA) was assessed.

Results: The majority of patients (72.5%) were aged 45–65 years, with a female predominance (63%) and rural background (87.5%). Mature cataracts were the most common (47%), followed by immature (30%) and hypermature (23%). Phacolytic glaucoma was the predominant subtype (82%), while phacomorphic glaucoma accounted for 18%. Patients presenting within one week of symptom onset achieved better visual outcomes, with 37.5% recording BCVA of 6/6–6/12. In contrast, delayed presentation was associated with poor vision (<6/60 in 7.5% of cases).

Conclusion: Lens-induced glaucoma predominantly affects middle-aged rural women with advanced cataracts. Early presentation is a critical determinant of favourable visual outcomes. Strengthening rural eye care services and promoting timely cataract surgery can substantially reduce the burden of lens-induced glaucoma-related blindness.

Keywords: Lens-induced glaucoma, Cataract Surgery, Postoperative Visual Outcomes, Tertiary Care Hospital, Northeast India

INTRODUCTION

Blindness remains a major public health challenge worldwide, with cataract and glaucoma consistently identified as the leading causes of visual impairment. In India, cataract accounts for nearly two-thirds of blindness, underscoring its disproportionate burden compared to developed nations.[1] While cataract surgery is widely recognised as the only effective intervention for visually significant cataracts, delayed presentation and lack of timely access to surgical care often precipitate serious complications. Among these, lens-induced glaucoma represents a particularly devastating sequela, contributing substantially to irreversible visual loss, especially in rural and underserved populations.[2]

The development of lens-induced glaucoma, classified as secondary glaucoma, is linked to cataracts in their mature or hypermature phases. The pathophysiology involves leakage of lens proteins into the anterior chamber, triggering phacolytic reactions or pupillary block mechanisms in phacomorphic glaucoma. If left untreated, either mechanism can lead to raised intraocular pressure (IOP), optic nerve injury, and swift visual decline.[3] The condition is largely preventable, yet it continues to occur at alarming rates in India due to sociocultural misconceptions, economic barriers, and limited awareness. A prevailing belief in many communities is that cataract surgery should only be undertaken once the cataract has "matured," leading to delayed reporting and increased risk of lens-induced glaucoma. Additional factors such as advanced age, systemic comorbidities, preserved vision in the fellow eye, and financial constraints further contribute to treatment delays.[4]

The clinical significance of lens-induced glaucoma lies not only in its acute presentation but also in its long-term impact on visual prognosis.[5] Patients often present late, with markedly elevated IOP, corneal edema, and optic nerve compromise.[6] In such scenarios, cataract extraction becomes both a therapeutic and vision-saving intervention.[5]

However, the visual outcomes of cataract surgery in lens-induced glaucoma patients are variable and depend on several prognostic factors, including duration of glaucoma, preoperative optic nerve status, IOP control, and associated ocular comorbidities.[7]

The World Health Organization (WHO) has established benchmarks for cataract surgery outcomes, defining "good" postoperative visual acuity as 20/20 to 20/60, "fair" as <20/60 to 20/200, and "poor" as <20/200. Adequate surgical success is achieved when more than 80% of patients attain good uncorrected visual acuity, and more than 90% achieve good, corrected acuity, while restricting borderline results to below 15% and poor outcomes to under 5%.[8] These standards serve as critical indicators for evaluating surgical quality and guiding public health strategies.[9]

Against these global standards, recent Indian studies demonstrate that despite the challenges posed by lens-induced glaucoma, favourable visual outcomes can be achieved with timely surgical intervention. Tudu et al. (2024) reported that cataract surgery in cases of lens-induced glaucoma, when performed promptly and accompanied by appropriate IOP management, resulted in significant visual improvement, with a majority of patients achieving WHO-defined "good" outcomes.[5] Similarly, Kshirsagar et al. (2019) emphasised that early identification coupled with surgical management plays a vital role in preventing irreversible blindness, particularly in rural populations where delayed presentation is common.[10]

Given the high prevalence of cataract in India and the continued occurrence of lens-induced glaucoma, evaluating the visual outcomes of cataract surgery in these patients is of paramount importance. Such assessments not only provide insights into surgical efficacy but also inform

strategies for community education, early detection, and improved access to ophthalmic care. However, the scarcity of such studies in Northeast India prompted us to evaluate the postoperative visual outcomes in patients with lens-induced glaucoma following cataract surgery.

