Original Article

Sutureless scleral buckle in the management of rhegmatogenous retinal detachment

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Purpose: To evaluate the anatomical and functional outcomes of sutureless scleral buckling for the repair of rhegmatogenous retinal detachment (RD). **Design:** Retrospective interventional case series. **Materials and Methods:** Retrospective analysis of 50 eyes of 49 patients with rhegmatogenous RD, who underwent sutureless scleral buckling from January 2009 to March 2013. **Results:** Primary retinal re-attachment rate of 86% was achieved with single surgery, but final anatomical success was 94% with additional interventions in the form of intravitreal gas, buckle revision, and/or pars plana vitrectomy. Best corrected logarithm of minimum angle of resolution visual acuity improved from 1.44 ± 1.01 preoperatively to 0.50 ± 0.40 at a mean follow-up of 6.7 months. **Conclusion:** Sutureless scleral buckling achieves excellent anatomical and functional success in majority of the patients with rhegmatogenous RD.

Key words: Retinal detachment, scleral buckling, sutureless

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Rhegmatogenous retinal detachment (RD) is characterized by a break in neurosensory retina with seepage of fluid into the subretinal space. Scleral buckling surgery has been considered as the "gold standard" for uncomplicated RD, despite recent trend toward pars plana vitrectomy. Final anatomical success rate of 96.7% and 93.2% in phakic and pseudophakic/aphakic RD, respectively, treated with scleral buckling, and 96.7% and 95.5% in patients treated with primary vitrectomy was reported in a major multicenter randomized clinical trial.[1] More recently, European VitreoRetinal Society RD Study Group has shown significantly higher final failure rate with vitrectomy with or without buckle as compared to scleral buckle alone in uncomplicated RD in phakic eyes, but no significant difference in pseudophakic eyes.[2]

Inadvertent penetration of globe while passing mattress sutures to secure the buckle has been reported to occur in about 5% of cases.[3] The presence of suture material is associated with the risk of buckle infection, which may in turn result in buckle extrusion. Sutureless scleral buckling technique avoids these complications associated with the placement of sutures.

In this retrospective case series, we report the anatomic and functional outcomes of sutureless scleral buckle in treatment of selected cases of rhegmatogenous RD. There is scarce data on the sutureless scleral buckling technique. A search on the PubMed.gov database using the keywords "sutureless," "scleral buckle" resulted in only 1 case report by Sternberg *et al*., in which belt loop made of polymethyl methacrylate was fixed with cyanoacrylate adhesive to a patient with RD with thin sclera.[4]

Materials and Methods

Medical records of all consecutive patients, who underwent sutureless scleral buckling surgery at Vitreoretinal Department at a Referral Hospital in South India from January 2009 to March 2013 were reviewed retrospectively for this study.

The baseline characteristics that were collected includes: Age, sex, preoperative best corrected visual acuity (BCVA), extent of RD, attached or detached status of macula, presence or absence of proliferative vitreo retinopathy (PVR), retinal breaks (types, location, number, and size), presence or absence of high myopia, and lens status. When present, PVR was graded according to the Retina Society Terminology Committee grading. All intraoperative and post-operative complications including redetachment were noted. The details of additional surgical techniques used to repair redetachment and their outcome was also noted. Final postoperative VA was noted as BCVA at final follow-up visit. VA was analyzed by means of logarithm of minimum angle of resolution (logMAR) given by Ferris *et al*.[5] The conversion of Snellen visual acuities to logMAR was done by the method given by Holladay.[6]

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Technique of sutureless scleral buckling in all the cases, 2.5 mm silicone band was used as encircling material along with a segmental scleral buckle. The encircling band was anchored to the sclera with partial thickness scleral tunnels, one in each quadrant, except the quadrant where a segmental silicone tire is to be placed. The segmental scleral buckle was secured beneath the encircling band, placed episclerally over the retinal break [Fig. 1]. Two scleral tunnels placed at the margins of the segmental buckle ensured that the buckle did not slip laterally. The encircling band passing between the two closely placed tunnels "buckles" the segmental silicone tire, and the sclera to create an adequate buckle eff ect provided that the segmental buckle is <11/2 clock hours in extent. The antero-posterior extent of the segmental buckle was based on the size of rhegma, the buckle being adequate to cover the retinal break and 2–3 mm of surrounding retina. For breaks located in more than one quadrant, multiple segments of silicone tire, one in each quadrant were used to support the retinal breaks. Watzke sleeve was used to secure the ends of encircling band. Drainage of subretinal fluid (SRF) by external needle drainage method either with visualization or blind (Charle's technique) was performed as judged by the surgeon. Cryotherapy around the retinal break was done in all cases. Intravitreal gas or air temponade was used occasionally for superior breaks. The conjunctiva was apposed either with cautery or sutures (7-0 Vicryl).

