

What IOP Should You Achieve at the End of a Cataract Surgical Case?

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Habitually overlooked, the IOP typically is not measured at the end of a cataract procedure. The IOP may be exploited, however, as a tool to prevent problems. Therefore, not only is the absolutely best IOP important, but the best IOP for a unique surgical situation ought to be considered.

By and large, the surgeons who contributed to this article recommend a final IOP of 20 to 30 mm Hg, along with stromal hydration, to ensure sealed surgical wounds. One might modify the IOP when inserting a toric IOL, however, where a slightly lower pressure permits broader contact between the IOL and the posterior capsule and thus helps prevent rotation of the lens during the early postoperative period.

Conversely, in a patient with intraoperative floppy iris syndrome, for whom there is an increased chance of iris prolapse, a higher IOP helps more firmly seal the incision by maximizing internal pressure. It is also beneficial to construct the surgical incision slightly more anteriorly and to allow for a longer intracorneal tunnel.

Read on to see what our panel of experts recommends.

—William J. Fishkind, MD, section editor

PAUL N. ARNOLD, MD

After the widespread adoption of clear corneal incisions for phacoemulsification and IOL insertion, it rapidly became clear to clinical observation that, if a surgeon elevates the IOP at the end of surgery, the 2.5- to 3-mm relatively square incision closes amazingly well. On the other hand, if an eye is left hypotonous, the incision will leak with the slightest provocation. Further research has confirmed that these clinical observations are correct.¹

Surgeons should attempt to leave the IOP at the highest, safest pressure at the conclusion of surgery. This has the effect of closing the internal corneal valve more securely. What is the highest, safest pressure? Knowing that the IOP can rise after cataract surgery, I try to leave the IOP around 20 mm Hg in most patients. If the IOP rises into the mid-20s within the first 24 hours, it will not present a problem in most patients. Obviously, glaucoma patients present a different set of goals.

I have learned to interpret my own Weck-Cel spear (Medtronic ENT, Jacksonville, FL) applanation tonometry over many years. After stromal hydration and the instillation of the final aliquot of solution (an intracameral antibiotic) through the paracentesis, I use the back end

of the cellulose spear to applanate the eye at the limbus. If the eye feels too firm, I use the spear to depress the posterior edge of the incision and release some fluid. If the eye is too soft, I instill more balanced salt solution through the paracentesis. I continue this process until the eye has an approximate pressure of 20 mm Hg. Once this level is reached, I use the cellulose sponge to test both incisions for watertight closures.

BROCK K. BAKEWELL, MD

At the end of cataract surgery, I attempt to leave the IOP at 20 mm Hg. I do this to help prevent ocular surface fluid from being sucked back into the clear corneal wound with blinking, which can be a factor in the development of endophthalmitis and has been shown to happen with India ink studies of clear corneal incisions.¹ Research has proven that higher IOP causes less wound gape, ergo less chance for reflux.² I have also noticed that ointment that is placed in the palpebral fissure at the end of surgery ends up in a nonhydrated clear corneal tunnel on postoperative day 1. As a result, in addition to an IOP at 20 mm Hg, hydration of the wound is mandatory to help prevent reflux into the wound and possible endophthalmitis.

Reliably leaving the pressure at 20 mm Hg is more difficult than it sounds. I estimate IOP by pressing on the limbus with a dry Weck-Cel sponge. During one day of surgery, I measured the IOP with a pneumatometer in all my cases to see how close I was to the intended 20 mm Hg. To my surprise, the IOPs measure from the midteens to as high as 30 mm Hg. This variability is probably due in part to the variable compliance of the cornea in different patients in addition to the imprecise method of estimation. Therefore, if a surgeon wants to be absolutely certain of the IOP at the end of cataract surgery, I recommend measuring pressure with a pneumatometer.

PAUL H. ERNEST, MD

I use bimanual I/A through two paracentesis incisions. Because of the manipulation of the incisions by the instruments, I spend a considerable amount of time hydrating both paracentesis wounds. The cataract incision that I use starts at the posterior limbus and is a square wound measuring 2.2 mm X 2.2 mm. This incision is stable and requires minimal-to-no stromal hydration. I carefully remove all viscoelastic material to prevent a pressure spike postoperatively. I aim for an IOP between 30 and 40 mm Hg to test the paracentesis wounds to ensure there is no leakage. I then reduce the pressure to approximately 20 mm Hg.

BRADFORD J. SHINGLETON, MD

For the majority of my patients, I strive for a case-completion IOP of approximately 20 mm Hg after phacoemulsification. I aim for this IOP for several reasons. Following a cataract procedure, all surgeons are concerned about IOP that is too low or too high. My colleagues and I reported two studies that assessed IOP 30 minutes after uncomplicated phacoemulsification.^{3,4} With temporal clear corneal phacoemulsification under topical anesthesia and a case-completion IOP of 10 mm Hg, almost 20% of patients had an IOP of 5 mm Hg or less by 30 minutes postoperatively. There were no cases of Seidel-positive wound leaks or endophthalmitis. In the follow-up study, patients received peribulbar anesthesia. The minimum length of the incision created with a keratome was 2.5 mm, and it had a posterior limbal entry. The case-completion IOP was 20 mm Hg. The IOP was less than 5 mm Hg by 30 minutes postoperatively in 5% of eyes, and there were no cases of Seidel-positive wound leaks or endophthalmitis. Attention to the details noted earlier may be important in reducing the incidence of early postoperative hypotony, and for that reason, I strive for a case-completion IOP of 20 mm Hg.

IOP spikes can also be a problem, so I avoid raising the case-completion IOP too high. IOP elevation may be the greatest 2 to 8 hours after surgery, but it can also be high on the first postoperative day. In two published reports involv-

ing patients with open-angle glaucoma and pseudoexfoliation glaucoma, we found IOP on the first postoperative day to be greater than 30 mm Hg in 17% to 30% of patients.^{4,5} This is a critical problem for patients with compromised optic nerves. I will not hesitate to check IOP 1 to 3 hours after surgery in eyes with compromised optic nerves that undergo phacoemulsification. A case-completion IOP of 20 mm Hg is reasonable for these eyes, with the addition of topical glaucoma medications and intracameral carbachol as needed. ■

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1. Ernest PH. Wound construction: the state of the art. *Review of Ophthalmology*. 2002;9:04. http://cms.revophth.com/index.asp?page=1_88.htm. Accessed February 23, 2010.
 2. May W, Castro-Combs J, Camacho W, et al. Analysis of clear corneal incision integrity in an ex vivo model. *J Cataract Refract Surg*. 2008;34(6):1013-1018.
 3. Shingleton BJ, Wadhvani RA, O'Donoghue MW, et al. Evaluation of intraocular pressure in the immediate period after phacoemulsification. *J Cataract Refract Surg*. 2001;27(4):524-527.
 4. Shingleton BJ, Rosenberg RS, Texiera R, O'Donoghue MW. Evaluation of intraocular pressure in the immediate postoperative period after phacoemulsification. *J Cataract Refract Surg*. 2007;33(11):1953-1957.
 5. Shingleton BJ, Laul A, Nagao K, et al. Effect of phacoemulsification on intraocular pressure in eyes with pseudoexfoliation: single-surgeon series. *J Cataract Refract Surg*. 2008;34(11):1834-1841.