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RETINAL REATTACHMENT OF SCLERAL BUCKLING WITH OR WITHOUT SUTURES FOR RHEGMATOGENOUS RETINAL DETACHMENT AT CIPTO MANGUNKUSUMO NATIONAL GENERAL HOSPITAL IN INDONESIA

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ABSTRACT

Introduction: Rhegmatogenous Retinal Detachment (RRD) is a common, vision-threatening condition traditionally managed by Scleral Buckling (SB), Pars Plana Vitrectomy (PPV), or Pneumatic Retinopexy. SB is effective, however, it carries risks such as strabismus and buckle extrusion, often linked to the use of sutures. This study aimed to determine the outcomes and compare complications of SB with and without sutures for primary RRD cases.

Methods: This was a retrospective, analytical cross-sectional study of 65 patients who underwent primary SB (alone or combined with PPV) at Cipto Mangunkusumo National General Hospital (RSCM) from January 2023 to December 2024. Data on demographics, clinical factors, anatomical success (retinal reattachment), functional success (BCVA), and complications were collected and analyzed using descriptive statistics and comparative tests (Chi-square, t-test/Mann-Whitney).

Result: During the period, 65 RRD patients underwent the SB procedure. Subjects included 28 cases with sutures and 37 cases without. The mean age was 32.88 years, with a majority of male patients (73.8%) with a mean RRD duration of 17.82 weeks. Preoperative clinical findings showed a high rate of myopia, phakic status, RRD extent in 1 and 4 quadrants, single tear, macula-on, and PVR grade A, with preoperative visual acuity of 1.49 logMAR. The overall anatomical success rate was 76.9%. Statistically, there was no significant difference in retinal reattachment success between SB without sutures (75.7%) and SB with sutures (78.6%) (p=0.784). No demographic or clinical factors was found to significantly predict reattachment success. Postoperative complications included cataract (24.6%) and glaucoma (21.5%). Strabismus (4.61%) was only found in the SB with sutures group. No buckle extrusion occurred in either group.

Conclusion: Scleral buckling provides a high enough anatomical success rate for RRD. The SB without sutures technique is equally effective in achieving retinal reattachment and shows a lower incidence of strabismus compared to SB with sutures, making it a viable option for RRD management.

Keywords: rhegmatogenous retinal detachment, retinal reattachment, scleral buckling, functional outcome, demographic characteristics

Introduction

Rhegmatogenous Retinal Detachment (RRD) is the separation of the neurosensory layer of the retina from the retinal pigment epithelium (RPE) under it, caused by fluid from the vitreous cavity entering the subretinal space through a full-thickness tear in the retina.[1] RRD is one of the most common forms of retinal detachment (RD), with an incidence reaching 12.6 per 100,000 population per year based on Rochester's study, and about 1 in 10,000 people experiencing RRD annually according to Ge et al.[2,3] The principle of RRD management is to find the break in the retina, bring the choroid closer to the retina, and create an adhesion between the retina and the choroid at each break to seal it. This process can be achieved through several approaches: scleral buckling (SB), pars plana vitrectomy (PPV), or pneumatic retinopexy.[2,4]

The choice of procedure depends on several factors, such as the number, location, and size of the break, lens status (phakic, aphakic, or pseudophakic), the patient's ability to follow optimal postoperative positioning advice related to the type of tamponade, the surgeon's ability and preference, and the presence or absence of proliferative vitreoretinopathy (PVR), which is a prognostic variable for surgical success.[4] The function of SB is to create an indentation on the sclera below the break, which reduces vitreous traction and minimizes the flow of vitreous fluid into the subretinal space until the RRD resolves.[5-8] To date, SB remains a treatment option for RRD with a success rate reaching 95% (82% after the primary procedure and 13% after 1 or more additional vitreoretinal procedures) in a 20-year follow-up.[9]

When compared to other procedure options, such as PPV, which is now considered superior with the development of small-gauge vitrectomy, the SB procedure yields equal or better results for RRD under certain conditions. The success of RRD management using the SB technique is also highly dependent on the patient's condition. Indications for using SB include: young age, absence of posterior vitreous detachment (PVD), phakic lens status, high myopia, absence of PVR or PVR grade A to B, and breaks located anterior to the globe's equator.[10-13]

