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Ophthalmic Technology Assessment

Laser Peripheral Iridotomy in Primary Angle Closure

A Report by the American Academy of Ophthalmology

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Purpose: To examine the efficacy and complications of laser peripheral iridotomy (LPI) in subjects with primary angle closure (PAC).

Methods: Literature searches in the PubMed and Cochrane databases were last conducted in August 2017 and yielded 300 unique citations. Of these, 36 met the inclusion criteria and were rated according to the strength of evidence; 6 articles were rated level I, 11 articles were rated level II, and 19 articles were rated level III.

Results: Reported outcomes were change in angle width, effect on intraocular pressure (IOP) control, disease progression, and complications. Most of the studies (29/36, 81%) included only Asian subjects. Angle width (measured by gonioscopy, ultrasound biomicroscopy, and anterior segment OCT) increased after LPI in all stages of angle closure. Gonioscopically defined persistent angle closure after LPI was reported in 2% to 57% of eyes across the disease spectrum. Baseline factors associated with persistent angle closure included narrower angle and parameters representing nonpupillary block mechanisms of angle closure, such as a thick iris, an anteriorly positioned ciliary body, or a greater lens vault. After LPI, further treatment to control IOP was reported in 0%-8% of PAC suspect (PACS), 42% to 67% of PAC, 21% to 47% of acute PAC (APAC), and 83%-100% of PAC glaucoma (PACG) eyes. Progression to PACG ranged from 0% to 0.3% per year in PACS and 0% to 4% per year in PAC. Complications after LPI included IOP spike (8−17 mmHg increase from baseline in 6%−10%), dysphotopsia (2%−11%), anterior chamber bleeding (30%−41%), and cataract progression (23%−39%).

Conclusions: Laser peripheral iridotomy increases angle width in all stages of primary angle closure and has a good safety profile. Most PACS eyes do not receive further intervention, whereas many PAC and APAC eyes, and most PACG eyes, receive further treatment. Progression to PACG is uncommon in PACS and PAC. There are limited data on the comparative efficacy of LPI versus other treatments for the various stages of angle closure; 1 randomized controlled trial each demonstrated superiority of cataract surgery over LPI in APAC and of clear lens extraction over LPI in PACG or PAC with IOP above 30 mmHg. *Ophthalmology 2018;■:1−12 © 2018 by the American Academy of Ophthalmology*

The American Academy of Ophthalmology prepares Ophthalmic Technology Assessments to evaluate new and existing procedures, drugs, and diagnostic and screening tests. The goal of an Ophthalmic Technology Assessment is to review systematically the available research for clinical efficacy and safety. After review by members of the Ophthalmic Technology Assessment Committee, relevant subspecialty societies, and legal counsel, assessments are submitted to the Academy's Board of Trustees for consideration as official Academy statements. The purpose of this assessment by the Ophthalmic Technology Assessment Committee/Glaucoma Panel is to examine the efficacy and complications of laser peripheral iridotomy (LPI) in subjects with primary angle closure (PAC).

Background

Laser peripheral iridotomy is an integral component in the management of PAC. Although LPI has been available since the 1980s, its role in the treatment algorithm for PAC is still debated; questions such as who should be treated with an iridotomy and whether iridotomy prevents disease progression continue to be relevant today.[1,2] When assessing the literature on LPI for PAC, an important issue is the paucity of studies with controls who were not treated with iridotomy. Another issue is the heterogeneity of study subjects who span the entire spectrum of PAC, ranging from subjects who have iridotrabecular contact (ITC) without any other abnormality, to those who have ITC, peripheral anterior synechiae (PAS),

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Table 1. Classification of Primary Angle Closure

Type of PAC	Characteristics
PACS	≥180° of ITC, normal IOP, no PAS, and no optic neuropathy
PAC	≥180° of ITC with PAS or elevated IOP, but no optic neuropathy
PACG	≥180° of ITC with PAS, elevated IOP, and optic neuropathy
APAC or AACC	Occluded angle with symptomatic high IOP

AACC = acute angle-closure crisis; APAC = acute primary-angle closure; IOP = intraocular pressure; ITC = iridotrabecular contact (defined as nonvisibility of posterior trabecular meshwork on static gonioscopy); PAC = primary angle closure; PACG = primary angle-closure glaucoma; PACS = primary angle-closure suspect; PAS = peripheral anterior synechiae.

and optic nerve damage. Because older studies used varying definitions for angle closure and grouped together different stages of angle closure, their results cannot be easily compared and should be interpreted with caution. With the wider use of a classification system that was first proposed by Foster et al in 2002,[3] and subsequently adopted by the American Academy of Ophthalmology's Primary Angle Closure Preferred Practice Pattern (PPP) Guidelines (Table 1),[4] the effect of various treatments for PAC can be better assessed and compared across different studies. The previous Ophthalmic Technology Assessment on LPI,[5] published in 1994, focused mainly on the technical aspects of a then relatively new procedure. The goal of the current assessment is to assess its efficacy and complications in the treatment of PAC.

