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Our results of the quadruple procedure in combined vitrectomy

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Abstract

Purpose To reveal the outcomes of combined phacovitrectomy and supplementary scleral buckling (SB) surgery in patients with inferior break retinal detachment (RD) and proliferative vitreoretinopathy (PVR) ≥ Stage-C.

Methods In this retrospective study, 22 eyes of 22 patients who underwent surgery in Bozyaka Training and Research Hospital between 2018 and 2020 were included. The demographic data, follow-up duration, preoperative & postoperative best-corrected visual acuity (BCVA) (Snellen), intraocular pressure (IOP), final anatomic status, and the recurrence rate of RD were recorded from the files of patients.

Results The mean age of the patients was 56.9 ± 15.2 years, and follow-up duration was 16.6 ± 10.2 months. The internal tamponade was silicone oil (SO) in 16 patients (72.7%), and perfluoropropane (C_3F_8) in 6 patients (27.2%). The BCVA was improved from 0.0065 ± 0.014 to 0.26 ± 0.17 after surgery (p:0,0001), and IOP changed from 12.3 ± 2.5 mmHg to 15.3 ± 2.4 mmHg. During follow-up period, the recurrent RD was only found in one patient (4.50%) and following to second surgery, anatomical success was achieved in all of the patients (100%) in final visit.

Conclusion The combined phacovitrectomy and SB is an effective and reliable surgical method in patients with inferior quadrant RD and advanced stage PVR.

Keywords Pars plana vitrectomy, Phacoemulsification, Proliferative vitreoretinopathy, Scleral buckling

Introduction

Retinal detachment (RD) is a sight-threatening disease that may be caused by retinal breaks (rhegmatogenous RD), tractional membranes (tractional RD), or exudation (exudative RD). The rhegmatogenous RD (RRD) is the most frequent type of RD. The incidence of RRD varies between 6.3 and 17.9 per 100,000 [1], and if the retinal breaks give rise to the detachment of the neurosensorial retina and retina pigment epithelium, surgical treatment is required. The aim of the surgery is the closing of retinal breaks, and the absorption of subretinal fluid by decreasing the vitreoretinal tractional forces. Although scleral buckling (SB) is known as a first-line surgical method, the rate of PPV has increased as a first-line approach in recent years [2]. The SB is successful in 90% of cases, but in complicated cases with the retinal breaks behind the equator, giant retinal tears, and accompanying proliferative vitreoretinopathy (PVR), the pars plana vitrectomy is required together with internal tamponade [3]. The combined SB provides the decrease of residual vitreoretinal tractions and prevents the reopening of retinal breaks or the formation of the novel retinal tears. In recent years, it is proposed that the vitreous base is completely cleaned

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with the use of wide-angle imaging methods, and combined SB is not required [4]. The initial surgical method is chosen according to the surgeon's experience, or both SB and PPV may be combined at the same session. Adding SB to PPV is a recommended procedure in patients with inferior retinal breaks because of inadequate tamponade effect of silicone oil (SO) and intracular gases on inferior quadrants [5].

The dense opacities in the lens or dense cataracts may prevent the evaluation of the posterior segment, so the combined cataract and retinal surgery can be performed. There are several advantages of combined phacovitrectomy, and if it is not performed in the first surgery, a second surgery can be challenging later in the absence of vitreous support.

In the light of these information, the aim of the study is to present the results of combined phacovitrectomy and supplementary SB surgery in the patients with RD caused by inferior retinal breaks and PVR. To the best of our knowledge, this is the first study that reveals the results of quadruple procedure in patients with inferior quadrant RD.