MATERIALS AND METHODS

Study design

This hospital-based observational study employed a longitudinal design.

Setting and duration

The study was conducted in the Department of Ophthalmology, Agartala Government Medical College, and GBP Hospital (AGMC & GBPH), Agartala, Tripura, India. Patients attending the Ophthalmology Outpatient Department with defective vision and pain in one eye were considered. The research spanned a period of 1.5 years.

Sample size and technique

A total of 40 patients from this population who were diagnosed with lens-induced glaucoma and scheduled for cataract surgery were enrolled in the study. The study employed a consecutive sampling technique.

Inclusion Criteria

- Patients clinically diagnosed with lens-induced glaucoma.
- Patients were recruited only after furnishing written informed consent for the planned surgical procedure.

Exclusion Criteria

- Cases of primary glaucoma.
- Other forms of secondary glaucoma include those resulting from ocular trauma, intraocular inflammation, or neovascularisation.
- Abnormal anterior chamber deposits, including pigment dispersion syndrome or pseudoexfoliation syndrome.
- Patients having complicated cataracts.
- Cases involving lens subluxation or dislocation.
- Coexisting corneal dystrophies or degenerative changes associated with cataract.
- Patients are deemed medically unfit for surgery due to severe systemic illness (e.g., uncontrolled diabetes mellitus, hypertension, or ischemic heart disease).
- Patients with lens-induced glaucoma were managed conservatively without surgery.
- Individuals who were non-compliant with treatment protocols.

Data Collection Methods

All patients were informed about the study, provided written consent, and underwent a detailed evaluation. Clinical history included demographic details, presenting complaints such as decreased vision, pain, redness, and photophobia, their onset, progression, and associated symptoms, along with past ocular history (glaucoma, surgery, trauma), systemic illnesses (diabetes, hypertension), medication use, and allergies. General and systemic examinations were performed to detect comorbidities, followed by a comprehensive ophthalmic assessment. Best corrected visual acuity (BCVA) was measured using Snellen's chart.

Near vision was documented, and slit-lamp evaluation of the anterior segment was performed to assess ciliary congestion, corneal edema, anterior chamber depth, presence of cells and flare, as well as pupillary characteristics. Gonioscopy was performed in both eyes to evaluate the angle, and fundus examination was carried out using slit-lamp biomicroscopy with a 90D lens, direct or indirect ophthalmoscopy; patients with obscured fundus view underwent B-scan ultrasonography.

Phacomorphic glaucoma was diagnosed based on pain, redness, photophobia, corneal edema, shallow anterior chamber, fixed dilated pupil, and intumescent cataract, whereas phacolytic glaucoma was identified by similar symptoms with corneal edema, normal or deep anterior chamber, presence of cells and flare with minimal keratic precipitates, and mature or hypermature cataract.
Postoperatively, patients were admitted for a minimum of two days if no complications arose. The eye pad was removed on the first day, after which topical antibiotics, steroids, cycloplegics, and mydriatics were initiated. Visual acuity and postoperative complications were assessed on day one, and patients were discharged on the third day with instructions for follow-up at the first week and six weeks. Each follow-up included a comprehensive ocular examination with visual acuity and slit-lamp evaluation.

Data Analysis

All study data were documented using a proforma specifically designed for this research. Upon completion of data collection, entries were made into a Microsoft Excel spreadsheet for initial organisation. The compiled data were subsequently analysed using SPSS software (version 26.0) and Epi-Info. Descriptive statistics were applied to summarise the findings, while appropriate statistical tests, such as the chi-square test and paired t-test, were employed for comparative analysis. A p-value of less than 0.05 was considered statistically significant.

Ethical Consideration

The study protocol was submitted to the Institutional Ethics Committee of AGMC and GBPH for review and approval. The research commenced only after obtaining formal clearance from the committee (Ref. No. F.4(6-13)/AGMC/Medical Education/IEC Approval/2022/21731).

