

Original Article

Lens-induced glaucoma - In a Tertiary Eye Care Center, Ethiopia

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Abstract

Background: Lens-induced glaucoma after untreated mature cataract is the commonest cause of secondary glaucoma in the developing world. The purpose of this study was to determine the common clinical features of lens-induced glaucoma, its management, and its outcome at Menelik II tertiary hospital, in Ethiopia.

Methods and Materials: This was a retrospective study of cases that were seen at the hospital from January to December 2020. Lens-induced glaucoma patients who undergo cataract extraction were included in the study. Medical charts review was performed, and analysis was done using SPSS version 24.0 Software.

Results: Forty-four lens-induced glaucoma patients were included in this study. Female participants were 65.9%. The mean age was 63.3(±Standard deviation (SD) 8.7) years. Phacomorphic glaucoma 88.6% was the leading cause. The common clinical symptoms identified were eye pain (100%), visual reduction (97.7%), and redness (38.8%). Visual acuity (3/60) or worse was reported in all patients with mean intraocular pressure of 37.3mmHg. After cataract surgery, the mean intraocular pressure reduced to 14.5± 6.55 mmHg while vision improved to better than 6/60 in 28 (63.6%) of patients. Of these, 21 (75%) patients seek medical treatment in the first two weeks of initial symptom.

Conclusion: This study has identified the main cause of LIG was phacomorphic with the common clinical findings of pain, redness, and visual reduction. Early cataract extraction was associated with better final visual recovery and intraocular pressure control. An intraoperative complication was often observed in those with delayed presentation. Therefore, creating awareness among the general population and healthcare givers is key to the timely management of lens-induced glaucoma.

Keywords: Glaucoma, Cataract, Phacomorphic, Intraocular pressure, Visual acuity

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Introduction

In Ethiopia blindness and low vision are major public health problems. A large proportion of low vision (91.2%) and blindness (87.4%) are due to avoidable (either preventable or treatable) causes. According to a 2006 national Ethiopian survey report, the prevalence of low vision was 3.7% and blindness was 1.6%. Cataract was the leading cause of both blindness (50%) and low vision (42%).^(1, 2)

Ethiopia burdens a larger number of cataract blindness, with an estimated backlog of 800,000 people. Only 70,000 Ethiopians receive cataract surgery each year, leaving hundreds of thousands waiting for surgery.⁽³⁾

Lens-induced glaucoma (LIG), also called lens-related glaucoma is one of the common causes of

secondary glaucoma in developing countries. It results from delayed cataract surgery which compromises the function of the optic nerve due to a rise in intraocular pressure. Elevated intraocular pressure (IOP) in lens-induced glaucoma has different mechanisms which include mechanical blockage of trabecular meshwork by lens particles or inflammatory cells, lens swelling/malposition from zonular weakness resulting in forward movement of iris lens diaphragm then secondary angle closure glaucoma finally resulting in permanent optic nerve damage and irreversible blindness.^(4, 5, 6) Even though timely cataract surgery is the absolute management to prevent LIG, there are multiple factors identified for delayed treatment which include low socio-economic status, distance from the service, relatively better vision in the other eye, and poor awareness. On the other hand, uneven

distribution of infrastructures, and personnel, insufficient attention, and provision from the government contribute to a lower cataract surgical rate in Ethiopia.⁽⁷⁻¹⁰⁾

Understanding the clinical presentation, the cause and the management outcome of LIG is important input in blindness prevention strategies.

Therefore, this study was done with the main aim of assessing the demographics, clinical features, and surgical outcomes of LIG patients at a tertiary referral hospital.

Materials and Methods

Study Design and Setting

A retrospective chart review of records of LIG patients was completed for those who underwent cataract surgery between January to December 2020, at Menelik II Hospital: a tertiary training eye care center in Addis Ababa, Ethiopia.

Sampling: Size Determination and Technique

Lens-induced glaucoma patients who visited the hospital from January 2020 to December 2020 were the study targets. All consecutive lens induced glaucoma patients during the study period, who fulfilled the inclusion criteria were enrolled in the study. Therefore, the study included 44 eyes of 44 patients.

Data Collection Instrument

Ophthalmic surgical registration logbooks were used to identify chart numbers of LIG patients during the study period and charts were collected from the hospital chart room by the responsible person. Eligible participants were screened after a detailed medical chart review.

Inclusion and Exclusion Criteria

Those who fulfilled all the inclusion criteria were involved in the study. The criteria include: 1) Age above 40, 2) Cataract with a rise in IOP causing symptoms like the acute onset of pain, redness, tearing, and progressive visual loss, 3) Slit lamp finding of intumescent, mature cataract, lens particles or lens displacement with raise IOP. 4) Who has undergone cataract extraction and had follow-up for at least 3 months. Exclusion criteria were: 1) known history of glaucoma diagnosis, 2) other secondary causes for glaucoma, and 3) Unclear diagnosis or incomplete data.

