

Evaluation of Visual Outcome and Intraocular Pressure Control after Cataract Surgery in Lens Induced Glaucoma

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Abstract: ***Aims:** To evaluate the visual outcome and to assess the intra ocular pressure control following cataract surgery in lens induced glaucoma. **Materials and Methods:** This is a hospital based prospective study of 48 patients attending and admitted in the Ophthalmology Department of Assam Medical College and Hospital, Dibrugarh between July 2017-June 2018. At presentation, visual acuity and IOP was recorded and post-operatively, the same parameters were evaluated after 1week and 1 month. **Results:** The best corrected visual acuity (BCVA) of 6/12 or more was found in 60.42% cases, whereas visual acuity of less than 6/60 was seen in 12.50% cases, post-operatively at the end of 1month. BCVA of 6/12 or more was achieved in 95.23% ($p < 0.01$) of cases with duration of symptoms less than 10days. The mean IOP was reduced from 37.92 ± 10.87 mmHg (at presentation) to 14.7 ± 2.9 mmHg (post-operatively, at the end of 1month). **Conclusion:** Early diagnosis and treatment is beneficial in LIG cases.*

Keywords: Lens induced glaucoma, Phacolytic glaucoma, Phacomorphic glaucoma, Phacotopic glaucoma

1. Introduction

Lens induced glaucoma (LIG) is a group of conditions in which IOP is raised secondary to some disorder of crystalline lens which includes Phacomorphic, Phacolytic, Phacotopic, Lens particle glaucoma and Phacoanaphylactic glaucoma. It is a type of secondary glaucoma and is an ophthalmic emergency. In the year 1900 Gifford and Von Reuss first described LIG in relation to cataract.[1]. A cataractous lens may also lead to glaucoma by obstruction of trabecular meshwork with protein and macrophages (phacolytic glaucoma), lens particles and debris (lens particle glaucoma) or inflammatory cells as a part of immune response to lens protein antigen (phacoanaphylactic glaucoma). A swollen or intumescent lens may lead to pupillary block and secondary angle closure glaucoma (phacomorphic glaucoma).[2,3,4] In partial subluxation, a large segment of the angle of the anterior chamber may be compressed or blocked. In complete dislocation into the anterior chamber, the entire angle may be blocked, especially if the iris becomes firmly contacted over the posterior surface of the lens. This is called phacotopic glaucoma.[5]

Lens induced glaucoma is a common occurrence in india, hardly surprising in a situation where the incident of cataract cases far exceeds the total number of surgeries performed currently. Though these are clinically distinct entities, they have certain common factors in that they are lens induced; they compromise the function of the optic nerve due to rise of intraocular pressure, cataract surgery is definitive treatment in these cases, and finally they uniformly share a guarded prognosis.[6]

Pre-operative and post-operative morbidity is more in an eye with lens induced glaucoma than that with a simple uncomplicated cataract. In general, after controlling the

intraocular pressure, cataract extraction with IOL implantation should be performed preferably.[7]

The present study evaluates the visual outcome and IOP control following cataract surgery in LIGs.

2. Materials and Methods

This is a hospital based prospective study of 48 patients with lens induced glaucoma attending and admitted in the Ophthalmology Department of Assam Medical College and Hospital, Dibrugarh between July 2017-June 2018 done after obtaining the Institutional Ethical Committee clearance.

Inclusion Criteria

All patients with lens induced glaucoma attending & admitted in the ophthalmology department of Assam Medical College and Hospital.

Exclusion Criteria

- No PL & PR.
- Already diagnosed primary glaucoma and associated mature or hypermature cataract.
- Complicated cataracts.
- Secondary glaucoma due to other causes.

All patients diagnosed as Lens induced glaucoma (LIG) on the basis of clinical symptoms and signs were included. A detailed clinical examination of both eyes included the status of the lens, depth of the anterior chamber, keratic precipitates, corneal oedema, cells and flare in the anterior chamber by slit lamp biomicroscopy and IOP recording by Goldmann applanation tonometry. At presentation, visual acuity using Snellens's chart, IOP, corneal changes were recorded. Diagnosis of Phacomorphic glaucoma was made in patients presenting with symptoms of pain, redness and watering of the eye, intolerance to light, presence of corneal edema, shallow anterior chamber and intumescent

Volume 8 Issue 10, October 2019

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cataractous lens and intra ocular pressure above 21 mm Hg. Diagnosis of Phacolytic glaucoma were made in patients presenting with pain in and around the affected eye, corneal oedema, deep anterior chamber showing intense flare and cells in anterior chamber, pseudo-hypopyon in severe cases, presence of hypermature cataract, with IOP above 21 mm Hg. Diagnosis of phacotopic glaucoma was made by the presence of a dislocated or subluxated lens in the anterior chamber causing pupillary block and secondary angle closure with IOP raised above 21 mm Hg.

