Comparative Surgical and Functional Outcomes of Combined Phacovitrectomy and Pars Plana Vitrectomy Alone in Primary Rhegmatogenous Retinal Detachment

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Abstract

Aim: To evaluate and compare the anatomical and functional outcomes of combined phacovitrectomy and pars plana vitrectomy (PPV) alone in the management of rhegmatogenous retinal detachment (RRD).
Methods: This retrospective study included patients who underwent surgery for primary RRD. The eyes were included in the phacovitrectomy and PPV-only groups basis of the initial lens status. Preoperative demographics, axial length, lens status, and intraocular pressure (IOP) were recorded. Surgical variables including tamponade use, adjuvant procedures, and perioperative complications were analyzed.
Results: A total of 69 eyes of 69 patients were analyzed. Single-surgery anatomical success was achieved in 87.9% of the eyes in the PPV-only group and 97.2% in the phacovitrectomy group ($p = 0.186$). Final reattachment was obtained in all eyes (100%). Recurrence occurred in 12.1% of the PPV-only cases versus 2.8% of the phacovitrectomy cases. Both groups demonstrated significant improvement in BCVA from baseline to the final visit ($p < 0.001$), with no significant intergroup difference ($p = 0.342$). Postoperative IOP elevation was observed in both groups but remained comparable ($p = 0.562$). The rates of epiretinal membrane formation, proliferative vitreoretinopathy, and inflammatory complications were similar between the two groups ($p > 0.05$ for all).
Conclusions: Both combined phacovitrectomy and PPV alone achieve high rates of retinal reattachment and significant functional recovery in primary RRD patients. Structured postoperative follow-up and careful surgical planning ensure predictable visual outcomes, with lens status serving as a key factor guiding individualized surgical strategies.
Keywords: *Cataract surgery; pars plana vitrectomy; phacovitrectomy; rhegmatogenous retinal detachment*

1. Introduction

Pars plana vitrectomy (PPV) remains a principal approach for managing complex rhegmatogenous retinal detachment (RRD), with lens status serving as an important determinant of anatomical and functional success.[1, 2] Cataract development is regarded as an unavoidable consequence of PPV when silicone oil serves as a long-term intraocular tamponade.[3]

Several studies have reported that combining vitreoretinal surgery with cataract extraction is a safe and effective approach for patients with both conditions, providing functional outcomes comparable to those of sequential procedures.[4-6] The initial rationale for adopting a combined surgical approach was the occurrence of advanced lens opacities that limit proper intraoperative visualization of the retina. There is a growing preference for the combined procedure among ophthalmic surgeons, as it minimizes the need for repeated anesthesia and recovery, facilitates immediate postoperative visual recovery, and is considered economically advantageous.[7]

Nevertheless, certain challenges must be considered when planning combined surgery, since the main limitations for intraocular lens power calculation are related to inaccuracies in axial length measurement and prediction of the effective lens position.[8] To address specific other intraoperative challenges and postoperative complications linked to combined procedures, the adoption of a staged technique has been advocated. These complications, which are uncommon after PPV alone, include corneal edema, pupillary constriction during surgery, fibrinous exudate with anterior chamber inflammation, and the later development of posterior capsular opacification.[9]

Although surgical approaches for RRD have been extensively studied, direct comparative evidence between combined phacovitrectomy and PPV alone in the treatment of primary RRD re-

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mains limited. In clinical practice, PPV and cataract surgery may be addressed either sequentially in separate sessions or simultaneously in a single operation. The presence of cataracts can limit intraoperative visualization and make PPV technically challenging. Combined phacovitrectomy performed in the same session offers a potential solution by allowing simultaneous cataract removal and retinal repair. However, evidence evaluating its safety, feasibility, and functional outcomes in these situations is scarce. This study addresses these gaps by providing a systematic comparison of both approaches, thereby offering contemporary evidence to guide surgical decision-making in patients with primary RRD.

2. Materials and Methods

This retrospective cohort study included patients who underwent surgical repair of primary RRD from January 2020 to January 2022. The study adhered to the tenets of the Declaration of Helsinki and was approved by the institutional ethics committee (approval number: 386, date: 19.09.2025). Informed consent was waived because of the retrospective nature of the study.

