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Cataract extraction slowed the visual field progression rate in patients with angle-closure glaucoma

Yu-Chun Cheng[1,2], Ming-Hui Sun[1,2], Wei-Chi Wu[1,2], Wei-Wen Su[1,2]*

Abstract:

PURPOSE: The purpose of this study is to evaluate the rate of progression of Humphrey visual field before and after the cataract surgery in patients with angle-closure glaucoma.

MATERIAL AND METHODS: Patients with angle-closure glaucoma who underwent regular visual field (VF) examination and received cataract surgery during the follow-up periods were retrospectively reviewed. The visual field rate of progression, visual acuity (VA), intraocular pressure (IOP), and number of glaucoma medication before and after cataract surgery were compared.

RESULTS: A total of 26 eyes were included. The mean follow-up duration before and after the cataract surgery were 5.14 ± 3.31 years and 5.97 ± 2.35 years. After cataract surgery, the IOP and VA improved significantly. The visual field rate of progression significantly slowed down after cataract surgery from – 1.39 ± 1.31 dB/year preoperatively to – 0.34 ± 0.64 dB/year postoperatively ($P = 0.003$).

CONCLUSION: The ACG eyes had rapid VF decline before cataract extraction, which was slowed down significantly after cataract removal.

Keywords:

Angle closure glaucoma, cataract surgery, visual field

Introduction

Cataract is common in patients with glaucoma because the prevalence of both diseases increases with age,[1,2] and that treatment of glaucoma accelerates cataract development.[3,4] Cataract extraction is effective in reducing intraocular pressure (IOP) and medical burden in patients with glaucoma, particularly in narrow-angle eyes. The EAGLE study suggested that clear lens extraction was more efficacious than laser peripheral iridotomy (LPI) in IOP control, and reduced requirement for subsequent glaucoma procedure even in eyes with angle-closure glaucoma (ACG) without evident cataract.[5] Nevertheless, the effect of lens extraction on visual field (VF) progression remains unclear. The purpose of this study is to compare the progression rate of Humphrey VF in patients with ACG before and after cataract surgery and to assess whether cataract extraction decelerates visual field decline.

Methods

This study was approved by the institutional review board (approval no. 202000875B0) and conducted in accordance with the tenets set forth in the declaration of Helsinki. The patient informed consent was obtained.

From July 2001 to December 31, 2018, we included patients with ACG who received regular VF examination and uncomplicated phacoemulsification with intraocular lens (IOL) implantation in Chang Gung Memorial Hospital Linkou, Taiwan. The diagnostic criteria of ACG included the presence of occludable or closed drainage

[1]*Department of Ophthalmology, Chang Gung Memorial Hospital, Linkou,* [2]*College of Medicine, Chang Gung University, Taoyuan, Taiwan*

***Address for correspondence:**
Dr. Wei-Wen Su, No. 5, Fu-Hsing Street, Kweishan, Taoyuan, Taiwan.
E-mail: vickysuweiwen@gmail.com

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angle (posterior trabecular meshwork not visible in more than 180° on gonioscopy), elevated IOP, glaucomatous optic neuropathy, and glaucomatous VF defects. All included eyes received LPI followed by various medical or surgical therapy for IOP control. Eyes with ocular diseases other than glaucoma, previous ocular trauma, or previous ocular surgery except trabeculecomy were excluded.

All visual field tests were performed every 6 months using the Humphrey Field Analyzer (Carl Zeiss Meditec Inc., Dublin, California, USA) with a 30-2 test pattern, size III white stimulus Swedish interactive threshold algorithm standard program. The reliability criteria were set as: false-positive rates <15%, false-negative rates <30%, and fixation losses < 20%. The last visual field test before the cataract surgery and the first one after the cataract surgery were required to be within 1 year from cataract surgery. Only eyes with mean deviation (MD) of the very first VF test better than −20 dB and at least three reliable visual field tests before and after cataract surgery, respectively, were included for the further analysis. The raw data of the retinal sensitivity of 52 test locations of each VF test were extracted and averaged after the removal of the edge points (except the two points closest to the nose across the horizontal midline) and the two points corresponding to the blind spot. The averaged retinal sensitivity (mean sensitivity [MS]) was regressed over time and the MS slope (dB/year) before and after the cataract surgery was calculated.

All cataract surgeries were performed with clear-corneal, small-incisional phacoemulsification. All patients received an acrylic foldable, monofocal IOL implanted in a capsular bag. Patients' gender, age at surgery, baseline MD, IOP, cup-to-disc ratio, preoperative (taken from the last record before the surgery), and postoperative (records of the 3rd month after the surgery) best-corrected visual acuity (BCVA, converted into logMAR), number of medication for glaucoma, number of VF tests, follow-up duration, and the MS slope were compared.

Statistical analyses were performed using the SPSS version 23.0 for Windows (SPSS Inc., Chicago, IL, USA). Categorical data were compared using the Chi-square test. Continuous variables are expressed as the mean ± standard deviation (SD). Differences between the preoperative and postoperative data were compared using a paired *t*-test. $P < 0.05$ indicated statistical significance.