Data Collection Procedure

A data collection format was prepared and filled by the primary investigator for 1) Socio-demographic information 2) Clinical characters including presenting symptoms and duration at an initial hospital visit, distance visual acuity, IOP, and recorded findings from slit lamp bio-microscopy 3) Preoperative investigations like ocular biometry for axial lengths and preoperative medications, 4) Intraoperative findings and the type of surgical procedures 5) Postoperative

findings and managements at 1st postoperative day, 1st week, and 3rd month (at discharge).

Operational Definitions: LIG was defined as the presence of elevated IOP in a setting of lens-related problems. Based on the condition of the cataractous lens LIG is further classified as phacomorphic glaucoma, phacolytic glaucoma, Phacoanaphylactic, and LIG due to lens malposition. Cases were diagnosed as phacomorphic glaucoma in the presence of pain, redness, and signs of corneal edema, shallow anterior chamber, intumescent lens, and elevated IOP > 21mmHg. Phacolytic glaucoma was defined by hypermature cataracts with an undisrupted anterior lens capsule with lens protein and flare in the anterior chamber. The diagnosis of a subluxated/dislocated lens was made after examining the position of the lens with a slit lamp. The delayed presentation was defined as seeking health care service after two weeks of the onset of symptoms.^(18, 20, 22)

Data quality control and analysis

The principal investigator revised each data for completeness and entered it into SPSS version 24 software to compute descriptive statistics like frequencies, percentages, mean and standard deviations. P-values less than 0.05 were considered statistically significant.

Result

Forty-four patients with lens-induced glaucoma who had undergone cataract surgeries were included in the study. Fifteen (34.1%) were male and 29(65.9%) were female. The mean \pm SD age was 63.3 ± 8.7 years (range, 45-80) and the majority were (45.5%) between 61-70 years. Most of the patients 37(84.1%) were residents of Addis Ababa, a capital city.

Phacomorphic glaucoma was the major type of LIG (39, 88.6%), followed by subluxated/dislocated lens (4, 9.1%) and phacolytic glaucoma (1, 2.3%).

The main clinical symptoms were eye pain (100%), reduced vision (97.7%), redness (38.8%), headache (22.7%), and nausea (2.3%). The time gap between initial symptoms to seeking medical help was recorded in weeks. Fifteen (34.1 %) patients looked for treatment in less than one week, 17(38.6%) came within 1-2weeks, 7(15.9%) were presented within 2-4 weeks while 5(11.4%) had symptoms for more than one month before the hospital visit.

Snellen's visual acuity records of all patients were less than 3/60 at the initial presentation. Of them, 91% had visual acuity of hand motion or light perception.

The intraocular pressure range at the initial hospital visit was from 23 to 66 mm Hg with a mean IOP of 37.3 ± 10.29 mmHg. A large number of patients (75 %) recorded an IOP greater than 31 mm Hg at their first visit. Reduction of IOP less than 20 mm Hg was attained in 31 (70.5%) eyes after the first week of cata-

tract surgery. On the last follow-up visit (3 months from cataract surgery), 39(88.6%) eyes were free of medication with IOP below 20 mm Hg and one patient had to use a single topical hypotensive drug. Four eyes remained with uncontrolled high IOP despite the use of two or more topical anti-glaucoma medications. The mean postoperative IOP at discharge was 14.5 ± 6.55 mmHg. (**Table 1**)

Table 1 Intraocular Pressure Before and After Cataract Extraction of LIG Adults Who Received Cataract Surgery at Menelik II Hospital, 2020 (n=44)

IOP interval in mmHg	Preoperative at the initial visit		Post-operative at discharge	
	Patient No.	Percent	Patient No.	Percent
0-20	0	0	39	88.6
21-30	11	25	3	6.8
31-40	18	40.9	1	2.3
41-50	11	25	1	2.3
51-60	1	2.3	0	0
>60	3	6.8	0	0
Total	44	100	44	100
Range	23-66mmHg		6-41mmHg	
Mean	37.3 mmHg		14.55mmHg	

LIG, Lens-Induced Glaucoma; IOP, Intraocular Pressure.

As part of preoperative evaluation and preparation, the value of axial length measurement was possible to obtain for 40 patients with a mean value of 22.9 ± 1.13 mm (Range, 20.65mm to 25.00mm). Even though 9 eyes had axial lengths below 22.00mm, this was not statistically significant when seen with the type of LIG. ($p=0.1$)

At the initial visit, all patients were given preoperative topical steroids to control inflammation. The majority of them, 42(95.5%) also received topical hypotensive drops preoperatively and 31 (70.5%) needed additional systemic hypotensive medication (acetazolamide tablets) to lower their eye pressure before surgery.

