LENS-INDUCED GLAUCOMA AT A TERTIARY EYE CARE CENTRE IN SOUTH INDIA- OUR EXPERIENCE
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ABSTRACT

BACKGROUND
Glaucoma in which the lens plays a role either by size or by position or by causing inflammation have been classified as lens-induced glaucoma. Lens-induced glaucomas are an important cause of secondary glaucoma in the developing world. This study was undertaken to outline the different characteristics of lens-induced glaucoma, to find out the proportion of their different subtypes, to find out why patients had delayed their cataract surgery, to find out visual outcome and the postoperative IOP control and optic disc changes and reasons for poor visual outcome.

MATERIALS AND METHODS
Prospective, consecutive case series of 100 patients with lens-induced glaucomas who presented to a tertiary care hospital in South India over a period of one year.

RESULTS
Phacomorphic (55%) and phacolytic (45%) were the common lens-induced glaucomas encountered. Small incision cataract surgery with IOL implantation was the commonest surgery performed. 42% of patients had a visual acuity outcome of 6/12 or better. 85% of patients who presented within 3 days had a visual acuity of 6/12 or better. Patients who presented after 2 weeks were most likely to have disc damage. IOP was controlled in 94% of patients following cataract extraction.

CONCLUSION
Cataract surgery after control of uveitis and IOP can lead to good visual outcome and normal IOP postoperatively in lens-induced glaucomas. However, prolonged raised IOP can lead to optic disc damage.

KEYWORDS
Phacomorphic, Phacolytic, Cataract, Uveitis.


BACKGROUND
Cataract accounts for significant proportion of the World's blind and in the developing world financial, cultural and psychosocial barriers still exist to accessing excellent surgical services. The uptake of eye care services by rural community has also been suboptimal in our country.

Cataract has been documented to be the most significant cause of bilateral blindness both in India as well as on the global scale. It has been estimated that there are about 12.5 million blind people in India with 50-80% of this group due to cataract.1 In the developing world, financial, cultural and psychosocial barriers still exist to access excellent surgical services. The uptake of eye care services by rural community has also been suboptimal in our country.

It has long been recognised clinically that several forms of glaucoma may occur in association with the formation of cataracts, which are an important cause of secondary glaucoma in the developing world. Though not all inclusive, Lens-Induced Glaucoma (LIG) are either secondary angle-closure glaucoma (phacomorphic glaucoma) or secondary open-angle glaucoma (phacolytic glaucoma) irrespective of these modes of presentation, the treatment has been oriented towards a single focus, namely removal of the cataractous lens. The clinical presentation of phacolytic glaucoma was first described by Giffords.2 It was not until 1955 that Flocks et al3 named it as 'phacolytic glaucoma' and suggested that it is associated with a leaking hypermature lens. Epstein and colleagues (1978)4 have shown that high molecular weight proteins are the causative element of trabecular block in this disease entity. Zeeman5 described the macrophagic response to leaking lens material and attributed this to the cause of raised intraocular pressure in these cases. Extracapsular surgery was first advocated by Irvine in 1957.6

Significance of lens-induced glaucoma is that a delay in presentation with consequent high intraocular pressures may compromise function of optic nerve and may jeopardise vision ultimately leading to blindness.
AIMS AND OBJECTIVES
- To study the subtypes of lens-induced glaucomas.
- To find out reasons for delay in cataract surgery.
- To study the proportion of postoperative complications.
- To study the outcome of management in terms of postoperative visual acuity, postoperative IOP control, optic disc changes at 2, 4, 6 weeks.

MATERIALS AND METHODS
The study was a prospective case series of 100 consecutive patients with lens-induced glaucoma who satisfied the inclusion criteria. The study period was one year and it was done at the Regional Institute of Ophthalmology, Trivandrum. Data was analysed using computer software and expressed in its frequency and percentage as well as mean and standard deviation. To elucidate the associations and comparisons between different parameters, Chi-square ($\chi^2$) test was used as nonparametric test. For all statistical evaluations, a two-tailed probability of value, <0.05 was considered significant.

Inclusion Criteria
- Patients with lens-induced glaucomas confirmed by slit lamp examination.

