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Role of Cataract Surgery in the Management of Glaucoma

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Abstract

A leading cause of blindness, glaucoma is estimated to affect 60.5 million people worldwide, with a projected increase to 79.6 million by 2020. Cataract surgery is the most commonly performed ophthalmic surgery, with the anticipated number of people requiring cataract surgery worldwide expected to rise to 30.1 million by the year 2020, a 50% increase from 2000. Cataract and glaucoma are both more prevalent among the elderly population and commonly coexist. This review will discuss the effect of cataract surgery on glaucoma treatment in various patient populations.

Introduction

A leading cause of blindness, glaucoma is estimated to affect 60.5 million people worldwide, with a projected increase to 79.6 million by 2020.¹ Glaucoma is defined as a progressive optic neuropathy with degeneration of retinal ganglion cells and visual field loss. Elevated intraocular pressure (IOP) is the most important known risk factor for glaucoma onset and progression, and one of the few that can be successfully modified.

Glaucoma can be separated into 2 broad categories based on whether the anterior chamber angle is open or narrow/closed, with treatment differing depending on angle anatomy. Regardless of angle anatomy, the risk of glaucoma increases with advancing age.^{2, 3}

Cataract surgery is the most commonly performed ophthalmic surgery, with the anticipated number of people requiring cataract surgery worldwide expected to rise to 30.1 million by the year 2020, a 50% increase from 2000.⁴ Cataract and glaucoma are both more prevalent among the elderly population and commonly coexist. An American Glaucoma Society survey on practice preference revealed that phacoemulsification cataract surgery alone is the preferred initial surgical approach for 44% ± 32% of patients with primary open angle glaucoma and visually significant cataract.⁵ This review will discuss the effect of cataract surgery on glaucoma treatment in various patient populations.

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Primary Open Angle Glaucoma

Primary open angle glaucoma is characterized by an open anterior chamber angle and painless, slowly progressive optic nerve damage. Although the pathophysiologic mechanism is not completely understood, there is a component of elevated IOP due to outflow obstruction at the level of the trabecular meshwork, Schlemm's canal, and distal collector system.³ Additionally, the optic nerve may have increased susceptibility to axonal damage due to premature apoptosis,⁶ local vasculopathy,⁷ and even autoimmune factors.⁸ IOP targets and treatments must, therefore, be individualized per patient.^{9, 10}

Management is achieved by keeping IOP low enough to prevent progressive optic nerve damage. Treatment typically starts with medications and laser procedures. Incisional glaucoma surgery, traditionally starting with filtering surgery such as trabeculectomy, is usually reserved for when more conservative approaches are unable to maintain disease control.

Cataract Extraction in Primary Open Angle Glaucoma

Many patients with glaucoma also have a concomitant cataract. The most common form of cataract is age-related, which is characterized by nuclear sclerosis, cortical opacities, and posterior subcapsular opacities. Cataract surgery alone has been shown to lower IOP in eyes that do not have glaucoma. Patients with ocular hypertension who do not yet have glaucomatous damage even experience better IOP lowering from cataract surgery than normotensive eyes.¹¹ In the Ocular Hypertension Treatment Study unmedicated control arm, IOP-lowering medications were initiated if an eye reached study endpoints of reproducible visual field or optic nerve progression. In this control arm, proportionally fewer eyes that underwent cataract surgery were started on IOP-lowering therapy compared with those that remained phakic throughout the study (6.3% [4/63] vs. 16.3% [121/743], $P=0.04$).¹²

Additional studies have also shown that cataract extraction improves IOP among glaucoma suspects. In a study by Shingleton et al of 44 glaucoma suspect eyes, cataract surgery alone resulted in an IOP decrease of 1.4 ± 4.2 mmHg ($P=0.004$) at 3 years postoperatively.¹² A prospective study on ocular hypertension and early glaucoma patients reported cataract surgery alone reduced IOP 8.5 ± 4.3 mmHg at 12 months postoperatively. However, 35% of these eyes were back on IOP-lowering medications at 12 months.¹³

