ORIGINAL ARTICLE

Two-year retrospective review of lens-induced glaucoma in Hospital Taiping, Perak, Malaysia

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ABSTRACT

Introduction: Delayed cataract surgery has long been known to cause lens-induced glaucoma (LIG). This study examined the demographic and clinical profile, ocular characteristics and outcomes of LIG in a tertiary referral centre in Malaysia.

Materials and Methods: Data from the National Eye Database (Malaysia) for cataract surgery performed at Hospital Taiping, Perak, between January 2019 and December 2020 were reviewed. The medical records of patients with LIG were retrieved to obtain demographic data, clinical profiles and visual outcomes.

Results: Of 3233 patients who underwent cataract surgery at Hospital Taiping, Perak, between 2019 and 2020, 25 underwent emergency surgery for LIG. However, only 24 patients fulfilling the diagnostic criteria for LIG were included in the study: 14 (58.33%) patients with phacomorphic and 10 (41.6%) patients with phacolytic glaucoma. The mean age of the patients was 66±12 years. Women and men were equally affected. Most patients were Malay (75%), followed by Chinese (16.67%) and Indian (8.33%). The anterior chamber depth (ACD) was significantly shallow with a mean value of 2.72 mm. Nineteen (79.1%) patients presented with visual acuity of worse than counting fingers. The mean intraocular pressure (IOP) at presentation was 47.5±13.66mmHg, which improved to 15.08±8.09mmHg postoperatively. A best-corrected visual acuity of 6/15 and better was achieved in 20 patients (83.33%) despite glaucomatous optic neuropathy being present in 41.67% of the cases. The majority (58.3%) of surgeries were performed via extracapsular cataract extraction, while six (25%) of our patients underwent successful phacoemulsification. Seven (29.17%) patients had intraocular complications: five with zonular dialysis and two with posterior capsule rupture. Of these seven cases, four ended up with intracapsular cataract extraction, leaving two of them aphakic.

Conclusion: Prompt cataract surgery is paramount in all LIG cases to reduce IOP and achieve better visual outcomes. Despite the promising prognosis associated with early surgical intervention, patients should be counselled about the potential for a guarded visual prognosis from complicated surgery and its long-term complications.

KEYWORDS:
Lens-induced glaucoma, phacomorphic glaucoma, phacolytic glaucoma, glaucomatous optic neuropathy

INTRODUCTION

Cataract is a leading cause of blindness worldwide. Despite significant visual impairment caused by delayed cataract surgery, cataract surgeries are nonacute and elective.[1,2] Cataracts have the potential to advance into mature, intumescent or hypermature stages, resulting in lens-induced glaucoma (LIG).[1] LIG is a secondary type of glaucoma that requires immediate attention and management to prevent blindness.[3,4] A sudden significant intraocular pressure (IOP) elevation in LIG eventually mechanically damages the optic nerve, leading to blindness if treatment is delayed or left untreated.[5]

The primary mechanism responsible for elevated IOP in LIG can be distinct. In phacomorphic glaucoma, aqueous humour obstruction occurs through secondary angle closure and pupillary block.[6] This is caused by the swelling of the cataractous lens, which pushes the iris forward, resulting in the blockage of the trabecular meshwork.[7] Meanwhile, the high IOP in phacolytic glaucoma is contributed by protein leakage through the intact capsule of a hypermature cataract with resultant intense anterior chamber (AC) inflammation.[7] The diagnosis of LIG is typically established by observing classical symptoms such as eye pain, redness, headache and reduced vision, coupled with an IOP exceeding 21 mmHg.[2-5] Additionally, characteristic signs include evidence of a unilateral shallow AC depth (ACD), a fixed dilated or sluggish pupil and the presence of an intumescent cataract in cases of phacomorphic glaucoma.[2,3] In phacolytic glaucoma, diagnosis is indicated by the presence of a hypermature morgagnian cataract with an intact capsule, along with a normal or deep anterior chamber containing floating lens particles and flare.[7,8]

This retrospective study emphasised the importance of early diagnosis and treatment and examined its outcomes.

