

Prospective case series on trabecular–iris angle status after an acute episode of phacomorphic angle closure

Jacky Lee¹, Jimmy Lai¹, Doris Yick², Can Yuen²

¹Department of Ophthalmology, University of Hong Kong, Hong Kong, China

²Department of Ophthalmology, Caritas Medical Centre, 111 Wing Hong Street Sham Shui Po, Kowloon, Hong Kong, China

Correspondence to: Jacky Lee. Department of Ophthalmology, University of Hong Kong, Hong Kong, China. jackywylee@gmail.com

Received: 2012-09-17 Accepted: 2012-12-30

Abstract

• **AIM:** To investigate the trabecular–iris angle with ultrasound biomicroscopy (UBM) post cataract extraction after an acute attack of phacomorphic angle closure.

• **METHODS:** This prospective study involved 10 cases of phacomorphic angle closure that underwent cataract extraction and intraocular lens insertion after intraocular pressure (IOP) lowering. Apart from visual acuity and IOP, the trabecular–iris angle was measured by gonioscopy and UBM at 3 months post attack.

• **RESULTS:** In 10 consecutive cases of acute phacomorphic angle closure from December 2009 to December 2010, gonioscopic findings showed peripheral anterior synechiae (PAS) $\leq 90^\circ$ in 30% of phacomorphic patients and a mean Shaffer grading of (3.1 ± 1.0) . UBM showed a mean angle of $(37.1^\circ \pm 4.5^\circ)$ in the phacomorphic eye with the temporal quadrant being the most opened and $(37.1^\circ \pm 8.0^\circ)$ in the contralateral uninvolved eye. The mean time from consultation to cataract extraction was (1.4 ± 0.7) days and the mean total duration of phacomorphic angle closure was (3.6 ± 2.8) days but there was no correlation to the degree of angle closure on UBM (Spearman correlation $P=0.7$). The presenting mean IOP was (50.5 ± 7.4) mmHg and the mean IOP at 3 months was (10.5 ± 3.4) mmHg but there were no correlations with the degree of angle closure (Spearman correlations $P=0.9$).

• **CONCLUSION:** An open trabecular–iris angle and normal IOP can be achieved after an acute attack of phacomorphic angle closure if cataract extraction is performed within 1 day – 2 days after IOP control. Gonioscopic findings were in agreement with UBM,

which provided a more specific and object angle measurement. The superior angle is relatively more narrowed compared to the other quadrants. All contralateral eyes in this series had open angles.

• **KEYWORDS:** angle; ultrasound biomicroscopy; phacomorphic; intraocular pressure

DOI:10.3980/j.issn.2222-3959.2013.01.14

Lee J, Lai J, Yick D, Yuen C. Prospective case series on trabecular–iris angle status after an acute episode of phacomorphic angle closure. *Int J Ophthalmol* 2013;6(1):67–70

INTRODUCTION

Phacomorphic angle closure is a secondary angle closure caused by the delayed extraction of a mature cataract resulting in both pupil block and trabecular-iris angle closure. If the intraocular pressure (IOP) is not lowered in time, permanent glaucomatous neuropathy will result in poor vision even after cataract extraction [1]. The IOP can be initially lowered by topical or oral anti-glaucoma medication, laser iridotomy or more recently argon laser peripheral iridoplasty (ALPI) followed by definitive cataract extraction [2]. As this disease entity often involves an elderly population with poor co-morbidities and even neglect [1], most publications are retrospective in nature and objective assessments of anatomical and functional outcomes post cataract extraction are often difficult [1,3]. Previously, postoperative IOP, visual acuity, cup-disc ratios, Humphrey Visual field, and gonioscopy findings have been described [1,3,4]. Lee *et al* [4] have documented an increase in anterior chamber depth with axial scan post cataract extraction in phacomorphic angle closure, but to date, there are no published case series objectively investigating the trabecular-iris angle after cataract extraction in phacomorphic angle closure. The angle status is of uttermost importance after phacomorphic angle closure because glaucomatous optic neuropathy can either develop during the period of sustained IOP elevation or from progressive chronic angle closure that develops due to peripheral anterior synechiae (PAS) formation from the initial secondary angle closure [1-3]. An objective assessment of the trabecular-iris angle post

phacomorphic angle closure will provide us with more information about the likely development of chronic angle closure and glaucomatous optic neuropathy. This study will examine the trabecular-iris angle with gonioscopy and ultrasound biomicroscopy (UBM) in a prospective manner after cataract extraction in cases of acute phacomorphic angle closure.