Results

Twenty-six eyes of 19 patients were included in this study. The mean surgical age was 68.15 ± 13.67 years old. The mean follow-up duration before and after cataract surgery was 5.14 ± 3.31 years and 5.97 ± 2.35 years, respectively. Six eyes (23.1%) had previous trabeculectomy. The mean number of VF tests performed before and after cataract surgery was 4.04 ± 1.61 and 4.50 ± 1.48, respectively [Table 1].

The mean logMAR BCVA significantly improved from 0.76 ± 0.41 preoperatively to 0.30 ± 0.29 postoperatively ($P < 0.001$). The mean IOP decreased from 14.87 ± 3.81 to 11.12 ± 2.92 mmHg ($P < 0.001$) after cataract surgery. The mean number of medication for glaucoma before and after the cataract surgery was 1.62 ± 0.98 and 0.81 ± 0.63 ($P < 0.001$), respectively. The MS slope was −1.39 ± 1.31 dB/year before the surgery and −0.34 ± 0.64 dB/year after the surgery ($P = 0.003$) [Table 1]. The MS of the visual field test immediately before and after the cataract surgery was 18.12 ± 7.51 and 17.28 ± 7.87 dB ($P = 0.154$), respectively. The SD of retinal sensitivity of visual field test immediately before and after the cataract surgery was 6.36 ± 3.14 and 7.35 ± 3.46 dB ($P = 0.024$), respectively [Table 2].

Discussion

In our study, the ACG patients benefited from cataract extraction with improvement in BCVA and decline in IOP. Moreover, the MS slope significantly flattened after the cataract surgery. The number of glaucoma medication also significantly decreased after cataract surgery.

Table 1: Visual acuity, intraocular pressure, number of glaucoma medications, and mean sensitivity slope of visual field before and after cataract surgery in angle-closure glaucoma eyes

	Before surgery (*n*=26)	After surgery (*n*=26)	*P*
Baseline MD	−6.52±5.44	−12.11±7.35	<0.001
BCVA			
LogMAR	0.76±0.41	0.30±0.29	<0.001
IOP (mmHg)	14.87±3.81	11.12±2.92	<0.001
Number of glaucoma medications	1.62±0.98	0.81±0.63	<0.001
Number of VFs	4.04±1.61	4.50±1.48	0.362
F/U periods (years)	5.14±3.31	5.97±2.35	0.378
VF rate of change (dB/year)	−1.39±1.31	−0.34±0.64	0.003

BCVA=Best-corrected visual acuity, IOP=Intraocular pressure, MD=Mean deviation, MS=Mean sensitivity, VF=Visual field, F/U=Follow-up, LogMAR=Logarithm minimum angle of resolution

Table 2: Change in visual field mean sensitivity and standard deviation before and after cataract surgery in patients with angle-closure glaucoma

	Last VF preoperative	First VF postoperative	*P*
Mean sensitivity (dB)	18.12±7.51	17.28±7.87	0.154
SD of retinal sensitivity	6.36±3.14	7.35±3.46	0.024

ACG=Angle-closure glaucoma, OAG=Open-angle glaucoma, SD=Standard deviation, VF=Visual field

Cataract causes diffuse loss of sensitivity on automated perimetry. Cataract extraction removes generalized depression and improves the global measures of visual field, although the reported changes in MD varied from no significant change[6,7] to significant improvement.[8-11] While most studies have focused on the short-term effects of cataract extraction, the long-term effects on visual field remains to be elucidated. De Moraes *et al*. reported that the MS slope in patients with ACG was −0.39 ± 0.5 dB/year,[12] whereas the baseline MD- or age- matched MD slope in phakic PACG was −0.4 to −0.42 dB/year according to the study of Ballae Ganeshrao *et al*.[13] The VF decline rate was much higher than previously reported in our ACG patients before the cataract surgery.

In the current study, all the ACG eyes had received LPI. LPI relieves the pupillary block component and may subsequently halt the progression of synechial closure and IOP elevation.[14] Therefore, it is strongly *recommended* in eyes with PAC or PACG. Nonetheless, there is a gradual narrowing of the angle over time after an initial widening of the angle, attributable to lens change.[15] Age-related growth of the lens plays a major role in the pathogenesis of ACG. Lens extraction effectively deepens the anterior chamber and widens the angle.[16] According to the EAGLE study, clear-lens extraction demonstrated greater efficacy in IOP control than conventional LPI.[5] However, the preoperative and postoperative VF decay rate was not reported in the EAGLE study. The current study revealed that VF decline more rapidly before cataract surgery in ACG eyes, and the rate significantly decreased after cataract surgery. Cataract extraction improved vision, reduced IOP, and also delayed VF decline in patients with ACG.

There are several limitations in this study. First, the retrospective design may introduce selection bias or information bias and the small sample size may have limited statistical significance. Furthermore, the effect of lens opacity on visual field test was not addressed. The study included East Asian eyes in a tertiary glaucoma clinic, and the findings may not be generalized to other populations.

Conclusion

ACG eyes had rapid VF decline before cataract extraction, which slowed significant after cataract removal.

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Conflicts of interest

The authors declare that there are no conflicts of interests of this article.

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