Inclusion criteria comprised patients with primary RRD, either phakic or pseudophakic, who underwent combined phacovitrectomy or PPV alone. Eyes with axial lengths of 21.00–27.00 mm were included. Eyes with previous vitreoretinal surgery, traumatic RRD, recurrent or tractional retinal detachment, proliferative vitreoretinopathy grade C or higher, or coexisting ocular pathology (uveitis, glaucoma and others) or very dense cataracts affecting visual acuity were excluded.

The baseline data collected included patient demographics (age, sex), systemic comorbidities such as diabetes mellitus, ocular history, axial length measured with optical biometry, lens status, and intraocular pressure. Preoperative best-corrected visual acuity (BCVA) was recorded via the Snellen chart and converted to logarithm of the minimum angle of resolution (logMAR) for statistical analysis. For patients undergoing phacovitrectomy, biometric measurements were obtained via the Lenstar LS-900 (Haag-Streit, Bern, Switzerland). An intraocular lens (typically a single-piece, square-edged, hydrophobic acrylic intraocular lens) was selected with the aim of achieving a postoperative refraction close to −0.25 D. Intraocular lens power was calculated via the Barrett Universal II formula. Cases where reliable measurements could not be obtained through either optical or acoustic biometry methods were omitted from the analysis. Measurements of axial length were obtained through two modalities: optical biometry and ultrasonography A-scan (Nidek, Gamagori, Japan). Optical biometry was used to determine the axial length from the tear film to the retinal pigment epithelium. When the axial length obtained by optical biometry was shorter than that of the fellow eye, applanation A-scan ultrasonography was employed to confirm the measurement.[10] Ten consistent measurements were obtained via optical biometry and ultrasonography, all performed by experienced operators to ensure accuracy. The average of all measurements was used for the further analysis.

All surgeries were performed by a single experienced vitreoretinal surgeon. A standard 23-gauge, three-port PPV was carried out, beginning with core vitrectomy and the induction of posterior hyaloid detachment. The perfluorocarbon mixture was subsequently instilled to stabilize and flatten the mobilized retina, after which meticulous vitreous base shaving was performed. Endolaser photocoagulation was then applied to all identified retinal breaks. Retinal breaks were treated with endolaser photocoagulation, and intraocular tamponade (silicone oil, C_3F_8, SF_6 or Densiron) was applied at the discretion of surgeon. Adjuvant procedures, including internal limiting membrane peeling, retinotomy, and encircling band placement, were documented.

In the combined phacovitrectomy group, phacoemulsification with intraocular lens implantation preceded PPV. During combined phacoemulsification and PPV procedures, three 25-gauge trocars were positioned 3.5 mm from the limbus in the superotemporal, inferotemporal, and superonasal quadrants and subsequently closed with plugs. A 2.2 mm clear corneal incision was then used to perform phacoemulsification. The capsulorrhexis was executed in a continuous curvilinear manner, with its diameter limited to a value less than that of the intraocular lens optic. Upon completion of cataract extraction, a standard three-port PPV was subsequently performed.

The follow-up regimen included examinations on the first postoperative day, after one week, and then once per month over the subsequent three months. Additional appointments were arranged in the event of clinical concerns. Postoperative follow-up included BCVA and intraocular pressure measurements, along with monitoring for complications such as epiretinal membrane formation, proliferative vitreoretinopathy, and inflammatory reactions. Anatomical success was defined as complete retinal reattachment without additional surgery. All patients were assigned for silicone oil removal at the three-month postoperative visit.

All relevant clinical and surgical data were compared between the two study cohorts: phakic eyes that underwent combined phacovitrectomy (phacovitrectomy group) and pseudophakic eyes that underwent only PPV (PPV-only group).

Statistical analyses were performed via SPSS software (version 28; IBM Corp., Armonk, NY, USA). Continuous variables are expressed as the means ± standard deviations, whereas categorical variables are presented as frequencies and percentages. The normality of the data distribution was assessed via the Kolmogorov-Smirnov test. Between-group comparisons of continuous variables were conducted via the independent samples t-test or the Mann–Whitney U test, as appropriate. Preoperative results were compared with the postoperative results within each group via the Wilcoxon signed rank test. Categorical variables were compared using the Pearson chi-square test or Fisher's exact test when the expected frequencies were small. A p-value < 0.05 was considered statistically significant.

