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## Surgical Management of Coexisting Cataract and Glaucoma

BY YVONNE M. BUYS, MD, FRCSC

Glaucoma and cataracts are both diseases associated with aging and, as a result, it is not unusual to find both conditions coexisting in the same patient. In the past, however, combined surgery was not a popular procedure since the individual surgeries have conflicting endpoints, namely satisfactory wound closure in cataract surgery and the maintenance of a filtering wound in glaucoma surgery. Earlier surgical techniques such as full-thickness glaucoma surgery – in which flat anterior chambers were commonplace and also an indication of success – were fundamentally at odds with cataract surgery, where this situation was specifically avoided. Improvements in cataract surgery (including small incision phacoemulsification and intraocular lens [IOL] designs), the conversion to guarded filtration surgery (in which flat anterior chambers are uncommon), and the use of antimetabolites have all contributed to improved outcomes both in terms of vision and intraocular pressure (IOP). The evolution of cataract surgery, IOL design, and filtration surgery is such that combined surgery is now relatively commonplace. This issue of *Ophthalmology Rounds* reviews the surgical management of patients with coexisting cataracts and glaucoma.

### Surgical strategies

Numerous factors require consideration when deciding the optimal surgical strategy for patients presenting with both cataracts and glaucoma. The approach is individualized by considering the specific type of glaucoma, severity of optic neuropathy, pressure control, the number of glaucoma medications being utilized and the number still available, rate of progression, target IOP, degree of cataract, and finally, quality of life issues. The published literature may provide further evidence for management, but the quality of these publications varies. For example, according to a systematic review of English publications from 1964 to July 2000, only 36 randomized controlled trials, 7 nonrandomized controlled trials, and 38 cohort studies were deemed to be of sufficient value for inclusion in an evidence-based review of this topic.<sup>1</sup> Twenty-five of these studies (31%) were graded 0% in terms of bias and confounding variables, suggesting that care must be taken when interpreting the outcomes of these studies and their applicability to individual practice patterns.

Surgical management of a patient with coexisting cataract and glaucoma may be considered for 1 of 2 situations:

- a visually significant cataract with medically controlled glaucoma, or
- uncontrolled glaucoma despite medical/surgical therapy and a lens opacity.

Currently preferred surgical strategies for patients with coexisting cataract and glaucoma include phacoemulsification alone, phacoemulsification followed by filtration surgery, trabeculectomy followed by phacoemulsification, and combined phacotrabeculectomy surgery. Newer alternatives such as phacoemulsification combined with trabecular aspiration,<sup>2</sup> viscocanalostomy,<sup>3</sup> deep sclerectomy,<sup>4</sup> endoscopic laser cycloablation,<sup>5</sup> or trabeculotomy<sup>6</sup> may alter the current standards; however, at the present



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time, there is insufficient scientific evidence to recommend the routine adoption of any of these techniques.

### *Phacoemulsification alone*

A study by Friedman et al reported a temporary decrease in IOP of 2-4 mm Hg at 1-2 years following phacoemulsification alone in glaucoma patients.<sup>7</sup> It is important to remember that "glaucoma" is a term that encompasses a heterogeneous group of diseases and specific subgroups of glaucoma patients may experience even further decreases in IOP with phacoemulsification alone. Hayashi et al reported an average decrease in IOP of 6.4 mm Hg at 1 year in 77 eyes with angle closure glaucoma (ACG) and a 4.1 mm Hg decrease in 73 eyes with open angle glaucoma (OAG).<sup>8</sup> Shingleton et al studied cataract extraction in patients with and without pseudoexfoliation (PEX) syndrome.<sup>9</sup> At 2 years, the IOP was 2.9 mm Hg lower than pre-operative levels ( $p < .00001$ ) and significantly fewer glaucoma medications were required in 297 patients *with* PEX syndrome, while in 427 patients *without* PEX syndrome, there was a 1.9 mm Hg reduction in IOP.<sup>9</sup>

