

Keeping Glaucoma Laser Therapy on Target

Strategies for avoiding and managing the complications involved in three common glaucoma laser procedures.

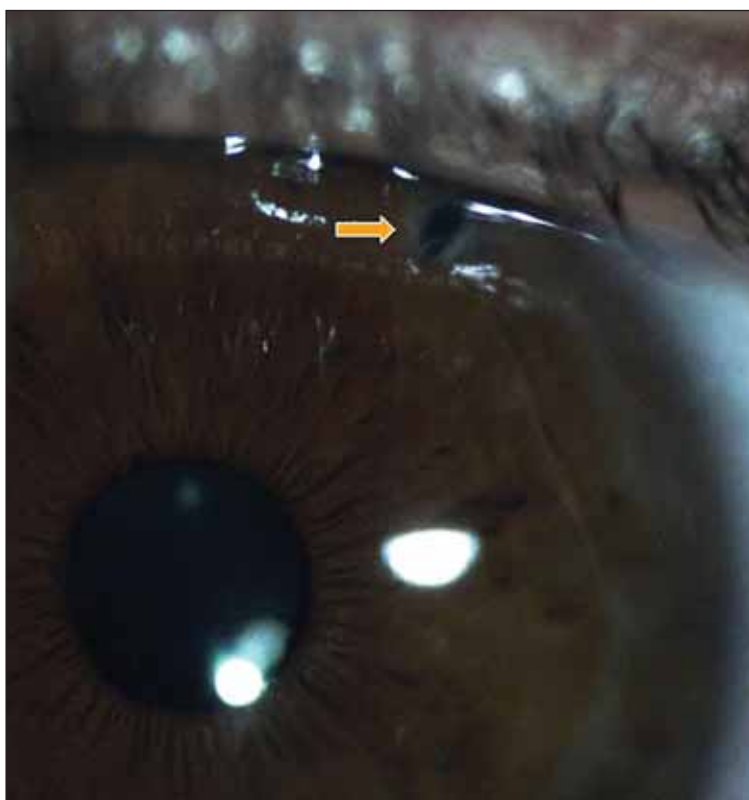
BY HYLTON R. MAYER, MD

Three of the most common laser procedures performed for the treatment of glaucoma are the laser peripheral iridotomy (LPI), selective laser trabeculoplasty (SLT), and transscleral cyclophotocoagulation (TCPC). A brief review of common and significant complications can expand the dialogue between the physician and patient as well as improve the surgeon's ability to reduce the incidence of perioperative laser-induced complications and to manage them when they occur.

LASER PERIPHERAL IRIDOTOMY

The complications arising from the performance of an LPI range in severity from mild to severe and in duration from transient to persistent. The most commonly reported complications include conjunctivitis, corneal abrasion, pain, bleeding, inflammation, increased IOP, failure of the iridotomy to improve the angle configuration, delayed closure of the iridotomy, and corneal scarring.¹ Less commonly reported—but potentially significant—complications include aqueous misdirection, corneal decompensation, cataract development, retinal damage, and photopsias or ghost images.

The pain associated with an LPI can be significant but is generally brief. Some patients may benefit from preoperative pain medication such as acetaminophen or a mild narcotic. It would be unusual, but reasonable, to administer a retrobulbar block prior to performing an LPI on a highly sensitive patient. If the patient has severe or prolonged postoperative pain, it is important to eval-



(Courtesy of Malik Y. Kahook, MD.)

Figure. A laser iridotomy (arrow) that is incompletely covered by the lid margin, or in proximity to the tear meniscus, may contribute to complaints of photopsias or ghost images (as experienced by the patient in this figure).

uate and treat him or her for common causes of pain such as ocular surface pathology, ocular hypertension, or intraocular inflammation. Postoperative inflammation is usually responsive to frequently dosed topical steroids, but it may require oral steroids or injected periocular steroids.