Table 1

The demographic and clinical characteristics of the study patients.

	Phacovitrecyomy Group	PPV-Only Group	p value
Number of patients / eyes	33 / 33	36 / 36	-
Age, years (mean ± SD)	52.70 ± 13.13	58.56 ± 12.88	0.033[a]
Sex, male / female	27 / 6	29 / 7	0.893[b]
Patients with diabetes mellitus, n (%)	3 (9.1)	3 (9.1)	0.911[b]
Axial length, mm (mean ± SD)	24.70 ± 1.77	24.95 ± 1.64	0.580[c]

PPV, pars plana vitrectomy; SD, standard deviation.
a Independent samples t-test
b Pearson chi-square test
c Mann-Whitney U test

Table 2

Surgical outcomes and postoperative complications of the study patients.

	Phacovitrectomy Group (n = 33)	PPV-Only Group (n = 36)	p value
Follow-up, months (mean ± SD)	11.24 ± 8.26	8.47 ± 6.84	0.070[a]
Eyes with PVR, n (%)	5 (15.2)	6 (16.7)	0.864[b]
Number of retinal tears, n (mean ± SD)	1.52 ± 0.97	1.74 ± 1.11	0.405[a]
Eyes with ERM n (%)	8 (24.2)	7 (19.4)	0.629[b]
Eyes underwent ILM peeling, n (%)	5 (15.2)	7 (19.4)	0.638[b]
Eyes underwent encircling band, n (%)	8 (24.2)	7 (19.4)	0.629[b]
Eyes underwent retinotomy, n (%)	6 (18.2)	6 (16.7)	0.868[b]
Intraocular tamponade, n (%)			0.235[b]
1000cs silicone oil	11 (33.3)	7 (19.4)	
C_3F_8	11 (33.3)	17 (47.2)	
5000cs silicone oil	6 (18.2)	6 (16.7)	
SF_6	5 (15.2)	3 (8.3)	
Densiron	0 (0.0)	3 (8.3)	
Reattachment with a single operation, n (%)	29 (87.9)	35 (97.2)	0.186[c]
Recurrence of retinal detachment, n (%)	4 (12.1)	1 (2.8)	0.186[c]
Final reattachment, n (%)	33 (100)	36 (100)	-
Preoperative IOP, mmHg (mean ± SD)	12.91 ± 4.49	12.19 ± 3.83	0.791[a]
Postoperative IOP, mmHg (mean ± SD)	15.03 ± 4.43	14.31 ± 3.88	0.562[a]
IOP rise of at least 10 mmHg, n (%)	4 (12.1)	1 (2.8)	0.186[c]
Eyes with postoperative fibrinous uveitis, n (%)	8 (24.2)	5 (13.9)	0.272[b]

C3F8, perfluoropropane; ERM, epiretinal membrane; ILM, internal limiting membrane; IOP, intraocular pressure; PPV, pars plana vitrectomy; PVR, proliferative vitreoretinopathy; SD, standard deviation; SF6, sulfur hexafloride.
a Mann-Whitney U test
b Pearson chi-square test
c Fisher's exact test

3. Results

A total of 69 eyes from 69 patients with RRD were included, comprising 33 phakic and 36 pseudophakic eyes. The mean age was significantly lower in the phacovitrectomy group than in the PPV-only group (52.70 ± 13.13 vs. 58.56 ± 12.88 years, p = 0.033). No significant differences were observed between the groups in terms of sex distribution or the prevalence of diabetes mellitus (p = 0.893 and p = 0.911, respectively). The mean axial length was 24.70 ± 1.77 and 24.95 ± 1.64 in the phacovitrectomy and PPV-only groups, respectively (p = 0.580) **(Table 1)**.

