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Original Article / Özgün Araştırma

Scleral Buckling Versus Primary Vitrectomy in the Management of Retinal Detachment Associated with Mild Vitreous Hemorrhage

Hafif Derecede Vitreus Hemorajisinin Eşlik Ettiği Retina Dekolmanının Tedavisinde Skleral Çökertme ile Primer Vitrektominin Karşılaştırılması

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Summary

Objectives: The aim of this study was to compare the surgical impact of scleral buckling (SB) and pars plana vitrectomy (PPV) on the anatomic results and visual recovery in cases of rhegmatogenous retinal detachment with mild vitreous hemorrhage.

Materials and Methods: In this study, we included 78 eyes of 78 phakic patients who underwent primary surgery for rhegmatogenous retinal detachment complicated by mild vitreous hemorrhage (38 eyes by SB,40 eyes by PPV);all patients had been followed for longer than 6 months after surgery. The surgical outcome and the rate of complications were retrospectively compared. Mann-Whitney U-test and chi-square test were used for the statistical analysis.

Results: The reattachment rate after the first surgery was 78.9% (30/38) in the SB group and 95% (38/40) in the PPV group. The difference between the groups was statistically significant (p=0.035). Unseen retinal breaks in 4 eyes, malpositioned buckle in 2 eyes and insufficient closure of the break in 2 eyes of SB cases, as well as reopening of the original break in 2 eyes of PPV cases were the causes of failure. Visual improvement in the PPV group was significantly better than in the SB group in the third and sixth postoperative months (p<0.001 and p=0.026, respectively). Peroperative and postoperative complications were as follows: in the SB group-subretinal hemorrhage (5.2%), PVR of grade B or worse (10.5%), macular pucker (7.8%), and postoperative cataract (13%); in the PPV group-iatrogenic breaks (10%), lens damage (5%), PVR of grade B or worse (5%),macular pucker (5%), and postoperative cataract (35%).

Conclusion: Even though the high incidence of peroperative complications such as iatrogenic breaks or postoperative complications such as cataract formation was the major drawback, the results indicate that PPV performed to alleviate peripheral vitreoretinal tractions and clear vitreous hemorrhage offers better anatomic and functional results than SB in the management of rhegmatogenous retinal detachment associated with mild vitreous hemorrhage. *(Turk J Ophthalmol 2014; 44: 92-7)*

Key Words: Retinal detachment, scleral buckling, vitrectomy, vitreous hemorrhage

Özet

Amaç: Çalışmanın amacı hafif vitreus hemorajisi bulunan regmatojen retina dekolmanı olgularında skleral çökertme (SÇ) ile pars plana vitrektominin (PPV) anatomik ve görsel iyileşmedeki cerrahi etkinliklerinin karşılaştırılması.

Gereç ve Yöntem: Çalışmaya hafif derecede vitreus hemorajisi ile komplike olmuş regmatojen retina dekolmanı olan ve bu nedenle daha önce operasyon geçirmemiş 78 hastanın 78 gözü dahil edildi (38 göz SÇ, 40 göz PPV). Tüm hastalar postoperatif altı aydan daha uzun sürelerde izlendi. Cerrahi sonuç ve komplikasyon oranları retrospektif olarak karşılaştırıldı. İstatistiksel analiz için Mann-Whitney U ve Ki-kare testleri kullanıldı.

Bulgular: İlk cerrahi sonrasında SÇ grubunda %78,9 (30/38), PPV grubunda %95 (38/40) oranında retinal yatışıklık sağlandı. Gruplar arasındaki farklılık istatistiksel olarak anlamlıydı (p=0,035). Skleral Çökertme grubundaki dört gözde retinal yırtığın görüntülenememesi, iki gözde uygunsuz yerleşimli çökertmenin bulunması ve iki gözde yırtığın yetersiz kapanması, PPV grubunda ise iki gözde asıl yırtıkların tekrar açılması cerrahi başarısızlık nedenleriydi. Postoperatif üçüncü ve altıncı aylardaki görsel gelişim PPV grubunda SÇ grubuna göre anlamlı derecede daha iyi bulundu (p<0,001 ve p=0,026). Peroperatif ve postoperatif komplikasyonlar; SÇ grubunda, subretinal hemoraji (%5,2), B veya daha ileri derecede proliferatif vitreoretinopati (PVR) (%10,5), makular pucker (%7,8), postoperatif katarakt (%13), PPV grubunda ise iyatrojenik yırtıklar (%10), lens hasarı (%5), B veya daha ileri derecede PVR (%5), makular pucker (%5) ve postoperatif katarakt (%35) oranlarında görüldü.

