Anatomical Success of Combined Scleral Buckle and Pneumatic Retinopexy in Primary Retinal Detachment Surgery

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ABSTRACT

Purpose: To describe the effect of combination of pneumatic retinopexy (PR) procedure to scleral buckle (SB) on rhegmatogenous retinal detachment surgery.

Materials and Methods: A comparison study to 39 patients with rhegmatogenous retinal detachment who underwent SB (group 1) or combined SB and PR (group 2) between January 2014 and December 2014 was performed. Break location, macula status, visual acuity before and after surgery, break apposition, attachment of retina, and recurrence of RD were recorded.

Results: The single surgery attachment rate for group 1 and 2 was 90% and 100%, respectively. Lower incidence of redetachment was noted in the combined SB and PR group. (0% vs 2%, p=0.487). We found that in 2 patients with malpositioned buckle in group 2, the break was closed after tamponade with SF6 and laser photocoagulation. The visual acuity in one-month follow-up was significantly different between the two groups (P=0.017).

Conclusion: Combination of SB with PR may improved the attachment rate and may be used routinely especially for beginner ophthalmologist regardless precise localization of the on-break buckle placement.

Key Words: Pneumatic retinopexy, scleral buckling.

ÖZ

Amaç: Yırtıklı retina dekolmanı cerrahisi skleral toka (SB) pnömatik retinopeksi (PR) prosedürün kombinasyonunun etkisini tanımlamak.

Gereç ve Yöntem: Ocak 2014 ile Aralık 2014 arasında SB uygulanan yırtıklı retina dekolmanı (grup 1) veya kombine SB ve PR (grup 2) ile 39 hastaya bir karşılaştırma çalışması yapıldı. , Ameliyat öncesi ve sonrası yerini, makula durumunu, görme keskinliği kırmak temasını, retinanın eki kırmak ve RD nüks kaydedildi.

Bulgular: Grup 1 ve 2 için tek cerrahi eki oranları sırasıyla% 90 ve% 100 idi. Nüks alt insidansı kombine SB ve PR grubunda görüldü. (% 0 2 vs%, p = 0.487). Biz grup 2'de yer değiştirdiği toka ile 2 hastada, kırılma SF6 ve lazer fotokoagülasyon ile tamponada sonra kapatıldı bulundu. Bir aylık takibinde görme keskinliğinde iki grup (p = 0.017) arasında anlamlı bir farklılık oldu.

Sonuç: PR ile SB kombinasyonu eki oranını gelişmiş olabilir ve özellikle üzerinde mola toka yerleştirme acemi göz doktoru ne olursa olsun kesin lokalizasyonu için rutin olarak kullanılabilir.

Anahtar Kelimeler: Pnömatik retinopeksi, skleral çökertme.

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INTRODUCTION

Rhegmatogenous retinal detachment (RRD) is the most common type of retinal detachment.[1] Several surgical techniques have been used successfully for at least five decades to repair rhegmatogenous retinal detachment. Modern scleral buckling procedure is considered the treatment of choice for most cases, unless severe proliferative vitreoretinopathy is present. Some studies found that the final anatomic success rate has been reported to be around 80%–90%.[2,3]

Scleral buckle produced indentation of the eye wall, thus decrease vitreous traction on the retinal tear in rhegmatogenous retinal detachment.[4] Circumferential scleral buckles help to decrease transretinal traction by decreasing the diameter and circumference of the vitreous base.[5] Hence the most critical aspect of scleral buckling is the accurate placement of the buckle, requiring precise location of retinal breaks on the scleral surface.[6] However, placing the buckle in accurate position considered as the most difficult part in scleral buckling procedure,[7] particularly for beginner. Intravitreal gas injection as in pneumatic retinopexy (PR) was developed in an attempt to minimize problems caused by scleral buckling. It helps to occlude the break and promoting rapid resorption of subretinal fluid by the retinal pigment epithelium (RPE).[8]

However, PR affords no permanent relief in vitreoretinal traction.[9] Failure for PR mostly due to persistent traction on the retinal break.[10] Therefore we try to combine the PR procedure with the SB in order to close the break and drains up the SRF while reducing the vitreous traction.

In this study, we compare the reattachment rate and visual recovery results between patients underwent scleral buckling and scleral buckling combined with PR.

MATERIALS AND METHODS

The study was conducted in Cicendo Eye Hospital and was approved by the Institutional review board at University of Padjajaran. We included in this comparative retrospective study 40 patients with phakic eyes that were undergoing scleral buckling primary surgery for rhegmatogenous retinal detachment; all patients had been followed up for 1 month after surgery. Inclusion criteria were primary RRD with a small peripheral break; less than 2 clock hours; had visual loss or symptoms of less than 30 days of duration.

