

# COMPLEX RETINAL DETACHMENT IN PHAKIC PATIENTS

## Previtrectomy Phacoemulsification Versus Combined Phacovitrectomy

GIAN MARCO TOSI, MD, PhD,\* ANGELO BALESTRAZZI, MD, PhD,\* STEFANO BAIOCCHI, MD,\* ANTONIO TARANTELLA, MD,\* GABRIELE CEVENINI, MD,† DAVIDE MARIGLIANI, MD,\* FRANCESCO SIMI, MD\*

**Purpose:** To assess the impact of phacoemulsification performed one week before pars plana vitrectomy versus combined phacovitrectomy on postoperative anterior segment status and final functional and anatomical outcomes in phakic patients affected by complex rhegmatogenous retinal detachment.

**Methods:** The authors retrospectively reviewed the records of 59 phakic patients affected by complex rhegmatogenous retinal detachment. Twenty-nine patients underwent cataract surgery 7 days before vitrectomy (preemptive cataract surgery—Group 1), whereas 30 patients underwent combined phacovitrectomy (Group 2). Preoperative, intraoperative, early- and late-postoperative outcomes were measured and compared.

**Results:** Numbers of previous retinal surgical procedures, nuclear sclerosis grade, proliferative vitreoretinopathy grade, eyes with inferior breaks, surgical time, and ratio of silicone oil/gas tamponade were all similar between the two groups. After surgery, there was less extension of posterior synechia in Group 1. There was no significant difference in fibrin, number of patients with posterior synechia, final intraocular pressure, retinal redetachment rate, final retinal status, or final best-corrected visual acuity.

**Conclusion:** Preemptive cataract surgery was associated with less extensive postoperative posterior synechia, however, its final functional and anatomical outcomes were not significantly different from those of phacovitrectomy. Both approaches were efficacious.

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Pars plana vitrectomy (PPV) is often necessary to repair complex rhegmatogenous retinal detachment (RRD),<sup>1–4</sup> and lens status may determine the anatomical success in such patients.<sup>3,5</sup> A preexisting cataract may limit visualization, the native lens may limit the extent to which the vitreous can be

removed and traction relieved, and peripheral pathology may be more difficult to identify and treat in the phakic eye.<sup>2,3,5–13</sup>

Eyes left phakic at the completion of surgery may have a lower rate of anatomical success when compared with eyes rendered aphakic or pseudophakic.<sup>2,3,13–16</sup> Pars plana vitrectomy associated with silicone oil or gas tamponade in a phakic eye leads to cataract. Oil removal is usually performed before cataract surgery, meaning multiple surgeries are needed in the case of redetachment. Moreover, cataract surgery may be more complex in the previously vitrectomized eye.<sup>17–19</sup>

Management options to render the eye nonphakic during vitrectomy include phacofragmentation through the pars plana (most often without intraocular lens—IOL) and combination anterior cataract surgery (with IOL). There are advantages to each approach.<sup>3,5,6,10–12,20–26</sup>

From the \*Ophthalmology Unit, Department of Medicine, Surgery and Neuroscience, University of Siena, Siena, Italy; and †Department of Medical Biotechnologies, University of Siena, Siena, Italy.

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Reprint requests: Gian Marco Tosi, MD, PhD, Ophthalmology Unit, Department of Medicine, Surgery and Neuroscience, University of Siena, Siena University Hospital, Viale Bracci 1, 53100 Siena, Italy; e-mail: gmtosi@tin.it

An alternative is to render the eye nonphakic before PPV (preemptive cataract surgery with IOL placement). The outcomes of this last approach have not been reported to date. We compared two groups of patients with phakic complex RRD from the specific view points of their postoperative anterior segment status and final anatomical and functional outcomes. In the first Group, phacoemulsification with IOL was performed one week before PPV (preemptive cataract surgery), whereas in the second Group, phacoemulsification with IOL was performed with PPV in the same sitting (combined phacovitrectomy).

### Patients and Methods

We retrospectively reviewed the clinical records of patients affected by RRD who were subjected to PPV between January 2011 and March 2015 at the Ophthalmology Unit of the Department of Medicine, Surgery and Neuroscience, University of Siena, Siena, Italy. The research adhered to the principles of the Declaration of Helsinki, and the institutional review board approved the study. Patients were treated after being informed of the nature of the treatment being offered, the potential risks, benefits, adverse effects, possible treatment outcomes, and after having signed a consent form.