Exclusion Criteria
- Patients with primary glaucoma who go on to develop cataract.
- Long-standing lens-induced glaucomas (>6 months) with no perception of light.
- Traumatic lens-induced glaucoma.

RESULTS
Out of the 100 patients studied, 43% were in the age group of 60-69 years and 42% were in the above 70 age group suggesting that lens-induced glaucoma is more of a disease of the elderly. Only 15% of patients were in the less than 60 yrs. age group. Males outnumbered the females in our study marginally (M:F 57:43). Majority of patients (90%) presented within 2 weeks of onset of symptoms, however, only 14% of patients presented acutely within 3 days of onset suggesting that patients tended to delay visiting the hospital due to lack of awareness regarding their eye condition or other socioeconomic constraints. 59% of patients delayed cataract surgery because of a feeling of adequate vision in the fellow eye. 57% of patients were pseudophakic with respect to the fellow eye suggesting that pseudophakic status was probably a major reason for delay in surgery. Lack of money was the reason among 33% of patients. 4% of patients had no escort to accompany them to the hospital. 4% of patients were unaware of their eye condition and its severity. 39% of patients had IOP in the range of 31-40 mm of Hg at presentation, whereas 37% of patients had IOP above 40 mm of Hg. 55% of patients were diagnosed to have phacomorphic glaucoma, whereas 45% of patients were found to have phacolytic glaucoma.

Intraoperatively, subluxated lens with zonular dialysis was found in 7 cases, whereas posterior capsular rent occurred in another 7 cases. Nearly, all of these cases were also associated with vitreous loss.

Final Visual Outcome

At the last follow up visit, at the end of 6 weeks, BCVA was 6/12 or better in 42% of patients, 6/18-6/60 in 39% of patients with 19% of patients having BCVA of <6/60, major causes for poor visual outcome being postoperative corneal oedema, uveitis, macular oedema and glaucomatous disc damage.

Causes for Poor Visual Outcome
Major causes for poor visual outcome were postoperative corneal oedema, uveitis and macular oedema. Glaucomatous disc damage was seen in 28% of cases probably due to prolonged raised IOP.

Final Postoperative IOP

At the last follow up visit, 94% of patients had an IOP <20 mm of Hg. 6% of patients had an IOP in the range of 21-24 mm of Hg, which required antiglaucoma medications for control.

On analysis of impact of duration of symptoms on final visual outcome, it was found that out of the 14 patients who presented within 3 days of onset of symptoms, 12 achieved a final BCVA of 6/12 or better. On the contrary
On analysis of the impact of preoperative IOP on postoperative visual outcome, it was found that among the 19 patients who had BCVA <6/60, 11 patients (57.9%) had preoperative IOP >40 mm of Hg, 4 (21.1%) had IOP between 31-40 mm of Hg and 3 patients had IOP below 30 mm of Hg on presentation.

On analysis of the impact of duration of symptoms, i.e. the time from onset of symptoms to surgery done on optic disc changes, it was found that none of the patients who presented within 3 days of onset of symptoms had disc damage. Moderate disc damage was found in 4 patients who presented within one week, 2 patients who presented in 2 weeks and 4 patients who presented after 2 weeks. Severe disc damage was seen in 1 patient who presented within a week, 2 patients who presented in 2 weeks and in 1 patient who presented after 2 weeks. Among the 10 patients who presented after 2 weeks, only 2 patients had normal discs, 3 patients had mild disc damage, 4 patients had moderate disc damage and 1 patient had severe disc damage suggesting that disc damage could occur due to prolonged raised IOP. On analysis of impact of preoperative IOP on optic disc changes it was found that moderate disc damage was found in 1 patient (9.1%) with IOP in range of 31-40 mm of Hg and in 10 patients (90.9%) of patients with IOP >40 mm of Hg. Severe disc damage was seen in 1 patient with IOP 21-30 mm of Hg, 2 patients with IOP 31-40 mm of Hg and in 1 patient with IOP >40 mm of Hg.

On analysis of impact of preoperative IOP on optic disc changes, it was found that moderate disc damage was found in 1 patient (9.1%) with IOP in range of 31-40 mm of Hg and in 10 patients (90.9%) of patients with IOP >40 mm of Hg. Severe disc damage was seen in 1 patient with IOP 21-30 mm of Hg, 2 patients with IOP 31-40 mm of Hg and in 1 patient with IOP >40 mm of Hg.