Other specific subgroups of glaucoma (eg, aqueous misdirection, phacomorphic, phacolytic, glaucoma secondary to spherophakia<sup>10</sup>) are examples where phacoemulsification surgery alone may reduce the IOP for a temporary period of time. Caution, however, should be exercised with this approach since decreases in IOP may not be maintained over the long-term. At 2 years, Hayashi et al reported the cumulative survival probability of IOP control to be 91.9% in 74 ACG patients and 72.1% in 68 OAG patients ( $P = .0012$ ); the IOP was controlled without medication in 30 eyes in the ACG group and 13 in the OAG group ( $P = .0055$ ).<sup>11</sup> A similar result was found by Pohjalainen et al who reported that 2.8 years following phacoemulsification alone, IOP control was improved or unchanged in 86% and worse in 14% of OAG eyes.<sup>12</sup> The mechanism of decreased IOP following cataract surgery has been attributed to improved aqueous outflow facility.<sup>13</sup>

### *Phacoemulsification followed by filtration surgery*

With improvements in combined phacotrabeculectomy surgery, there is no indication for *planned* phacoemulsification surgery followed by filtration surgery. This approach is reserved for medically uncontrolled IOP following cataract surgery in either the early or late postoperative period.

### *Filtration surgery followed by phacoemulsification*

There is strong evidence demonstrating that IOP is lower following trabeculectomy surgery alone than

following combined surgery. A review of the literature from 1964 to 2000 concluded that an additional IOP lowering of 2-4 mm Hg can be expected when trabeculectomy surgery alone is performed compared to combined surgery.<sup>7</sup>

The question remains: When will the IOP be lower, after staged surgery, (trabeculectomy followed by phacoemulsification), or after combined surgery? There are currently no randomized controlled trials addressing this question.

The effect of subsequent cataract surgery on IOP and bleb function (ie, post-trabeculectomy) varies.<sup>14-20</sup> Table 1 summarizes the results of 6 retrospective studies<sup>14-19</sup> and 1 prospective study<sup>20</sup> that evaluated the success of filtration surgery following subsequent phacoemulsification in terms of the effect on IOP. Two studies compared the success rate with a matched control group who underwent trabeculectomy alone and did not find a statistically significant difference in terms of success.<sup>14,18</sup> This suggests that the failure rate for trabeculectomy after a subsequent phacoemulsification is performed is the same as for the natural course for trabeculectomy alone.

There were conflicting results concerning the possible factors associated with increased rates of failure to control IOP post-surgery. In one study, when cataract extraction was performed after trabeculectomy, the following factors were associated with worsened IOP control: age  $\leq 50$  years, preoperative IOP  $> 10$  mm Hg, intraoperative iris manipulation, and early post-op IOP  $> 25$  mm Hg.<sup>15</sup> In regards to iris manipulation, one additional study<sup>18</sup> found a similar result; however, 2 other studies<sup>19,20</sup> failed to find an association between iris manipulation and filtration success.

The optimal time interval between trabeculectomy and subsequent phacoemulsification is unknown. Chen et al found that  $> 6$  months between surgeries was associated with significantly improved success.<sup>15</sup> Two other studies did not find the time interval between surgeries to influence the success of filtration.<sup>17,20</sup> In one, the intervals studied were  $< 1$  year, 1-3 years, and  $> 3$  years,<sup>17</sup> while in the other, the shortest interval between trabeculectomy and phacoemulsification was 13 months.<sup>20</sup> Derbolav et al found that although intervals of  $< 6$  months between trabeculectomy and phacoemulsification had a statistically similar increase in the number of medications, there was a statistically significant increase in IOP in eyes when  $> 6$  months elapsed between surgeries.<sup>19</sup>

There is strong evidence indicating that trabeculectomy may accelerate cataract formation (Table 2).

