

Encircling Narrow Band versus Buckle for Retinal Detachments with Intrabasal or Unseen Retinal Breaks

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Abstract

Purpose: To compare the results of narrow encircling band surgery with standard encircling scleral buckling for retinal detachments (RDs) with intrabasal or unseen breaks.

Methods: In a retrospective study, eyes with intrabasal or unseen breaks underwent narrow band implantation (group N) or standard encircling buckling plus wide tire placement (group W) and were followed for at least one year.

Results: A total of 112 eyes including 39 eyes in group N and 73 eyes in group W were studied. Preoperatively visual acuity of eyes in group N was significantly better (1.55 ± 0.9 vs. 1.93 ± 0.9 logMAR, $P = 0.043$). The two study groups (N and W) were comparable in terms of the extent of RD (2.8 ± 0.96 vs. 2.8 ± 0.93 quadrants), interval to surgery (88.3 ± 176.4 vs. 71.9 ± 135.4 days) and percentage of visible breaks (56.4% vs. 63%), respectively (all P values > 0.05). More atrophic holes were present in group W and more dialyses were reported in group N. The single operation success rate at 12 months was 69.2% in group N and 74% in group W ($P = 0.1$). The single operation success rate for eyes with unseen breaks was also comparable (66.7% vs. 85.7%, $P = 0.157$). Final corrected visual acuity was also similar (0.63 ± 0.44 vs. 0.85 ± 0.69 log MAR). The only factor influencing success rate was the type of retinal breaks ($P = 0.04$). Type of scleral buckling did not affect the single operation success rate ($P = 0.460$).

Conclusion: Narrow encircling band surgery is a possible option with acceptable single operation success rate for RDs with intrabasal or unseen breaks.

Keywords: Eye; Retinal Detachment; Scleral Buckling; Surgery

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INTRODUCTION

Scleral buckling is considered the standard procedure for repairing rhegmatogenous retinal detachments (RRDs).^[1] PPV has recently been proposed as the primary procedure in cases with aphakic and pseudophakic RRD,^[2-5] but the value of scleral buckling has been re-emphasized in eyes with primary phakic RRD.^[6]

Successful treatment of RRDs needs exact localization and closure of all retinal breaks.^[7,8] Despite a thorough examination, retinal breaks can be missed in 3-14% of primary RRDs.^[8] Considering the challenges posed in treating such cases, a number of techniques namely encircling scleral buckling and pars plana vitrectomy

have been suggested.^[8-11] Primary anatomical success rates of 53-85% have been reported for RRDs with unseen breaks.^[8,12,13]

Encircling scleral buckling needs extensive manipulation of periocular and orbital tissues and may cause several complications such as extraocular muscle restrictions and lid retraction. Many surgeons have attempted to minimize manipulations by using segmental buckling techniques.^[12] Encircling buckles may also interfere with choroidal circulation.^[14-18]

Encircling procedures are especially indicated in eyes with several retinal breaks in multiple quadrants,

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myopia, diffuse vitreoretinal pathologic conditions such as extensive lattice degeneration or vitreoretinal degenerations and proliferative vitreoretinopathy (PVR) of grade B or more.^[12] Encircling buckling is performed in cases without visible retinal breaks with the proposition that posterior breaks are rarely missed in a complete fundus examination, whereas invisible retinal breaks are usually small anterior breaks in the region of the vitreous base.^[12,13]

One solution to reduce manipulation of orbital tissues during encircling scleral buckling is to use narrow bands rather than wide tires; advantages include more anterior suturing, less need for pulling on muscles and reduced dissection of peri-muscular sheaths for more exposure. This approach also helps maintain globe anatomy as compared to the large antero-posterior indentation and distortion following wide U-shaped sutures used for fixing tires. Use of narrow bands instead of wide tires in eyes with unseen breaks seems prudent as small anterior breaks can be supported by the indentation of a band.

In the present study, we report the single operation success rate of the narrow band technique in eyes with intrabasal or invisible retinal breaks. The results were compared with similar eyes in which the conventional wide encircling buckling procedure was performed by the same surgeon during the same period of time.

METHODS

Study Population

This retrospective interventional case-control study included consecutive patients who underwent scleral buckling for RRD by a single surgeon (TB) in different ophthalmology departments affiliated to Mashhad University of Medical Sciences from July 2001 to March 2010. All cases had retinal detachment with PVR less than grade C1. Encircling buckling was performed in cases where limited scleral buckling was judged to be inadequate either due to the presence of multiple breaks in different quadrants or in eyes with no visible retinal breaks. Patient data were collected from hospital files and included gender, age, duration of retinal detachment (RD), status of the fellow eye, preoperative visual acuity, intraocular pressure (IOP), relative afferent papillary defect (RAPD), lens status, extent of RD and macular status, type of scleral buckling, intraoperative complications, postoperative visual acuity, retinal and macular reattachment, complications and the need for reoperations.

All patients underwent a comprehensive ophthalmologic examination pre and post-operatively including high-contrast Snellen visual acuity measurement, swinging flash light test, slit lamp biomicroscopy, Goldmann applanation tonometry, and dilated fundus examination. Snellen acuities were

converted to logMAR (logarithm of the minimum angle) notations for statistical purposes.