In this study, we investigate the trabecular-iris angle with UBM post cataract extraction after an acute attack of phacomorphic angle closure.

SUBJECTS AND METHODS

Consecutive cases of acute phacomorphic angle closure from December 2009 to December 2010 were recruited from a district hospital in Hong Kong Special Administrative Region, People's Republic of China. Patient's IOP was lowered initially either by ALPI or systemic acetazolamide. The selection between the two initial treatments was randomized. The randomization was part of a treatment protocol of another study comparing the effects of initial treatment modalities in phacomorphic angle closure. Those receiving ALPI received laser applications 360° to the peripheral iris with power titrated to achieve visualized contractions of the iris. All ALPI's were performed by a single surgeon. Those receiving systemic acetazolamide received intravenous acetazolamide 500mg stat followed by oral acetazolamide 250mg four times daily and slow-release potassium chloride tablets 600mg twice daily if there were no systemic contraindications. All patients were put on the following eye drops: Atropine 1% daily (Alcon Inc., Hünenberg, CH-6331, Switzerland), Pred forte 1% four times daily (Allergan Inc., Irvine, CA 92623-9534, USA), and Timolol 0.5% twice daily (Santen Pharmaceutical Co. Ltd., Osaka, 533-8651, Japan) in the attack eye. Patients with presenting IOP higher than 60mmHg or IOP higher than 40mmHg after two hours of treatment were given 200 milliliters of 20% mannitol intravenously over one hour. Hourly IOP was documented until it was below 25mmHg.

Cases were included for consenting individuals with a first episode of acute (less than 14 days) phacomorphic angle closure with an IOP more than 40 mmHg. The diagnosis of phacomorphic angle closure was based on the presence of an intumescent cataract and signs of acute angle closure: conjunctival injection, shallow anterior chamber, corneal edema in the index eye or an open angle in the contralateral eye as determined by gonioscopy. Cases were excluded if IOP lowering treatment was given for this acute episode prior to the study or where ALPI was not possible either due to a severely edematous cornea or uncooperative patient.

All cases received extracapsular cataract extraction (ECCE)

and intraocular lens (IOL) insertion under regional anesthesia by one of the three glaucoma surgeons at our center within three days of presentation to our clinic. All glaucoma medications were discontinued immediately after the cataract extraction. ECCE was chosen over phacoemulsification due to less endothelial damage from ultrasound energy and phacoemulsification would impose greater surgical risk in the setting of phacomorphic angle closure especially in the presence of any residual corneal oedema and zonule loosening [1].

Patients were followed up on day one, one week, one month, three months and as needed post-operatively and IOP was measured by Goldman applanation tonometry each visit. Best corrected visual acuity (BCVA) was measured by Snellen chart at one month post-operatively.

At three months post cataract extraction, the Ultrasonic BioMicroscope UBMP40 (Paradigm Medical Industries Inc. 4273 South 590 West, Salt Lake City, UT 84123, United States) was used for the assessment of the trabecular-iris angle which was defined as the angle from the trabecular meshwork to the iris at a point 500 micrometer from the sclera spur. Angle measurements were performed in all four quadrants in both eyes by a single operator.

Statistical Analysis Spearman correlation was used to investigate for correlation of the trabecular-iris angle with the presenting IOP, three month IOP, and the duration of phacomorphic angle closure (time from symptoms to cataract extraction). For all statistical calculations $P < 0.05$ was considered significant and all means were presented as mean \pm standard deviation (SD). The institutional review board of the Hospital Authority of Hong Kong approved this study. The study protocol followed the principles in the Declaration of Helsinki. Informed consent was obtained from all patients prior to all treatments and investigations. The authors declare no proprietary interest or financial sponsorship in relations to this study.

