ORIGINAL

Preliminary outcomes of primary phacoemulsification plus intraocular lens implantation for primary angle-closure glaucoma

Hiroko Hata[1], Shinta Yamane[2], So Hata[3], and Hiroshi Shiota[1]

[1]*Department of Ophthalmology, Institute of Health Biosciences, the University of Tokushima Graduate School, Tokushima, Japan ;* [2]*Yamane Eye Clinic, Tokushima, Japan ; and* [3]*Hata Eye Clinic, Tokushima, Japan*

Abstract : Purpose : To evaluate effects and safety of primary phacoemulsification plus intraocular lens implantation for controlled chronic angle-closure glaucoma (CACG) or primary angle-closure (PAC). Design : Prospective, non-randomized comparative trial. Methods : Two treatment groups were used. The IOL group included the use of phacoemulsification plus intraocular lens (IOL) implantation in 27 eyes. The LI group included treatment by laser iridotomy (LI) in 23 eyes. Intraocular pressure (IOP), numbers of anti-glaucoma medications, complications, and corneal endothelial cell counts were examined in each group. Results : In the IOL group, IOP was significantly reduced from a preoperative mean of 14.8 ± 4.2 mmHg to a 6-month-postoperative mean of 10.8 ± 1.6 mmHg (P < .05). However, in the LI group, mean preoperative IOP was 15.5 ± 4.1 mmHg, and the 6-month-postoperative IOP was 14.7 ± 4.7 mmHg (P = .76). In the IOL group, no patient used anti-glaucoma medications 6-month postoperatively, whereas in the LI group, mean number of anti-glaucoma medications was 0.2 ± 0.4 (P < .05). There were no significant differences in preoperative and postoperative corneal endothelial cell counts between IOL and LI groups (P = .39). Conclusions : Primary phacoemulsification plus intraocular lens implantation for controlled CACG or PAC seems to be a safe and effective method in reducing IOP. This procedure might become the first treatment of choice for controlled CACG or PAC with cataract. J. Med. Invest. 55 : 287-291, August, 2008

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Chronic angle-closure glaucoma (CACG) or primary angle-closure (PAC) and cataract often coexist. Management of these conditions depends mainly on the control of intraocular pressure (IOP). In cases where IOP severely rises, causes might be appositional closure due to pupillary block, adhesive closure due to extensive peripheral anterior synechia, or combined glaucoma. Depending on cases, we used laser iridotomy (LI) or peripheral iridectomy to relieve pupillary block ; or glaucoma surgery and/or cataract surgery. On the other hand, in cases where IOP does not rise so severely, due to early stage detection, only relief of pupillary block is necessary to treat CACG or PAC. For eyes with CACG (or PAC) and cataract, treatment involves either LI followed by cataract surgery or primary phacoemulsification and IOL implantation.

Many reports described that cataract extraction

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Address correspondence and reprint requests to Hiroko Hata, MD, Department of Ophthalmology, Institute of Health Biosciences, the University of Tokushima Graduate School, Kuramoto-cho, Tokushima 770-8503, Japan and Fax : +81-88-631-4848.

with posterior chamber IOL implantation decreased IOP in eyes with angle-closure glaucoma (1-12). Regarding the simultaneous use of phacoemulsification plus IOL implantation for CACG, although some reports demonstrated IOP reduction and changes in the anterior chamber angle width and depth, a few reports evaluated outcomes of phacoemulsification plus IOL implantation for CACG before the relief of pupillary block (4, 6, 8, 9, 12, 13).

We hereby report effects and safety of primary phacoemulsification plus IOL implantation for the control of CACG or PAC with cataract.

METHODS

This prospective study comprised 50 consecutive eyes of 39 patients who were treated for CACG or PAC between October 2003 and July 2005. Patients with cataract, no history of previous ocular surgeries, and whose IOP was controlled with or without anti-glaucoma medications were included in the study. Due to the possibility of additional glaucoma surgery, this prospective study did not include eyes with uncontrolled CACG.

Diagnosis of CACG was made when slit-lamp biomicroscopy showed a peripheral anterior chamber as narrow as one third of the corneal thickness or less using the van Herick method, and when gonioscopy revealed Shaffer 1 or 2, and peripheral anterior synechia without iritis and inflammatory nodules. In addition, the presence of glaucomatous optic disc excavation or visual field defects leads to the diagnosis of CACG. Eyes without those glaucomatous changes were diagnosed as PAC according to the Japan Glaucoma Society guidelines for glaucoma (14).