Preoperative Medical Line of Treatment

Medical measures to decrease intraocular pressure included topical application of Timolol maleate 0.5% twice daily supplemented with oral Acetazolamide 250 mg four times a day, and if still not controlled Mannitol 200 ml of 20% were given intravenously at a rate of 45-60 drops per minute. Ciprofloxacin eye drop (0.3%) were given 5 times daily, 1 day prior to surgery. A combination of topical phenylephrine 10% and 1% tropicamide was used to achieve mydriasis just before surgery.

Surgical line of treatment

In all patients, cataract extraction with intraocular lens (IOL) implantation was offered under guarded prognosis. Local anaesthesia using peribulbar technique was given in the affected eye of the patient, before surgery. After obtaining informed consent and explanation of relatively guarded prognosis, small incision cataract surgery with intraocular lens implantation in the posterior chamber was done in all the cases except 2 cases where IOL were not implanted, since the patient had posterior capsular tear.

Postoperatively, all the patients received topical antibiotic steroid combination with a tapering dose for 6 weeks and a

short acting cycloplegic for 1 week. All the patients were periodically followed up after 1 week and after 1 month. The data was recorded in terms of Age, sex, types of lens induced glaucoma, pre and post operative IOP(after 1st day, 1 week and 1 month) and corrected distant visual acuity pre operatively & post operatively after after 1 week and 1 month. Statistical analysis test - paired t test & Fischer exact test was used wherever applicable with p <0.05 as significant.

3. Results

A total of 48 patients were included in this study. The mean age of presentation was **58.31 ± 11.54 years**. If we look at the age distribution, maximum number of LIG cases occurred in the age group between **40-60 years (56.25%)**, followed by the age group of **61-80 years (35.42%)**. (Table 1).

Table 1: Age Distribution

Age (In Years)	No. of Patients	Percentage (%)
<40	1	2.08
40 - 60	27	56.25
61 - 80	17	35.42
>80	3	6.25
TOTAL	48	100.0

The male to female ratio was **1:1.08**. Phacomorphic Glaucoma was found to be the most common type of LIG with 26 cases (54.17%), followed by phacolytic glaucoma in 18 cases (37.50%). There were 4 cases of Phacotopic glaucoma (8.33%) (Figure 1).

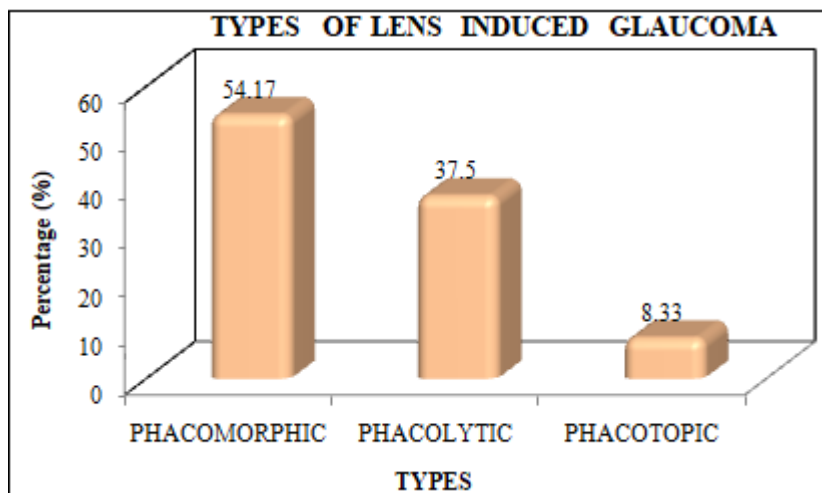


Figure 1: Types of LIG

At presentation, most cases had visual acuity of Perception of light- **26 cases (54.17%)** & Hand Movement- **18 cases (37.50%)**. Only **4 cases (8.33%)** had visual acuity of counting of finger at 1m.