Most commonly used surgical modality was SICS with PCIOL, which gave better visual results. Among the 72 patients who underwent SICS with PCIOL, 40 patients achieved a BCVA >6/12.25 patients were left aphakic due to intraoperative complications like zonular dialysis and posterior capsular rupture and visual outcome in this group was not as satisfactory as in the group, which underwent PCIOL implantation.

On analysis of impact of systemic steroids on final outcome, it was found that 37 among the 57 patients in the group, which had received systemic steroids preoperatively had a visual acuity >6/12, whereas only 5 patients who had not received systemic steroids had a final BCVA, which was statistically very highly significant.

**DISCUSSION**

Cataract has been documented to be the most significant cause of bilateral blindness both in India as well as on the global scale. It has been estimated that there are about 12.5 million blind people in India with 50-80% of this group due to cataract. Lens-induced glaucomas are a common occurrence in India, hardly surprising in a situation where the incidence of cataract cases far exceeds the total number of surgeries performed currently and also due to a lack of awareness of cataract and delayed surgical intervention removal. Though the different subgroups of lens-induced glaucomas 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 curative in these cases and finally they uniformly share a guarded prognosis.

A total of 100 patients with lens-induced glaucomas were included in this study. Males marginally outnumbered the females (M:F=53:47) probably due to the

<table>
<thead>
<tr>
<th>Duration of Symptoms</th>
<th>Fundus (Optic Disc) Changes</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Mild Disc Damage</td>
</tr>
<tr>
<td>&lt;=3 days</td>
<td>14</td>
<td>18.40%</td>
</tr>
<tr>
<td>4-7</td>
<td>32</td>
<td>42.10%</td>
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<tr>
<td>8-15</td>
<td>28</td>
<td>36.60%</td>
</tr>
<tr>
<td>&gt;15 days</td>
<td>2</td>
<td>2.60%</td>
</tr>
<tr>
<td>Total</td>
<td>76</td>
<td>9</td>
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</tbody>
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**Chi-square— 24.811; P<0.01**

**Duration of Symptoms vs. Optic Disc Changes**
socioeconomic constraints, which females had in seeking medical help.

In this study, the age range was from 51 years to 88 years. Highest number of cases (43%) were found in the 60-69 years age group with the above 70 age group coming a close second constituting 42% of cases. Pradhan et al in a study conducted in Nepal in 2001 have found occurrence of LIG in the age range of 40 to 80 years with the highest in the 60 to 69 years (43.1%) age group indicating that the lens-induced glaucomas are a condition of old age.

Two subtypes of lens-induced glaucomas were encountered in our study. Phacomorphic glaucoma was found in 55% of cases, whereas phacolytic glaucoma was found in 45% of cases. Lim reported a ratio of 12:1 for phacomorphic to phacolytic glaucoma and Prajna et al found more or less equal numbers in their series. Pradhan et al found the ratio of phacomorphic-phacolytic glaucoma to be 72:28%. However, occurrence of lens-induced glaucomas in different studies show variations.

On assessing the status of the fellow eye, we found that 57% of fellow eyes were pseudophakic, 20% had immature cataracts, 10% had mature cataracts and 10% were aphakic. In the Pradhan study examination of the fellow eyes revealed that 270 (65.4%) were phakic, 123 (29.8%) aphakic, 16 (3.8%) pseudophakic and 4 (1%) were one-eyed.

On analysing reasons for delay in cataract surgery, it was found that good vision in the fellow eye was the predominant reason probably due to pseudophakic status of fellow eye. Economic reasons, lack of bystanders to accompany the patients, lack of awareness regarding the eye condition and its graveness were other reasons cited. The major reasons for late presentation in the study done by Pradhan et al were "no escort" in 143 (34.6%) and "lack of money" in 128 (31.0%) cases. Other reasons were "lack of time" in 29 (7.0%), "no desire for surgery" in 27 (6.5%), "uncertainty about where to go" in 25 (6.1%), "feeling of adequate vision" in 22 (5.3%), "no mature cataract" in 19 (4.6%), "fear" in 18 (4.4%) and "uncontrolled systemic diseases" - (diabetes mellitus and hypertension) in 2 (0.5%) patients.