Questions for Assessment

The focus of this assessment is to address the following questions: (1) What is the efficacy of LPI? Specifically, what is its effect on anterior chamber angle width, intraocular pressure (IOP) control, and disease progression? and (2) What are the clinically relevant short- and long-term complications of LPI?

Description of Evidence

Literature searches in the PubMed and Cochrane databases, which were originally performed in 2014 and last conducted in August 2017, yielded a total of 300 unique citations. After review by the panel, 36 articles that met the following inclusion criteria were selected: (1) The study reported on outcomes or complications of LPI in patients with PAC; (2) the study contained at least 50 eyes if reporting on short-term outcomes or complications, and the study contained at least 30 eyes with a minimum of 1-year follow-up (or 6 months for acute primary angle closure [APAC]) if reporting on intermediate to long-term outcomes or complications; and (3) the definition of PAC was in accordance with the Academy's Primary Angle Closure PPP guidelines. If the definition of PAC did not meet these guidelines, the Methods section had to provide sufficient detail to reclassify patients into the categories defined in the PPP (Table 1), namely, PACS, PAC, PACG, and acute angle-closure crisis or APAC. Studies on fellow eyes of APAC were included regardless of the classification scheme used because these eyes are a unique subset in which LPI is known to prevent an acute attack of angle closure.[4] Studies that used Scheimpflug photography to measure angle width were excluded because this technology cannot image the angle recess. Older studies that focused on initial experience with LPI were considered to be not relevant for the purpose of this assessment.

After identifying articles that met the inclusion criteria, the panel methodologist (K.N.-M.) assigned a level of evidence based on the rating scale developed by the Oxford Centre for Evidence-Based Medicine.[6] A level I rating was assigned to well-designed and well-conducted randomized clinical trials; a level II rating was assigned to well-designed case-control and cohort studies and poor-quality randomized trials; and a level III rating was assigned to case series, case reports, and poor-quality cohort and case-control studies. Six articles were rated level I, 11 were rated level II, and 19 were rated level III.

Published Results

Studies Evaluating the Effect of Laser Peripheral Iridotomy on Anterior Chamber Angle Width

Various qualitative and quantitative parameters were used to report the effect of LPI on angle width (Table 2). Gonioscopic descriptors included mean Shaffer grade, angle width in degrees, and proportion of eyes with persistent ITC after LPI. The most common imaging-based quantitative parameter reported was the angle opening distance (AOD), the perpendicular distance between the anterior iris surface, and a point 500 μm (AOD 500) or 750 μm (AOD 750) anterior to the scleral spur.

Seventeen studies[7–23] compared anterior chamber angle width before and after LPI; of these, 11 studies[8–10,13–16,18–20,22] assessed short-term effects with an interval of 1 to 8 weeks between the pre- and post-LPI assessment, 5 studies[7,11,12,17,21] evaluated longer-term effects with an interval of 11 to 37 months between the pre- and post-LPI assessment, and in 1 study,[23] the timing of post-LPI assessment was not specified. The angle was evaluated by gonioscopy in 13 studies,[7,8,10,12,14–19,21–23] by ultrasound biomicroscopy (UBM) in 5 studies,[9,13,14,18,19] and by anterior segment OCT (ASOCT) in 5 studies.[7,10,11,15,20] Six studies used both gonioscopy and imaging (UBM or ASOCT) to evaluate the angle. Of the 13 studies that used gonioscopy, 10 studies[7,8,10,12,15–19,21] reported the change in angle width after LPI, 2 studies[22,23] reported only the proportion of subjects with persistent ITC after LPI, and 1 study[14] only commented on the change in PAS after LPI. All but 3 studies had subjects of Asian origin, including Chinese, Mongolian, Korean, Indian, and Vietnamese.

Short-term Changes in Angle Width. Short-term changes in angle width were evaluated by gonioscopy in 13 studies. The angle width increased in all 10 studies that reported on change in this parameter from before to after LPI (levels II and III). In PACS eyes, the average Shaffer grade was