Long-term outcome after cataract extraction in patients with an attack of acute phacomorphic angle closure

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Abstract

Background: Phacomorphic glaucoma arises due to acute angle closure precipitated by sudden hydration of a cataractous lens, which blocks the angle by forward displacement of the iris. During an acute attack, the intraocular pressure is markedly elevated. The initial treatment is aimed at lowering the intraocular pressure followed by definitive treatment in the form of removal of the cataractous lens. We aimed to determine long-term outcome after cataract extraction in patients with acute phacomorphic angle closure.

Methods: Fifty-nine eyes of 59 consecutive patients with acute phacomorphic angle closure presenting from June 1998 to December 2008 were included. Patients were treated for initial intraocular pressure reduction followed by cataract extraction and intraocular lens implantation. The presenting features, initial treatment instituted, duration of attack, subsequent visual outcome, intraocular pressure, gonioscopic findings, and optic disc status were reviewed and analysed from patient medical records.

Results: The mean patient age was 78.6 (standard deviation, 7.7) years and the mean follow-up period was 58.5 (standard deviation, 36.9) months. The mean presenting intraocular pressure was 56.0 (standard deviation, 11.4) mm Hg, which was successfully controlled with medications or argon laser peripheral iridoplasty. Cataract extraction with intraocular lens implantation was performed in all eyes 1 to 11 days after remission of the acute attack. All eyes had intraocular pressure of <21 mm Hg without medication in the immediate post–cataract extraction period. Gonioscopic findings showed peripheral anterior synechial angle closure of >180° in 16 eyes (27.1%). Ten (16.9%) of the 59 eyes subsequently developed an increase in intraocular pressure of >21 mm Hg, for which medical treatment was given. Final visual acuity improved in 74.6% of the eyes. A more extensive peripheral anterior synechial angle closure was associated with a longer duration of acute attack, but not the method of cataract extraction or the method of initial intraocular pressure control.

Conclusions: In acute phacomorphic angle closure, rapid reduction of intraocular pressure and control of inflammation followed by extracapsular cataract extraction or phacoemulsification is associated with favorable long-term visual outcomes.

Key words: Cataract extraction; Glaucoma, angle-closure; Intraocular pressure; Lenses, intraocular

Introduction

Phacomorphic glaucoma is due to an intumescent cataractous lens, which causes secondary angle closure and compromises normal aqueous drainage pathways. During an acute attack, the intraocular pressure (IOP) is markedly elevated and the eye is acutely inflamed. There is corneal edema and the anterior chamber is shallow. The initial treatment is aimed at lowering the IOP by medications or argon laser peripheral iridoplasty (ALPI).[1,2] Once the IOP is controlled, removal of the cataract by extracapsular cataract extraction (ECCE) or phacoemulsification is regarded as the definitive treatment.[3-5] Cataract extraction usually normalises the IOP, unless the angle is damaged during the attack or there is permanent peripheral anterior synechial (PAS) angle closure. Literature regarding the long-term outcome of acute phacomorphic angle closure after removal of the cataract is limited. This study aimed at evaluating the long-term visual outcome and IOP control after cataract extraction in patients with an attack of acute phacomorphic angle closure.

Patients and methods

This was a retrospective case series study approved by the Kowloon East Cluster Clinical Research Ethics Committee. Tenets of the Declaration of Helsinki were followed. The medical records of patients with consecutive acute phacomorphic angle closure secondary to senile cataract who presented to a regional general hospital between June 1998 and December 2008 were reviewed. Exclusion criteria were: (1) history of uveitis, (2) history of acute primary angle closure attack, (3) history of previous intraocular surgery in the attacked eye, and (4) follow-up period of less than 12 months. Differentiation of phacomorphic glaucoma from primary angle closure glaucoma is often difficult and it is difficult to perform detailed investigations in the eye enduring an acute phacomorphic attack in the emergency room. This is especially problematic with an acutely inflamed and painful eye. So the diagnosis of acute phacomorphic angle closure was made clinically based on the following features: (1) acute ocular pain with or without associated headache, nausea and vomiting, (2) decrease in vision, (3) corneal edema with a semi-dilated pupil and injected conjunctiva, (4) IOP of ≥40 mm Hg, and (5) angle closure in the presence of a mature or intumescent cataract. The duration of attack suggested by the onset of pain was recorded. Visual acuity (VA), IOP measurement, corneal clarity, gonioscopic findings were also documented. Wherever possible, the optic disc status (cup-disc ratio [CDR]) was documented as well as gonioscopic findings of the unaffected eyes.