Sonuç: İyatrojenik retinal yırtıklar ve postoperati ve katarakt gelişimi PPV olgularındaki en belirgin sorunlar olmasına karşın periferal vitreoretinal çekintilerin çözülebilmesi ve vitreus hemorajisinin temizlenebilmesi nedeniyle hafif derecede hemorajinin eşlik ettiği regmatojen retina dekolmanı olgularında PPV anatomik ve fonksiyonel olarak daha iyi sonuçlar göstermektedir. *(Turk J Ophthalmol 2014; 44: 92-7)*

Anahtar Kelimeler: Retina dekolmanı, skleral çökertme, vitrektomi, vitreus hemorajisi

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Introduction

Scleral buckling (SB) is currently regarded by most vitreoretinal surgeons as the preferred method for treating most primary rhegmatogenous retinal detachments (RRD)[1] despite inadvertent complications such as subretinal hemorrhage, extraocular muscle imbalance,[2] corneal contour changes,[3] chorioretinal circulatory disturbances,[4] and limitations in achieving early functional recovery.[5] A single operation is often successful in more than 90% of uncomplicated cases.[6,7]

On the other hand, pars plana vitrectomy (PPV) offers certain advantages over SB in that it affords a direct approach to vitreous traction especially in cases with large or deeply located tears. Kloeti[8] in 1983 and Escoffery et al.[9] in 1985 reported an excellent outcome of PPV in eyes with RRD caused by deeply located tears without proliferative vitreoretinopathy (PVR).

Although preoperative vitreous hemorrhage is assumed a PVR-inducing factor in RRD[10] and PPV today is certainly more widely accepted, some surgeons still remain conservative especially in RRD with vitreous hemorrhage that the retinal break (s) are visible. A number of reports have been published about surgical outcomes of primary PPV in RRD complicated with vitreous hemorrhage; however, to the best of our knowledge, there is no study comparing the surgical outcomes of the two approaches in the ophthalmic literature.

The goal of this study was to compare the surgical impact of SB and PPV on the anatomic results and visual recovery in cases of RRDs associated with mild vitreous hemorrhage.

Materials and Methods

Seventy-eight eyes of 78 patients underwent SB or PPV as the initial surgery for primary RRD associated with mild vitreous hemorrhage. All surgeries were performed between January 2006 and December 2009. All patients provided informed consent before surgery.

To evaluate the impact of these two surgical techniques on anatomic and visual recovery, only patients who met the following criteria were included in the analysis: the presence of RRD with retinal breaks associated with vitreous hemorrhage resulting from rupture of a peripheral retinal blood vessel and not obscuring the view of the fundus periphery (especially the retinal break region), optic disc and vascular structures (grade1- mild vitreous hemorrhage with visible fundus details). The degree of intravitreal hemorrhage was scaled according to the diabetic retinopathy vitrectomy study grading system (Table 1).[11] Excluding criteria were presence of vitreous hemorrhage obscuring the evaluation of the preoperative fundus (grade 2 or 3), retinal detachment due to giant retinal tears or trauma, aphakia, and PVR of grade C or greater. Finally, a total of 78 cases (38 SB and 40 PPV) met the criteria for data analysis.

Surgical Technique

Informed consent was obtained from all patients before surgery. The choice of one of the two procedures was based on the surgeon's preference. All of the patients were operated under peribulbar anesthesia. When SB was performed, preoperative bed rest and elevation of the patient's head was applied for a couple of days. During the surgery, chorioretinal adhesions were created with cryopexy around the retinal breaks. Segmental silicone sponge in combination with an encircling silicone band was used to support the peripheral retinal breaks in all cases. External drainage of subretinal fluid was performed in most eyes.