The exact mechanism of IOP reduction after cataract surgery is unknown. One hypothesis is that by converting a narrower phakic angle to a more open pseudophakic angle, aqueous outflow is increased.¹⁴ Another theory suggests that the trabecular meshwork widens by increasing mechanical tension on the zonules, thus decreasing resistance to outflow.¹⁵ Johnstone et al proposed that the aqueous outflow system acts as a mechanical pump. In eyes with glaucoma, the aqueous pump fails as a result of apposition of the wall of Schlemm's canal and trabecular tissue stiffening.¹⁶ Poley et al proposed that by extracting the cataract, pump failure is reversed by returning the lens capsule and zonule position to a more youthful state. Moreover, Poley et al suggested that phacomorphic glaucoma is a continuous progressive condition, where open angle glaucoma can be the midpoint of a

continuum of open angle and phacomorphic angle closure glaucoma states. Cataract extraction removes the phacomorphic factor in open angle glaucoma.¹⁷

The ability of cataract surgery to lower IOP can be a useful adjunct to the treatment of glaucoma. Multiple studies have found that cataract surgery alone reduces IOP in primary open angle glaucoma (POAG) patients.^{12, 13, 18–28} Higher preoperative IOP, older age, and a deeper anterior chamber depth before surgery were found to be associated with greater IOP reduction after cataract extraction in POAG patients.²⁷ IOP reduction is correlated with preoperative IOP¹⁷; however, higher preoperative IOP is also associated with late treatment failure.²²

Although cataract surgery alone may help maintain glaucoma control, it is generally not effective enough to treat active glaucomatous progression that requires significant IOP lowering. Iancu and colleagues prospectively investigated 38 Romanian patients with uncontrolled POAG (defined as IOP > 21 mmHg but < 28 mmHg on maximum medical therapy, with documented optic nerve damage and visual field defects). At 12 months after cataract surgery, the average IOP was reduced 1.9 ± 3.7 mmHg compared to the preoperative IOP ($P < 0.0001$); however, medication use did not differ (2.66 ± 0.66 medications prior to surgery, 2.71 ± 0.75 at 6 months after surgery, and 2.9 ± 0.53 at 12 months after surgery). Thirty-two (84.2%) of 38 patients were still diagnosed with uncontrolled glaucoma and required glaucoma surgery (mean time to surgery was 11.6 ± 4.18 months).²²

Combined Trabeculectomy and Cataract Extraction

Glaucoma filtering surgery (such as trabeculectomy) has traditionally been employed to adequately lower IOP when glaucoma progression occurs. If the eye has a coexistent cataract, cataract extraction performed during the same surgery may compromise the IOP-lowering efficacy of the procedure. Naveh et al compared 24-month postoperative results between patients who underwent trabeculectomy alone versus combined phacoemulsification cataract extraction/trabeculectomy. Patients in the combined surgery group had an average IOP reduction of 9.2 ± 4.2 mmHg from preoperative levels, while the trabeculectomy alone group had a reduction of 15.8 ± 3.9 mmHg ($P < 0.01$). The combined group also required more IOP-lowering medications than the trabeculectomy alone group (2.31 ± 1.52 vs. 0.55 ± 1.05 , $P = 0.003$, respectively).²⁹

One study also showed that trabeculectomy and combined phacoemulsification/trabeculectomy both resulted in significant IOP reduction from baseline (4.2 ± 6.9 mmHg, 24.6% for the trabeculectomy group vs. 2.9 ± 5.0 mmHg, 20.8% for the phacotrabeulectomy group), whereas phacoemulsification alone resulted in less IOP reduction (0.9 ± 3.4 mmHg, 6.5%; $P = 0.009$).³⁰ Yu et al showed no statistically significant difference in IOP reduction or medication use between combined phacotrabeulectomy and trabeculectomy alone groups.³¹

