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Comparison of New Visual Disturbances after Superior versus Nasal/Temporal Laser Peripheral Iridotomy

A Prospective Randomized Trial

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Purpose: To determine whether laser peripheral iridotomy (LPI) location affects postoperative dysphotopsia symptoms.

Design: Multicenter, randomized, prospective, single-masked trial.

Participants: Five hundred fifty-nine South Indian patients 30 years of age or older diagnosed as primary angle-closure suspects (PACSs) or with primary angle closure (PAC) or primary angle-closure glaucoma (PACG) in both eyes.

Methods: Patients were randomized to either bilateral superior or bilateral nasal/temporal LPI. Occurrence of new visual disturbances was evaluated before and 2 weeks after LPI using a questionnaire based on the 7-item dysphotopsia symptoms described by Spaeth et al.

Main Outcome Measures: New-onset dysphotopsia symptoms.

Results: Superior LPI (n = 285) and nasal/temporal LPI (n = 274) patients were matched for age ($P = 0.6$), gender ($P = 0.7$), and distribution of PACS versus PAC or PACG ($P = 0.7$). Similar initial laser energy settings were used in both groups ($P = 0.3$), although superior LPIs required more shots ($P = 0.006$) and greater total energy ($P < 0.001$) than nasal/temporal LPIs. No significant differences in postoperative anterior chamber reaction ($P = 0.7$) or LPI area ($P = 0.9$) were noted between the 2 groups. No group differences were noted regarding the proportion of patients demonstrating 1 or more dysphotopsia symptoms before LPI (15.8% for superior vs. 13.9% for nasal/temporal; $P = 0.1$) or any individual dysphotopsia symptom ($P > 0.2$ for all). After LPI, 8.9% of all patients reported 1 or more new symptoms, the most common consisting of linear dysphotopsias, glare, and blurring in 2.7%, 4.3%, and 4.3% of patients, respectively. Patients undergoing superior LPI were not more likely to describe the new onset of 1 or more dysphotopsia symptoms as compared with patients undergoing nasal/temporal LPI (8.4% vs. 9.5%; $P = 0.7$), nor did the frequency of any new individual symptoms differ by group ($P \geq 0.3$ for all). In multivariate logistic regression analysis, neither LPI location nor LPI area nor total laser energy predicted higher odds of new postoperative dysphotopsias ($P > 0.1$ for all).

Conclusions: Laser peripheral iridotomy likely is safe with respect to visual dysphotopsias regardless of location, LPI size, and amount of laser energy used. *Ophthalmology 2018;125:345-351 © 2017 by the American Academy of Ophthalmology*

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Primary angle-closure glaucoma (PACG), despite being less prevalent than primary open-angle glaucoma, is responsible for most glaucoma-related blindness in India[1,2] and worldwide.[3–7] Laser peripheral iridotomy (LPI) is the primary treatment for angle closure based on its ability to relieve pupillary block,[8–10] and roughly 80 000 LPIs[11] are performed annually in the United States Medicare population, with many more likely performed in the non-Medicare population and in other countries where angle closure is more prevalent. The large numbers of LPIs performed in part reflect the low complication rate associated with the procedure. However, given the numbers of LPIs performed and the fact that many are performed in eyes with angle closure but no visual field loss, it is important to assure that the procedure is as safe and as free of complications as possible.

One complication previously associated with LPI is subjective visual dysphotopsias (blurring, lines, glares, halos, spots, and shadows), which have been reported to occur in 2% to 16% of patients undergoing LPI.[12–18]

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Location of the LPI has been implicated as a potential cause of these visual phenomenon, with various authors postulating degree of coverage by the upper eyelid[12–14] and the prism effect resulting from the tear meniscus at the eyelid margin[14,15] as possible factors. However, formal evaluation of these hypotheses has yielded mixed results, with some studies implicating LPI location proximate to the eyelid margin[12,14] as the cause of dysphotopsias, whereas others found no such association.[16] Only 1 prior study formally evaluated the importance of LPI location through a randomized controlled trial, although in this trial, patients were randomized to a superior LPI in one eye and temporal LPI in the second eye, with postoperative symptoms evaluated and compared at the level of the eye, and not under normal binocular conditions.[14] The purpose of our study was to determine, in a randomized controlled study, if location of LPI (superior vs. nasal/temporal) affects the development of postoperative dysphotopsias, assessed under physiologic binocular conditions. To our knowledge, this is the largest study of its kind to date.