RESULTS

Among the 40 patients included in this study, the majority (72.5%) were between 45 and 65 years of age. A clear female predominance was observed, with women accounting for 63% of cases compared to 37% men, yielding a female-to-male ratio of 1.3:1. The majority of the patients (87.5%) originated from rural areas. Laterality analysis showed that 45% of cases involved the right eye, while 55% affected the left eye. Regarding the time of presentation, 26 patients (65%) reported within the first week of symptom onset, 11 patients (28%) presented between one and two weeks, and 3 patients (7%) sought medical attention after two weeks **(Figure 1)**.

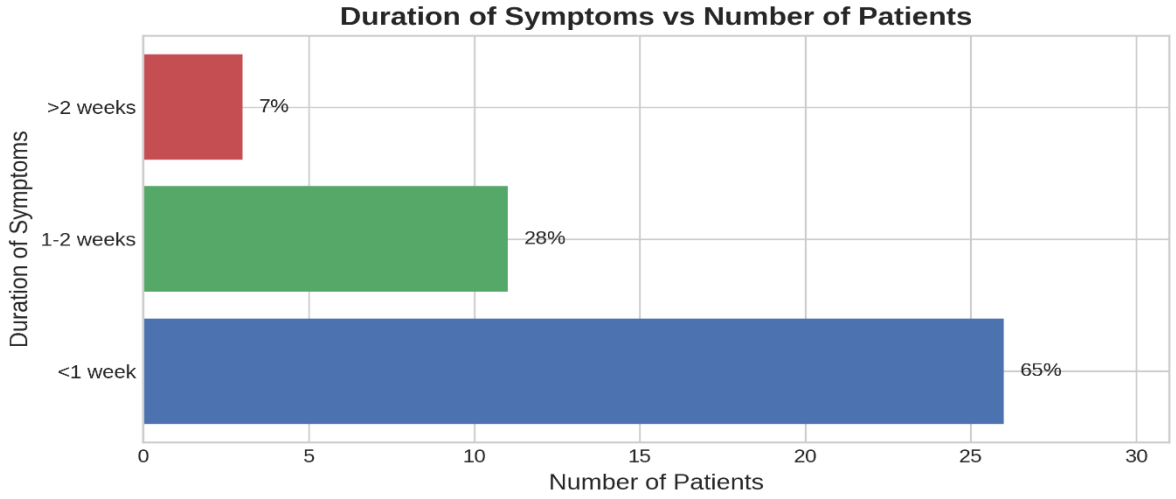


Figure 1: Duration of symptoms vs number of patients

Figure 2 illustrates that mature cataract was the predominant type, representing 19 cases (47%). Immature cataract was present in 12 patients (30%), whereas hypermature cataract was documented in 9 patients (23%).

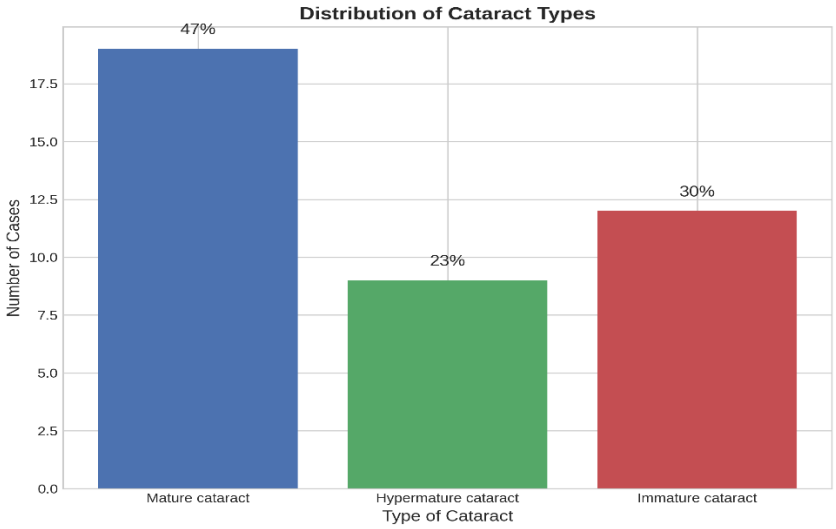


Figure 2: Distribution of cataract types

Figure 3 demonstrates that phacolytic glaucoma represented the predominant subtype of lens-induced glaucoma, occurring in 33 patients (82%). In contrast, phacomorphic glaucoma was identified in 7 patients (18%).