**Table 1. The effect of subsequent phacoemulsification on IOP in eyes after trabeculectomy (ie, with a filtering bleb)**

Study	# of eyes	Follow-up (months)	% Success	Definition of success
Park <sup>14</sup>	40	20.1	80% at 3 years	IOP < 22 mm Hg or >20% reduction compared to pretrabeculectomy. No need for additional glaucoma medications or further glaucoma surgery
	40 controls (trabeculectomy only)	18.7	79% at 3 years	
Chen <sup>15</sup>	57	17.6	74	No need for additional glaucoma medication, bleb needling, or further glaucoma surgery
Manoj <sup>16</sup>	21	15.1	100	IOP < 21 mm Hg and no need for additional glaucoma medication.
Crichton <sup>17</sup>	69	22.2	77	No need for additional glaucoma medication.
Casson <sup>18</sup>	28	24	82	No need for additional glaucoma medication.
	28 controls (trabeculectomy only)	24	96 (p=0.089)	
Rebolleda <sup>20</sup>	49	19.5	67	No need for additional glaucoma medication, bleb needling, or further glaucoma surgery.
Derbolav <sup>19</sup>	48	23	67	IOP < 22 mm Hg and no need for further glaucoma surgery

- In the Collaborative Normal Tension Glaucoma Study (CNTGS), cataracts (defined as the loss of 2 Snellen lines attributed to lens opacity) occurred in 48% of eyes after undergoing trabeculectomy compared to 25% of eyes treated with medication ± argon laser trabeculoplasty (ALT) and 14% of controls, with mean follow-up periods of 5.8 years in the treated group and 4.0 years in the control group.<sup>21</sup>

- The Advanced Glaucoma Intervention Study (AGIS) reported cataracts in 4% of eyes following initial trabeculectomy and in 7% following a second trabeculectomy, compared to 1% following ALT after mean follow-up periods of 9.8, 6.6, and 10.0 years, respectively.<sup>22</sup>

- In the Collaborative Initial Glaucoma Treatment Study (CIGTS),<sup>23</sup> at 3 years there was a 3-fold increased rate of cataracts in the surgical group (17%) compared to the medicine group (6%).

The varying rates of cataracts in these studies are due to the different definitions of cataract and may be related to changes in trabeculectomy surgery technique. The current trend in trabeculectomy surgery to avoid early hypotony and flat anterior chambers may decrease the rate of cataract formation. The corollary, however, is that 52%-96% of eyes do not develop cataracts following trabeculectomy after up to 10 years follow-up. This suggests that for the glaucoma patient with only a mild-to-moderate cataract, trabeculectomy may be sufficient and many may never require cataract surgery.

### *Combined phacotrabeculectomy surgery*

There are few studies addressing quality of life issues in glaucoma management, however, intuitively there are several advantages associated with combined surgery over staged procedures. These advantages include:

- decreased risk when only 1 operation and anesthetic is performed
- decreased costs both in terms of healthcare costs and costs to the patient
- faster visual rehabilitation
- possibly, decreased risk of post-operative IOP spikes associated with cataract surgery.

Surgical techniques may influence outcomes, including 1-site versus 2-site surgery, limbal- versus fornix-based conjunctival flap, and the use of antimetabolites. Several randomized controlled trials comparing 1- versus 2-site surgery have reached similar conclusions. These studies all found lower IOP following 2-site surgery, however, this difference was not statistically significant (Table 3). Significantly fewer glaucoma medications were required in the 1-site group in one study,<sup>24</sup> and in the 2-site group in another.<sup>25</sup> A third study found significantly more clinically appearing filtering blebs in the two-site group.<sup>27</sup> An evidence-based review of 1- versus 2-site surgery concluded that there was modest evidence that 2-site surgery provided 1-2 mm Hg lower IOP than 1-site surgery.<sup>28</sup> This same review also concluded that combined cataract and glaucoma