Cataract extraction surgery was done for all patients with or without intraocular lens implantation. Manual small incision cataract extraction procedure was the choice for 38(86.4%) eyes while extracapsular cataract extraction was done for 6 eyes (13.6%). Thirty-

six (82%) patients had IOL implantation at the posterior chamber while 8(18%) eyes remained aphakic because of poor posterior capsular support and vitreous loss.

Data on the status of the fellow eye was also obtained from the record. Nine eyes (20.5%) were pseudo-phakic with visual acuity from 6/60 to 6/9 and 8 (18.1%) eyes had NLP due to trauma, complicated previous cataract surgeries, and non-operated complicated cataract in 2, 2, and 4 eyes respectively. Immature and mature cataract was documented in 25 and 2 eyes respectively. Those who were bilaterally blind due to either absolute blindness (NLP) or mature cataract in the fellow eye gained postoperative vision better than 6/60 in the affected LIG eye.

In this study, unaided visual acuity at 3 months postoperative follow-up was better than 6/18 in 6(13.6%) of patients. Half (50%) of patients had Snellen's distance visual acuity between 6/18-6/60 at the end of their follow-up. Visual acuity of below 3/60 was recorded in 15 patients (34.1%) due to aphakia with persistent corneal edema in 6 patients and glaucomatous optic nerve damage in 7 patients. The cause of low vision was unrecorded in two patients. (**Table 2**)

Table 2 Preoperative and Postoperative Visual Acuity of Eyes with Lens-Induced Glaucoma of Adults Who Underwent Cataract Extraction, 2020 (n=44)

Snellen's Visual Acuity	Preoperative (Initial visit)	Post-operative at discharge (3 months/ last follow-up)
NLP	0 (0%)	0 (0%)
LP	32 (72.7%)	3 (6.8%)
<3/60-HM	12 (27.3%)	12 (27.3%)
3/60-<6/60	0 (0%)	1 (2.3%)
6/60-<6/18	0 (0%)	22 (50%)
6/18-6/6	0 (0%)	6 (13.6%)
Total	44 (100%)	44 (100%)

LIG, Lens Induced Glaucoma; NLP, No Light Perception; LP, Light Perception; HM, Hand Motion

Out of 28 cases who regained distance visual acuity of 6/60 or better at the end of their follow-up, 21 (75%) were presented within 2 weeks of the onset of symptoms. An early hospital visit and relatively lower initial IOP was seen in eyes with better visual acuity at the end of their follow-up. (**Table 3, 4**)

Table 3 Snellen's Visual Acuity at last follow up in Relation to The Duration of Symptom at Presentation of LIG Adults Who Received Cataract Surgery at Menelik II Hospital, 2020 (n=44)
LIG, Lens-induced glaucoma.

Duration of symptoms at the initial visit	Visual acuity at discharge/ last visit and number of eyes			
	6/6-6/18	<6/18-6/60	<6/60-3/60	<3/60
< 1 week	4	7	0	4
1-2 weeks	2	8	0	7
>2-4weeks	0	5	0	2
>1 month	0	2	1	2
Total	6	22	1	15

Table 4 The Relationship Between Preoperative IOP at Presentation and Final Visual Acuity at Three Months of Lens-Induced Glaucoma Adults Who Received Cataract Surgery at Menelik II Hospital, 2020 (n=44)

Preoperative IOP at presentation (mmHg)	Visual acuity at discharge (3 months) and number of eyes			
	6/6-6/18	<6/18-6/60	<6/60-3/60	<3/60
21-30	4	3	1	3
31-40	2	8	0	8
41-50	0	7	0	4
51-60	0	1	0	0
>60	0	3	0	0
Total	6	22	1	15

LIG, Lens induced glaucoma; IOP, Intraocular pressure.

Cataract extraction was uneventful in 29(65.9%) of patients. The major intraoperative complications observed were zonular dialysis in 8 (18.2%), posterior capsular rent with/without loss of vitreous in 4(9.1%), and poor pupillary dilation in 3(6.8%). Delayed presentation greater than 2 weeks was observed in 42% of cases with intraoperative complications. Ten (66.7%) of cases with these intraoperative complications had final visual acuity below 3/60. (p=0.00)

The most common early postoperative complication was striate keratopathy which was documented in 35 (79.5%), anterior segment inflammation in 6(13.7%), and cortical remnant in 3 (6.8%). Some of the late complications include persistent edematous cornea in 4 eyes besides uncontrolled high intraocular pressure in four eyes.

Discussion

This study assessed the overall clinical presentation of patients with LIG including, level of distance vision and IOP change before and after cataract extraction along with intraoperative and postoperative complications.

