

A STUDY ON LENS-INDUCED GLAUCOMA

Savithiri Visvanathan¹, Shobha Ponmudy², Manupriya Murali³

¹Assistant Professor, Department of Ophthalmology, Regional Institute of Ophthalmology-Government Ophthalmic Hospital, Egmore, Chennai.

²Assistant Professor, Department of Ophthalmology, Regional Institute of Ophthalmology-Government Ophthalmic Hospital, Egmore, Chennai.

³Postgraduate Student, Department of Ophthalmology, Regional Institute of Ophthalmology-Government Ophthalmic Hospital, Egmore, Chennai.

ABSTRACT

BACKGROUND

A study on factors in lens responsible, duration, time of interference and management of increased IOP in lens-induced glaucoma and estimation of aqueous protein level in lens-induced glaucoma.

MATERIALS AND METHODS

A randomised clinical trial on all cases of phacolytic and phacomorphic glaucoma seen in Coimbatore Medical College Hospital between January to December 2004.

RESULTS

In this study, males and females had equal prevalence. Out of 50, left eye was affected in 31 cases. Majority were phacolytic and phacomorphic glaucoma. The aqueous protein level was found to be high in lens-induced glaucoma.

CONCLUSION

Final visual recovery in lens-induced glaucoma is dependent on duration of glaucoma. ECCE or SICS with PCIOL is curative. If duration is more than 7 days, a trabeculectomy has to be added. Periodic checkup of fellow eye is indicated in all cases.

KEYWORDS

Lens-Induced Glaucoma, Phacolytic Glaucoma, Phacomorphic Glaucoma.

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BACKGROUND

Secondary glaucoma associated with changes in the lens is attributed to either the morphology of the lens as in intumescent cataract, the position of the lens as in dislocation or subluxation or to the consequences of a loss of integrity of the lens capsule as in hypermature cataract or Morgagnian cataracts.¹ The lens-induced glaucomas are either open angle as in the case of phacolytic or lens protein glaucoma or narrow angle, which occurs in phacomorphic glaucoma. In both cases, the outflow of aqueous is compromised and results in raised IOP. The rise in IOP can be high enough to cause injury to the ganglion cells of the nerve fibre layer and irreversible loss of vision.²

The types of lens-induced glaucomas are-³

1. Phacolytic glaucoma.
2. Phacomorphic glaucoma.
3. Lens particle glaucoma.

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Corresponding Author:

Dr. Shobha Ponmudy,

Assistant Professor, Department of Ophthalmology,

Regional Institute of Ophthalmology,

Government Ophthalmic Hospital, Egmore, Chennai.

E-mail: sureshobha@gmail.com

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4. Phacoanaphylaxis.

5. Glaucoma associated with (spontaneous, congenital and traumatic) dislocation of the lens.

- Spontaneous dislocation into the vitreous cavity.
- Spontaneous dislocation into the anterior chamber.⁴
- Hypermature cataract with subluxation of lens.

MATERIALS AND METHODS

Randomised clinical trial was conducted at CMCH.

Inclusion Criteria

All cases of phacolytic and phacomorphic glaucoma seen in Coimbatore Medical College Hospital between January to December 2004.

Clinical Features

1. History of acute onset of pain, redness and watering following a period of painless progressive loss of vision.
2. Hypermature cataract.
3. IOP >21 mm of Hg.
4. Cells and flare.
5. White spots on lens capsule.
6. Refractile crystals in AC.
7. Pseudohypopyon.
8. Intumescent lens with shallow AC.



Exclusion Criteria- Cases with immature cataract, lens-induced glaucoma associated with trauma or uveitis and other causes of secondary glaucoma were excluded. Any associated systemic illness like diabetes, hypertension, ischaemic heart disease and bronchial asthma recorded.

Patient Evaluation- All cases were examined by a qualified ophthalmologist with at least 1 year experience in the glaucoma clinic and confirmed by a glaucoma specialist. They underwent a complete preoperative ocular examination of both eyes. This included V/A, Slit-Lamp Examination, Applanation tonometry, gonioscopy and ophthalmoscopy (of the fellow eye).

