

EARLY DETECTION, LIFELONG VISION: THE PROMISE OF TIMELY TREATMENT IN LENS-INDUCED GLAUCOMA

Ophthalmology

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ABSTRACT

It has been recognized in clinical settings for a considerable time that different types of glaucoma can arise in tandem with cataracts, which serve as a major cause of secondary glaucoma, especially in developing nations. There are several obstacles including financial, cultural, and psychosocial factors hindering access to quality surgical services. This is a retrospective study conducted at a tertiary care hospital in Karnataka from June 1 to November 30 2024, focusing on patients with lens-induced glaucoma who visited R I O, Minto ophthalmic hospital in Bengaluru. 50 patients with lens-induced glaucoma who had undergone cataract surgery and followed up till one week postop were taken up for the study. Analysing the results, most common type of LIG was found to be Phacomorphic and least common was lens particle type. 16% of patients presented after 5 days of symptoms and most common reason for late presentation were negligence (27.6%) and poor awareness (27.6%).

KEYWORDS

Lens induced glaucoma(LIG), antiglaucoma medications(AGM), phacomorphic glaucoma, phacolytic glaucoma

INTRODUCTION:

Glaucoma refers to a variety of acute and chronic, progressive optic nerve conditions that involve multiple factors. Intraocular pressure, along with other contributors, causes a typical loss of retinal ganglion cell axons, resulting in the atrophy of the optic nerve with demonstrable visual field defects.¹

Glaucoma affects more than 67 million people worldwide in a year, of whom about 10% or 6.6 million are estimated to be blind. It is responsible for 14% of all blindness.²

Glaucoma is a chronic, progressive condition that is a leading cause of preventable yet irreversible blindness (5.80%) in India next only to cataract (62.50%).¹ 96% of the overall burden of diseases across the nation is contributed by glaucoma.⁴ Glaucoma affects 2-3% individuals over the age of 40, with nearly 50% remaining undiagnosed. It ranks as the second leading cause of blindness worldwide, and it is projected that by 2040, 111.8 million people will be impacted by this condition, indicating a rising trend in its prevalence.⁵

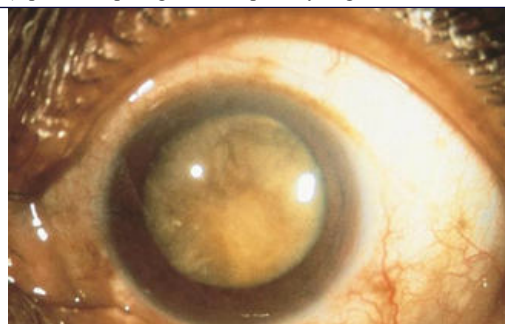
Lens Induced Glaucoma (LIG), a primary contributor to secondary glaucoma attributed to senile cortical cataracts, requires prompt identification and treatment to avert blindness.⁶

The annual increase of cataract cases by approximately 3.8 million in India⁷ is contributing to the alarming rise in lens-induced glaucoma cases in the country.⁸

LIG was first identified independently by Gifford⁹ and von Reuss¹⁰ in 1900. Gifford described it as glaucoma secondary to hyper mature cataracts, while von Reuss characterized it as related to the spontaneous absorption of lens material through an intact capsule.¹¹

Lens-induced glaucoma can be due to either secondary angle-closure or open-angle. Angle-closure may occur due to lens swelling (phacomorphic glaucoma) or lens dislocation (ectopia Lentis). In contrast, open-angle glaucoma can arise from various factors, including the leakage of lens proteins through the capsule of mature or hyper mature cataracts (phacolytic glaucoma), obstruction of the trabecular meshwork following cataract surgery, capsulotomy, or ocular trauma due to dislodged lens fragments (lens-particle glaucoma), as well as hypersensitivity to lens proteins following surgical intervention or trauma (phacoantigenic glaucoma).¹²

Different forms of lens-induced glaucoma are classified based on the mechanism of elevated intraocular pressure and lens status.⁸



Clinical Pic.1. Phacomorphic glaucoma



Clinical Pic.2. Anteriorly dislocated lens



Clinical Pic.3 Phacolytic glaucoma



Clinical Pic.4 Phacotopic glaucoma



Clinical Pic.5 Lens-particle glaucoma

This study aims to investigate the features and risk elements associated with LIGs, along with their effects on postoperative visual outcome, intraocular pressure (IOP), and changes to the optic disc.

