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Original Article

Scleral buckling surgery using multiple radial buckles: A valid option?

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Abstract

Purpose: To determine whether radial buckling surgery using two or more radial buckles with or without circumferential silicone tires is still a treatment option for rhegmatogenous retinal detachment (RRD) in the current scenario.
Methods: Retrospective chart review. Patients with RRD with two or more horse-shoe tears with/without proliferative vitreoretinopathy up to grade C1 who underwent buckling surgery using at least two radial buckle segments without encircling bands or drainage and with at least a 3 year follow up were included in the study. Data collected included demographics, corrected distance visual acuity (CDVA) at baseline and final follow up, details of the examination, surgical procedure(s) and complications noted, if any. Appropriate statistical analysis was done. Statistical significance was set at $p < 0.05$.
Outcome measures: Proportion of patients who had an attached retina at final follow up, improvement in CDVA and complications.
Results: 25 patients (25 eyes; 12 males and 13 females; 9 pseudophakic) were included.
Median age: 35.15 ± 8.32 years. Median baseline CDVA: 1.97 ± 1.12 log MAR. Median final CDVA: 0.65 ± 0.37 log MAR (significant improvement). Most common presenting complaint was decreased vision (87.5%). Number of radial buckle segments placed varied between 2 and 4 per eye. One patient required vitrectomy for persistent retinal detachment. One required buckle removal for infection 5 years after the primary procedure. One patient required strabismus surgery.
Median follow up: 12.25 years ± 2.14 years. None of the other patients had any complications.
Conclusion: Radial buckling surgery (two or more segments) is a reasonably safe and valid alternative to vitrectomy for RDs with multiple breaks in different planes.

Keywords: Radial buckle, Scleral buckling, Rhegmatogenous retinal detachment

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Introduction

Scleral buckling is a time-tested treatment modality for rhegmatogenous retinal detachment,[1–5] with protagonists reporting very high success rates after a single, or uncommonly two procedures.[1–4] It requires considerable expertise in the use of the indirect ophthalmoscope for accurate localization of breaks.[1–5] Also, retinal detachment with multiple breaks in different planes is currently considered to be a relative indication for primary vitrectomy and subsequent endotamponade,[6] either with gas or silicone oil. Exponential advances in equipment, controlled fluidics, the use of micro-incisional surgery and finer instruments and the use of high resolution wide angle viewing systems have considerably reduced surgical trauma and improved the anatomic and visual outcomes.[7–10] An alternative to vitrectomy in such

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patients is the radial placement of a silicone sponge, either single or multiple, depending upon the number of retinal tears. While cumbersome, and possibly more uncomfortable for the patient in the immediate post operative period, radial buckling surgery has the advantage of avoiding intraocular surgery and its associated complications. This in turn needs to be balanced with the possibility of sponge infections,[9] and, should the buckle surgery fail, vitrectomy. We undertook the study to analyze the long-term visual and anatomical outcomes of eyes that underwent multiple radial buckle surgery (i.e. placement of at least two radial buckles for rhegmatogenous retinal detachment and thus determine if 'complex' scleral buckling is still a valid treatment option in the current era).

Methods

A retrospective chart review was performed to look for patients who underwent scleral buckle surgery with placement of two or more radial buckles (without drainage or encircling bands). The review adhered to previous guidelines for retrospective analyses.[11] For inclusion, patients were required to have: (1) Rhegmatogenous retinal detachment with multiple tears, (2) proliferative vitreoretinopathy no worse than C1 as per the current classification, (3) scleral buckling surgery with placement of at least two radial buckle segments in the same eye. Patients who had had drainage of sub-retinal fluid, encerclage, any form of intraocular tamponade and a follow up of less than 3 years were excluded from the analysis. The institutional review board approved of the study. Informed consent for academic use of data had been obtained from patients at the time of the primary visit. The study adheres to the tenets of the Declaration of Helsinki.

The following data were obtained for analysis: (1) Demographics, (2) details of the ocular exam, i.e. the corrected distance visual acuity (CDVA, recorded in log MAR), slit lamp biomicroscopy, the retinoscopy findings, axial length measurements, gonioscopy, the intraocular pressure measured by applanation tonometry, indirect ophthalmoscopy, details of the systemic examination, surgical details, complications and the final visual and anatomical outcomes. Secondary procedures performed, if any, were noted.

