Clinical outcomes of clear lens extraction in eyes with primary angle closure

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PURPOSE: To evaluate the effect of clear lens extraction (CLE) on intraocular pressure (IOP) and the anterior chamber angle in primary angle closure after laser peripheral iridotomy (LPI).

SETTING: Tertiary eyecare center at a university hospital, New Delhi, India.

DESIGN: Prospective case series.

METHODS: The study included eyes with primary angle closure and an IOP over 25.0 mm Hg more than 8 weeks after LPI. All eyes had CLE by phacoemulsification. Absolute success was defined as an IOP less than 18.0 mm Hg without medications at 12 months.

RESULTS: In 44 eyes (24 women, 20 men; mean age 57.2 years ± 4.2 [SD]), the mean preoperative IOP of 27.1 ± 1.55 mm Hg decreased to 13.2 ± 1.12 mm Hg at 12 months ($P < .0001$). The angle opening distance at 500 μm increased from baseline values at 0 degrees (from 0.104 ± 0.015 mm to 0.31 ± 0.013 mm) and 180 degrees (from 0.202 ± 0.008 mm to 0.412 ± 0.012 mm). The trabecular iris angle also increased at 0 degrees (from 9.3 ± 3.2 degrees to 32.7 ± 5.6 degrees) and 180 degrees (from 9.12 ± 3.2 degrees to 31.7 ± 5.6 degrees) (all $P < .0001$). In multivariate analysis, the preoperative IOP was the strongest determinant of IOP change ($R^2 = 0.69$, $P < .0001$). Absolute success was achieved in 38 eyes (86.3%).

CONCLUSION: Clear lens extraction led to a significant reduction in IOP, a widening of the anterior chamber angle, and a reduced need for ocular hypotensive medications in eyes with primary angle closure and persistently raised IOP after LPI.

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Primary angle closure has been defined as an eye with an occludable drainage angle and features indicating trabecular obstruction by the peripheral iris, such as peripheral anterior synechiae, elevated intraocular pressure (IOP), iris whirling, glaukomflecken, and excessive pigment deposition on the trabecular surface, without glaucomatous optic neuropathy.[1]

It has been reported that one third of eyes with primary angle closure and ocular hypertension develop primary angle-closure glaucoma (PACG).[2,3] According to estimates in 2010, PACG affects approximately 15 million people and is responsible for one half of glaucoma-related blindness.[4] Because PACG has a high population attributable risk percentage, a significant proportion of PACG-related blindness is preventable if the disease is treated in an early stage.[4–7]

The crystalline lens plays a pivotal role in the pathogenesis of primary angle closure. Eyes with primary angle closure have a thicker, more anteriorly positioned crystalline lens than normal eyes.[8–16] Many studies[17–21] have evaluated the effects of lens extraction on IOP control and angle widening in eyes with established PACG.

Conventional management of primary angle closure starts with laser peripheral iridotomy (LPI), which effectively prevents acute angle-closure attacks and slows the progression of primary angle closure to the irreversible stage of glaucomatous optic neuropathy (ie, PACG). However, reports suggest that LPI is not universally effective in preventing asymptomatic IOP elevations in the long term and that the disease could continue to progress despite a patent LPI.[22–25] Therefore, medical and/or surgical intervention might

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be required if the LPI fails to reduce the IOP. Removing the crystalline lens can deepen the anterior chamber and relieve crowding of the angle, an effect that should occur irrespective of the cataract status of the lens. Deepening of the anterior chamber and widening of angles after clear lens extraction (CLE) in PACG have been clearly demonstrated.[26,27] A recent review discussed the effectiveness of this procedure in eyes with primary angle closure[26] and summarized that early lens extraction might be therapeutic. However, there are no studies of the clinical outcomes of CLE in primary angle closure to support this hypothesis.

The present study evaluated the effect of CLE on IOP control and on anterior chamber angle parameters in eyes with primary angle closure and persistently raised IOP in which LPI had been performed.

PATIENTS AND METHODS

The study was approved by the Institutional Ethics Committee of the All India Institute of Medical Sciences and adhered to the tenets of Declaration of Helsinki. All patients provided informed written consent and were recruited from the outpatient services of a tertiary eyecare center at a university hospital from July 1, 2011, to December 31, 2013.