Following informed consent, patients chose primary phacoemulsification plus IOL implantation or LI as a method to relieve pupillary block. As the result, 27 eyes of 22 patients chose phacoemulsification plus IOL implantation (IOL group), and 23 eyes of 17 patients chose LI (LI group). In the IOL group, 15 eyes showed primary angle-closure glaucoma, including 3 eyes with exfoliation syndrome. The other 12 eyes showed no glaucomatous neuropathy and were diagnosed PAC. In the LI group, 16 eyes showed primary angle-closure glaucoma, including 2 eyes with exfoliation syndrome. The other 7 eyes including 2 eyes with exfoliation syndrome were diagnosed PAC.

Two surgeons (H.H. and S.Y.) performed phacoemulsification plus IOL implantation. Operative procedures were as follows. Under topical anesthesia, a 2.8 mm sclerocorneal tunnel was made. After continuous curvilinear capsulorhexis using a 25-gauge bent needle, standard phacoemulsification was performed. A posterior chamber IOL with a 6.0 mm acrylic optic or a 5.5 mm polymethyl methacrylate optic was implanted through a 4.1-5.5 mm sclerocorneal tunnel.

Meanwhile, LI using combined argon and Nd : YAG laser surgery was performed as follows : several shots of green laser light (power, 0.15-0.2 W ; spot size, 300 μm ; duration, 0.2 s), 50-100 shots with power of 0.85-1 W, 50-μm spot size, and 0.02-s duration were done. Next, several pulses of Nd : YAG laser with power of 1.3-2.3 mJ were repeated until a patent iridotomy was formed.

IOP and numbers of anti-glaucoma medications were assessed in each group preoperatively, and 1, 2, 3, and 6 months postoperatively. IOP was measured using a Goldmann applanation tonometer. Preoperative and postoperative corneal endothelial cell counts (Noncon Robo Specular Microscope, Konan) were compared between each group. Cases that failed to follow up at least 1 month were excluded from the study.

Results were reported as means ± standard deviation. Statistical analyses used a parametric two-group unpaired *t*-test, a parametric two-group paired *t*-test, and a Fisher's exact test. A P value $< .05$ was considered significant.

RESULTS

Preoperative patients' demographics including age, gender, and duration of follow-up did not significantly differ between the two groups (Table 1).

Mean IOPs before treatment and 1, 2, 3 and 6 months after treatment are shown in Table 2 and

Table 1. Characteristics of patients

Characteristics	IOL group	LI group
Men/women	3/24	2/21
Mean age ± SD (range)	75.8 ± 7.2* (56-87*)	72.1 ± 6.5* (55-81*)
Mean follow-up (range)	9.3 ± 6.3* * (1-21* *)	11.4 ± 6.3* * (1-23* *)

IOL = intraocular lens ; LI = laser iridotomy
* years
* * months

Table 2. Mean IOP over time

Time of examination	Mean IOP ± SD		
	IOL group	LI group	P value
Preoperative	14.8 ± 4.2	15.5 ± 4.1	0.4848+
Postoperative (months)			
1	11.6 ± 2.8 **	15.9 ± 3.1	0.0016*
2	11.5 ± 1.8	15.6 ± 2.7	0.0002*
3	11.2 ± 1.5	14.6 ± 2.4	0.0009*
6	10.8 ± 1.6	14.7 ± 4.7	0.0369*
P value	< 0.05* *	> 0.05+	

+ No significant difference
* Significant difference between the 2 groups
* * Significant difference between pre- and post operative time

Table 3. Mean number of anti-glaucoma medications

Time of examination	Mean number ± SD		
	IOL group	LI group	P value
Preoperative	0.41 ± 0.75	0.52 ± 0.67	0.5735+
Postoperative (months)			
1	0.04 ± 0.19 **	0.22 ± 0.42 **	0.0518+
2	0.04 ± 0.20	0.18 ± 0.40	0.1097+
3	0	0.21 ± 0.42	0.0266*
6	0	0.24 ± 0.44	0.0289*
P value	< 0.05* *	< 0.05* *	

+ No significant difference
* Significant difference between the 2 groups
* * Significant difference between pre- and post operative time

Figure 1. There was no significant difference in mean preoperative IOPs between the 2 groups. Following treatment, mean IOPs in the IOL group were significantly reduced from a preoperative mean of 14.8 ± 4.2 mmHg to a 6-month-postoperative mean of 10.8 ± 1.6 mmHg (P = .0276). In the LI group, no significant difference in IOPs was found between pre- and postoperative time (15.5 ± 4.1 mmHg, vs 14.7 ± 4.7 mmHg at 6-months postoperation, P = .7591).