A single surgeon (AMS) performed all procedures using a standardized surgical technique. Patients underwent extensive preoperative evaluation (with scleral indentation) to identify all breaks and note the configuration of the detachment as well as to note the severity of proliferative vitreoretinopathy, should it be present. The surgical procedure was performed under either peri-bulbar anesthesia or general anesthesia, if the patient was a child or an apprehensive adult. After limited peritomy in the appropriate quadrants, the corresponding recti muscles were tagged using 4–0 silk sutures. Indirect ophthalmoscopy was repeated to confirm the preoperative findings. Cryo-therapy (until blanching was just appreciated) was applied to the area of the retinal tears. Subsequently, pre placed 5–0 Dacron sutures were secured in the area where the buckle was to be placed. A radial sponge of appropriate length was then inserted into position, and the sutures tightened. As already stated, drainage or encircling procedures were not resorted to. The final buckle height was confirmed with indirect ophthalmoscopy and the retinal artery pulsations checked. Anterior chamber paracentesis was performed when needed. This was followed by closure of peritomy with 8–0 absorbable vicryl sutures.

Post-operatively, patients were given topical antibiotics (ofloxacin eye drops 0.3%) six times a day for a week, topical steroids (prednisolone acetate 1% eye drops) tapered over a month and a topical cycloplegic (homatropine 2%) at bedtime for a week. Anterior chamber paracentesis was performed when needed. Oral non-steroidal anti-inflammatory agents were advised as needed for post operative pain, if the patient had any. Patients were reviewed on post-operative days 1, 3, 5, 7, 30, 90, 180 and then yearly.

Descriptive statistics were used to analyze the data. The paired *t*-test was used, wherever appropriate. All statistical analyses were performed using the SPSS software (V. 17.0, Chicago, IL). Both the final CDVA and the proportion of patients with an attached retina at final follow up constituted the primary outcome measure. Secondary outcome measures were the noted complications, if any (Figs. 1–4).

Results

A total of 25 patients (25 eyes; 12 males and 13 females) were included in the final analysis. The median age was 35.15 ± 8.32 years with a range of 25–52 years. The median baseline spherical equivalent error was −4.00 ± 2.15 diopters (range 1.25 diopters to 10.75 diopters). The median best-corrected visual acuity at baseline was 1.97 ± 1.12 log MAR with a range of 0.1–3 log MAR. The most common presenting complaint was decreased vision (89.2%).

Examination revealed a rhegmatogenous retinal detachment in all patients. Nine patients were pseudophakic; the rest were phakic. Two of the pseudophakic patients had undergone Nd:Yag capsulotomy for posterior capsular opacification. The detachment spared the macula in 3 eyes. All patients had at least 2 breaks in 2 different quadrants, necessitating the placement of at least 2 radial buckle segments. The maximum number of radial segments placed was 4 for 4 horseshoe tears in four different quadrants in one eye. Five patients had PVR changes, the highest grade being C1. The radial buckle most commonly used was a 5.0 mm silicone sponge (style 505, MIRA Inc, Uxbridge, USA). Three patients required a 3.0 mm sponge (style 503, MIRA Inc, Uxbridge, USA).

The median final corrected visual acuity was 0.65 ± 0.37 log MAR with a range of 0.0–2 log MAR. The final median spherical equivalent error was −5.42 ± 3.14 dioptres, which was not statistically significantly different from the baseline refractive error ($p = 0.24$). The median follow up period was 12.25 years ± 2.14 years with a range of 3–16 years. Only one patient required an anterior chamber paracentesis. The patient who did require chamber paracentesis required the placement of four radial buckles; the size of the buckle however, was not larger than the aforementioned average size. It could however, be related to the number of buckles used, as none of the other patients required four radial buckles in four quadrants and none of them required a paracentesis. None of the patients had a re-detachment except one patient who developed a radial sponge infection 5 years after the procedure and had to undergo sponge removal and subsequent vitrectomy with endo-tamponade as he had a re-detachment one month after sponge removal. None of

