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# Three-year results of combined pars plana vitrectomy and phacoemulsification in diabetic vitreous hemorrhage

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## ABSTRACT

**Aim:** The purpose of this study was to evaluate the efficacy and safety of complications following combined pars plana vitrectomy and phacoemulsification surgery of the eyes for the management of vitreous hemorrhage due to proliferative diabetic retinopathy as well as pronounced cataracts.

**Material and Method:** Phacoemulsification and 23G pars plana vitrectomy procedures were performed for the management of vitreous hemorrhage and cataracts. Age, gender, best-corrected visual acuity before and after surgery, and intra- and post-operative complications were recorded in patients with cataracts who underwent surgery due to vitreous hemorrhage.

**Results:** A total of 40 eyes of 40 patients, 22 females (55%) and 18 males, were included in the study. The mean age was 58.7±7.1 (44–76) years. Logmar visual acuity changed from a mean of 2.82±0.5 preoperatively to a mean of 0.7±0.6 postoperatively. Visual acuity increased in 38 eyes (95%) postoperatively. No reduction in visual acuity was observed in any eye. Complications associated with surgery included transient intraocular pressure increase (12 eyes), hyphema (2 eyes), posterior capsule rupture (1 eye), anterior chamber fibrin exudation (4 eyes), neovascular glaucoma (1 eye), vitreous hemorrhage (4 eyes), retinal detachment (1 eye), and posterior capsule opacification (2 eyes).

**Conclusion:** It was found that combined phacoemulsification and PPV surgery was safe and effective in patients with proliferative diabetic retinopathy. Combined phaco-vitrectomy is a reliable method with a minimum complication profile and prevents the need for subsequent cataract surgery.

**Keywords:** Diabetic retinopathy, cataract, phacoemulsification, vitrectomy

## INTRODUCTION

Cataract and vitreoretinal diseases can coexist, especially in the elderly population. In combined cases, when vitreoretinal surgery is performed first, the presence of a cataract may make it difficult to visualize the fundus during vitreoretinal surgery, and contact with the lens during the surgical procedure is a potential risk for cataract progression. Especially in cases that require extensive cleaning of the vitreous floor, such as proliferative vitreoretinopathy, the possibility of contact with the thickened lens due to aging increases (1). In the two-year period after pars plana vitrectomy (PPV) surgery, cataract development has been reported at rates as high as 17%-80% (2-3). When silicone oil is used as a buffer, this rate rises to 100% (4). In addition, the risk of zonular dialysis, excessively mobile posterior capsule, and posterior capsule rupture increase in cataract surgery performed in vitrectomized eyes because there is no vitreous support (5-6).

The simultaneous removal of the lens with vitreoretinal surgery allows rapid visual recovery in cases with the coexistence of cataract and vitreoretinopathy but also increases cost-effectiveness (7-9). Although the prevalence of combined phacoemulsification and pars plana vitrectomy surgery in the treatment of cataract-related vitreoretinal disorders has been shown in many studies (10-16), there are few studies in the literature reporting the long-term results of combined therapy (17-18).

In this study, we presented the three-year results of patients who underwent combined pars plana vitrectomy and phacoemulsification surgery with the diagnosis of diabetic vitreous hemorrhage.

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## MATERIAL AND METHOD

The study was initiated with the approval of the Gaziantep Islam Science and Technology University Non-interventional Clinical Researches Ethics Committee (Date: 07.06.2022, Decision No: 113.17.02). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Medical records of patients who underwent PPV with phacoemulsification for vitreous hemorrhage due to proliferative diabetic retinopathy (PDR) and accompanying cataract between May 2018 and January 2019 were retrospectively reviewed. Before surgery, patients were informed about possible complications. Informed written consent was obtained from all patients. All surgeries were performed by the same surgeon (MFK).

The charts of the patients were evaluated. Patients with incomplete records and less than 3 years of follow-up were excluded. Preoperative and postoperative visual acuity, slit-lamp biomicroscopy, intraocular pressure (IOP) measurements, and indirect ophthalmoscopy findings were recorded. When the fundus could not be visualized, ultrasonography was performed to evaluate the vitreous and retina. Visual acuity was assessed using Snellen visual acuity and converted to the logarithm of the minimum resolution angle value (logMAR) for statistical analysis.

Oculus SDI Inverter 2 (OCULUS Surgical, Inc. Port St. Lucie, USA), in conjunction with Oculus BIOM 2, was used for retinal imaging. Surgical procedures were performed under general anesthesia. PPV was applied first after phacoemulsification. In all patients, triple accesses were performed with the transconjunctival 23 G vitrectomy technique before phaco. In phakic eyes, an inferior temporal sclerotomy was made with an MVR blade at a distance of 4 mm from the limbus, and in pseudophakic and aphakic eyes, 3.5 mm from the limbus, and two sclerotomies from the superior nasal and superior temporal regions, one for the light source and the other for the vitrectomy probe. All phaco accesses were made with a 2.8 mm clear corneal incision. Core and peripheral vitrectomy were performed according to the needs of the cases. Additional surgical interventions such as endolaser photocoagulation, endocautery application, peeling of epiretinal membranes, tractional membranes, and application of intravitreal steroid or antivascular endothelial growth factor were performed according to indications. Silicone oil, air, or gas (C3F8) was used as a buffer. An intraocular lens (IOL) was placed. At the end of the surgery, tightness control was performed, and when necessary, the port entrances were closed with 8.0 vicryl.