Materials and methods

This retrospective-design study included 22 patients who had inferior quadrant break RD, and dense cataracts (equal or more than Grade 2 according to the Lens opacification classification system (LOCS) II grading system) [6], PVR more or equal to Grade C [7], and underwent a combined surgery including phacoemulsification, intraocular lens implantation, PPV, and SB in Bozyaka Training and Research Hospital between 2018 and 2020 by one surgeon (M.O.Z). We would also like to point out that, based on the literature and our observations, IOL power was calculated considering that the axial length increased by 1 mm. The files of patients were investigated, and the data about age, sex, follow-up duration, preoperative & postoperative best-corrected visual acuity (BCVA) (Snellen - decimals), intraocular pressure (IOP) (Goldmann applanation tonometer), final anatomic status, and the recurrence rate of RD were recorded. Furthermore, in postoperative period, no cataract complications occurred in any case. In patients where SO was used, SO was taken in the 6th month. The flatness of retina and the absence of retinal breaks were defined as anatomically successful. Exclusion criteria were the history of RD surgery, PVR less than Grade C, round hole detachments (that can be managed successfully with SB alone), giant retinal tears, traumatic eyes, and retinoschisis. Patients with follow-up less than 6 months were also excluded.

Ethics approval and consent to participate

The study was approved by the local Ethics Committee of Izmir Katip Celebi University (Registration number:2022/0012) and adhered to the tenets of the Declaration of Helsinki.Also, informed consent to participate was obtained from all of the participants in the study. Operated patients were informed one by one that only their pre- and post-operative quantitative data would be used and that no retinal photographs would be shared.

Surgical procedure

A standardized surgical procedure was applied to all patients. The surgery was initiated by performing regional anesthesia with a retrobulbar anesthetic injection (lidocaine 2% and bupivacaine 0.5%, 3–4 ml).

The phacoemulsification surgery was initiated with two side-port incisions with 20 G MVR knife, injection of combined viscoelastic (DisCoVisc, Alcon Laboratories, Inc., Fort Worth, TX, USA), opening the main incision with 2.75 mm knife, CCC, and phacoemulsification with quick chop technique. The intraocular lens (SA60AT, Alcon Laboratories, Inc., Fort Worth, TX, USA) was inserted into the capsular bag, and the remnant viscoelastic was cleared. The side-port incisions were closed with stromal hydration, and the surgery was ended after controlling no leakage.

In SB, a 360°, 2 mm, 41 size number silicone bandage was applied, and a discharge puncture was routinely performed during surgery. The bandage was fixed to the sclera under the rectus muscles in four quadrants following 360° limbal conjunctival peritomy.

The bimanual method was used in all patients. A twinlight chandelier was implanted between superotemporal and superonasal trocars after the placement of three trocars. PPV was performed in all patients using a 23-gauge EVA™ (Dutch Ophthalmic Research Center, DORC), Zuidland, Netherlands) system, using a wide-angle noncontact viewing system. A central/core vitrectomy was performed in all eyes. After core vitrectomy, 360° vitreorrhexis was applied to the vitreous tissue around the traction area, the appropriate area was determined at the vitreoretinal interface, and all the supraretinal membranes were peeled off from the retina, starting from this area. Intravitreous triamcinolone (40 mg/mL, Kenacort; Bristol-Myers Squibb, New York, NY) was used in all patients for better visualization of the posterior vitreous. The internal tamponade was selected randomly as perfluoropropane (C_3F_8) (12%) or SO. In eyes that were treated with SO) endotamponade, SO (Silikon TM 1000; Alcon, Fort Worth, TX, USA) was injected after fluid-air exchange. All surgeries were performed by one experienced surgeon (M.O.Z).

The postoperative treatment schedule was topical antibiotics (Moxifloxacin 0.5%, Vigamox, Alcon, Fort Worth, TX, USA) and topical corticosteroids (Dexamethasone 0.1%, Alcon Laboratories, Inc, Fort Worth TX) four times per day for one month.

The anatomical success was defined at the final visit according to the status of the retina as flat or detached. The main outcomes were BCVA, IOP, anatomical success, and the recurrence rate of RD at the final visit.