The patients included had clinical signs of primary or recurrent chronic total or subtotal macula-involving complex RRD (RRD extent  $270^\circ$  or greater, very low mobility, rolled edges of retinal breaks, or well-established proliferative vitreoretinopathy (PVR) with epiretinal and/or subretinal proliferation) and had not previously been subjected to cataract surgery.

We excluded patients with recent onset partial, subtotal, or total phakic RRD, recent and late onset pseudophakic or aphakic RRD, tractional diabetic retinal detachment, RRD due to giant retinal tear, RRD related to ocular traumas, and patients subjected to previous intraocular surgery except vitreoretinal surgery.

Cataract surgery was performed either 1 week (range: 6–8 days; mean: 7 days) before PPV (preemptive cataract surgery—Group 1) or during the PPV procedure (combined phacovitrectomy—Group 2). In particular, in Group 1 cataract surgery was performed at the time of the initial visit and PPV 6 days to 8 days (mean: 7 days) after cataract surgery. In the combined Group, the surgical procedure was performed between 3 and 6 days after initial diagnosis.

The patients were assigned to either Group 1 or Group 2 based on the logistics and timing of repair, that is, patient preference, available operating room time, etc.

Phacoemulsification was performed by one of three surgeons (A.B., S.B. or G.M.T.) in both Groups.

Vitreotomy was performed by the same surgeon (G. M.T.) assisted by a vitreoretinal fellow.

The cataract procedure, the IOL inserted (aspheric, hydrophobic acrylic, foldable, one-piece IOL [AcrySof SA60AT; Alcon Inc, Fort Worth, TX]), and the phacoemulsification machine (Infiniti Vision System; Alcon Inc), were identical in Group 1 and Group 2. The cataract wound was sutured in every patient in both Groups. No intracameral steroids were used at the conclusion of the cataract surgery in either Group. Intraocular lens calculation was based on the biometric findings and anteroposterior globe measurements of both eyes, as well as the opposite eye refraction.

In patients who underwent preemptive cataract surgery, a posterior capsulectomy was not performed at the time of PPV.

Encircling scleral buckling was associated with PPV in all patients using a 41 band. For the patients who had previously been subjected to scleral buckling for RRD, no scleral buckling revision was performed. In both Groups, extensive 3-port 20- or 23-gauge PPV was performed using the Stellaris PC (Bausch and Lomb, Rochester, NY) and a panoramic contact viewing system (Advanced Visual Instruments, Inc, New York, NY). Twenty-gauge PPV was chosen because of the temporary absence of appropriate instrumentation for bimanual membrane dissection in small-gauge PPV. Epiretinal membrane peeling and retinotomy were performed when necessary and appropriate. Intraocular tamponade was achieved with either silicone oil 1000 cSt or gas (C3F8 13%). Silicone oil was used if the patient was monocular; when maintaining prone positioning was too difficult; when a retinotomy of more than  $90^\circ$  was required; and at the discretion of the operating surgeon.

Postoperative management after preemptive cataract surgery consisted of the topical instillation of tobramycin–dexamethasone four times daily, moxifloxacin three times daily, and bromfenac twice daily, up to the day of the PPV procedure.

Postoperative management after PPV for both Groups consisted of the topical instillation of tobramycin–dexamethasone four times daily, bromfenac twice daily, and cyclopentolate twice daily.

Preoperative data were reviewed together with postoperative data from days 1, 7, 15, and 22, and months 1, 2, 3, and 6. For eyes with longer follow-up periods, subsequent information was also reviewed.

The following preoperative variables were identified: patient age/sex, number and type of previous retinal surgeries, best-corrected visual acuity, anterior segment status, intraocular pressure (IOP), and RRD characteristics. In particular, we recorded the corneal endothelial cell count, degree of nuclear sclerosis (graded from 1 to

4), location of retinal breaks, and extent of PVR (updated PVR classification).<sup>27</sup> For the intergroup comparison of preoperative retinal status, we divided the PVR grade C into two subgroups, the first lower than C6 and the second equal to or greater than C6.