MATERIALS AND METHODS

This is a retrospective study conducted at a tertiary care hospital in Karnataka carried out from June 1 to November 30 2024, focusing on patients with lens-induced glaucoma who visited the R I O, Minto ophthalmic hospital in Bengaluru.

A total of 50 patients with lens-induced glaucoma who had undergone cataract surgery and followed up till one week postop were taken up for the study. History and examination findings including lens status, depth of anterior chamber (measured using slit lamp biomicroscopy) and intraocular pressure (assessed through applanation tonometry) were noted. Visual acuity, intraocular pressure and inflammatory changes in cornea which were recorded at presentation and repeated after institution of medical line of management were also obtained from patient records. Visual outcome was tested with Snellen's chart, IOP with Applanation Tonometry, fundus evaluation with 90D, IDO and 20D lens. Optic disc changes were graded according to cup disc ratio as mild, moderate and severe.

Preoperative Medical Treatment

In all cases, preoperative treatments aimed at lowering intraocular pressure (IOP) included applying topical timolol 0.5% twice daily, administering oral acetazolamide 500 mg twice daily, and giving intravenous mannitol 20% right before surgery for refractory cases. Shortly before surgery, topical mydriatics like phenylephrine 10% and cycloplegics were also administered to facilitate a smooth capsulotomy. To maintain the sterility of the conjunctival sac, various combinations of local antibiotics-ciprofloxacin, chloramphenicol, polymyxin, ofloxacin, and gatifloxacin-were used. Additionally, oral ciprofloxacin (500 mg) was prescribed every 12 hours as a preventive measure against postoperative infections. All patients received topical steroids during the preoperative phase.

Surgical Management

All patients received cataract surgery alongside the implantation of an intraocular lens (IOL). Prior to the procedure, all patients provided written consent. Surgery was carried out on the same day or the next, based on the patient's situation, regardless of how much intraocular pressure was lowered. Post-surgery care in the hospital involved the application of a topical antibiotic-steroid combination six times a day and a mydriatic-cycloplegic combination twice daily.

Objectives Of The Study:

- To study the demographics of patients undergoing cataract surgery due to lens induced glaucoma.
- To assess the effectiveness of cataract surgery in lowering intraocular pressure (IOP) in these patients.

- Identify and analyse the factors contributing to delayed presentation.

Inclusion Criteria:

This study included patients with lens-induced glaucoma who had undergone cataract surgery and followed up till one week postop in our hospital.

Exclusion Criteria:

- Individuals with cataracts and a prior diagnosis of other glaucoma types.
- Long-term cases of lens-induced glaucoma (lasting over 6 months) that presented with no light perception (visual acuity) at the time of evaluation.¹³
- Patients who had abnormal material accumulation in the anterior chamber (such as pseudo exfoliation or pigment dispersion).¹⁴
- Congenital cataracts, secondary cataracts, traumatic cataracts, complicated cataracts, and established cases of glaucoma.

RESULTS

On the basis of inclusion and exclusion criteria, 50 cases were selected for the study and all the data collected were coded and entered in Microsoft Excel sheet which was re-checked and analysed using SPSS statistical software version 25. The paired t-test was utilized to compare IOP values before and after surgery. A p-value of less than 0.05 was deemed statistically significant.

1. Age

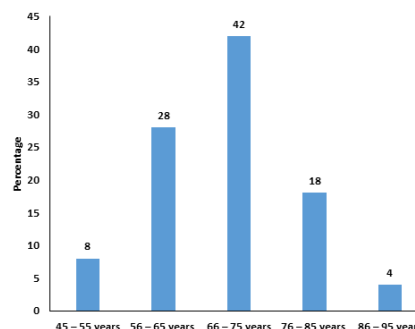


Fig.1. Distribution Of Age

Most of the patients (42%) were aged between 66 to 75 years. Mean was 68.48 years and median was 68.