All eyes were treated either with medications or immediate ALPI. The selection of the initial treatment was not randomized. Surgeons who had acquired the skills of ALPI used this option for all the cases regardless of the presenting IOP and corneal clarity. Surgeons who had not mastered the ALPI skills used medical treatment for all their cases. In the medical treatment group, systemic acetazolamide and topical beta-blocker were given. In the ALPI group, before the laser treatment only topical beta-blocker but no systemic acetazolamide was given. The laser parameters used were 0.3 to 0.5 second durations, with 300 to 500 micron spot size and 200 to 300 mW titrated till peripheral iris contraction was visualized. The whole 360 degrees of the peripheral iris was treated. In both groups of patients, topical prednisolone acetate 1% (4 times/day) was given until cataract extraction was performed; intravenous mannitol was used if the IOP was not controlled in 2 hours. Ophthalmic ultrasound was performed for all eyes to rule out posterior segment pathology.

Cataract extraction by either phacoemulsification or ECCE method with posterior chamber intraocular lens (PCIOL) implantation was performed in all eyes after remission of the acute attack. The choice of method of cataract extraction was based on the status of corneal edema, pupil size, and individual surgeon's competence. After cataract extraction, chloramphenicol 0.5% (4 times/day) and prednisolone acetate 1% (8 times/day) eye drops were prescribed for at least 2 weeks and then continued with chloramphenicol 0.5% + dexamethasone 0.1% eye drops (4 times/day) for another 6 weeks. All the ocular hypotensive medications were stopped.

All patients were given periodic follow-up appointments. During follow-up, their VA, IOP, indentation gonioscopic findings and the vertical CDR were documented. Increased CDR was defined as presence of narrowing of the neuroretinal rim (whether locally or diffusely). When the ratio of the cup to the neuroretinal rim was more than 0.7, it was defined as advanced cupping. Pupillary reaction and fundoscopy were also recorded. Whenever the IOP showed elevation to >21 mm Hg in 2 visits, anti-glaucoma medication was re-started.

The statistical package for social sciences (Statistical Package for the Social Sciences, Windows version 11.0; SPSS Inc, Chicago [IL], USA) was used for statistical analysis. Chi-square test and Fisher's exact test were used and a p value of <0.05 was considered statistically significant.

Results

There were 60 acute phacomorphic angle closure attacks (in 60 patients) in the period between June 1998 and December 2008. Nineteen patients died in the follow-up period. Only one of them was excluded because his follow-up duration was less than 1 year. The medical records of the remaining 59 patients (42 females and 17 males) were reviewed. The mean age was 78.6 (standard deviation [SD], 7.7; range, 63 to 96) years. **Table 1** summarizes the patients' demographics. The mean follow-up time was 58.5 (SD, 36.9; range, 12 to 142) months. Forty-two per cent of the patients had more than 5 years' follow-up and only 18% had follow-up duration of 1 to 2 years. Their VA during the acute attack of phacomorphic angle closure ranged from

Table 1. Patients' demographics.	
Demographics	**Value**
Mean (SD) age (years)	78.6 (7.7)
Sex	
Female	42
Male	17
Range of presenting visual acuity	LP to CF
Mean (SD) presenting IOP (mm Hg)	56.0 (11.4)
Mean (SD) follow-up period (months)	58.5 (36.9)
Phacoemulsification	11
ECCE	48
Range of visual acuity at last follow-up	NLP to 0.7
Mean (SD) IOP at last follow-up (mm Hg)	15.6 (9.9)

Abbreviations: SD = standard deviation; IOP = intraocular pressure; LP = light perception; CF = counting fingers; NLP = no light perception; ECCE = extracapsular cataract extraction.

