



A comparative study on recent advances in the management of patients with coexisting Cataract and Glaucoma

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ABSTRACT

To review the role of cataract surgery in glaucoma patients in terms of intraocular pressure (IOP) reduction, as well as diagnostic and therapeutic concerns for people with both disorders. In those with open-angle glaucoma, ocular hypertension, and angle-closure glaucoma, recent research suggests that cataract extraction can result in a considerable and long-term reduction in IOP. After cataract surgery, re-establishing perimetric and optic nerve imaging baselines is indicated to improve the practitioner's ability to interpret perimetric tests. Although some evidence suggests that cataract surgery may be beneficial in the clinical management of eyes with angle-closure glaucoma, recent research suggests that the reduction in IOP following cataract surgery alone may be limited and transitory in eyes with open-angle glaucoma. The combination of cataract surgery and trabeculectomy is still the best option. As the efficacy of "minimally invasive glaucoma procedures" improves, there is a growing role for combined cataract and glaucoma surgery in individuals with early to moderate glaucoma.

KEYWORDS:- Cataract, Glaucoma, surgery, therapeutic effects

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I. INTRODUCTION

In our older patient population, cataract and glaucoma frequently coexist. In the United States, it is estimated that 20% of cataract surgeries are performed on people who have glaucoma and ocular hypertension. Patients with cataracts and glaucoma need to be treated differently. Cataracts can occur naturally alongside glaucoma, be a cause of glaucoma, or even be a result of glaucoma surgery. In a 2010 survey of the Middle East and North Africa, cataract was the major cause of blindness (23.4%), with glaucoma accounting for a significant fraction (9.6%), followed by refractive error (13.1%) and macular degeneration (10.3%). According to recent World Health Organization reports from 2002, cataracts and glaucoma are the two leading causes of vision impairment globally, affecting 17 (47.8%) and 4.4 million (12.3%) people, respectively. According to UN world population forecasts, 7.9 million people were affected by the diseases, Open-angle glaucoma, and Angle-closure glaucoma (ACG) in 2020, of which 74 percent were having open-angle glaucoma (OAG). 5.9 million and 5.3 million were bilaterally blind from these two illnesses, respectively.

A cataract is a clouding of the lens within the eye that causes vision loss. When a patient has glaucoma that necessitates surgery, there may be a unique chance to remove the concomitant cataract without putting the glaucoma procedure in danger. Furthermore, when a patient has cataracts and glaucoma, removing the cataract may allow a glaucoma operation to be performed at the same time, perhaps reducing the patient's requirement for glaucoma eye drops or improving eye pressure control.

Several glaucoma surgeries, including trabeculectomy, glaucoma drainage devices, canaloplasty, endocyclophotocoagulation, and the newest micro-invasive glaucoma surgeries, can be combined with cataract surgery (MIGS). These techniques can reduce IOP even more than cataract surgery alone.

PRIMARY CONCEPTS

- Patients following cataract surgery are more likely to develop glaucoma and have a higher IOP.
- Newer glaucoma techniques that may be used in conjunction with phacoemulsification include endoscopic cyclophotocoagulation (ECP), a trabecular micro-bypass stent (iStent), ab interno trabeculectomy (Trabectome), and canaloplasty.
- Because phacoemulsification can lower intraocular pressure (IOP), studies comparing the effectiveness of combined cataract and glaucoma operations should include a phacoemulsification-only control group.
- The newer glaucoma techniques appear to be less efficient than trabeculectomy at lowering IOP, although they are associated with fewer surgical complications.

ENDOSCOPIC CYCLOPHOTOCOAGULATION AND COMBINED PHACOEMULSIFICATION

ECP is a newer cyclophotocoagulation technique that involves laser therapy of the ciliary processes while under direct observation. ECP has been used to treat refractory glaucoma in both adults and children, however, it is most typically used in conjunction with phacoemulsification in eyes with medically controlled or uncontrolled glaucoma.

