Intraocular Pressure Control Following Phacoemulsification in Patients with Chronic Angle Closure Glaucoma

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Objectives: *To evaluate intraocular pressure (IOP) and glaucoma control following phacoemulsification with posterior chamber intraocular lens implantation in patients who had chronic angle closure glaucoma (CACG) whose peripheral anterior synechiae (PAS) were less than 270 degrees.*
Design: *Non-randomized consecutive cases series.*
Participants: *CACG cases at the glaucoma service, Ramathibodi Hospital who underwent Neodymium YAG laser peripheral iridotomy (PI) and subsequently received or did not receive anti-glaucoma medication.*
Material and Method: *Retrospective analysis of CACG patients who had PAS 270 degrees or less and underwent YAG-PI with or without anti-glaucoma medication to control IOP at 21 mmHg or less. The IOP and number of anti-glaucoma medication used at 1, 3 and 6 months were measured. Patients were classified into 2 Groups according to degree of PAS: Group1 were patients who had PAS 180 ^{o} or less and Group 2 were those whose PAS was between 181 ^{o} and 270 ^{o} .*
Main Outcome Measures: *The IOP and number of anti-glaucoma medication at baseline and postoperatively at 1, 3 and 6 months were compared by nonparametric statistics.*
Results: *There were 28 patients (48 eyes) in the present study. Twenty two were females and 6 were males. Patients' age ranged from 45 to 76 years old with a mean of 55 $\pm$ 6.5 years.Of the 48 eyes, 34 were in Group1 and 14 were in Group2. In Group1, the mean baseline IOP was 20 $\pm$ 2.5 mmHg. and the average number of preoperative anti-glaucoma medication used was 0.08. At 1,3 and 6 months postoperatively, the IOPs were 16.2 $\pm$ 2.2, 17.1 $\pm$ 2.0, 18.1 $\pm$ 1.4 mmHg. respectively with an average number of anti-glaucoma medications of 0, 0.3 and 0.3, respectively, whereas in Group2, the mean baseline IOP was 22 $\pm$ 3.8 mmHg and mean preoperative number of anti-glaucoma was 1.8, whereas postoperatively, the IOPs at 1, 3 and 6 months were 17.1 $\pm$ 2.2,17.3 $\pm$ 1.8,and 17.1 $\pm$ 1.7 mmHg, with an average number of 1.1, 1.4 and 1.4 anti-glaucoma medications used, respectively. When compared between the 2 Groups, Group 1 had a significant difference in IOP control at 1 and 3 months and less use of antiglaucoma medications than Group 2 up to at least 6 months.*
Conclusion: *Phacoemulsification in CACG helped control of glaucoma. There was a statistically significant difference in IOP reduction and number of anti-glaucoma medication used before and after phacoemulsification in the CACG patients whose PAS did not exceed 270 degrees at least up to 6 months.*

Keywords: *Chronic angle closure glaucoma, Phacoemulsification*

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Glaucoma is the leading cause of visual impairment and blindness worldwide[1].Angle closure glaucoma (ACG) is a major form of glaucoma resulting in greater morbidity including bilateral blindness in Asian descent[2-4]. Risk factors include race, female gender, older age, anatomic abnormalities i.e. shallow anterior chamber (AC), small corneal diameter, increased lens thickness, pseudo-exfoliation syndrome, as well as exposure to certain drugs[5-7].Mechanisms of primary

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angle closure include relative papillary block, plateau iris configuration and forward movement of the lens. The mean AC depth in eyes that have ACG is approximately 1.8 mm shorter than in normal eyes [8] due to an increasing lens thickness and anterior position of the lens[14]. A long-term cure of ACG could be expected if the angle obstruction was removed earlier before permanent closure of the filtration angle occurs. Goniosynechialysis (GSL), as well as phacoemulsification (PE) with GSL have been shown to successfully lower the IOP in patients with uncontrolled ACG[10]. However, the authors wanted to know whether or not PE and posterior chamber intraocular lens (IOL) implantation in eyes that underwent YAG-PI would possibly help control IOP of these patients. The objective of the present study was to assess the IOP control in CACG patients with PAS $\leq 270^{o}$ who had underwent YAG-PI with or without antiglaucoma medication prior to phacoemulsification.