From the study result females' predominance was observed over males 29 (65.9%), which is parallel to studies by Shrestha et al (57%), I.S.V.S et al (58%), and Rajkumar P. (62.3%). This might be explained by the poor medical-seeking behavior of older women, and social, cultural, and economic constraints. Another reason for female predominance could be the anatomic predisposition of females with shallow anterior chambers for the development of LIG. (5, 6, 11)

LIG is a disease of elderly people related to the formation of cataracts and its complications. This fact was also seen in this study occurring at the mean age of 63.3 years. Studies by Shrestha, Jarwal PN, and Sharanabasamma have also reported the mean age of affected people as 61.1-year, 61.6-years and 60.8 years respectively. (5, 12, 13)

Phacomorphic glaucoma was the most common cause in (88.6%) of our study in agreement with other studies from southern India (78. %), Rijal et al (65%), and Pradhan et al (72%). (14-16)

Subluxed /dislocated lens was higher in this study (9.1%) than with I.S.V.S et al (2%) and Rajkumar et al (2.7%) since our study included trauma-related lens displacement, unlike the other reports. (6, 11)

The mean IOP at the initial visit was 37.27mmHg which correlates with studies by R. Ramakrishnan et al (mean 38.4mmhg) and Shrestha R et al (mean 42.74 mmHg). Many patients (88.6%) had post-operative IOP below 20mmHg with no medication. This explained the cause of high IOP was lens related and its removal will result in IOP control. Similar results were obtained from studies led by Yaakub et al and Sharanabasamma with mean IOP 15.2mmHg and 15.6mmHg respectively. (5, 13, 17, 18)

In our study, all patients had initial Snellen's visual acuity in the category of blindness. The light perception was seen in 72.7% and visual acuity was worse than 3/60 in 27.3%. Similar findings were reported by Raghunandan K. and Mohindar S that reported LP in 78.0% and 90% respectively. The low visual acuity at presentation was attributed to corneal edema and cataractous lens. (19-21)

The Snellen's visual acuity (uncorrected) after three months of cataract surgery has been reported 6/18 or superior only in 13.6% of eyes, 6/60-<6/18 in 22 (50%) cases, and below 3/60 in 15(34.1%). The reason for lower visual acuity was surgical aphakia, per-

sistent edematous cornea, and glaucomatous optic neuropathy. Additionally, this lower vision could be explained by the fact that the final visual acuity taken was uncorrected.

In this study, the common postoperative complications were striate keratopathy in 79.5%, inflammation in 13.7%, posterior capsular rent with loss of vitreous in 9.1%, and cortical fragments in 6.8%. Similar findings were reported by Raghunandan K. and Venkataratnam with posterior capsular tear at 10% in both studies, cortical remnants at 6.0% and 12%, and inflammation at 33.3% in both studies. A higher percentage of striate keratopathy was reported in our study than in these studies which reported 24.6% and 26% respectively. This higher level of striate keratopathy in our study was associated with initial corneal edema and shallow anterior chamber at the initial hospital visit which was observed in 68% and 95.5% of cases respectively.^(14, 17, 20)

Glaucomatous disc damage (VCDR > 0.7) was observed in 29.5% of eyes which correlates with 34.0% of D Pradhan et al study. Higher IOP >31mmHg at presentation contributed to 69% of optic atrophy in our study with $p=0.64$.⁽¹⁶⁾

Despite the painful nature of the disease, delayed presentation was seen in 12 patients. This could be due to the acceptance of poor vision as aging which is seen in 25% of bilaterally blind patients. The presence of better vision in the fellow eye also contributes to delayed presentation in 18% of pseudophakic fellow eyes. Other factors include poor health education, fear of operation, lesser expectations, socio-economic constraints, waiting for the cataract to get matured, misdiagnosis, and a delayed referral system.

Conclusion

This study has identified the main cause of LIG was phacomorphic with the common clinical findings of pain, redness, and visual reduction. Early cataract extraction was associated with better final visual recovery and intraocular pressure control. Intraoperative complications were often observed in those with delayed presentation. Therefore, creating awareness

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among the general population and healthcare givers is key to the timely management of lens-induced glaucoma.

Limitation of the Study

As this study was a retrospective study it was a challenge to get complete data on the clinical profile of patients which leads to a higher rate of exclusion of samples. The sample size was small to generalize, and it was also difficult to identify the factors associated with the delayed presentation of patients.

Abbreviations

HM, Hand Motion; IOP, Intraocular Pressure; LIG, Lens Induced Glaucoma; LP, Light perception, NLP, No Light Perception; PMG, Phacomorphic glaucoma.

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Ethical Consideration

The study proposal was presented and submitted to the Research and Publication Ethics Committee of Addis Ababa University and approval was obtained. The study was done in agreement with the declaration of Helsinki. All patient data were kept confidential.

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