The study included phakic eyes of patients older than 50 years with primary angle closure, a corrected distance visual acuity (CDVA) of 20/20 or better with a patent LPI, and an IOP of more than 25.0 mm Hg at least 8 weeks after LPI despite the use of ocular hypotensive medications. Excluded were eyes with PACG, acute primary angle closure, or primary angle closure suspect. One-eyed patients were also excluded.

Primary angle closure was defined as the presence of occludable angles in at least 3 quadrants on gonioscopy (Sussman 4-mirror gonioscope, Ocular Instruments), an elevated IOP, and no evidence of optic nerve damage or nerve fiber layer defect. The preoperative workup included visual acuity measurement, slitlamp biomicroscopy, evaluation of the optic nerve head using a 90.0 diopter lens, gonioscopy, applanation tonometry, A-mode contact ultrasonography (Sonomed A2500, Haag-Streit), keratometry, perimetry (Humphrey Field Analyzer II-*i*, Carl Zeiss Meditec AG), and anterior segment optical coherence tomography (AS-OCT) (Visante, Carl Zeiss Meditec AG) for evaluating the various angle parameters. The angle parameters evaluated were the anterior chamber depth (ACD) (measured along the posterior corneal surface to the anterior pole of the lens); lens thickness (the distance between the anterior and posterior poles of the lens); the angle-opening distance 500 μm and 750 μm from the scleral spur at 0 and 180 degrees; the distance between the posterior corneal surface and the anterior iris surface (measured on a line perpendicular to the trabecular meshwork 500 μm and 750 μm from the scleral spur); the trabecular iris angle at 0 and 180 degrees (measured with the apex at the iris recess and the arms of the angle passing through a point on the trabecular meshwork 500 μm from the scleral spur and through a point on the iris perpendicularly opposite); the trabecular iris surface area at 0 degrees and 180 degrees (trabecular iris surface area 500 is an area bounded anteriorly by the angle opening distance 500, posteriorly by a line from the scleral spur perpendicular to the plane of the inner scleral wall to the opposing iris, superiorly by the inner corneoscleral wall, and inferiorly by the iris surface); lens vault, defined as the perpendicular distance between the anterior pole of the crystalline lens; and the horizontal line joining the 2 scleral spurs on horizontal AS-OCT scans.

Preoperatively, the number of ocular hypotensive medications that the patients were taking was recorded. Next, the same surgeon (T.D.) performed CLE by phacoemulsification with implantation of a posterior chamber foldable single-piece hydrophobic acrylic intraocular lens (IOL) in the capsular bag.

Postoperatively, a 4-week tapered course of a topical steroid and antibiotic was prescribed for all patients. The preoperative ocular hypotensive agents were discontinued after surgery. The postoperative IOP was recorded at 1 and 3 days, 2 and 4 weeks, and 3, 6, and 12 months. Ocular hypotensive medications were reinstituted for patients in whom the IOP was over 21.0 mm Hg at any follow-up. The postoperative distance and near visual acuities were recorded at 1, 3, 6, and 12 months. Anterior segment OCT was repeated postoperatively at 3, 6, and 12 months.

The primary outcome measure was a change in the IOP from preoperatively to postoperatively. Secondary outcome measures included the preoperative to postoperative change in anterior chamber angle parameters and a reduction in the number of ocular hypotensive medications prescribed. Absolute success was defined as having an IOP less than 18.0 mm Hg without use of ocular hypotensive medication. A qualified success was defined as having an IOP less than 18.0 mm Hg with the use of 1 ocular hypotensive medication.

Data were recorded in Excel software (Microsoft Corp.) and were analyzed using SPSS software (version 11.5, SPSS, Inc.). The paired *t* test was used to analyze quantitative data. Correlations were assessed using the Pearson correlation test and multivariate analysis. Categorical data were analyzed using the chi-square test. A *P* value less than 0.05 was considered statistically significant.

RESULTS

The study comprised 44 eyes of 44 patients. The mean age of the 24 women and 20 men was 57.2 years ± 4.2

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