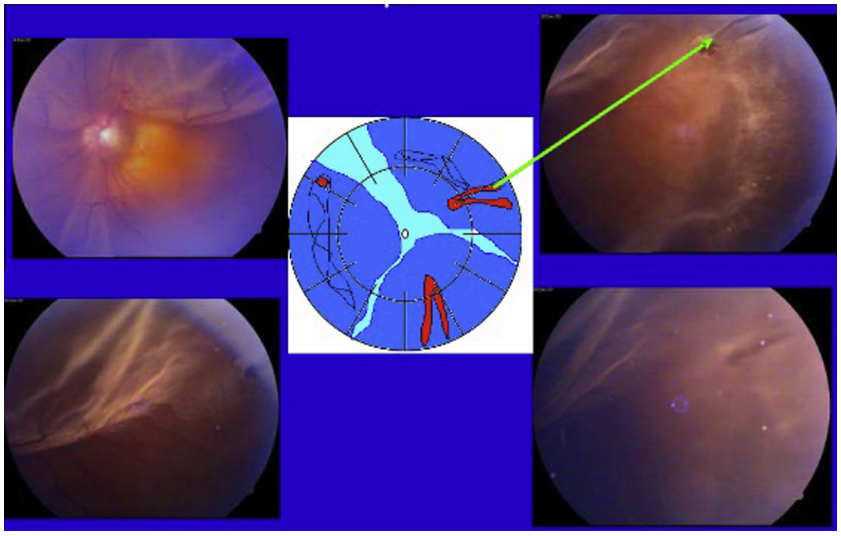

Figure 1. Shows the schematic diagram and clinical photographs of a 30 year old female patient who presented with a rhegmatogenous retinal detachment in the left eye. As shown, she had two circumferential lattices, the nasal one with a hole within and two horse shoe tears in the supero-temporal and infero-temporal quadrants.

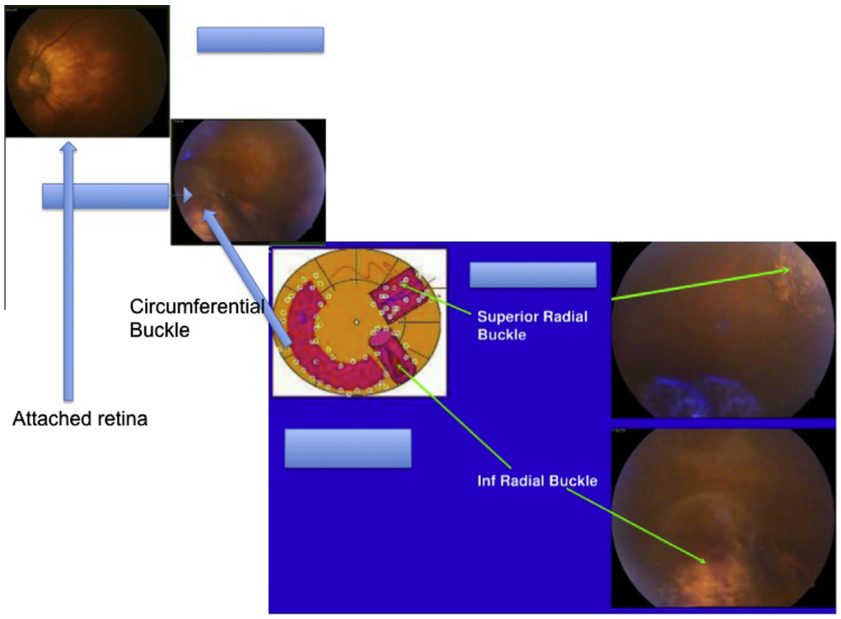

Figure 2. Shows the fundus photographs and a schematic representation of the procedure carried out in the same patient at the 8 year follow up; she was treated with two radial buckles (5.0 mm; style 505) for the two horse shoe tears and a circumferential silicone band (277) nasally. Encerclage or drainage was not performed. The scleral indent is well seen. The yellow dots indicate cryopexy.

the other patients required a secondary procedure till the end of the follow up period.

