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Original Article

The Effect of Combining Scleral Buckle Surgery with Pars Plana Vitrectomy for Treatment of Recurrent Retinal Detachment Secondary to Proliferative Vitreoretinopathy

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Abstract

Objectives: The objectiove of the study is to evaluate and compare the outcomes of pars plana vitrectomy (PPV) and PPV combined with scleral buckle (SB) in vitrectomised cases with recurrent retinal detachment (RD) and to analyze the effects of adding SB to the procedure.

Methods: Patients with recurrent RD due to grade C proliferative vitreoretinopathy (PVR) were included in this retrospective comparative case series. Patients who underwent re-PPV with or without SB were included and two groups (re-PPV; re-PPV+SB) were compared in terms of anatomical and functional success.

Results: Sixty-five cases were included in the study: 32 underwent re-PPV and 33 underwent re-PPV+SB procedures. Reattachment was achieved in 59.4% of the re-PPV group versus 81.8% of the re-PPV+SB group (p=0.047). Although preoperative BCVA was worse in the re-PPV+SB group (p=0.005), postoperative BCVA at the last visit was similar in both groups (p=0.065).

Conclusion: In the treatment of recurrent RD with grade C PVR, combining the SB procedure with PPV contributes to anatomical and functional outcomes.

Keywords: Pars plana vitrectomy, Proliferative vitreoretinopathy, Retinal detachment surgery, Scleral buckle, Vitreoretinal surgery

Introduction

Proliferative vitreoretinopathy (PVR), known as the most common cause of failure of primary RD repair, is an inflammatory response to the repair of the retinal tear, which can be accompanied by cellular proliferation and membrane formation in the epiretinal, subretinal, and vitreous areas (1,2). The anatomical success rates of surgery for recurrent retinal detachment (RD) with PVR are lower (3-5). Today, there are two different surgical methods in the treatment of recurrent RD: pars plana vitrectomy (PPV) and SB. Both surgical methods are used separately or in combination (6).

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Choosing between the techniques is still controversial, as PVR remains a challenging situation for vitreoretinal surgeons. There are few studies that have only evaluated cases with PVR, excluding other etiological causes of recurrent RD (7-9). We considered that in cases of recurrent RD caused by PVR, intensifying the inferior quadrant and causing traction, combining SB with PPV will reduce the effect of tractions, support the inferior quadrant, and provide a less invasive vitreoretinal surgery. In this study, we aimed to investigate the results of adding SB to PPV in the treatment of recurrent RD in patients with PVR.

Methods

Data were obtained through a retrospective review of the medical records of patients who underwent re-PPV or re-PPV+SB for recurrent RD between 2015 and 2018. The study protocol was approved by the Clinical Studies Ethics Committee of the University of Health Science Istanbul Taksim Training and Research Hospital (Approval no: 49) and adhered to the ethical principles of the Declaration of Helsinki.

Sixty-five cases who underwent PPV for primary RRD and developed recurrent RD due to grade C PVR were included in this study. The cases underwent vitrectomies only or combined vitrectomies with SB and were divided into two groups according to the surgical technique performed: the re-PPV and re-PPV+SB groups. The surgeries were performed by multiple experienced surgeons and each surgeon chose the surgical technique according to his approach and discretion, based on their personal experience and the surgical methods they are used to.

The classification of RD with PVR was made according to the classification and grading of PVR published by the Retina Society Terminology Committee in 1983 (9). Patients older than 18 years with grade C PVR were included. Patients who were diagnosed with non-primary RRD detachment underwent scleral buckling, retinotomy, or retinectomy in the first surgery. Those with early grade (A, B) PVR, with recurrent detachment due to macular hole, the presence of intravitreal hemorrhage, choroidal detachment, the presence of vascular retinopathy or neovascularization, a history of trauma or glaucoma surgery, the presence of aphakia and with follow-ups of less than a year were excluded.

Age, gender, ocular and systemic disease history, and the interval between primary surgery and recurrent RD of all cases were recorded. The best-corrected visual acuity (BCVA) (logarithm of the minimum angle of resolution), intraocular pressure (IOP) values measured by Goldmann applanation tonometry, slit-lamp microscopy, and fundus examination findings were noted. The absence of recurrent RD at least 6 months following tamponade removal with a single surgical intervention was accepted as an anatomical success.