MATERIALS AND METHODS

This retrospective study included patients who underwent cataract surgery at Hospital Taiping, Perak, Malaysia, between January 2019 and December 2020. Data for cataract surgeries were retrieved from the National Eye Database (Malaysia). All patients with LIG who underwent emergency cataract surgery at our hospital were included. Patients with primary or secondary glaucoma due to other causes than LIG or traumatic cataract or those with poor general condition that made them unfit for surgery were excluded from this

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Table I: Demographic data of patients with lens-induced glaucoma.

Variable	Frequency (n)	Percentage (%)
Age (years)		
Mean±SD	66±12	
Range	43-91	
Age group		
40–49	1	4.16
50–59	6	25
60–69	7	29.17
>70	10	41.67
Gender		
Male	13	54.1
Female	11	45.83
Race		
Malay	18	75
Chinese	4	16.67
Indian	2	8.33

Table II: Clinical profile of lens-induced glaucoma.

Clinical profile	Frequency (n)	Percentage (%)
Type of LIG		
Phacolytic	10	41.7
Phacomorphic	14	58.3
Symptom duration		
<1 week	15	62.5
1–2 weeks	3	12.5
3–4 weeks	4	16.6
>4 weeks	2	8.33
Waiting time for operation		
<1 week	13	54.1
1–2 weeks	10	41.7
>2 weeks	1	4.2
Type of surgery		
Phacoemulsification	6	25.0
ECCE	14	58.3
ICCE	4	16.7
BCVA (At presentation)		
6/60	4	16.7
Counting finger	1	4.2
Hand movement	11	45.8
Perception of light	8	33.4
BCVA (postoperative)		
6/6–6/15	20	83.3
6/18–6/60	1	4.2
<6/60	3	12.5
IOP		
At presentation (mmHg)		
Mean±SD	47.5±13.66	
<40	7	29.2
>40	17	70.8
Postoperative (mmHg)		
Mean, years, ± SD	15.08±8.09	
<21	21	87.5
>21	3	12.5

Abbreviations: LIG: Lens-induced glaucoma; ECCE: Extracapsular cataract extraction; ICCE: Intracapsular cataract extraction; BCVA: Best-corrected visual acuity; IOP: Intraocular pressure

study. We also excluded patients with subluxated and dislocated lenses due to incomplete data.

Data were recorded in terms of age, gender, race, comorbidities, visual acuity (VA), ACD, corneal condition, IOP recording using Goldmann applanation tonometry, A-scan result and postoperative refraction. The duration between symptoms and surgery was also recorded. Initial IOP was controlled using oral acetazolamide and topical antiglaucoma agents. Then, patients were scheduled for cataract extraction as soon as possible under emergency list. Postoperatively, IOP was measured on day-1, day-5 and week-6. Refraction was performed 4 to 6 weeks postoperatively to obtain the best-corrected VA (BCVA). Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 27. Descriptive statistics were used to summarise the patients' demographic and clinical profiles. The Chi-square test was used to

Table III: Ocular characteristic of lens-induced glaucoma.

Clinical profile	Frequency (n)	Percentage (%)
Axial Length (mm)		
Mean	23.31	
<22	3	12.5
22 -24	17	70.8
>24	4	16.7
Anterior chamber depth (mm)		
Mean	2.72	
<2.8	15	62.4
2.8-3.5	3	12.6
>3.5	6	25.0
Type of cataract		
Intumescent	14	58.3
Morgagnian	6	25.0
White	4	16.7
Optic disc		
Normal	14	58.3
Glaucomatous optic neuropathy	10	41.7

Table IV: Comparison between phacolytic and phacomorphic glaucoma.