Table 3 shows mean numbers of anti-glaucoma medications before and after treatment. There was not a significant difference in preoperative mean numbers between the 2 groups. No cases used anti-glaucoma medications 6 months postoperatively in the IOL group ; whereas in the LI group, mean number of anti-glaucoma medications decreased to 0.24 ± 0.44 (P = .0093). Both groups showed significantly reduced numbers of medications. No patients needed additional glaucoma surgery.

One case in the IOL group showed infusion misdirection syndrome (15) during irrigation and aspiration at the operation. However, in that case, an IOL was inserted into the capsular bag, so that no particular problems were seen after the operation. One case showed slight hyphema after LI. However, hyphema disappeared within a few days, and no anti-glaucoma medications and operation were needed.

There were no significant differences in preoperative and postoperative corneal endothelial cell counts between IOL and LI groups (P = .3922).

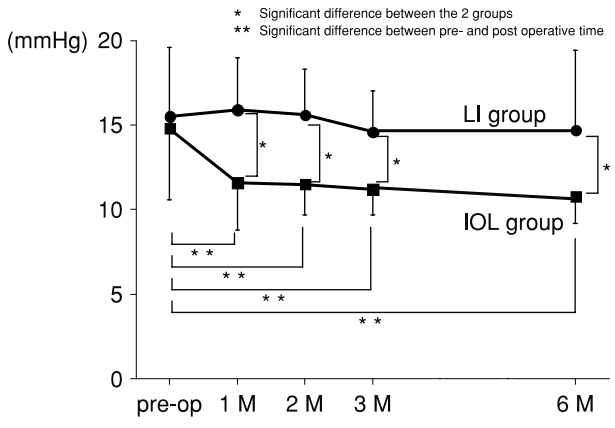

Figure 1. Mean IOP over time

DISCUSSION

Treatments of eyes with CACG (or PAC) and cataract involve simple relief of pupillary block using either LI, peripheral iridectomy, or phacoemulsification plus IOL implantation. In addition, glaucoma surgery alone or glaucoma surgery combined with cataract surgery may be performed.

Although many reports described that cataract extraction with posterior chamber IOL implantation decreased IOP in eyes with angle-closure glaucoma (1-12), there are few reports on phacoemulsification and IOL implantation for CACG before the relief of pupillary block (4, 6, 8, 9, 12, 13).

We found that primary phacoemulsification plus IOL implantation significantly decreased IOP at least 6 months after operation (Table 2, Figure 1), indicating that IOL implantation not only relieved pupillary block, but also reduced IOP. On the other hand, LI did not reduce IOP within 6 months of treatment. As the reason, we agree the view of Hayashi K, *et al.* who think that IOL implantation can make the anterior chamber wide and deep, which may lead to the decrease of IOP (13). In

addition, we think IOL implantation can relieve the pupillary block completely where as LI may not relieve it completely (16). Anyhow this result revealed that LI was not effective as a glaucoma treatment for IOP reduction at least in eyes with controlled CACG.

However, both treated groups showed significantly reduced numbers of medications (Table 3). Therefore, IOL implantation and LI improved CACG or PAC. Moreover, 3 and 6 months postoperatively, no cases used anti-glaucoma medications in the IOL group. This indicates that IOL implantation is more effective in reducing the number of anti-glaucoma medications than LI.

With respect to safety, we examined intraoperative and postoperative complications including reduction in corneal endothelial cell counts.

As for intraoperative complications, only one case in the IOL group showed infusion misdirection syndrome (15) during operation. Although an IOL could be inserted into the capsular bag in this case, care should be taken in avoiding zonular fiber disorder.

There were no significant differences in corneal endothelial cell counts between IOL and LI groups (Table 4), indicating that phacoemulcification plus IOL implantation were as safe as LI. A long-term study is desirable about the safty and effect of these treatments to get the final conclusion.

Table 4. Mean corneal endothelial cell counts

Time of examination	Mean number ± SD		
	IOL group	LI group	P value
Preoperative (cells/mm^2)	2669 ± 542	2690 ± 355	0.8923$^+$
Postoperative (cells/mm^2)	2488 ± 767	2658 ± 298	0.3922$^+$
(months)	6.2 ± 5.0	5.6 ± 4.0	0.6783$^+$
P value	0.0562$^+$	0.7702$^+$	

$^+$No significant difference

CONCLUSION

Primary phacoemulsification plus intraocular lens implantation for the control of CACG or PAC seems to be a safe and effective method in reducing IOP. Therefore, this procedure will become the first treatment of choice for controlled CACG or PAC with cataract.

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