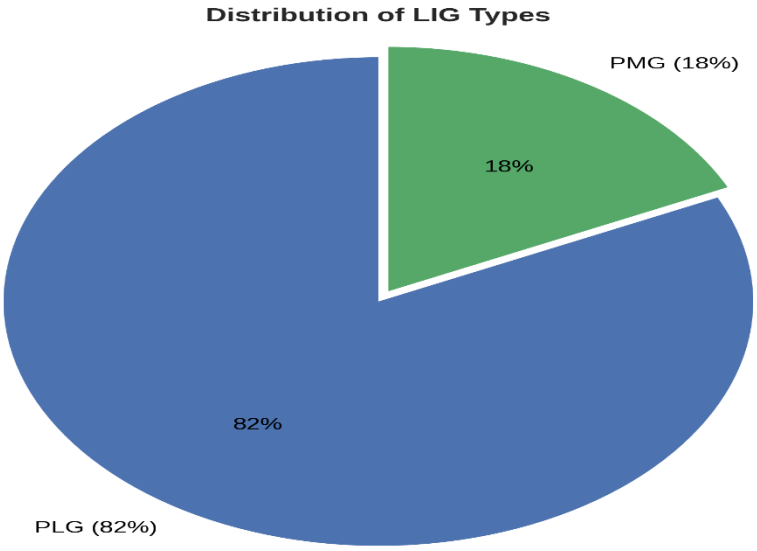


Figure 3: Types of lens-induced glaucomas

Visual outcomes varied according to the duration of symptoms at presentation. Patients who reported within one week demonstrated comparatively better vision, with 15 individuals (37.5%) achieving a BCVA between 6/6 and 6/12. Conversely, those presenting after more than one week had poorer outcomes, with 3 patients (7.5%) recording a BCVA of <6/60 **(Figure 4)**.

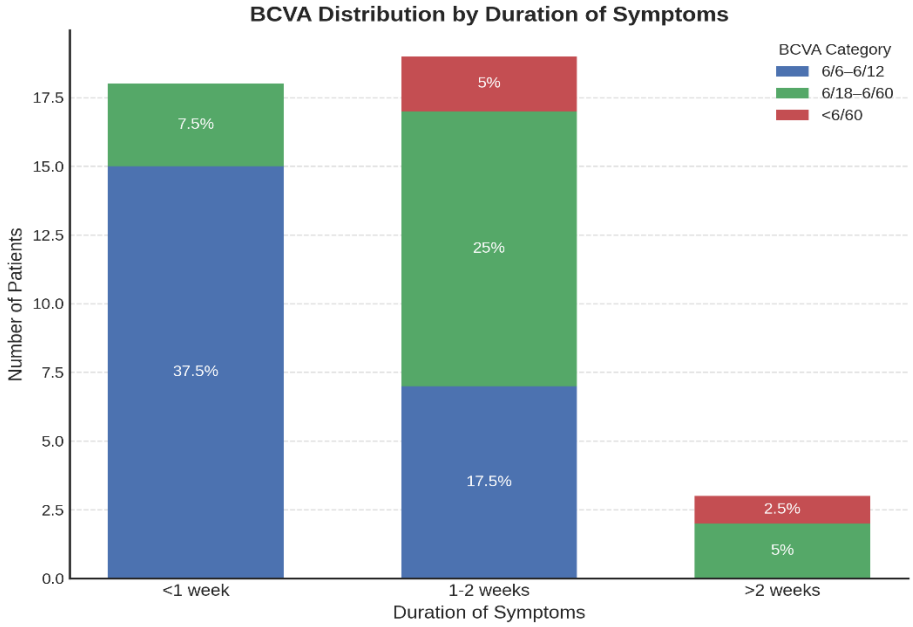


Figure 4: Comparison of BCVA with duration of symptoms

Among patients with a preoperative IOP between 22 and 40 mmHg, 16 individuals (40%) achieved a BCVA of 6/6–6/12. In contrast, those with IOP levels exceeding 40 mmHg showed poorer outcomes, with 3 patients (7.5%) recording a visual acuity of <6/60 **(Figure 5)**.