Despite the advantages of SB, there are drawbacks and potential complications. Intraoperative complications may include issues related to subretinal fluid drainage and accidental scleral perforation during suturing. Intraocular hemorrhage, hypotony, and choroidal detachment can also occur intraoperatively. Surgeons must also be mindful of post-SB complications, such as strabismus, glaucoma, buckle infection and extrusion, and refractive changes that can be bothersome.[10]

The buckle used in SB to obtain retinal break closure and reducing vitreoretinal traction, is placed in proximity to the equator (or anteriorly), at 11–14 mm from the limbus. It runs underneath the four recti muscles and is secured to the sclera through non absorbable sutures.[6] Intraoperative complications like scleral perforation during buckle suturing are reported to occur in about 5% of surgeries. Additionally, the suture material itself is a possible cause of postoperative complications, such as infection that leads to buckle extrusion. In our hospital, there were 4 cases of buckle extrusion that underwent buckle explantation procedure were reported, all of which were complications of SB with suture procedure performed outside of our hospital. In SB without sutures, scleral tunnels are created in each quadrant, and the buckle is secured beneath the partial thickness scleral tunnels.[14] The option of performing SB without sutures is hoped to avoid the aforementioned problems, and according to several studies, this technique provides equally good management outcomes in all cases requiring SB.[15]

Methods

This is a retrospective observational study. All data gathered from both conventional and electronic medical records from the Vitreoretina Division, Department of Ophthalmology, Cipto Mangunkusumo National General Hospital, Jakarta were reviewed retrospectively. The study was conducted from February to March 2025, after the protocol received approval from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia (No. KET155/UN2.F1/PPM.00.02/2025).

We included patients who were diagnosed with RRD at the division and underwent their first vitreoretinal surgery using the SB technique (either with or without sutures, and alone or in combination with PPV procedure) between January 2023 and December 2024, with a follow-up examination between 1 and 12 months post-operatively. Patients were excluded if their medical records were incomplete, if they had undergone previous vitreoretinal procedures (prior PPV), or if they had other abnormalities unrelated to RRD or RRD risk factors, such as posterior uveitis, retinitis pigmentosa, glaucoma, or optic neuritis.

Data was collected using total sampling and reviewed to match the inclusion and exclusion criteria. Qualifying subjects were included in the study. The information extracted from the medical records covered three main areas: demographic data (age and sex); clinical data (refractive status, lens status, RRD duration, preoperative visual acuity, intraocular pressure, macula status, location and number of retinal breaks, extent of RRD, and PVR grade); and outcome data (anatomical success defined as retinal reattachment, functional success defined as postoperative visual acuity, and complications).

For data processing and analysis, the collected information was first managed in Microsoft Excel to ensure completeness. Next, analytical statistical testing was performed using SPSS Statistics 16.0. Categorical variables were presented as proportions. Numerical variables were checked for normality before being presented as mean ± standard deviation (for normal distribution) or median (minimum - maximum) (for non-normal distribution). Relationships between categorical variables were assessed using the chi-square test, while relationships between numerical variables were assessed using the Pearson/Spearman test. The independent t-test (for normal distribution) or the Mann-Whitney U test (for non-normal distribution) was used to analyze the relationship between a categorical independent variable and a numerical dependent variable, or vice versa.

Scleral Buckling Technique

After the 360-degree conjunctival peritomy and isolation of the rectus muscles is performed by placement sutures, buckle is placed at 11-14 mm from the limbus around the equator and is secured to the sclera with non-absorbable sutures. Buckle is then tightened with sleeve in the superotemporal or inferotemporal side of the eye. A 23G PPV port for illumination is made to help identify the retinal detachment and tear. Transscleral drainage is perform and cryopexy is done around the tear under the microscope and guidance of the illumination probe without advancing too much into the vitreal cavity.

The same procedure applies to the SB without sutures. Only the sutures are replaced with scleral tunnels. These tunnels are created approximately 11-14mm form the limbus in each quadrant between the four rectus muscles, and buckle is inserted under the muscles and scleral tunnels. The SB procedure, with or without sutures, always preceded the PPV in combined procedure.

