

ORIGINAL ARTICLE

Visual Outcome of Lens-induced Glaucoma versus Control after Cataract Surgery with Intraocular Lens Implantation: A-5-year Registry Study in East Coast of Peninsula Malaysia

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ABSTRACT

Introduction: To compare cataract surgery outcome between lens-induced glaucoma (LIG) and control group. **Materials and methods:** Data extracted from National Eye Database of cataract surgery performed between 2018 and 2022 in Kelantan and Terengganu. LIG group were among phacomorphic & phacolytic glaucoma whereas control group were among senile cataract. Patients with other ocular comorbidity and missing postoperative data were excluded. Good visual acuity outcome was defined as best corrected visual acuity (BCVA) 6/12 or better at 6 weeks onwards postoperatively. **Results:** Sixty-six eyes of LIG cases were included, where 42 eyes were phacomorphic and 24 eyes were phacolytic. The control group comprised 69 eyes. Mean ages for the LIG and control groups were 65.24±12.23 years and 65.97±9.12 years, respectively ($p = 0.695$). Preoperative VA showed that 95.5% of LIG cases had vision worse than 3/60, compared to only 42.0% in the control group. Surgical durations were significantly longer in the LIG group (46.10±20.53 minutes) compared to the control group (31.12±13.67 minutes) ($p < 0.001$). The mean postoperative logMAR BCVA was higher in the LIG group (0.69±0.84) than in the control group (0.10±0.14) ($p < 0.001$). Good VA was achieved in 95.7% of the control group versus 53.0% of the LIG group ($p < 0.001$). LIG patients exhibited a 19.49 times higher risk of poor postoperative visual outcome compared to controls. Operative complications recorded only in LIG group, comprising posterior capsule rupture (19.7%), zonulysis (7.6%), and corneal edema (1.5%). **Conclusion:** LIG patient experienced longer surgical durations, more complications and poorer visual outcomes.

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INTRODUCTION

Lens induced glaucoma (LIG) is a secondary glaucoma that can be either opened or closed angle. The closed angle subtype can be due to lens swelling (phacomorphic glaucoma) or lens dislocation (ectopia lentis). The opened angle subtype can be due to obstructed trabecular meshwork by lens material leaking from an intact capsule of hypermature cataract (phacolytic glaucoma) or lens material liberated from a traumatically or surgically injured lens (lens particle glaucoma) and hypersensitivity to own lens protein following surgery or penetrating trauma (phacoantigenic glaucoma) (1). In developing countries, the most

prevalent subtypes are phacomorphic and phacolytic glaucoma in which neglected senile cataract is the main culprit. In India, few studies demonstrated proportion of phacomorphic glaucoma were between 66.7% to 86% whereas phacolytic glaucoma was between 14.0% to 30.0% of LIG cases (2–4). In Malaysia, proportion of phacomorphic glaucoma was between 65.8% to 73.7% whereas phacolytic glaucoma was between 21.1% to 34.2% of LIG cases (5,6).

The ultimate effect of the above-mentioned mechanism of LIG is impairment of aqueous outflow and eventually acute rise in intraocular pressure (IOP). Immediate cataract surgery after adequate medically controlled IOP is the definitive treatment (1). However, the visual outcome might be suboptimal and higher risk of intra and postoperative complication in comparison to elective cataract surgery because of associated pre-existing intraocular inflammation and possible optic

nerve compromise due to prolonged elevated IOP.

Several studies reported that post operative visual acuity of 6/12 or better among LIG cases were between 44% to 56.25% (2,7). Mean postoperative Logarithm of the Minimum Angle of Resolution (logMAR) were reported between 0.34 to 0.42 (4,8) which equivalent to Snellen visual acuity (VA) of 6/12 to 6/18. However, these reported visual outcomes were not compared to a control group. Comparing the postoperative visual outcome of LIG case with no ocular comorbid cases will provide better understanding about the magnitude of its morbidity.