Cataract surgery after trabeculectomy may jeopardize the filter's success. Awai-Kasaoka et al showed that phacoemulsification within 1 year after trabeculectomy was significantly associated with trabeculectomy failure for primary open angle glaucoma.³² The order of the trabeculectomy and phacoemulsification may also affect IOP outcome. In a study by Nguyen

et al, patients were divided into 2 groups: phacoemulsification followed by trabeculectomy (n=30) (phaco-trab), with at least 6 months in between, and phacoemulsification subsequent to trabeculectomy (trab-phaco) (n=18). During the 2 years of follow-up (from the time of trabeculectomy), there was no significant difference in the percentage of patients meeting IOP criteria (criteria A, 12 mmHg; B, 15 mmHg; C, 18 mmHg) with or without additional topical treatment. However, significantly more patients who had trabeculectomies first required additional topical IOP-lowering therapy or surgical interventions to achieve IOP control ($P = 0.028$) at 12 months.³³ Another study by Longos et al of 108 eyes showed that the risk for trabeculectomy failure is lower if the time between trabeculectomy and phacoemulsification is longer ($P = 0.007$).³⁴ Therefore, in patients with borderline cataracts who need a trabeculectomy, combined surgery may be prudent to minimize the risk of a subsequent cataract surgery causing trabeculectomy failure.

Tube Shunt and Cataract Extraction

Studies analyzing combined tube shunt implantation and phacoemulsification have shown the procedure to be, for the most part, a safe and effective option. In a retrospective review of 35 eyes with combined phacoemulsification and Ahmed Glaucoma Valve (New World Medical, Inc., Rancho Cucamonga, CA) implantation, Valenzuela et al found both IOP and number of medications were reduced significantly postoperatively ($P < 0.001$). There were no failures, and no patients lost vision, with 35 eyes (85%) showing visual improvement.³⁵ El Wardani et al compared 38 phakic eyes undergoing combined Baerveldt (Abbott Medical Optics, Inc., Santa Ana, CA) tube shunt implantation and phacoemulsification with 39 pseudophakic eyes undergoing Baerveldt implantation alone. At 36 months, the failure rate was significantly higher in the combined cases (37% vs. 15%, $P = 0.02$), with the main reason being uncontrolled IOP. Postoperative complications rates and the requirement for medications were similar in both groups, but median IOP decreased 40% in the combined group vs. 52% in the Baerveldt alone group. There was no difference in vision at 36 months between groups.³⁶ Although combined phacoemulsification and Baerveldt implantation are effective, Baerveldt implantation alone may be a better option for glaucoma control.

There is controversy as to whether phacoemulsification affects the functioning of a prior working tube shunt. Bhattacharyya et al's study showed that in 11 eyes of 11 patients with functioning tube shunts, there was no IOP difference after cataract surgery (17.4 ± 3.7 mm Hg vs 17.8 ± 5.9 mmHg; $P = 0.85$; follow-up time: 4–97 months).³⁷ In a study by Gujral et al of 23 eyes with Ahmed implants, the mean IOP and number of medications did not significantly change after phacoemulsification during follow-up. However, one eye (4%) required a second Ahmed device.³⁸ Sa et al also reviewed 13 patients who underwent phacoemulsification with prior Ahmed Glaucoma Valve placement. While IOP did not increase significantly from baseline, the number of IOP-lowering medications did, with 6 patients requiring additional medications approximately 1 month after cataract extraction.³⁹

Minimally Invasive Glaucoma Surgery and Cataract

Minimally invasive glaucoma surgery (MIGS) procedures are being increasingly performed. While these procedures are less effective for lowering IOP than trabeculectomy or tube shunt surgery, they may offer an improved postoperative safety profile.⁴⁰ MIGS procedures

can be divided into 4 subgroups based on the anatomical mechanism of IOP lowering: angle/canal-based, supraciliary shunting, translimbal shunting, and cyclodestruction. While many of these procedures are approved by the FDA for stand-alone use, some are only approved in conjunction with cataract surgery.