On analysis of visual outcome, it was found that 42% of patients attained a final visual acuity of 6/12 or better. 19% of patients had a final acuity of 6/60 or worse. Major causes for poor visual outcome were persistent postoperative corneal oedema, uveitis and uveitis-related cystoid changes at macula, which can be accounted for by the intense inflammation associated with these lens-induced glaucomas. Some form of glaucomatous disc damage was noted in 24 patients with 4 patients having severe disc damage, which was probably due to prolonged raised IOP. 25 patients were left aphakic due to intraoperative complications and 17 among these patients had visual acuity of 6/60 or less probably reflecting that postoperative complications affecting visual acuity were also higher in the aphakic group.

In a study conducted by Ramakrishnan et al in Tirunelveli to find out visual outcome in phacomorphic glaucoma, they found that 68% of patients had a BCVA of 20/40 or better and 20/200 or better was found in 20% of patients. Patients had BCVA <20/200 causes being pre-existing diabetic retinopathy and glaucomatous optic atrophy.

In the Pradhan et al study done in Nepal, it was found that 120 (38.6%) of 311 operated cases achieved 6/60 or better. Of 105 cases reporting for follow up between 4 and 12 weeks, 33 (31.4%) eyes achieved 6/18 or better with best correction and 22 (21.0%) were blind (less than 3/60 vision) mainly due to optic atrophy in 15 (68.2%) out of 22 eyes.

In the study conducted by Prajna et al in Madurai, 57% of phacomorphic glaucomas and 61% of phacolytic glaucomas attained postoperative corrected visual acuity of 6/12 and better. None of these patients had a compromised optic nerve due to the glaucomatous process. Five patients (10.2%) with phacomorphic glaucomas and six patients (13.6%) with phacolytic glaucomas had visual acuity less than 6/60. All these five patients with phacomorphic glaucomas and four of the six patients with phacolytic glaucomas had compromised optic nerves due to the glaucomatous process itself. The reason for the visual acuity remaining poor in the rest of the two patients with phacolytic glaucoma was due to severe persistent postoperative uveits and resultant cystoid changes in the macula.

On analysis of postop IOP, it was found that 94% of patients had IOP below 21 mm of Hg following surgery, 6 patients had IOP in the range of 22-24, which could probably be due to persistent postoperative inflammation, uveits and hyphaema and required antiglaucoma medications to control IOP.

In the Prajna et al study, the intraocular pressure was controlled in 95% of patients (<=21 mmHg) without the need for any antiglaucoma medication and the mean postoperative final intraocular pressure was 14±6.5 mmHg for the phacomorphic group and 12±2.6 mmHg for phacolytic group.

In the study done by Pradhan et al at follow-up, 89 (84.8%) eyes had an IOP below 22 mmHg.

In the study done by Ramakrishnan et al, IOP on final follow up was less than 20 mm of Hg in all 74 patients without the need for antiglaucoma medications.

Intraoperative complications were absent in 79% of cases. Among the remainder zonular dialysis with subluxated lens was the major complication. Posterior capsular rupture was seen in 11 cases. Vitreous loss was also a major complication jeopardising final visual outcome.

On comparison of duration of symptoms with final BCVA, it was found that 85% of patients who presented early, i.e. within 3 days of symptoms had a final BCVA of 6/12 or better. 87% of patients who presented within a week had a final visual acuity of 6/60 or better, whereas among those who presented after 2 weeks, only 40% had BCVA of 6/60 or better and remaining 60% of patients had...
a visual acuity of 6/60 or less. The association between duration of symptoms and final visual acuity was statistically very highly significant suggesting that shorter the duration between onset of symptoms and surgery, better is the visual prognosis.

In the study conducted by Ramakrishnan et al at Tirunelveli, they found that there was a significant association between duration of symptoms and postoperative BCVA. 51 patients had a visual acuity better than 20/40, out of them significantly more number of patients had duration of symptoms less than 10 days (84%) as compared to those with duration more than 10 days (16%).