2. Gender

Tab.1. Gender Distribution Of Patients

Sex no(%)	
Male	20(40)
Female	30(60)

3. Mechanism Of LIG

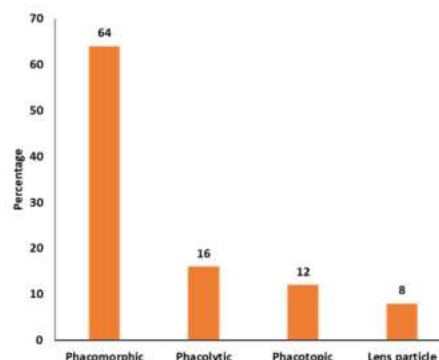


Fig.2. mechanism of LIG in the study population

The most common mechanism of LIG in the population was phacomorphic (64%) and lens particle type found to be the least common (8%).

4. Duration Of Symptoms

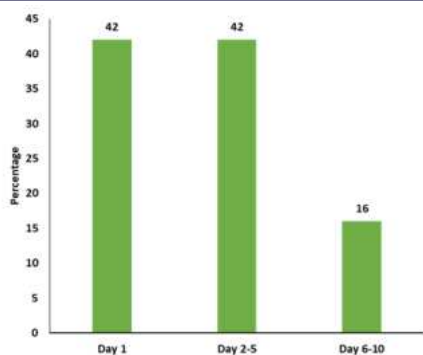


Fig.3. Duration of symptoms (no. of days)

Most of the patients presented within first 5 days among which half of them presented on the same day. 16% of patients presented late, after 5 days.

5. Reason For Late Presentation

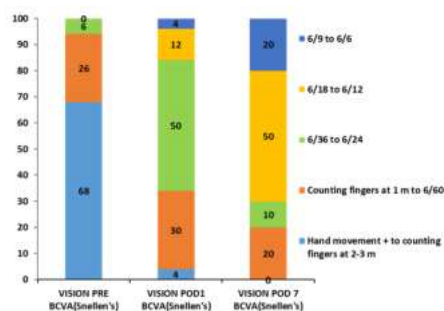


Fig.4. Reasons for delayed presentation to hospital

More than half of the population were either unaware or negligent about their eye health.

6. Analysis Of Vision

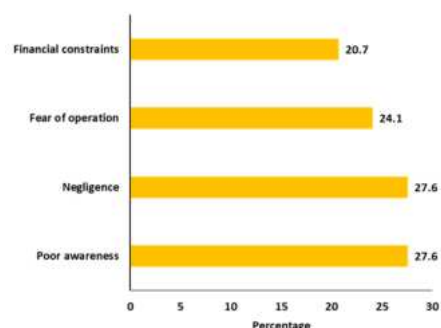


Fig.5. Comparison between pre and postop vision on day1 and 7
Improvement in vision

Tab.2. Improvement in vision (log MAR scale)

Pre LogMAR		
Mean ± SD	1.97±0.47	
Median (IQR)	2(1.80-2.40)	
LogMAR at POD 1		
Mean ± SD	0.87±0.50	0.016*
Median (IQR)	0.69(0.60-1)	
LogMAR at POD 7		
Mean ± SD	0.48±0.35	0.041*
Median (IQR)	0.39(0.30-0.60)	

*Statistically significant

Significant improvement in vision was seen in most of the patients, with mean log MAR vision of 0.87 at POD1 and 0.48 at POD7 compared to the 1.97 preop, which was found to be statistically significant. Vision has improved from HM⁻-Cf@2-3m to 6/36 - 6/24 in 50 % of population on POD1 and to 6/18 - 6/12 in 50 % of population by POD7.

