Subsequent Receipt of Interventions for Glaucoma Among a Nationwide Sample of Patients Who Underwent Laser Peripheral Iridotomy

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• PURPOSE: To evaluate use of medical, laser, or incisional surgical interventions for glaucoma after laser peripheral iridotomy (LPI).
• DESIGN: Retrospective longitudinal cohort study.
• METHODS: All enrollees aged ≥21 years in a US managed-care network who underwent bilateral LPIs in 2001–2011 were identified. The mean numbers of pre- and post-LPI glaucoma medication classes prescribed and the proportion of enrollees requiring cataract or glaucoma surgery within 2 years after the LPIs were determined. Multivariable logistic regression assessed factors associated with enrollees' prescription of ≥1 glaucoma medication class after bilateral LPIs.
• RESULTS: Of the 1660 patients undergoing bilateral LPIs, 1280 (77.1%) had no pre- or post-LPI prescriptions for any glaucoma medication class. Of the remaining patients, 251 (66.1%) required more glaucoma medication classes after than before the procedures, whereas 44 (11.6%) used fewer after the procedures; 85 (22.4%) were prescribed the same number before and after the LPIs. A total of 167 patients (10.1%) underwent cataract surgery and 79 (4.8%) received glaucoma surgery over the 2-year follow-up. Black patients had a 130% increased odds for glaucoma medication–class prescriptions after bilateral LPIs, compared with white patients ($P = .02$). The odds of post-LPI glaucoma medication use increased by 21% for every additional 5 years of age ($P < .0001$).
• CONCLUSION: Most patients undergoing bilateral LPIs received no pre- or post-LPI glaucoma medication–class prescriptions and had no cataract or additional glaucoma surgery within 2 years after LPIs. Clinicians should alert black or older patients and those already taking glaucoma medications before the procedure of their higher odds of requiring medications afterward. (Am J Ophthalmol 2015;160(2):275–282. © 2015 by Elsevier Inc. All rights reserved.)

ANATOMICALLY NARROW- OR CLOSED-ANGLE ENtities are defined by a spectrum of findings including iridotrabecular meshwork contact, trabecular meshwork dysfunction, and occasionally elevated intraocular pressure (IOP).[1] Most eyes with angle closure possess a component of relative pupillary block[2] with increased iridolenticular resistance to aqueous movement from its site of production in the posterior chamber to its site of egress at the anterior chamber angle. A laser peripheral iridotomy (LPI) often successfully eliminates the relative pupillary block component of the angle-closure process.[2] Creation of the LPI allows aqueous to flow more freely from the posterior chamber to the anterior chamber with a change in the iris configuration such that it often opens up the angle. LPI is also recommended as prophylactic treatment for primary angle-closure suspects (PACS) or patients with occludable angles.[3]

Most studies of patients undergoing LPIs have focused on the impact of the procedure on IOP and anatomic outcomes (ie, ultrasound biomicroscopy, anterior chamber optical coherence tomography, gonioscopic findings), such as changes in anterior chamber depth, changes in angle appearance, and progression to angle closure.[4–18] A few small studies have described the incidence of progression of persons considered PACS to primary angle closure (PAC) or primary angle-closure glaucoma (PACG) after LPI; recurrence of angle closure due to plateau iris syndrome, lens relocation, or ciliary block[19,20]; or complications of LPI such as corneal damage.[21–24] However, little is known about the need for additional interventions for glaucoma following LPI, such as IOP-lowering medications, cataract extraction, or laser or incisional glaucoma surgery; or if there are factors that increase or decrease the probability of requiring additional

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interventions following LPIs. Such information is important for clinicians to adequately advise patients what to expect after the procedure. Using data from a large managed-care network, we identified 1660 patients who underwent bilateral LPIs and followed them continuously for 2 years to determine the need for medical, laser, or incisional glaucoma surgery following the iridotomies.