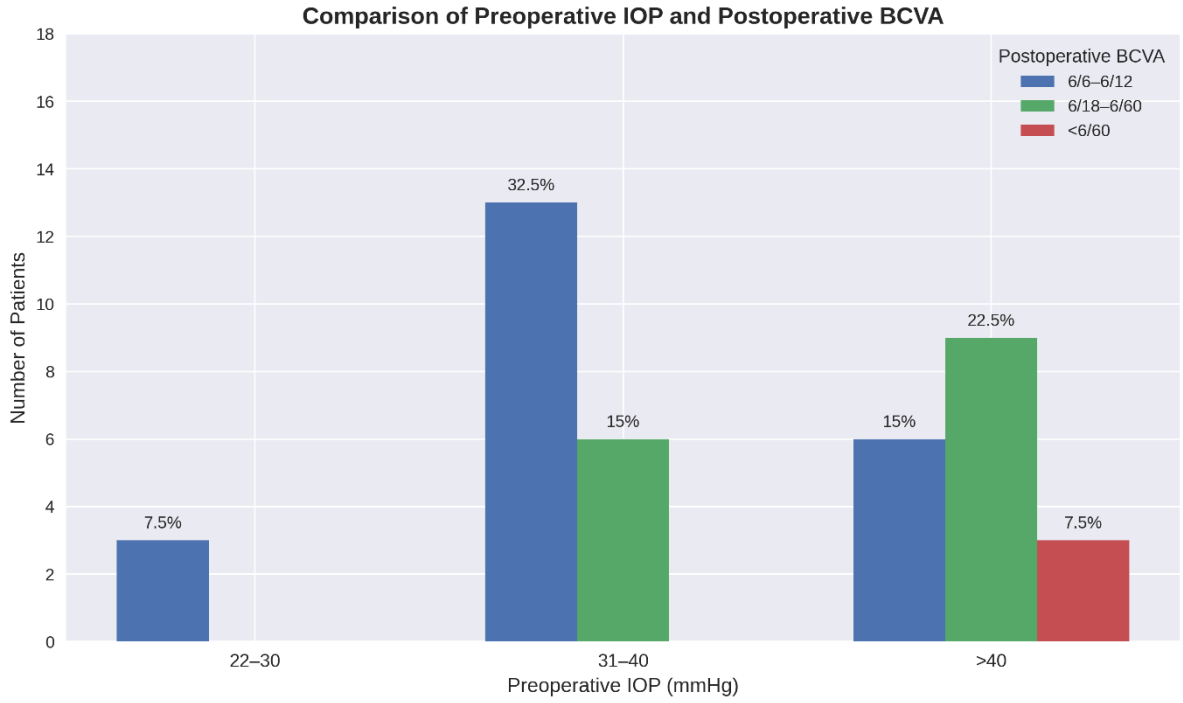


Figure 5: Comparison of Preoperative IOP & Postoperative BCVA

DISCUSSION

Lens-induced glaucoma remains a notable source of preventable visual loss in low-resource settings, particularly in rural communities where delays in cataract surgery are common. The present study of 40 patients provides important aspects of the demographic profile, clinical presentation, and visual outcomes in lens-induced glaucoma. The findings highlight the interplay between age, gender, rural residence, cataract maturity, and type of glaucoma in determining prognosis.

Demographic Characteristics

Most patients (72.5%) were between 45 and 65 years of age, consistent with the established epidemiology of lens-induced glaucoma, which typically occurs in the sixth decade or later due to delayed cataract extraction. Cataract persists as the foremost contributor to blindness across India, and the burden is disproportionately higher in rural populations where healthcare infrastructure is limited.[11] Our finding that 87.5% of patients originated from rural areas underscores the need for targeted public health interventions in these communities.

