

Filtration Surgery and Primary Angle-Closure Glaucoma

Choose a surgical approach based on the contributing mechanism and stage of the disease.

BY SARWAT SALIM, MD

Primary angle-closure glaucoma (PACG) is a major form of glaucoma worldwide. The complex pathophysiology and various underlying mechanisms associated with PACG present both diagnostic and therapeutic challenges for physicians. The spectrum of this disease may range from occludable angles to chronic angle-closure glaucoma (CACG), and management options vary depending on the stage of the disease. Iridotomy, iridoplasty, goniosynechialysis, cataract extraction, trabeculectomy, or a combination of these interventions are all viable treatments, and the indication for each requires an understanding of the anatomic factors and mechanisms and the disease severity.

INDICATIONS FOR FILTRATION SURGERY

The indications for glaucoma filtering surgery for PACG are similar to those for primary open-angle glaucoma (POAG). Trabeculectomy is performed when the IOP cannot be effectively controlled with medical and/or laser therapy, if the patient exhibits poor compliance or tolerance to medical therapy, if there is progressive glaucomatous optic nerve damage and/or visual field loss, or if there is poorly controlled glaucoma at the time of planned cataract extraction.

When addressing the spectrum of PACG, physicians must remember that the level of the initial IOP and gonioscopic findings may not accurately predict the need for trabeculectomy. If there is 180° or more of peripheral anterior synechiae of relatively short duration with stable optic nerve and visual field status, then goniosynechialysis or cataract extraction may be tried. Before proceeding with trabeculectomy, it is important to ascertain that relative pupillary block has been relieved with laser peripheral iridotomy and/or cataract extraction and that plateau iris configuration has been addressed with pilocarpine,

iridoplasty, or cataract extraction. In the presence of a functionally significant cataract and an IOP slightly above target, cataract removal alone may be sufficient.

LITERATURE REVIEW

In a retrospective, noncomparative case series of 56 patients in Singapore, Aung et al reported a high risk of surgical failure (34.4%) and complications with trabeculectomy without use of an adjunctive antimetabolite in medically unresponsive cases of acute primary angle closure.¹ Failure was defined as an IOP less than 21 mm Hg with or without medications, loss of light perception vision, or the need for further glaucoma surgery. The authors attributed high failure rates in these eyes to elevated preoperative IOP and associated inflammation.

Chen et al found significantly different surgical outcomes of trabeculectomy with an adjunctive antimetabolite in eyes with acute primary angle-closure glaucoma (APACG) and chronic primary angle-closure glaucoma (CPACG).² Surgical success (IOP < 21 mm Hg with or without medications) was lower in patients with APACG versus CPACG (60% vs 91.9%). Worse visual outcomes and more postoperative complications were observed in the APACG group. The authors concluded that trabeculectomy might not be the procedure of choice in medically unresponsive cases of APACG.

The prevalence of PACG increases with age and frequently coexists with cataract. Cataract extraction has been reported to significantly reduce IOP in eyes with APACG and CPACG.³⁻⁶ Refractory cases and those requiring a lower target pressure in the setting of progressive optic nerve and visual field damage may require a trabeculectomy or combined phacoemulsification-trabeculectomy (phaco-trab).

Tham et al compared phacoemulsification alone (n = 35 eyes) and phaco-trab with adjunctive mitomycin C

(MMC; $n = 37$ eyes) in patients with medically controlled CACG with cataract.⁷ No statistically significant difference was found in the mean IOP between the two treatment groups, except at 1 and 3 months postoperatively. Although phaco-trab resulted in 0.80 fewer topical glaucoma medications ($P < .001$) compared with phacoemulsification alone at the final 24-month follow-up visit, more postoperative complications were reported for the phaco-trab group. Only one eye in the CACG group treated with phacoemulsification subsequently required a trabeculectomy to control IOP. Given the very small improvement in IOP and higher number of complications in the phaco-trab group, the authors recommended performing phacoemulsification alone in eyes with medically controlled CACG and coexisting cataract.

Tham et al compared phacoemulsification alone ($n = 27$ eyes) and phaco-trab with adjunctive MMC ($n = 24$ eyes) in patients with medically uncontrolled CACG with coexisting cataract.⁸ No significant differences in mean IOP were observed between the two treatment groups pre- and postoperatively, except at 3, 15, and 18 months. There were more postoperative complications in the phaco-trab group.

Tham et al compared phacoemulsification ($n = 26$ eyes) versus trabeculectomy with adjunctive MMC ($n = 24$ eyes) in patients with medically uncontrolled CACG without cataract.⁹ Both groups resulted in significant and comparable IOP reduction at 24 months postoperatively (34% for phacoemulsification and 36% for trabeculectomy; $P = .76$). The trabeculectomy group required on average 1.1 fewer drugs than the phacoemulsification group ($P < .001$) but had more postoperative complications (46% vs 4%; $P = .001$). The authors concluded that phacoemulsification alone may be a possible alternative to trabeculectomy as an initial surgical intervention in medically uncontrolled CACG eyes without cataract.