7. Analysis Of IOP

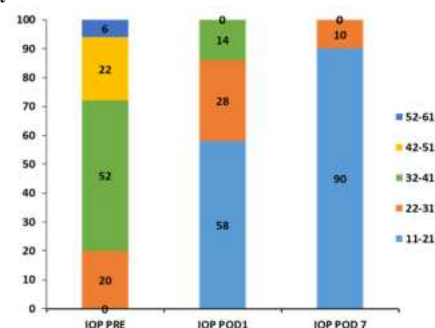


Fig.6. Comparison between pre and postop IOP

Reduction In IOP

Tab.3. Comparison of preop and postop IOP and its reduction

IOP pre	
Mean ± SD	37.52±7.36
Median (IQR)	37.50(32-42)
IOP POD 1	
Mean ± SD	22.90±6.45
Median (IQR)	20(18-26.50)
Reduction of IOP at POD1	
Mean ± SD	14.62±5.56
Median (IQR)	15.50(12-20)
IOP POD 7	
Mean ± SD	17.58±4.42
Median (IQR)	18(15-18.25)
Reduction of IOP at POD7	
Mean ± SD	19.94±6.03
Median (IQR)	21(15-23.25)

*Statistically Significant

Tab.4. P values of mean reduction in IOP at POD1 & POD7

Variable	Mean difference ± SD	P value
IOP pre – IOP POD 1	14.62±5.56	<0.001*
IOP pre – IOP POD 7	19.94±6.03	<0.001*

Mean IOP at presentation was 37.52±7.36 which got reduced to 22.90±6.45 at POD1 and to 17.58±4.42 at POD7. Following lens extraction, mean reduction in IOP was found to be 14.62±5.56 by POD1 and 19.94±6.03 by POD7 which are statistically significant (P value less than 0.001).

8. Surgery

Tab.5. Type Of Surgery Done

Surgery-no(%)	
SICS + PCIOL	38(76)
SICS + iris claw	5(10)
SICS + foldable	2(4)
SICS + aphakia	2(4)
Phaco + foldable	3(6)

SICS + PCIOL was the procedure performed for most of the patients (76%) and Iris claw lens was put for 5 patients (10%) while two patients were left aphakic.

9. Disc Changes

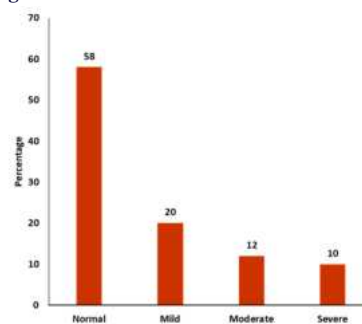
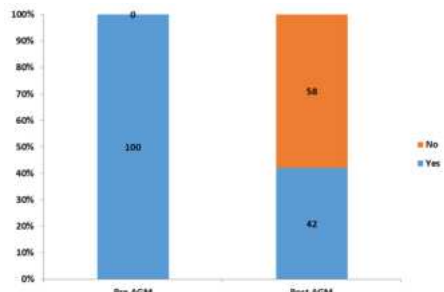


Fig.7.Changes in optic disc

On fundus examination 20% of patients had mild disc changes, whereas 12% had moderate and 10% had severe changes. 58% of patients had a normal disc

10. Use Of Anti-glaucoma Medications

**Fig.8. Requirement of AGM preop & postop**

All patients had to use AGM preoperatively, while 58% of the patients were able to discontinue its use after surgery.

11. Complications

Tab.6. Association between initial IOP and intra-op complications

a) Association between initial IOP and intra-op complications

IOP pre	Complications intra-op					P value
	Nil (N=27)	PCR (N=7)	Shallow AC (N=13)	PAS (N=2)	Iris prolapse (N=1)	
22-31	10(100)	0(0)	0(0)	0(0)	0(0)	0.005*
32-41	11(42.3)	3(11.5)	11(42.3)	1(3.8)	0(0)	
42-51	4(36.4)	4(36.4)	2(18.2)	0(0)	1(9.1)	
52-61	2(66.7)	0(0)	0(0)	1(33.3)	0(0)	

Tab.7. Association between initial IOP and post-op complications

b) Association between initial IOP and post-op complications

IOP pre	Complications post-op				P value
	Nil (N=36)	Fibrin strands (N=7)	Corneal edema (N=6)	Hyphaema (N=1)	
22-31	9(90)	0(0)	1(10)	0(0)	0.019*
32-41	22(84.6)	2(7.7)	2(7.7)	0(0)	
42-51	3(27.3)	5(45.5)	2(18.2)	1(9.1)	
52-61	2(66.7)	0(0)	1(33.3)	0(0)	

Both Intra-op and post-op complications were relatively more common in patients presented with high IOP, and the association was found to be statistically significant.

