The effect of cataract surgery on lowering intraocular pressure

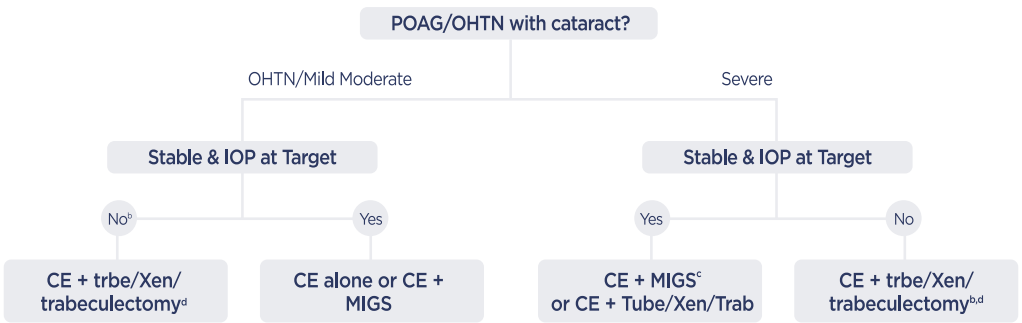
Shah YS, Garg AK, Ramulu PY. *Curr Opin Ophthalmol* 2025;36(1):46-53.

Purpose

본 리뷰는 안압(IOP)이 높거나 녹내장이 있는 환자에서 백내장 수술 단독 또는 다른 수술과 결합한 백내장 수술이 안압에 미치는 효과를 평가한 문헌을 검토하였습니다.

Results

Recommendations in treating patients with primary open angle glaucoma



- 백내장 수술은 정상안, 고안압, 개방각 및 폐쇄각 녹내장 모두에서 안압을 감소시키는 효과가 있습니다.
- **개방각 녹내장 환자에서 백내장 수술과 MIGS 병합은 추가적인 안압 강하 효과를 기대**할 수 있으나, 폐쇄각 녹내장 환자에서 백내장 수술+MIGS 병합 수술 효과는 추가 연구가 필요합니다.
- 폐쇄각 녹내장 환자에서 백내장 수술+섬유주절제술 병합은 안압 감소 효과가 확인되었지만 수술 합병증이 증가할 우려가 있으므로 신중한 risk-benefit 분석이 필요합니다.
- 기존 섬유주절제술을 받은 눈에서 백내장 수술을 시행할 경우 기존 여과포 기능이 저하될 가능성이 높으며, 이를 예방할 방법에 대한 추가 연구가 필요합니다.

Key message

- POAG(원발 개방각 녹내장) 환자의 경우 MIGS를 병행하면 추가적인 안압 강하 효과를 얻을 수 있습니다.
- POAG(원발 개방각 녹내장) 환자에서 백내장 수술과 MIGS의 병행 효과에 대한 연구는 아직 충분하지 않아 더 많은 연구가 필요합니다.

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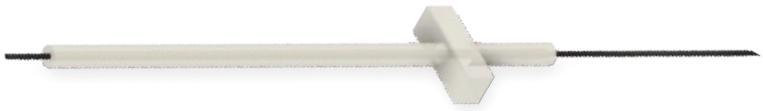

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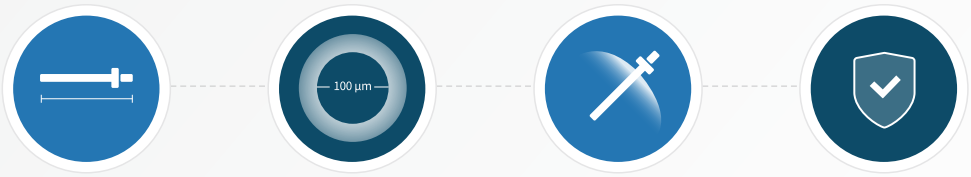

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1. Shah YS, et al. *Curr Opin Ophthalmol* 2025;36(1):46-53. **2.** Astream® 의료기기 제조 허가서.