METHODS

• **DATA SOURCE:** The Clinformatics Data Mart database (OptumInsight, Eden Prairie, MN) contains detailed claims data of all beneficiaries in a nationwide US managed-care network. The dataset contains healthcare claims data for all individuals with ≥1 International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)[25] codes for eye-related diagnoses (360–379.9); ≥1 Current Procedural Terminology[26] codes for any eye-related visits, diagnostics, or therapeutic procedures (65091–68899 or 92002–92499); or any other claim submitted by an ophthalmologist or optometrist from 2001 to 2011. For each enrollee, we had access to all medical claims for ocular and nonocular conditions and sociodemographic information, including age, sex, race, education level, and income. The database also captures information on all outpatient medications filled. All persons in the medical plan were also fully enrolled in the pharmacy plan. The database has been used in the past to study patients with glaucoma.[27–29] Since all the data for these analyses were de-identified to the investigators, the University of Michigan Institutional Review Board approved this retrospective longitudinal cohort study as a nonregulated study.

• **PARTICIPANTS AND SAMPLE SELECTION:** Individuals were included in the analysis if they met the following criteria: age ≥21 years, continuous enrollment in the medical plan, and the receipt of bilateral LPIs (CPT code 66761) within a 3-month period. Eligible enrollees were also required to have ≥2 years in the plan prior to the first LPI and ≥2 years in the plan after the second LPI (Supplemental Figure, available at AJO.com).

Individuals were excluded if they had any record of cataract surgery or laser or incisional glaucoma surgery during their time in the plan prior to the LPIs. Also excluded were those with noncontinuous enrollment and those who did not undergo bilateral LPIs within a 3-month time frame. Because this data source does not reliably capture the laterality of the eye undergoing the LPI, we limited our study to those undergoing this procedure on 2 separate occasions within a 3-month period so that if either or both eyes required subsequent medical or surgical interventions for glaucoma, we would know with greater certainty that the interventions were performed on at least 1 eye that had undergone LPI surgery. Since this study's focus was on the effectiveness of LPI, we did not consider enrollees who underwent surgical iridectomy.

• **REASON FOR THE LASER PERIPHERAL IRIDOTOMY:** To attempt to understand the reason why each enrollee underwent LPI, we queried the database to determine the primary ICD-9-CM diagnosis code listed on the encounter when the initial LPI was performed for each patient.

• **OUTCOMES:** In the 2 years following the second LPI, we assessed the proportion of enrollees who were prescribed glaucoma medications or underwent cataract or glaucoma surgery. Eight medication classes were identified: topical beta-blockers, alpha-agonists, prostaglandin analogues, topical carbonic anhydrase inhibitors, oral carbonic anhydrase inhibitors, miotics, adrenergics, and combination medications. We quantified the number of medication classes ever prescribed for a given patient during the time period of interest. For example, during the 2-year period prior to first LPI, if a patient was taking a prostaglandin analogue for 6 months followed by a topical beta-blocker for 3 months, we considered him to have taken 2 medication classes during that period. Likewise, if she took both medications simultaneously during the 2-year interval, she would also be considered to have taken 2 classes. Patients taking a fixed combination were treated as taking each individual component. Similar quantification of medication use was done for the 2-year interval after the LPIs. The following surgeries were also considered: cataract surgery, laser glaucoma surgery (iridoplasty, laser trabeculoplasty), or incisional glaucoma surgery (trabeculectomy, glaucoma drainage device) (Supplemental Table 1, available at AJO.com).

• **ANALYSES:** Statistical analyses were performed using SAS software, version 9.3 (SAS Institute, Cary, North Carolina, USA). Participant characteristics were summarized for the entire sample using mean values and standard deviations for continuous variables and frequencies and percentages for categorical variables. We determined the proportion of enrollees who were prescribed IOP-lowering medications and the number of agents prescribed in the 6, 12, and 24 months prior to bilateral LPI and during the 6, 12, and 24 months after the LPIs. Since glaucoma medication use can fluctuate owing to addition, substitution, or discontinuation of medications, to help simplify the quantification of medication use prior to and after the LPIs, we looked at the number of glaucoma medication classes each enrollee was prescribed on the specific date corresponding to 6, 12, and 24 months prior to the initial LPI and 6, 12, and 24 months afterwards and determined means for each time point. The proportion of enrollees who required cataract extraction or laser or incisional glaucoma surgery following bilateral LPI was also captured,