

A COMBINED OPERATION FOR GLAUCOMA AND CATARACT*

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SENILE CATARACT AND CHRONIC SIMPLE GLAUCOMA are common eye disorders arising independently in the same age group. Although the two conditions frequently occur in an individual eye, the management of such cases often remains a source of discussion and controversy, primarily because the treatment of one of the abnormalities commonly affects the second. Thus, miotic therapy for glaucoma classically reduces the visual acuity out of proportion to the amount of cataract present; and some of the stronger miotics, such as phospholine iodide, may cause an acceleration of cataract progression. Similarly, surgical therapy of glaucoma may result in rapidly increased lens opacification, especially if prolonged hypotony occurs or the lens is directly traumatized. Conversely, cataract extraction may make medical control of glaucoma more difficult, and it definitely makes subsequent surgical therapy more hazardous; also, a cataract extraction performed after the establishment of a successful filtering bleb often results in the loss of the functioning fistula and uncontrolled glaucoma.

In spite of these problems, when one of the disorders is much more significant than the other, case management has become relatively standardized. Thus, simple filtering operations are usually performed in patients with uncontrolled chronic simple glaucoma accompanied by insignificant lens changes, and routine cataract extractions are typically performed when the intraocular tension is easily controlled medically.^{1,2,3} However, when the pressure is borderline or uncontrolled on maximum medical therapy, and significant lens opacities are present, management is much more controversial. Many physicians favor routine cataract extraction as a primary procedure and delay

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glaucoma surgery until indicated in the aphakic eye.^{4,5,6} Others believe that glaucoma should be controlled surgically before attempting removal of the lens.^{7,8,9} A third alternative is a single operation to produce both aphakia and controlled tension. Although this is at least theoretically the most desirable alternative, comparatively few writers have supported the use of so-called combination procedures.

A small number of operations combining filtration and cataract extraction have been performed for many years, but there are relatively few references to such procedures in the literature. In 1937, Wright¹⁰ briefly described a "combined extraction-iridectomy-sclerectomy" for cases of cataract and severe glaucoma. In the questions and answers section of a 1941 issue of the *Archives of Ophthalmology*,¹¹ a combination of iridencleisis and cataract extraction was recommended for such cases. A few years later, O'Brien¹² and MacMillan¹³ independently advocated the use of a Lagrange sclerectomy with an intracapsular cataract extraction, but, along with Wright, gave no statistics concerning the procedures. In 1945, Guyton¹⁴ mentioned the use of combination procedures but did not advocate them. In 1950, Lee and Weih¹⁵ reported the results of combination procedures. They obtained excellent results and advised that such operations be performed in all patients with uncontrolled tensions who also needed cataract extractions. In 1952, Birge¹⁶ reported good results when combining cataract extraction with iridencleisis, and Wolfe¹⁷ recommended combined filtration and cataract operations. In discussing Birge's paper, MacLean¹⁸ mentioned a preference for a trephine procedure combined with intracapsular cataract extraction. In 1955, Wenaas and Stertzbach¹⁹ described their procedure of cataract extraction with iris inclusion; and one year later Callahan²⁰ described a combination operation in his textbook. In 1959, Hughes²¹ discussed his procedure of combining sclerectomy and iris inclusion with cataract extraction; and in 1963²² he reported the results of the same operation in an expanded series of 122 patients. He was sufficiently satisfied with the operation to advocate its use in patients with uncontrolled tensions and only minor lens opacities. In 1962, Sugar³ mentioned that cataract extraction combined with iridencleisis might occasionally be an acceptable procedure, but he specifically warned against other types of combined filtration surgery. In 1964, Stocker²³ described an operation combining cautery sclerostomy and buried sutures with lens removal. J. M. McLean²⁴ referred to this type of operation as "the only satisfactory combined ... technique" in his hands. In the same year, A. L.

