

Effect of Lens Extraction on Primary Angle Closure in a Thai Population

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Objective: To determine the effect of phacoemulsification surgery in eyes with acute or chronic angle closure glaucoma in terms of intraocular pressure (IOP) control and vision improvement.

Material and Method: A total of 58 eyes from 46 patients with angle closure received phacoemulsification and intraocular lens implantation. The patients were followed-up for a minimum period of 6 months.

Results: The mean age was 68.5 years. Two eyes were acute angle closure and 56 eyes were chronic angle closure glaucoma. Peripheral anterior synechiae were present in 88% of the patients. The mean pre-operative IOP was 23.3 ± 10 mm Hg and the mean post-operative IOP was 14.8 ± 6.5 mmHg ($p < 0.05$). The mean visual acuity was improved from 0.92 logMar to 0.53 logMar ($p < 0.01$). The extent of peripheral anterior synechia was decreased from 2.3 quadrants to 2.0 quadrants ($p = 0.076$).

Conclusion: Phacoemulsification and intraocular lens implantation can lower the intraocular pressure, remove pupillary block, increase angle width, relieve peripheral anterior synechiae, decrease antiglaucoma medications and improve visual acuities in patients with angle closure glaucoma and cataracts.

Keywords: Phacoemulsification, Intraocular lens, Primary angle closure glaucoma, Peripheral anterior synechiae

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Primary angle closure is appositional or synechial closure of the anterior-chamber angle caused by pupillary block⁽¹⁾. The angle closure may or may not be associated with elevated intraocular pressure or glaucomatous optic neuropathy and may occur in either acute or chronic form. The abnormal anatomy of the anterior segment was demonstrated by many biometric studies. An eye with primary angle closure is anatomically characterized by the shallow anterior chamber, the narrow anterior chamber angle, a thicker than normal lens with steeper curvature of the anterior surface, a more anterior lens position, small corneal diameter and the shorter axial length⁽²⁻⁵⁾. These anatomical findings and laxity of the zonules associated with aging and lens growth are conducive to the development of relative pupillary block⁽⁶⁾.

Primary angle closure is treated with a peripheral iridotomy, which alleviates the effect of the

pupillary block by creating a new route for aqueous egress from the posterior chamber to the anterior chamber⁽⁷⁻⁹⁾. In some instances, the intraocular pressure is still elevated after iridotomy, because the longstanding appositional closure may predispose to peripheral anterior synechiae formation and give rise to uncontrollable intraocular pressure. After cataract extraction, whether extracapsular cataract extraction or phacoemulsification, intraocular pressure is reduced substantially and satisfactory IOP control is obtained⁽¹⁰⁻¹³⁾. A quantitative evaluation of angle configuration using UBM revealed that the anterior chamber was 1.37 times deeper and the angle was 1.57 times wider after cataract surgery. The present study also finds that the anterior depth increase significantly in angle closure glaucoma patients than in open angle glaucoma patients⁽¹⁴⁾. This finding indicated that lens removal can partially remove the anatomic cause of angle closure. The objective of the present study was to prospectively examine changes in intraocular pressure, degree of angle opening, visual acuity and glaucoma medications in a period of

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6 months.

Material and Method

The authors prospectively studied 58 eyes of 46 Thai patients (31 women, 15 men), who were seen at the Ophthalmology Department, Rajavithi Hospital, Bangkok, Thailand, from March 2005 to June 2006 with acute angle closure or chronic angle closure glaucoma. All of whom had some degree of cataract and underwent phacoemulsification and IOL implantation before June 2006, the minimum follow-up was 6 months. The inclusion criteria were uncontrolled IOP caused by angle closure with or without peripheral anterior synechiae. All eyes were treated with laser iridotomy. The eyes with previous surgery, advanced cupping (C/D > 0.8), history of uveitis, ocular trauma, diabetic retinopathy and other retinal diseases were excluded. Eyes with obvious anterior lens dislocation and secondary angle closure were excluded as well.