Table 2. Causes of poor visual outcome.	
Causes	**No. of eyes**
No improvement in visual acuity	
Corneal pathologies*	3
AMD*	2
CRAO*	1
Glaucoma progression	1
Unknown	1
Optic nerve damage in acute attack	2
No light perception (all had advanced optic nerve damage in acute attack); co-morbidity in 3 eyes	
Corneal pathologies*	2
CRVO	1

Abbreviations: AMD = age-related macular degeneration; CRAO = central retinal artery occlusion; CRVO = central retinal vein occlusion.
* Pre-existing ocular disease.

Figure. Visual acuity at final visit in comparison with presenting visual acuity during acute attack (n=59).

acute attack, which was defined as seeing ≥0.2 at the last follow-up. Ten eyes (16.9%) had no change in their VA and 5 eyes (8.5%) developed NLP (**Figure**). In the 10 eyes with no improvement in the VA, 2 had advanced glaucomatous optic nerve damage at presentation (CDR >0.7) and 1 had progressive glaucomatous optic nerve damage. The remaining 7 eyes had other pre-existing ocular pathologies (**Table 2**). Of the 5 eyes that developed NLP, all had advanced glaucomatous optic nerve damage at the time of the acute attack with vision in the range of HM to LP. Two of the 5 eyes also had pre-existing corneal scarring and 1 developed central retinal vein occlusion during the follow-up period (**Table 2**). All eyes had their IOP maintained <21 mm Hg without medication in the first month after the cataract extraction. Ten eyes (16.9%) subsequently developed an increase in IOP to >21 mm Hg and received anti-glaucomatous medications. Three of them had their IOP controlled to <21 mm Hg with medications, 7 were medically uncontrolled without having any surgical intervention (mainly due to poor expected visual outcomes). The mean onset time of IOP elevation was 4.2 (SD, 4.0; range, 1 to 12) months. The mean IOP at the last follow-up was 15.6 mm Hg (SD, 9.9; range, 8 to 51 mm Hg).

Gonioscopic findings of the eyes with phacomorphic acute angle closure attack at the final follow-up showed PAS closure involving more than 180° in 16 eyes (27.1%), and 90° to 180° in 14 eyes (23.7%). The remaining 29 eyes (49.2%) were either PAS free or had angle closure of less than 90°. In the 10 eyes with a subsequent rise in the IOP, 7 had 360° PAS angle closure and 3 had only scattered PAS. Of the 59 fellow eyes, 53 were phakic and 6 were pseudophakic. Gonioscopy of the 53 phakic fellow eyes revealed that 37 had open angles, 13 had appositional closure, and 3 had various degrees of PAS angle closure. In the 10 eyes with attacks and a subsequent rise in the IOP after the acute attack, 2 had some degree of PAS angle closure in the fellow eyes, 1 had appositional closure for which laser peripheral iridotomy was performed and 7 had an open angle.

The extent of PAS >180° at the final visit was significantly associated with a longer duration of the acute attack

