Breaking the Blockage With Laser Iridotomy

A safe and effective treatment for angle closure caused by relative or absolute pupillary block.

BY CARLA J. SIEGFRIED, MD

By equalizing the pressure in the anterior and posterior chambers, laser peripheral iridotomy (LPI) is currently the therapy of choice for pupillary block with angle closure and for the elimination of any component of pupillary block in conditions such as phacomorphic glaucoma, aqueous misdirection syndrome, and nanophthalmos. Surgeons use LPI to confirm the diagnosis of plateau iris configuration as well as for prophylactic treatment in eyes they deem to be at risk for angle-closure glaucoma (eg, fellow eyes of patients with acute primary angle closure). Pupillary block can also be induced by the presence of silicone oil, in which case the problem is managed by the inferior placement of the iridotomy if a surgical iridectomy has not been performed.

It is important to note that LPI is not a cure for acute angle closure, especially in eyes with extensive peripheral anterior synechiae (PAS). Iridotomy may fail to prevent the progressive development of PAS and recurrent elevations in IOP. In both Singapore and the United States, most eyes with established primary angle-closure glaucoma (PACG) require additional therapy to control the IOP.[1] The long-term benefit of LPI in the management of pigmentary glaucoma, with relief of its reverse pressure gradient and posterior peripheral iris bowing (reverse pupillary block), has not been proven in any long-term studies.[2]

A LOOK BACK

Female gender, older age, and Asian ancestry are major risk factors for PACG, predicted to account for half of the approximately 11 million individuals who will be blinded by glaucoma by the year 2020.[3] A chronic, asymptomatic clinical course similar to that of primary open-angle glaucoma—and unlike the less common, classic, symptomatic episodes of acute angle closure—affects many patients worldwide. Recently, interest has grown regarding the classification, epidemiology, and utilization of newer technologies for the diagnosis and understanding of the mechanisms of PACG and the efficacy of various treatments for the disease.

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After Von Graefe's introduction of the peripheral iridectomy to treat "congestive" glaucoma, ophthalmologists came to consider the procedure to be traditional and effective therapy.[4] What followed was the development of noninvasive techniques to create iridotomies: zenon-arc photocoagulation by Meyer-Schwickerath,[5] argon laser in 1973 by Khuri,[6] Q-switched ruby laser,[7] and Nd:YAG laser iridotomy.[8] With these approaches, a trip to the OR may be avoided.

DIAGNOSIS

Surgeons perform a prophylactic LPI as initial therapy for narrow angles with appositional closure to prevent

progression to PACG. Dynamic indentation gonioscopy remains the gold standard for evaluating the configuration and structures of the anterior chamber angle. The diagnosis of appositional closure, however, requires a subjective evaluation, and there is only moderate agreement on these findings among observers.[9] A variety of angle-grading schemes, different findings with various gonioscopic lenses, mechanical compression with a lens placed on the eye, and the effect of light on the angle's configuration are changing this reference standard for diagnosis.

Newer diagnostic technologies may be more objective alternatives to gonioscopy.[10] Examples include ultrasound biomicroscopy, Scheimpflug photography, anterior segment optical coherence tomography, spectral domain optical coherence tomography, and the EyeCam (Clarity Medical Systems, Inc.), which has been modified to visualize the structures of the angle. The objectivity, reproducibility, and quantitative analysis of these technologies provide clear advantages, but there is currently no substitute for clinical indentation gonioscopy.

TECHNIQUE

As with any surgical procedure, LPI may be performed using several techniques (Figure). Although many surgeons preoperatively instill pilocarpine to constrict the pupil and put the iris on stretch, an alternative that avoids the occasionally severe brow ache patients suffer is to shine a light into the fellow eye during the procedure. The latter technique takes advantage of the consensual pupillary light reflex. Perioperative dosing of apraclonidine or brimonidine has been shown to be beneficial in controlling postoperative IOP spikes.[11] The use of a contact lens such as the traditional Abraham iridotomy lens minimizes corneal burns. It also facilitates the surgeon's identification of an iris crypt by magnifying the iris structures, and it helps to keep the eye open during the procedure.

As noted earlier, surgeons initially used the argon laser to perform the iridotomy. The procedure was associated with a high rate of failure (20%) in brown eyes, however, as well as a closure rate of up to 30%.[12] The introduction of the Nd:YAG laser was advantageous, because less total energy was required than with the argon laser. LPI using the Nd:YAG laser was highly effective in patients with light-colored irides and was associated with a lower closure rate (power settings of 4-8 mJ, 1-3 pulses/burst). The treatment of darkly pigmented irides resulted in complications related to the use of higher levels of laser energy, iris hemorrhage, and focal corneal opacity associated with a reduced endothelial cell count. De Silva and colleagues described a technique for these challenging cases.[13] The surgeon first applies low levels of argon laser energy (95-180 mW for 0.05 seconds, 50-µm spot size of 15-25 shots) in a circular pattern, followed by higher energy (700 mW for 0.1 seconds, 50-µm diameter for 10-25 shots). This approach creates a thin central area for a final "punch" with the Nd:YAG laser.

Figure. Laser peripheral iridotomy.

Researchers have studied the optimal size of the iridotomy. Fleck suggested 200 µm based on a mathematical model and clinical observations of recurrent angle closure successfully treated with enlargement of the iridotomy.[14] If closure recurs, as in young patients with uveitis, it may be necessary to perform a surgical iridectomy. Postoperatively, topical steroids are used to control the usually mild inflammation to avoid the formation of PAS. The postoperative examination must include repeat gonioscopy to evaluate changes in the angle's anatomy.

COMPLICATIONS

Various complications may occur after LPI such as a transient rise in IOP, inflammation, corneal epithelial disturbance, PAS, focal cataract, corneal endothelial damage, and bleeding of the iris. Other rare complications include malignant glaucoma,[15] choroidal and retinal detachment,[16] and macular hole.[17] Visual complications include transient blurring as well as glare and ghost images.

In their review, Murphy and Trope examined 480 patients who had undergone LPI over a 3-year period.[18] Thirteen patients (2.7%) described monocular blurring or a colored line in their vision. Partial exposure of the iridotomy by the upper lid was noted to be a common factor. The symptoms were relieved by completely covering or exposing the patent iridotomy site as well as by using tinted contact lenses or spectacles. Weintraub and Berke later hypothesized that the base-up prism effect of the tear meniscus at the upper lid margin caused this visual

disturbance.[19] The prism effect bends light rays upward, causing patients to perceive the extra image as displaced downward. The researchers also noted that the location of the iridotomy did not alter the visual disturbance.

Spaeth and colleagues studied these issues in depth.[20] They examined 172 eyes that had undergone LPI with at least 1 month of follow-up and stratified the patients based on whether the iridotomy was completely covered (52.3%), completely exposed (23%), or partially exposed (24%). Visual symptoms were more likely to occur in patients whose laser iridotomies were either partially or fully exposed.

Some surgeons advocate placing the iridotomy in the horizontal meridian, which avoids problems with arcus senilis and difficulty with downward gaze by the patient. Moreover, because it remains out of the central visual axis, bleeding does not alter vision.

In conclusion, Nd:YAG LPI represents a safe and effective procedure for the treatment of angle closure caused by relative or absolute pupillary block. ■

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