MacLean²⁵ discussed limbal lip cautery, which he said was easily combined with cataract extraction. Boberg-Ans²⁶ described a combination of cyclodialysis and filtration with lens removal. In more recent years several more reports on the subject have appeared in the literature.^{27,28,29,30,31} Combination procedures of cyclodialysis and cataract extraction have not been so widely recommended as the filtering varieties, although some authorities feel that the former are often more satisfactory.^{2,32,33}

In spite of these optimistic reports on cataract-filtration operations, most authors have felt the procedures are not justified, primarily because of the possibility of postoperative complications related to shallow or flat anterior chambers occurring secondary to planned "inadequate wound closure." Thus, in the summary of a symposium on indications for surgery in glaucoma at the American Academy of Ophthalmology meeting in 1963, Dunnington³⁴ stated that the panel did not endorse combination procedures. At a round-table discussion on cataract extraction at the 1964 Pan American Conference,³⁵ five of six participants, including one of us (AEM), expressed dissatisfaction with such operations. In a more recently published symposium on glaucoma,³⁶ none of the authors speaking on the subject advocated the use of these procedures.

The purpose of this paper is to present a variation of previously described operations combining cataract extraction and filtration. The procedure is a simple modification of our routine method of lens removal, differing only in the number of sutures and the application of cautery to the wound edge. In fact, it was first attempted after observing the high number of unplanned filtering blebs that occurred after we began using a posterior section, 8-0 to 10-0 buried silk sutures, and microsurgical techniques in cataract surgery.

DESCRIPTION OF OPERATION

Lid block, anesthesia, and akinesia are obtained in the usual fashion using lidocaine (Xylocaine). An arcuate incision is then made through the conjunctiva and Tenon's capsule, between approximately 9:00 and 3:00, 8 mm posterior to the limbus. This flap is turned inferiorly, and the remaining subconjunctival tissue is gently, bluntly pushed downward to the limbus. A razor-blade incision approximately two-thirds the thickness of the sclera is then made at the posterior edge of the limbus at an angle of 70° to the surface of the sclera, for 150° between 9:30 and 2:30. A single 9-0 black silk suture is preplaced

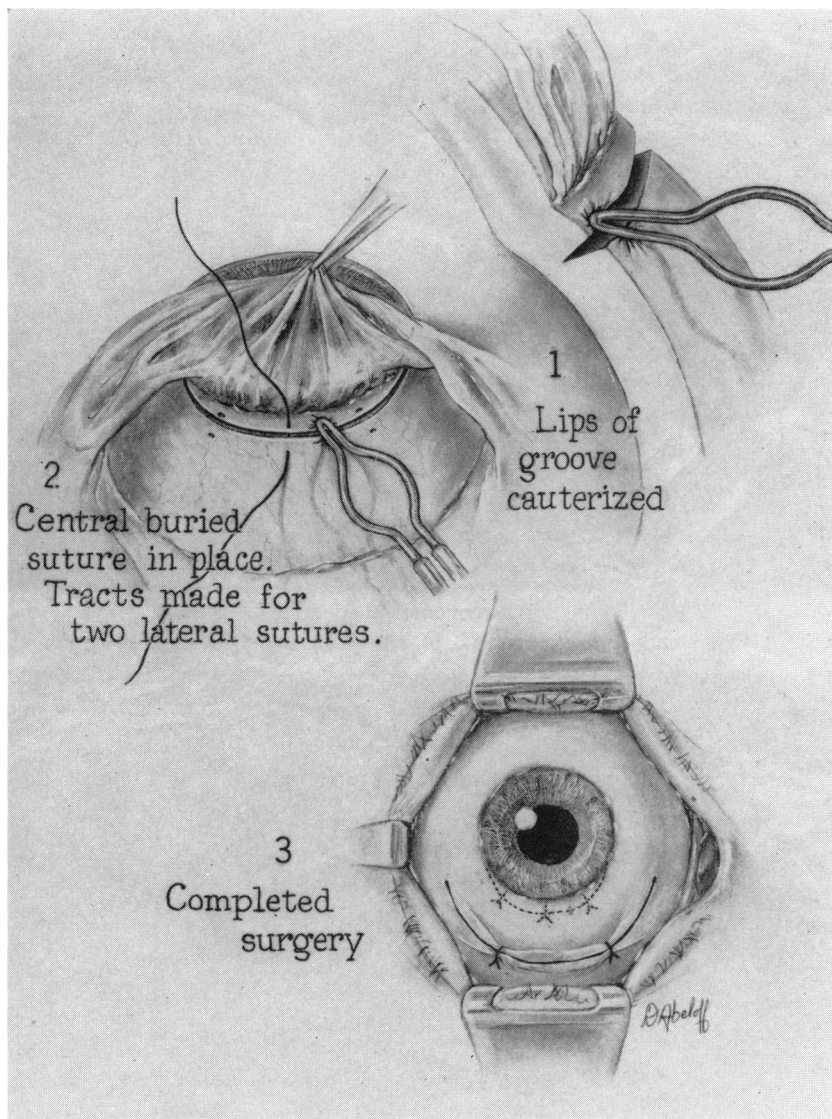


FIGURE 1

The combined operation features buried 9-0 silk sutures and cauterization of the lips of a posterior cataract section.