	Total Eyes	PAU (n)	Incidence PAU (%)	Odds Ratio (95% CI)	p-value
All race/ethnicities					
Phaco alone	4242	72	1.7%	Reference	<0.0001
Phaco/ECP	181	27	14.9%	10.2 (5.8–17.7)	
White					
Phaco alone	3140	23	0.7%	Reference	<0.0001
Phaco/ ECP	120	14	11.7%	17.9 (7.8–41.1)	
Non-white					
Phaco alone	1102	49	4.4%	Reference	<0.0001
Phaco/ECP	61	13	21.3%	5.8 (2.8–12.1)	
African-American					
Phaco alone	349	43	12.3%	Reference	0.025
Phaco/ECP	25	7	28.0%	2.8 (1.1–6.7)	
Hispanic					
Phaco alone	340	2	0.6%	Reference	0.005
Phaco/ECP	20	2	10.0%	18.8 (2.4–146)	
Other race/ethnicity					
Phaco alone	413	4	1.0%	Reference	<0.0001
Phaco/ECP	16	4	25.0%	34.1 (6.4–181)	

Note: Bolding represents major study groups.
Abbreviation: PAU, persistent anterior uveitis.

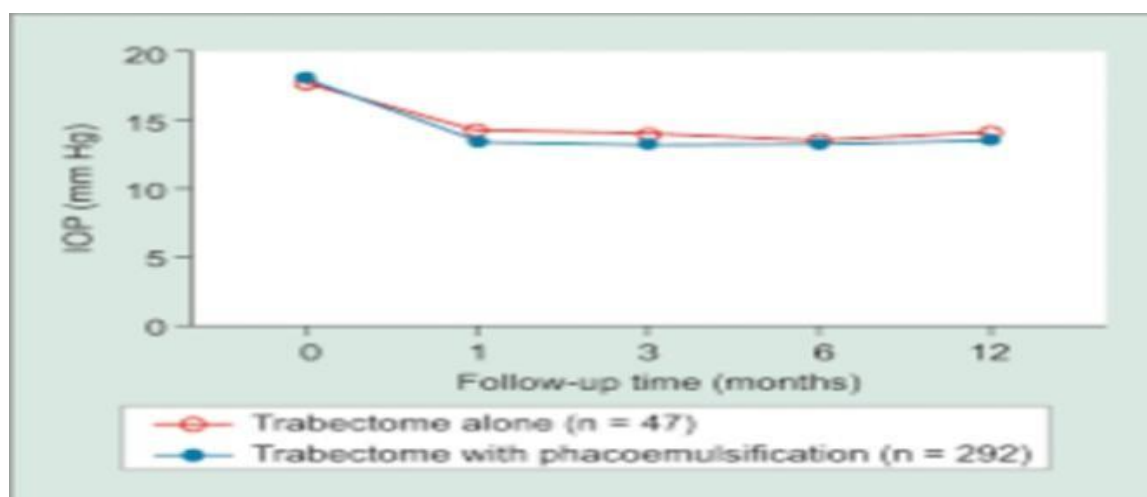
ECP, according to most surgeons, results in a mild-to-moderate reduction in IOP and medication therapy. Following phacoemulsification–ECP, IOP reductions ranging from 17.6 to 57 percent have been recorded. Differences in study demographics, length of follow-up, and treatment methodology (i.e., degrees of laser application, ECP through the bag or under the intraocular lens, etc.) could explain the wide range of results. With partial reperfusion by one month, ECP induces localized shrinking of ciliary processes and a reduction in blood flow, according to histopathological research. It's been suggested that the partial restoration of blood flow will increase aqueous production and, as a result, an increase in IOP. This mechanism could explain the necessity to retract an eye with ECP after a first effect.

PHACOEMULSIFICATION AND TRABECTOME COMBINED

Ab interno trabeculectomy, also known as Trabectome (NeoMedix, Tustin, California, USA), is a novel surgery in which electrocautery is given via the anterior chamber to ablate parts of the trabecular meshwork. The amount of trabecular meshwork ablated depends on the exposure and visualization, but it is usually 3–4 clock hours. When used in conjunction with cataract surgery, the Trabectome is usually administered before phacoemulsification because the process requires great vision, and corneal clarity may be diminished after phacoemulsification, making visualization difficult.