The mean IOP at presentation for all cases of LIG was **37.92 ± 10.87 mm Hg**. Maximum number of cases (**21 i.e 43.75%**) presented IOP in the range of **31-40mmHg**. (Figure 2)

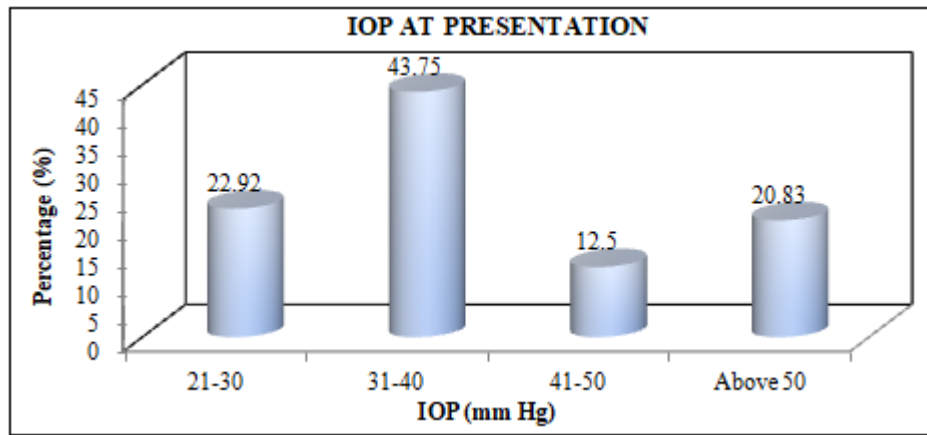


Figure 2: IOP at presentation

The mean IOP was reduced from 37.92 ± 10.87 mm Hg to 24.92 ± 6.73 mmHg after medical treatment.

All the cases underwent SICS with IOL implantation, except 2 cases. Though, there were intraoperative complications in few cases, all other cases i.e 46 cases were rendered pseudophakic & most cases had adequate IOP control after surgery. In this study, 5 cases (10.42%) had vitreous prolapse, out of which 3 cases belong to the phacotopic glaucoma group.

16 cases had early postoperative uveitis which was controlled with use of topical corticosteroids. Only 3 cases

had persistent uveitis. 4 cases had corneal oedema & 1 case presented with hyphaema.

After the end of 1 month, there was a dramatic improvement in the visual acuity. 60.42 % patients had best corrected vision of 6/12 or more. Only 6 cases i.e 12.50% had poor visual acuity of less than 6/60 (Table 2). 2 of these cases had posterior capsular rent & vitreous prolapse during surgery & were rendered aphakic. 1 case developed optic atrophy & others had post-operative uveitis & corneal oedema.

Table 2: Final BCVA after follow-up of 1 month by sub group

BCVA	Phacomorphic		Phacolytic		Phacotopic		No. of patients	%
	No.	%	No.	%	No.	%		
6/6-6/12	17	65.38	11	61.11	1	25.00	29	60.42
6/18-6/36	8	30.77	4	22.22	1	25.00	13	27.08
6/60- 3/60	1	3.85	2	11.11	1	25.00	4	8.33
<3/60	0	0.00	1	5.56	1	25.00	2	4.17
Total	26	100.0	18	100.0	4	100.00	48	100.00

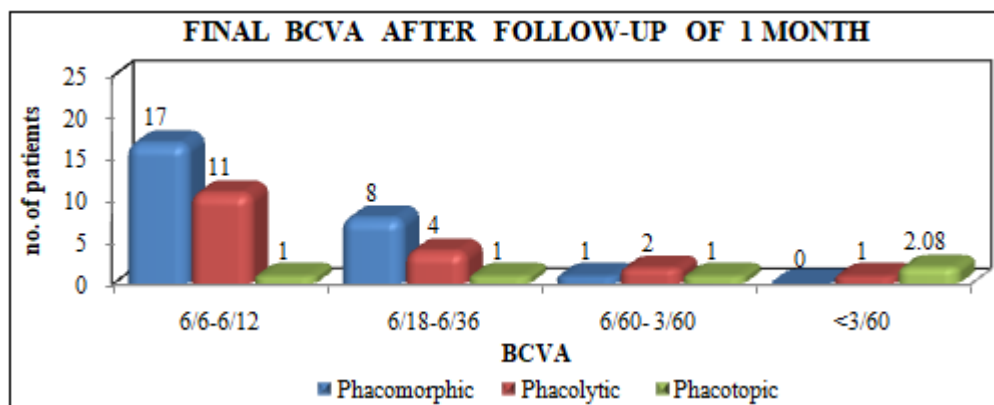


Figure 3: Final BCVA after follow-up of 1 month by sub group

When we subdivided the groups, 65% of phacomorphic glaucoma cases, 61% of phacolytic glaucoma cases & 25% of phacotopic (anterior dislocated lens) glaucoma cases had good visual acuity of 6/12 or more. 50% of phacotopic glaucoma cases had poor visual acuity of less than 6/60. So,

we have seen that phacomorphic & phacolytic glaucoma had good visual recovery while phacotopic glaucoma cases had poor visual recovery. (Figure 3)