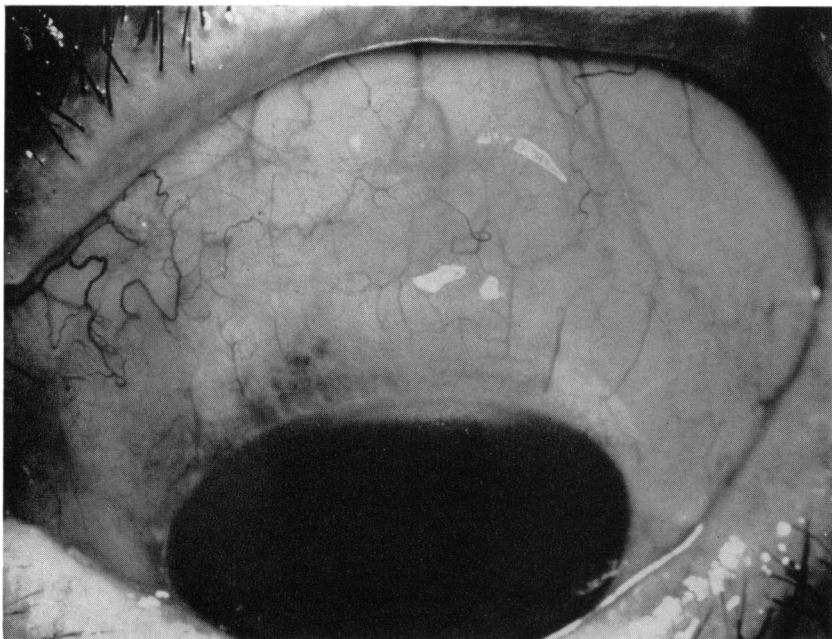


FIGURE 2

Case 3. One month after surgery. The eye is quiet, and a diffuse bleb is present.

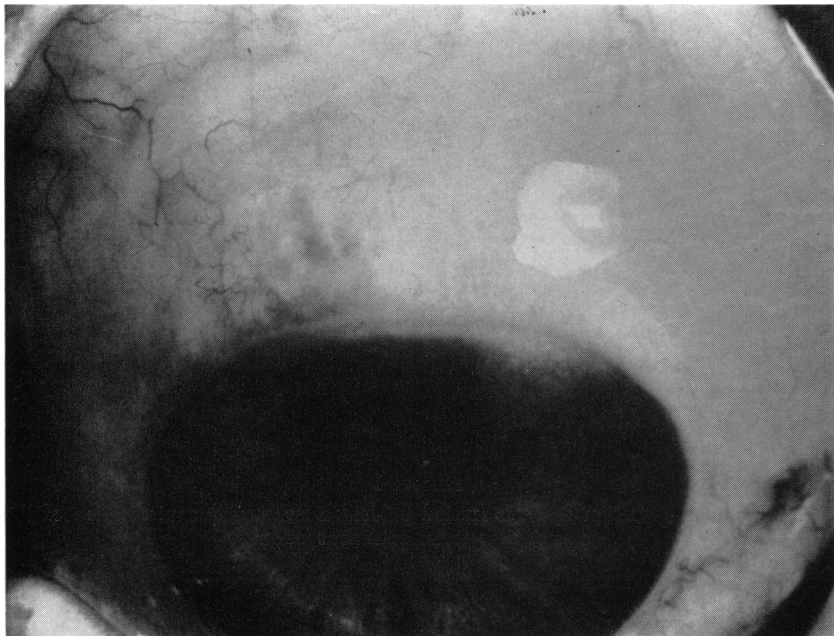


FIGURE 3

Case 3. One year after surgery. The bleb is smaller.