The objective of this study is to compare mean postoperative logMAR and proportion of good postoperative VA between LIG and control group (elective cataract surgery) who have no ocular comorbid preoperatively. Other than that, this study also aims to estimate the risk of poor postoperative visual outcome in LIG cases in relation to control.

MATERIALS AND METHODS

This is a retrospective cohort registry study. The data was retrieved from a web-based Malaysian Cataract Surgery Registry. Consent was not taken as the data from the registry was recorded without patient identifier. This study was approved by the Institutional Ethics Committee (NMRR ID-24-01622-SAB) and adhered to the tenets of the declaration of Helsinki. Data of cataract surgery performed from January 2018 to December 2022 at east coast of Peninsular Malaysia (Kelantan & Terengganu) were identified.

A convenient sampling method was applied to include all patients that was labelled as phacomorphic & phacolytic for the LIG group as other LIG subtype were not captured in our registry. The control group was among elective senile cataract surgery cases and was sampled via systematic random sampling to give a ratio of 1:1 between groups. For both groups, exclusion criteria were age less than 40-year-old, presence of other ocular comorbidity, missing postoperative VA and without intraocular lens implantation.

Demographic, preoperative, intraoperative, and postoperative data were analyzed. The primary outcome is postoperative best corrected VA (BCVA) measured at 6 weeks onward postoperatively in the form of Snellen acuity chart and was converted to logMAR value for data analysis. The Snellen VA and its logMAR equivalent is shown in Table I. Good VA outcome was defined as those that achieved BCVA of 6/12 and better at 6 weeks and onwards postoperatively.

Table I: Snellen VA with equivalent logMAR value

Snellen VA	logMAR
6/6	0.00
6/9	0.22
6/12	0.30
6/18	0.50
6/24	0.60
6/36	0.80
6/60	1.00
5/60	1.10
4/60	1.22
3/60	1.30
2/60	1.52
1/60	1.60
Counting finger	2.00
Hand movement	3.00
Perception of light	3.00
No Perception of Light	3.00

Statistical analysis was performed using IBM SPSS Statistics 26.0. Continuous variables were summarized as mean and standard deviation (SD), whereas categorical variables were summarized as frequency and percentage. Normality testing was checked prior statistical analysis. The Pearson chi-squared test was used to compare categorical variables. The independent t test was used to compare continuous variables. Odd ratio with 95% confidence interval (95% CI) were reported as risk estimation outcome of interest. P-value less than 0.05 is considered significant.

RESULTS

A total of 12703 eyes that underwent cataract surgery from January 2018 to December 2022 at east coast of Peninsular Malaysia (Kelantan & Terengganu). Eighty-seven of them (0.68%) were phacomorphic and phacolytic glaucoma. Out of 87 eyes, 66 eyes were included as LIG group after the exclusion criteria. Out of 66 eyes, 42 eyes (63.6%) were phacomorphic and 24 eyes (36.4%) were phacolytic glaucoma. For the control group, systematic random sampling was performed over the included subject with a sample size of 69 eyes.

Demographic, preoperative, intraoperative and postoperative data of LIG and control group were presented in Table II. Both groups showed mean age of 65-year-old with male to female ratio of 1:1. The proportion of first eye being operated was significantly higher (p = 0.043) in LIG than control group (75.8% vs 59.4% respectively). Preoperatively, 95.5% of LIG group came with blind vision (VA worse than 3/60) as compared to control group that showed bimodal distribution; 39.1% with VA 6/24 to 6/60 and 42.0% with blind vision.