The ophthalmologic examinations include best-corrected visual acuity, slit-lamp biomicroscopy, applanation tonometry, gonioscopy, axial length biometry, keratometry and indirect ophthalmoscopy. The UBM were done in suspect of plateau iris configuration or anterior lens movement. Of the 58 eyes, 2 eyes had acute angle closure and the rest were chronic angle closure. The laser iridotomy was performed with either YAG laser or Argon laser before the antiglaucoma drugs were given. After follow-up visit for 1-2 months if the IOP was not well controlled with 2 or more medications, the cataract surgery was scheduled.

Surgical technique

Phacoemulsification surgery was performed by the same surgeon (PP) using the same technique. Under topical anesthesia, all patients underwent temporal clear corneal incision 2.75-3 mm length. The procedure included the viscoelastic injection, lysis of posterior synechiae in order to allow pupillary dilatation for easier phacoemulsification of the nucleus, the goniosynechialysis was not done in any case despite the presence of peripheral anterior synechiae. The one-piece soft acrylic IOLs with 6.0 mm. Optic (SA 60 AT, Alcon) were implanted in all eyes. During the post-operative period, each patient received a combination of steroid and antibiotic drops without antiglaucoma medications.

Patients were examined 1 day, 1 week, 1 month, 3 months and 6 months after surgery. At 3-6 months follow up, a complete ophthalmic examination including the IOP measurement, gonioscopy, visual acuity,

refraction, ophthalmoscopy, visual field and UBM were performed. Statistical analyses were performed using SPSS software. Differences of mean \pm standard deviation (SD) between pre-operative and post-operative values were assessed by means of the paired t-test. Linear regression analysis was performed to determine the post-operative visual acuity and gonioscopy data related to the reduction of IOP. A p-value of less than 0.05 was considered statistically significant.

Results

The mean patient age was $68.5 \pm$ SD 7.85 years, ranging from the age of 52 to 83 years consisted of 15 men and 31 women. The pre-operative data are listed in Table 1. All the patients had a Thai ethnic background. Two (4%) of them were newly diagnosed with an acute attack of ACG, 5 (10%) had symptoms of angle closure and the rest (86%) were asymptomatic. All of the eyes received laser iridotomy prior to phacoemulsification surgery. The post-operative course was uneventful in all eyes. The mean follow-up period was $17.2 \pm$ SD 7.4 months, the mean visual acuity, from the last follow-up, improved from 0.92 (logMar) to 0.53 (logMar) (Fig. 1). The mean post-operative IOP was $14.83 \pm$ SD 6.5 mm.Hg (Fig. 2). There was statistically significant difference between pre-operative and post-operative visual acuity and IOP ($p < 0.01$) (Table 2.). The success rate, defined as IOP < 22 mm Hg without antiglaucoma medication or surgical intervention, reached 93%.

The pre-operative gonioscopy data revealed the angle closure more than 180 degree in all of the eyes and 46% had peripheral anterior synechiae more

Table 1. Pre-operative data of the patients

Characteristic	All eyes (n = 58) Mean \pm SD
Age, yr	68.5 \pm 7.8
Female, No. (%)	31 (67.4%)
Symptomatic, No. (%)	7 (14%)
Intraocular pressure, mm Hg	23.3 \pm 10
Visual acuity, logMar	0.92 \pm 0.7
A-scan axial length,mm	22.7 \pm 0.9
Angle width	
Close < 180 degree	0 (0%)
Peripheral anterior synechiae (%)	51 (88%)
< 180 degree	24 (41.4%)
> 180 degree	27 (46.6%)
360 degree	20 (34.5%)
No. of glaucoma medication	2.1 \pm 0.7