Angle/canal-based MIGS—MIGS procedures that work at the level of the anterior chamber angle and Schlemm's canal have arisen from modifications to traditional goniotomy and trabeculotomy procedures, as they share improved aqueous outflow by removing or bypassing the trabecular meshwork. Angle-based MIGS procedures/devices that are currently FDA-approved and commercially available in the USA include the Trabectome (NeoMedix, Inc., Tustin, CA), Kahook Dual Blade (New World Medical, Rancho Cucamonga, CA), TRAB360/VISCO360 (Sight Sciences, Menlo Park, CA), and Gonioscopy-Assisted Transluminal Trabeculotomy. These procedures can be performed with or without cataract surgery.

Another canal-based MIGS device is the iStent (Glaukos, San Clemente, CA), which is approved by FDA to be performed with cataract surgery. The iStent is a small metal device that bypasses the trabecular meshwork (TM) to shunt aqueous directly from the anterior chamber into Schlemm's canal. In a study comparing combined phacoemulsification/iStent with phacoemulsification alone, the mean reduction from preoperative IOP was similar in both groups at 1 year (1.5 ± 3.0 mmHg vs. 1.0 ± 3.3 mmHg).¹³ Although only approved for implantation of 1 device at the time of cataract surgery, there is mounting evidence that implantation of 2–3 iStents achieves better IOP lowering.⁴¹

Supraciliary shunting—Supraciliary shunting devices are inserted in the anterior chamber angle between the scleral spur and ciliary body, with the purpose of directing aqueous from the anterior chamber to the supraciliary/suprachoroidal space. In the US, the CyPass (Alcon Laboratories, Inc, Fort Worth, TX) is the only device approved by the FDA and only in conjunction with cataract surgery. In the COMPASS Trial, 505 subjects were randomly assigned to combined cataract extraction with CyPass or cataract surgery alone. The combined surgery had greater IOP lowering (7.4 mmHg reduction in combined group vs. 5.4 mmHg in cataract surgery alone group at 2 years [$P < 0.001$]); 85% of the patients in the combined group did not require IOP-lowering medications.⁴²

The iStent Supra (Glaukos, San Clemente, CA) is inserted using a similar *ab interno* approach as the CyPass under gonioscopic visualization. It is currently under FDA review. Junemann et al described a series of 42 eyes with open angle glaucoma that underwent iStent Supra placement. At 12 months after surgery, 98% of eyes achieved a greater than 20% reduction in IOP with a mean reduction of 1 medication, and 90% of eyes met the secondary endpoint of IOP < 15 mmHg and reduction of 1 medication.⁴³

Translimbal shunting—Translimbal shunting procedures bring aqueous from the anterior chamber to the extraocular subconjunctival space. The Ex-PRESS Shunt (Alcon Laboratories, Inc., Fort Worth, TX) is a modification of the trabeculectomy where the metal device is inserted under a scleral flap, standardizing the sclerostomy. Studies have shown similar IOP-lowering efficacy to traditional trabeculectomy.⁴⁴

The XEN 45 Gel Stent (Allergan, Irvine, California) is a 6 mm stent made of porcine gelatin crosslinked with glutaraldehyde. Via an *ab interno* approach, it is inserted through the anterior chamber angle, across the limbus, and into the subconjunctival space. Similar to trabeculectomy, intraoperative use of antimetabolites is advised to minimize postoperative episcleral/subconjunctival fibrosis. Although approved for stand-alone use, XEN Gel Stents can also be implanted at the time of cataract surgery.⁴⁴ In a study of 65 eyes implanted with XEN shunt alone, Grover et al found that 76.3 % (50) of eyes had a 20% IOP reduction from baseline on the same or fewer medications. Mean medications decreased from 3.5 ± 1.0 to 1.7 ± 1.5. The probability of success at 12 months was 75%, and postoperative complications were mostly mild/moderate and transient.⁴⁵ A prospective nonrandomized study by Sheybani and colleagues of 37 eyes showed that at 12 months postoperatively, one XEN implant combined with cataract surgery reduced IOP from 22.4 ± 4.2 mmHg to 15.4 ± 3.0 mmHg ($P < 0.001$). The number of IOP medications was also reduced from 2.5 ± 1.4 to 0.9 ± 1.0 ($P < 0.001$).⁴⁶