light perception (LP) to counting fingers (CF) and the mean presenting IOP was 56.0 (SD, 11.4; range, 40 to 75) mm Hg. The mean duration of an attack as determined by the onset of symptoms was 7.9 (SD, 14.8; range, 0.2 to 30) days. Immediate IOP-lowering treatments included ALPI to 19 eyes, systemic and topical ocular hypotensive medications to 30 eyes, and combined ALPI and medications to 10 eyes. All eyes had their IOPs lowered to <21 mm Hg within 3 hours immediately after the treatment. Forty-eight patients (81.4%) had ECCE and PCIOL implantation and 11 (18.6%) had phacoemulsification and PCIOL implantation performed from 1 to 11 days (mean, 3.8; SD, 2.6 days) after the acute attack. Two eyes in the ECCE group had posterior capsule tears repaired using scleral fixated intraocular lens. The VA at the last follow-up ranged from no light perception (NLP) in 5 eyes to 0.7. The VA in 44 (74.6%) patients improved, which was defined as an increase by 2 or more Snellen lines. For patients with LP vision, there was an improvement in CF and hand movement (HM) during the
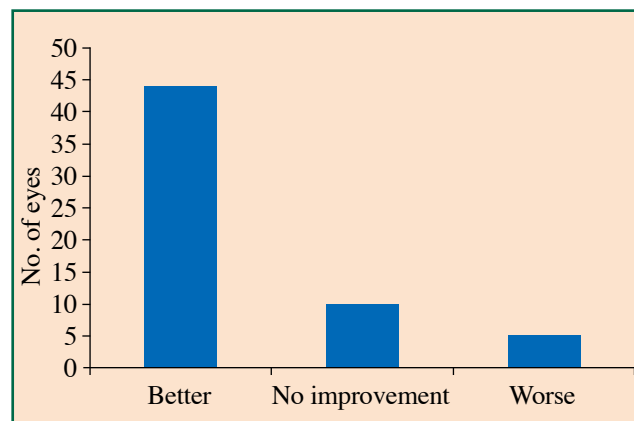
(p = 0.004; Fisher's exact test) in 51 eyes. The duration of the acute attack in the remaining 8 eyes was not detailed in the patient history; they were therefore excluded from the duration of attack / extent of PAS analysis (**Table 3**). Notably, there was no association between the type of initial IOP-lowering treatment, the type of cataract surgery and the extent of PAS at the final visit (p = 0.500, 0.322 respectively; chi-square test; **Tables 4 and 5**).

Discussion

A mature or intumescent cataract can precipitate an attack of acute angle closure, previously known as phacomorphic glaucoma. The swollen lens causes forward displacement of the peripheral iris. An acute phacomorphic angle closure attack is conventionally treated with medications to control the IOP, followed by extraction of the cataractous lens. Once the large cataractous lens is removed, the anterior chamber is deepened and the angle width is increased. The IOP can usually be normalized, unless there is persistent PAS angle closure or the angle is damaged during the acute attack.

In our series, most of the eyes had improved vision (74.6%) and satisfactory IOP control (88.1% total success) after

Table 3. Final extent of peripheral anterior synechiae in correlation with the duration of attack (n = 51).

Duration of attack (days)	Final extent of PAS[*]	
	≤180°	>180°
1-15	35 (68.6%)	8 (15.7%)
16-30	2 (3.9%)	6 (11.8%)

Abbreviation: PAS = peripheral anterior synechiae.
* p = 0.004 (Fisher's exact test).

Table 4. Final extent of peripheral anterior synechiae associated with different types of initial intraocular pressure–lowering treatment (n = 59).

Initial treatment (No.)	Angle status[*]		
	Open	Some PAS	PAS >180°
Medical (30)	14 (23.7%)	6 (10.2%)	10 (16.9%)
ALPI (19)	8 (13.5%)	6 (10.2%)	5 (8.5%)
Medical + ALPI (10)	7 (11.9%)	2 (3.4%)	1 (1.7%)

Abbreviations: ALPI = argon laser peripheral iridoplasty; PAS = peripheral anterior synechiae.
* p = 0.500 (chi-square test).

Table 5. Final extent of peripheral anterior synechiae associated with the method of cataract extraction (n = 59).

Cataract extraction (No.)	Angle status[*]		
	Open	Some PAS	PAS >180°
Phaco (11)	7 (11.9%)	3 (5.1%)	1 (1.7%)
ECCE (48)	22 (37.3%)	11 (18.6%)	15 (25.4%)

Abbreviations: Phaco = phacoemulsification group; ECCE = extracapsular cataract extraction; PAS = peripheral anterior synechiae.
* p = 0.322 (chi-square test).

extraction of the mature cataract. Our results are comparable to those reported in other series.[3,6] Only 2 eyes developed uncontrolled IOP leading to progressive optic nerve damage and subsequent blindness in 1 eye. The other eyes with poor visual outcomes had advanced glaucomatous optic nerve damage during the attack (before treatment was initiated) or non-glaucomatous ocular pathologies.