Results

A total of 50 eyes of 49 patients (37 male and 12 female) were included in this study. The most common configuration was macula-off superior RD, and the most common retinal break was a tear. Median follow-up of the patients was 7 months (mean: 6.7 ± 6.4 months; range: 3–36 months). The baseline characteristics of the patients are summarized in Table 1.

Primary anatomic success of 86% (43 out of 50 cases) was achieved by single procedure. An assessment of causes of primary surgical failure [Table 2] showed lifted break with fish mouthing in 2 patients; 3 patients developed PVR causing redetachment within 6–8 weeks of primary surgery; lifted lattice with hole at the edge of improperly positioned buckle was found to be the cause of redetachment in 1 patient, which required scleral buckle revision; and the last patient with failed primary surgery had subretinal hemorrhage, occurring at the time of SRF drainage, with persistent macular detachment postoperatively and was also having preexisting PVR C1. The final anatomic success was 94% (n = 47 out of 50) after subsequent retina procedures. One patient developed recurrence after twice undergoing pars plana vitrectomy with silicone oil temponade, and subsequently no surgery was done in view of poor prognosis; the remaining 2 patients failed to follow-up but were counted as surgical failure because lack of documentation of the retinal status.

The final BCVA of the patients in our study improved from preoperative median logMAR BCVA of 1.40 (2/60 Snellen VA) (mean ± 1 standard deviation [SD]: 1.44 ± 1.01) to 0.50 (6/18 Snellen VA) (mean ± 1SD: 0.50 ± 0.40). Thirty eyes (60%) achieved final BCVA ≥ 0.50 logMAR (6/18 Snellen VA) at final follow-up.

The intraoperative and postoperative complications observed are shown in Table 3. Subretinal hemorrhage was observed in 5 (10%) of eyes; out of these, 1 patient underwent pars plana vitrectomy to drain the hemorrhage. Seven (14%) patients experienced raised intra ocular pressure (IOP > 21 mm Hg) during postoperative period; IOP was controlled with anti-glaucoma medications in all except 2 patients, who required glaucoma surgery, both patients had RD with inferotemporal dialysis postblunt trauma and angle recession secondary to blunt trauma.

Discussion

In our series of 50 eyes with rhegmatogenous RD and PVR ≤ Grade C1 treated with sutureless scleral buckling, primary retinal reattachment with single surgery could be achieved in 86% of eyes, and final reattachment in 94% after subsequent retinal procedure. Anatomical outcomes of our study correlate well with other major studies showing primary success rate of scleral buckling of 63–84%.[1,7] The functional outcomes in terms of improvement in BCVA also corroborate well with the other major studies with 30 (60%) eyes showing BCVA logMAR ≥0.50 (6/18) at final follow-up.[1] The success rate of buckling surgery in our study were not influenced by