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The effect of cataract surgery on lowering intraocular pressure

Yesha S. Shah, Anupam K. Garg and Pradeep Y. Ramulu

Purpose of review
To review the literature evaluating the effectiveness of cataract surgery alone and cataract surgery in combination with other procedures and surgeries on intraocular pressure (IOP) in patients with ocular hypertension and glaucoma.

Recent findings
Recent studies of large trials have shown the IOP-lowering effect of cataract surgery and the beneficial effect of minimally invasive glaucoma surgery (MIGS). More studies are being published on when to use cataract surgery alone, with MIGS, or with traditional glaucoma surgeries for both primary open angle glaucoma and primary angle closure glaucoma.

Summary
Patients with ocular hypertension and visually significant cataracts would benefit from cataract surgery alone to lower intraocular pressure. Patients with mild to moderate glaucoma would likely benefit from cataract surgery and MIGS to achieve a lower IOP. Patients with more advanced glaucoma would benefit from cataract surgery combined with a traditional incisional glaucoma surgery. Clear lens extraction can be used in patients with primary angle closure and early primary angle closure glaucoma. In patients with more advanced disease, phacoemulsification and another glaucoma surgery is likely to be required to achieve IOP control. MIGS are starting to be used in angle closure glaucoma, although more research needs to be done to define its role.

Keywords
cataract surgery, glaucoma, intraocular pressure, minimally invasive glaucoma surgery

INTRODUCTION

Cataract surgery is the most common ophthalmic surgery performed worldwide and has been shown to have an intraocular pressure (IOP)-lowering effect on normal eyes, or eyes with ocular hypertension, open angle glaucoma, closed angle glaucoma [1,2], and various other conditions (i.e. pseudoexfoliation, phacomorphic glaucoma, phacolytic glaucoma, etc.). Given the recent increase in glaucoma procedures performed in combination with cataract surgery, it is important to understand the IOP-lowering effect of cataract surgery itself, and the additional effect of various concurrent procedures, to determine if and when they should be utilized. Furthermore, it is important to evaluate the impact of cataract surgery, and special considerations that should be taken for cataract surgery, in eyes that present with unique glaucoma situations, including advanced glaucoma eyes with functional glaucoma surgeries, clinically significant hypotony from over-functioning glaucoma surgery, or lens-related disorders in which cataract surgery itself may be a viable treatment for the condition. This review will summarize the IOP-lowering effect of cataract surgery in eyes with open and closed angles, in eyes that undergo adjunct MIGS and trabeculectomy, and in special circumstances arising in glaucoma management.

CATARACT SURGERY AND INTRAOCULAR PRESSURE IN OCULAR HYPERTENSION AND PRIMARY OPEN ANGLE GLAUCOMA

The IOP-lowering effect of cataract surgery has been studied in patients without glaucoma, those with ocular hypertension, and in primary open angle glaucoma (POAG). One large informatics-based

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KEY POINTS

- Cataract surgery alone can effectively lower IOP, and MIGS can be used in combination for an added IOP-lowering effect in patients with POAG.
- Although LPI was previously the standard treatment for angle closure, data has shown that clear lens extraction is more effective at lowering IOP, maintaining drop-free control, and improving quality of life.
- Phacotrabeculectomy may be required in patients with advanced PACG, especially because phacoemulsification with MIGS has not been extensively explored yet in PACG.
- Cataract surgery in eyes with preexisting trabeculectomy may result in bleb failure, and further research to elucidate treatments to prevent this is required.
- The mechanism of cataract surgery-lowering IOP may be related to inflammatory cytokines regulating trabecular meshwork outflow or ciliary body fibrosis, but further research is required.

study looked at cataract surgery's IOP-lowering effects on both patients with POAG, narrow angles, and normals and found that there was an IOP-lowering effect for all groups [1], indicating that cataract surgery can lower IOP even in patients without ocular hypertension or POAG. Studies primarily focused on POAG patients have shown that on average, there is about a 2–4 mmHg drop in IOP with cataract surgery [3–6], and the effects of IOP lowering wane after about 2 years [6]. Additionally, patients with higher preoperative IOPs have been shown to have a greater decrease in IOP [7].