Table 3: Comparison between final BCVA at the end of 1 month and age at presentation

Age (in years)	6/6 - 6/12		6/18 - 6/36		6/60- 3/60		< 3/60		Total no.	%
	No.	%	No.	%	No.	%	No.	%		
<40	0	0.00	1	100	0	0.00	0	0.00	1	100
40- 60	17	62.97	8	29.63	1	3.70	1	3.70	27	100
61-80	11	64.71	3	17.65	2	11.76	1	5.88	17	100
>80	1	33.33	1	33.33	1	33.33	0	0.00	3	100

About 62.97% of patients in the age group of 40- 60 years and 64.71% in the age group of 61-80 years had good visual acuity(final BCVA) of 6/12 or more at the end of 1 month. About 20% of cases with age more than 60years had final

BCVA of less than 6/60. However, the relation between age at presentation and visual acuity was found to be statistically insignificant.(Table 3)

Table 4: Comparison between duration of Symptoms and Final BCVA at the End of 1 Month

Duration of symptoms (in days)	6/6-6/12		6/18- 6/36		6/60-3/60		<3/60		Total	%
	No.	%	No.	%	No.	%	No.	%		
<10	20	95.24	1	4.76	0	0.00	0	0.00	21	100.00
10-20	7	41.18	6	35.29	2	11.76	2	11.76	17	100.00
>20	2	20.00	6	60.00	2	20.00	0	0.00	10	100.00

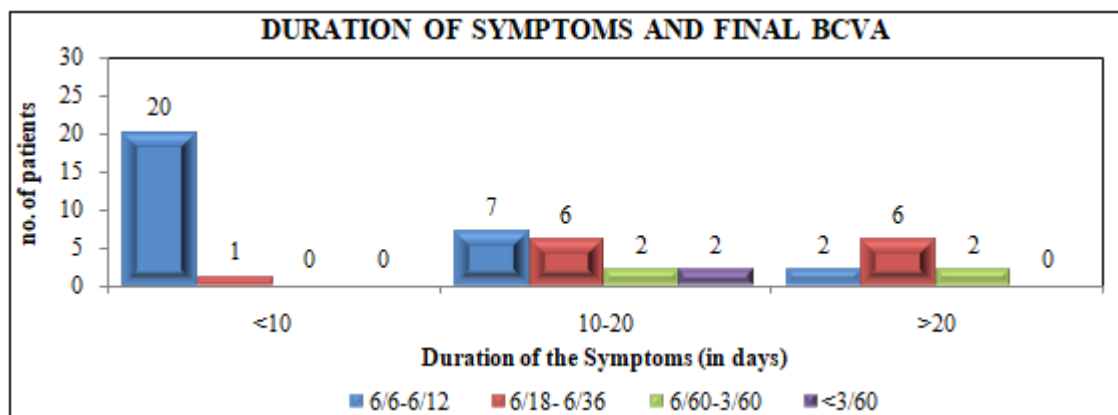


Figure 4: Duration of symptoms and Final BCVA

The final BCVA of 6/12 or better was achieved in 20 (95.23%) out of the 21 cases with duration of symptoms less than 10 days & only in 2 (20%) out of 10 cases with symptoms more than 20 days. The duration of the symptoms in patients had a linear relationship with final visual

outcome. The more the duration of symptoms, poorer was the visual outcome which was clinically & statistically significant (p<0.0001) on applying Fisher’s exact test.(Table 4)