Aqueous Protein Level- From all the 50 cases of lens-induced glaucoma, 0.2 mL of aqueous was taken intraoperatively and sent for evaluation of total protein by Biuret method. Aqueous from 50 cases of control were also sent.

Preoperative Management- All cases were managed with hourly topical steroids during the day and short-acting cycloplegics twice daily. The intraocular pressure was controlled medically with acetazolamide and hyperosmotics (Mannitol) when needed. Some cases needed IV Mannitol preoperatively.

Surgery- The operations were performed by consultants. Regional anaesthesia (retrobulbar and facial blocks) was used. Informed consent was obtained and relative guarded prognosis was explained to the patient.

Type of Surgery- 30 cases had ECCE. Small incision cataract surgery with PCIOL implantation was done in 20 cases in our study. Advantages of SICS in lens-induced glaucomas-

1. Minimal intraoperative bleeding and tissue injury.
2. Reduced chances of positive vitreous pressure or expulsive haemorrhage.
3. Less postoperative inflammation.
4. Minimum astigmatism.
5. Surgery safe despite uncontrolled IOP preoperatively.

Cataract surgery with trabeculectomy was performed without the use of mitomycin C. Postoperatively, in all cases that had trabeculectomy, the conjunctival bleb was examined for the extent, height, the vascularity and leak with the use of slit lamp. It was subjectively graded by the examiner as small, average or large. The releasable suture was trimmed at the sixth week review. The anterior chamber was examined for the presence of hyphaema or hypopyon. The depth of the anterior chamber was graded as shown below-

Grade 1- Peripheral iridocorneal touch.

Grade 2- Collarette touch.

Grade 3- Lenticular corneal touch.

The cornea was examined for epithelial oedema and clarity. The fundus was examined for the presence of choroidal detachment, suprachoroidal haemorrhage, optic disc oedema, maculopathy or choroidal folds.⁵

Postoperative Management- All patients were examined postop by concerned surgeons. Those who underwent cataract surgery alone received oral acetazolamide 250 mg postop 6 hourly for 1 day. Postop IOP was treated if more than 30 mm of Hg or if associated with corneal oedema.

In cases that had trabeculectomy, IOP >30 mm of Hg was successfully treated by gentle bleb massage. Topical steroids at hourly intervals and short-acting cycloplegics twice daily were used in all operated eyes to control the inflammation. Eyes which develop severe postop uveitis or an exudative membrane were treated with SC injection or a short course of systemic steroids.

Follow Up- All cases were followed as inpatients at CMCH for 5 days. Postop follow up examination was done by the concerned surgeons every day for the first 5 days. The patient was reviewed after 7 days and at 6 weeks following surgery. At each visit, routine postoperative examination was done. The parameters that were tested were-

1. Best corrected visual acuity.
2. IOP by applanation tonometry.
3. Anterior segment examination with the slit lamp.
4. Ophthalmoscopy with biomicroscopic evaluation of the optic disc.

RESULTS

From the study of 50 cases of lens-induced glaucoma by various lens-induced mechanisms on patients attending our Coimbatore Medical College Hospital from January 2004 to December 2005, the following conclusions have been arrived at-

1. The maximum prevalence of lens-induced glaucoma occurred in the age group of above 56-60 years.
2. In this study, both males and females were equally affected.
3. Out of 50 cases, left eye was affected in 31 cases.
4. Majority of the patients were affected by phacolytic and phacomorphic glaucoma.
5. 32 patients had good vision in the unaffected eye. The good vision was the major factor besides the economical and familial factors in delaying in reporting for treatment of affected eye.
6. The aqueous protein level in lens-induced glaucoma was found to be higher than controls. There was no significant difference in the aqueous protein level between phacomorphic and phacolytic glaucoma.
7. Preoperative rise of intraocular pressure, accuracy of light projection and final visual recovery were related to the duration of glaucoma. A good functional recovery was obtained if the attack lasted less than 15 days beyond, which only a hand movement or perception of light could be recovered.