The impact of cataract surgery as a standalone procedure was well described as part of the Ocular Hypertension Treatment Study (OHTS), a randomized controlled trial comparing observation vs. medical treatment in patients with ocular hypertension [7]. This prospective study had the advantage of following patients longitudinally for several years, which allowed for baseline IOP to be well established and the long-term effects of cataract surgery to be described. Additionally, because of its design, the study avoids bias in the timepoint for electing to proceed with cataract surgery based on IOP, avoiding a problem that may affect results from other studies. In a publication focused on the untreated group, OHTS showed that cataract surgery resulted in about a 16.5% decrease in IOP [7]. On average, preoperative IOP was 23.9 mmHg whereas postoperative IOP was 19.8 mmHg. Postoperative IOP was calculated as an average IOP as postoperative visits from 0 to 12 months after surgery. About 39.7% of eyes had at least a 20% decrease compared with preoperative IOP levels [7]. Notably, however, 17.5% of eyes had a less than 10% reduction in IOP, whereas 11.1% had an increase in IOP [7], demonstrating that cataract surgery is not a very reliable method for reducing IOP in eyes with OHTN. OHTS found that postoperative IOP remained lower than preoperative IOP for at least 36 months, though the effect did wane over time, with postoperative IOP increasing roughly 0.05 mmHg/month over the 36 month period [7]. A second OHTS paper analyzed the impact of standalone cataract extraction in the treated OHTN group, finding no effects on IOP after 12 months, but reductions in the need for medications extending out to 2 years [8]. Notably, no strict protocol was applied to when IOP medications were to be continued (or changed to another agent). Also, the reduction in the average number of medications was mild (1.5 classes of medications preoperatively vs. 1.2 classes postoperatively at 48 months), though the number of eyes off medications increased from 3.4 to 18.9% at 48 months [8].

A 2015 AAO report reviewed the literature regarding IOP-lowering after cataract surgery and found that an across study analysis of patients with POAG showed a mean IOP before surgery of 17.7 mmHg on a mean of 1.7 medications, decreasing to 15.4 mmHg with 1.5 medications after cataract surgery, indicating about a 13% reduction in IOP and 12% reduction in topical medications [4]. Multiple other studies have also shown that cataract surgery results in 12–20% reduction of IOP [3,5,6]. Studies with longer follow-up have suggested a waning of the IOP-lowering effect with time, with one study showing patients with POAG who underwent cataract surgery with a decrease in IOP of 12, 14, 15, and 9% compared with baseline at 6, 12, 24, and 36 months after phacoemulsification, respectively [6].

It is difficult to quantify the IOP-lowering effect of cataract surgery when patients are already on IOP-lowering topical therapies. Indeed, even medication reduction can be overstated, as additional eyedrops are often added over the course of time in response to periodic IOP elevations (some occurring because of fluctuation or noncompliance as opposed to true drift in IOP). For example, a recent study evaluating the impact of medications as part of a preoperative medication washout found that IOP reduction was 5.7 mmHg for a single agent, with additional agents resulting in an incremental IOP reduction of 1.2, 1.9, and 0.7 mmHg, respectively, for a second, third, or fourth agent [9].

Recently, a meta-analysis of the phacoemulsification-only arms of nine randomized controlled

trials studied the IOP-lowering effect of cataract surgery 12 months after surgery in patients with POAG, pseudoexfoliation glaucoma, normal tension glaucoma, or ocular hypertension [10▪]. The average IOP was reduced by 3.77 mmHg across all patients. A subgroup analysis found that there was a more pronounced IOP-lowering effect of 5.25 mmHg after cataract surgery in groups that required a washout period of IOP-lowering drops compared with 3.13 mmHg of IOP-lowering after cataract surgery if there was not a washout [10▪]. This suggests that the precise effect of cataract surgery in lowering IOP is likely masked by topical therapies. Notably, these randomized controlled trials often required a minimum IOP for study inclusion, or offered the prospect of reducing IOP (if the patient was randomized into the treatment group), resulting in a bias towards inclusion of eyes on days where the eye was higher than normal, and an observed IOP reduction that likely includes both true IOP-lowering and regression to the mean, which could explain the greater impact of these studies on IOP as compared with that observed in the treated arm of OHTS.

