Different Modes of Intraocular Pressure Reduction After Three Different Nonfiltering Surgeries and Trabeculectomy

Etsuo Chihara and Ken Hayashi

Sensho-kai Eye Institute, Kyoto, Japan

Abstract

Purpose: To study the mode of intraocular pressure (IOP) reduction based on correlation with the preoperative IOP after filtering and nonfiltering surgeries.

Methods: Pre- and postsurgical IOPs at 6 months were compared in one eye of each of 789 subjects with primary open-angle glaucoma, pseudoexfoliation glaucoma, or ocular hypertension who underwent trabeculectomy with adjunctive mitomycin C alone (Lectomy-MMC) \( (n=145) \), phaco-viscocanalostomy (Phaco-VCS) \( (n=320) \), phaco-trabeculotomy ab externo (Phaco-lotomy) \( (n=116) \), or phacoemulsification aspiration and intraocular lens implantation alone (PEA+IOL) \( (n=208) \).

Results: The correlation between the preoperative and 6-month postoperative IOP was not significant in eyes that underwent Lectomy MMC \( (r=-0.026, P=0.7552, \text{IOP reduction 51.9%}) \), but was significant in eyes treated by Phaco-VCS \( (r=0.409; \text{IOP reduction, 24.8%}) \) or PEA+IOL alone \( (r=0.294; \text{IOP reduction, 9.9%}) \), and was marginal in eyes treated by Phaco-lotomy \( (P=0.062; r=0.174; \text{IOP reduction, 24.1%}) \). Among the four cohorts studied, the variation in the 6-month postoperative IOP was the largest after Lectomy-MMC.

Conclusion: After glaucoma surgery, there are two modes of IOP reduction. The postoperative IOP after Lectomy MMC did not correlate with the preoperative IOP, whereas the postoperative IOP levels after Phaco-VCS, Phaco-Lotomy, and PEA+IOL correlated with preoperative IOP levels. We may be able to predict postsurgical IOP after nonfiltering surgery.

Keywords: bleb, filtering surgery, IOP reduction mode, nonfiltering surgery

Introduction

Two types of glaucoma surgery, filtering surgery and nonfiltering surgery, are frequently performed to reduce intraocular pressure (IOP). Among them, trabeculectomy with adjunctive mitomycin C (Lectomy-MMC) is the current gold standard. However, many glaucoma surgeons have serious reservations about this type of surgery because of the high incidence of postoperative complications such as bleb leaks, blebitis, shallow anterior chambers, serous or hemorrhagic choroidal detachments, hypotensive maculopathy, cataract progression, and unpredictable postoperative IOP levels.\(^1\) Thus, nonfiltering surgery such as viscocanalostomy\(^2\) (VCS), deep sclerectomy,\(^3\) canaloplasty,\(^4\) Trabectome,\(^5\) and trabeculotomy ab externo (lotomy),\(^6\) as well as others, have been evaluated and their surgical outcomes reported. The modes of IOP reduction after these types of nonfiltering surgery may differ from those of filtering surgery such as Lectomy-MMC, but they have not been studied extensively.

Currently, glaucoma surgeons set a target pressure preoperatively. Therefore, knowledge about the modes of IOP reduction after both filtering and nonfiltering surgery is important for predicting the postoperative IOP. In the current
study, we analyzed the modes of IOP reduction after four different types of surgery: Lectomy-MMC alone, phaco-viscoceilanalostomy (Phaco-VCS), phaco-trabeculotomy ab externo (Phaco-lotomty), and phacoemulsification aspiration and intraocular lens implantation alone (PEA+IOL).

Subjects and Methods

We retrospectively studied 1643 eyes of 1013 patients who underwent glaucoma, cataract, or combined glaucoma and cataract surgery at the Sensho-kai Eye Institute from 1994 to 2008. The indications for surgery were poor IOP control, decreased visual acuity (VA), deterioration of visual field defects, or some or all of these. Eyes that underwent glaucoma drainage device surgery, goniosynechialysis, or deep sclerectomy were excluded from this study, leaving 1492 eyes. These 1492 eyes were treated by one of the following procedures: Lectomy-MMC alone, 186; Phaco-Lectomy MMC, 99; Phaco-VCS, 522; VCS alone, 16; Phaco-lotomty, 127; Lotomty alone, 17; and PEA+IOL, 525 eyes. Our surgical procedures for lotomy,7,8 Phaco-lotomty,8,9 Lectomy-MMC,10 Phaco-VCS,8,11 and PEA+IOL11 have been reported previously.