Statistical analysis

Statistical analyses were conducted using SPSS for windows version 23.0 (SPSS inc., Chicago, IL, USA). The categorical variables were tested using Fisher exact test and the frequency of variables were analyzed using Frequency tests. A p value < 0.05 was considered statistically significant.

Results

The study included 22 eyes of 22 patients (Female/Male:4/18). The mean age of the patients was 56.9 ± 15.2 (43–72) years, and the mean follow-up duration was 16.6 ± 10.2 (12–23) months. Posterior synechiae developed in 2 patients and improved with medical treatment. The internal tamponade that was applied at the end of surgery was SO in 16 patients (72.7%), and C_3F_8 in 6 patients (27.2%). The BCVA was improved from 0.0065 ± 0.014 to 0.26 ± 0.17 after surgery (p:0,0001), and the mean of IOP was 12.3 ± 2.5 mmHg in the preoperative period while it was 15.3 ± 2.4 mmHg in the postoperative period. During the follow-up period, the recurrent RD was found in one patient (4.50%) and the additional retinectomy procedure was applied in this patient by achieving final anatomical success. In the final visit, anatomical success was achieved in all of the patients (100%). Regarding our secondary outcomes, a significant improvement in BCVA was seen at the end of follow-up in all cases.

Discussion

In our series, the rate of anatomical success in patients who underwent PPV, gas tamponade, and SB for inferior break RD was 90.9%. Although about half of the RRD patients can be treated with only SB successfully, PPV with gas tamponade has been popular in the primary RRD treatment in recent years [8]. The classical SB is effective in most of the cases, except for complicated cases. In such cases, SB should be combined with PPV, and also cataract surgery if needed. The requirement of PPV is mandatory in patients with bullous detachments, vitreous opacity that prevents the visualization of the retina, and multiple, posterior retinal breaks [5]. However intraocular gas tamponades may support the temporal, nasal, and also superior quadrant retinal breaks with appropriate position, the inferior retinal breaks require alternative solutions [9], so the combined SB or the novel heavy SO tamponade could be preferred [10].

The placement of a SB may be challenging technically, prolongs operation time, and have possible complications such as refractive changes [11], diplopia or strabismus [12], explant intrusion or extrusion [13], infection [14], choroidal hemorrhage [15], and anterior segment ischemia [16]. However, these risks are negligible if superior results are achieved. Heimann et al. found a significant recurrence rate in patients who underwent alone PPV for inferior break RD and concluded that the short-acting internal tamponades are not sufficient to provide the flatness of inferior breaks in the absence of additional buckling. They also commented that the diagnosis of inferior breaks is delayed due to asymptomatic and less likely spontaneous absorption of subretinal fluid due to gravity [17]. The longer existence of retinal breaks may lead to intravitreal fibro cellular proliferations and redetachments, but this data is not proven [18]. Related to the possible complications of SB, the authors suggested that the vitrectomy alone provides acceptable success rates in RRD. Sharma et al. compared the outcomes of PPV in inferior and superior retinal breaks retrospectively and resulted no significant difference between groups [19]. In only inferior break RD, Wickham et al. reached the conclusion that there was no significant difference in the outcomes of PPV alone and combined PPV/SB [20]. The disadvantage of these studies is the retrospective design because it is not always possible to reach the data about PVR. In our series, all the patients had PVR that is equal to or more than stage C, so we have combined our surgeries with SB to prevent the vitreoretinal tractions due to PVR. Finally, the success of our result exceeded the previous reports.