CATARACT SURGERY AND MINIMALLY INVASIVE GLAUCOMA SURGERY

The use of minimally invasive glaucoma surgery (MIGS) has become increasingly popular in recent years given their ease and safety profile. A study using the national IRIS registry found that there was a two-fold increase in the use of MIGS procedures in surgical glaucoma cases between 2013 and 2018 with iStent placement accounting for 43.7% of all glaucoma surgical procedures by 2017 [11]. In another IRIS registry study, the iStent and Hydrus were the most commonly performed MIGS procedures [12]. Both have had large randomized controlled trials comparing effects of IOP-lowering to cataract surgery alone. The study with the longest postoperative follow-up was the HORIZON trial, which evaluated the effectiveness of the Hydrus stent with cataract surgery compared to cataract surgery alone. After 24 months, there was a 20% reduction in IOP in 77.3% of patients who underwent phacoemulsification with Hydrus compared with a 20% reduction in IOP in 57.8% of eyes that underwent phacoemulsification alone [13]. Overall, eyes that underwent phacoemulsification and Hydrus had about 2 mmHg more of IOP-lowering compared with phacoemulsification alone, as judged by a planned washout IOP at 1 and 2 years [13]. Another study looked at 5 year outcomes of Hydrus and cataract surgery versus cataract surgery alone. In this study, clinicians added IOP-lowering drops as needed. At 5 years, patients who underwent Hydrus and cataract surgery went from an IOP of 17.9 mmHg preoperatively to 16.8 postoperatively whereas patients with cataract surgery alone went from 18.1 to 17.2 mmHg postoperatively, in non-washout IOPs. Although the IOP was not significantly different, the mean number of medications in the Hydrus group was 0.5 compared with 0.9 medications in the cataract surgery alone group [14]. Another study analyzing 5 years outcomes of the HORIZON trial showed that the mean rate of progression of visual fields was −0.26 dB/year in the Hydrus and cataract surgery group compared to −0.49 dB/year in the cataract surgery alone group, which was a statistically significant difference. Furthermore only 17% of this effect was explained by the difference in IOP [15]. Most of these group differences likely resulted from a more rapid progressors that were more common in the phaco-alone group as compared with the phaco-Hydrus group. These data suggest that MIGS procedures may be able to protect against glaucoma damage independent of clinic-measured IOP, either by reducing the need for medication, protecting against noncompliance, or eliminating spikes in IOP that might be missed outside of office hours. A large iStent trial compared eyes with cataract surgery and iStent compared with cataract surgery alone and found that patients who also underwent iStent placement had about 1.6 mmHg of additional IOP lowering at 2 years [16].

Patients in the above trials had mild to moderate glaucoma. The role of cataract surgery and MIGS in patients with severe glaucoma that require lower IOP has more limited evidence. One study showed that cataract surgery and Hydrus was only able to reach a target IOP of less than 15 mmHg about 32% of the time, though patients were on less than one medication on average after surgery, suggesting that the treating physicians had room for advancing therapy through medications, and did not make an active effort to reduce IOP below 15 [17]. However, another study evaluated patients with severe glaucoma who underwent phacoemulsification and a MIGS procedure, which could include iStent, endocyclodestruction, Kahook Dual Blade, Hydrus, or a combination of these procedures. This study found that mean preoperative IOP was 16.7 and postoperative IOP after phacoemulsification with MIGS was 13.5 with 47.5% of patients reaching an IOP lower than 12 mmHg and 87.5% of patients 17 mmHg or less [18▪▪]. Again, postoperative medication load was generally short of maximal medical therapy (mean of 1.7 medications), suggesting that eyes had room for additional medication therapy, and that with this therapy, more eyes may have been able to reach these lower IOP targets [18▪▪]. Further studies are needed to evaluate the true effect of IOP-lowering

on eyes that already have IOPs in the mid to upper teens but need a lower target. Another area that requires more evidence is cataract surgery combined with MIGS on patients who have already undergone a glaucoma surgery such as a trabeculectomy or tube shunt. Future studies, especially prospective studies, would do well to set IOP treatment targets, and to evaluate the success of reaching lower IOP targets with phaco-MIGS only in eyes with low IOP targets, where physicians would be motivated (or, in the setting of a formal study, obligated) to meet these targets via the addition of medications.