A female predominance was observed, with women accounting for 63% of cases. This is in line with other Indian studies that report higher rates of lens-induced glaucoma among women, often attributed to sociocultural barriers that delay access to ophthalmic care.[12] The female-to-male ratio of 1.3:1 in our cohort reflects this disparity. Addressing gender inequities in healthcare access is therefore critical to reducing the burden of lens-induced glaucoma.

Laterality and Presentation

Laterality analysis revealed a near-equal distribution, with 45% of cases involving the right eye and 55% the left. Previous studies have similarly reported no significant laterality predilection.[13] More clinically relevant is the timing of presentation: 65% of patients reported within one week of symptom onset, while 35% delayed presentation beyond this period. Delayed presentation has been consistently linked to poorer visual outcomes.[14] Our study revealed that patients presenting after two weeks had markedly worse vision, with 7.5% recording BCVA <6/60. These results reinforce the importance of early recognition and referral for optimal outcomes.

Cataract Types

Mature cataract was the predominant type (47%), followed by immature (30%) and hypermature cataracts (23%). This distribution reflects the natural progression of untreated cataracts, where mature and hypermature forms are more likely to precipitate secondary glaucomas. The predominance of mature cataracts in our cohort is consistent with hospital-based studies in India.[15] Hypermature cataracts, though less frequent, are particularly concerning as they predispose to phacolytic glaucoma through leakage of lens proteins.[16]

Types of Lens-Induced Glaucoma

Phacolytic glaucoma was the most common subtype, occurring in 82% of patients, while phacomorphic glaucoma accounted for 18%. The predominance of phacolytic glaucoma has also been documented in earlier studies conducted in India.[17] In contrast, Vudayana et al. reported differing findings in their study, noting that phacomorphic glaucoma was the predominant subtype of lens-induced glaucoma (70%), whereas phacolytic glaucoma accounted for 23.3% of cases.[18] Phacomorphic glaucoma, though less frequent, remains clinically significant due to its angle-closure mechanism and potential for rapid IOP elevation. Both conditions highlight the consequences of delayed cataract surgery.

Visual Outcomes

Visual outcomes varied according to both duration of symptoms and preoperative IOP. Patients presenting within one week demonstrated better vision, with 37.5% achieving BCVA of 6/6–6/12. In contrast, those presenting after more than one week had poorer outcomes, with 7.5% recording BCVA <6/60. Consistent with prospective studies conducted in India, our results confirm that delayed presentation is a major prognostic factor for poor vision.[17]

Preoperative IOP was another critical determinant. Among patients with IOP between 22–40 mmHg, 40% achieved the BCVA of 6/6–6/12. Conversely, patients with IOP >40 mmHg had significantly worse outcomes, with 7.5% recording the BCVA <6/60. Elevated IOP is a well-established predictor of poor postoperative vision, as prolonged pressure damages the optic nerve and retinal ganglion

cells.[18] Studies have shown that cataract surgery itself can reduce IOP, but patients with very high preoperative levels often sustain irreversible optic nerve damage.[19]

Clinical Implications

The findings underscore several important clinical implications:

- **Early cataract surgery** is essential to prevent progression to lens-induced glaucoma. Public health initiatives should prioritise awareness campaigns in rural areas, emphasising the risks of delayed surgery.
- **Gender disparities** must be addressed by improving access for women, who are disproportionately affected.
- **Community outreach programs** should focus on screening and referral, particularly in rural populations where the burden of untreated cataract is highest.

Limitations

The relatively limited sample size and single-centre nature of this study restrict its generalizability. Multicentric research with broader representation is warranted to validate the outcomes and explore regional variations. Additionally, long-term follow-up was not available, which may have provided further insights into sustained visual outcomes.

Conclusion

This study demonstrates that lens-induced glaucoma predominantly affects middle-aged to elderly rural women, with phacolytic glaucoma being the most common subtype. Mature cataracts were the leading precipitating factor. Early presentation was associated with better visual outcomes, underscoring the need for prompt cataract surgery and glaucoma management. Strengthening rural eye care services and promoting awareness can significantly reduce the burden of lens-induced glaucoma-related blindness.

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