8. Extracapsular cataract extraction or small incision cataract surgery with posterior chamber IOL implantation alone is sufficient to reduce the IOP in lens-induced glaucoma of duration less than 7 days. In cases of duration of more than 7 days, a trabeculectomy has to be added. The need for trabeculectomy in lens-induced glaucoma needs further study.
9. The postoperative intraocular pressure control was better in cases with duration of attack of less than 3 days and worse if duration of attack was more than 10 days.
10. Lens-induced glaucoma is a pathological entity clinically easily recognisable, readily preventable and curable.

Age Incidence- Out of 50 cases of lens-induced glaucoma, the incidences of the entity in different group was as following.

Age in years	Number of Cases
Less than 45	1
45-50	5
51-55	6
56-60	13
61-65	12
66-70	8
71-75	2
76-80	2
More than 80	1

Table 1. Age Incidence

Sex- Out of 50 cases of lens-induced glaucoma, 26 were females and 24 were males.

Females	Males
26	24

Table 2. Sex

RE	LE	BE
18	31	1

Table 3. Laterality

Status of the Fellow Eye- Out of these 50 cases of lens-induced glaucoma, only one patient had lens-induced glaucoma with one eye phacolytic glaucoma and other eye phacomorphic glaucoma simultaneously.

Status of the Fellow Eye	Number of Cases	Percentage
Aphakia	2	4
Pseudophakia	30	60
Senile immature cataract	18	36

Table 4. Status of the Fellow Eye

Duration of Attack- The duration of attack of lens-induced glaucoma at presentation was less than 3 days in 18 cases, 6-10 days in 15 cases and 11-15 days in 8 cases.

Duration of Attack	Number of Cases
Less than 3 days	18
3-5 days	6
6-10 days	15
11-15 days	8
More than 15 days	3

Table 5. Duration of Attack

Patient's Complaints- All the patients were admitted for the complaints of severe pain, headache of varying severity. The visual accuracy at the time of admission varied from no perception of light, to perception of light to ability to distinguish hand movements and 1/60.

Sign	Number of Cases	Percentage
Shallow AC	24	48%
Corneal oedema	22	44%
Aqueous flare	22	44%
Pseudohypopyon	4	8%
Phacodonesis	12	24%
Deposits of lens	20	40%
Posterior synechiae	4	8%

Table 6. Local Examination

Intraocular Pressure- All 50 cases had high intraocular pressure. The intraocular pressure level varied markedly from 30-81 mm of Hg. Majority of patients had intraocular pressure in the range of 40-45 mm of Hg followed by 13 cases with a range of 35-40 mm of Hg. Highest pressure of 81.2 mm of Hg was found in 4 cases.

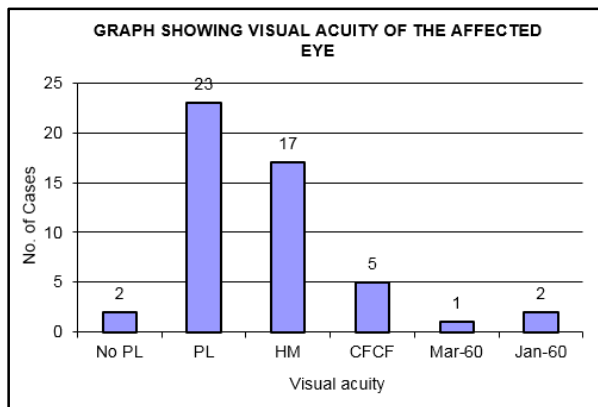
Intraocular Pressure mm of Hg	Number of cases
30-35	1
36-40	13
40-45	14
45-50	3
50-60	11
60-70	4
>80	4

Table 7. Intraocular Pressure

Visual Acuity- Visual acuity in both eyes was tested in all the patients. They were subjected to appreciation for Hand Movements (HM), Counting Fingers Close to Face (CFCF) and Perception of Light (PL) where the visual acuity was less. The visual acuity of the affected eye was as follows-