Figure 1 shows a chart for recommendations in treatment patients with POAG.

CATARACT SURGERY IN PATIENTS WITH ANGLE CLOSURE

Angle closure glaucoma can be either acute or chronic and is caused by poor aqueous outflow due to pupillary block leading to iridotrabecular contact obstructing outflow. Often times, a thicker and anteriorly displaced lens can lead to narrowing or closure of the angle. Laser peripheral iridotomy (LPI) can be employed to relieve pupillary block, however, it often may not adequately reduce IOP if trabecular meshwork (TM) dysfunction is permanent. Angle closure may still persist after LPI, though the implications of residual iridotrabecular contact is of unclear significance. Cataract extraction is one of the mainstays of angle closure glaucoma treatment, as it can mechanically relieve pupillary block and in many cases open the angle by replacing the thick native lens with a much thinner synthetic lens.

Previously, laser iridotomy was the mainstay of treatment, and cataract surgery was reserved for cases with a visually significant cataract. However, the EAGLE trial compared clear/early lens extraction to iridotomy and found that cataract surgery decreased IOP from 29.5 to 16.6 mmHg and was more cost effective than standard therapy [19]. Compared with iridotomy, clear lens extraction lowered IOP 1.18 mmHg more. Another analysis found that patients with clear lens extraction were 10 times more likely to maintain drop-free good IOP control [20]. Small improvements in quality of life (as judged by the EQ-5D questionnaire) were noted with cataract surgery as compared with LPI, though these may reflect the refractive benefits of cataract surgery in a largely hyperopic group of patients, mild improvements in vision in those with early cataract (effects were greatest in those with slightly worse vision), or a surgical placebo effect [19].

The effectiveness of cataract surgery with adjunct trabeculectomy versus cataract surgery alone has also been explored. One randomized clinical trial analyzed patients with visually significant cataract and medically controlled chronic angle closure glaucoma and found that there was no difference in IOP control at 24 months between phacoemulsification and phacotrabeculectomy, but the latter did have 0.8 fewer topical glaucoma drugs at 24 months [21]. Complications were also higher in the phacotrabeculectomy group.

Another analysis of two prospective randomized controlled clinical trials compared patients with primary angle closure glaucoma who underwent phacoemulsification versus phacotrabeculectomy [22]. They found that phacotrabeculectomy was more effective than phacoemulsification alone at reducing IOP up to 5 years later and required fewer postoperative medications. Mean IOP was decreased by 29.5% in patients undergoing phacotrabeculectomy compared with 20.7% in phacoemulsification alone. However, phacotrabeculectomy was associated with more postoperative complications. Specifically, in