Age, gender, break location, visual acuity before and 1 month after surgery were recorded. The break locations were classified as in superior quadrant, inferior quadrant, temporal or nasal quadrant. Patients with PVR more than grade B and vitreous opacities obscuring the view of operative fundus, other ocular abnormalities, and aphakia or pseudophakia were excluded from this study. A single surgeon did all of the surgery.

The patients were then grouped into scleral buckle group (group 1) and combined scleral buckle with pneumatic retinopexy group (group 2). The surgical procedure included peribulbar anesthesia or general anesthesia, drainage of subretinal fluid if there were bullous retinal detachment, and the placement of encircling buckle with or without combining local tyre confined to the areas of the break. Patients in group 2 continued with injection of 0.4-0.6cc of 100% SF6, using 30G spuit needle directly after external drainage was carried out.

As mentioned earlier, drainage of subretinal fluid was performed if there were bullous retinal detachment. For cases in group 2, retinopexy was executed intraoperatively using laser indirect ophthalmoscope (LIO). The LIO was performed with a green (532 nm) laser delivered by 20D condensing lens, around the break with 0.1 second pulse duration and 100mW power settings. For other cases that subretinal fluid drainage was not performed, laser photocoagulation was executed a day after the intraocular gas facilitating rapid resorption of subretinal fluid by the retinal pigment epithelium. The laser photocoagulation was performed with a green (532 nm) frequency-doubled YAG laser mounted on a slitlamp and delivered by Mainster contact lens with topical anesthesia (0.5% tetracaine hydrochloride). Short burn duration (0.2 second) and low (200 mW) power settings were used initially, and both were gradually increased as determined by observation. Patients in group 2 were instructed to maintain the prone position following surgery for the remainder of the day, but were permitted to take any position other than supine thereafter after laser photocoagulation were done one-day post-surgery.

The primary outcome was the 1-week reattachment rate. The secondary outcomes were the 1-month reattachment rate, rate of subsequent operations and visual acuity based on ETDRS charts. Statistical comparison method was used for analyzing the result.

RESULTS

There were 25 male and 15 female patients, ranging in age from 16 to 63 years (mean 36 years, SD 13 years). Of the 40 eyes, 20 eyes underwent scleral buckling combined with intravitreal SF6 injection and 20 eyes underwent scleral buckle surgery without gas injection. In 29 eyes, the break was located in superior quadrant and most of them (79%) were due to horseshoe tear and followed by single round break or small multiple holes in lattice degeneration. s. The macula was attached in 6 (15.3%) patients; 3 patients in group 1 and 3 patients in group 2.

The primary anatomical success rate in one week is 100% for combined group and 90% for scleral buckle group, and in one month is 100% for both groups. In 20 eyes with only scleral buckling procedure, 2 eyes failed in reattachment after 1 week of surgery. Initial failure in those eyes was caused by mal-positioned buckle or PVR development. For the eyes with initial failure, reoperations were conducted with vitrectomy surgery.

In one eye in group 1 and two eyes in group 2, the break were not in exact apposition with the buckle, however the SF6 gas helps to close the remaining open breaks and for easier laser application in group 2. One day after surgery, 17 patients in group 2 undergoing laser photocoagulation procedure to create chorioretinal adhesion around the breaks. Cryopexy was applied to all eyes in group 1, laser indirect ophthalmoscope to three eyes in group 2.

Table 1: *Comparison of Preoperative Characteristics Between Group 1 (SB) and Group 2 (SB + PR), Mean±SD.*

Characteristics	Group 1 (n = 20)	Group 2 (n = 20)	P
Age (y)	34	38	0.08[a]
Preoperative visual acuity (logMAR)	1.5	1.6	0.294
Myopia (no[%])			
<3.00D	8 (40%)	9 (45%)	0.804
3.00-6.00 D	6 (30%)	6 (30%)	0.961
>6.99 D	6 (30%)	5 (25%)	0.699
Break location			
Superior	12	17	0.9197
Inferior	8	3	

[a]Ttest.

Table 2: *Comparison of Anatomical and Visual Outcomes between Group 1 (SB) and Group 2 (SB+PR).*

Outcome	Group 1 (n = 20)	Group 2 (n = 20)	P
Rate of operation success			
Single operation success (no.[%])	18 (90%)	20 (100%)	0.487[a]
Postoperative retinal detachment (no.[%])	2 (10%)	0 (0%)	
Overall success (no.[%])	20 (100%)	20 (100%)	
Hole status			
On buckle	20 (100%)	18 (90%)	0.487[a]
Off buckle	0 (0%)	2 (10%)	
Final visual acuity (logMAR)	1.44	0.73	0.016[b]*

DISCUSSION

Since first introduced by Ernst Custodis6, the main principles of rhegmatogenous retinal detachment surgery are reducing traction from vitreous base and closing the retinal breaks. The use of encirclement or segmental scleral buckle combined with cryopexy had been proven effective in over 90% cases of RRD.[11] Scleral buckling are more preferable for some surgeons because it does not cause cataract formation, reduced risk for proliferative vitreoretinopathy development, and more cost effective.[12]

Unfortunately, this technique sometimes needs additional procedure such as extraocular drainage to facilitate resorption of subretinal fluid by RPE cells to allow reattachment of the retina.[13] Precise localization of the break on buckle indentation plays a critical role in the success of scleral buckling surgery, which often is difficult to perform particularly for retinal break in posterior region or for beginner ophthalmologists.