In the current study, we defined primary open-angle glaucoma (POAG) as an eye with open angle and glaucomatous optic disc findings or glaucomatous visual field defects detected by static perimetry (Octopus 300 G1 program; Haag Streit, Bern, Switzerland). Either a cluster of three adjacent points depressed by at least 5 dB or two independent points depressed by at least 10 dB in a comparison visual field in the Bjerrum, paracentral, or nasal horizontal raphe area were considered to be glaucomatous changes. Patients with pseudoexfoliation glaucoma (PEG) had exfoliative material and the clinical features of POAG. Ocular hypertension (OH) was defined as the presence of an open angle, a mean of three consecutive IOP measurements exceeding 21 mmHg, and no sign of a glaucomatous optic disc. Eyes with neuro-ophthalmological disease, vascular accidents or iridocyclitis were excluded. Data from one eye of each subject were used for analysis.

Selection of Surgical Procedures

As an institutional general rule, nonfiltering surgery is performed when the IOP with medication does not exceed 26 mmHg and the mean visual field defects are 10 dB or less. Prior to 2001, lotomy was the only nonfiltering surgery applied; after that, VCS became the standard procedure. The indication criteria for both types of nonfiltering surgery were the same. Filtering surgery was performed when the IOP with medication was 26 mmHg or higher or the mean visual field defect exceeded 10 dB.

When the VA was decreased as the result of a cataract in patients with POAG, PEG, or OH, IOP with medication was less than 23 mmHg, and the mean visual field defect did not exceed 10 dB, only PEA+IOL through clear corneal incision was performed.

Exclusion and Inclusion Criteria

Patients with a history of neuro-ophthalmologic diseases, retinal diseases, toxic or traumatic optic nerve diseases, iridocyclitis, vascular diseases, or diabetes mellitus were excluded from the study. Eyes with a diagnosis of POAG, PEG, or OH were included, while those with a diagnosis of primary angle-closure glaucoma or secondary glaucoma (except for PEG) were excluded. When a filtering bleb did not form after filtering surgery, the eye was no longer included in the statistical analysis. Eyes with postoperative iridocyclitis, incomplete wound closure, vitreous incarcerations to the wound, or incomplete pre- or postoperative IOP records were also excluded. To avoid the effects of changes in medication, we included eyes in which antiglaucomatous medication either remained unchanged or decreased after surgery. In cases treated by PEA+IOL, only eyes that had been treated using a small clear corneal incision (<3 mm) were included. When the sample size of the cohort after an application of the inclusion and exclusion criteria was less than 100 eyes, the cohort was excluded from this study. Finally, one eye of each of the 789 subjects who underwent Lectomy-MMC alone (n = 145), Phaco-VCS (n = 320), Phaco-lotomty (n = 116), or PEA+IOL alone (n = 208) was included and the 6-month postoperative IOP was analyzed.

All subjects provided informed consent. The study protocol was approved by an internal ethics committee at Sensho-kai Eye Institute.

Statistical Analysis

The mean of three consecutive preoperative IOP values was compared with the 6-month postoperative IOP value. After creation of a scatter graph, the correlation coefficient, P value by Fisher’s z transformation, linear regression line, and 95% confidence interval were calculated. Statview (SAS, Cary, NC, USA) software was used.

Results

Table 1 shows data of the four study groups, including age, number of medications used, preoperative IOP, and glaucoma types. Table 2 shows preoperative IOP and best-corrected visual acuity, and the IOP and best-corrected visual acuity at 6 months postoperatively.

The relationship between the preoperative IOP and the 6-month postoperative IOP or the net reduction in IOP differed among the four surgical procedures (Figs. 1, 2). Lectomy-MMC was the most effective in reducing the IOP (P < 5 × 10<sup>-55</sup>), with a reduction rate of 51.9% at 6 months (Table 2), and the preoperative IOP was significantly correlated with the net IOP reduction (r = 0.880, P < 0.0001) (Fig. 1A, Table 3). Both the net reduction expressed in mmHg and the rate of IOP reduction, expressed as a percentage, increased with an increase in the preoperative IOP (Fig. 1A, Table 4). On the other hand, there was no signifi-