Methods

The study protocol was approved by the institutional review board of the Aravind Eye Hospital, and written informed consent was obtained from all study participants. The study complied with the tenets of the Declaration of Helsinki. The trial was registered at ClinicalTrials.gov (identifier, NCT03187821).

Participants

Patients 30 years of age or older diagnosed as primary angle-closure suspects (PACSs) or with primary angle closure (PAC) or PACG in both eyes were recruited between September 2012 and December 2013 from the glaucoma clinics at Aravind Eye Hospital branches in Pondicherry, Madurai, Tirunelveli, and Coimbatore, located in South India. Individuals were not eligible for recruitment if they were pseudophakic in either eye; had undergone prior iridotomy, iridoplasty, or incisional glaucoma surgery in either eye; showed signs or symptoms consistent with acute angle closure; or demonstrated lens opacities obscuring undilated fundus evaluation.

Clinical Assessment

All patients underwent a standardized baseline interview before iridotomy to collect demographic data and relevant past ocular history, including use of intraocular pressure (IOP)-lowering drops. Trained technicians measured visual acuity and performed refraction to obtain best-corrected visual acuity. Glaucoma-trained specialists at each center (K.S., K.P., R.V., M.A.K., G.R., S.R.) completed slit-lamp examination of the anterior segment and posterior pole (optic disc and macula), Goldmann applanation tonometry to measure IOP, and gonioscopy as previously detailed.[19] For all examinations, the ophthalmologist was masked to the patient's diagnosis. All testing and ophthalmic evaluations were performed immediately before LPI (on the same day). Based on the baseline examination, findings in the more severely affected eye were used to classify patients as PACS, PAC, or PACG categories, according to International Society of Geographical and Epidemiological Ophthalmology guidelines,[20] modified to collapse PAC and PACG into a single category (as previously described), given that reliable visual fields were not consistently available.[19,21] This classification scheme was used to assess the occurrence of postoperative dysphotopsia symptoms in eyes with PAC or PACG, reflecting angle closure with either manifest disease or a significant risk of future disease.

Neodymium:Yttrium–Aluminum–Garnet Laser Peripheral Iridotomy

Using a binary random number generator, patients were randomized in a 1:1 ratio to undergo LPI in the superior quadrant or the nasal/temporal quadrant. Randomization location was placed in a sealed envelope that was opened immediately before placing the LPI (completed by N.Z.). Both eyes underwent LPI according to the assigned randomization outcome. Randomization could be broken at physician discretion if the assigned location of LPI was deemed not to be feasible. Patients were masked to the location of the LPI.

Laser peripheral iridotomy was performed using neodymium:yttrium–aluminium-garnet laser after pretreatment with 2% pilocarpine. Superior LPIs were placed between the 11- and 1-o'clock positions such that they were covered completely by the upper eyelid; nasal/temporal LPIs were placed between the 2- and 4-o'clock positions or the 8- and 10-o'clock positions such that they were completely clear of the lid margin. Preference was given to iris crypts, avoiding iris vessels when possible. Laser peripheral iridotomies were performed in both eyes during the same visit and were confirmed to be patent after the procedure. Intraoperative data collected included initial per-shot laser energy in millijoules, number of laser shots, and total laser energy in millijoules. All the patients were treated with prednisolone acetate 1% eye drops after surgery for 10 days. Additionally, patients with elevated IOP were treated before LPI, after LPI, or both with IOP-lowering drops at the treating physician's discretion.

Assessment after Laser Peripheral Iridotomy

Patients were re-examined at 2 weeks after LPI, at which time slit-lamp biomicroscopy of the anterior segment was repeated. Level of anterior chamber inflammation was assessed using the Standardization of Uveitis Nomenclature Working Group criteria.[22] After confirming the patency of the LPI, the approximate size of the LPI was estimated to the nearest 0.5 mm in height and width using the slit beam, and dilated fundus examination was performed. Laser peripheral iridotomies that were found to be occluded or not clearly patent ($n = 5$) were enlarged or repeated at the 2-week postoperative visit at the same randomization location. These patients were re-examined at 2 weeks after the secondary LPI, and all the above procedures were repeated, documented, and used in subsequent analyses.