Material and Method

The present study was a retrospective consecutive cases series of a single surgeon who performed PE with IOL in the eyes of patients who had cataract and CACG. These eyes previously underwent YAG-PI and subsequently received anti-glaucoma medication. Patients were classified into 2 Groups according to degree of PAS. Group 1 consisted of patients who had PAS of 180^{o} or less and Group 2 were those whose PAS were between 181^{o} and 270^{o}. Patients with PAS more than 270^{o} were excluded from the study. All eyes underwent clear corneal PE with foldable intraocular lens implantation and received antiglaucoma medication to control IOP postoperatively targeted at 21 mmHg or lower. The authors evaluated the outcome by means of comparing IOP and number of anti-glaucoma medication required between the 2 Groups at baseline and at 1,3 and 6 months postoperatively by Wilcoxon Sign Romb test for peakline vs 1, 3, 6 months and Mann Whitney U-test to compare between Group 1 and Group 2 at 1, 3, 6 months respectively with statistical significance at $p < 0.05$.

Results

From Tables 1 and 2 it was found that at one month postoperatively, patients in Group 1 had a mean IOP of 16.2 ± 2.2 mmHg and none required any glaucoma medication, while in Group2, the mean IOPs was 17.1 ± 2.2 mmHg with an average of 1.1 medication. At 3 months postoperatively, the mean IOPs in Group 1 were 17.1 ± 2.0 mmHg with an average of 0.03 medication, whereas in Group2 mean IOP was 17.3 ± 1.8 mmHg with an average of 1.4 medication. At the last follow-up at 6 months, the mean IOP in Group1 was 18.1 ± 1.4

Table 1. Mean IOP $\pm$ SD in Group 1 and Group 2 at baseline and postoperatively

	N = 48 eyes	Mean baseline IOP $\pm$ SD	Mean Postop IOP $\pm$ SD		
			1m	3m	6m
Group 1	34	20 ± 2.5	16.2 ± 2.2	17.1 ± 2.0	18.1 ± 1.4
Group 2	14	22 ± 3.8	17.1 ± 2.2	17.3 ± 1.8	17.1 ± 1.7
p value			0.0078	0.033	0.11

SD = Standard deviation

Table 2. Average number of antiglaucoma medications used in Group1 and Group2 at baseline and postoperatively

	N = 48 eyes	Average number of antiglaucoma med (Baseline)	Average number of antiglaucoma med (Postop)		
			1m	3m	6m
Group 1	34	0.08	0	0.03	0.03
Group 2	14	1.8	1.1	1.4	1.4
p value			0.05	0.01	0.01

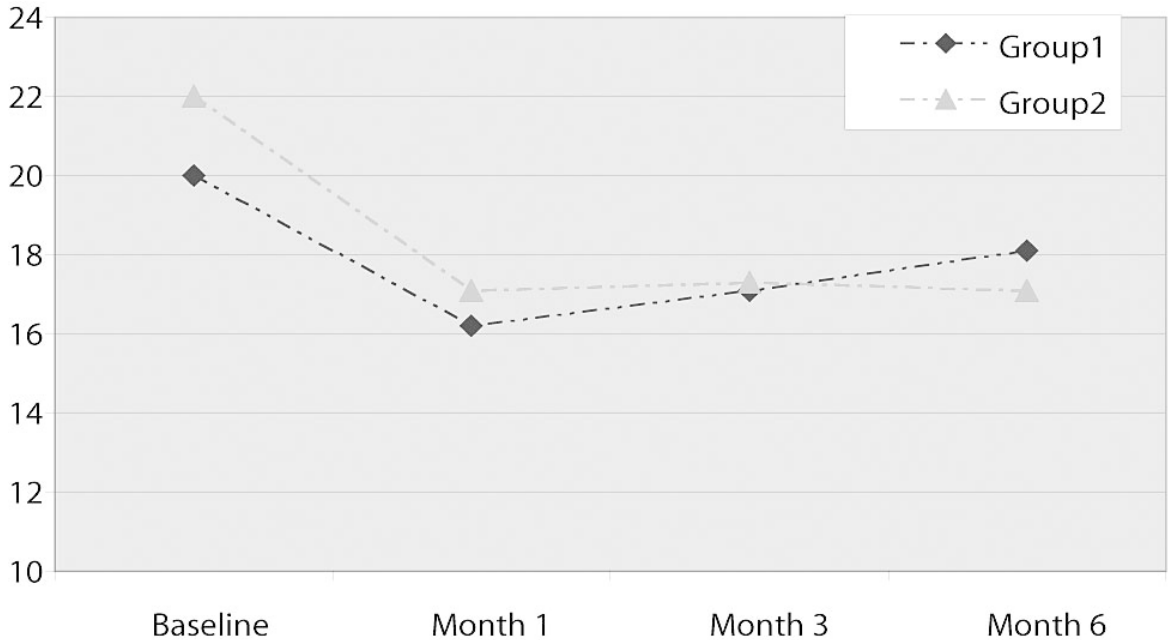

Fig. 1 Mean IOP of Patiens in Group 1 (PAS < 180) and Group 2 (PAS 181-270) at Baseline and Postoperatively at 1, 3 and 6 months