Prajna et al[3] reported an association of a poor final visual outcome if the duration of an attack exceeded 5 days. Jain et al[6] also reported poorer visual outcomes and more advanced optic disc damage in patients with longer duration attacks. We failed to confirm their findings in our series, which might be because many eyes in our series had co-morbidities affecting their visual outcomes. We could not find an association of poorer visual outcomes and higher presenting IOPs during the acute attack. 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. Our small sample may be another reason for the above findings.

Despite removal of the mature cataract, more than 50% of the eyes were found to have various degrees of angle closure. Statistical analysis showed a positive association with the duration of acute attack. This is logical because the longer the angle remains closed during the acute attack, the more likely is it for PAS to form. There was, however, no association with the type of initial IOP-lowering treatment or the type of cataract surgery performed. These preliminary findings may mean that ALPI does not increase the risk of angle closure in the long term, despite laser spots being placed at the angle and phacoemulsification having no advantage over ECCE in angle opening. The data analysis was limited by the significantly smaller number of phacoemulsifications than ECCEs in this series. This was because phacosurgery was not as advanced as it is now and at that time most of the surgeons felt more comfortable using ECCE than phacoemulsification when treating these difficult cataract cases. In areas where the phacoemulsification machine is not available or the surgeon's experience is limited, ECCE remains a safe and effective surgical method for cataract removal in phacomorphic glaucoma after IOP reduction is achieved during the acute attack.

Acute phacomorphic angle closure can occur in eyes with a pre-existing open angle and in those with an occludable angle where pupillary block is the major contributing factor. In our series, 69.8% of the cases had open angles and 30.2% (16 out of 53 phakic fellow eyes) had some degree of angle closure in the unaffected fellow phakic eye. In Prajna et al's series,[3] 60% of the fellow phakic eyes of phacomorphic glaucoma had narrow angles. We only found a 30% narrow angle rate in the phakic fellow eyes of our series.

Interestingly, only 7 of the 10 eyes with subsequent rise in IOP developed 360° PAS angle closure, of which 3 had only scattered PAS of less than 90°. These 3 eyes may have suffered damage to the trabecular meshwork during the

acute attack of angle closure, so their IOP increased despite the presence of minimal PAS. The 10 eyes developed IOP elevation within 1 year after remission of the initial acute attack. Few studies have shown that high IOP levels are associated with the extent of PAS in eyes with chronic angle closure glaucoma.[7] Close monitoring of the IOP and serial gonioscopic examinations are therefore necessary in the first year after the acute attack, in order to detect early PAS development and glaucoma progression in eyes with phacomorphic attack.

Limitations of our study were that: it was retrospective, had non-standardized preoperative management of the phacomorphic attack, and the selection of the type of cataract surgery and follow-up periods varied. The diagnosis of phacomorphic glaucoma was based on clinical features without actual lens thickness and anterior segment biometrical measurements. Nevertheless, this study was unique in that all patients received rapid medical or laser IOP-lowering treatment in the acute phase, followed by early cataract extraction (mean delay, 3.8 days) and most were followed up for a long period (mean of 58.5 months; 64% were followed up for >3 years). Other limitations include lack of perimetry assessment because most of the patients in this series failed to produce reliable fields, making interpretation confusing; lack of optical coherence tomography (OCT), and slit-lamp–adapted OCT documentation of nerve fiber layer thickness and anterior segment anatomy due to unavailability of the relevant machines at that time. These shortcomings were circumvented by clear documentation of gonioscopic findings and optic disc morphology.

Notwithstanding these limitations, our study demonstrated that a shorter duration of the acute attack and cataract extraction with intraocular lens implantation after remission of the acute attack of acute phacomorphic angle closure resulted in a favorable long-term outcome. Though the results of this study have been reported in our recently published paper,[8] the current study differs in that the patients had initial IOP control by either laser or medical treatment, rather than initial medical treatment for all the patients. Moreover, there was a longer follow-up period.

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