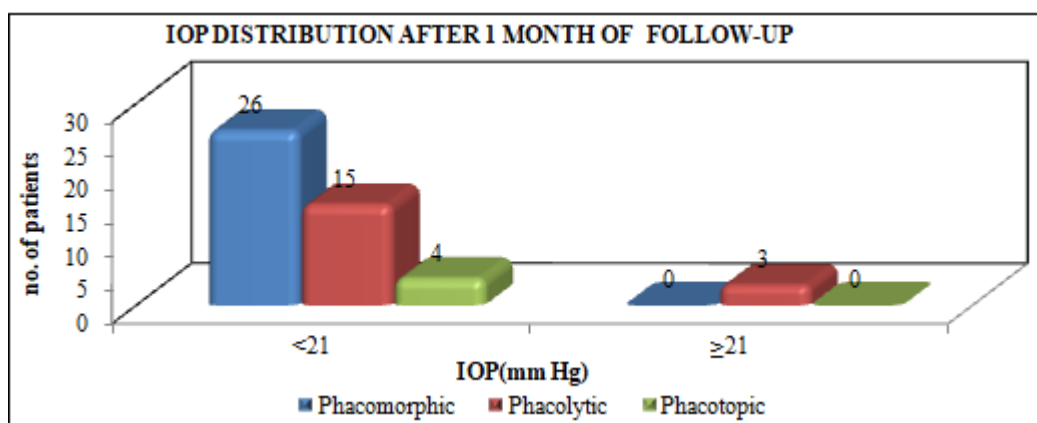


Figure 5: IOP Distribution after follow up of 1 month

Post-operatively, IOP was controlled in most cases. At the last follow-up, i.e at the end of 1 month, only 3 cases all belonging to phacolytic glaucoma cases had IOP >21 mm Hg (Figure 5). 2 such cases developed bullous keratopathy,

while one case developed optic atrophy. The mean IOP reduced from 37.92 ± 10.87 mmHg to 14.7± 2.9 mm Hg, which was statistically significant (t=17.63, p<0.0001) on applying paired t-test.

Table 5: Comparison between IOP at Presentation and Final BCVA At The End Of 1 Month

IOP at presentation (mm Hg)	FINAL BCVA								Total no.	%
	6/6-6/12		6/18-6/36		6/60-3/60		<3/60			
	No.	%	No.	%	No.	%	No.	%		
21-30	7	63.64	4	36.36	0	0.00	0	0	11	100.00
31-40	15	71.44	2	9.52	2	9.52	2	9.52	21	100.00
41-50	4	66.67	2	33.33	0	0	0	0	6	100.00
>50	3	30.00	5	50.00	2	20.00	0	0	10	100.00
Total	29	60.42	13	27.08	4	8.33	2	4.17	48	100.00

Out of 11, 7 cases i.e 63.64% of patients having IOP in the range of 21-30 mmHg had final BCVA of 6/12 or more at the end of 1 month. Only 3 cases out of 10 cases i.e 30% of patients having IOP more than 50 mm Hg at presentation had final BCVA of 6/12 or more. No case having IOP in the range of 21-30 mmHg had final BCVA of less than 6/60, while 20% cases having IOP more than 50 mm Hg at presentation had final BCVA of less than 6/60. Hence, patients having lower IOP at presentation had better visual outcome. However, it was statistically insignificant.

4. Discussion

Lens induced glaucoma is a common occurrence in India, as here the incidence of cataract cases far exceeds the total number of cataract surgeries performed annually. This study comprises of a total 48 cases of lens induced glaucoma and an attempt is made to evaluate the visual outcome & intraocular pressure control after cataract surgery.

The age range of our study was **37-90 years** and the mean age at presentation for all LIG cases was **58.31 ± 11.54 years**. *Kothari et al*^[8], in their study reported mean age of presentation as **68.84 years**, (range **56-81 years**). The age range in both type of LIG, phacomorphic & phacolytic as reported by *Pradhan et al*^[9] was **40-80 years**, very similar to our study. In our study, there was a slight female preponderance (**52%**) over male (**48%**). The male to female ratio was **1:1.08**. Similar observations were made by other studies. In studies done by *Prajna et al*^[10] and *Braganza et al*^[11] there was a slight female preponderance (54%) compared to male population (46%). It is possible that these entities are more common in females because of socio-economic repression.

Phacomorphic Glaucoma was the most common type of LIG with 26 cases (54.17%), followed by phacolytic glaucoma in 18 cases (37.50%), in our study. In their study, *Prajna et al*^[10] reported that phacomorphic glaucoma (52.7%) was slightly more than phacolytic glaucoma cases (47.3%).

At presentation, most cases had visual acuity of Perception of light- **26 cases (54.17%)** & Hand Movement- **18 cases (37.50%)**. Only **4 cases (8.33%)** had visual acuity of counting of finger at 1m. After surgical management, in all the cases there was improvement in visual acuity.