Surgical Technique

Pars plana vitrectomies were performed using a 23-gauge three-port system and non-contact wide-angle visualization for re-detachment surgery. In cases of silicone oil (SiO), removal of SiO and cataract surgery with phacoemulsification were performed when necessary. If there was peripheral residual vitreous, it was removed, detachment of posterior hyaloid was checked and then epiretinal and subretinal PVR membranes were removed. In cases where retinal stiffness persisted despite the removal of the membranes, retinal relaxation was performed with sufficient retinotomies and retinectomies. After the retina was reattached with perfluorocarbon and air-fluid exchange, combined with internal drainage of subretinal fluid, all retinal breaks were surrounded by laser retinopexy using endo photocoagulation. SiO or gas tamponade was injected at the end of the surgery.

Scleral buckle (SB) surgery was performed before PPV or during intraocular surgery with suspended vitrectomy. Conjunctiva and tenon were dissected 360 degrees around the limbus. A 2.2-mm silicone band was used for 360-degree encircling SB. The silicone band was sutured to the sclera with 5/0 dacron sutures. Then, PPV steps were applied in order and the operation was terminated.

Statistical Analysis

Descriptive statistics were used to describe the study population characteristics. Continuous data were expressed as mean, standard deviation (SD), median and minimum-maximum. The distribution normality of the variables was tested using the Kolmogorov-Smirnov test. The Mann–Whitney U test was used in the analysis of quantitative independent data. Categorical data were expressed as counts and proportions and were analyzed with chi-square or Fisher's exact tests. Statistical analysis was performed using SPSS 20.0 software (IBM Corp., Armonk, NY, USA), and values of $p<0.05$ were considered statistically significant.

Results

Sixty-five consecutive cases were included in the study; 32 underwent re-PPV and 33 underwent re-PPV combined with SB procedures. There was no significant difference between the two groups in terms of gender but age was significantly lower in the re-PPV+SB group ($p=0.006$) (Table 1). The average duration of follow-up was 16.6±6.4 months. Although the interval between the first vitreoretinal surgery and the diagnosis of recurrent RD was shorter in the re-PPV group, it was not statistically significant (re-PPV = 80.1±46.4 vs. re-PPV+SB = 110.9±71.8 days) ($p=0.208$).

Preoperative PVR grade was observed to be significantly more advanced in the re-PPV+SB group ($p=0.023$). The location of recurrent RD was predominant in the inferior quadrant in both groups ($p>0.05$). Macular involvement was seen

Table 1. Demographic features of the cases and clinical data related to primary PPV surgery

	re-PPV Group (n=32)	re-PPV+SB Group (n=33)	p
Age			
Mean±SD, years	63±8.8	50.3±18.5	0.006*
Gender			
Female/Male	10 /22	15 /18	0.239
Number of break			
Single	21	15	0.196
Multiple	3	8	
Giant Tear	3	3	
Re-detachment time following surgery			
Mean±SD, days	80.1±46.4	110.9±71.8	0.208

*: Statistically significant; PPV: Pars plana vitrectomy; SB: Scleral buckle; SD: Standard deviation.

in 8 cases (25%) in the re-PPV group and 17 cases (51.5%) in the re-PPV+SB group (p=0.028). Preoperative phakic and pseudophakic states of the cases with recurrent RD were similar in both groups (with 10/22 in the re-PPV group and 11/22 in the re-PPV+SB group) (Table 2).

The rate of anatomical success in the last follow-up visit was 59.4% (19/32) in the re-PPV group and 81.8% (27/33) in the re-PPV+SB group (p=0.047). Retinotomy/retinectomy rates are similar in both groups (Table 3). During the surgery,

Table 2. Clinical findings before recurrent retinal detachment surgery

	re-PPV Group (n=32)	re-PPV+SB Group (n=33)	p
PVR grade			
C1	10 (31.2%)	2 (6.1%)	0.023*
C2	8 (25.0%)	8 (24.2%)	
C3	14 (43.8%)	23 (69.7%)	
Macular status			
Off	8 (25.0%)	17 (51.5%)	0.028*
On	24 (75.0%)	16 (48.5%)	
Lens status			
Phakic	10 (31.2%)	11 (33.3%)	0.857
Pseudophakic	22 (68.8%)	22 (66.6%)	

*: Statistically significant; PPV: Pars plana vitrectomy; SB: Scleral buckle; PVR: Proliferative vitreoretinopathy.