Discussion

The purpose of this analysis was to determine whether radial buckle surgery for detachments that require at least two or more radial buckle segments is still a valid treatment option in the modern era of vitrectomy. This study reports good results in eyes that required placement of multiple radial segments for multiple breaks in different planes. The presence of limited PVR did not seem to affect the end result. Radial buckle aids retinal re-attachment without violation of the internal anatomy of the eye. Anterior chamber paracentesis does mean an intrusion in the intraocular space, and the relative advantage of a procedure that is otherwise extraocular in its entirety is lost; however, only one patient in the entire series required a paracentesis.

The choice of primary procedure for rhegmatogenous retinal detachment continues to be a matter of debate.[7,12] Scleral buckling, vitrectomy or a combination of the two is generally considered more successful than pneumatic retinopexy.[13] While primary vitrectomy is considered to be the procedure of choice for pseudophakic eyes,[14–17] scleral buckle is generally considered first in phakic eyes.[1–4,12–17] Many authors favor scleral buckling for primary surgery.[1–5] Vitrectomy remains undoubtedly the procedure of choice in complicated detachments, but some authors challenge its

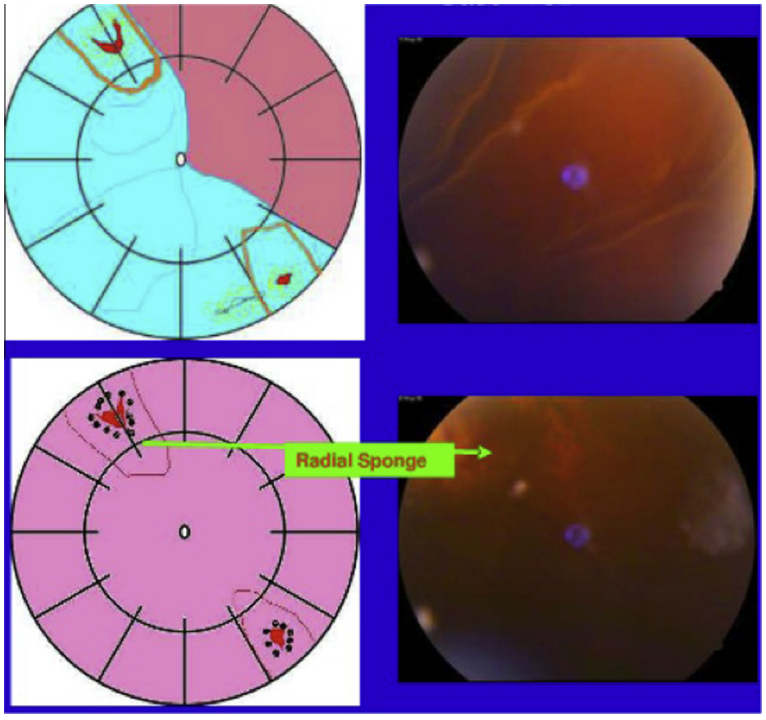

Figure 3. Shows the schematic representation and clinical fundus photographs of a 34 years old pseudophakic patient who had two horse shoe tears as shown. The pictures on top indicate the pre operative scenario; the pictures on the bottom show the retina at the 10 year follow up. The superior radial buckle indent is well seen.