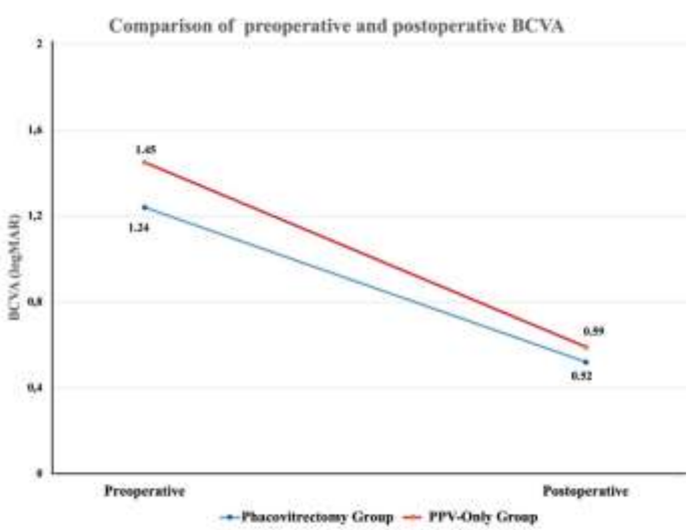
The mean follow-up duration was 11.24 ± 8.26 months in the phacovitrectomy group and 8.47 ± 6.84 months in the PPV-only group (p = 0.070). No significant differences were observed between the two groups in terms of the presence of proliferative vitreoretinopathy, the number of retinal tears, or the rates of epiretinal membrane formation, internal limiting membrane peeling, retinotomy, or encircling band placement (p = 0.864, p = 0.405, p = 0.629, p = 0.638, p = 0.629 and p = 0.868, respectively). The most commonly used intraocular tamponades in the phacovitrectomy group were 1000 cs silicone oil and C_3F_8, each applied in 11 eyes (33.3%). In the PPV-only group, the most common tamponade was C_3F_8, which was used in 17 eyes (47.2%). Densiron was applied in only 3 eyes (8.3%) in the PPV-only group. Overall, the distribution of intraocular tamponades did not differ significantly between the groups (p = 0.235) **(Table 2)**.

Single-surgery anatomical success was achieved in 29 eyes (87.9%) in the phacovitrectomy group and 35 eyes (97.2%) in the PPV-only group (p = 0.186). Final retinal reattachment was observed in all eyes (100%) in both groups. Recurrence of retinal detachment occurred in 12.1% of the patients in the phacovitrectomy group and 2.8% of the patients in the PPV-only group, although the difference was not statistically significant (p = 0.186). The mean preoperative and postoperative intraocular pressures, as well as the incidence of significant intraocular pressure elevation, were comparable between the phacovitrectomy and PPV-only groups (p = 0.971, p = 0.562, and p = 0.186, respectively). The mean postoperative mean intraocular pressure was significantly greater than the preoperative value in the phacovitrectomy and PPV-only groups (p = 0.014 and p = 0.002, respectively). The incidence of postoperative fibrinous uveitis was low (24.2% and 13.9% for the phacovitrectomy and PPV-only groups, respectively) and did not differ significantly between the groups (p = 0.272) **(Table 2).**

The preoperative BCVA was 1.24 ± 0.74 logMAR in the phacovitrectomy group and 1.45 ± 0.65 logMAR in the PPV-only group (p = 0.223). At the final follow-up, BCVA improved significantly in both groups, to 0.52 ± 0.59 logMAR and 0.59 ± 0.57 logMAR, respectively (p < 0.001 for both within-group comparisons), with no significant intergroup difference (p = 0.342) **(Figure 1, Table 3)**. The mean improvement in BCVA was −0.72 ± 0.73 logMAR in the phacovitrectomy group and −0.85 ± 0.85 logMAR in the PPV-only group (p = 0.380). An improvement of ≥2 Snellen lines was achieved in 21 eyes (63.6%) and 24 eyes (66.6%) in the phacovitrectomy and PPV-only groups, respectively (p = 0.792). At the last follow-up, BCVA remained better than baseline in 24 eyes (72.7%) and 29 eyes (80.6%) in the phacovitrectomy and PPV-only groups, respectively, without a significant difference between the groups (p = 0.419) **(Table 3)**.

Figure 1

Comparison of preoperative and postoperative best-corrected visual acuity (BCVA) between the phacovitrectomy and PPV-only groups.



