

## Current management options in primary angle closure disease

Primary angle closure glaucoma (PACG) is a leading cause of blindness<sup>[1]</sup> worldwide, especially in Asia. An estimated 5.3 million persons will be blind globally from the disease by 2020,<sup>[2]</sup> a majority of whom are women and inhabit the densely populated Asian nations. Although primary open-angle glaucoma (POAG) is the most common form of glaucoma, PACG is more likely to result in blindness if inappropriately treated. Half of those blind from glaucoma are due to angle-closure disease,<sup>[3]</sup> although it accounts for only 25% of persons detected with any glaucoma. Risk of blindness is at least three times higher than in open-angle glaucoma (OAG). Early detection of PACG and its appropriate management presents a challenging task, especially in the developing world.

Conventionally, treatment of PACG is laser iridotomy (LI) to eliminate pupillary block and widen the angles by reducing the pressure differential between the anterior and posterior chambers. Stepped up, standard glaucoma medications are added if intraocular pressure (IOP) remains high despite LI. Trabeculectomy is more often preferred when conservative therapy fails to achieve the desired target IOPs after LI and maximal tolerated topical medical treatment. Major objective of surgical management in PACG are reduction of IOP and opening of the anterior chamber angle (ACA). Widening of the angles and prevention of peripheral anterior synechiae (PAS) may not be achieved by trabeculectomy, which actually may be counterproductive and exacerbate angle closure and PAS due to unrestricted aqueous outflow or forward movement of the lens iris diaphragm. LI may not necessarily widen the angle as 80% of eyes with narrow angles have gonioscopic residual angle closure following iridotomy.<sup>[4]</sup> Cataract extraction is an alternative surgical option in persons with primary angle closure disease (PACD), which concurrently lowers IOP and widens the angle.

In acute primary angle closure (PAC), all patients had resolution of acute episode of IOP elevation after LI, but 58% subsequently required medical therapy and 32% eventually had trabeculectomy<sup>[5]</sup> for IOP reduction. Half of those diagnosed with PAC or angle-closure glaucoma (ACG) require supplemental medical or surgical intervention subsequent to LI. In eyes with extensive PAS, LI seldom has beneficial effect and IOP lowering effect was much less in eyes with anteriorly located ciliary processes. In eyes, initially presenting with IOP > 35 mm, PAS > 180 degrees of the angle, or glaucomatous optic neuropathy, LI<sup>[6]</sup> is likely to be ineffective in controlling IOP and likely to require surgical intervention other than or in addition to LI. There is as yet no consensus on the best approach to surgical management of PACG. Surgical options Post PI are diverse and include trabeculectomy, combined lens extraction with filtering surgery, lens extraction alone, angle-widening procedures such as goniosynechialysis (GSL), usually combined with cataract extraction.

Glaucoma filtering surgery in PACG is associated with high risk of failure or surgical complications including anterior chamber shallowing, aqueous misdirection, hypotony, choroidal effusions or hemorrhage, and cataract formation. High incidence of visual loss were reported,<sup>[7]</sup> and 6.6% of eyes were blind in 5 years due to choroidal detachments, hypotonic maculopathy, cataracts, and bullous keratopathy. Ultrasound biomicroscopy (UBM) studies have revealed that ACD decreases after trabeculectomy in PACG, while ciliary processes were posteriorly positioned and ACA significantly widened in eyes that had combined cataract extraction and trabeculectomy. Posterior shift in position of ciliary processes in combined glaucoma procedures is indirect evidence of the role of the crystalline lens in influencing the ACA configuration in eyes with angle closure.

