Effects of Phacoemulsification and Intraocular Lens Implantation on Intraocular Pressure in Primary Angle Closure Glaucoma (PACG) Patients

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Objective: *To investigate the effect of cataract surgery by phacoemulsification on the intraocular pressure (IOP) in primary angle closure glaucoma (PACG) patients.*
Material and Method: *Sixty PACG patients who underwent phacoemulsification between January 2004 and May 2009 were retrospectively reviewed. Pre- and post-operative visual acuity, IOP, and number of anti-glaucoma medications were recorded. Lens thickness and anterior chamber depth (ACD) of pre-operative were also recorded. Patients who had previous intraocular surgeries or complicated cataract surgeries were excluded.*
Results: *Visual acuity logMAR improved significantly (0.17, $p < 0.01$). Mean IOP after cataract surgery decreased significantly (4.50 mmHg, $p < 0.01$). There was no significant relationship between the decrease in IOP and lens thickness or ACD. Twenty percent of PACG patients were free of antiglaucoma medication after cataract surgery.*
Conclusion: *Phacoemulsification not only improves the visual acuity in PACG patients but also reduces IOP and number of anti-glaucoma medications required significantly. The change in IOP does not significantly correlate with lens thickness or ACD.*

Keywords: *Phacoemulsification, Primary angle closure glaucoma, Intraocular pressure, Lens thickness, Anterior chamber depth*

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Primary angle closure glaucoma (PACG) was found to be one of the leading causes of blindness in Thailand and worldwide[1,2]. The risk factors for PACG include age, gender, race, refractive error, and family history. With these risk factors, a shallow anterior chamber has been recognized as a factor that predisposes towards angle closure. The depth of the anterior chamber tends to reduce with age, which may result from increased lens thickness[3].

Cataract surgery was found to help control intraocular pressure (IOP) in both angle closure glaucoma and open angle glaucoma[4]. Studies found that cataract surgery not only improve visual acuity in PACG patients but also reduce IOP, extent of peripheral anterior synechiae, and number of antiglaucoma drugs required[4-7].

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In previous studies, there were different study results about the relationship of pre-operative biometry and the reduced IOP. Some show no significant correlation between the reduced IOP and anterior chamber depth (ACD) or lens thickness[8].

The purpose of the present study was to investigate the IOP reduction in PACG patients after phacoemulsification.

Material and Method

The present study is a retrospective study. Patients who underwent cataract surgery with phacoemulsification in Songklanagarind Hospital between January 2004 and May 2009 were retrospectively reviewed. The protocol for the present study was approved by the Institutional Review Board.

Sixty patients who were included in the present study were diagnosed with PACG and cataract in the same eye underwent uncomplicated phocoemulsification cataract surgery with posterior chamber intraocular lens implantation. PACG is defined as an IOP more than 21 mm Hg with the presence of

angle closure obstructing the trabecular meshwork on gonioscopy and glaucomatous optic nerve head changes. Patients with previous ocular surgeries other than phacoemulsification, those who had complications with cataract surgery, and patients with secondary glaucoma were excluded.

Three pre-operative visits were reviewed and best-corrected visual acuity, IOP, number of antiglaucoma drugs, ACD, and lens thickness were recorded. Post-operative best corrected visual acuity, IOP, and number of antiglaucoma drugs was recorded from three post-operative visits. Paired t-test was used to compare the mean different between pre- and post-operative data. The relationship between change in IOP and ACD or lens thickness was calculated using linear regression. A p-value of less than 0.05 was considered statistically significant.

Results

There were 20 male patients and 40 female patients. Pre-operatively, the mean age is 70 $\pm$ 7.88 years old. The mean IOP was 17.44 $\pm$ 3.45 mm Hg. Mean logMAR visual acuity was 0.44 $\pm$ 0.29, as well as mean number of antiglaucoma drugs was 1.87 $\pm$ 0.77, the ACD was 2.55 $\pm$ 0.42 mm, and the lens thickness was 5.06 $\pm$ 0.48 mm, as shown in Table 1.