This can be related to the additional cataract surgery. The dense opacities in the lens or dense cataracts may prevent the evaluation of the posterior segment. In such cases, combined cataract and retinal surgery could be performed. There are several advantages of combined phacovitrectomy such as better visualization of the peripheric retina for requirement the complete peripheric vitrectomy and endolaser photocoagulation, visualization of retinal breaks, and reduced rate of second surgery which can be challenging in the absence of vitreous support. In 'lens sparing' PPV surgeries, the complete vitreous cleaning may not always be achieved due to inadequate visualization of the peripheric retina. Even the lens removal and complete vitreous cleaning were performed, the rate of success was 90.5% with primer surgery in our series. We comment that all of the eyes had advanced stage PVR, and the success rate increased to 100% after repairing redetachment in a PVR stage D patient. Whether the removal of the lens may vary depending on the surgeon's preference and the condition of the lens, but in selected cases, the lens extraction is mandatory if there is a traumatic large detachment, requirement of extensive vitreous cleaning, the need for medium to long-term viscous tamponade, the lens

is already not clear [21]. On the other hand, there are a few disadvantages of lens removal such as postoperative refractive error due to misalignment of intraocular lens calculation, removal of accommodation function in no or mild cataract cases.

The most frequent complication after SB and PPV was reported as cataract [4]. In previous literature, the duration between PPV (no matter etiology) and cataract extraction varies between 16 and 24 months [22]. In fact, the formation of cataracts is even much earlier. The underlying mechanism of cataract formation is not well-understood [23]. The protective role of the vitreous has been defined by preventing the direct interaction between the lens and molecular oxygen in retinal vasculature [24]. The secondary surgery may be challenging in a vitrectomized and scleral-buckled eye due to hypotony, so the combined procedure including both retinal surgery and lens extraction seems reasonable. In previous studies, the final visual acuity after 'lens-sparing' PPV was found similar to the extracted lens at the end of follow-up [25], but the possible formation of the cataract after surgery should be discussed with the patient before surgery.

In our series, the rate of anatomical success after combined surgery was 90.9% with primary surgery and 100% at the final. There is no data about the combined surgery in inferior quadrant RDs, so we can compare our results with combined vitrectomy and phacoemulsification. Mora et al. found the anatomical success rate after combined PPV and phacoemulsification as 96.7% [21], while Haugstad et al. achieved anatomical success with the rate of 98.1% with only PPV, and 100% with combined PPV and SB [26]. Similar to our results, Ling et al. reported the anatomical success rate as 90.5% in primary RRD [27]. Tan et al. reported the primary anatomical success rate as 84.3% in the combined group (PPV + Fako), and 89.2% in the only PPV group [28]. Guber et al. detected retinal re-detachment in 10.1% of the patients [29]. In total, we recorded one case of recurrence, and resurgery was performed in this patient with SO tamponade. The failure after the first surgery was related to advanced PVR (stage D).

The difference between the efficacy of internal tamponades for complicated RDs was investigated in Silicone Oil Study and resulted that the effectiveness of SF_6 is less than SO and C_3F_8 while there was no difference between SO and C_3F_8 [30]. In this study, C_3F_8 and SO were used as internal tamponade in primary surgery, and SO was used in patient who had recurrence RD. The main advantage of the usage of C_3F_8 is no requirement of secondary surgery for reuptake and the absence of SO-related complications.

The limitation of the study was the relatively small sample size and the absence of a control group. The results can not be generalized to the general population due to the sample size. Although the study helded in a tertiary hospital that the retinal surgery is performed frequently, only the patients with inferior break RD and equal or above PVR-stage C were selected, and the number of the included cases were small.

In conclusion, the combined phacovitrectomy and SB is an effective and reliable surgical method in patients with inferior quadrant RD.

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Author contributions
M.Ö.Z and Y.Z.G: Writing original draft and ConceptuzualtionM.V, G.V.S and E.K: Analyzing data, collecting data and checking spelling and language of manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
The study was approved by the local Ethics Committee of Izmir Katip Celebi University (Registration number:2022/0012) and adhered to the tenets of the Declaration of Helsinki. Also, informed consent to participate was obtained from all of the participants in the study.
We have a retrospective ethical approval form. If you want, we can send you the pdf form.

Consent for publication
Not applicable.
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Competing interests
The authors have no financial interest to declare. The authors declare that there is no conflict of interest.

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