

Cataract Surgery and IOP

An overview of current theories about why and how cataract extraction lowers IOP in some glaucoma patients.

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Over the past several years, there has been increased interest in the effects of cataract surgery on IOP in glaucoma patients. In clinical trials of microinvasive glaucoma procedures, the IOP dropped in some glaucoma patients who underwent phacoemulsification alone. Patients in the Ocular Hypertension Treatment Study (OHTS) also demonstrated decreased IOP after cataract surgery. Many questions about the relationship between cataract surgery and IOP remain. Why does cataract surgery lower IOP? Which patients will have an IOP-lowering response? How robust will that response be? In this installment of "Peer Review," Mark Slabaugh, MD, and Philip Chen, MD, thoughtfully review some of the issues and published data on this topic.

—Barbara Smit, MD, PhD, section editor

Most ophthalmologists who regularly treat individuals with glaucoma will almost certainly discuss cataract surgery at some point with their patients. The concurrence of glaucoma and cataracts, coupled with the fact that the only known modifiable risk factor in glaucoma management is IOP, has heightened interest in the effect of cataract surgery on IOP. The observation that IOP often decreases after cataract surgery was first published several decades ago.¹⁻³ Many studies have since investigated this finding, and there are several extensive reviews of the subject.^{4,5} Cataract surgery has been described as the single best glaucoma surgery due to its IOP-lowering effect. An examination of the literature to date, however, reveals that the outcomes are much more complicated than a blanket recommendation that every patient with glaucoma undergo cataract extraction.

WHAT MECHANISM LOWERS IOP?

Narrow-Angle Glaucoma

The exact mechanism by which cataract surgery lowers IOP remains unknown. Evidence strongly sug-

gests that, in patients with narrow-angle glaucoma, the level of IOP lowering after cataract surgery is proportional to the resultant widening of the angle.⁶⁻⁸ Thus, patients with the narrowest angles preoperatively may benefit the most from cataract extraction as a single procedure, provided that the angle has not become permanently closed by peripheral anterior synechiae. Gonioscopy remains indispensable for successfully identifying these patients. Anterior segment optical coherence tomography provides additional objective data about the angle's morphology as well as characteristics of the iris, the angle's opening, and the lens' vault, all of which can assist in predicting which glaucoma patients might benefit the most from cataract surgery.^{8,9}

A recently published randomized trial of phacoemulsification versus trabeculectomy in patients with medically uncontrolled, chronic angle-closure glaucoma demonstrated a significant reduction in IOP after phacoemulsification alone, but 73% of patients continued to require medications or underwent trabeculectomy 2 years after cataract surgery. The authors concluded that, although there was a significant benefit from phacoemulsification alone, trabeculectomy was more effective at controlling IOP, even though it was associated with more complications than phacoemulsification.¹⁰ The Effectiveness of Early Lens Extraction With Intraocular Lens Implantation for the Treatment of Primary Angle-Closure Glaucoma (EAGLE) study is currently investigating primary lensectomy as a treatment for angle-closure glaucoma as compared with a more traditional stepped approach with laser iridotomy and medical therapy.¹¹ It is hoped that the results of EAGLE will help guide the management of these challenging patients.

Open-Angle Glaucoma

In patients with more open angles, it has been proposed that the trabecular endothelium is remodeled in

response to stress from the ultrasonic vibrations that occur during phacoemulsification, which in turn affects IOP.¹² This hypothesis has been tested in the laboratory, but further investigation is needed to determine its role in a clinical situation, as it is unclear whether endothelial remodeling produces a clinically relevant change in IOP. A related but untested hypothesis is that the trabecular endothelium undergoes stress-induced remodeling in response to the supra-physiologic IOP that is experienced by the anterior segment during routine phacoemulsification.^{13,14}

Pseudoexfoliation

A discussion of cataract surgery in patients with pseudoexfoliation (PXF) is a topic unto itself, but the IOP response to phacoemulsification in these patients appears to be greater than in those with primary open-angle glaucoma.^{15,16} The copious irrigation of the anterior segment that occurs during phacoemulsification may be partly responsible for the IOP-lowering response in PXF. Phakic patients with PXF can also develop a shallow anterior chamber secondary to zonular laxity, which can affect IOP in two ways: by directly narrowing the anterior chamber angle, which may then be reversed by cataract extraction, and by decreasing tension on the ciliary body, which leads to the relaxation of the scleral spur and trabecular dysfunction that may then be reversed by cataract extraction.¹⁷ Regardless of the mechanism by which the IOP decreases, patients with PXF syndrome command an extra measure of caution and counseling prior to surgery but can be expected to benefit from uncomplicated surgery.

PROPORTIONAL IOP RESPONSE

Another consistent finding across multiple populations and studies is that, in patients with open angles at baseline, the level of IOP lowering is proportional to the preoperative IOP.¹⁸⁻²⁰ That is, patients with a higher preoperative IOP will have a greater IOP-lowering effect from cataract surgery than those who have a preoperative IOP in the normal physiologic range. This observation appears to be true whether patients are treated with glaucoma medications or not, but it is not intuitively obvious why this should be the case. Although the phenomenon of regression to the mean has been proposed as an explanation,⁴ a recent report derived from the OHTS showed that this finding held true in patients undergoing cataract extraction.¹⁹ Several measures were in place in the OHTS trial to prevent regression to the mean, including multiple pre- and postoperative IOP measurements and testing that was performed according to strict guidelines using cali-

brated equipment. The lack of a proposed mechanism to explain this proportional effect highlights the need for a better understanding of the physiology that leads to elevated IOP.

One corollary to the proportional IOP response is that patients with a low preoperative IOP may have higher IOPs after uncomplicated surgery. Poley et al demonstrated that, although approximately 55% of patients with a preoperative IOP between 15 and 17 mm Hg had a lower IOP after cataract surgery, 30% had a higher postoperative IOP, and the remainder experienced no change.¹⁸ In the group with a preoperative IOP below 15 mm Hg, approximately 55% of patients had a higher IOP, and 35% had a lower IOP postoperatively.¹⁸

DISCUSSION

There are many reasons to consider cataract extraction in glaucoma patients. These individuals derive great visual benefit from the increased acuity and improved contrast sensitivity provided by a clear artificial lens.²¹ An improvement in vision allows for more accurate visual field monitoring, and a clear optical pathway enhances the quality and reproducibility of optic nerve imaging. The effect of cataract extraction on IOP is more complicated and requires additional discussion with patients.

The information presented herein applies to medically treated glaucoma patients. The effect of cataract surgery on the IOP of patients who have undergone prior filtering surgery is a separate topic. Several studies have shown that the IOP will increase by about 2 mm Hg on average in this situation, with some loss of trabeculec-tomy function, and that 30% to 50% of patients require additional medication.²²⁻²⁴

Patients with narrow angles and/or a high preoperative IOP often benefit from the IOP-lowering effects of cataract surgery as a single procedure. If the preoperative IOP is already low before cataract surgery, an additional decrease should not be expected from surgery alone, and patients should be counseled about the risk of a higher postoperative IOP. ■

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