After phacoemulsification, there was a statistically significant improvement in the mean visual acuity and a significant reduction of the mean IOP. Twelve patients (20%) did not need any antiglaucoma medications after the cataract surgery. As for those patients that continued using anti-glaucoma medication, the number of medications used significantly decreased ($p < 0.001$), as demonstrated in Table 2.

The level of post-operative visual acuity improvement was significantly related to pre-operative visual acuity and lens thickness as shown in Table 3.

The post-operative IOP reduction significantly correlated with pre-operative IOP ($p < 0.001$) but there was no significant correlation with lens thickness and anterior chamber depth ($p = 0.908$ and $p = 0.591$ respectively). The reduced number of antiglaucoma medication used after cataract surgery had a significant correlation with pre-operative IOP but did not correlate with lens thickness and ACD, Table 3.

Table 1. Pre-operative demographic data in PACG patients

Pre-operative data (n = 60)	Mean $\pm$ SD
Mean age (year)	70.00 $\pm$ 7.88
Best corrected visual acuity (logMAR)	0.44 $\pm$ 0.29
Mean IOP (mmHg)	17.44 $\pm$ 3.45
Mean number of antiglaucoma drugs	1.87 $\pm$ 0.77
Anterior chamber depth (mm)	2.55 $\pm$ 0.42
Lens thickness (mm)	5.06 $\pm$ 0.48

PACG = primary angle closure glaucoma; logMAR = logarithm of minimum angle of resolution; IOP = intraocular pressure

Discussion

The present study demonstrates that cataract surgery can improve the patients' visual acuity significantly and decrease IOP in both PACG patients. The correlation of IOP reduction and pre-operative factors that was reported in the present study were also seen in a study by Issa et al[8] that is the difference of IOP between pre-operative and post-operative correlate with pre-operative IOP but does not correlate with lens thickness or anterior chamber depth. However, this result is different from a study by Lui et al[9] which reported that patients with higher pre-operative IOP would have little IOP reduction due to a more damaged trabecular meshwork.

The reduction of antiglaucoma medication needed after cataract surgery in this was statistically significant in PACG patients as reported in a previous study by Hayashi et al[4]. The results of the present study showed that twenty percent of the patients could stop using antiglaucoma medication while the study by Hayashi showed that forty percent of their

Table 2. Comparison of pre-operative and post-operative data in PACG

Parameters (n = 60)	Pre-operative	Post-operative	Change	p-value
Visual acuity (logMAR)	0.44 $\pm$ 0.29	0.26 $\pm$ 0.21	0.17 $\pm$ 0.25	<0.001
Mean IOP (mmHg)	17.44 $\pm$ 3.45	12.93 $\pm$ 2.49	4.51 $\pm$ 3.04	<0.001
Mean number of antiglaucoma	1.87 $\pm$ 0.77	1.43 $\pm$ 1.03	0.43 $\pm$ 0.65	<0.001

PACG = primary angle closure glaucoma; logMAR = logarithm of minimum angle of resolution; IOP = intraocular pressure

Table 3. The correlation of pre-operative and post-operative parameters in PACG group

Post-operative	Pre-operative factor	Correlation (r)	p-value
Difference of visual acuity	Visual acuity	0.709	<0.001
	Lens thickness	0.263	0.042
Difference of IOP	IOP	0.711	<0.001
	Lens thickness	0.015	0.908
	Anterior chamber depth	-0.071	0.591
Difference of number of medication	IOP	0.332	0.010
	Lens thickness	0.026	0.841
	Anterior chamber depth	0.079	0.548

IOP = intraocular pressure; PACG = primary angle closure glaucoma

patients did not need to continue antiglaucoma medication. The difference in the number could be because of a longer follow-up time in the study by Hayashi that followed the patients up to two years while the present study was able to collect post-operative data up to only six months.