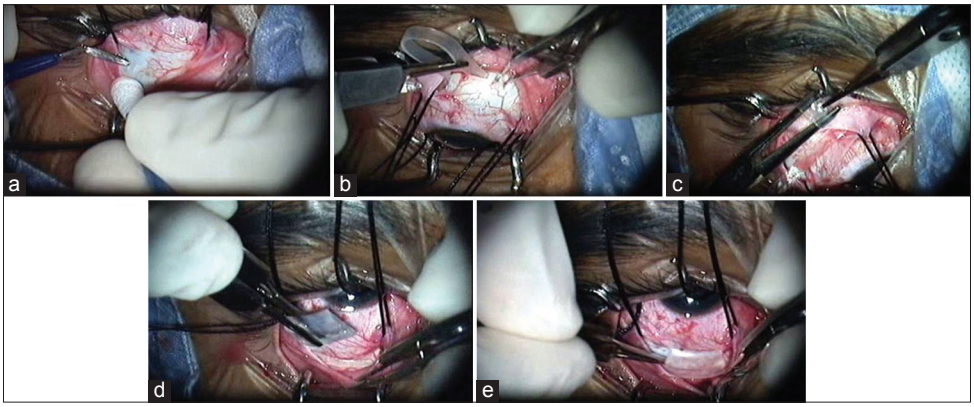

Figure 1: (a) Scleral tunnel creation with a crescent blade. (b) Placement of the encircling band through the tunnels in all quadrants. (c) Securing the ends of encirclage with Watzke sleeve. (d) Placement of solid silicone segment snugly between the two tunnels created adjacent to the break. (e) Solid silicone segment creating the buckle effect

Table 1: Baseline characteristics of patients undergoing sutureless scleral buckling surgery

Age (years) (mean±SD)	49±18.5
Sex, *n* (%)	
Male	37 (75.6)
Female	12 (25.4)
Preoperative BCVA (logMAR) (mean±SD)	1.44±1.01
Preoperative macula status, *n* (%)	
Detached	41 (82)
Attached	9 (18)
Lens status, *n* (%)	
Phakic	26 (52)
Pseudophakic	24 (48)
Myopia, *n* (%)	23 (46)
PVR status, *n* (%)	
Absent	48 (96)
Present (upto stage C1)	2 (4)
Configuration of RD, *n* (%)	
Total RD	11 (22)
Superior	25 (50)
Inferior	14 (28)
Types of breaks, *n* (%)	
Tear	37 (58)
Lattice with hole	16 (25)
Retinal hole	6 (9.4)
Dialysis	5 (7.6)
Both tear and lattice	8
Number of breaks	
One	39 (78)
Two	8 (16)
≥Three	3 (6)
Type of buckle used	
9 mm solid silicone tire (number 279)	33 (66)
7 mm solid silicone tire (number 276)	13 (26)
10 mm solid silicone tire (number 280)	4 (8)
Follow-up (months) (mean±SD)	6.7±6.4

SD: Standard deviation, BCVA: Best corrected visual acuity, logMAR: Logarithm of minimum angle of resolution, PVR: Proliferative vitreo retinopathy, RD: Retinal detachment

the lens status of the patient with phakic and pseudophakic eyes showing no significant difference in terms of outcome, similar to the finding of Thelen *et al*. in their large retrospective study.[7]

Sutureless scleral buckling avoids the risk of inadvertent penetration of the globe, when passing sutures. Intrascleral placement of the sutures is associated with a steep learning curve, while the sutureless technique is easily mastered by the novice surgeon. In our series, intraoperative complications were minimal (10%) and consisted only of subretinal hemorrhage related to drainage of SRF and not attributable to the sutureless technique described here.

Buckle infection, a significant postoperative complication has been reported to occur between 0.5% and 5.6% of patients and is related to the use of sutures, which act as a nidus for infection.[8,9] Sutureless scleral buckling grossly decreases this risk of buckle infection.

Sutureless scleral buckling technique can be employed to treat most rhegmatogenous retinal detachments, but not those with multiple breaks close to each other at various distances from the ora serrata. The buckle effect is achieved by the encircling band snugly running between the two closely placed scleral tunnels and not by undue tightening of the encircling band. It is hence, not necessary to tighten the encircling band more than that required with a routine scleral buckle to achieve the buckle effect in sutureless scleral buckle. However for the sutureless technique to work, the extent of the buckle should be 1½–2 clock hours; scleral tunnels for more extensive buckles would have to be placed further apart, and the resulting laxity of the encircling band causing an inadequate buckle effect. On theoretical basis, broader buckles may have less uniform indentation than a narrow buckle (7 or 9 mm buckle) resulting in surgical failure. However in our series, failure was most commonly associated with the use of a 9 mm buckle and none with a 10 mm buckle, possibly because the 9 mm buckle was the most commonly used in this series and not because of the width of the buckle. Considering that presence of multiple breaks in different quadrants is most often managed with vitrectomy, most cases that are candidates for simple scleral buckling can be managed with the sutureless technique. The sutureless technique also has the advantage of avoiding unnecessarily high and/or irregular buckle, which often can occur when employing sutures. The limitation on the other hand of a sutureless buckle is that it is difficult to relocate the buckle to a new area, if the buckle location is found inappropriate after SRF drainage; we would, however, have the option of converting it to a regular sutured buckle in such a case.