After the end of 1 month of follow-up, there was a dramatic improvement in the visual acuity. **60.42 %** patients had good visual outcome with final best corrected vision of 6/12 or more. Only 6 cases i.e **12.50%** had poor visual acuity of less than 6/60. 2 of these cases had posterior capsular rent & vitreous prolapse during surgery & were rendered aphakic. 1

case developed optic atrophy & others had post-operative uveitis & corneal oedema. *Murthy Srinivasa et al*^[12] and *Ushalatha B et al*^[13], reported good visual outcome of 6/12 or more in 80% of the patients, slightly more than our study and poor visual outcome of less than 6/60 in only 5 patients, similar to our study. They reported optic atrophy to be a common cause of poor visual outcome.

When we subdivided the groups, 65% of phacomorphic glaucoma cases, 61% of phacolytic glaucoma cases & 25% of phacotopic (dislocated lens) glaucoma cases had good visual acuity of 6/12 or more. 50% of phacotopic glaucoma cases had poor visual acuity of less than 6/60. So, we have seen that phacomorphic & phacolytic glaucoma had good visual recovery while phacotopic glaucoma cases had poor visual recovery. It is similar to the findings of the study, *Prajna et al*^[10] who found 57% of eyes with phacomorphic glaucoma & 61% with phacolytic glaucoma had visual acuity of 6/12 or more.

In our study, about 62.97% of patients in the age group of 40- 60 years had good visual acuity (final BCVA) of 6/12 or more at the end of 1 month and only 2 patients i.e 7.4% had poor visual acuity of less than 6/60 at the end of 1 month. 20% of the patients with age more than 60 years had poor visual outcome of less than 6/60. *Prajna et al*^[10] reported similar findings.

The BCVA at the last follow-up of 6/12 or better was achieved in 20 out of the 21 cases (95.23%) with duration of symptoms less than 10 days & only in 2 out of 10 cases (20%) with duration of symptoms more than 20 days, which was clinically & statistically significant ($p < 0.0001$). Similar to our study, *Sharanabasamma M et al*^[14] in their study found good visual acuity achieved in cases presented within 2 weeks (72%) was more than the cases presented beyond 2 weeks (16%).

The mean IOP at presentation for all cases of LIG was **37.92 ± 10.87 mm Hg**, in our study. The presenting IOP ranged from **21-59 mm Hg**. In the study *Sharanabasamma M et al*^[14], mean IOP at presentation was **38.88 ± 11.31 mm Hg**, almost similar to our study. After surgery, at the last follow-up, i.e at the end of 1 month, only 3 cases all belonging to phacolytic glaucoma cases had IOP >21 mm Hg. 2 such cases developed bullous keratopathy, while one case developed optic atrophy. The mean IOP reduced from **37.92 ± 10.87 mmHg** to **14.7 ± 2.9 mm Hg**, which was statistically significant ($t = 17.63$, $p < 0.0001$). In the study by *Venkatesh R et al*^[15], all the cases achieved IOP < 20 mm Hg at the end of their follow-up period.

63.64% of patients having IOP in the range of 21-30 mmHg at presentation had final BCVA of 6/12 or more. Only 3 out

of 10 cases (30%) having IOP more than 50 mm Hg at presentation had final BCVA of 6/12 or more. *Pinipe SD et al*^[16] made a similar observation that good visual acuity achieved by cases with IOP less than 35 mm Hg at presentation (60%) was more than the cases with IOP higher than 35 mm Hg at presentation (33.33%). Hence, lower IOP at presentation has better visual prognosis.

5. Conclusion

Lens induced glaucoma are one of the most common type of secondary glaucoma. It is a condition of old age which is slightly more common in females.

Visual outcome and intra ocular pressure control following cataract surgery in lens induced glaucoma is excellent with negligible residual complications. IOP is reduced to 21mm Hg following surgery in most cases and final best corrected visual acuity of more than 6/60 is achieved in most cases. The results have shown that good visual acuity can be achieved in LIG cases presenting within 10 days & with IOP lower than 40mm Hg at presentation. Meticulous control of IOP and inflammation with medications pre-operatively, followed by planned small incision cataract extraction with IOL implantation is the curative treatment. A good follow-up with efficient management of complications, and inflammations are the key factors in management.

Hence, emphasis should be made about importance of early diagnosis, creating awareness about cataract, its implications among the rural community, ophthalmic assistants, and peripheral health workers.

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