Both groups demonstrated significant improvement in the mean BCVA following surgery. Although both groups demonstrated substantial postoperative visual gains and the final BCVA was slightly better in the phacovitrectomy group, no significant difference was observed between the groups.

Table 3

Functional outcomes of the study patients

	Phacovitrectomy Group (n = 33)	PPV-Only Group (n = 36)	p value
Preoperative BCVA, logMAR (mean ± SD)	1.24 ± 0.74	1.45 ± 0.65	0.223[a]
Postoperative BCVA, logMAR (mean ± SD)	0.52 ± 0.59	0.59 ± 0.57	0.342[a]
Difference in BCVA, logMAR (mean ± SD)	-0.72 ± 0.73	-0.85 ± 0.85	0.380[a]
Eyes with an increase in BCVA of at least two Snellen lines, n (%)	21 (63.6)	24 (66.6)	0.792[b]
Postoperative visual status, n (%)			0.419[b]
Improved	24 (72.7)	29 (80.6)	
Stable	5 (15.2)	2 (5.5)	
Worsened	4 (12.1)	5 (13.9)	

BCVA, best corrected visual acuity; PPV, pars plana vitrectomy; SD, standard deviation.
a Mann-Whitney U test
b Pearson chi-square test

4. Discussion

The present study demonstrated that both combined phacovitrectomy and PPV alone yield excellent anatomical and functional outcomes in the management of primary RRD. Although single-surgery reattachment rate was slightly higher in the PPV-only group, the difference was not statistically significant, and all eyes ultimately achieved final reattachment, confirming the reliability of both surgical strategies. Functional improvement, as reflected by significant postoperative gains in BCVA, was comparable between the phacovitrectomy and PPV-only groups. This suggests that initial lens status does not substantially influence visual rehabilitation when appropriate surgical techniques and structured postoperative care are implemented. Moreover, the incidence of postoperative complications, including intraocular pressure elevation, epiretinal membrane formation, and proliferative vitreoretinopathy, was similarly low across both groups.

Our findings align with previous reports indicating that the concurrent management of cataracts and RRD does not compromise either anatomical or visual outcomes.[1, 4, 7] Phacovitrectomy offers distinct advantages, including improved intraoperative visualization, faster postoperative rehabilitation, and the avoidance of a second anesthetic and surgical exposure. Thus, the present study reinforces the growing clinical preference for single session phacovitrectomy, particularly when lens opacity may limit retinal visualization.

The coexistence of cataract and vitreoretinal disease poses a significant surgical challenge, as it can hinder optimal intraoperative retinal visualization and complicate postoperative visual rehabilitation, while also increasing the risk of potential complications.[11] In particular, corneal edema has been identified as a major intraoperative concern in cases undergoing combined phacoemulsification with PPV.[3] Li et al.[11] observed temporary corneal edema in six eyes (3.2%) within their cohort of 186 eyes that underwent phacovitrectomy In these cases, removal of the swollen epithelium led to corneal epithelial defects in four eyes (2.1%), likely associated with surgical manipulation.[11] In the present study, however, no clinically significant corneal edema was observed, likely reflecting refined phacoemulsification techniques, the use of dispersive viscoelastic agents, and careful intraoperative fluid control, all of which help preserve endothelial integrity. These findings suggest that, with appropriate intraoperative precautions, the risk of corneal complications can be substantially reduced even with combined procedures.

Postoperative elevation of intraocular pressure is frequently reported as an early complication of combined surgery.[4, 12] In the present study, a postoperative intraocular pressure increase of ≥10 mmHg from baseline was observed in 12.1% of phakic eyes and 2.8% of pseudophakic eyes. Importantly, these postoperative pressure elevations were readily controlled with pharmacologic therapy, demonstrating that such changes, while common, do not compromise the safety or feasibility of combined phacovitrectomy.

Posterior capsular opacification has been reported as the leading complication of combined surgery, with frequencies documented between 2.2% and 28.4% in prior studies.[4, 13] In our cohort, no posterior capsular opacification was detected during follow-up visits. This likely reflects both the short follow-up period and the use of modern intraocular lens designs with posterior edge modifications that effectively limit lens epithelial cell migration, reducing the incidence of secondary opacification. Collectively, these findings suggest that posterior capsular opacification has become a more predictable and controllable postoperative event in contemporary combined surgery.