RESULTS

General Results Eleven consecutive cases of acute phacomorphic angle closure presented to our center during the study period. One case was later excluded because of defaulting follow-up after cataract extraction. Four cases received ALPI and six cases received systemic acetazolamide as the initial mean of control IOP. All IOP's were lowered to less than 25mmHg within 5 hours of treatment with corneal clarity achieved day one after treatment. Two cases received intravenous mannitol because one presented with IOP more than 60mmHg and the other had persistent IOP > 40mmHg two hours after treatment with systemic acetazolamide. There were no systemic side effects from the mannitol. All cases

received ECCE+IOL within three days of presentation to our center. There were no intra-operative complications. One case required scleral fixation IOL due to post-operative posterior chamber IOL subluxation one week after the initial operation.

For the ten cases, the mean age was (79.1±8.3) years. The presenting mode visual acuity was light perception (LP). The post-operative BCVA was (0.4±0.2), including a case with pre-existing macular atrophy that had a presenting VA of LP and a post-operative VA of 0.1. The mean follow-up was (9.8±1.9) months.

Trabecular-iris Angle Results At three months after cataract extraction, gonioscopic findings showed PAS ≤90° in 3/10 (30%) of phacomorphic patients and a mean Shaffer grading of (3.1±1.0). UBM showed a mean trabecular-iris angle of (37.1°±4.5°) in the phacomorphic eye with the temporal quadrant (45.5°±9.7°) being the most opened followed by the inferior (38.0°±7.7°), nasal (30.3°±12.7°), and superior (28.0°±11.4°) quadrants. All (100%) eyes had a mean angle opening of more than 20° in all four quadrants.

The presenting mean IOP was (50.5±7.4)mmHg and the mean IOP at three months was (10.5±3.4)mmHg without medication but here was no significant correlation between the trabecular-iris angle and the presenting or three month IOP (Spearman correlations $P=0.9$).

The mean time from consultation to cataract extraction was (1.4±0.7) days and the mean duration of phacomorphic angle closure (time from symptoms to cataract extraction) was (3.6±2.8) days and there was no significant correlation to the degree of trabecular-iris angle closure on UBM (Spearman correlation $P=0.7$).

For the uninvolved contralateral eye, four were phakic with two eyes previously received laser iridotomy for primary angle closure suspect and six were pseudophakic. The mean gonioscopic Shaffer grading was (3.4±0.9). On UBM, all contralateral eyes had a trabecular-iris angle of more than 20° with a mean of (37.1°±8.0°).

DISCUSSION

Previous studies have established that a longer duration of phacomorphic angle closure was associated with a poorer visual outcome and a greater extent of PAS [1,3]. What has not been well established is whether or not angle status is correlated with the presenting or post-operative IOP. There are few studies investigating the angle status post phacomorphic angle closure and this is the first prospective case series using UBM to objectively assess the trabecular-iris angle after an acute attack of phacomorphic angle closure.

In the phacomorphic eye, gonioscopic findings performed at

three months post cataract extraction showed an open angle configurations in all eyes with a mean Shaffer grading of (3.1±1.0) with 30% of the cases having of PAS. The gonioscopic findings were in agreement with the UBM assessments which provided a more specific and object angle measurement; all eyes had a mean angle of more than 20° in all four quadrants with a mean angle of (37.1°±4.5°), very similar to the angle status of the contralateral uninvolved eye, 37.1±8.0°. Thus, all eyes in our series of phacomorphic angle closure were able to achieve an open angle configuration post cataract extraction. The temporal quadrant was the most opened and the superior quadrant was relatively shallower. This is compatible with findings in primary angle closure where the superior angle has also been reported to be the most frequent quadrant for closure post-attack [5].

The percentage of patients with PAS was consistent with that reported in a previous retrospective study, around 30%, but the extent of PAS was significantly lower, ≤90° in this prospective series versus ≥180° in the retrospective series. Furthermore, 100% of our cases had open angles on gonioscopy and UBM versus only 49.2% previously reported via gonioscopy [3]. We attribute these significant improvements in angle configuration not only to more accurate assessment with UBM but more importantly due to improvement in the management of phacomorphic angle closure over the years, not only in the initial IOP lowering but the prompt extraction of the intumescent lens preventing prolonged trabecular-iris angle closure and PAS formation. In the past, it is not uncommon to wait for a week or more after IOP control before the cataract is extracted. This resulted in angle closure and significant PAS formation despite cataract extraction [1,3]. With a better understanding of the concept that even after the control of IOP with medical therapy, ALPI, or laser iridotomy, the angle can still remain closed [6,7], the waiting time for cataract extraction has been shortened over the years [6] and in our series, the time from presentation to cataract extraction was nearly shortened by three times to 1.4 days, compared to 3.8 days in a previous retrospective study [3].