In PPV cases, a standard three-port PPV under binocular indirect ophthalmomicroscope (BIOM- Oculus Germany) was performed. Vitrectomy involved releasing vitreous traction at the region of flap tears following core vitrectomy, and an attempt was made to remove as much of the peripheral vitreous as possible in combination with scleral indentation. Perfluorocarbon liquid injection and fluid-air exchange were performed, and subretinal fluid was drained from the original tears. All retinal tears were treated by either endophotocoagulation or transscleral cryotherapy. The crystalline lens was removed only when it was cataracteous. Long-acting gas (C3F8) of 16% concentration was used for endotamponade in all cases.

Statistical analysis of visual functional outcome and retinal reattachment status was performed with data obtained only from patients with third- and sixth-month follow-up visits.

Visual acuity was measured with decimal visual acuity system. For statistical comparison, visual acuity was expressed as a logarithm of the minimum angle of resolution (logMAR) equivalents. The data were analyzed with Mann-Whitney U-test and chi-square test. A p-value of <0.05 was considered to be statistically significant.

Results

SB or PPV was performed in 78 eyes of 78 patients; 38 patients (18 right, 20 left eyes) underwent SB and 40 patients (18 right, 22 left eyes) - primary PPV. Of the 78 patients, 59% (46 of 78) were men and 41% (32 of 78) were women. The ages of the patients ranged from 17 to 71 years (mean±SD, 50.5±12.9 years). A retinal detachment that involved the macula was found in 27 eyes (71%) of the SB group and in 27 eyes (68%) of the PPV group. Multiple tears were noted in 6 eyes (15.7%) in the SB group and in 10 eyes (25%) in the PPV group. The tears were located anteriorly in all cases. Superior location of the breaks was found in 87% (33 of 38) of the SB group and in 85% (34 of 40) in the PPV group. The mean interval from the onset of symptoms to the initial surgery was 9.1±7.5 days in the SB group and 10.3±6.2 days in the PPV group.

The postoperative follow-up period ranged from 8 to 24 months (mean±SD, 15.5±5.2 months) in the SB group and from 6 to 15 months (mean±SD, 10.9±3.5 months) in the PPV group. There were no statistically significant differences in the baseline characteristics between the two groups except for the duration of the follow-up. The baseline characteristics of the 78 patients are summarized in Table 2.

In the PPV group, vitrectomy combined with phacoemulsification followed by intraocular lens implantation was performed in 8 eyes (20%). Long-acting gas (16% C3F8) was used in all patients.

The retina was reattached after the initial surgery in 78.9% of the SB group (30 of 38 cases) and in 95% of the PPV group (38 of 40 cases). The difference was statistically significant (p=0.035). In 8 eyes of the SB group in which the first operation failed in reattachment, the cause of the initial failure was unseen retinal breaks in 4 eyes, malpositioned buckle in 2 eyes, and insufficient closure of the break in 2 eyes. In 2 eyes of the PPV group in which the first operation failed in reattachment, the cause of the initial failure was reopening of the original break. At the final follow-up examination, all eyes (78 eyes) in both groups achieved retinal reattachment after one or more operations.

In the SB group, the incidence of intra- and postoperative complications was as follows: In 2 eyes (5.2%), subretinal hemorrhage occurred at the time of subretinal fluid drainage; postoperative visual acuity was not compromised. PVR of grade B or worse developed in 4 eyes (10.5%) within 2 weeks postoperatively. Macular pucker was noted in 3 eyes (7.8%); no further surgery was applied because the visual acuity was not impaired. Postoperative cataract developed in 5 eyes (13%) during the study period; 2 of 5 eyes underwent subsequent cataract surgery to treat the secondary visual impairment.

In 4 PPV cases (10%), iatrogenic breaks occurred during peripheral manipulation and were treated with endolaser photocoagulation. No retinal detachment attributable to these retinal breaks occurred. PVR of grade B or worse developed in 2 eyes (5%) within 2 weeks postoperatively. Macular pucker was noted in 2 eyes (5%); no further surgery was applied because of the minimal disturbance on visual acuity. Ocular hypertension was noted in 1 eye, but the IOP was controlled by a topical antiglaucoma drug in the postoperative period. Postoperative cataract developed in 14 eyes (35%) during the study period; 8 of 14 eyes required subsequent cataract surgery to treat the secondary visual impairment. Peroperative and postoperative complications are shown in Table 3.