Adequacy

Phacoemulsification–Trabectome has been shown in several studies to reduce IOP by 4–7 mmHg. A comparison group of patients who underwent phacoemulsification alone was included in one of these investigations. Patients were not randomized, and their IOP differed by 6 mmHg at baseline.



PRIMARY OPEN-ANGLE GLAUCOMA (POAG) AND CATARACT SURGERY

Cataract surgery has been established in numerous trials over the last few decades to result in a sustained reduction in IOP in POAG patients. Bigger and Becker noticed lower IOP in individuals receiving straightforward intracapsular cataract excision as early as the 1970s. Matsumura et al. prospectively tracked 93 eyes in the mid-1990s and discovered that cataract surgery reduced IOP by 1.5 mmHg on average after three years. In a group of POAG patients, glaucoma suspects, and normal people, Shingleton et al. followed them for an average of 5 years. These patients had IOP drops of 1.8 mmHg, 1.3 mmHg, and 1.5 mmHg after phacoemulsification, respectively. Friedman et al. observed a consistent (although small) 2-4 mmHg reduction in IOP by either phacoemulsification or extracapsular cataract excision in a 2002 Cochrane literature review.

First author (year)	Country	Design	No. of patients	No. of eyes	Mean age±SD (y)		M/F (n)		Intervention regimen	Follow up (mo)
					Glaucoma surgery	Combined surgery	Glaucoma surgery	Combined surgery		
Bilgin (2014)	Turkey	CCT	49	52	69.6±7.1	66.6±9.5	15/11	12/11	NPDS vs phaco-NPDS	30.9/28.7
Bull (2011)	Germany	RCT	101	101	67.3±9.9	67.3±9.9	-	-	Canaloplasty vs phacocanaloplasty	36/36
Cillino (2004)	Italy	RCT	65	65	68.6±1.7	71.7±2.0	9/8	8/7	NPDS vs phaco-NPDS	24/24
					71.3±1.2	74.6±1.1	8/10	9/6	PT vs phaco-PT	24/24
D'Eliseo (2003)	Italy	RCT	42	42	71.5	79	15/6	8/13	DS vs Phaco-DS	12/12
Ting (2012)	USA	Pro	713	713	68±15	74±9	181/256	104/155	Trabeculectomy vs cataract extraction and trabeculectomy	12/12
Wishart (2003)	England	Pro	151	192	66.9±10.1	78.9±12.3	13/7	23/33	VC vs phaco-VC	36.4/32.2
					67±11.7	77±8.9	21/22	17/18	DS vs phaco-DS	36.3/35.1
Wishart (2002)	UK	Pro	73	101	75.2	75.2	-	-	VC vs phaco-VC	36/36
Parikh (2016)	USA	Retro	753	753	69±11	72±9	-	-	Trabeculectomy vs phaco-trabeculectomy	12/12
Tetz (2015)	Germany	Retro	112	112	63.5±9.9	74.8±9.0	44/38	12/18	Canaloplasty vs phacocanaloplasty	36/36
Salaga-Pylak (2013)	Poland	Retro	122	122	70.8±6.3	70.7±7.0	32/40	12/38	TrabMMC vs phaco-trabMMC	18/18
Chihara (2011)	Japan	Retro	789	789	60.2±17.6	68.7±13.9	-	-	TrabMMC vs phaco-trabMMC	6/6
					60.2±17.6	71.4±9.6	-	-	VC vs phaco-VC	
Rotchford (2007)	UK	Retro	63	63	72.8±7.6	79.2±7.5	17/13	16/16	MT vs phaco-MT	43.5/41.8
Marek (2006)	Poland	Retro	35	67	-	-	-	-	DS vs phaco-DS	12/12
Uretmen (2003)	Turkey	Retro	40	40	71.8±7.7	71.1±6.4	10/10	12/8	VC vs phaco-VC	12/12

CATARACT SURGERY AND GLAUCOMA DIAGNOSTIC MANAGEMENT

Cataract extraction improves the practitioner's ability to diagnose and track glaucomatous progression by increasing visibility, and it also improves the patient's visual acuity. Following cataract removal, fundoscopic evaluation of the optic nerve, optical coherence tomography (OCT), and stereoscopic disc images are more accurate. The presence of a cataract considerably impacts both spectral domain-OCT (SD-OCT) and time domain-OCT readings, according to Kim et al (TD-OCT). After cataract surgery, patients with SD-OCT were shown to have increased retinal nerve fiber layer thickness as well as alterations in the signal.