The intraoperative information recorded included phacoemulsification- or PPV-associated complications, PPV surgical time, type of PPV (noncannulated 20 gauge or protected 23 gauge), PPV-associated procedures (scleral buckle and PVR removal), and postoperative tamponade.

Postoperative outcomes were divided into early postoperative (first 6 months after surgery) and late postoperative (more than 6 months after surgery). The early postoperative outcomes were presence of corneal edema, first postoperative day IOP, use of IOP-lowering medication in the first 3 weeks after PPV, formation of fibrin and posterior synechia, extent of posterior synechia, occurrence of IOL dislocation, occurrence of pupillary block, occurrence of optic/iris capture, and whether postoperative prone positioning was recommended. In the early postoperative period, IOP-lowering medications were initiated if the IOP was above 25 mmHg. Each topical antiglaucoma medication was given a score of 1, and an additional 1 point was calculated if a systemic anhydrase inhibitor was added. Fibrin in the anterior chamber was documented by its presence or absence, without grading its severity. The extent of posterior synechia was noted and documented after dilatation of the pupil with tropicamide, according to the extent of pupillary margin involvement (less than 90° [1 point], between 90° and 180° [2 points], between 180° and 270° [3 points], and more than 270° [4 points]).

The late postoperative outcomes included final IOP including the number of patients with hypotony (IOP  $\leq$  5 mmHg); patients on IOP-lowering medications to maintain an IOP  $\leq$  20 mmHg; number of patients with posterior synechia and extent of posterior synechia; number of patients with optic iris capture; cystoid macular edema; occurrence of postoperative macular epiretinal membrane; recurrence of retinal detachment and its cause; number of patients with oil in the eye at last follow-up; final best-corrected visual acuity; and final refractive status.

#### Statistical Analysis

Group comparisons were performed using the Student's *t*-test for quantitative continuous variables; the nonparametric test of medians for quantitative discrete variables; and the Fisher exact test (applied to contingency tables) for qualitative variables. A Bonferroni correction of the *P* value was not used

because only one comparison (between the two Groups) was performed for each variable. A statistical significance level of 95% was used for all computations (*P* = 0.05).

## Results

### Demographics

After the application of inclusion and exclusion criteria, 73 patients were identified. Fourteen patients were unable to attend the follow-up visit and were not included in the study. A total of 59 eyes of 59 subjects participated in the study. The mean age was 64.8  $\pm$  10.4 years; 37 patients were male and 22 were female.

Twenty-nine eyes constituted Group 1 (preemptive cataract surgery) and 30 eyes constituted Group 2 (combined phacovitrectomy Group). Follow-up ranged from 9 months to 48 months in Group 1 (mean 21.1 months) and from 9 to 48 months in Group 2 (mean 23.6 months) (*P* = 0.412).

### Entry and Intraoperative Findings

At entry, a significantly worse best-corrected visual acuity was found in Group 1 compared with Group 2 (*P* < 0.001) (Table 1). One patient had a posterior capsular break in the preemptive cataract surgery Group (3.4%), whereas no patient had a posterior capsular break in the combined Group. In the patient with capsular break, the IOL was implanted in the capsular bag and the patient underwent PPV 7 days later, receiving C3F8 13% as a postoperative tamponade, without developing postoperative posterior synechia or IOL dislocation. No patient required the use of iris retractors in Group 1, whereas 2 patients required the use of iris retractors in Group 2 because of sudden intraoperative myosis during the phacoemulsification procedure (*P* = 0.364). No other complication was encountered during phacoemulsification and the PPV procedure in either Group. In Group 1, five patients required retinotomy (17.2%), whereas in Group 2, four patients required retinotomy (13.3%) (*P* = 0.731).

### Early Postoperative Findings

No patients in either Group experienced corneal edema on postoperative day 1 (Table 2). The first postoperative day IOP was significantly lower in Group 1 (25.66  $\pm$  5.7 mmHg) compared with Group 2 (29.77  $\pm$  7.6 mmHg) (*P* = 0.022), as was the mean number of IOP-lowering medications at Week 1 (*P* = 0.005), 2 (*P* = 0.003), and 3 (*P* = 0.035) after surgery. Fibrin formation was lower in Group 1, although not significantly, (1 of 29 eyes [3.4%]) compared with Group 2

Table 1. Entry and Intraoperative Variables of Group 1 Patients (Preemptive Cataract Surgery) and of Group 2 Patients (Combined Phacovitrectomy)