mmHg with an average of 0.03 medication while in Group 2 mean IOP was 17.1 $\pm$ 1.7 mmHg with an average of 1.4 medication. When comparing IOP control of patients before and after phacoemulsification in Group1 and Group 2, it was found that patients in Group 1 had IOP control significantly better than those in Group 2 at 1 and 3 months postoperatively ($p = 0.008$ and $p = 0.03$, respectively), but not at 6 months ($p = 0.11$). As to the number of anti-glaucoma used, it was found that patients in Group1 used less anti-glaucoma medication than those in Group 2 significantly at all 3 visits post-operatively ($p = 0.05$, $p = 0.01$ and $p = 0.01$ at 1, 3 and 6 months respectively) which reflected a more severe degree of PAS with less functioning trabecular mesh-work in the latter Group.

Discussion

The prevalence of primary angle-closure glaucoma (PACG) is higher among the Asian race compared to Caucasians[4,11,12]. The study analysis population data from Mongolia and Singapore suggested that AC depth is a risk factor for angle closure and that the angle width appears to be correlated with the proportion of PAS. In that study the rate of PAS among Mongolians increased dramatically in eyes with AC depth < 2.4 mm while in Singaporeans the increase in PAS was more gradual[13]. Comparisons of data between populations is relatively consistent with this finding[14]. However, a recent study has shown that angle width depends on many factors and can rapidly vary as shown in ultra-sound biomicroscopy[15].

ACG and other clinical subtypes of plateau iris syndrome, plateau iris configuration and floppy zonule or mobile lens, all are surgical cases. Among these cases despite post-iridectomy, a large number of patients required additional medical therapies in which glaucoma surgical interventions usually were unavoid-able in the long-term follow-up. The mechanisms of uncontrollable IOP were due to trabecular damage, creeping angle-closure and mechanical forward move-ment of the lens.

Lens removal, whether it was cataractous or not, in an appropriate time prior to irreversible perma-nent synechial closure of the angle will add favorable outcome to glaucoma control. Removal of cataract in narrow eyes or eyes with ACG has an impact on AC width and depth. Hayashi et al found that the width and depth of the anterior chamber angle in eyes with angle-closure glaucoma increased significantly after cataract extraction and intraocular lens (IOL) implanta-tion and became similar to that in eyes with open-angle glaucoma (OAG) and that in normal eyes[16]. Greve has reported the effect of ECCE and posterior chamber IOL implantation on IOP in patients with PACG. In many

cases ECCE was performed instead of a filtering surgery with good IOP reduction and only a few eyes needed anti-glaucoma medication after surgery and preferred cataract surgery only rather than a cataract and future trabeculectomy[17,18]. Yang and Hung reported the anterior chamber angle widened significantly in all quadrants after lens removal and all eyes in the ACG group maintained an IOP under 21 mm Hg during the 6-month follow-up with eighty-four percent maintained or decreased their anti-glaucoma medication and 16% required more medication[19]. The results of the present study show that phacoemulsification with IOL implantation in eyes with CACG previously treated with YAG-PI can achieve a satisfactorily IOP control in CACG patients whose PAS was 180 ° or less better than those whose PAS was more extensive (181-270 degrees), up to 6 months. At target pressure of 21 mm Hg or less, patients with lesser degree of PAS used less anti-glaucoma medication than those with more advanced PAS significantly. Phacoemulsification can reopen the relative closed angle that was not permanently closed. The increasing lens thickness in this anatomically small eyes when replaced with artificial lens which is thinner than a natural lens, can significantly restore the angle structure function because trabecular meshwork itself is not permanently damaged. The authors advocate the choice of the first cataract procedure with subsequent trabeculectomy as we believe that a significant number of CACG patients may benefit from cataract surgery with additional few anti glaucoma medications than a trabeculectomy followed by a cataract procedure or a combined procedure of cataract/glaucoma surgery in the first setting which in the long-term may pose a problem of risking development of bleb-related endophthalmitis. Other more complicated procedures such as drainage surgery in patients with ACG is associated with multiple surgical interventions and deterioration in visual function. The present study had limitation in long term follow up of IOP control and comparison with combined phaco-trabeculectomy in each study group. Future studies on evaluation of this procedure using a new evaluation of an angle width with other intervention would be justified.

