

EVALUATION THE EFFECTIVENESS OF PHACOEMULSIFICATION COMBINED WITH GONIOSYNECHIALYSIS IN TREATMENT OF CHRONIC PRIMARY ANGLE-CLOSURE GLAUCOMA WITH CATARACT

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ABSTRACT

Objectives: To evaluate the results of phacoemulsification combined with goniosynechialysis on chronic primary angle-closure glaucoma (PACG) with cataract and to demonstrate the factors related to surgical results. **Subjects and methods:** A prospective descriptive study with no control was conducted on a total of 30 eyes from 27 PACG patients with cataracts, which underwent phacoemulsification combined with goniosynechialysis in Ha Dong Eye Hospital since February 2019 to September 2019. **Results:** Among 27 patients with 30 eyes in the study group, the absolute success rate was 86.7% and the relative success rate was 13.3%, while there were no patients with treatment failure. Visual acuity increased from 1.01 ± 1.01 before surgery to 0.37 ± 0.94 after surgery. Intraocular pressure decreased from 29.56 ± 3.02 mm Hg to 18.37 ± 2.65 mm Hg. Synechiae decreased from $227.9^\circ \pm 34.5^\circ$ to $46.6^\circ \pm 4.5^\circ$ after 1 month and $54.7^\circ \pm 8.1^\circ$ after 3 months. No serious complication was reported, most common complication was anterior chamber exudate (20%) which responded well to treatment and didn't affect surgical results. Factors related to surgical results included time of disease detection less than 1 year had a success rate 7 times higher than disease detection over 1 year; eyes with anterior chamber angle $<180^\circ$ before surgery had an absolute success rate 2.15 times higher than

eyes with anterior chamber angle $>180^\circ$ before surgery. **Conclusions:** Phacogoniosynechialysis is an effective and safe surgical option for chronic PACG with cataracts.

Keywords: phacogoniosynechialysis, glaucoma, cataracts.

I. INTRODUCTION

Glaucoma is one of the leading causes of irreversible blindness with more than 3.9 million people suffering from binocular blindness as of 2010 and 5.3 million in 2020 [6]

Primary angle-closure glaucoma consists of two main forms, acute and chronic. Based on the pathogenesis of angle-closure glaucoma and the association between cataracts and the progression of angle-closure glaucoma, in cases where angle-closure glaucoma is accompanied by cataracts, phacoemulsification combined with trabeculectomy is often indicated for the purpose of addressing two conditions in the same operation [3], [4], [5]. However, recent research has shown that phacoemulsification combined with trabeculectomy can decrease intraocular pressure better than phacoemulsification alone but causes more complications in the postoperative process, mainly related to the fistula and permeability of trabeculectomy [7].

Goniosynechialysis in glaucoma treatment has been implemented in clinical practice because it can solve the mechanism of pupil obstruction, expanding the anterior chamber angle, and stripping peripheral anterior synechiae, helping to restore the pathway of physiological drainage. Moreover,

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goniosynechialysis avoids the complications of probe surgery, which is essentially non-physiological drainage.

Currently, there are no studies in Vietnam evaluating the effectiveness of treatment for chronic primary angle-closure glaucoma with cataract. Therefore, we conducted a study namely "Evaluation the effectiveness of phacoemulsification combined with goniosynechialysis in treatment of chronic primary angle-closure glaucoma with cataract" with the following two objectives:

1. To evaluate the effectiveness of phacoemulsification combined with goniosynechialysis in treatment of chronic primary angle-closure glaucoma with cataract.

2. To analyze several factors related to the results of surgery.

II. RESEARCH SUBJECTS AND METHODS

The study was conducted from February 2019 to September 2019 on eyes diagnosed with chronic primary angle-closure glaucoma with cataracts.

1. Inclusion criteria

- Patients diagnosed with chronic primary angle-closure glaucoma.
- Anterior chamber angle $\geq 90^\circ$ (it is not necessary to be consecutive)
- Grade III or higher cataracts according to LOCS III classification [1]
- Agree to participate in the study.

2. Exclusion criteria

- Have done intraocular interventional surgery before (except MMCB laser)
- History of eye injury that damaged the anterior corner (such as anterior chamber angle recession)
- Have taken anticoagulants
- History of uveitis, endophthalmitis, corneal ulcers.
- Endothelial cell density $< 1000 \text{ mm}^2$

3. Research methodology

Prospective descriptive study with no control.

4. Study sample size

Apply the sample size calculation formula:
$$n = Z_{1-\alpha/2}^2 \frac{p(1-p)}{\Delta^2}$$

The minimum calculated sample size was 29 eyes. A sample of 30 eyes was collected in reality.

5. Steps to conduct research

- Patients selected for the study were comprehensively examined, tested and had medical records. Then patients received surgery and followed up after 1 week, 1 month, and 3 months.

- The results of surgery was evaluated and influencing factors were analyzed.

6. Data analysis

Data was analyzed using the SPSS 23.0 software. Surgical results were analyzed and tested using T test and Mann-Whitney test

III. RESULTS AND DISCUSSION

Of the 27 patients in the study, 17 were female (63%), which nearly twiced as many as male patients (10 males, accounting for 37%). Female proportion in this study was consistent with the epidemiological characteristics of angle-closure glaucoma, which was more common in females than males and can be observed in studies of primary angle-closure glaucoma.