Variables	Phacomorphic (n=14)	Phacolytic (n=10)	p-value*
Axial length (mm)			
<22	3	0	0.137
22-24	10	7	
>24	1	3	
ACD (mm)			
<2.8	15	2	<0.001
2.8 – 3.5	1	2	
>3.5	0	6	
Operative complication			
Nil	11	6	0.147
Zonular dialysis	3	2	
PCR	-	2	
Type of surgery			
Phacoemulsification	5	1	0.357
ECCE	7	7	
ICCE	2	2	
Type of lens			
PCIOL	12	4	0.045
ACIOL	1	5	
Aphakic	1	1	

Abbreviations: ACD: Anterior chamber depth; PCR: Posterior capsular rupture; ECCE: Extracapsular cataract extraction; ICCE: Intracapsular cataract extraction; PCIOL: Posterior chamber intraocular lens; ACIOL: Anterior chamber intraocular lens
*Chi-square test, p<0.05 is significant

determine associations between categorical variables, with p<0.05 is considered significant.

RESULTS

A total of 3233 cataract surgeries were performed in Hospital Taiping over 2 years (1981 and 1252 cases in 2019 and 2020, respectively). Twenty-five patients underwent emergency cataract surgery for LIG; however, only 24 patients who fulfilled the diagnostic criteria for LIG were included in the study. Among them, 10 were operated in 2019 and 14 in 2020. A double increase was observed from 0.5% of total cataract surgery performed in 2019 to 1.2% in 2020. The mean age was 66 ± 12 years (range 43-91 years). Women and men were equally affected, with a ratio of 1:1.18. The demographic characteristics of patients with LIG are summarised in Table I.

We observed a slightly higher number of cases of phacomorphic glaucoma (58.33%) than those of phacolytic glaucoma. During the presentation, all patients had VA worse than 6/60. Of the 24 patients, 15 (62.56%) presented with symptoms of <1 week duration. Cataract surgery was performed between 3 days to 3 weeks from presentation, as the cornea became clearer. The mean IOP at presentation was 47.5 ± 13.66 mmHg, which improved to 15.08±8.09mmHg postoperatively. Twenty (83.3%) patients achieved good visual outcome, BCVA of 6/15 or better. The clinical profile of LIG is presented in Table II.

We further analyse the ocular characteristic of our LIG patients (Table III). The mean axial length was 23.31 mm while the ACD was 2.72 mm. Majority (58.3%) of the patients had intumescent cataract. Glaucomatous optic disc changes were observed in almost half (41.67%) of the cases.

A few clinically important ocular characteristics and surgical profiles between our phacomorphic and phacolytic patients were presented in Table IV. The majority (58.3%) of surgeries were performed via extracapsular cataract extraction (ECCE), while six (25%) of our patients underwent successful phacoemulsification. Among complications observed were zonular dialysis and posterior capsule rupture, with four cases ended up with intracapsular cataract extraction (ICCE), leaving them aphakic. The categorical data were further analysed using Chi-square test. The result showed that two clinically significant findings were the ACD ($p<0.001$) and the type of intraocular lens used during the surgery ($p=0.045$).

DISCUSSION

Lens-induced glaucoma (LIG) is an important cause of secondary glaucoma in the ageing population of developing countries, with phacomorphic glaucoma being the most common etiology.[1,9] The high incidence of LIG among elderly individuals indicates that LIG is a disease of old age.[10] In our study, the highest number of LIG cases occurred in patients aged 70 years and older, in align with previous study.[9] Patients in the older age group generally have difficulty attending hospital and are unaware of potentially blinding complications in painful eyes.[10]

We observed an increase in emergency cataract surgeries due to LIG in 2020 compared with the corresponding time in 2019. This could be related to the COVID-19 pandemic in 2020, in which all elective cataract surgeries were postponed, leading to an increased incidence of LIG.[11-13] A recent study found that the number of cases of LIG increased by almost double during the pandemic (from 7.7% in 2019 to 13.2% in 2020).[11] Patients were not allowed to go out during the pandemic period because of the movement control order unless they had medical symptoms that required them to go to the hospital for treatment. Therefore, they seek treatment only when eye pain becomes significant.[11]

In our study, phacomorphic glaucoma was more common than phacolytic glaucoma, consistent with previous studies.[5,9] Intumescent cataracts were observed in patients with phacomorphic glaucoma, whereas both morgagnian and white cataracts were observed in patients with phacolytic glaucoma.[5,9] We also determined that 50% of phacolytic glaucoma cases in our study occurred in patients aged 70 years or older. Phacolytic glaucoma likely occurs because of the aggregation of high-molecular-weight lens proteins clogging the trabecular meshwork over time, often associated with advancing age.[5]