Table II: Demographic and operative data in LIG and control group

Characteristic	LIG (n=66) n (%)	Control (n=69) n (%)	p-value
Age	65.24 (12.23) *	65.97 (9.12) *	0.695 ^a
Gender			
Male	32 (48.5)	34 (49.3)	0.927 ^b
Female	34 (51.5)	35 (50.7)	
Surgery on			
First eye	50 (75.8)	41 (59.4)	0.043 ^b
Second eye	16 (24.2)	28 (40.6)	
Preoperative UCVA			
6/12 and better	0	2 (2.9)	
6/18	0	6 (8.7)	
6/24 to 6/60	2 (3.0)	27 (39.1)	<0.001 ^b
5/60 to 3/60	1 (1.5)	5 (7.2)	
2/60 and worse	63 (95.5)	29 (42.0)	
Type of surgery			
Phacoemulsification with IOL	21 (31.8)	62 (89.9)	<0.001 ^b
ECCE with IOL	38 (57.6)	6 (8.7)	
ICCE with IOL	7 (10.6)	1 (1.4)	
Duration of surgery (minutes)	46.10 (20.53) *	31.12 (13.67) *	<0.001 ^a
Intraoperative complication			
PCR with or without vitreous loss	13 (19.7)	0	0.010 ^b
Zonulysis	5 (7.6)	0	0.020 ^b
Central corneal edema	1 (1.5)	0	0.305 ^b
Post operative BCVA			
6/12 and better	35 (53.0)	66 (95.7)	<0.001 ^b
6/18 and worse	31 (47.0)	3 (4.3)	

LIG = Lens induced glaucoma, UCVA = Uncorrected visual acuity, BCVA = Best corrected visual acuity, ECCE = Extracapsular cataract extraction, ICCE = Intracapsular cataract extraction, IOL = Intraocular lens, PCR = Posterior capsular rupture

^aIndependent sample t-test applied, $\alpha = 0.05$

^bPearson chi-square test applied, $\alpha = 0.05$

*Mean (SD)

P-value < 0.05, significant

Extracapsular cataract extraction (ECCE) with IOL implantation was the higher number of cataract surgery performed in LIG group (57.6%) as compared to control group. On the other hand, phacoemulsification with IOL implantation (89.9%) was the main type of cataract surgery in control group. Mean duration of surgery was significantly longer in LIG group as compared to control group, 46.10 (± 20.53) minutes and 31.12 (± 13.67) respectively ($p < 0.001$). Intraoperative reported complication in LIG group were posterior capsular rupture with or without vitreous loss (19.7%), zonulysis (7.6%) and central corneal edema (1.5%). However, there was no reported complication in control group.

Postoperative BCVA outcome showed favourable outcome in control group in which 95.7% achieved BCVA 6/12 and better postoperatively as compared to

LIG which only 53.0% ($p < 0.001$) (Table II). In subgroup analysis of LIG cases only, those who underwent manual cataract extraction showed 50% of good and 50% of poor postoperative outcome. In contrast, those who underwent phacoemulsification showed 90.4% of good and 9.6% of poor postoperative outcome.

The mean postoperative logMAR BCVA was significantly better in control group, 0.10 ± 0.84 (Snellen BCVA 6/6 to 6/9) compared to LIG group, 0.69 (Snellen BCVA 6/24 to 6/36) ($p < 0.001$) (Table III). Subgroup analysis among LIG group showed that there was no significant difference of mean postoperative logMAR BCVA between phacomorphic and phacolytic glaucoma, 0.71 ± 0.80 and 0.65 ± 0.92 respectively ($p = 0.766$) (Table III).

Table III: Comparison of mean postoperative logMAR BCVA between groups

Group (n)	Mean (SD)	Mean difference (95% CI)	t-statistic ^a (df)	p-value
LIG vs Control				
LIG (n=66)	0.69 (0.84)			
Control (n=69)	0.10 (0.14)	0.59 (0.39, 0.79)	5.75 (133)	<0.001
LIG subgroup				
Phacomorphic (n=42)	0.71 (0.80)			
Phacolytic (n=24)	0.65 (0.92)	0.06 (-0.37, 0.50)	0.30 (64)	0.766

LIG = Lens induced glaucoma

^aIndependent t-test was applied

P-value < 0.05, significant

For the risk of poor vision postoperatively (BCVA 6/18 and worse), LIG cases has 19.49 higher odds of having poor visual outcome compared to the control group ($p < 0.001$) (Table IV). In subgroup analysis, the proportion

of patient who achieved poor vision postoperatively higher in phacomorphic group (71.0%) compared to phacolytic group (29.0%) (Table IV).