Statistical analyzes were performed using the SPSS 16.0 package program (SPSS Inc, Chicago, IL, USA). All numerical data were expressed as median (minimum-maximum) or mean±standard deviation. All categorical variables were expressed as numbers and percentages (n, %). Wilcoxon test was used to compare variables. A value of $P < 0.05$ was accepted as the statistical significance level.

## RESULTS

Forty eyes of 40 patients were recorded. The mean age of the patients was 58.7±7.1 (44-76) years. There were 22 women (55%) and 18 men (45%). All patients had diabetes mellitus. Other than diabetes, 22 patients had hypertension as a systemic disease. Laser endophotocoagulation was performed in all eyes. For tamponade, silicone oil was injected in 16 eyes (40%), C3F8 gas was injected in 12 eyes (30%), and the air was injected in 2 eyes (5%).

Preoperative best corrected visual acuity (BCVA) was between 20/40 and 20/400 in five (12.5%) eyes and between 20/400 and light perception in 35 (87.5%) eyes. The mean preoperative logMAR visual acuity changed from 2.82±0.5 to 0.7±0.6 postoperatively. This difference was statistically significant ($p= 0.002$). BCVA increased in 38 eyes (95%) postoperatively. At 3 years postoperatively, BCVA was 20/200 or better in 28 eyes (70%) and 20/40 or better in 8 eyes (20%). It was 10/200 in both eyes. Visual acuity in both eyes was at the level of hand movements and remained unchanged after surgery (**Table 1**). Optic nerve atrophy was present in both of these two cases, one of which was secondary to neovascular glaucoma. No decrease in visual acuity was observed in any eye.

**Table 1.** BCVA distribution before and after surgery

| BCVA (logMAR) | Preoperative | Postoperative |
|---|---|---|
| 0-1 | 5 (12.5%) | 36 (90%) |
| 2-3 | 35 (87.5%) | 4 (10%) |

BCVA: Best corrected visual acuity; logMAR: logarithm of the minimum resolution angle value

Posterior capsule rupture (2.5%) was observed in only one eye as an intraoperative complication. Postoperative complications are given in **Table 2**. Postoperative transient intraocular pressure (IOP) increase (< 24 mmHg) was observed in 12 eyes (30%), but all were medically controlled with topical antiglaucomatous drugs. Moderate transient vitreous hemorrhage (10%) was observed in 4 eyes. All resolved within an average of two weeks without surgery. Retinal detachment requiring reoperation developed in one patient (2.5%) three months after primary surgery. Fibrin exudation (10%) in the anterior chamber (AC) was observed in four eyes and hyphema in two eyes (5%). These findings also regressed with appropriate treatment. No complications related to endophthalmitis or intraocular lens (IOL) were observed in any of the patients.

**Table 2.** Intraoperative and postoperative complications

| Complications | Patients, n (%) |
|---|---|
| Posterior capsule tear | 1 (2.5%) |
| Transient increase in IOP | 12 (30%) |
| Hyphema | 2 (5%) |
| Neovascular glaucoma | 1 (2.5%) |
| Vitreous hemorrhage | 4 (10%) |
| Fibrin exudation in the AC | 4 (10%) |
| Retinal detachment | 1 (2.5%) |
| Posterior capsule density | 2 (5%) |

IOP: Intraocular pressure, AC: Anterior chamber

## DISCUSSION

In this study, it was found that combined pars plana vitrectomy and phacoemulsification surgery provided a significant improvement in visual acuity in diabetic vitreous hemorrhage, and acceptable complications were observed in the 3-year follow-up, consistent with the literature.

Cataract is a common condition in eyes with PDR. In addition to changing the visual acuity of the patients, it also causes the surgeon to distort the vision during vitreoretinal surgery. Although it is reported in the literature that combined surgery is mostly more advantageous and preferable, there is no consensus yet on leaving the patient phakic during pars plana vitrectomy or performing combined surgery (7-8, 16).

Many advantages of combined surgery have been reported. The visibility of the posterior pole is better during vitrectomy. It provides early visual rehabilitation after surgery. It is more comfortable for the patient and also offers advantages such as cost-effectiveness. This method also allows for a detailed vitreous floor cleaning surgery (19). Pars plana vitrectomy with cataract surgery is especially important in cases where cataracts and vitreoretinal disorders are seen together. There are studies showing that combined PPV and phaco surgery are safe and effective. (20-22). In addition, no significant difference was observed in the studies when combined and sequential procedures were compared in terms of postoperative visual outcome (23, 24).