Pneumatic retinopexy is another procedure of choice for RRD surgery. Cheng et al mentioned that PR technique has limitation since it only closed the break without reducing the vitreoretinal traction at the vitreous base.[14]

Encirclement buckle produces permanent support of the vitreous base, hence we did encirclement buckle with tire placement in all the patients to release vitreoretinal traction at the vitreous base, and we combined this procedure with pneumatic retinopexy as a tamponade to retinal breaks, whether it is fishmouthing or not to ensure closure of the break. Thus this study aimed to describe whether combined SB and PR procedure minimize the limitations of each procedure to increase reattachment of the retina

The primary anatomical success rate in one month is 100% for combined group and 90% for scleral buckle group. However, the high anatomical success rates found in this study must be analyzed with caution because the treated patients had primary RRD with a small peripheral break (less than 2 clock hours) and no prescence of proliferative vitreoretinopathy more than grade C.

In group 1, two eyes failed in reattachment after 1 week of surgery due to PVR development and malpositioned buckle. It may be caused by previously unidentified break or cryocoagulation procedure, since it has since it has been shown to promote RPE cell dispersion, as well to induce a breakdown of the blood-retinal barrier.

The primary anatomical reattachment success rate in one month for group 2 is 100%, even for the 2 eyes where the break were not in exact apposition with the buckle indentation. It showed that the pneumatic effect produced by the high surface tension between gas and fluid is sufficient to close the break and create apposition of the retina and facilitate chorioretinal adhesions created by laser photocoagulation. It must be noted that positioning of the patient's head is critical so the bubble covered the retinal break to create an effective seal. It allows the retinal pigment epithelium (RPE) to absorb any remaining subretinal fluid to facilitate reattachment of the retina. This combined technique provides an alternative procedure especially in cases where the buckle indentation was not in exact apposition with location of the break. With this technique, anatomical success may still be retained.

Retinopexy was done using cryotherapy or laser indirect ophthalmoscopy intraoperatively, or with laser photocoagulation one day postoperatively to create chorioretinal adhesion. Meurs et al showed that postoperative laser coagulation is a feasible alternative retinopexy mode in scleral buckling surgery, with encouraging anatomical reattachment after surgery.[15] Cryocoagulation may be a risk factor for the development of PVR, since it has been shown to promote RPE cell dispersion, as well to induce a breakdown of the blood-retinal barrier.[15] In this study we did not evaluate the correlation between cryocoagulation use and PVR development or to visual outcome.

Effective seal around the retinal break is produced due to the high surface tension between gas and fluid, and the buoyancy of intraocular gas is greatest at the apex of the bubble.

These properties allow the retinal pigment epithelium (RPE) to absorb any remaining subretinal fluid to facilitate reattachment of the retina. Careful positioning of the patient's head is critical so that the bubble covered the retinal break, until chorioretinal adhesions created by laser photocoagulation or cryotherapy can be established.16-18 There are some journals did mention that intraocular gas (air) injection is a well defined procedures. However, some operators have only performed this procedure in certain conditions, frequently in patients with pseudophakia, subtotal detachment, or horseshoe tears.

Indications for drainage of subretinal fluid during scleral buckling surgery remain controversial.[13,19,20] The rationale for drainage in this study is to diminish intraocular volume, allowing elevation of the buckle without elevating intraocular pressure and to allow the retina to settle on the elevated buckle by removing fluid from the subretinal space. In this study, drainage was done only in bullous retinal detachment, particularly in inferior breaks. It helps to facilitate reattachment of the retina and easier cryo or laser application, since the postoperative positioning in these patients would be difficult. In most of the patients of this study, external drainage was not done.

Comparison of visual acuity, rate of PVR, and long term effect of gas tamponade to scleral buckling surgery can only be approximative, as differences in case selections have a major influence on the ratio of macula on/off detachments and risk factors for PVR.

The 1 month best corrected visual acuity (BCVA) results in both groups were statistically different. This postulated because the recovery speed of visual acuity was faster in the group 2, due to the possibly of faster relieved of sub retinal fluid. However, this finding has to be proven further since the final BCVA is depended to many factors.