The InnFocus Microshunt (Santen Pharmaceutical Company Ltd, Osaka, Japan) is a device with a 70 µm lumen tube composed of a biocompatible and biostable material poly(styrene-block-isobutylene-block-styrene).^{44, 47} The InnFocus Microshunt is inserted under conjunctiva via an *ab externo* approach and can be implanted alone or in conjunction with cataract surgery. It is currently undergoing evaluation by the FDA for approval in the US.⁴⁴ In a prospective nonrandomized study of 23 eyes with uncontrolled POAG, where 9 eyes underwent combined cataract surgery and microshunt placement and 14 underwent InnFocus placement alone, the mean IOP was reduced from 23.8 ± 5.3 mmHg preoperatively to 10.7 ± 2.8 (55% reduction), 11.9 ± 3.7 (50% reduction), and 10.7 ± 3.5 mmHg (55% reduction), at 1 year (n=23), 2 years (n=22), and 3 years (n=22), respectively, in all patients. The mean number of IOP-lowering medications was also reduced, from 2.4 ± 0.9 preoperatively to 0.3 ± 0.8, 0.4 ± 1.0, and 0.7 ± 1.1 medications, at 1 year (n=23), 2 years (n=22), and 3 years (n=22), respectively, in all patients. Complications included transient hypotony (13%, 3/23) and transient choroidal effusion (8.7%, 2/23).⁴⁸

Cyclodestruction—Endocyclophotocoagulation (ECP) is a cilioablative laser procedure that can be administered during cataract surgery or in pseudophakic eyes to decrease aqueous production by the ciliary body. Lindfield et al demonstrated an IOP-lowering effect after ECP among 56 eyes with early glaucoma from 21.54 mmHg preoperatively to 14.43 mmHg at 18 months and 14.44 mmHg at 24 months; however, there was no change in the number of IOP-lowering medication required. It is difficult to interpret how much of the IOP-lowering effect was from cataract removal alone. Interestingly, unlike phacoemulsification alone, the IOP-lowering effect was from day 1, which suggests that ECP might have a lower risk of IOP spiking, thus improving the safety of phacoemulsification.⁴⁹ Combining iStent implantation, cataract extraction and ECP (ICE procedure) has also been shown to be effective at lowering IOP.⁵⁰

Primary Angle Closure

Primary angle closure (PAC) is an anatomic abnormality that results from pupillary block due to contact between the crystalline lens and the posterior surface of the iris. The

peripheral iris then bows anteriorly to occlude the angle and prevent aqueous outflow through the trabecular meshwork. Persistent appositional angle closure can lead to the formation of peripheral anterior synechiae.

PAC is comprised of a spectrum of patients classified into 3 groups: PAC suspects (PACS), PAC, and PAC glaucoma (PACG). PACS is characterized by occludable angles for more than 180 degrees of the angle circumference without evidence of trabecular dysfunction or an acute/subacute attack. PAC is defined by occludable angles and evidence of irido-trabecular obstruction characterized by factors such as peripheral anterior synechiae, elevated IOP, iris sector atrophy, glaukomflecken, or excessive pigment deposition on the trabecular surface. Primary angle closure glaucoma (PACG) is defined as PAC with glaucomatous optic neuropathy. Acute angle closure attacks can cause painful, rapid, and irreversible loss of vision due to glaucomatous optic neuropathy.² PACG is a leading causes of vision loss. While POAG is a more common form of glaucoma, irreversible bilateral visual impairment is more prevalent among PACG patients.⁵¹