Unlike in primary acute angle closure where PAS was correlated with the presenting IOP [5], we found that there was no correlation between degrees of trabecular-iris angle closure on UBM and the presenting IOP or IOP at three months. These findings do tell us two important conclusions: first, an open angle configuration with minimal PAS formation is obtainable post-phacomorphic angle closure if prompt IOP lowering and cataract extraction is performed early within one day to two days after IOP control. Second, using ALPI as the initial IOP lowering modality does not result in more angle closure or PAS formation despite laser

applications to the peripheral iris.

The contralateral eye all had an open angle configuration on gonioscopy and UBM. This is possibly because six of the eyes were pseudophakic and two had previous laser iridotomy for primary angle closure suspect but there were two cases of phakic contralateral eyes with open angle configuration. It is not surprising that they developed phacomorphic angle closure in the other eye despite an open angle in the contralateral eye as phacomorphic angle closure can occur in any eye irrespective of its angle status^[8].

Our study had its limitations. Other than using UBM, an anterior segment Optical Coherence Tomography would be an even more ideal imaging modality for angle assessment in terms of speed, comfort, and resolution but due the limitation in available resources at the time of this study, UBM was used instead. We also did not find any statistically significant association between the duration of phacomorphic angle closure and the degree of angle closure because all of our cases had prompt cataract extraction and an overall short mean duration of phacomorphic angle closure of only (3.6±2.8) days; it would have been unethical to delay the cataract extraction to elicit its impact on angle status.

In conclusion, after an acute attack of phacomorphic angle closure, an open trabecular-iris angle with less than one quadrant of PAS and normal IOP without medication can be achieved if cataract extraction is performed within one day to two days after IOP control with either medical therapy or

ALPI. Gonioscopic findings were in agreement with UBM assessments which provided a more specific and object angle measurement. The superior angle is relatively more narrowed compared to the other quadrants. All contralateral eyes in this series had open angles.

REFERENCES

- 1 Lee JW, Lai JS, Yick DW, Tse RK. Retrospective case series on the long-term visual and intraocular pressure outcomes of phacomorphic glaucoma. *Eye (Lond)*2010;24(11):1675–1680
- 2 Sowka J. Phacomorphic glaucoma: case and review. *Optometry* 2006;77(12):586–589
- 3 Lai JS, Chan JC, Rita G, Lee JW. Long-term outcome after cataract extraction in patients with an attack of acute phacomorphic glaucoma. *Hong Kong J Ophthalmol* 2011;15(2):65–67
- 4 Lee SJ, Lee CK, Kim WS. Long-term therapeutic efficacy of phacoemulsification with intraocular lens implantation in patients with phacomorphic glaucoma. *J Cataract Refract Surg*2010;36(5):783–789
- 5 Lee JY, Kim YY, Jung HR. Distribution and characteristics of peripheral anterior synechiae in primary angle-closure glaucoma. *Korean J Ophthalmol* 2006;20(2):104–108
- 6 Tham CC, Lai JS, Poon AS, Chan JC, Lam SW, Chua JK, Lam DS. Immediate argon laser peripheral iridoplasty (ALPI) as initial treatment for acute phacomorphic angle-closure (phacomorphic glaucoma) before cataract extraction: a preliminary study. *Eye (Lond)* 2005;19(7):778–783
- 7 Sowka J, Girgis N. Bilateral phacomorphic angle-closure glaucoma in a highly myopic patient secondary to isolated spherophakia. *Optometry* 2010;81(9):432–436
- 8 Tomey KF, Al-Rajhi AA. Neodymium: YAG laser iridotomy in the initial management of phacomorphic glaucoma. *Ophthalmology*1992;99(5):660–665