**Table 2: Rate of cataract formation following trabeculectomy surgery.**

Study	Intervention	# of eyes	Mean follow-up (years)	# of cataracts (%)
CNTGS <sup>21*</sup>	Control	79	4.0	11 (14)
	Medication ± ALT	28	5.8	7 (25)
	Trabeculectomy	33	5.8	16 (48)
AGIS <sup>22**</sup>	ALT as 1st or 2nd intervention	461	10.0	3 (0.7)
	Trabeculectomy as 1st or 2nd intervention	513	9.8	21 (4.1)
	Trabeculectomy as 3rd intervention	46	6.6	3 (7.0)
CIGTS <sup>23***</sup>	Medication	300	3	52 (17.3)
	Surgery	307	3	19 (6.2)

Legend: \*CNTGS = Collaborative Normal Tension Glaucoma Study; \*\*AGIS – Advanced Glaucoma Intervention Study; \*\*\*CIGTS = Collaborative Initial Glaucoma Treatment Study

surgery augmented with mitomycin-C and not 5-fluorouracil results in lower IOP.<sup>28</sup> Three publications comparing IOP-lowering of fornix- and limbal-based flaps in phacotrabeculectomies found no influence of conjunctival flap on final IOP.<sup>29-31</sup>

### Conclusion

There is no single approach to the patient with coexisting cataract and glaucoma. Each case must be individualized in terms of glaucoma type and severity, rate of progression, response to glaucoma therapy, and degree of cataract. Finally, there are evolving surgical techniques that may alter one's approach. When all of these issues are taken into consideration, the following approaches to the different presentations in patients with coexisting cataract and glaucoma would be appropriate:

#### *The patient with controlled glaucoma and a visually significant cataract*

Phacoemulsification alone has been shown to provide a transient 2-4 mm Hg reduction in IOP for 1-2 years<sup>7</sup> and, as such, should be considered for patients with mild-to-moderate glaucomatous optic neuropathy controlled with 1 or 2 glaucoma medications. Specific glaucoma sub-

groups, such as those with ACG,<sup>8</sup> PEX glaucoma,<sup>9</sup> aqueous misdirection, phacomorphic glaucoma, phacolytic glaucoma, and glaucoma secondary to microspherophakia,<sup>10</sup> have a greater likelihood of improved IOP control following phacoemulsification alone. However, it is imperative to closely monitor IOP in the post-operative period since there are reports that up to 28% of primary OAG patients have worse IOP control and that 7% require filtration surgery within 2 years of phacoemulsification.<sup>11</sup>

#### *The patient with uncontrolled glaucoma and cataract*

This scenario is unlikely to be improved by phacoemulsification alone. Although trabeculectomy surgery alone may provide slightly better IOP control than combined phacotrabeculectomy,<sup>7</sup> the effect of subsequent cataract surgery on bleb function remains open to debate.<sup>14-20</sup> In addition, quality of life issues including the possibility of reduced risk with 1 versus 2 procedures, increased cost of 2 procedures, and longer visual rehabilitation, all support combined phacotrabeculectomy as the procedure of choice in this situation. Technically, a 2-site approach with the addition of mitomycin-C may provide additional IOP reduction.<sup>28</sup>

**Table 3: 1-site versus 2-site phacotrabeculectomy.**

Study	# of eyes	Mean Follow-up (months)	Mean IOP (mm Hg) One-Site (% reduction)	Mean IOP (mm Hg) Two-Site (% reduction)
Wyse <sup>25</sup>	33	16.5	15.3±4.1 (23%)	13.3±4.0 (31%)
Borggreffe <sup>26</sup>	50	19	16.8±5.1 (43%)	15.0±3.1 (50%)
El-Sayyad <sup>27</sup>	74	12	19.1±3.1 (27%)	17.6±3.3 (37%)



## *The patient with advanced glaucomatous optic neuropathy with mild-moderate cataract*

If prevention of post-operative IOP spikes and long-term IOP reduction are of paramount importance, performance of trabeculectomy with mitomycin-C first, followed at least 6 months later by cataract surgery (if required) would be the most appropriate approach. With current trabeculectomy day surgery, the rate of subsequent cataract progression may be such that a significant number of patients will be visually satisfied and never require cataract surgery.