across the lips of the wound at 12:00; the posterior exit site of the suture is twice as far from the wound as the anterior entrance site (Figure 1). Tracts are then made with the same needle in the same fashion at 1:30 and 10:30. Cautery sufficient to cause retraction of about the outer half of the sclera is then placed, with the Hildreth unit, at a focal point on both sides of the groove near the superior suture. The anterior chamber is then entered at the temporal extent of the groove with the Smith-Green knife, and the wound is enlarged to 150° with curved corneal scleral scissors. A small peripheral iridotomy is then made superiorly. The lens is then slid through the wound, using the cryoprobe in the usual fashion. The preplaced suture is drawn and tied, and the knot is pulled far posteriorly to avoid subsequent erosion through the conjunctiva. Two additional sutures are similarly placed through the previously created tracts and are tied and cut. The anterior chamber is reformed with Guy's solution if necessary; but it is never allowed to remain filled with air, because we believe this increases chances of compressing subconjunctival tissues and diminishes the chances of filtration. The conjunctival incision is then closed with only two interrupted sutures of the same silk material. No effort is made to make this wound watertight. The lids are dressed with petrolatum ointment, and no medication is placed in the eye. A pad and shield are placed over the operated eye only. The eye is dressed only once daily with a small amount of steroid ointment. The anterior chamber typically remains at phakic to aphakic depth, and the blebs do not usually appear until the second or third postoperative day. The eyes routinely remain quiet (Figures 2 and 3), and the patients are discharged from the hospital on the sixth or seventh postoperative day. The blebs progressively assume a flat, succulent appearance and may become rather difficult to appreciate without using a slit lamp. The patient must be followed closely for several months. If filtration slowly deteriorates, ocular massage must be initiated in an attempt to maintain an open fistula.

RESULTS

This operation has been performed in 20 eyes of fifteen patients with glaucoma and cataracts; 17 of the eyes had chronic simple glaucoma, 2 had chronic narrow-angle glaucoma with permanent trabecular damage, and 1 had an acute angle-closure tension rise (Table 1). All but the latter patient were on medical management for glaucoma, and 8 of these eyes had histories of previously unsuccessful glaucoma surgery. One of this latter group had a history of interstitial keratitis

TABLE 1. PREOPERATIVE STATUS OF PATIENTS

Case	Type of glaucoma	Visual acuity	Medications	Previous operations	Tension
1	Chronic simple	CF	Pilocarpine & Daranide		14
2	Chronic simple	20/300	Diamox, epinephrine, & PI	Filtering surgery	20
3	Chronic simple	20/100	Pilocarpine & epinephrine		14
4	Chronic simple	20/100	Pilocarpine	Iridectomy	20
5	Chronic simple	20/70	Pilocarpine		26
6	Chronic simple	20/100	Pilocarpine		30
7	Chronic simple	20/200	PI & Diamox		19
8	Chronic simple	20/200	PI & Diamox		19
9	Chronic simple	20/200	PI, epinephrine, & Diamox		17
10	Chronic simple	LP	PI, epinephrine, & Diamox		15
11	Chronic simple	2/200	Pilocarpine, epinephrine, & Diamox	Filtering surgery	30
12	Chronic simple	20/80	Pilocarpine, epinephrine, & Diamox	Filtering surgery	30
13	Chronic simple	20/200	PI, epinephrine, and Diamox	Iridectomy	24
14	Chronic simple	20/400	PI, epinephrine, and Diamox	Filtering surgery	30
15	Chronic simple	20/70	PI & pilocarpine		21
16	Chronic narrow-angle with permanent trabecular damage				
17	Chronic narrow-angle with permanent trabecular damage	20/50	Pilocarpine & Diamox	Iridectomy	21
18	Chronic simple	20/60	Pilocarpine & Diamox		21
19	Chronic simple	CF	Pilocarpine, epinephrine, & Daranide	Iridectomy	19
20	Acute-angle closure	20/50	Pilocarpine, epinephrine, & Daranide		19
		20/40-J8	None (closed-angle attack)		43