In addition to the above-mentioned advantages of combined surgery, some disadvantages are also known. Capsulorhexis may be difficult to do because the red reflex is weak. Difficulties in visualization may increase the risk of posterior capsule rupture, increasing the risk of postoperative neovascular glaucoma. Manipulations during posterior segment surgery may cause corneal wound leakage and anterior chamber loss, which may result in prolonged surgical time. Miosis, bleeding from anterior segment structures, folds in Descemet's membrane, and corneal edema after cataract extraction, intraocular lens-related prismatic effects, and unwanted light reflections during vitreoretinal surgery, iris capture in patients with tamponade, postoperative anterior chamber inflammation and diffuse fibrin formation are potential limitations of combined surgery. (20-21, 24-29).

Yang et al. (30) in a study in which they compared the results of combined and sequential phacoemulsification and PPV surgeries in patients with PDR, it was found that BCVA improved in 18 (62.1%) eyes, remained the same in 8 (27.6%) eyes, and decreased in 3 (10.3%) eyes in the combined surgery group. , on the other hand, reported improvement in 7 eyes (58.3%), remained the same in 4 (33.3%) eyes and decreased in 1 (8.3%) eye in patients who underwent sequential surgery. In another study, in which the results of 91 eyes that underwent pars plana vitrectomy with phacoemulsification and intraocular lens implantation were shared, it was shown that postoperative BCVA improved significantly compared to preoperatively ($p<0.001$). The authors reported that BCVA increased by 61%, remained stable at 24%, and decreased by 15% (18). In another study reporting the results of combined PPV and phacoemulsification in the treatment of vitreous hemorrhage in patients with proliferative diabetic retinopathy, Canan et al. (31) reported that postoperative BCVA improved in 79 (92.9%) eyes, remained unchanged in 6 (7.1%) eyes, and no decrease in visual acuity was observed in any eye. In our study, similar to the literature, postoperative BCVA increased in 38 (95%) eyes and remained unchanged in only two (5%) eyes. No decrease in visual acuity was observed in any eye.

Intraoperative and postoperative complications of combined surgery have generally been reported at acceptable levels. Canan et al. (31) reported intraoperative posterior capsule rupture in one eye and transient corneal edema in 5 eyes in combined surgery. Similarly, posterior capsule rupture developed in only one eye (2.5%) in our study. Transient increase in IOP, corneal epithelial defects, hyphema, vitreous hemorrhage, retinal tears, and retinal detachment are generally reported among the postoperative complications of combined surgery (30-32).

The rate of recurrent bleeding in patients with posterior capsular opacity diabetic vitreous hemorrhage has been reported to be between 12% and 63% in publications (33-37). In our study, moderate vitreous hemorrhage was observed in 4 eyes (10%). All resolved within an average of two weeks without surgery. Neovascularization of the iris is a well-known complication of PDR. In this study, one patient had preoperative neovascular glaucoma that did not improve after surgery.

A transient increase in IOP may occur after combined surgery. The rate of transient IOP increase has been reported between 9.7-25% in various publications

(28,38). We observed a transient increase in IOP in 30% (12 eyes) of the patients. IOP returned to normal levels in all patients with antiglaucomatous therapy. We speculate that this transient increase in IOP may be due to viscoelastic that was not completely aspirated at the end of surgery.

Güven et al. (18) In their 3-year follow-up, 57 eyes with combined surgery required additional treatment, of which 17.6% had antiglaucomatous treatment, 16.5% had silicone oil removal and/or PPV repeated, 16.5% had intravitreal drug injection and 1.1% had IOL reposition. They have stated. In our study, retinal detachment requiring reoperation developed in only one patient (2.5%) three months after primary surgery.

There are some limitations of our study. First, due to the retrospective design, we only included patients with complete charts, which may have created a partial selection bias. Secondly, our sample size was relatively small since we were the only center. Despite these limitations, to our knowledge, there are few studies in the literature reporting long-term results of combined therapy. In addition, we think that it would be beneficial for the centers to present their own experiences in reaching a certain level of scientific evidence and would be valuable in the preparation of treatment algorithms.

## CONCLUSION

Combined pars plana vitrectomy and phacoemulsification surgery seem safe and effective in diabetic vitreous hemorrhage. Eliminating the need for a second surgery for cataract extraction also provides benefits in terms of both complication risk and cost. Given the advantages of the procedure, we believe that combined surgery can be safely performed in suitable patients.

## ETHICAL DECLARATIONS

**Ethics Committee Approval:** The study was initiated with the approval of the Gaziantep Islam Science and Technology University Non-interventional Clinical Researches Ethics Committee (Date: 07.06.2022, Decision No: 113.17.02).

**Informed Consent:** Because the study was designed retrospectively, no written informed consent form was obtained from patients.

**Referee Evaluation Process**: Externally peer-reviewed.

**Conflict of Interest Statement:** The authors have no conflicts of interest to declare.

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