Fortunately, eyes on the PAC spectrum can often be identified and treated prophylactically before damage develops. PAC is commonly found in moderate to high hyperopes. These eyes typically have relatively short axial lengths, and the anterior chamber angle appears narrow gonioscopically. Since PAC eyes have occludable angles with only mild evidence of synechial angle closure, laser iridotomy is typically sufficient to prevent both acute angle closure attacks and chronic glaucomatous nerve damage.² If a cataract is present, removal of the crystalline lens and replacement with an implanted intraocular lens has been demonstrated to widen the anterior chamber angle even better than iridotomy.^{52, 53} Although IOPs improve after lens extraction, patients may still require IOP-lowering medication.

The logical next question is whether removal of a clear, non-cataractous crystalline lens in eyes with PAC is a safer and more effective treatment than iridotomy. The Effectiveness of Early Lens Extraction with Intraocular Lens Implantation for the Treatment of Primary Angle Closure Glaucoma (EAGLE) study addressed this question with a prospective investigation of 155 eyes with primary angle closure and 263 eyes with primary angle closure glaucoma. To be eligible for inclusion in the study, the baseline IOP needed to be greater than 30 mmHg in the PAC arm. The PACG patients must have had IOP > 21 mmHg documented at least once. Two hundred and eight eyes underwent clear lens extraction, and 211 underwent standard of care treatment (laser peripheral iridotomy and escalation of medical treatment with or without subsequent peripheral iridoplasty). Mean postoperative IOP 36 months after treatment was lower after clear lens extraction compared to standard of care treatment ($P = 0.004$). Patients from the clear lens extraction group also had better visual acuity ($P = 0.003$).⁵¹ More importantly, the study showed the quality of life was superior in the in the lens extraction group, and clear lens extraction was more cost effective at 36 months after initial diagnosis.^{51, 54} The rate of adverse events did not differ between the 2 groups, indicating a similar safety profile between the 2 treatments.⁵¹ EAGLE showed that lens extraction could be a safe and effective first-line treatment for PAC and PACG. However, EAGLE did not address how to manage PAC if the IOP is not elevated. Removal of the clear lens in PAC patients with normal IOP is still controversial.

Role of lens extraction for PAC management

Although not yet studied in a clinical trial, if a patient is a PAC suspect, clear lens extraction should also be effective. However, this would unnecessarily expose the patient to potential postoperative complications of cataract surgery, including but not limited to infection, cystoid macular edema, and retinal detachment. Furthermore, if the patient has not yet fully become naturally presbyopic, the sudden loss of accommodation may be a difficult adaptation. Therefore, laser peripheral iridotomy should be the first-line treatment in these patients.

Many patients present with occludable angles and evidence of iridotrabecular contact but have IOP in the teens or low 20s. EAGLE only addressed how to manage PAC if the IOP was >30 mmHg at baseline. Hata demonstrated IOP lowering without the need for postoperative IOP-lowering medications for normotensive PAC eyes after cataract surgery (14.8 ± 4.2 mmHg preoperatively vs. 10.8 ± 1.6 mmHg postoperatively; $P < 0.05$).⁵⁵

If the patient has PACG, the angle has become scarred enough to drive up the IOP such that nerve has already become damaged. Cataract surgery may help manage the underlying PAC problem, but lens extraction alone is unlikely to sufficiently lower IOP enough to halt progression, and glaucoma filtering surgery may also be necessary.