IOP spikes can be mitigated with a topical adrenergic agonist, but they may require additional or prolonged

use of topical β -adrenergic blockers or a topical or oral carbonic anhydrase inhibitor. Surgeons can limit bleeding by avoiding iris blood vessels, pretreating the eye with the argon laser to coagulate vascular tissue, and/or exerting firm pressure on the eye with an Abraham-type contact lens to raise the IOP if bleeding occurs. LPs performed with the Nd:YAG laser may close less frequently than those executed with an argon laser.² Surgeons can decrease the rate of closure, however, by creating an iridotomy that is large enough to avoid appositional closure of its edges and “plugging” of the hole by clumps of pigment or fibrin. Adequate control of inflammation after LPI may also reduce its early or late closure. It may be difficult to predict the failure of a patent LPI to widen the anterior chamber angle as desired, but a careful preoperative evaluation can offer clues to postoperative outcomes. Compression gonioscopy, for example, can identify synechial closure or the “double-hump” sign, suggestive of plateau iris configuration, neither of which typically improves after a patent LPI.

Surgeons can prevent corneal scarring, cataract formation, and retinal damage through their careful attention to the focal point of the laser energy and by selecting a target on the iris that is a reasonable distance between the iris and cornea, if possible. Using an Abraham-type contact lens steepens the focal angle, thus diminishing the effect of the laser energy beyond the plane of focus and reducing the potential for incidental damage from the laser energy. Occasionally, corneal stromal opacification will occur during the creation of an LPI, in which case eccentric fixation by the patient can permit the continued application of laser energy to the iris tissue. Peripheral corneal opacities are rarely significant and typically resolve over time.

It is important to warn patients of the potential for photopsias or ghost images. Many patients are more upset by a lack of disclosure than the actual inadvertent visual phenomena. Surgeons can avoid or limit the unintended induction of visual phenomena by creating a smaller iridotomy and by either ensuring that the opening is totally covered by the upper lid margin or placing the iridotomy in the interpalpebral opening (at 3 or 9 o'clock) to avoid the tear meniscus, which may play a role in the aberrant refraction of light (Figure).

SELECTIVE LASER TRABECULOPLASTY

SLT has become a popular first- or second-line therapy for lowering the IOP in many types of open-angle glaucoma. Complications associated with this procedure include conjunctivitis, corneal abrasion, excessive inflammation, a significant short-lived or sustained elevation in

IOP, and failure to achieve a persistent decrease in IOP.³ Rare complications of SLT include the formation of peripheral anterior synechiae, refractive shifts, and corneal edema or corneal stromal inflammation.

Titrating to a low dose of laser energy—just enough to see occasional “champagne bubbles”—and carefully aiming the laser to avoid contact with iris tissue may reduce the incidence of post-SLT inflammation. Some patients may be prone to ocular inflammation after laser treatment. SLT should generally be avoided in patients with a history of significant or recent ocular inflammation. Postoperative medical management typically requires only topical nonsteroidal anti-inflammatory drugs or infrequently administereded topical steroids for the control of inflammation and pain. High-dose topical or oral steroids can reduce the inflammatory response to SLT in some patients. Peripheral anterior synechiae rarely form postoperatively but may develop in eyes with uncontrolled inflammation.

The use of a short-acting α -adrenergic agonist can blunt pressure elevations. This complication occurs more often in patients with heavy pigmentation or pseudoexfoliation glaucoma, those using multiple topical IOP-lowering medications, and individuals with significantly compromised outflow (high preoperative IOPs). Surgeons may prevent IOP spikes by dividing SLT treatment into two or three sessions, such as two 180° applications or three 120° applications, performed over a few weeks. IOP elevations due to excessive inflammation or laser-induced trabeculitis may respond to more frequently administered topical steroids. Increased pressure can be reduced with the addition of topical or oral IOP-lowering medications until the function of the trabecular meshwork improves. Patients should be warned that, in rare cases, the increase in IOP may persist, requiring long-term medical therapy or incisional surgery.

Surgeons must set realistic expectations for patients on the outcome of SLT. Target IOP reductions are less likely to be achieved in patients with high initial IOPs, those on multiple IOP-lowering medications, and older patients. Individuals who receive 360° of treatment are more likely to obtain lower IOPs than patients who receive 180° of treatment.