Result

A total of 154 SB procedures were performed, either alone or in combination with PPV. Of all these cases, 65 primary SB procedures were performed for RRD cases, with 33 being SB alone (pure) and the remaining 32 combined with PPV. SB with sutures was performed in 28 cases, and 37 cases were performed without sutures.

Demographic and Clinical Characteristics

The proportion of male patients (73.8%) was higher than female patients (26.2%). The age range of the patients in the study was from 9 to 64 years, with a mean age of 32.88±14.638 years.

Regarding the clinical characteristics, the mean duration of RRD in this study was 17.82±21.215 weeks. The most frequent refractive status found in patients before SB was myopia and high myopia, accounting for 34 patients (52%) and 23 patients (35%), respectively. The macula status found in this study was 58% macula-off and 42% macula-on. The extent of retinal detachment was 4 quadrants in 25 patients (38.5%), 3 quadrants in 8 patients (6.2%), 2 quadrants in 12 patients (18.5%), and 1 quadrant in the remaining 24 patients (36.9%).

Table 1. Demographic and Clinical Characteristics

Characteristic	Total n=65	Percentage (%)
Gender		
Men	48	73.8%
Women	17	16.2%
Age, years		
Median (min-max)	30 (9-64)	
Mean (standard deviation)	32,88 (±14,638)	
Duration of RRD, weeks		
Median (min-max)	8 (1-96)	
Mean (standard deviation)	17.82 (±21.215)	
Refractive status		
Non myopia	8	12.3
Myopia	34	52.3
High myopia	23	35.4
Lens status		
Aphakic	3	4.6
Pseudophakic	25	38.5
Phakic	37	56.9
Macula status		
Attached (on)	37	56.9
Detached (off)	28	43.1
Extent of detachment		
1 Quadrant	24	36.9
2 Quadrants	12	18.5
3 Quadrants	4	6.2
4 Quadrants	25	38.5
Number of tears		
Single	56	86.2
Multiple	9	13.8
PVR		
Grade A	26	40
Grade B	25	38.4
Grade C	14	21.6

The most common number of retinal breaks found was a single tear in 56 patients (86.2%), while the remaining 9 patients (13.8%) had multiple tears.

Visual Acuity and Retinal Reattachment Outcomes

The success of SB surgery can be determined by anatomical success (retinal reattachment after SB, either immediately or with additional procedures) and functional success (change in visual acuity).

Overall, both SB with and without sutures resulted in anatomical success (retinal reattachment) in 50 patients (76.9%), with the retina remaining detached in 15 patients (23.1%). The mean postoperative visual acuity for both groups was 1.26 logMAR (approximately 3/60), compared to the mean preoperative visual acuity of 1.49 logMAR (approximately 2/60).

Table 2. Visual Acuity and Retinal Reattachment Outcomes

Variable	Total n=65	Percentage (%)
Preoperative visual acuity		
Median (min-max)	1.00 (0-4)	
Mean (standard deviation)	1.49 (±1.148)	
Postoperative visual acuity		
Median (min-max)	1.00 (0-4)	
Mean (standard deviation)	1.26 (±0.940)	
Retina status		
Attached	50	76.9
Detached	15	23.1

Comparison of Retinal Reattachment Outcomes Between Scleral Buckling With and Without Sutures

Bivariate analysis comparing SB with and without sutures on retinal reattachment found no significant difference between the two groups, with a p-value of 0.784.

Table 3. Comparison of Retinal Reattachment Outcomes Between SB With and Without Sutures

Variable	Anatomical Outcome		p value	Odds Ratio (IC 95%)
	Detached	Attached		
SB with suture	6 (21.4%)	22 (78.6%)	0.784	0.848 (0.262-2.745)
SB without suture	9 (24.3%)	28 (75.7%)		

Analysis of Factors Affecting Retinal Reattachment Outcomes

Several demographic and clinical characteristics estimated to affect the success of retinal reattachment are shown in Table 1. Regarding refractive status, non-myopia, myopia, and high myopia all showed retinal reattachment success rates of >70%, but no relationship was found between refractive status and retinal reattachment success. Based on lens status, phakic eyes showed higher postoperative reattachment (83.8%) compared to pseudophakia (72%) and aphakia (33.3%), but no relationship was found between preoperative lens status and retinal reattachment success. For postoperative macula status, macula-on status resulted in 82.1% retinal reattachment compared to macula-off status at 73%, with the statistical analysis showing no significant relationship (p=0.554) between macula status and retinal reattachment success.