Tab.8.Association between prophylactic steroid use and post-op complications

c) Association between prophylactic steroid use and post-op complications

Pre steroid use	Complications post-op				P value
	Nil (N=36)	Fibrin strands (N=7)	Corneal edema (N=6)	Hyphaema (N=1)	
Yes	36(81.8)	1(2.3)	6(13.6)	1(2.3)	<0.001*
No	0(0)	6(100)	0(0)	0(0)	

Among the patients who received preoperative topical steroids, 81.8% experienced no postoperative complications, while all the patients who have missed to use steroids had severe Anterior Chamber reactions (Fibrin strands). These associations were found to be statistically significant.

DISCUSSION

Cataracts continue to be the main reason for blindness in developing nations, predominantly impacting the elderly population in rural areas. Delayed treatment often results in serious complications, such as lens-induced glaucoma, which can cause irreversible vision loss. LIG is a major issue for our ophthalmic patients, particularly in rural regions. The presence of surgical facilities and the committed work of the National Programme for Control of Blindness (NPCB), NGOs, government bodies, and private practitioners have made cataract surgery an affordable and effective solution. Despite this, many individuals still suffer vision loss due to insufficient awareness about the importance of early intervention. The illiterate, elderly, and rural populations are the most severely affected.¹⁵

Analysing the results, most common type of LIG was found to be Phacomorphic and least common was lens particle type. 16% of

patients presented after 5 days of symptoms and most common reason for late presentation were negligence(27.6%) and poor awareness(27.6%). Significant improvement in vision was seen in patients, with mean log MAR vision of 0.87 at POD1 and 0.48 at POD7 compared to the 1.97 preop. Vision has improved from HM - Cf@2-3m to 6/36 - 6/24 in 50 % of population on POD1 and to 6/18 - 6/12 in 50 % of population by POD7. Mean IOP at presentation was 37.52±7.36 which got reduced to 22.90±6.45 at POD1 and to 17.58±4.42 at POD7. Following lens extraction, mean reduction in IOP was found to be 14.62±5.56 by POD1 and 19.94±6.03 by POD7 which are statistically significant. SICS + PCIOI was the procedure performed for most of the patients (76%) and Iris claw lens was put for 5 patients (10%) while two patients were left aphakic. All patients had to use AGM preoperatively, while 58% of the patients were able to discontinue its use after surgery. Both Intra-op and post-op complications were relatively more common in patients presented with high IOP, and the association was found to be statistically significant. Out of the patients who have used preoperative topical steroids, 81.8% had no postop complications whereas all the patients who have missed to use steroids had severe Anterior Chamber reactions (Fibrin strands)

The initial approach to treating phacomorphic glaucoma involves managing pain and intraocular pressure (IOP), followed by addressing the underlying cause. The main goals of medical therapy are to widen the angle and decrease IOP to ensure corneal clarity for laser treatment or to lower IOP for safer surgical options. The ultimate solution for this condition is cataract removal. However, if cataract extraction is not feasible due to particular situations (like a critically ill patient) or needs to be postponed, an iridotomy should be performed. It's important to note that iridotomy may not resolve the issue in every case particularly when lens-induced pressure plays a more significant role than pupillary block.¹⁶

CONCLUSION

This study reveals that the most common type of LIG presentation is Phacomorphic while negligence and poor awareness results in late presentation in most of the cases. Significant improvement in vision as well as reduction in IOP was observed following surgical management. Majority of patients could be weaned off from the use of Anti-glaucoma medications after surgery. A high IOP at presentation was significantly associated with occurrence of both intra-op as well as post-op complications and prophylactic usage of topical steroids has significant effect on avoiding and reducing postop complications.

Declaration And Patient Consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed

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Nil

Conflicts Of Interest

There are no conflicts of interest

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