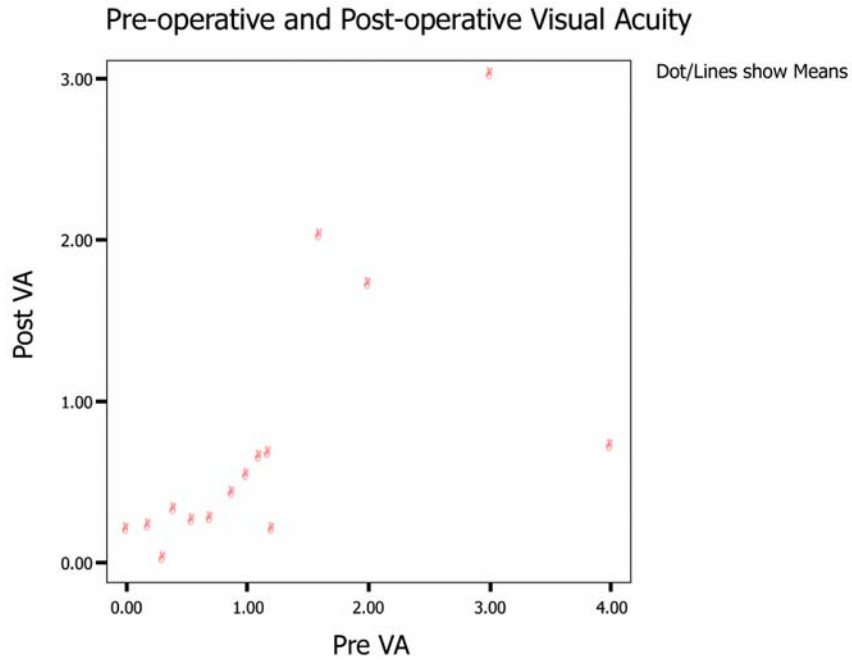


Fig. 1 Correlation between the pre-operative and post-operative visual acuity (log MAR)

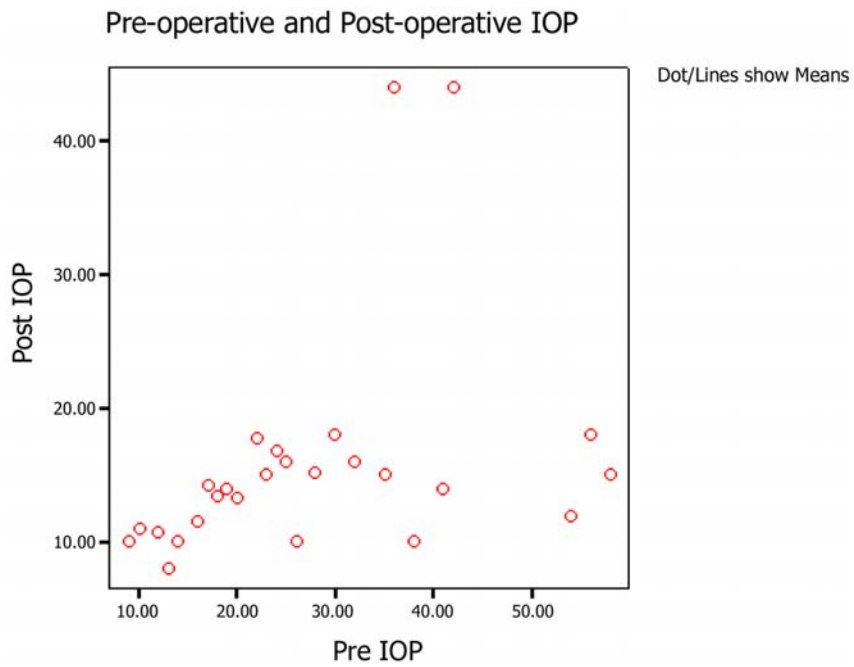


Fig. 2 Correlation between the pre-operative and post-operative intraocular pressure

Table 2. Pre and post-operative visual acuity, intraocular pressure and peripheral anterior synechiae

	Pre-operative	Post-operative	p-value
Visual acuity (logMar)	0.92 ± 0.69	0.53 ± 0.69	<0.001
Intraocular pressure (mm Hg)	23.30 ± 10.6	14.83 ± 6.54	0.003
Extent of PAS (quadrant)	2.310 ± 1.47	1.98 ± 1.60	0.076

than 180 degree, the total PAS was found in 34.5%. From the latest follow-up, the gonioscopy revealed open angle (close ≤ 180 degree) and deepening of the anterior chamber as shown in the UBM study (Fig. 3). The mean extent of peripheral anterior synechiae was decreased from 2.3 ± 1.5 quadrants to 2.0 ± 1.6 quadrants (p = 0.076) (Table 2). The reduction of IOP was not correlated with the mean post-operative extent of peripheral anterior synechiae (p = 0.19). There were 4 eyes with IOP > 21 mmHg and the antiglaucoma was started from the first week after surgery, two of them had to undergo trabeculectomy approximately 3 months later. The most frequent complication in the early post-operative period was anterior chamber reaction (14%) followed by transient IOP spike (6.8%) and corneal edema (6.8%). They were successfully treated with topical corticosteroid and IOP-lowering medications.