TABLE 2. POSTOPERATIVE STATUS OF PATIENTS

Case	Preoperative visual acuity	Visual acuity	Adequate filtration	Medications	Tensions	Follow-up
1	CF	20/20	+	0	22	6 months
2	20/300	20/15	0	Max. meds.	21	18 months
3	20/100	20/20	+	0	14	10 months
4	20/100	20/25	+	0	17	1 year
5	20/70	20/20	+	0	15	7 months
6	20/100	20/25	+	0	17	9 months
7	20/200	20/25	+	0	18	1 year
8	20/200	20/25	+	0	14	
9	20/200	20/20	0	Max. meds.	9	
10	LP	HM 4'	0	Diamox	17	
11	2/200	20/20	0	Pilocarpine	21	
12	20/80	20/20	+	0	17	8 months
13	20/200	20/30	0	Pilocarpine & epinephrine	25	
14	20/400	20/50	0	Pilocarpine & Diamox	20	
15	20/70	20/30	0	Epinephrine	15	
16	20/50	20/25	0	0	17	
17	20/60	20/20	+	0	17	18 months
18	CF	20/25	+	0	17	3 years
19	20/50	20/25	+	0	10	6 months
20	20/40	20/30	+	0	15	6 months

secondary to syphilis. Aside from an uncomplicated extracapsular cataract extraction in one case, and a tiny buttonhole in the conjunctival flap in one other, there were no problems at the time of surgery. A flat anterior chamber developed in a single eye, case 17, approximately 14 days after surgery; this subsequently required drainage of suprachoroidal fluid and reformation of the anterior chamber. The only lasting problem has been a loss of adequate filtration in 8 eyes as noted in Table II. Two failures have filtering blebs and observable wound defects, but still require medication for control of tension. One eye no longer has a filtering bleb, but no medication is required for control of tension. The twelve remaining eyes are filtering well and require no medication. The follow-up period in the 12 successful cases ranges from six months to three years. Prolonged follow-ups in many of our referred patients was quite difficult, and it is probable that prompt initiation of massage with the first signs of filtration failure would have resulted in a higher frequency of success.

Of the seven failures, four had histories of unsuccessful glaucoma surgery, five had been on phospholine iodide, five had been on epinephrine preparations, and one had inactive interstitial keratitis. These important historical factors were less frequently present in the group of successes. The failures requiring medication remain adequately controlled on therapy, although three require carbonic anhydrase inhibitors. No postoperative tensions are any more difficult to control than preoperatively, and none of the patients has required further surgical procedures.

Nineteen of the 20 eyes had a significant increase in visual acuity, and 18 of them reached 20/30 vision or better. One patient with a history of severe glaucoma only improved from light perception to hand movements at four feet in spite of an unremarkable cataract extraction. Another patient attained only 20/50 vision because of the severity of the glaucoma.

In summary, 12 of the 20 eyes had excellent results with successful cataract extractions, significant increases in vision, and functioning filtering blebs. Seven eyes have required various medications for control of tension, but all have had satisfactory cataract extractions and 6 of the 7 showed a very significant improvement in their vision. A single eye with 20/25 vision is apparently not filtering, but requires no medication for glaucoma. In no eyes did the tension become more difficult to control or the vision worse. There have been no serious complications related to the use of this combination procedure.

DISCUSSION

Successful filtration depends upon the maintenance of a transscleral fistula and adequate permeability and absorptive ability of the subconjunctival tissues.³⁷ Meticulous microsurgical techniques, relatively inert buried fine silk sutures, and closure of the conjunctival flap with only two simple sutures all contribute to a markedly reduced postoperative inflammatory response and thereby greatly improve the chances for ultimate success of the filtering portion of the operation. Mild retraction of the sclera at the point of cauterization further reduces the chances of healing in that area.³⁸ Nevertheless, the wound is sufficiently closed to prevent a high number of shallow anterior chambers. The delay of appearance of the bleb until the second or third postoperative day, in the presence of a normal or deep anterior chamber, implies that the fistula is indeed small and requires significant intraocular tension to propel aqueous through it. The immediate situation after surgery therefore closely simulates that in which a cataract operation has been performed in an eye with a functioning filtering bleb. In both cases the wound is well closed except for a tiny fistula, and maintenance of the anterior chamber depends upon the resistance of the subconjunctival tissues to the outflow of aqueous.

The only serious complication has been the loss of filtration due to "overly successful wound closure." This failure most often occurs secondary to condensation of the subconjunctival tissues,³⁷ a factor aggravated by the previous surgical manipulation and the use of strong miotics and epinephrine preparations in the majority of these patients. There was not an increase in complications related to attempts at filtration, for the procedure is basically a cataract extraction and generally insures satisfactory aphakia. Since so many authors now advocate cataract extraction prior to glaucoma surgery in cases such as these,^{4,5} the loss of filtration, unassociated with other problems, is not a cause for concern.