In conclusion, combining PR with SB proved to be useful to improve attachment rate and faster visual recovery in patients with rhegmatogenous retinal detachment. It may be used routinely for beginner ophthalmologist regardless precise localization of the break. However, further case control study using large sample has to be carried out to confirm this result.

REFERENCES/KAYNAKLAR

1. Richards, A.J., Scott, J.D. & Snead, M.P. Molecular genetics of rhegmatogenous retinal detachment. Eye 2002;16:388-92.
2. Schwartz, S.G., Kuhl, D.P., McPherson, A.R., Holz, E.R. & Mieler, W.F. Twenty-year follow-up for scleral buckling. Archives of ophthalmology 2002;120:325-9.
3. Haritoglou, C., Brandlhuber, U., Kampik, A. & Priglinger, S.G. Anatomic success of scleral buckling for rhegmatogenous retinal detachment--a retrospective study of 524 cases. Ophthalmologica. Journal international d'ophtalmologie. International journal of ophthalmology. Zeitschrift fur Augenheilkunde 2010;224:312-8.
4. Thompson, J.T. & Michels, R.G. Volume displacement of scleral buckles. Archives of ophthalmology 1985;103:1822-4.
5. Banaee, T., Hosseini, S.M., Ghooshkhanei, H., Moosavi, M. & Khayyatzadeh-Kakhki, S. Anatomical and visual outcomes of three different scleral buckling techniques. Journal of ophthalmic & vision research 2009;4:90-6.
6. Rezaei KA, Abrams GW. The History of retinal detachment surgery. Primary retinal detachment. Europian medical alliance 2015:1-24.
7. Baino, F. Scleral buckling biomaterials and implants for retinal detachment surgery. Medical engineering & physics 2010:32:945-56.
8. Tornambe, P.E. Pneumatic retinopexy: the evolution of case selection and surgical technique. A twelve-year study of 302 eyes. Transactions of the American Ophthalmological Society 1997;95:551-78.
9. Tornambe, P.E. & Hilton, G.F. Pneumatic retinopexy. A multicenter randomized controlled clinical trial comparing pneumatic retinopexy with scleral buckling. The Retinal Detachment Study Group. Ophthalmology 1989;96:772-783; discussion 784.
10. Zaidi, A.A., Alvarado, R. & Irvine, A. Pneumatic retinopexy: success rate and complications. The British journal of ophthalmology 2006;90: 427-28.
11. Oshima, Y., et al. Two-year follow-up study comparing primary vitrectomy with scleral buckling for macula-off rhegmatogenous retinal detachment. Japanese journal of ophthalmology 2000;44:538-49.
12. Liu, F., Meyer, C.H., Mennel, S., Hoerle, S. & Kroll, P. Visual recovery after scleral buckling surgery in macula-off rhegmatogenous retinal detachment. Ophthalmologica. Journal international d'ophtalmologie. International journal of ophthalmology. Zeitschrift fur Augenheilkunde 2006;220:174-80.
13. Patterson, D.F. & Ryan, E.H. Controlled drainage of subretinal fluid using continuous monitoring with indirect ophthalmoscopy. JAMA ophthalmology 2013;131:228-31.
14. Cheng, H.C., et al. Short-term external buckling with pneumatic retinopexy for retinal detachment with inferior retinal breaks. American journal of ophthalmology 2013;155:750-6.
15. van Meurs, J.C., Feron, E., van Ruyven, R., Mulder, P. & Veckeneer, M. Postoperative laser coagulation as retinopexy in patients with rhegmatogenous retinal detachment treated with scleral buckling surgery: a prospective clinical study. Retina 2002;22:733-9.
16. de Juan, E., Jr., McCuen, B. & Tiedeman, J. Intraocular tamponade and surface tension. Survey of ophthalmology 1985;30:47-51.
17. Gupta, D. Face-down posturing after macular hole surgery: a review. Retina 2009;29:430-43.
18. Scharwey, K., Pavlovic, S. & Jacobi, K.W. [Early posterior capsule fibrosis after combined cataract and vitreoretinal surgery with intraocular air/SF6 gas tamponade]. Klinische Monatsblatter fur Augenheilkunde 1998:212;149-53.
19. Yepez, J.B., Cedeno de Yepez, J., Valero, A. & Arevalo, J.F. Modified self sealing sclerotomy for drainage of subretinal fluid during scleral buckling surgery. The British journal of ophthalmology 2004;88:589-90.
20. Brillat, E., et al. A case-control study to assess aspirin as a risk factor of bleeding in rhegmatogenous retinal detachment surgery. Graefe's archive for clinical and experimental ophthalmology = Albrecht von Graefes Archiv fur klinische und experimentelle Ophthalmologie 2015.