Table 3. Intraoperative and postoperative characteristics of patients in each group

	re-PPV Group (n=32)	re-PPV+SB Group (n=33)	p
Retinal re-attachment			
Success	19 (59.4%)	27 (81.8%)	0.047*
Retinotomy/Retinectomy			
Present	16 (50.0%)	17 (51.5%)	0.903
Tamponade			
SiO 1000 cSt	17 (53.1%)	14 (42.4%)	0.291
SiO 5000 cSt	9 (28.1%)	16 (48.5%)	
C3F8	5 (15.6%)	3 (9.1%)	
SF6	1 (3.1%)	0 (0.0%)	
IOP increase			
Present	11 (34.4%)	7 (21.9%)	0.266

*: Statistically significant; C3F8: Perfluoropropane; cSt: Centistokes; IOP: Intraocular pressure; PPV: Pars plana vitrectomy; SB: Scleral buckle; SF6: Sulfur hexafluoride; SiO: Silicone oil.

phacoemulsification and IOL implantation were performed in 7 cases (21.9%) in the re-PPV group and 3 cases (9.1%) in the re-PPV+SB group. SiO was used for 56 of 65 patients while gas tamponade was used for the 9 patients. Recurrent RD was observed in 8 of 31 eyes filled with 1000 cst SiO, 7 of 25 eyes filled with 5000 cst SiO, and 4 of 9 eyes filled with gas tamponade. No significant correlation was found between tamponade used and recurrent RD development (p=0.604).

Postoperative IOP increase was encountered in 11 of the eyes at an average of 14.1±2.1 days after the surgery in the re-PPV group, and in 7 of the eyes in the re-PPV+SB group at an average of 3.1±2.3 days after the surgery (p=0.215). All eyes that showed an IOP increase responded to antiglaucomatous medications. The mean IOP was 14.6±4.0 mmHg in the re-PPV group and 13.9±5.8 mmHg in the re-PPV+SB group in the last control (p=0.345). Although BCVA was better in the re-PPV group in preoperative and postoperative visits in the first 6 months, BCVA values were statistically similar in both groups at the last visit (p=0.065) (Table 4).

Discussion

Although innovations in surgical techniques have significantly increased anatomical success in primary RRD treatment, recurrent RD develops in 5–11% of cases due to PVR (5,6,10). Vitrectomy techniques are routinely employed to reattach the retina associated with extensive intravitreal, preretinal, and subretinal membranes due to PVR. SB can increase the tamponade effect of SiO on the inferior retina, as it creates

Table 4. Baseline and postoperative best corrected visual acuities in each group

	re-PPV Group (n=32) (mean±SD)	re-PPV+SB Group (n=33) (mean±SD)	p
Preop BCVA (logMar)	1.82±0.74	2.32±0.88	0.005*
Postop BCVA (logMar)			
1st month	1.58±0.79	2.08±0.69	0.008*
3rd month	1.47±0.78	1.98±0.72	0.007*
6th month	1.45±0.68	1.84±0.86	0.047*
Last visit	1.46±0.84	1.87±0.84	0.065

*: Statistically significant; BCVA: Best corrected visual acuity; logMAR: Logarithm of the minimum angle of resolution; SD: Standard deviation.

an area of contact by bringing the peripheral retina closer to the SiO bubble while relieving the traction on the retina circumferentially and supporting retinal breaks (11). Considering these effects of SB surgery, we wanted to investigate whether the combination of SB with PPV contributes to anatomical success in recurrent detachment cases with grade C PVR. In this study, we retrospectively analyzed the anatomical and functional success rates of re-PPV and re-PPV+SB outcomes according to the surgical approach.

Two age peaks have been described for RRD:(12) The incidence of RRD at a young age due to myopia and trauma is relatively high. The highest incidence rate is seen in the older cases at the age of 60–69 years. In our study, the mean age was 63±8.8 years in the re-PPV group and 50.3±18.5 years in the re-PPV+SB group (p=0.006). Although the frequency and severity of PVR were expected to be higher in younger cases, a decrease in success rate due to young age was not observed in the re-PPV+SB group comparing the re-PPV group.