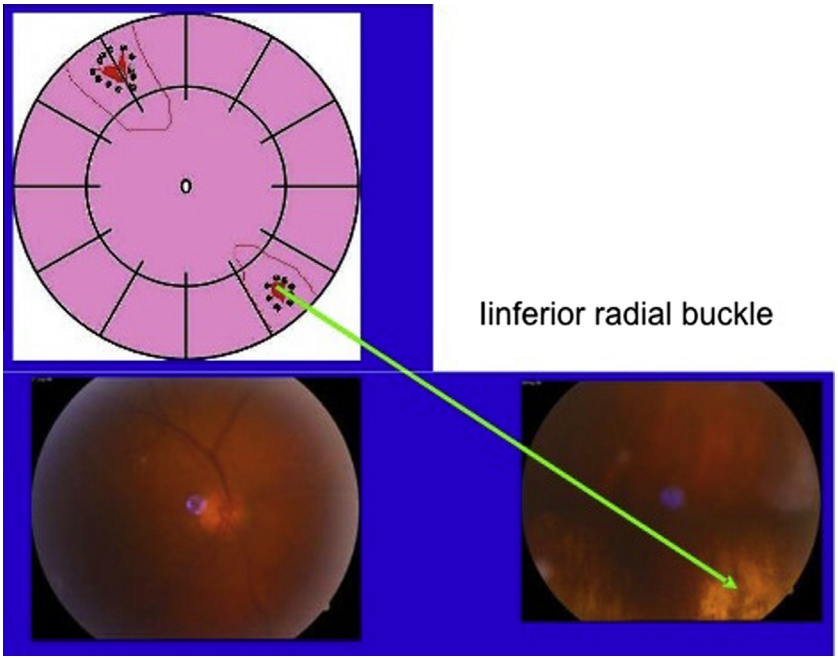

Figure 4. Shows the inferior radial buckle of the same patient at the ten year follow up; the retina is well attached. Encerclage or drainage was not performed.

primacy in pseudophakes and in phakic patients with multiple breaks in different planes.[1–5,12,14–17] Better instrumentation and visualization has simplified vitrectomy and it is said to hold an advantage in pseudophakes and aphakes[7–9,14–17] as these are the very patients in whom peripheral minute holes may be missed during indirect ophthalmoscopy, even in experienced hands. Success rates (in terms of retinal re-attachment) are said to be higher with vitrectomy as opposed to scleral buckles in pseudophakes.[8,15,16] Also, vitrectomy almost entirely eliminates the possible complications of scleral buckle surgery.[8,18] Scleral buckling, on the other hand may be the procedure of choice in phakic patients who are at

risk for cataract formation. Additionally, non-drainage scleral buckling is an external procedure in its entirety and avoids all complications of intraocular surgery.

The current study analyzes a subset of patients in whom considerable effort would be required to avoid re-detachment or even achieve primary attachment with a single surgery using scleral buckling alone. Large series have already been published on minimal scleral buckling. This study gives a focused analysis of patients who received two or more radial buckle segments, without circumferential silicone bands, encircling procedures and external drainage in the era of modern vitrectomy. Over a third of the patients were pseudophakes, but subset analysis did not seem to suggest failure in this group. Long term follow up of these patients shows that nearly all patients (24/25, 96%) did well both in terms of visual recovery and anatomic success. One patient who developed a buckle infection required vitrectomy and endo-tamponade after explantation of the sponge; this however, happened five years after the primary buckling procedure. Most series that look at complications of buckling analyze patients who underwent hydrogel implants.[19,20] Finally, radial buckles would probably cause lesser alterations in the morphology and biomechanical properties of the cornea as opposed to encerclage.[21] Encircling surgery can alter corneal hysteresis and corneal resistance factor measurements, although it is not associated with a significant change in corneal morphology.[21] This can lead to altered intraocular pressure measurements and can be avoided with radial buckling surgery.

Finally, one patient developed a buckle infection and had to undergo buckle removal. The retina redetached one month after the buckle removal and required endo-tamponade. Re-detachments following buckle explantation is not unknown[22]; while in some cases it occurs due to inadvertent perforation, in some cases the cause may not be identified.[22] In our series, this probably occurred due to persistent traction at the site of the break and because of the loss of external indentation secondary to buckle removal.

Limitations of our study include its retrospective nature, lack of a comparative arm and the small number of patients. In spite of these limitations, however, our study presents several features of interest: Given that very few patients undergo multiple radial buckle placements in the current scenario, we consider this information valuable. Should complications arise, they are generally limited to the extraocular space. The period under study that we have chosen is purposefully so; we seek to determine whether multiple buckling surgery is still a valid option in an age where there have been tremendous advances in vitrectomy technology and techniques.

Based on our observations, we recommend that patients with rhegmatogenous retinal detachments with multiple breaks but without extensive PVR changes be treated with scleral buckling; should the retina fail to settle, the subsequent vitrectomy and tamponade would be rendered easier by peripheral external support to the retina and vitreous base. We believe that radial scleral buckling using two or more radial segments continues to hold an important place in the modern era for the treatment of rhegmatogenous retinal detachments.

Conflict of interest

The authors declared that there is no conflict of interest.

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