In the SB group, at 3 months postoperatively, best-corrected visual acuity (BCVA) improved in 32 eyes (84%) and did not change in 6 eyes (16%). Visual acuity of 0.1 or better was achieved in 20 eyes (52%). Visual acuity of 0.4 or better was achieved in 4 eyes (10.5%).

In the PPV group, at 3 months postoperatively, BCVA improved in 38 eyes (95%) and did not changed in 2 eyes (5%). Visual acuity of 0.1 or better was achieved in 32 eyes (80%). Visual acuity of 0.4 or better was achieved in 14 eyes (35%).

Mean visual acuity at 3 months postoperatively was 1.09±0.47 logMAR (range, 0.2 and 2.1) in the SB group and 0.83±0.54 logMAR (range, 0.2 and 2.1) in the PPV group. The difference was statistically significant (p=0.01).

Mean visual acuity at 6 months postoperatively was 0.74±0.53 logMAR (range, 0.2 and 1.8) in the SB group and 0.71±0.44 logMAR (range, 0.2 and 2.1) in the PPV group. The difference was not statistically significant (p=0.93). Postoperative visual acuity of the study eyes is summarized in Table 4.

Mean visual acuity improvement at 3 months postoperatively was -0.29±0.53 logMAR (range, -1.10 and 0.90) in the SB group and -0.82±0.53 logMAR (range, -1.88 and 0.0) in the PPV group. The difference was statistically significant (p<0.001).

Mean visual acuity improvement at 6 months postoperatively was -0.64±0.67 logMAR (range, -1.80 and 1.40) in the SB group and -0.93±0.53 logMAR (range, -1.88 and 0.0) in the PPV group. The difference was statistically significant (p=0.026). Visual acuity improvement at the third and sixth months are summarized in Table 5.

Table 2. Baseline characteristics of the study patients (n=78)

Variables	Scleral Buckling	Primary Vitrectomy	p-value
Patients/eyes	38/38	40/40	
Age (years)			
Mean±SD	51.6±12.7	49.6±13.2	0.330
Range	17-69	19-71	
Sex [n (%)]			
Male	24 (63.2)	22 (55)	0.610
Female	14 (36.8)	18 (45)	
Visual Acuity			
Median (logMAR)	1.38±0.66	1.65±0.49	0.110
Range (logMAR)	0.3- 2.1	0.5- 2.1	
Status of lens [n (%)]			
Phakic	32 (84)	32 (80)	0.850
Pseudophakic	6 (16)	8 (20)	
Retinal Breaks			
Median	1.2	1.6	
Range	1-3	1-7	
Macula [n (%)]			
Attached	11 (29)	13 (32)	0.920
Detached	27 (71)	27 (68)	
Symptom to surgery interval	9.1±7.5	10.5±6.2	0.060
Mean±SD	2-30	3-30	
Range			
Duration of follow-up			
Mean±SD	15.5±5.2	10.9±3.5	0.001
Range	8-24	6-15	

Table 1. Intravitreal hemorrhage scaling according to the diabetic retinopathy vitrectomy study

Description	Grade
No vitreous hemorrhage	0
Mild vitreous hemorrhage with visible fundus details	1
Moderate vitreous hemorrhage with no visible fundus details but with an orange fundus reflex	2
Severe vitreous hemorrhage with no retinal details and no orange fundus reflex	3

Discussion

When vitreous hemorrhage is present in the setting of an acute PVD, the incidence of retinal tears is reported between 20 and 30%.[12,13] Vitreous hemorrhage due to rupture of a blood vessel at the site of a retinal break is common in eyes with an acute RRD. Sarrafizadeh et al. reported that surgery (vitrectomy with/or without SB) was required for RRD in 78% of their patients presenting with acute, spontaneous, nontraumatic posterior vitreous separation with dense vitreous hemorrhage.[14]

Mild preoperative vitreous hemorrhage was not reported as an independent risk factor for postoperative PVR in primary RRDs by some authors,[15] however, some others reported that the incidence of preoperative or postoperative PVR increases in the presence of preoperative vitreous hemorrhage in these eyes.[10,16,17] Therefore, RRD with preoperative vitreous hemorrhage may be assumed one of the complicated types of RRD.