CATARACT AND GLAUCOMA PROCEDURES COMBINED

While cataract surgery alone will reduce IOP, it can also be combined with MIGS operations to further reduce IOP. Non-penetrating treatments such as canaloplasty, trabectome, and iStent can be used as main surgical procedures, however, they are frequently combined with cataract surgery. "Cataract plus" treatments are changing the glaucoma therapy paradigm by providing a safer option for patients who need additional IOP control

but aren't ideal candidates for standard filtration surgeries, which come with their own set of complications. Several MIGS treatments spare the conjunctiva, preventing future conjunctiva-based glaucoma surgical operations from being compromised. It's critical to understand how these new options can be used to supplement IOP management as they become more widely utilized. Combining canaloplasty and phacoemulsification might be difficult technically, but it is said to result in considerable IOP reduction. Bull et al. reported a sustained decrease in IOP for both arms of a prospective multicentre study of 109 OAG patients who underwent canaloplasty or combined cataract-canaloplasty surgery, with the combined procedure having a greater, though not statistically significant, effect than canaloplasty alone. At three years after surgery, eyes getting cataract-canaloplasty surgery had their IOP drop from $24.3 \pm$ mmHg to 13.8 ± 3.2 mmHg, while canaloplasty eyes saw their IOP drop from 23.0 ± 4.3 mmHg to 15.1 ± 3.1 mmHg. Patients in both groups required around one fewer glaucoma medications after surgery on average.

II. DISCUSSION

With the aging of the population, glaucoma or OH affects at least 4% to 10% of elderly people with severe cataracts. Gender, age, smoking, previous trauma, use of topical medication, ocular surgery, and diabetes are all risk factors for glaucoma and cataracts, respectively. As a result, the issue arises: "How do you weigh your options for these cataract and glaucoma problems?"

Many operations are available to patients who have cataracts and glaucoma. Although cataract surgery restores vision and can even save a person's life, glaucoma filtering methods were developed to lower the IOP and hence the risk of vision loss. For this condition, combined phacoemulsification with IOL implantation and trabeculectomy (phaco trabeculectomy) is commonly performed as a single surgical treatment. The benefits of combination surgery include an instant enhancement in visual acuity as well as cost savings. It may also be necessary for people whose medical issues make several surgical operations impossible. Trabeculectomy has been the most popular glaucoma surgery to be paired with phacoemulsification among all glaucoma surgical methods. Ocular hypotony and its effects are the main risks of trabeculectomy and phaco trabeculectomy. The two classes of adverse events had similar occurrences. It could be linked to the study's limited sample size and short follow-up period.

III. CONCLUSION

Cataract surgery is an exceptionally cost-effective option for glaucoma sufferers from a public health standpoint. When compared to more typical glaucoma surgeries like trabeculectomy and tube shunt surgery, it may be done rapidly with minimal infrastructure, requires less postoperative care, and has fewer and less serious consequences. Cataract surgery has been demonstrated to reduce postoperative glaucoma medication dependency on average. For all of these reasons, cataract surgery is a particularly attractive alternative for long-term glaucoma therapy in underserved locations with limited access to glaucoma subspecialty care. In recent years, the surgical alternatives for treating cataracts and glaucoma at the same time have grown. To give additional IOP reduction and reduce the burden of glaucoma medical therapy, canaloplasty, Trabectome, iStent, and ECP may be used in concert with phacoemulsification. Compared to trabeculectomy, these novel techniques appear to be less effective. They do, however, have a better safety profile and a lower incidence of surgical complications. The relevance of newer glaucoma procedures in glaucoma care is still up for debate; nevertheless, in patients with minor glaucomatous damage who do not require phacoemulsification, they are best paired with phacoemulsification. Each operation has its own set of complications that must be considered when suggesting one over the other, however, the iStent and Trabectome, when used in conjunction with phacoemulsification, have the fewest.

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