	Group 1 (29 Patients)	Group 2 (30 Patients)	<i>P</i>
Sex, n (%)			0.288
Male	16 (55.2)	21 (70)	
Female	13 (44.8)	9 (30)	
Mean age	66.2 ± 9.9	63.9 ± 10.3	0.385
Previous surgery, n (%)	4 (13.8)	7 (23.3)	0.506
Entrance VA, n (%)			0.001
CF	2 (6.9)	21 (70)	
HM	22 (75.8)	7 (23.3)	
LP	5 (17.2)	2 (6.6)	
Mean preop IOP, mmHg	15 ± 3	13.8 ± 4.7	0.244
Nuclear sclerosis, n (%)			0.989
Grade 1	12 (41.3)	13 (43.3)	
Grade 2	13 (44.8)	13 (43.3)	
Grade 3	4 (13.8)	4 (13.3)	
Inferior breaks	14 (48.2)	15 (50)	1.000
PVR grade, n (%)			0.296
A	6 (20.6)	10 (33.3)	
B	11 (37.9)	12 (40)	
<C6	7 (24.1)	7 (23.3)	
≥C6	5 (17.2)	1 (3.3)	
PPV caliper, n (%)			0.748
20 G	5 (17.2)	7 (23.3)	
23 G	24 (82.8)	23 (76.6)	
Need for iris retractors during PPV, n (%)	0 (0)	2 (6.6)	0.364
Retinotomy, n (%)	5 (17.2)	4 (13.3)	0.731
Tamponade, n (%)			1.000
Silicone oil	14 (48.2)	15 (50)	
Gas	15 (51.7)	15 (50)	
Mean surgical time, minutes	178.5 ± 34.4	176.9 ± 27.7	0.816
Posterior capsule break, n (%)	1 (3.4)	0 (0)	0.246

CF, count fingers; HM, hand motion; LP, light perception; VA, visual acuity. Statistically significant values are in italics.

(6 of 30 eyes [20%]) ( $P = 0.103$ ). No significant between-group difference was found in terms of the number of patients with posterior synechia (3 of 29 in Group 1 [10.3%] and 7 of 30 in Group 2 [23.3%]) ( $P = 0.118$ ), whereas the extension of posterior synechia was lower in Group 1 ( $P = 0.019$ ). In fact, a total of 4 quadrants of pupillary margin were involved in Group 1, whereas a total of 14 quadrants were involved in Group 2. The 2 patients who needed iris retractors in Group 2 did not develop fibrin but did develop posterior synechia. Among the 6 patients in Group 2 who showed fibrin, 4 developed posterior synechia; the 1 patient in Group 1 showing fibrin did not develop posterior synechia. No patients in either Group experienced IOL dislocation, optic/iris capture, or pupillary block.

#### Late Postoperative Findings

No significant differences were found between Groups 1 and 2 in terms of final IOP ( $P = 0.560$ ) (Table 3). With reference to the 3 hypotony patients (1 in

Group 1 and 2 in Group 2), the 2 patients in Group 2 showed fibrin formation and developed 3 and 4 quadrants of posterior synechia, respectively. Neither of these two showed recurrent RRD. The patient in Group 1 did not develop fibrin nor posterior synechia but suffered recurrent retinal detachment from PVR.

All the recurrences of RRD (1 in Group 1 and 3 in Group 2) were related to PVR; none of the patients with recurrent RRD showed postoperative fibrin or posterior synechia.

#### Discussion

In complex retinal detachment, eyes managed with PPV and left phakic at the completion of surgery may have a lower rate of anatomical success compared with eyes rendered aphakic or pseudophakic.<sup>3,14-16</sup> Even in uncomplicated RRD, although the results are not always conclusive,<sup>4,28</sup> Orlin et al<sup>13</sup> and Caiado et al<sup>2</sup> found a significantly increased redetachment rate in

Table 2. Early Postoperative Variables of Group 1 Patients (Preemptive Cataract Surgery) and of Group 2 Patients (Combined Phacovitrectomy)