Acute angle closure is defined by obstruction of the entire angle suddenly with rapid, high IOP rise. Acute angle closure is an ophthalmic emergency and requires timely medical treatment. Among acute PAC patients, IOP reduction has been shown to be substantial with lens extraction (56–79%), and very few of these patients required IOP-lowering medication postoperatively.^{19, 56–59}

Plateau iris syndrome

Plateau iris syndrome (PIS) is characterized by a narrow angle with a flat iris plane and anterior rotation of the ciliary body. In eyes with PIS, the angle does not sufficiently deepen after laser iridotomy is used to treat any component of pupillary block.² PIS has been shown to account for up to 52.2% of angle closure cases.^{60, 61} There have only been small studies and case reports detailing the results of cataract surgery in PIS eyes. One case report showed immediate resolution of angle closure following clear lens extraction by phacoemulsification and intraocular lens implantation. The IOP was reduced from 42 mmHg bilaterally on maximal medical treatment (including intravenous mannitol) to 10 and 9 mmHg on no glaucoma medications at 3 months postoperatively.⁶² A case series by Tran et al showed that the iridociliary contact remained unchanged despite an increased anterior chamber depth after cataract extraction in 6 patients.⁶³

Pseudoexfoliation Glaucoma (PXG)

Pseudoexfoliative syndrome is characterized by progressive accumulation and deposition of extracellular material at the trabecular meshwork, which has been hypothesized to be the cause of the increased IOP in PXG. PXG is most commonly a secondary open angle glaucoma but may also present as secondary angle closure characterized by anterior displacement of the lens due to zonular weakness/dehiscence. As a result, PXG is often

challenging to manage.⁶⁴ Theoretically, removing the cataract does not affect aqueous outflow since the trabecular meshwork is still clogged. However, several studies have shown that phacoemulsification leads to long-lasting IOP control in PXG.^{19, 20, 65–68}

Jacobi et al compared the efficacy and safety of combined trabecular aspiration/phacoemulsification to phacoemulsification alone in PXG patients. Both groups achieved IOP lowering ($P < 0.001$ in both arms), but the trabecular aspiration group required fewer medications. Success rates were 36% for the phacoemulsification alone group and 64% for the combined trabecular aspiration/phacoemulsification group at 2 years. However, the combined group had complications of intraoperative reflux bleeding (61%, 16 eyes) and Descemetolysis (19%, 5 eyes) ($n=26$).⁶⁶ Similarly, Georgopoulos et al also found that fewer medications were required after combined trabecular aspiration/phacoemulsification compared to phacoemulsification alone ($P < 0.05$).⁶⁵ In a retrospective study of 1122 eyes with PXG, the IOP reduction was statistically significant for up to 7 years after phacoemulsification compared with IOP preoperatively, but the difference was not statistically significant at 10 years ($P = 0.088$).⁶⁹ Therefore, cataract extraction can be an effective initial surgical approach among patients with pseudoexfoliation and possibly delay additional glaucoma surgical intervention.

Conclusion

In summary, cataract surgery plays a role in IOP reduction in open angle glaucoma and angle closure glaucoma. However, cataract surgery alone does not always offer adequate IOP control. A prospective clinical trial including medication washout and long-term follow-up would be necessary to elucidate the effect of cataract surgery alone on glaucoma control.

With the increasing availability of MIGS procedures, surgeons managing patients with concomitant glaucoma and cataracts have more options for surgical IOP control prior to offering traditional glaucoma filtering surgery. Given that these procedures are relatively new, the long-term efficacy of each is still being determined.

Although cataract extraction at the same time as trabeculectomy may compromise filtering surgery control, removing the cataract after a successful trabeculectomy can also result in late surgical failure or decreased efficacy. If the patient has a borderline visually significant cataract when the trabeculectomy is being scheduled, it may be prudent to perform a combined case or wait to remove the cataract until at least 1 year after the trabeculectomy. Cataract surgery does not appear to undermine the success of tube shunt surgery.

Both cataractous and clear lens extraction should be considered in the management of PAC and PACG, as it may be curative if significant trabecular dysfunction and glaucomatous optic neuropathy have not yet developed.

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