Table 4. Bivariate Analysis Between Demographical and Clinical Characteristics with Retinal Reattachment Outcomes (Categorical Variables)

Variable	Anatomical Outcome		p value	Odds Ratio (IC 95%)
	Detached	Attached		
Refraction status				
Non myopia	2 (25%)	6 (75%)	0.881	0.963 (0.738-1.257)
Myopia	7 (20.6%)	27 (79.4%)		
High myopia	6 (26.1%)	17 (73.9%)		
Lens status				
Aphakic	2 (66.7%)	1 (33.3%)	0.609	0.706 (0.457-2.817)
Pseudophakic	7 (28%)	18 (72%)		
Phakic	6 (16%)	31 (83.8%)		
Macula status				
Attached (on)	10 (27%)	27 (73%)	0.554	1.704 (0.509-5.708)
Detached (off)	5 (17.9%)	23 (82.1%)		
Extent of detachment				
1 Quadrant	5 (20.8%)	19 (79.2%)	0.743	1.226 (0.363-4.135)
2 Quadrants	1 (8.3%)	11 (91.7%)		
3 Quadrants	1 (25%)	3 (75%)		
4 Quadrants	8 (32%)	17 (68%)		
Number of tears				
Single	13 (23.2%)	43 (76.8%)	1.00	0.945 (0.174-5.119)
Multiple	2 (22.2%)	7 (77.8%)		
PVR				
Grade A	4 (15.4%)	22 (84.6%)	0.343	0.706 (0.226-2.202)
Grade B	6 (24%)	19 (76%)		
Grade C	5 (35.7%)	9 (64.3%)		

Preoperative RRD extent of <4 quadrants showed success rates of >70% compared to 4 quadrants at 68%, with statistical analysis unable to determine a relationship between RRD extent and retinal reattachment success. From the number of breaks, both multiple and single breaks showed retinal reattachment success rates of >70%, with no significant relationship (p=1.00) found between the number of breaks and retinal reattachment success. Based on PVR, PVR grade A showed the highest retinal reattachment success rate (84.6%) compared to PVR grade B (76%) and grade C (64.3%). However, no significant relationship was found between preoperative PVR and retinal reattachment success.

Table 5. Bivariate Analysis Between Demographical and Clinical Characteristics with Retinal Reattachment Outcomes (Numerical Variables)

Variable	p value
Age	0.282
Duration of symptoms	0.876
Preoperative visual acuity	0.090

Regarding age, duration of symptoms until surgery, and preoperative visual acuity, this study found no significant relationship between these three numerical characteristics and the success of retinal reattachment (Table 5).

Postoperative Complications

Some possible postoperative complications of SB include cataract, glaucoma, buckle extrusion, and strabismus. In the SB with sutures group, the complications found were strabismus (10.7%), cataract (32.1%), and glaucoma (10.7%).

In the SB without sutures group, only cataract (18.9%) and glaucoma (29.7%) were found. No cases of strabismus were found in the SB without sutures group, and no cases of buckle extrusion were found in either group (Table 6).

Table 6. Postoperative Complication

Variable	Complication			
	Strabismus	Cataract	Glaucoma	Buckle extrusion
SB with suture (n = 28)	3 (10,7%)	9 (32,1%)	3 (10,7%)	0 (0%)
SB without suture (n = 37)	0 (0%)	7 (18,9%)	11 (29,7%)	0 (0%)
Total (n = 65)	3 (4,61%)	16 (24,6%)	14 (21,5%)	0 (0%)

Discussion

Demographic and Clinical Characteristics

In this study, 74% of patients who underwent SB for RRD were men and 26% were women. The gender distribution in RRD varies among studies but generally shows a male predominance across various age groups.[16] A higher proportion of males is often found in RRD cases in children[17,18], and young adults aged 20–39 years[19], a group for which SB is considered effective. This male predominance is sometimes speculated to be related to males having a longer axial length of the globe.[16]