A single procedure that accomplishes two purposes is much more desirable than two separate operations, if it does not increase the chances of harming the eye. Because of the lack of significant complications and the high frequency of success, we believe that this operation is indicated in any patient with documented chronic simple glaucoma needing a cataract extraction. In addition, its use should be of benefit in cataract patients with either form of narrow-angle glaucoma and in many cases of secondary glaucoma. It is hoped that

increasing familiarity with this procedure will help us more adequately resolve a relatively common ophthalmic dilemma.

SUMMARY

A combination filtration-extraction procedure for glaucoma and cataract has been described. The operation is performed under the microscope and involves a posterior section, buried silk sutures, and focal cauterization of the wound edges. Surgery has been performed on 20 eyes; 12 of these are filtering well, with satisfactory tensions requiring no medication; 7 need various medicines for adequate control of the glaucoma. A single eye has normal tensions without medication and with no evidence of filtration. Lens extractions have been unremarkable, and there have been no increases in complications related to attempts at filtration.

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DISCUSSION

DR. ANGUS L. MACLEAN. Why did filtration develop in 12 of the 20 eyes and why was there loss of adequate filtration in the remaining 8 eyes?

I believe the authors have demonstrated the importance of always establishing a connection between the anterior chamber and Schlemm's canal in any filtering operation for the control of glaucoma. I believe that is what was accomplished in the successful cases in their series and was not accomplished in the cases that were not successful, where the glaucoma recurred.

Making a connection between the anterior chamber and Schlemm's canal by sweeping the knife just anterior to the white line of the scleral spur is one of the goals in goniotomy for infantile glaucoma. It is the only goal in Mr. Peter Watson's external trabeculectomy operation where, after the meshwork has been dissected free and removed, the scleral flap is turned back and sutured firmly into its original position.

Trabeculectomy along with sclerectomy insures success in the trephine operation for glaucoma. By tilting the handle of a sharp 1.25-mm trephine slightly forward so that the anterior edge of the blade will enter the anterior chamber while the posterior edge is just reaching Schlemm's canal, the meshwork will remain to act as a hinge when the scleral button, with the trabecular layer still attached, is tilted upward. It will then be drawn outward as a rolled-up band which easily becomes detached or can be cut free at the base of the opening. It has been my experience that if the meshwork was not removed with the scleral button in the trephine operation, the outcome was not successful.

In the authors' combined operation, as buried sutures were used, it was necessary to place the initial groove about 1.5 mm posterior to the base of the flap, which corresponds to the margin of Bowman's membrane and the margin of clear cornea. As the base of the flap is 1.75 mm from a point on the sclera opposite the root of the iris and as Schlemm's canal extends about 0.5 mm anterior to this, any incision perpendicular or almost perpendicular to the surface made at this location – that is, 1.5 mm behind the base of the flap – will be in direct line with the anterior half of Schlemm's canal. If extended deep enough, it should enter the canal or, if not, the connection will be made when the incision is completed with the cataract knife cutting from within outward. In this way a trabeculotomy will be performed and, with one or two thermal sclerostomies to the external collector channels, this should be enough to establish filtration for a time at least. Trabeculectomy, however, by extending the thermal treatment to the anterior chamber will give a more permanent functioning fistula.

It is conceivable that the benefit of trabeculectomy may derive from aqueous gaining entrance to the entire canal and thus having access to the entire system of external collector channels. This, however, is difficult to prove and requires further investigation. I am convinced, however, that filtration will not develop or will not be permanent if the incision is cut anterior to Schlemm's canal and I believe that this may be what happened in the 8 failures in the authors' series.

One can, therefore, say that the use of buried sutures necessitating placement of the groove posterior to the limbus was a very fortunate selection by

the authors, for it has led to this wonderful discovery. I am not ready, however, to admit that buried sutures are mandatory for this combined operation. In my experience, exposed non-buried 7-0 black silk sutures are preferable.