Symptoms suggestive of phacomorphic glaucoma typically occur at night because of mid-dilation of the pupil during this scotopic condition, which predisposes the patient to relative pupillary block.[4] In contrast, hypermature cataracts in patients with phacolytic glaucoma leak lens protein from the intact capsule at no specific time of day.[14] Irrespective of the type, both phacomorphic and phacolytic glaucoma eventually result in inflammation that leads to increased IOP.[14] An acute significant increase in IOP compromises optic nerve function and may lead to irreversible loss of vision if not treated on time.[15]

The presenting VA was poor in all patients in this study, 6/60 and worse due to significant lens opacity and corneal oedema. This corresponds to a previous study conducted in northeastern Malaysia.[16] A direct correlation existed between the duration of symptoms and the postoperative BCVA, indicating that prolonged symptom duration was associated with poorer visual outcomes.[9] A significant risk of poor visual outcome was established when the duration between the onset of pain and surgery exceeded 5 days.[5] Nevertheless, most of our patients had good postoperative BCVA despite late presentation of more than 3 weeks. These findings show that a good visual outcome can be achieved in LIG if glaucomatous optic neuropathy has not yet developed.

As opposed to age- and sex-matched control subjects, patients with phacomorphic glaucoma typically exhibited shallower ACD and had statistically shorter axial length (AL).[17,18] However, our in-depth analysis revealed that, among phacomorphic and phacolytic patients, only ACD was significantly different, not AL. Additionally, we found that while the type of surgery and intraoperative complications did not differ statistically between phacomorphic and phacolytic patients, there was a significant difference between the two groups in terms of the implanted intraocular lens.

The definitive and effective treatment for IOP lowering in patients with LIG is prompt cataract extraction. This is consistent with our observation that 70.8% of patients had an IOP of greater than 40 prior surgery and following operation, 87.5% patients were able to achieve a normal IOP of less than 21 mmHg without a need for antiglaucoma medication. This finding aligns with a previous study, where 89.5% of their patients recorded a postoperative IOP of less than 20 mmHg.[19] However, three cases (12.5%) in our study were found to have persistent IOP of more than 21 mmHg postoperatively, requiring at least one topical antiglaucoma. The causes for the refractory glaucoma in them were due to central retinal vein occlusion with subsequent neovascular glaucoma in one patient, another had prolonged postoperative inflammation, and the third patient had extensive peripheral anterior synechia formation. Unfortunately, we lacked data on their long-term outcomes. This limitation arose because our data collection was confined to the online database and included follow-up only up to six-weeks post-operation. Future study centred around LIG should incorporate extended follow-up periods to assess cases with postoperative refractory glaucoma.

The choice of surgery for treating LIG depends on several factors including the severity and subtype of LIG, lens density, surgeon's expertise, and the patient's overall health.[20] Majority of our patients underwent extracapsular cataract extraction (ECCE) and achieved significant VA

improvement to 6/15 or better. ECCE are often preferred at tertiary centres for managing LIG as these techniques mitigate the risk of thermal injury to the corneal endothelium, minimise zonular stress, and facilitate lens delivery.[21,22] These techniques also offer an effective solution for handling the dense nucleus of intumescent cataracts in phacomorphic cases.[22] Conversely, phacoemulsification, a modern and safe technique, has shown efficacy in IOP reduction and achieving favourable visual outcome with minimal complications in the management of LIG when performed by experienced surgeons.[23]

CONCLUSIONS

LIG poses a significant risk of vision loss. Prompt cataract extraction serves as the definitive treatment as it effectively lowers intraocular pressure (IOP) and leads to favourable visual outcomes. Despite the promising prognosis associated with early surgical intervention, patients should be counselled about the potential for a guarded visual prognosis, which may arise from complicated surgery and long-term complications following LIG and the surgery.

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