In some cases, the vitreous hemorrhage is severe and prohibits effective visualization of the fundus. Bed rest, elevation of the patient's head, and bilateral patches often result in settling of the hemorrhage into the inferior vitreous cavity during a 1- to 5-day period.[18] If a retinal break that accounts for the configuration of the detachment can be seen, conventional retinal reattachment surgery is performed. If visualization is not adequate despite a trial of bed rest and patching, a PPV is performed combined with retinal reattachment surgery.

A few number of studies that report only the surgical outcomes of primary PPV or SB to treat RRD with vitreous hemorrhage have been published in the ophthalmic literature. In the presence of vitreous hemorrhage, a final anatomic success rate of 86.5% for primary PPV in RRD has been reported by Hoerauf et al.[19] Bonnet estimated a postoperative PVR rate of 30% after SB for RRD with vitreous hemorrhage.[10] However, to the best of our knowledge, to date, there is no study comparing the surgical outcomes of the two approaches in the ophthalmic literature. In this retrospective study including cases of RRD with mild vitreous hemorrhage, we observed a single-procedure success rate of 78.9% in the SB group and 95% in the PPV group. The difference was statistically significant (p=0.035). Following a second operation, our final reattachment rate was 100% in both treatment groups. Regarding complicated types of RRDs, in eyes with multiple tears, the initial reattachment rate was reported better in the PPV group (96.9%) than in the SB Group (69.9%).[20] The primary reattachment rate in eyes with complicated RRDs was found high and similar with both procedures.[21] Oshima et al. have reported a single-procedure success rate of 91% in both treatment groups in non-complicated RRDs.[22] And finally, in the SPR Study in which SB was compared with primary PPV in RRDs of medium complexity, the difference in primary reattachment rates was not statistically significant in the phakic subtrial.[23]

In our series, visual acuity improved in both treatment groups at the third- and sixth-month examinations. The visual improvement was better in the PPV group than in the SB group at three and six months (p<0.001 and p=0.026, respectively). There was a statistically significant difference in the BCVA at the third postoperative month (p=0.01). However, there was no statistically significant difference in the mean visual acuity at the sixth postoperative month (p=0.93). In the phakic subgroup of the SPR study, the mean BCVA change was reported significantly greater in the scleral buckling group than in the vitrectomy group. It is difficult to compare the visual results of primary vitrectomy with those of a conventional procedure because many preoperative factors including surgical indications,

Table 3. Peroperative and postoperative complications

Complication	Scleral Buckling (n=38) No. (%)	Vitrectomy (n=40) No. (%)	p-value (Chi-square)
Initial surgical failure	8 (21.1)	2 (5)	0.035
Intraoperative			
Iatrogenic retinal breaks	0 (0)	4 (10)	0.045
Subretinal hemorrhage	2 (5.2)	0 (0)	
Postoperative			
Macular pucker	3 (7.8)	2 (5)	0.670
PVR	4 (10.5)	2 (5)	0.425
Ocular hypertension	0 (0)	1 (2.5)	
Cataract progression	5 (13)	14 (35)	0.025

Table 4. Postoperative visual acuity of the study eyes at the third and sixth months.

Visual Acuity (logMAR)	Scleral Buckling Median (Min-Max)	Vitrectomy Median (Min-Max)	p-value (Mann-Whitney U-test)
Postoperative 3mo	1.1 (0.2-2.1)	0.7 (0.2-2.1)	0.010
Postoperative 6mo	0.55 (0.2-1.8)	0.6 (0.2-2.1)	0.930

Table 5. Visual acuity improvement at the third and sixth months.