	Group 1 (29 Patients)	Group 2 (30 Patients)	<i>P</i>
Corneal edema	0	0	1.000
Mean postop IOP (Day 1), mmHg	25.6 ± 5.7	29.7 ± 7.6	0.022
Mean no. postop antiglaucoma medications (Week 1)	0.62 ± 0.7	1.23 ± 0.9	0.005
Mean no. postop antiglaucoma medications (Week 2)	0.37 ± 0.7	1.16 ± 1.2	0.003
Mean no. postop antiglaucoma medications (Week 3)	0.24 ± 0.5	0.76 ± 1.2	0.035
Prone position, n (%)	14 (48.2)	15 (50)	1.000
Fibrin, n (%)	1 (3.4)	6 (20)	0.103
Posterior synechia, n (%)	3 (10.3)	7 (23.3)	0.118
Synechia extension among patients with posterior synechia, n (%)			0.019
0°–90°	2 (66.6)	3 (42.8)	
90°–180°	1 (33.3)	2 (28.5)	
180°–270°	0 (0)	1 (14.2)	
270°–360°	0 (0)	1 (14.2)	
IOL dislocation	0	0	1.000
Pupillary block	0	0	1.000
Optic/iris capture	0	0	1.000

Statistically significant values are in italics.

phakic compared with pseudophakic/aphakic eyes. In addition, Caiado et al<sup>2</sup> demonstrated the importance of combined phacovitrectomy in relation to improved outcomes in RRD repair, with success rates similar to primary PPV in pseudophakic eyes. Both Orlin et al<sup>13</sup> and Caiado et al<sup>2</sup> hypothesized more extensive

vitreal removal to be the major reason for increased reattachment rates in pseudophakic or aphakic PPV compared with phakic PPV. They included patients without PVR<sup>13</sup> or with a PVR grade of up to CPI.<sup>2</sup>

Management options to render the eye nonphakic during vitrectomy include combination anterior

Table 3. Late Postoperative Variables of Group 1 Patients (Preemptive Cataract Surgery) and of Group 2 Patients (Combined Phacovitrectomy)

	Group 1 (29 Patients)	Group 2 (30 Patients)	<i>P</i>
Final IOP, n (%)			0.560
Norm	26 (89.6)	24 (80)	
Hypo	1 (3.4)	2 (6.6)	
Hyper	2 (6.8)	4 (13.3)	
Posterior synechia	3 (10.3)	7 (23.3)	0.118
Synechia extension among patients with posterior synechia, n (%)			0.019
0°–90°	2 (66.6)	3 (42.8)	
90°–180°	1 (33.3)	2 (28.5)	
180°–270°	0 (0)	1 (14.2)	
270°–360°	0 (0)	1 (14.2)	
Optic/iris capture	0	0	1.000
CME, n (%)	0 (0)	0 (0)	1.000
ERM, n (%)	7 (24.1)	4 (13.3)	0.333
Recurrent RRD, n (%)	1 (3.4)	3 (10)	0.483
Recurrence due to PVR, n (%)	1 (100)	3 (100)	0.483
Final retinal reattachment, n (%)	29 (100)	30 (100)	1.000
Eyes with permanent silicone oil, n (%)	1 (3.4)	1 (3.3)	0.746
Mean final BCVA, logMAR	0.42 ± 0.65	0.45 ± 0.63	0.859
Mean refractive status	−1.86 ± 0.75	−1.99 ± 1.59	0.687

BCVA, best-corrected visual acuity; CME, cystoid macular edema; ERM, epiretinal membrane.

Statistically significant values are in italics.

cataract surgery and phacofragmentation through the pars plana.

Phacofragmentation, by removing the potential scaffold for re proliferation constituted by the lens and the capsule, is reserved primarily for advanced PVR with a significant anterior component.<sup>3,5</sup>

Combination cataract surgery (with IOL) with vitrectomy (combined phacovitrectomy) affords enhanced access to and management of the anterior pathology when compared with phakic vitrectomy. However, combined phacovitrectomy may lead to anterior segment complications such as optic/iris capture, posterior synechia, capsular phimosis, and secondary pupillary block.<sup>3,5,6,10,12,20,21</sup> This development may be due to the displacement of the lens anteriorly from the vitreous tamponade, possibly in combination with an inflammatory response after vitrectomy and endophotocoagulation.<sup>3,5</sup> After combined phacovitrectomy, the anterior segment outcomes reported in the literature are variable, including up to 55.8% of patients with elevated IOP,<sup>6,14,18,21</sup> between 4% and 22% with fibrin formation,<sup>6,18</sup> between 7% and 30% with posterior synechia,<sup>11,18</sup> and up to 33% with posterior capsule opacification.<sup>6,10,20,26</sup> In addition, in case the vitreoretinal surgeon does not perform the cataract surgery, combined phacovitrectomy requires two surgeons, thus becoming logistically challenging.