Redetachment of the retina represents a frequent and sight-threatening complication that may occur in the postoperative period.[11] In the present study, the recurrence rates were 12.1% in the phacovitrectomy group and 2.8% in the PPV-only group. The difference between the two groups was not statistically significant, suggesting comparable anatomical outcomes. The relatively short follow-up period should be considered when interpreting these findings, as late recurrences may not have been included. This finding underscores that, within the observed timeframe, both surgical approaches provide reliable retinal stability.

Despite notable advancements in improving the accuracy of intraocular lens power calculations during combined phacovitrectomy, refractive outcomes remain variable across studies, underscoring the persistent difficulty of achieving optimal intraocular lens power prediction in these cases.[10, 14, 15] Compared with A-mode ultrasonography, optical biometry generally provides superior precision. However, its accuracy in macula-off RRD must be interpreted cautiously and cross-checked with the fellow eye's axial length and refraction.[16-18] Although refractive outcomes were not the primary endpoint in this study, the absence of patient-reported refractive complaints and consistent postoperative visual improvement suggest that any potential refractive shift was minimal and clinically insignificant.

Patients who undergo phacovitrectomy for vitreomacular abnormalities including epiretinal membrane, macular hole, and RRD have been shown to experience a postoperative shift toward myopia.[6, 19, 20] In the present study, refractive outcomes were not systematically evaluated, as the primary focus was on visual acuity and anatomical reattachment. Nevertheless, patients were closely followed for three months post-operatively, during which time the gas tamponade was fully absorbed. While silicone oil removal was not performed in this cohort, the structured follow-up and timely resolution of the intraocular tamponade likely facilitated visual recovery and may explain the minimal impact on refractive outcomes. These findings likely reflect meticulous preoperative biometry, careful intraocular lens power selection, and standardized surgical techniques performed by experienced vitreoretinal surgeons.

The present study has several strengths, including the use of standardized surgical protocols performed by experienced vitreoretinal surgeons and a well-defined patient population limited to primary RRD. The analysis provides valuable real-world data on single session phacovitrectomy, confirming its safety and functional benefits when lens opacity impairs intraoperative visualization. However, several limitations should be acknowledged. The retrospective design and relatively small sample size may restrict the generalizability of the results. Moreover, patients were not stratified according to macular status (on/off), which could have influenced postoperative functional outcomes. An additional limitation is the relatively short follow-up period, which may underestimate late complications such as posterior capsular opacification or delayed retinal re-detachment, both of which can emerge months after the initial surgery. Future prospective studies with larger cohorts and longer follow-up periods are warranted to validate these findings.

In conclusion, combined phacovitrectomy and PPV alone provide excellent anatomical and functional outcomes in primary RRD. Both approaches are safe, predictable, and associated with low complication rates. Careful preoperative planning, including accurate biometry and intraocular selection, supports reliable visual recovery, whereas structured postoperative follow-up ensures optimal outcomes. In addition, combined surgery may reduce the need for a second operation, thereby limiting anesthesia exposure and shortening overall recovery time, which can ease the patient's postoperative burden. The surgical strategy can be individualized on the basis of lens status without compromising efficacy, offering flexible and effective options for patients with primary RRD.

Statement of ethics

The study was conducted in accordance with the Declaration of Helsinki and approved by the institutional ethics committee (approval number: 386, date:19.09.2025). All participants were informed in detail about the study's purpose and procedures, and written informed consent was obtained from each participant in accordance with the Declaration of Helsinki.

genAI

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Conflict of interest statement

The authors declare that they have no conflict of interest.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Author contributions

Concept:Ş.C.İ and C.Y.; Design: S.K. and Ş.C.İ.; Supervision: Ş.C.İ. and C.Y.; Resource: S.K. and Ş.C.İ.; Data Collection and/or Processing: S.K., Ş.C.İ., and M.K.; Analysis and/or Interpretation: S.K., Ş.C.İ., M.K., and C.Y.; Literature Search: S.K. and M.K.; Writing: : S.K., Ş.C.İ., M.K., and C.Y.; Critical Reviews: Ş.C.İ., and C.Y.

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