Size and position of the lens play a major role in pathogenesis of PACG. With aging, there is increase in thickness of the lens and a relatively more anterior lens position. Lens extraction and posterior chamber intraocular lens (PCIOL) implantation has been found to result in satisfactory IOP control post-operatively in eyes with PACG. It is postulated that deepening of anterior chamber results in reduction in angle crowding and relief of pupillary block. Width and depth of angle in PACG increases significantly after phaco and becomes similar to those in eyes with open angles. Lens extraction lowers IOP and reduces likelihood of progressive angle closure. Role of crystalline lens in PACD and beneficial effect of lens extraction in management of ACG have been well established. In the EAGLE study,<sup>[8]</sup> fewer participants in the lens extraction group needed any treatment, including medications to control IOP and fewer required additional surgeries compared to the laser peripheral iridotomy (LPI) group.

Lens extraction has been recommended in PACG patients with closed angles after LPI and uncontrolled IOP on medications. Lens extraction in medically uncontrolled PACG reduced the mean IOP as much as trabeculectomy, but more complications and surgical interventions were observed in the trabeculectomy group. However, 16% of medically uncontrolled PACG need additional treatments of trabeculectomy or glaucoma drainage devices after phacoemulsification (PE) within 2 years. Long-term IOP control after PE has been positively associated with preoperative IOP, ACD, and extent of PAS. It is likely that interventions to reverse PAS prior to or concomitant with lens extraction are likely to improve outcomes after PE in PACG.

Although PE can significantly lower IOP and prevent progressive angle closure, it cannot reverse PAS or trabecular dysfunction due to synechial closure. GSL is a surgical procedure to release PAS from the angle in an attempt to restore trabecular function and reestablish aqueous outflow. Lens extraction combined with GSL achieved lower IOP without glaucoma medications with significant improvement in ACA parameters by anterior segment optical coherence tomography (AS-OCT)<sup>[9]</sup> when compared to cataract extraction alone. Inflammation, hyphema, IOP spike, and cystoid macular edema (ME) were higher in eyes subsequent to GSL, which may be ineffective in eyes with permanent trabecular damage underlying PAS.<sup>[10]</sup>

Combined PE and endoscopic cyclophotocoagulation<sup>[11]</sup> (PE + ECP) could effectively reduce IOP in medically uncontrolled glaucoma while avoiding serious complications associated with transcleral cyclophotocoagulation and adverse effects related to glaucoma filtering surgery such as trabeculectomy. ECP could decrease aqueous production through ciliary ablation in a controlled and predictable fashion due to ablation of ciliary processes under direct visualization. PE + ECP have become a well-accepted surgical option, sparing patients of the adverse effects of traditional filtering surgery while offering advantages of minimally invasive glaucoma surgery. Ablation of ciliary processes additionally widens the ACA, especially in eyes with plateau iris configuration.

In this issue, Panse *et al.*<sup>[11]</sup> have reported on the surgical outcomes of phaco and GSL with and without ECP in eyes with chronic ACG (CACG). ECP combined with phaco and GSL in ACG has hardly been reported in the ophthalmic literature. A short-term observation in a small cohort of patients with PACG seems to significantly reduce IOP without sight-threatening complications. These minimally invasive procedures also preserve intact conjunctiva, should filtering surgeries be required in future. Though effects of ECP diminished over time, it is possible to safely employ ECP in addition to phaco and GSL in advanced CACG, where lower target IOP is required and postoperative IOP spike may be prevented.

A major shortcoming of the study has been an inadequate sample size and a short-term follow up of 12 months. The results of the study need to be validated in a larger cohort of patients with longer follow up. GSL and ECP when combined with phaco provide a safe, less invasive means of complementarily lowering IOP associated with significantly lesser complications than traditional filtering surgeries.

Although ECP is still an expensive technique, largely unavailable in most facilities across developing world like India, PE is a technique of cataract extraction that is increasingly being performed safely by ophthalmologists. It is possible to combine GSL by cataract surgeons with little training. Prevention of blindness and visual impairment from angle closure disease is well within the realm of possibility provided all ophthalmologists are trained to detect angle closure early by gonioscopy and perform safe PE in eyes with cataracts or by performing LI in eyes with risk of impending angle closure.

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#### Conflicts of interest

There are no conflicts of interest.

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