The mean age in this study was 32.88 years, suggesting that RRD cases managed with SB were more common in young adults. No association was found between age at the time of SB and postoperative retinal reattachment success. SB is a preferred choice for RRD patients under 45 years old, as younger patients are often phakic, resulting in a lower risk of postoperative cataracts and generally having stronger vitreous and retinal adhesion.[20,21] Older age, especially above 40 years, where Posterior Vitreous Detachment (PVD) is more common, can be a factor contributing to the difficulty of retinal reattachment with SB.[6,22]

A study by Ludwig et al. in the United States showed that patients with high myopia had a 39 times higher risk of RRD compared to non-myopia, and patients with myopia had a 3 times higher risk.[23] Research on RRD and myopia in the Netherlands showed an increase in RRD incidence by 44% from 2009 to 2016, accompanied by a rise in mild, moderate, and severe myopia prevalence in the same period.[24] In our study, 23 patients (35.4%) had high myopia, 34 patients (52.3%) had myopia, and the rest (12.3%) were non-myopic. All three refractive statuses yielded retinal reattachment success rates > 70%, and no relationship was found between refractive status and retinal reattachment success. The longer axial length in myopic eyes causes thinning of the retinal layers, particularly in the equatorial and pre-equatorial areas, increasing the risk of retinal rupture. Therefore, high myopia is a risk factor for RRD. Highly myopic eyes also experience PVD at a younger age than non-myopic eyes, which can influence SB success.[25]

Lens status in RRD patients is a consideration for choosing SB. According to Park et al.[11] and Fallico et al.[6], SB results in better success rates in phakic eyes and is therefore more frequently performed in RRD cases with phakic lens status.

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Avoiding postoperative cataract complication in phakic eyes is also a consideration. In this study, 56.9% of RRD patients were phakic, 38.5% were pseudophakic, and 4.6% were aphakic. Proportionally, retinal reattachment success was higher in phakic (83.8%) and pseudophakic (72%) patients compared to aphakic patients (33.3%). However, no significant relationship was found between lens status and retinal reattachment outcome.[6,20]

In this study, 41% of patients had macula-on status and 59% had macula-off status. Studies on SB without sutures[14] and general SB for RRD[26] reported 82% and 60% preoperative macula-off status, respectively. Preoperative macular attachment is a critical factor often cited as a determinant of functional success in RRD surgery. Our study found that 73% of macula-off patients and 82.1% of macula-on patients achieved good retinal reattachment, but no significant relationship was found between preoperative macula status and retinal reattachment success. This contrasts with Salicone et al., who stated that preoperative macula status is a factor for retinal reattachment success, although the duration of macular detachment until intervention is also a consideration.[27,28]

The most common extent of RRD in this study is 1 quadrant (36.9%) and 4 quadrants (38.5%). All groups showed retinal reattachment success above 70%, except for the 4-quadrant group (68%), but no relationship was found between the extent of RRD and retinal reattachment success. SB is generally indicated for non-complicated and moderately complicated RRD, which is why studies show it is often used for RRD involving < 4 quadrants.[6] A single tear with a limited extent of detachment on 1 quadrant is cited to have better success with SB. Salicone et al. suggested that fewer involved retinal quadrants can be a positive prognostic factor for surgical success.[11,27]

Our study found that RRD with PVR grade A (40%) and grade B (38.4%) were more frequent than grade C (21.6%). Preoperative PVR status is a risk factor that influences SB success.[29] According to Fallico et al., SB success is higher in patients with PVR grade A and B (moderate complexity), although patients with PVR grade C can also achieve good results.[6,11] Proportionally, retinal reattachment success in our study was higher in PVR grade A (84.6%) and grade B (76%) compared to grade C (64.3%), but the difference was not statistically significant.