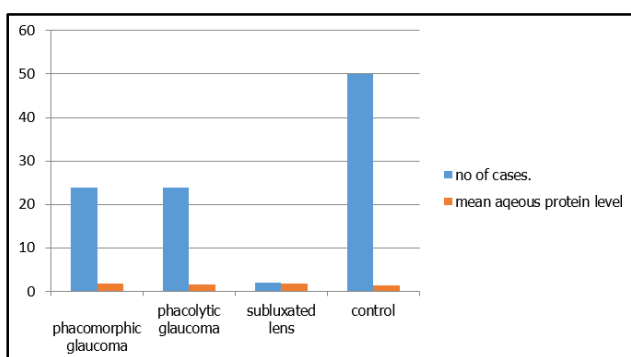
Visual Acuity	Number of Cases
No PL	2
PL	23
HM	17
CFCF	5
3/60	1
1/60	2

Table 8. Visual Acuity



Graph 1. Visual Acuity of the Affected Eye

Aqueous Protein Level- 0.2 mL of aqueous protein was sent for evaluation of total protein level by Biuret method from 50 cases and 50 controls.



Graph 2. Aqueous Protein Level

Type	Number of Cases	Mean Aqueous Protein Level (g/dL)
Phacomorphic glaucoma	24	1.8
Phacolytic glaucoma	24	1.7
Subluxated lens	2	1.8
Control	50	1.5

Table 9. Aqueous Protein Level

Type of Glaucoma	Open	Subtotal Angle Closure	Angle Closure	Not Shown
Phacolytic glaucoma	15	0	9	9
Phacomorphic glaucoma	0	11	13	0
Subluxated lens	2	0	0	0

Table 10. Gonioscopic Examination

Duration of Attack (Days)	Number of Eyes	>6/12	6/18 6/24	6/36 6/60	6/60 or Less	HM PL	NO PL
<3	18	10	4	2	1	0	0
3-5	6	4	1	1	0	0	0
6-10	15	2	5	6	1	1	0
11-15	8	1	3	2	1	1	0
>15	3	0	0	0	2	0	0

Table 13. Postoperative Visual Acuity

Type of Surgery Done- In the 50 cases of lens-induced glaucoma, if duration was more than 7 days, a trabeculectomy was added to the cataract extraction.

Type of Surgery	Number of Cases
ECCE with Trabeculectomy	2
ECCE with PCIOL	14
ECCE with PCIOL with Trabeculectomy	14
SICS with PCIOL	20

Table 11. Type of Surgery Done

Correlation between Duration, IOP and Visual Acuity

It was found that in cases with duration of attack of less than 3 days, the visual acuity was perception of light in 17 cases and no perception of light in 1 case out of 18 cases. In duration of attack more than 10 days, it was found that perception of light was present in 7 cases and absent in 1 case out of 8 cases. The average IOP in cases with duration of attack less than 3 days was found to be 43.5 mm of Hg, whereas in duration of attack more than 10 days, the average IOP was found to be 53.4 mm of Hg.

Duration of attack	No. of Cases	Average IOP Mm of Hg	Visual No PL	Acuity PL
<3 days	18	43.5	0	18
3-5 days	6	45.3	0	6
6-10 days	15	52.36	1	13
11-15 days	8	53.49	1	7

Table 12. Criteria

Postoperative Visual Acuity- It was found that in cases with duration of attack lasting less than 3 days (18 cases), the visual recovery was more than 6/12 in 10 cases, 6/18-6/24 in 4 cases, 6/36-6/60 in 2 cases and 6/60 in 1 case, whereas in cases where the duration of attack was more than 10 days (11 cases), the visual acuity was no PL in one case, PL in one case, 6/60 or less in 3 cases, 6/36-6/60 in 2 cases and 6/18-6/12 in 4 cases.

Visual Recovery in Eyes with Inaccurate Projection (?PL)

In 50 cases of lens-induced glaucoma, the visual acuity was inaccurate projection (?PL) in 2 cases. Among the 2 cases, the case in which the duration of attack of less than 3 days, the visual recovery was PL and in the case in which the duration of attack was more than 15 days, the visual recovery was no PL.