In closing, we are indebted to the authors for bringing to our attention a procedure which, if carried out with proper precision, will result in Schlemm's canal being interplaced between the inlet and outlet of the fistula and will thus insure more permanent filtration for control of the glaucoma following this combined procedure.

DR. WENDELL L. HUGHES. In 1948, Dr. Birge read a paper before this Society on a combination procedure; in 1949, I read a paper on this same subject. I think that the concept of doing a combination surgical procedure designed to lessen the chances of glaucoma following cataract extraction is an extremely important one.

I doubt very much if it makes much difference how the sclerectomy is done. The technique that I use is an anterior sclerectomy with iris inclusion, and I like to bring a piece of iris out in the wound at the same time, to assure fistula drainage.

There have been many papers read in the last few years on combination procedures, notably at the International Congress in New Delhi and last year at the Pan-American Association of Ophthalmology Congress in Mar del Plata.

I would like to show a couple of slides of the section of an eye that was taken out one year after the procedure had been done. This is the sclerectomy opening with the piece of iris pulled out in it, and you can see the sub-conjunctival drainage area. I like to close the conjunctival flap very carefully throughout the entire length and also put the knots of the sutures far back from the limbus to avoid any chance of the knots eroding through the conjunctiva.

DR. FREDERICK W. STOCKER. I should like to refer to a technique of combined cataract extraction and scleral cauterization which I first described in 1960 at the meeting of the Section on Ophthalmology of the American Medical Association. The first slide demonstrates the revised technique now used; the second, the favorable results obtained.

DR. CHARLES E. ILIFF. It is important to extract the cataract as the primary operation when there is both glaucoma and cataract, because in a high percentage of patients the glaucoma will be controlled. In about 1946, Dr. Guyton gave a paper on this problem and Dr. Chandler got up and said that he recalled that in all of his last 8 cases with cataracts and glaucoma, the cataract extraction had controlled the glaucoma. He, of course, in his delightful way, said that one is always wont to remember the cases that do well.

However, I think that we must all realize that when a cataract is removed, there is a decrease in tension. Dr. Maumenee has pointed this out, along with Dr. Becker, in the past in discussions on this subject. This decrease in tension may last up to one or two or three years, and in some, even longer.

DR. HENRY L. BIRGE. I think those of us who have used this procedure for 20 years have a feeling that if the iris is incarcerated in the sclerectomy there will be perhaps a 90 per cent cure of the tension for any number of years.

It is true that after a year or two a simple sclerectomy may close. It is very rare that a sclerectomy with cleisis does that. I would say less than 1 per cent.

DR. A. EDWARD MAUMENEE. In 15 patients out of 50 who had cataract extraction without glaucoma, when buried sutures were used and the cautery was not placed at the wound edge, filtering blebs followed the cataract extraction. In several of these patients I had to go back and repair these blebs because they were irritating to the patient.

I feel that a combination of factors produce the filtration: first, the very fine sutures which cause little reaction; second, the relatively post-placed incision where the sclera does not heal quite as well as it does in the limbus; and, probably, third, the relatively small amount of cautery.

I realize that glaucoma-cataract procedures have been done for a long time. In the slide that Dr. Wilkinson presented, most of the investigators who have contributed to this subject are mentioned.

In my hands and in the hands of my residents, however, when we have attempted to do a filtering operation, such as a trephine or iridencleisis, in combination with a cataract extraction, we have had a high percentage of flat anterior chambers and other complications. Therefore, we would like to stress again that this procedure is a cataract extraction modified only by a very light amount of cautery and reduced number of scleral sutures.

I would like to emphasize again the fact that it is not necessary to close the conjunctiva with a water-tight closure. For the past two years in glaucoma filtering procedures I have closed the conjunctiva with only one interrupted suture and have yet to find a positive Seidel test from leakage of fluid from under the conjunctiva in the area of the conjunctival incision.

Finally, I come to Dr. MacLean's very nice discussion and interesting concept that an incision into Schlemm's canal is the cause of the filtration. I can only say that on gonioscopic examination the cleft in the wound or the cataract incision is in front of Schwabe's line. I am afraid, therefore, I cannot agree that the functioning bleb is due primarily to incision in Schlemm's canal.

One other interesting point about these patients is that the bleb under the conjunctiva usually does not appear until about the third postoperative day when the patient begins to secrete aqueous; usually in the first two or three postoperative days, there is very little evidence of a bleb.