Retinal Reattachment and Visual Acuity Outcomes

The retinal reattachment success rate with the SB technique in this study reached 76.9% out of 65 patients, with 20% requiring subsequent intervention with PPV. Studies show that the retinal reattachment rate after SB is often above 80% for various RRD cases, both primary and after subsequent surgery.[8,9] Wong et al. reported anatomical success of the SB procedure up to 88.8% in primary surgery and 97.7% after further intervention.[29] Failure of retinal reattachment in primary SB can occur, often necessitating an additional PPV procedure. Patel et al. found that 13% of SB procedures failed at reattaching the retina, with 5% linked to preoperative PVR.[30]

The mean preoperative visual acuity in this study was 1.49±1.148 logMAR. A study by Shanmugam, et al. on SB without sutures reported a mean preoperative visual acuity of 1.44±1.01 logMAR, while the study by Starr, et al., which compared SB groups with and without sutures, showed a mean preoperative visual acuity of 1.03±1.04 logMAR in the group with sutures and 1.05±1.06 logMAR in the group without sutures.[14,15] Statistically, no relationship was found between preoperative visual acuity and retinal reattachment success in this study. This differs from the results of Salicone et al., whose research indicated that preoperative visual acuity can be a determinant of functional outcome success.[27]

Comparing retinal reattachment outcomes between SB with and without sutures, this study showed that both techniques gave similar results: 78.6% for SB with sutures and 75.7% for SB without sutures. Statistical analysis also showed no significant difference in reattachment outcomes between the two. Shanmugam et al. reported an 86% primary retinal reattachment success rate for SB without sutures. In comparison, Starr et al. showed no difference in retinal reattachment outcomes between SB without sutures (87.3%) and SB with sutures (88.6%).[14,15]

Postoperative Complications

Common postoperative complications of SB include cataract, glaucoma, buckle extrusion, and strabismus. In this study, the more frequent complications in both SB groups were cataract and glaucoma. In the SB with sutures group, we found strabismus (10.7%), cataract (32.1%), and glaucoma (10.7%). The SB without sutures group only showed cataract (18.9%) and glaucoma (29.7%). Importantly, no strabismus occurred in the SB without sutures group, and no buckle extrusion was found in either group.

Strabismus post-SB can occur in up to 3.8% of cases in a study by Goezinne et al., often due to extraocular muscle restriction, which is still unclear whether this is associated with the buckle's position.[31] Another possible cause of strabismus after SB is ischemia that results in extraocular muscle injury.[6,31] In our study, this complication was only found in the SB with sutures group, though the exact cause distinguishing the two groups could not be determined from the medical records.

Cataract is one of the most studied post-SB complications, with SB often preferred in phakic RRD to avoid it. In this study, cataracts were more frequent in the SB with sutures group. Upon medical records review, these cataracts were primarily found in cases combined with PPV or following PPV after a failed primary SB. Heimann et al[32] reported a 46% cataract incidence in phakic eyes after 1 year, and Schwartz et al.[33] reported up to a 30% cataract surgery rate post-SB procedure on phakic eyes in a 20-year follow-up.

Glaucoma occurred in 21.5% of all cases in this study. According to Sahoo et al., postoperative glaucoma after SB had an incidence of 1.4-4.4%.[32] This condition can be caused by buckle placement that compresses veins, obstructing aqueous humor drainage, leading to blockage and swelling of the ciliary body. The swollen ciliary body changed the iris lens diaphragm, which resulted in the narrowing of the anterior chamber. Glaucoma may also be caused by gas tamponade usage in the SB procedure. Apart from pure SB, we also found glaucoma in combined SB/PPV cases and cases that underwent PPV after a primary failed SB.

Therefore, the glaucoma may also be influenced by the use of silicone oil tamponade in combined or subsequent PPV.[34,35] Buckle extrusion did not occur in this study. Extrusion is often caused by postoperative infection (incidence 0.5-5.6%), which is linked to the use of sutures to secure the buckle.[14] Buckle extrusion is a frequent indication for buckle explantation (61.63% according to Patel et al.).[36] SB without sutures is an option to avoid complications related to suture use.

Another postoperative complication that can cause retinal reattachment failure is postoperative PVR, but this could not be assessed due to lack of reporting in the reviewed medical records, representing a limitation of the study.

Conclusion

Scleral buckling provides a high enough anatomical success rate for RRD. The SB without sutures technique is equally effective in achieving retinal reattachment when compared with SB with sutures, and more importantly, it shows a lower incidence of strabismus, making it a viable option for RRD management.

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