Prajna et al in their study also found that there was a significant risk of obtaining poor visual acuity when the duration between the onset of pain and surgery exceeded 5 days (OR=3.1; 95%, CI=1.21-8.13).

Jain et al also found that as the duration of attack increased, there was a progressive decline in the recovery of visual acuity and beyond 3 weeks only light perception or hand movements could be recovered.

On comparison of the impact of preoperative IOP on final visual outcome, we found that of the 42 patients who attained visual acuity of 6/12 or better, 35.7% had an IOP of 21-30 mm of Hg, 40.5% had an IOP of 31-40 mm of Hg and 23.8% had an IOP of >40 mm of Hg. Among those who had IOP, >40 mm of Hg 57.9% had a final visual acuity of 6/60 or less. The association between preoperative IOP and postop visual acuity was not statistically significant. This maybe because the IOP on presentation represents only one single reading at a particular time point in the acute attack and may not reflect the IOP profile during the entire period of angle closure.

Ramakrishnan et al in their study also found no association between preop IOP and postop visual acuity.

Duration of symptoms was also found to have a statistically significant impact on postoperative optic disc changes. 80% of patients who presented later than two weeks had some form of disc damage, whereas those who presented within 3 days were not found to have any disc damage.

In a study done on phacomorphic glaucoma in Guru Nanak Centre, Delhi, by Das et al among the 12 patients who had longer duration of symptoms, all had glaucomatous optic nerve head cupping of 0.6 or more.

In a study done by Jain et al in Delhi in 1983, they found that optic disc showed changes, which were significantly related to the duration of attack of glaucoma. Up to 10 days of the attack, a large majority of optic discs (76.2%) retained good color. When the attack lasted more than 3 weeks, nearly all the eyes developed pallor, cupping or atrophy of the disc. On analysing the impact of systemic steroids on final outcome, it was found that 88.1% of patients who had received systemic steroids preoperatively and was tapered gradually attained a final acuity of 6/12 or better whereas 94.7% of those who had not received steroids preoperatively had a visual acuity of 6/60 or less.

In the study done by Das et al in Delhi, they used both antiglaucoma medications and systemic + topical steroids to control IOP and found that chances of visual rehabilitation were better if IOP was well-controlled preoperatively and with greater intraocular inflammation, it was found that the visual prognosis deteriorated. Steroids by controlling intraocular inflammation have an important role in improving the visual prognosis.

SICS with PCIOL was the predominant surgical modality used in the treatment. Extracapsular Cataract Extraction (ECCE) requires a large incision in a globe with a very high IOP, which increases the risk of sight threatening complications. SICS with trypan blue staining of anterior capsule has an advantage over ECCE and phacoemulsification. It has been shown that SICS gives better uncorrected vision compared to ECCE due to higher postoperative astigmatism in ECCE. SICS has been reported to be safe and effective for the management of phacolytic glaucoma in a study done by Venkatesh et al. Phacoemulsification is difficult in lens-induced glaucoma especially in phacomorphic because of the shallow chamber, iris prolapse, peripheral capsulorhexis tears, endothelial cell loss is greater because of closer proximity of phaco tip to endothelium during nucleus emulsification and reduced endothelial cell reserve in these patients. SICS does not require expensive equipment like phacoemulsification, anterior chamber is more stable due to shelving scleral wound along with minimum surgery related complications, learning curve for beginners is shorter and allows high volume surgery in a developing country like India without compromising quality of medical care.

In our study, among the patients who attained final visual acuity of 6/12 or better 95.2% of patients had undergone SICS with PCIOL.

CONCLUSION

- Phacomorphic and phacolytic glaucomas were the major lens-induced glaucomas encountered in the study.
- Good vision in the fellow eye either due to pseudophakic or phakic status was the most common reason for delay in surgery.
- Good visual outcome can be achieved if the time duration between onset of symptoms to surgery is short and if inflammation and IOP is well controlled before surgery.
- Corneal oedema and uveitis were the most common complications encountered postoperatively. This probably represents the intense inflammation associated with these lens-induced glaucomas.
- Prolonged raised IOP can lead to optic disc damage.
- Cataract surgery after control of uveitis and IOP can lead to good visual outcome and normal IOP postoperatively.
REFERENCES