1. Age characteristics

The study involved 30 eyes of 27 patients aged from 53 to 81, with an average of 66.87 ± 8.56 . In which, the older-than-70 group accounted for a higher proportion with 13 patients accounting for 43.4%, as the frequency of chronic angle-closure glaucoma increases with age. Another study by Takanori Kameda (2012) on 109 patients indicated an average age of 70 ± 9.4 [8].

2. The result of surgery

3. Intraocular pressure results

Table 1. Pre-operative and post-operative intraocular pressure

Intraocular pressure Time	Average Mean ± SD (mm Hg)	Difference before and after surgery Mean ± SD (mm Hg)	% decrease	P
Before surgery	29.56 ± 3.02			
1 week after surgery	19.30 ± 2.68	10.26 ± 4.29	34.7 %	<0.001
1 month after surgery	18.13 ± 2.43	11.43 ± 4.12	38.7 %	<0.001
3 months after surgery	18.37 ± 2.65	11.19 ± 4.17	37.8%	<0.001

Remarks: The average pre-operative intraoperative intraocular pressure of patients was 29.56± 3.02 mmHg. After 3 months of surgery, the average post-operative intraocular pressure was 18.37 ± 2.65, reducing 11.19 mmHg corresponding to a reduction of 37.9% compared to the pre-operative intraocular pressure.

Table 2. Intraocular pressure treatment result

Intraocular pressure Time	<21 mmHg, without using medicines to reduce intraocular pressure n (%)	<21 mmHg with using medicines to reduce intraocular pressure n (%)	>21mmHg n (%)
1 week after surgery	24 (80%)	6 (20%)	0 (0%)
1 month after surgery	26 (86.7%)	4 (13.3%)	0 (0%)
3 months after surgery	26 (86.7%)	4 (13.3%)	0 (%)

Remarks: There were 26 patients (86.7%) achieved absolute treatment success, 4 patients (13.3%) achieved relative success, and none experienced treatment failure after 3 months of surgery.

Comparison to other studies indicated similar results in the reduction of intraocular pressure after surgery, which was statistically significant. The highest reduction of intraocular pressure was observed in a study by Varma, reducing intraocular pressure from 52.1 mmHg before surgery to 14.1 mmHg after surgery, which could be due to the selection of patients with relatively high intraocular pressure before surgery.

4. Visual acuity results

Table 3. Pre-operative and post-operative visual acuity

Visual acuity		Mean ± SD	Min-max	p (before -after surgery)
Before surgery *		1.01 ± 1.01	2.3 - 0.5	
After surgery	1 week	0.54 ± 0.89	1 - 0.2	<0.001
	1 month	0.40 ± 0.98	0.7 - 0.2	<0.001
	3 months	0.38 ± 0.94	0.6 - 0.2	<0.001

*₂ Visual acuity is calculated according to the LogMar chart

*₁ Visual acuity is calculated according to the Snellen panel

Remarks: The average postoperative visual acuity increased from 1.01 to 0.54 after 1 week of surgery, equivalent to 5 rows on the Snellen panel, and continued to increase to 0.37 at 3 months with maximum corrective glasses. This can be explained by the fact that, after surgery, many patients may have an inflammatory reaction in the anterior chamber and pupillary exudates.

The improvements of visual acuity in our study were much higher than in as study by Paul J. Harasymowycz in 2005 [2]. The explanation for this difference may be that all 21 patients in this study group received acute treatment and laser peripheral iridotomy, and 6 of the 21 patients received iris-shaping laser surgery. As a result, the preoperative vision acuity of patients in Harasymowycz's study was much higher than in our study.

Anterior chamber angle results

The anterior chamber angle was clinically assessed by angular scanning and determining the opening level of 4 angles. Before surgery, the opening levels of all angles were grade 0 or I and increased to grade III and IV after surgery. However, after 3 month of surgery, grade IV was common in lower angle and temporal angles, accounting for 96.7% and 90%, respectively.

Evaluation of the anterior chamber angle via ultrasound biomicroscopy found an increase in the angle from 7.46° to 36.89°, which was statistically significant with $p < 0.001$. Evaluation results on both clinical angoscopy and ultrasound biomicroscopy showed that the anterior chamber angle significantly improved after surgery. This can be explained by the fact that vitreous removal losed the pupil blockage mechanism, created a clear passage to the anterior chamber; moreover, goniosynechialysis revealed the

raft area, facilitating the circulation of aqueous fluid, also contributing to increased anterior chamber angle.

5. Complications of surgery

In our study, the most common postoperative complication was anterior chamber exudate, occuring on 9 out of 30 patients, accounting for 30%. Other complications such as hyphema, eyelid split or iris injury are absent. Our results were quite similar to other studies, such as Chaiwait Teekhasaenee reported pupillary exudates on 19.2% eyes (10/52) and Hinenobu reported 35,7% eyes (25/70), which were also the main complication in these studies [9].