Sub analysis of the 7 cases of failed primary surgery showed that preoperative factors such as preexisting PVR (1 eye) and multiple horse shoe tears (HSTs) (1 eye) and a large two disc diameter sized HST (1 eye) as the possible causes of failure. Postoperatively failure occurred due to fish mouthing of the break (1 eye) and PVR (3 eyes). Sutureless scleral buckling technique could have been the cause for recurrence in the eye with large HST, but not in the other 6 eyes wherein recurrence could be attributed to other well knows causes of recurrent RD.

The drawback of our study is being a retrospective in nature would require prospective validation, or head to head comparison between sutureless scleral buckling with already established techniques of repairing RD. Other weakness was that 2 patients were lost follow-up, this being attributable to our center being a tertiary care referral center, drawing patients from distant places.

There has been a continuous debate over last decade about the best surgical procedure for RD, and some centers have greatly increased their percentage of pars plana vitrectomy as a primary procedure for RD.[10] Scleral buckling is practiced/taught with decreasing frequency with a preference toward vitrectomy in recent times. The major recent clinical trials both randomized and nonrandomized have however, shown the benefits of scleral buckling over vitrectomy in terms of both anatomical and functional outcomes in the management

Table 2: Causes of primary surgical failure

Primary anatomic success rate	43 (86%)
Final anatomic success rate	47 (94%)
Final BCVA (mean±SD)	0.50±0.40
Causes of primary failure	**Management with outcome**
Lifted large HST (>2 DD)	Underwent pars plana vitrectomy with silicone oil injection - retina attached postoperatively at 3 months follow-up
Lifted HST with increased SRF	Intravitreal injection of C3F8 postoperatively - retina attached at last follow-up at 12 months postoperative period
PVR with new break	Vitrectomy with silicone oil temponade twice along with relaxing retinectomy - developed recurrent RD with PVR
	No further surgery done in view of poor prognosis
PVR with lifted break	Was advised vitrectomy - patient lost to follow-up
PVR with new breaks formation	Vitrectomy with C3F8 temponade - retina attached at last follow-up at 3 months postoperative period
Lifted lattice with hole at the edge of buckle	Scleral buckle repositioning - developed recurrent RD after 2 weeks postoperative period. Advised vitrectomy; patient lost to follow-up
Persistent RD with subretinal hemorrhage because of SRF drainage complication (patient had inferior PVR C1 preoperatively)	Vitrectomy with inferior localized retinectomy to drain subretinal hemorrhage along with silicone oil temponade done 4 days after primary surgery - retina attached 12 months postoperative period last follow-up

SD: Standard deviation, BCVA: Best corrected visual acuity, HST: Horse shoe tear, SRF: Subretinal fluid, PVR: Proliferative vitreo retinopathy, RD: Retinal detachment

Table 3: Intra and post-operative complications of sutureless scleral buckling surgery

Complications	Number, *n* (%)
Intraoperative complications	
Subretinal hemorrhage	5 (10)
Postoperative complications	
Raised IOP >21 mm Hg	7 (14)
IOP controlled with anti-glaucoma medications	5
Patients requiring surgery for glaucoma	2
PVR	3 (6)
ERM	3 (6)

PVR: Proliferative vitreo retinopathy, ERM: Epiretinal membrane, IOP: Intra ocular pressure

of uncomplicated rhegmatogenous RDs.[1,2] Scleral buckling results in earlier visual recovery in the absence of tamponades used with vitrectomy, decreases the risk of cataract that occurs after vitrectomy, and a second surgery to remove the tamponade is also not required. Hence, scleral buckling that gives equivalent results as vitrectomy is not a procedure to be shunned easily. Sutureless scleral buckling is relatively easy to master and is likely to revive scleral buckling for treating simple rhegmatogenous RD.

Conclusion

Sutureless scleral buckling is easy to adapt to and achieves excellent anatomical and functional success in majority of the patients with rhegmatogenous RD.

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Conflicts of interest

There are no conflicts of interest.

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