The most common cause of surgical failure after primary RRD surgery is PVR (1,13). Although PPV is frequently preferred in PVR surgery, studies suggest PPV surgery combined with SB, especially in the presence of advanced PVR and inferior tears (7,14-16). Storey et al. reported that the anatomical success rate in the PPV+SB group was significantly higher than in the PPV group in patients with higher PVR risk during primary RD surgery (PPV+SB = 75%, PPV = 48.3%) (7). Churashov et al. compared the surgical procedures applied to recurrent inferior RD cases and analyzed the recurrence rates. They showed that after the treatment of the first recurrence, the second recurrence rate in the PPV+SB group was statistically significantly lower than that of the PPV (p=0.0012) (16). As far as we can determine, the study designed in the most similar way to our study was reported by Rush et al. They compared re-PPV and re-PPV+SB surgery in recurrent RD cases. Anatomical success was achieved in 65.2% in the re-PPV group and 74.3% in the re-PPV+SB group. Similar to our study, although they found the success rate higher in the re-PPV+SB group and a significant proportional difference between the success rates, they were not found a statistically significant difference between these methods (p=0.34) (15). In another study, Wei et al. compared re-PPV and SB surgery in vitrectomised, siliconized, recurrent inferior detachment cases. They emphasized that SB surgery and re-PPV had similar anatomical success rates (SB = 65.3% vs. re-PPV = 72.2%) in the early stages of siliconized recurrent inferior detachments, but the results of re-PPV were better in the late stage (SB = 47.8% vs. re-PPV = 73.3%) (17). In our study, which included recurrent RD cases with stage C PVR, the anatomic success rate was 81.8% in the group where we combined re-PPV and SB surgery and 54.9% in the group where we performed only re-PPV (p=0.047). Although the proportional difference between success rates is obvious, we found it statistically borderline significant. This result was obtained although the re-PPV+SB group contained more cases with more advanced PVR grade, younger cases expected to develop more severe PVR, and more cases with macular involvement than the re-PPV group (p=0.023, p=0.006, p=0.028, respectively). In terms of functional success, in our study, the preoperative and 6th-month BCVA values were better in the re-PPV group (p=0.005, p=0.047). However, BCVA values were similar in both groups at the last follow-up visit after (p=0.065). Also, Rush et al. did not report any difference between re-PPV and re-PPV+SB groups in terms of BCVA values postoperatively (15).

In PVR surgery, relaxing retinotomies or retinectomies may be needed for retinal reattachment (18). The decision to perform a relaxing retinectomy was made only after maximal removal of preretinal membranes had failed to adequately release the retinal traction. In eyes with PVR, retinal reattachment was reported in 76–90% of patients who underwent retinectomy during PPV (19-21). On the other side, retinotomy and retinectomies performed during vitrectomy can release RPE cells and trigger the development of postoperative PVR (22). The aim of adding SB to the re-PPV procedure was to increase success by reducing the need for retinotomy/retinectomy in severe cases. Although there were more intense PVR cases in the re-PPV + SB group in our study, similar rates of retinotomy/retinectomy were performed during surgery (re-PPV = 50%, re-PPV+SB = 51.5%, p=0.903). Previous studies have reported the advantages and drawbacks of phacoemulsification during PPV (23,24). A prospective randomized trial comparing PPV and phacovitrectomy in the treatment of phakic RRD reported similar retinal reattach-

ment rates and BCVA in both groups (25). Lens extraction may be performed during vitrectomy due to lens opacification, poor visualization of the posterior segment, the need for a more extensive vitrectomy and endolaser, and the potential challenges of subsequent phacoemulsification surgery due to loss of vitreous support (26). However, lens-sparing surgery can be performed in cases with the risk of postoperative inflammation and IOP elevation, the risk of postoperative refractive error especially in macula-off cases, the risk of increased epiretinal membrane in the long term, and most importantly the presence of accommodating clear lens or mild cataract (24,27). In our study, phacoemulsification and IOL implantation were performed in 7 patients in the re-PPV group and 3 patients in the re-PPV+SB group. The patients in the re-PPV+SB group were younger and therefore had more clear and non-thickened lenses. We performed less lens extraction in this group both because there was no obstacle to visualization of the peripheral retina during surgery and to preserve the accommodating lenses of younger patients.

The limitation of this study is caused by its retrospective design. Surgical indication criteria were similar in both groups. Some surgeons added SB to the procedure intending to reduce the rate of retinectomy applied and increase the success rate, while other surgeons did not. Thus, more severe PVR cases were collected in the re-PPV+SB group based on the surgeons' discretion. This is the only important difference between the two groups that could affect the anatomical outcome. This situation can be seen as a drawback affecting the similarity between the two groups in comparison. Nevertheless, the higher success rate in the re-PPV+SB group compared to the re-PPV group reveals the contribution of SB addition to PPV in recurrent RD surgery.

Disclosures

Ethics Committee Approval: The study protocol was approved by the Clinical Studies Ethics Committee of the University of Health Science Istanbul Taksim Training and Research Hospital (Approval no: 49) and adhered to the ethical principles of the Declaration of Helsinki.

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