An alternative is to render the eye nonphakic before PPV. Preemptive cataract surgery performed before planned vitreous surgery, although submitting the patient to two separate surgeries in a short period, may diminish the risk of these anterior segment/IOL complications, whereas maintaining the advantages of a pseudophakic vitrectomy. Rendering the eye pseudophakic 1 week before surgery may limit the degree of postvitrectomy inflammation and may allow the IOL to "sit firmly" in the capsule, thus limiting the risk of optic prolapse and capture.

To this end, we compared patients treated with phacoemulsification before PPV to patients who underwent combined phacovitrectomy. The 7-day time lapse between cataract surgery and PPV aimed to reduce anterior segment reaction without significantly postponing RRD surgery, possibly limiting further retinal damage.

We would have expected a longer surgical time in the combined group, however, no significant difference was encountered. This might be explained by the fact that cataract surgery is relatively brief, in an otherwise long surgical procedure because of the severity of preoperative retinal status, which in our custom is addressed with a meticulous vitreous removal and the placement of an encircling band.

The anatomical and functional outcomes after the surgical repair of these complex retinal detachments were similar between the Groups, perhaps because the retinal surgery was performed within the same relative period. All RRD recurrences were due to PVR; in particular, the recurrence rate was higher in the combined Group, although this was not statistically significant. In addition, the number of secondary macular epiretinal membranes was higher in the preemptive cataract Group; again, this was not significant. One patient in each Group required permanent silicone oil tamponade as a consequence of severe hypotony.

The anticipated purpose of preemptive cataract surgery was to reduce anterior segment inflammatory and mechanical complication rates after PPV with an extended vitreous tamponade. Fibrin formation and the number of patients with posterior synechia were higher in the combined Group, although not significantly. The extension of posterior synechia was significantly greater in the combined Group. This occurred in the absence of between-group differences in prone positioning. Meticulous vitreous removal was possible without the need for iris retractors in the preemptive cataract surgery Group, whereas two patients in the phacovitrectomy Group required iris retractors. These two patients developed posterior synechia. The absence of postoperative use of short acting mydriatics, which have been shown to reduce the incidence of posterior synechia, could have impacted our posterior synechia findings.<sup>11,12</sup> However, the topically prescribed regimen was the same in both Groups. The slightly increased anterior segment inflammatory response in the combined Group may have been partially responsible for the early postoperative IOP findings. In fact, the phacovitrectomy Group showed a significantly higher first day postoperative IOP.

The fact that cell and flare were not evaluated and fibrin and posterior synechia were not quantitatively measured constitute limitations of this study. Moreover, the retrospective nature of the study and the lack of randomization in relation to the type of treatment constitute a bias. However, as previously noted, patient allocation to either preemptive or concurrent cataract surgery was based on logistical concerns (see Patients and Methods), and, in our opinion, had no effect on our results. In fact, because no significant between-group differences were encountered in sex, age, PVR grade, number of patients with inferior breaks, nuclear sclerosis, preoperative IOP, 20-gauge/23-gauge ratio, oil/gas ratio, surgical time, number of previous retinal surgeries, or number of patients who required prone positioning postoperatively, and because best-corrected visual acuity at entry, although significantly different

between Groups, was no better than count fingers in either Group, the above-mentioned limitations may be considered of minor importance.

The peculiarities of this study are represented by the surgical approach/timing, which has never been reported so far, and by the select subcohort of patients affected by high-risk RRD. Preemptive cataract surgery in the management of phakic patients with complex RRD seems to at least slightly reduce the postoperative inflammatory component when compared with combined phacovitrectomy. However, in the present series, the two approaches had no significantly different final anatomical or functional outcomes. Both approaches were efficacious.

**Key words:** complex rhegmatogenous retinal detachment, pars plana vitrectomy, preemptive cataract surgery, combined phacovitrectomy, intraocular inflammation.

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