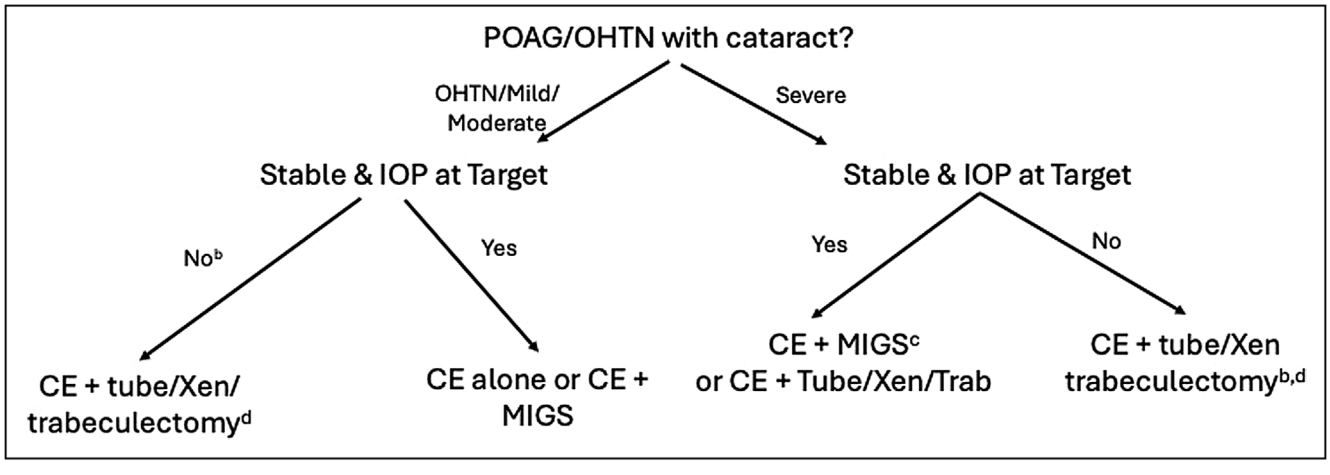

FIGURE 1. Recommendations in treating patients with primary open angle glaucoma.

the phacoemulsification group, 6 patients developed posterior capsular opacification (PCO) whereas in the phacotrabeculectomy group, 4 developed PCO, whereas 21 developed other complications such as blebitis, bleb leak, anterior chamber shallowing, conjunctival wound leak, choroidal detachment, and others [22]. Another meta-analysis analyzed seven randomized controlled trials and found that phacotrabeculectomy resulted in an IOP reduction of 1.45 mmHg more with 0.59 fewer topical medications needed compared with phacoemulsification alone [23▪]. Thus, trabeculectomy combined with phacoemulsification may result in lower IOPs; however, it does have higher surgical complications, suggesting that it is best reserved for eyes with very advanced disease, those intolerant to topical medications, poorly adherent patients, or those demonstrating incomplete reduction of IOP with cataract surgery in the other eye.

Apart from trabeculectomy, other surgical procedures combined with phacoemulsification have also been studied in angle closure glaucoma. In patients in whom anterior synechiae have formed, goniosynechiolysis has been advocated to release synechiae in the angle to improve access of aqueous to the trabecular meshwork. Multiple studies have analyzed phacoemulsification and goniosynechialysis compared with phacoemulsification alone and found that there is no difference in IOP-lowering effect between the two [24–26]. Goniotomy is one MIGS, which has been combined with phacoemulsification and, when necessary, goniosynechialysis, although there is limited data on its incremental IOP-lowering beyond cataract surgery alone. Recently, one randomized controlled trial compared phacoemulsification and goniosynechialysis to phacoemuslficiation and gonioscynechialysis with goniotomy, and found that the former group had a 4.6 mmHg of IOP-lowering compared with 6.93 mmHg in the latter group [27], suggesting a possible benefit of goniotomy. Most implant-based MIGS are contraindicated in angle closure glaucoma unless the angle is open enough after iridotomy, iridoplasty, or cataract extraction. There are limited data comparing the IOP-lowering effects of phacoemulsification alone compared with phacoemulsification and MIGS. However, in recent years, there have been a few retrospective studies showing various MIGS procedures such as iStent and Kahook dual blade goniotomy, when combined with phacoemulsification are effective in lowering IOP [28–30]. Anecdotally, implantation of larger stents such as the Hydrus may be more challenging in eyes with prior closed angles (perhaps because of areas of Schlemm's canal stricture, making it harder to pass the stent), as opposed to small focal stents such as the iStent. One study did show that patients with narrow angle glaucoma whose angles opened after iridotomy who underwent the iStent procedure required fewer glaucoma medications compared with phacoemulsification alone postoperatively, although IOP-lowering effects of both were similar [31]. Further research on comparison between phacoemulsification and MIGS with phacoemulsification alone is required in eyes with angle closure to guide treatment paradigms.