Sihota et al evaluated the long-term results of trabeculectomy without an adjunctive antimetabolite in 26 POAG eyes and 38 CPACG eyes in an Asian population.¹⁰ Both groups had comparable IOP control and visual field preservation over 10 years. Postoperatively, cataract formation was more common in eyes with CPACG than with POAG, with subsequent cataract removal in 21% and 11.5%, respectively. Hong et al compared long-term IOP control of trabeculectomy and phaco-trab in 1,542 eyes with POAG and CPACG.¹¹ Surgical success of trabeculectomy and phaco-trab (IOP reduction $\geq 30\%$ from baseline with or without anti-glaucoma medications) was 0.613 and 0.733 at 15 years, respectively. The success probability of trabeculectomy and phaco-trab in reducing IOP below 18 mm Hg was 0.748 and 0.825 at 15 years, respectively.

OPTIMIZING SURGICAL OUTCOMES

Although the surgical technique for filtration surgery in PACG is similar to in other types of glaucoma, several precautionary steps should be taken to optimize surgical outcomes and minimize complications. The scleral flap and sclerotomy should be more anteriorly placed to avoid the ciliary body in these usually hyperopic eyes. Patients with PACG are at high risk of developing malignant glaucoma. Every effort should be made to avoid extreme IOP fluctuations intraoperatively and postoperatively, including maintaining a deep anterior chamber with balanced salt solution or a viscoelastic agent, multiple tight sutures, preplacement of sutures, judicious laser suture lysis, and cycloplegic therapy.

CONCLUSION

Proper management of angle-closure glaucoma requires a thorough understanding of the underlying mechanism, which may be at the level of the iris, ciliary body, lens, or vectors posterior to the lens. A combination of mechanisms may coexist in the same patient. In addition to medical and laser therapy, various surgical options, including trabeculectomy, phacoemulsification, phaco-trab, goniosynechialysis, and combined phacoemulsification-goniosynechialysis, are available for treating the spectrum of angle-closure disease. We currently lack well-controlled, randomized clinical trials comparing long-term outcomes of these various surgical interventions. For now, a surgical approach should be individualized based on the contributing mechanism and stage of the disease. ■

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1. Aung T, Tow SL, Yap EY, et al. Trabeculectomy for acute primary angle closure. *Ophthalmology*. 2000;107:1298-1302.
2. Chen YH, Lu DW, Cheng JH, et al. Trabeculectomy in patients with primary angle-closure glaucoma. *J Glaucoma*. 2009;18:679-683.
3. Di Staso S, Sabetti L, Taverniti L, et al. Phacoemulsification and intraocular lens implant in eyes with primary angle-closure glaucoma: our experience. *Acta Ophthalmol Scand Suppl*. 2002;236:17-18.
4. Acton J, Salmon JF, Scholtz R. Extracapsular cataract extraction with posterior chamber lens implantation in primary angle-closure glaucoma. *J Cataract Refract Surg*. 1997;23:930-934.
5. Hayashi K, Hayashi H, Nakao F, et al. Effect of cataract surgery on intraocular pressure control in glaucoma patients. *J Cataract Refract Surg*. 2001;27:1779-1786.
6. Lai JS, Tham CC, Chan JC. The clinical outcomes of cataract extraction by phacoemulsification in eyes with primary angle-closure glaucoma (PACG) and co-existing cataract: a prospective case series. *J Glaucoma*. 2006;15:47-52.
7. Tham CCY, Kwong YYY, Leung DYL, et al. Phacoemulsification versus combined phacotrabeculectomy in medically controlled chronic angle closure glaucoma with cataract. *Ophthalmology*. 2008;115:2167-2173.
8. Tham CCY, Kwong YYY, Leung DYL, et al. Phacoemulsification versus combined phacotrabeculectomy in medically uncontrolled chronic angle closure glaucoma with cataracts. *Ophthalmology*. 2009;116:725-731.
9. Tham CCY, Kwong YYY, Baig N, et al. Phacoemulsification versus trabeculectomy in medically uncontrolled chronic angle closure glaucoma without cataract. *Ophthalmology*. 2013;120:62-67.
10. Sihota R, Gupta V, Agarwal HC. Long-term evaluation of trabeculectomy in primary open angle glaucoma and chronic primary angle closure glaucoma in an Asian population. *Clin Experiment Ophthalmol*. 2004;32:23-28.
11. Hong S, Park K, Ha SJ, et al. Long-term intraocular pressure control of trabeculectomy and triple procedure in primary open angle glaucoma and chronic primary angle closure glaucoma. *Ophthalmologica*. 2007;221:395-401.