Duration of Attack (Days)	Number of Eyes	>6/12	6/18 6/24	6/36 6/60	<6/60	HM PL	NO PL
<3	1	0	1	0	0	0	0
3-5	1	0	0	1	0	0	0
6-10	9	2	2	3	1	1	0
11-15	7	1	1	2	2	1	0
>15	3	0	0	0	0	2	1

Table 14. Visual Recovery in Eyes with Inaccurate Projection (?PL)

Duration of Attack (Days)	Number of Eyes	Visual Acuity
6-10	1	6/24
11-15	3	6/18, 6/24/, 6/60
>15	3	CFCF, HM, NO PL

Table 15. Visual Recovery in Combined Surgery

Duration of attack (days)	Intraocular pressure	No. of cases
<7	17.3	30
7-10	20.8	14
>15	30.6	2

Graph 16. Postoperative Intraocular Pressure

DISCUSSION

50 cases of secondary glaucoma, induced by lens were studied to find out the various mechanisms by which lens can cause glaucoma.⁶ Among these various mechanisms by which lens can produce glaucoma, the phacolytic and phacomorphic types are the prime causes in the study of 50 cases. In this study of 50 cases, 36% of cases were represented by patients in the group of 51-60 years. According to Milton Flock et al, the majority of patients in their study of 138 cases were above 70 years. In this study, males and females were almost equally affected (M-24, F-26). The incidence of glaucoma in left eye was slightly higher than right eye. The unaffected opposite eyes were studied in all the cases and found them to be aphakic in 2 cases and pseudophakic in 30 cases. Among these 30 cases of pseudophakia, 25 cases were found to be having good vision. 48% of cases of this study were induced by phacolytic glaucoma, which is an open angle secondary glaucoma with the higher incidence in the age group of 51-60 yrs. 48% of secondary glaucoma in this study were caused by⁷ intumescent lens. The incidence was almost equal in both males and females, both right eyes and left eyes equally. Phacolytic glaucoma is a secondary open angle glaucoma caused by obstruction of the trabecular meshwork by protein laden macrophages and⁸ high molecular weight soluble lens protein. The aqueous protein level in lens-induced glaucoma was found to be higher than controls.⁹ Evaluation of the aqueous humour in phacolytic glaucoma by cytological studies and phase contrast microscopy has shown macrophages. The macrophages alone or with engulfed lens protein can cause obstruction at the trabecular meshwork, thus decreasing the outflow and causing a rise in IOP.

Epstein investigated the influence of high molecular weight soluble lens protein on the facility of outflow. It has been shown that¹⁰ cataract extraction alone is effective in relieving the raised IOP in phacolytic glaucoma. The clinical experience in our department is that cases with a long¹¹ duration of symptoms (or an inadequately controlled preop IOP) had a stormy postop course. They generally had high IOP that required multiple antiglaucoma medications.¹² A study addressing this issue found that the addition of a trabeculectomy prevents an uneventful postop period and decreases the amount of postop medication.

CONCLUSION

1. From this study, it appears clear that phacomorphic and phacolytic glaucoma are more common among the lens-induced glaucoma.
2. In patients with raised preoperative IOP, timely intervention after the control of IOP gives better visual recovery and also control of IOP.
3. Preoperative rise of IOP, accuracy of light perception and final visual recovery were related to the duration of glaucoma. A good functional recovery was obtained if the attack lasted less than 15 days beyond, which only a hand movement or perception of light could be recovered.
4. ECCE or11 SICS with PCIOL alone is sufficient to reduce the IOP in lens-induced glaucoma of duration less than 7 days. In case of duration more than 7 days, a trabeculectomy has to be added. The need for trabeculectomy needs further study.
5. The aqueous protein level in lens-induced glaucoma was found to be higher than controls.
6. It is always better to advice patients in postoperative period who have undergone cataract surgery in one eye to have periodic checkup of the other eye and also to advise the patient to report immediately as soon as the signs and symptoms of lens-induced glaucoma develop in other eye.
7. Attempts should be made to create awareness among paramedical ophthalmic assistants about the need for early surgery in mature and hypermature cataracts.

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