Treatment paradigms in how to treat angle closure glaucoma with visually significant cataract should vary across disease severity, though consensus stage-specific recommendations are lacking. Notably, several aforementioned clinical trials of cataract surgery alone versus phacotrabeculectomy were conducted in eyes with advanced glaucoma (average mean deviation worse than −13 dB in one study) [21]. In this same study, the mean postoperative IOP was 14.5 in the cataract surgery-alone group [21], which may not be sufficient for eyes with advanced disease (particularly eyes noted to have progression in the mid to upper teens). One study found that phacoemulsfication and goniosynechialysis was effective in both acute and chronic angle closure; however, 100% of patients in the acute phase versus 64% in the chronic phase achieved an IOP 21 mmHg or less [32]. Furthermore, PAS re-formed 30% of the time in the acute group compared with 83.3% of the time in the chronic group. Thus, in patients with advanced PACG, surgeons should more strongly consider another surgery combined with phacoemulsification to achieve good IOP control. Figure 2 shows a chart for recommendations in treating patients with angle closure.

PHACOEMULSIFICATION IN EYES WITH PREEXISTING TRABECULECTOMY OR TUBE SHUNT

Phacoemulsification in eyes who have previously undergone a trabeculectomy have often been shown to cause a decrease in the filtering bleb's function with postoperative elevation in IOP [33–36]. This is thought to be due to stimulation of fibrosis after cataract surgery, which causes partial or complete failure of the bleb. Fibrosis may be because of either postoperative inflammation or conjunctival manipulation during phacoemulsification [33].

One study found that cataract surgery performed less than 6 months after trabeculectomy was a risk factor for decreased bleb function, indicating that it may be favorable to wait at least 6 months before cataract surgery in patients with trabeculectomy [37], though this can be difficult in eyes that rapidly develop cataract after trabeculectomy (i.e. due to

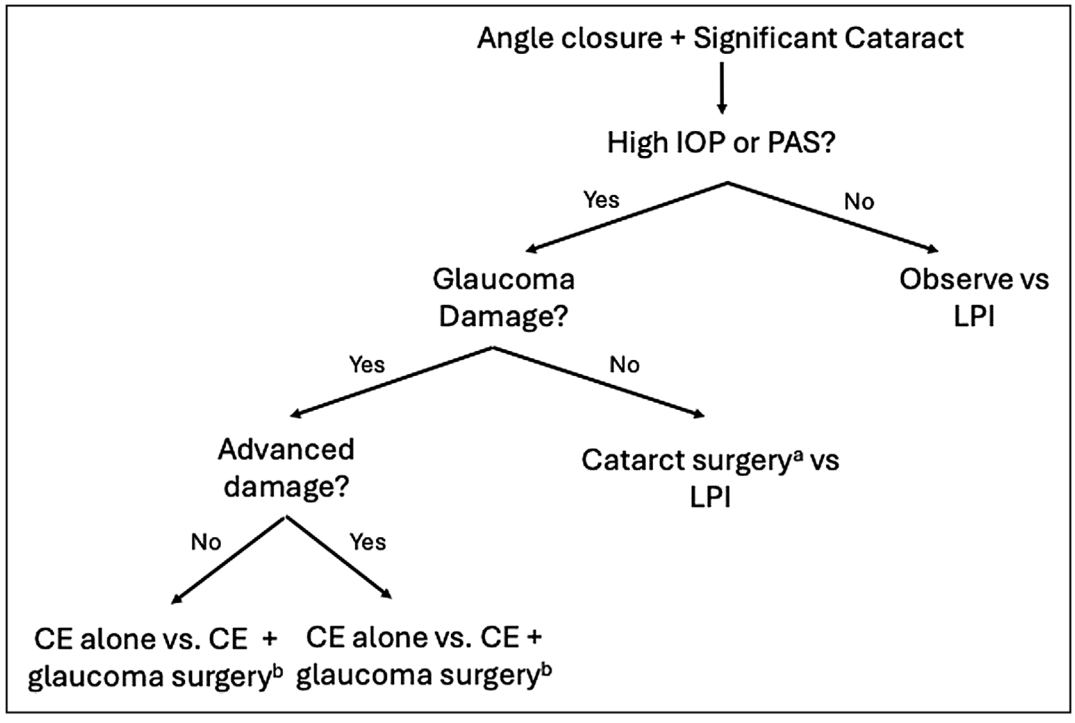

FIGURE 2. Recommendations in treating patients with angle closure.

shallow chamber or severe inflammation). Another study similarly evaluated bleb failure after cataract surgery was performed 6 months, 1, and 2 years after trabeculectomy and found that the sooner cataract surgery was performed, the higher the risk of failure [33]. Another study also found that iris manipulation [37] (which includes posterior synechiolysis, stretching, sphincterotomies, sector iridectomy, or use of iris retraction hooks) is a risk factor for decreased bleb function, perhaps because of the breakdown of the blood–aqueous barrier and increased inflammation [37].