There was no correlation between the reduction of IOP after cataract surgery and anterior chamber depth, which is different from the study by Kashiwagi et al[10]. That study reported that patients with shallower anterior chamber depth would have more IOP reduction. However, the patients with shallower anterior chamber in the study by Kawashigi et al also had higher pre-operative IOP hence the IOP reduction might be influenced from the higher level of pre-operative IOP.

Different studies had tried to demonstrate the relationship between pre-operative factors and the post-operative IOP reduction in PACG patients especially the correlation with lens thickness and anterior chamber depth. The different study results may be from the different patient selection and study designs. However, those studies all reported that cataract surgery helps significantly reduce IOP and number of antiglaucoma medication needed.

The present study is a retrospective study causing a limitation of data collection, post-operative period and was not able to demonstrate the change in anterior chamber depth after cataract surgery. A further study demonstrating the change of anterior chamber depth and the possible correlation with the reduced IOP would be useful.

In conclusion, the present study showed that cataract surgery by phacoemulsification not only improves the visual acuity in PACG patients but also reduces IOP and number of antiglaucoma medications required significantly. The change in IOP does not significantly correlate with lens thickness or anterior chamber depth.

Potential conflicts of interest

None.

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ผลของการผ่าตัดต้อกระจกโดยวิธีสลายต้อกระจกต่อความดันลูกตาในผู้ป่วยต้อหินมุมปิดปฐมภูมิ

นุสรา ยุทธสมภพ, บุญชัย หวังศุภดิลก

วัตถุประสงค์: *ศึกษาผลของการผ่าตัดต้อกระจกโดยวิธีสลายต้อกระจกต่อความดันลูกตาในผู้ป่วยต้อหินมุมปิดแบบปฐมภูมิ*

วัสดุและวิธีการ: *ผู้ป่วยต้อหินมุมปิดแบบปฐมภูมิ 60 คน ที่เข้ารับการผ่าตัดต้อกระจกโดยวิธีสลายต้อกระจกที่โรงพยาบาลสงขลานครินทร์ระหว่างเดือนมกราคม พ.ศ. 2547 ถึงพฤษภาคม พ.ศ. 2552 ได้รับการสืบค้นโดยเก็บข้อมูล (ระดับสายตา, ความดันลูกตา, จำนวนยาต้อหิน รวมถึงความหนาของเลนส์ตา และความลึกของช่องหน้าลูกตา) ก่อนและหลังการผ่าตัดต้อกระจก ผู้ป่วยที่เคยได้รับการผ่าตัดตามาก่อน หรือ เกิดการแทรกซ้อนในระหว่างการผ่าตัดจะถูกตัดออกจากการศึกษา*

ผลการศึกษา: *ระดับสายตาดีขึ้นอย่างมีนัยสำคัญทางสถิติทั้งในกลุ่มต้อหินมุมปิดปฐมภูมิ (0.17, $p < 0.01$) ความดันลูกตาเฉลี่ยภายหลังผ่าตัดต้อกระจกลดลงอย่างมีนัยสำคัญทางสถิติ (4.50 มม.ปรอท, $p < 0.01$) ทั้งไม่พบความสัมพันธ์ระหว่างความดันลูกตาที่ลดลงกับความหนาของเลนส์ตาและความลึกของช่องหน้าลูกตา พบว่าร้อยละ 20 ของผู้ป่วยต้อหินมุมปิดปฐมภูมิไม่ต้องใช้ยารักษาต้อหินภายหลังการผ่าตัดต้อกระจก*

สรุป: *การผ่าตัดต้อกระจกโดยวิธีสลายต้อกระจก ไม่เพียงแต่จะทำให้ระดับการมองเห็นดีขึ้น ในผู้ป่วยต้อหินมุมปิดปฐมภูมิ แต่ยังช่วยลดความดันลูกตา และจำนวนยารักษาต้อหินที่ใช้ได้อย่างมีนัยสำคัญแต่ไม่พบว่าความดันลูกตาที่เปลี่ยนไปมีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ กับความหนาของเลนส์ตาและความลึกของช่องหน้าลูกตา*