Table IV: Association between group and visual outcome

Group	Visual outcome		OR (95% CI)	χ -statistic ^a (df)	p-value
	6/18 and worse n (%)	6/12 and better n (%)			
LIG vs Control					
LIG	31 (91.2%)	35 (34.7%)	19.49	32.52 (1)	<0.001
Control	3 (8.8%)	66 (65.3%)	(5.56, 68.28)		
LIG subgroup					
Phacomorphic	22 (71.0%)	20 (57.1%)	-	1.36 (1)	0.244
Phacolytic	9 (29.0%)	15 (42.9%)			

LIG = Lens induced glaucoma
^aPearson Chi-square test applied
 P-value < 0.05, significant

DISCUSSION

This study evaluates the outcome of cataract surgery with intraocular lens implantation among LIG group. The outcome was compared to the control group which among the senile cataract that underwent cataract surgery electively. The postoperative visual outcome in LIG group was poorer in comparison to control group. In addition to that, LIG group has higher intraoperative complications.

In Malaysia, rate of LIG (phacomorphic + phacolytic glaucoma) was ranged from 0.43% to 0.63% per year for the past 15 years (10). The rate of LIG in our study was 0.68% which is slightly higher compared to the national level. More effort is recommended at our area to expand the cataract surgery outreach program that has been established.

Our study showed similar pattern of presentation among LIG patient compared to other study from local and abroad (2–9). The mean age was ranged from 60- to 70-year-old. There is higher proportion among female and phacomorphic type. Neglected cataract was shown by 95.5% of them presented with vision worse than 3/60 in our study which is considered late presentation for cataract surgery. This trend is comparable with a study done in India where 91.7% of them presented with VA of hand movement and worse (7).

Intraoperatively, most of LIG cases (68.2%) underwent manual cataract extraction but 31.8% of them had underwent phacoemulsification. Given the presence of intraocular inflammation and compromised media clarity, manual cataract extraction was deemed the preferable approach for managing LIG cases. Intraoperative complication that were recorded in our study were PCR with or without vitreous loss, zonulysis and central corneal edema. Other complication that were reported from other studies were severe anterior chamber inflammation, hyphema, wound leak, nucleus drop, IOL drop and descemet membrane detachment (7,8).

LIG imposed significant ocular morbidity despite receiving definitive therapy. The post operative visual outcome was suboptimal. LIG has 19.49 higher risk of poor vision postoperatively (VA 6/18 and worse). This condition was further elucidated when only about half of them (53%) achieved good vision postoperatively compared to 95.7% in control group. This is comparable with other studies where proportion of LIG cases that achieved good postoperative VA ranged from 44.0% to 56.3% (2,7). The causes of decreased vision in LIG cases after cataract surgery has been reported to be due to glaucomatous optic neuropathy, aphakic bullous keratopathy, non-glaucomatous optic neuropathy, macular scar, full thickness macular hole and epiretinal membrane (7).

The retrospective nature of this study constitutes a limitation, as it hindered the retrieval of comprehensive data on intraocular pressure and various subtypes of LIG, including ectopia lentis, lens particle glaucoma, and phacoantigenic glaucoma, due to their absence from the registry. Furthermore, post-operative ocular examination findings were not documented in the registry, thereby precluding the identification of specific causes of diminished visual acuity. To achieve a comprehensive understanding of LIG cases, a prospective study is warranted in the future.

CONCLUSION

LIG patients showed a longer duration of surgery, poorer visual outcome and higher risk of operative complication compared to the control group. Therefore, public education and outreach cataract surgery need to be expanded to increase cataract surgery uptake in community. Hence, reduce the incidence of LIG in future.

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