Some options for reducing bleb failure after cataract surgery include using 5-fluorouracil (5-FU) at the same time as cataract surgery. One study showed that while the IOP in patients who got 5-FU at the same time as cataract surgery compared with no 5-FU did not statistically differ, the former group did require fewer glaucoma medications postoperatively [38].

It has been shown that topical steroids, and compliance with steroid regimens [39], increase the chance of success postoperatively from a trabeculectomy [40] and thus many surgeons also increase the frequency and duration of topical steroids after phacoemulsification in eyes with trabeculectomies (i.e. continuing some steroid 2–3 months out from cataract surgery). However, there is limited evidence studying the effect of steroids on these eyes, and further research should be done.

Although the effect of cataract surgery on eyes with trabeculectomies has been extensively studied, there is not as much literature on cataract surgery on eyes with a functioning tube shunt. Some studies have shown that the mean IOP and number of medications did not change after phacoemulsification in eyes with tube shunts [41,42▪]. Although postoperative day 1 and month 1 IOP may be higher, IOP was stable compared with preoperative IOP afterward. However, cases of hypotony after cataract surgery have been described with nonvalved shunts [43].

MECHANISM OF PHACOEMULSIFICATION-LOWERING INTRAOCULAR PRESSURE

As discussed above, studies have shown that phacoemulsification lowers IOP in both eyes with and without glaucoma [2] and also persists in different types of glaucoma. One hypothesis for the mechanism of why IOP is lowered focused on inflammatory signals. It is possible that inflammatory cytokines could cause remodeling of the trabecular meshwork or fibrosis of the ciliary body [44]. This study found that normal trabecular meshwork does not produce IL-1α but after treatment with ultrasound energy, IL-1α was detected in trabecular meshwork. It is believed that this cytokine causes changes to outflow of aqueous by affecting ciliary muscle tone or stimulating other matrix metalloproteinases causing tissue remodeling. Other cytokines have also been shown to be expressed after ultrasound energy, which likely produces a stress response and causes increase in trabecular meshwork outflow. Another

hypothesis is that cataract surgery may not only wash away material such as pseudoexfoliation material but also activate resident macrophages [45] thus increasing aqueous outflow. Notably, one study comparing phacoemulsification to manual small incision cataract surgery in normal eyes found no IOP difference between the groups, suggesting that phacoemulsification itself does not lower IOP [46].

CONCLUSION

Cataract surgery results in an IOP-lowering effect in normal eyes, ocular hypertension, and in both closed and open angle glaucoma. Cataract surgery in combination with MIGS likely provides additional IOP-lowering benefit and should be considered in patients with open angle glaucoma. Cataract surgery in angle closure glaucoma has been proven to be more effective than traditional iridotomy, and further research is needed to see if adjunct MIGS would be useful. Cataract surgery in combination with trabeculectomy in closed angle glaucoma also has proven IOP-lowering benefit but given increased surgical complications, risk–benefit analysis should be weighed before proceeding. Furthermore, cataract surgery in an eye with a functioning trabeculectomy has a higher chance of decreased bleb function and further research in how to prevent this is needed. The mechanism of cataract surgery resulting in a lower IOP is likely because of remodeling of trabecular meshwork and ciliary body via inflammatory cytokines in open angle glaucoma compared with a direct mechanical effect in closed angle glaucoma. Overall, further research is needed to determine which patients should undergo cataract surgery alone, cataract surgery with MIGS, and cataract surgery with traditional glaucoma surgery.

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Conflicts of interest

P.Y.R. has served as a consultant to Alcon.

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Papers of particular interest, published within the annual period of review, have been highlighted as:

- ■ of special interest
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