Other studies also found that pupillary exudates were more common in acute glaucoma than chronic glaucoma, which usually occurred within the first week after surgery, and responded very well to treatment. Other complications such as hyphema, severe anterior chamber lesions or Descemet detachment were often rare due to the glass system allowing good surgical observation as well as combined with a specialized angular adhesive separator that allowed good control of operations during the adhesive separation process and limit complications.

6. Influencing factors to the surgery results

Table 4. Several factors are related to post-operative success rates

Factors		N (successful surgeries) *	%	OR	95%CI	p
Pre-operative intraocular pressure	≥30 (n=9)	8	88.9	1.18	0.12 – 14.87	0.82
	<30 (n=21)	18	85.7			
Pre-operative anterior chamber angle	≥180 (n=15)	12	80	2.15	0.17 – 26.67	0.55
	<180 (n=15)	14	93.3			
Detection time	>1 year(n=8)	5	62.5	7.00	1.54 – 91.11	0.048
	< 1 year (n=22)	21	95.5			
Anterior chamber depth	<2mm (n=29)	25	86.2			>0.05
	≥2mm (n=1)	1	100			

* Absolute success of intraocular pressure < 21 mmHg, without using medicines to reduce intraocular pressure after 3 months of surgery.

The study assessed the impact of a number of relevant factors such as age, gender, pre-operative intraoperative pressure, anterior chamber angle, number of medications taken before surgery, time of detection, anterior chamber depth on success rate of surgery after 3 months. The surgery's success rate in the group detecting the disease for less than 1 year was 95.5% while the success rate in the group detecting the disease for over 1 year was 62.5%, with OR= 7 and $p < 0.05$, indicating that the surgery's success rate of the group detecting the disease for less than 1 year was 7 times higher than that of the group detecting the disease for over 1 year. Regarding anterior chamber angle, eyes with anterior chamber angle $< 180^\circ$ before surgery had a 2 times higher treatment success rate than those with anterior chamber angle $> 180^\circ$ before surgery. Other factors such as pre-operative intraoperative pressure and anterior chamber depth did not affect surgical results.

IV. CONCLUSION

1. The results of phacoemulsification combined with goniosynechialysis

Phacoemulsification combined with goniosynechialysis was a safe and effective surgery:

- The absolute success rate was 86.7%, the relative success rate was 13.3%, with no patients experienced treatment failure.

- Visual acuity increased from 1.01 ± 1.01 before surgery to 0.37 ± 0.94 after surgery.

- Intraoperative pressure decreased from 29.56 ± 3.02 mm Hg to 18.37 ± 2.65 mm Hg after surgery.

- Anterior chamber angle decreased from $227.9^\circ \pm 34.5^\circ$ to $46.6^\circ \pm 4.5^\circ$ after 1 month of surgery and $54.7^\circ \pm 8.1^\circ$ after 3 months of surgery.

- Postoperative complications were very few, mainly anterior chamber exudate (20%), which responded well to treatment and did not affect surgical results.

2. Influencing factors

- Disease detection less than 1 year had a 7-fold higher success rate than disease detection over 1 year.

- Eyes with pre-operative anterior chamber angle less than 180° had a 2-fold higher success rate than eyes with pre-operative anterior chamber angle higher than 180° .

REFERENCES

1. **National Eye Hospital**, Ophthalmology Vol. 2, Medical Publishing House, 2012
2. **Harasymowycz PJ, Papamatheakis DG, Ahmed I, et al (2005)**, Phacoemulsification and goniosynechialysis in the management of unresponsive primary angle closure, *J Glaucoma* 14:186-9.
3. **Hayashi K, Hayashi H, Nakao F, Hayashi F (2000)** Changes in anterior chamber angle width and depth after intraocular lens implantation in eyes with glaucoma, *Ophthalmology* 107:698-703.
4. **Heijl A, Leske MC, Bengtsson B, et al, (2003)**, Measuring visual field progression in the Early Manifest Glaucoma Trial, *Acta Ophthalmol Scand* 81:286-93.
5. **Jacobi PC, Dietlein TS, Luke C et al (2002)**, Primary phacoemulsification and intraocular lens implantation for angle-closure glaucoma, *Ophthalmology*, 109(9):1597-1603
6. **Kurimoto Y, Park M, Sakaue H, Kondo T, (1997)**, Changes in the anterior chamber configuration after small-incision cataract surgery with posterior chamber intraocular lens implantation. *Am J Ophthalmol* 124:775-80.
7. **Lee JY, Kim YY, Jung HR, (2006)**, Distribution and characteristics of peripheral anterior synechiae in primary angle-closure glaucoma, *Korea J ophthalmology*, 20(2) 104-8
8. **Lowe RF (1970)**, Aetiology of the anatomical basis for primary angle closure glaucoma. *Br J Ophthalmol* 54: 161-9
9. **Mapstone R, (1974)** Precipitation of angle closure. *Br J Ophthalmol*. 58:36--54
10. **Markowitz SN, Morin JD, (1984)**, Angle-closure glaucoma: relation between lens thickness, anterior chamber depth and age. *Can J Ophthalmol* 19:300-2