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## Abstracts of Interest

### Methodologic rigor of clinical trials on surgical management of eyes with coexisting cataract and glaucoma.

JAMPEL HD, FRIEDMAN DS, LUBOMSKI LH, ET AL.  
BALTIMORE, MARYLAND

**OBJECTIVE:** To assess the methodologic quality of published studies of the surgical management of coexisting cataract and glaucoma.

**DESIGN:** Literature review and analysis.

**METHOD:** We performed a systematic search of the literature to identify all English language articles pertaining to the surgical management of coexisting cataract and glaucoma in adults. Quality assessment was performed on all randomized controlled trials, nonrandomized controlled trials, and

cohort studies. Overall quality scores and scores for individual methodologic domains were based on the evaluations of two experienced investigators who independently reviewed articles using an objective quality assessment form.

**MAIN OUTCOME MEASURES:** Quality in each of five domains (representativeness, bias and confounding, intervention description, outcomes and follow-up, and statistical quality and interpretation) measured as the percentage of methodologic criteria met by each study.

**RESULTS:** Thirty-six randomized controlled trials and 45 other studies were evaluated. The mean quality score for the randomized, controlled clinical trials was 63% (range, 11%-88%), and for the other studies the score was 45% (range, 3%-83%). The mean domain scores were 65% for description of therapy (range, 0%-100%), 62% for statistical analysis (range, 0%-100%), 58% for representativeness (range, 0%-94%), 49% for outcomes assessment (range, 0%-83%), and 30% for bias and confounding (range, 0%-83%). Twenty-five of the studies (31%) received a score of 0% in the bias and confounding domain for not randomizing patients, not masking the observers to treatment group, and not having equivalent groups at baseline.

**CONCLUSIONS:** Greater methodologic rigor and more detailed reporting of study results, particularly in the area of bias and confounding, could improve the quality of published clinical studies assessing the surgical management of coexisting cataract and glaucoma.

*Ophthalmology* 2002;109:1892-1901.

#### Effect of technique on intraocular pressure after combined cataract and glaucoma surgery. An evidence-based review.

JAMPÉL HD, FRIEDMAN DS, LUBOMSKI LH, ET AL,  
BALTIMORE, MARYLAND

**TOPIC:** To analyze the literature pertaining to the techniques used in combined cataract and glaucoma surgery, including the technique of cataract extraction, the timing of the surgery (staged procedure versus combined procedure), the anatomic location of the operation, and the use of antifibrosis agents.

**CLINICAL RELEVANCE:** Cataract and glaucoma are both common conditions and are often present in the same patient. There is no agreement concerning the optimal surgical management of these disorders when they coexist.

**METHODS/LITERATURE REVIEWED:** Electronic searches of English language articles published since 1964 were conducted in Pub MED and CENTRAL, the Cochrane Collaboration's database. These were augmented by a hand search of six ophthalmology journals and the reference lists of a sample of studies included in the literature review. Evidence grades (A, strong; B, moderate; C, weak; I, insufficient) were assigned to the evidence that involved a direct comparison of alternative techniques.

**RESULTS:** The preponderance of evidence from the literature suggests a small (2-4 mmHg) benefit from the use of mitomycin-C (MMC), but not 5-fluorouracil (5-FU), in combined cataract and glaucoma surgery (evidence grade B). Two-site surgery provides slightly lower (1-3 mmHg) intraocular pressure (IOP) than one-site surgery (evidence grade C), and IOP is lowered more (1-3 mmHg) by phacoemulsification than by nuclear expression in combined procedures (evidence grade C). There is insufficient evidence to conclude either that staged or combined procedures

give better results or that alternative glaucoma procedures are superior to trabeculectomy in combined procedures.

**CONCLUSIONS:** In the literature on surgical techniques and adjuvants used in the management of coexisting cataract and glaucoma, the strongest evidence of efficacy exists for using MMC, separating the incisions for cataract and glaucoma surgery, and removing the nucleus by phacoemulsification.

*Ophthalmology* 2002;109:2215-24.

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