Temporary or permanent refractive shifts have been anecdotally reported after SLT, possibly due to alterations in corneal curvature or changes to the ciliary body. Corneal edema or corneal stromal inflammation is an extremely rare complication (occurring in one of 2,000 patients in one report) and a seemingly idiosyncratic reaction to SLT.⁴ Published and unpublished accounts of post-SLT keratitis suggest that the frequent administration of topical steroids can control the

“Performing transscleral cyclophotocoagulation in the outpatient surgical setting, if possible, may improve patients’ comfort and safety.”

corneal inflammation, although subsequent corneal scarring may result in permanent refractive shifts or decreased BCVA.⁵

TRANSSCLERAL CYCLOPHOTOCOAGULATION

TCPC using a diode laser has commonly been reserved for recalcitrant cases of glaucoma and/or patients who are not good candidates for incisional surgery. Some problems related to TCPC are expected and are usually straightforward to manage, including anesthesia-related complications, pain, inflammation, elevated or decreased IOP, bleeding, and decreased visual acuity. Rare, serious complications associated with the procedure include cataract formation, retinal detachment, phthisis, and sympathetic ophthalmia.⁶

If a patient’s pain during the procedure is significant, the retrobulbar injection should be repeated, or the surgeon should wait a few minutes for the anesthetic to diffuse into the orbit. Rare complications of retrobulbar anesthetic injection, despite a careful and appropriate technique, include a retrobulbar hemorrhage, a perforated globe, vasovagal syncope, and respiratory collapse. Surgeons should ensure that appropriate instrumentation and equipment are available to manage injection-related complications (eg, a hemostat and Westcott scissors to perform a lateral canthotomy or bag-valve-mask and oxygen if a patient experiences respiratory compromise) when administering retrobulbar anesthetic injections in the office. Performing TCPC in the outpatient surgical setting, if possible, may improve patients’ comfort and safety.

Lidocaine and a long-acting anesthetic such as bupivacaine can help control pain on the day of the procedure. Patients typically require a cycloplegic agent such as atropine 1% ophthalmic and nonnarcotic pain control for a few days, but some individuals may benefit from narcotic analgesia after TCPC. A patient with significant or prolonged pain should be evaluated for signs of inflammation, elevated IOP, or other ocular pathology. Surgeons can avoid excessive inflammation by titrating power down to minimize the “pops” heard during TCPC. Longer, lower-powered laser applications may

also reduce inflammation. Most patients only require topical steroids to control inflammation, but those with a history of ocular inflammation or active inflammation at the time of surgery may benefit from a depot injection of triamcinolone.

Physicians should taper patients’ use of pressure-lowering medication, if possible, until the desired IOP level is obtained. Because of the proinflammatory nature of TCPC, prostaglandin analogues and/or cholinergic agents are typically discontinued at the time of surgery. If IOPs are persistently high, TCPC can be repeated as soon as 1 day after the original procedure, but it is preferable to wait at least a week to repeat cyclodestruction in order to avoid overtreatment, thus possibly reducing the incidence of hypotony. If IOPs are too low, the surgeon should confirm that IOP-lowering medications were stopped. Hypotony can also be a sign of inflammation or other intraocular pathology and should be treated accordingly. Phthisis may be a natural progression of the preexisting ocular pathology, but it may result from excessive destruction of the ciliary body.

Vision loss may be inevitable in eyes with severe preexisting pathology. If a patient unexpectedly experiences a decrease in visual acuity, he or she should be evaluated for cataract progression, macular edema, and other retinal pathology. Patients should be informed that TCPC is not designed to improve their vision and that some individuals lose vision after surgery. Although few options are available for preventing sympathetic ophthalmia, patients and physicians should be aware and observant of this potential complication.

CONCLUSION

The advent of lasers has significantly improved the care of glaucoma patients. As with all interventions, physicians should endeavor to use laser therapy appropriately, to avoid or reduce the incidence of complications when possible, and to identify and manage problems as they arise. □

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