Discussion

The incidence of primary angle closure glaucoma in a Thai population over 40 years of age is about 0.9%⁽¹⁵⁾, where women are three times more likely to be affected than men. The incidence increases significantly in those older than 55 years of age^(6,9). The ratio

of POAG: PACG in Thais was 3.2:1, different from Caucasians (10:1), Indians (2.4:1) and Singapore Chinese (1.6:1)⁽¹⁵⁾. These may be due to the difference in axial length and anatomy of the anterior segment of the eyes. In the present study, 67.4% were women and mean age at the time of surgery was 68.5 years. There was some degree of cataract in all of them. The size and position of the lens are believed to play a major role in the pathogenesis of primary angle closure⁽⁶⁾. With aging, there is an increase in the thickness of the lens forming a dense central nucleus, sometimes making the refractive error more myopic or less hyperopia. The increase in thickness and curvature of the lens, combined with an age-related laxity of the zonules resulted in forward displacement of the lens-iris diaphragm, are conducive to the development of relatively pupillary block. This effect is likely to be accentuated and the result is crowding in the angle and anterior segment with greater predisposition to pupillary block⁽¹⁶⁾. Lens extraction by extracapsular cataract extraction and intraocular lens implantation has been found to result in satisfactory IOP control post-operatively in eyes with primary angle closure glaucoma⁽¹⁷⁻¹⁹⁾. The changes also occurred in POAG and normal eyes but it was always transient and marginal at 1 year after surgery. It is postulated that the deepening of the anterior chamber from lens removal result in reduction of angle crowding and relief of relative pupillary block. A study using Scheimpflug videophotography for measuring the angle width and depth showed that the angle in eyes with PACG increased significantly after phacoemulsification, and became similar to that in eyes with open angles⁽²⁰⁾. A quantitative study of angle configuration using UBM revealed that lens extraction has a more potent effect than iridotomy in deepening of the anterior chamber and widening of the angle⁽²¹⁾. In the present study, all

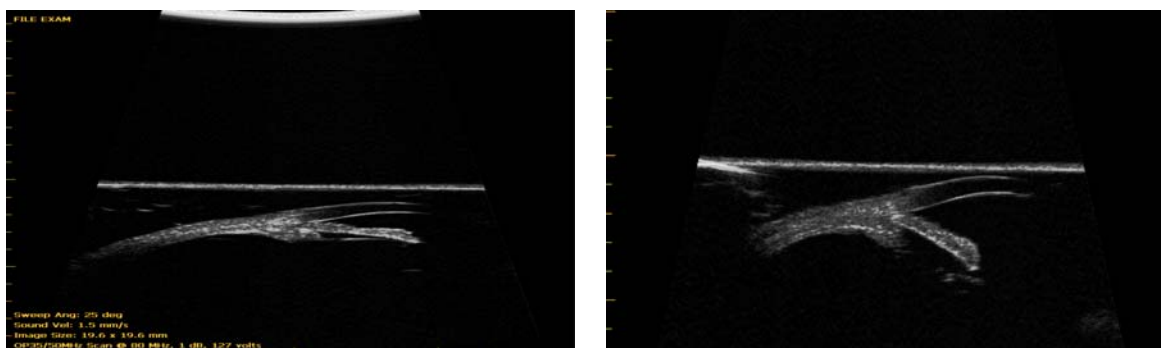


Fig. 3 The UBM study shows the anterior depth and the angle width increase after phacoemulsification surgery