Visual Acuity Improvement (logMAR)	Scleral Buckling Median (Min-Max)	Vitrectomy Median (Min-Max)	p-value (Mann-Whitney U-test)
Postoperative 3mo	-0.4 (-1.1-0.9)	-0.95 (-1.88-0)	< 0.001
Postoperative 6mo	-0.65 (-1.8-1.4)	-1.00 (-1.88-0)	0.026

and postoperative factors such as corneal refractive changes,[3,24] choroidal circulation disturbances,[4] and extraocular muscle imbalance[2] may be quite different between these two techniques. However, in the present series, we found that primary PPV was more effective than SB for achieving early visual recovery. In cases treated with SB surgery, although retinal reattachment can be funduscopically observed after external subretinal fluid drainage, some subretinal fluid may still remain in the submacular space because of its high viscosity. During the delay in fluid absorption, photoreceptor degeneration or apoptosis at the macula may result in poor visual recovery. In addition, in the presence of vitreous hemorrhage, cleaning of the vitreous gel from the hemorrhage may take time with a delayed visual recovery in SB procedure when comparing with primary PPV. This may be confirmed as there was no statistically difference between the BCVA of the two groups at the sixth month examination.

In our series, the encircling buckle was not used in the PPV group. The use of an additional buckling procedure is considered to relieve traction caused by residual vitreous, which can cause the original breaks to reopen or create new breaks. But, even when encircling buckle is used, inadequate removal of the vitreous may cause residual vitreous contraction and reopening of the retinal breaks leading to retinal detachment. Vitreous hemorrhage may play a role as an additive causative factor in the anatomic failure by reopening the break with persistent traction.

No iatrogenic break occurred during the subretinal fluid drainage in the SB group. During PPV, iatrogenic tears occurred in 4 eyes (10%). The incidence of this complication was higher than that in previous studies in which the incidence of iatrogenic breaks ranged from 8% to 15%.[19-21,25] The effort to perform as much as possible vitrectomy for the vitreous hemorrhage close to the detached retina to prevent postoperative PVR may increase this complication. Endolaser photocoagulation was applied around the breaks to prevent postoperative retinal detachment and they did not affect the initial success rate.

Macular pucker was observed in 3 cases (7.8%) in the SB group and in 2 cases (5%) in the PPV group. Intraocular proliferative factors, such as retinal pigment epithelial cells and cytokines, can be directly eliminated during vitrectomy and additionally, laser photocoagulation is less invasive than cryoretinopexy to disperse viable retinal pigment epithelial cells. The difference however, was not statistically significant between the two groups (p=0.67). The incidence of this complication was comparable to that in previous studies.[26-28]

In our study, vitrectomy combined with phacoemulsification surgery was performed in 8 eyes (20%). Simultaneous hydrophobic acrylic IOL implantation was performed in all cases. In the follow-up period, postoperative cataract developed in 14 eyes (35%); 8 of 14 eyes required subsequent cataract surgery to treat the secondary visual impairment. When excluding 8 eyes in which cataract surgery was combined with vitrectomy, 44% of the eyes (14/32) developed postoperative cataract. Cataract progression is recognized as a major drawback of primary vitrectomy.[29] The incidence of nuclear cataract following vitrectomy in patients older than 55 has been reported to be very high.[23,30] For this reason, more surgeons today are performing simultaneous cataract surgery in patients over a certain age even though the patient may have a relatively transparent crystalline lens.

As one of the postoperative complications, PVR of grade B or worse developed in 4 eyes (10.5%) in the SB group and in 2 eyes (5%) in the PPV group. The difference was not statistically significant (p=0.425). The incidence of this complication in the SB group was comparable with previous reports including complicated RRDs[10,31] and extremely low in the PPV group compared with previous reports.[26,31] As the retinal detachment and proliferative changes occur together, PVR may be immediately induced especially in the presence of the vitreous hemorrhage. However, the development of the surgical instruments such as wide-field viewing systems and the increased use of cataract surgery combined with vitrectomy facilitate intraoperative viewing and safe manipulation at the vitreous base.

The limitation of the study is the small numbers in the study groups. A prospective trial with larger series is desirable to obtain an optimal information. Nevertheless, we think that the current study may give us some important information when comparing with the previous studies reporting only the surgical impact on the anatomic results and visual recovery of SB or vitrectomy procedures in RRDs complicated by mild vitreous hemorrhage.

In summary, the present series demonstrated that primary PPV offers better anatomic results and is more effective than SB in obtaining early visual recovery in RRD complicated by mild vitreous hemorrhage. Even though the high incidence of peroperative or postoperative complications such as iatrogenic breaks and postoperative cataract formation is the major drawback, PPV has some advantages over SB in eyes with RRD complicated by mild vitreous hemorrhage.

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