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การควบคุมความดันลูกตาในผู้ป่วยต้อหินมุมปิดชนิดเรื้อรังหลังผ่าตัดสลายต้อกระจกด้วยคลื่นเสียงความถี่สูง

อัทยา อยู่สวัสดิ์, สุขุมา วรศักดิ์

วัตถุประสงค์: *เพื่อประเมินความดันลูกตาและจำนวนยาต้อหินที่ใช้ในการควบคุมต้อหิน ในผู้ป่วยที่เป็นต้อหินชนิดมุมปิดเรื้อรัง และต้อกระจก ภายหลังผ่าตัดต้อกระจกโดยวิธีสลายต้อกระจกด้วยคลื่นความถี่สูง และฝังเลนส์แก้วตาเทียม*

วัสดุและวิธีการ: *ศึกษาย้อนหลังผู้ป่วยที่เป็นต้อกระจกชนิดมุมปิด และได้รับการรักษาขั้นต้นด้วยการยิงเลเซอร์ YAG เจาะรูม่านตาส่วนริมและอาจใช้ยาต้อหินควบคุมความดันลูกตาต่อ เพื่อให้ได้ความดันลูกตาในระดับไม่เกิน 21 มม.ปรอท จำแนกผู้ป่วยเป็น 2 ประเภท ตามความมากน้อยของมุมตาที่ปิด คือกลุ่มที่ 1 หมายถึง ผู้ป่วยที่มีมุมตาที่ปิดภายใน 180 องศา และกลุ่มที่ 2 มีมุมตาปิด ตั้งแต่ 181-270 องศา วัดผลโดยเปรียบเทียบค่าเฉลี่ยความดันในลูกตาและจำนวนยาต้อหินที่ใช้ควบคุมความดันลูกตา ระหว่างก่อนผ่าตัด และ ที่ 1, 3 และ 6 เดือนหลังผ่าตัด โดยถือว่ามีความแตกต่างอย่างมีนัยสำคัญ ที่ความเชื่อมั่นในระดับ $p<0.05$*

ผลการศึกษา: *มีผู้ป่วยทั้งสิ้น 28 ราย (48 ตา) เป็นผู้หญิง 22 คน และผู้ชาย 6 คน อายุระหว่าง 45 ถึง 76 ปี โดยอายุเฉลี่ย 55 $\pm$ 6.5 ปี ในจำนวน 48 ตา อยู่ในกลุ่ม 1 จำนวน 34 ตา และกลุ่มที่ 2 จำนวน 14 ตา ค่าเฉลี่ยความดันลูกตาก่อนผ่าตัดในกลุ่มที่ 1 วัดได้ 20 $\pm$ 2.5 มม.ปรอท และยาที่ใช้เท่ากับ 0.08 ตัว หลังผ่าตัดพบว่าความดันลูกตาลดลงที่ 1, 3 และ 6 เดือน ลดลงตามลำดับอย่างมีนัยสำคัญ และค่าเฉลี่ยของยาที่ใช้ คือ 0, 0.03 และ 0.03 ส่วนในกลุ่มที่ 2 ค่าความดันลูกตาก่อนผ่าตัดวัดได้เฉลี่ย 22 $\pm$ 3.8 มม.ปรอท และค่ายาเฉลี่ยที่ใช้ หลังผ่าตัดความดันลูกตาลดลงอย่างมีนัยสำคัญ และค่าเฉลี่ยของยาที่ใช้เท่ากับ 1.1 ตัว, 1.4 ตัว และ 1.4 ตัว ตามลำดับ เมื่อเปรียบเทียบค่าดังกล่าวระหว่างผู้ป่วยในกลุ่มที่ 1 และ 2 พบว่า ความดันลูกตาและจำนวนยาที่ใช้หลังผ่าตัดลดลงในกลุ่มที่ 1 ดีกว่าในกลุ่มที่ 2 อย่างมีนัยสำคัญทางสถิติ*

สรุป: *การสลายต้อกระจกโดยใช้คลื่นเสียงความถี่สูง มีส่วนช่วยให้การควบคุมต้อหินดีขึ้น โดยค่าเฉลี่ยของความดันลูกตาลดลง และจำนวนยาที่ใช้ช่วยควบคุมความดันลูกตาลดลงอย่างน้อยเป็นระยะเวลา 6 เดือน*