the patients underwent laser iridotomy and the IOP was not well controlled despite eliminating the process of pupillary block. The non-pupillary blocking mechanism continued to cause appositional closure. The authors found from gonioscopy that there were peripheral anterior synechiae more than 180 degree in all of them. As in many studies, the IOP control after iridotomy is quite poor in the patients with advanced stage of PACG^(22,23). After phacoemulsification surgery the IOP decreased significantly whereas the anterior chamber was deepened shown by UBM, but the extent of peripheral anterior synechiae was nearly the same as pre-operative condition. These findings indicate that the removal of the lens can remove the anatomic cause of angle closure, the angle widening and chamber deepening seem to improve aqueous outflow facility to some degree. These support the postulation that the relative pupillary block or the lens-iris contact and the crowding of the anterior segment play the major role in pathogenesis of the PACG. But these effects were limited in the chronic angle closure glaucoma with peripheral anterior synechiae because the angle structures were permanently closed by the peripheral iris. The authors also found that the reduction of IOP was not correlated with the mean post-operative extent of peripheral anterior synechiae. In a few patients with long standing peripheral anterior synechiae, the permanent damage to the trabecular meshwork may occur and the IOP is uncontrolled after reopening of the angle by phacoemulsification even with goniosynechialysis. The only definitive treatment is filtering surgery⁽²⁴⁾.

Conclusion

In the present series of patients with PACG and cataract, the removal of the lens by phacoemulsification can lower the IOP to some extent. The patients with chronic angle closure glaucoma had better control of the IOP, and by phacoemulsification procedure with clear-cornea approach, the conjunctiva was well preserved for further filtering surgery if needed. It is not worth that lens removal should be done first in patients with acute angle closure. The laser iridotomy can eliminate the process of pupillary block and the further procedure should be considered after complete gonioscopy. Depending on gonioscopic findings and uncontrolled IOP, the phacoemulsification, goniosynechialysis or filtering surgery could be done at a later stage.

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ผลของการผ่าตัดเอาเลนส์ออกในผู้ป่วยต้อหินมุมปิดในกลุ่มประชากรไทย

พงศ์ศักดิ์ ปัจฉิมะกุล, ญาณภา อินทะจักร

วัตถุประสงค์: เพื่อศึกษาผลของการผ่าตัดโดยใช้อัลตราซาวด์สลายเลนส์ต่อกระจกในตาที่เป็นต้อหินมุมปิด โดยดูผลของการควบคุมความดันลูกตาและระดับสายตาดูที่ขึ้นหลังการผ่าตัด

วัสดุและวิธีการ: จำนวนตาทั้งหมด 58 ตาจากผู้ป่วยต้อหินมุมปิด 46 คนได้รับการผ่าตัดโดยใช้อัลตราซาวด์สลายต่อกระจก และใส่เลนส์แก้วตาเทียม ตรวจติดตามผู้ป่วยอย่างน้อย 6 เดือน

ผลการวิจัย: อายุเฉลี่ยของผู้ป่วยเป็น 68.5 ปี มี 2 ตาเป็นต้อหินมุมปิดชนิดเฉียบพลัน และ 56 ตา เป็นต้อหินมุมปิดชนิดเรื้อรัง 86%เป็นมุมม่านตาปิดถาวร ค่าความดันลูกตาเฉลี่ยก่อนผ่าตัดเป็น 23.3 มม.ปรอทหลังผ่าตัดเป็น 14.8 มม.ปรอท ($p < 0.05$) ระดับสายตาดูผู้ป่วยดีขึ้นจาก 0.92 logMar เป็น 0.53 logMar อย่างมีนัยสำคัญทางสถิติ ($p < 0.01$) มุมม่านตาปิดถาวรลดลงจาก 2.3 เป็น 2.0 ควอดแดรนต์ ($p = 0.076$)

สรุป: การผ่าตัดโดยใช้อัลตราซาวด์สลายต่อกระจก และใส่เลนส์เทียมจะช่วยลดความดันลูกตา ลดการปิดกั้นของมุมม่านตา เพิ่มความกว้างของมุมตา ลดปริมาณมุมตาที่ปิดถาวร และทำให้ระดับสายตาดูดีขึ้นในผู้ป่วยต้อหินมุมปิดที่มีต่อกระจกรวมด้วย