Ethical Considerations

Informed consent was obtained from patients after the surgical procedure had been explained. The research followed the tenets of the Declaration of Helsinki and was approved by the Ethics Committee at Mashhad University of Medical Sciences.

Surgical Procedure

One surgeon (TB) performed all procedures selecting the technique according to the condition of the eye and at her own discretion. The extent of the wide buckle (solid silicone asymmetrical tire #276, Mira Inc., Uxbridge, MA, USA) was chosen to tamponade all visible retinal breaks. When confronted with subtotal RD without visible retinal breaks, the wide buckle was placed accordingly. In some cases with narrow buckles (silicone circling band #240, Mira Inc., Uxbridge, MA, USA), preservation of the superior conjunctiva was achieved via the technique previously described by the author.^[19]

In the narrow band implantation (group N), the band was tightened to produce only mild scleral indentation. In the wide tire placement (group W), the main indentation was produced by applying scleral sutures (polyester, Mersilene 4-0 or 5-0, Johnson and Johnson, Ireland) with a bed 2 mm wider than the buckle width and tightening them over the buckle. The accompanying narrow band was tightened to the extent that it adhered tightly to the sclera without causing visible indentation.

In uncomplicated cases, postoperative follow-up examinations were scheduled on the first post-operative day and 1, 3, 6 and 12 months after surgery. Cases with complications were followed at the discretion of the surgeon. Postoperative anatomical success was defined as complete retinal reattachment 12 months after the operation without additional procedures. Postoperative pneumatic retinopexy and laser therapy were not considered as additional procedures.

Data Analysis

Data analysis was performed using SPSS statistical software (version 11.5, SPSS, Inc., Chicago, Illinois, USA). Student's *t*-test was used to compare mean values; qualitative variables were compared using the Chi-square test and Mann-Whitney test when the distribution was not normal. *P* values < 0.05 were considered as statistically significant.

RESULTS

The current series includes a total of 112 eyes of 112 patients (70 male and 42 female subjects) for which encircling scleral buckling was performed; 39

eyes (34.8%) received only a narrow band (group N) whereas 73 eyes (65.2%) underwent surgery using a narrow band plus a silicone tire (group W). Cryotherapy and subretinal fluid drainage (SRFD) were performed based on the surgeon's judgment. Cryotherapy was performed for 14 (35.9%) eyes in group N and 46 (63%) eyes in group W ($P = 0.005$). SRFD was performed for 5 (12.9%) eyes in group N and 27 (35.5%) eyes in group W ($P = 0.01$). All patients were followed for at least 12 months after the operations.

Twelve patients (10.4%) had a history of retinal detachment in the fellow eye including 7 eyes (18%) in group N and 5 eyes (6.9%) in group W ($P = 0.071$). Demographic data are presented in Table 1. The average time from first presentation to surgery was 82 ± 161.2 days (1-730 days) overall, and 88.3 ± 176.4 versus 71.9 ± 135.4 days in groups N and W, respectively ($P = 0.407$). The preoperative condition of the affected eyes are reported in Table 1. Preoperative visual acuity of eyes in group N was significantly better than group W (1.55 ± 0.91 vs. 1.93 ± 0.93 logMAR, $P = 0.043$).

Single operation reattachment was achieved in 81 eyes (72.3%) overall, including 27 eyes (69.2%) in group N and 54 eyes (74%) in group W ($P = 0.1$). No significant difference was observed between the two groups in terms of reattachment rates at 1, 3 and 6 months. There was no significant difference in postoperative corrected visual acuity between the study groups at any time point [Table 2].

In eyes without visible retinal breaks, 36 (78.3%) achieved single operation success at 12 months including 12 (66.67%) eyes in group N and 24 (85.7%) eyes in group W ($P = 0.157$). There was no statistically significant difference between eyes with seen and unseen breaks in terms of reattachment rates at 12 months overall ($P = 0.241$).

Preoperative factors including the extent of RD, the number and visibility of retinal breaks, type of retinal breaks, lens status (phakic vs. pseudophakia/aphakia), operative factors including cryotherapy and subretinal fluid drainage, and the type of buckle were compared between eyes with success and failure. Only the type of retinal breaks was found to be significantly different between the two groups ($P = 0.043$). The type of buckle was not significantly different between eyes achieving or those failing to achieve single operation success at 12 months ($P = 0.460$).

DISCUSSION

In order to achieve successful retinal reattachment, thorough attention must be paid to the identification and treatment of all retinal breaks along with complete release of vitreous traction. Most surgical failures are due to not addressing one or both of these factors.^[8,9,12,20]

There are two ways to achieve the latter principle, i.e. vitreous traction release. The surgeon can either perform vitrectomy or can opt for encircling buckling. An

Table 1. Demographic data and preoperative condition of operated eyes

	Total (112)	Group N (39)	Group W (73)	P
Age*	39.32±22.88	33.60±22.80	42.51±22.46	0.048
Female	40 (36.7%)	14 (35.9%)	28 (38.4%)	0.79
Right eye	68 (62.4%)	21 (55.3%)	47 (66.2%)	0.264
Preoperative VA (logMAR)*	1.79±0.94	1.55±0.91	1.93±0.93	0.043
RAPD*	2.02±0.73	2.23±0.75	1.9±0.71	0.094
IOP (mmHg)*	11.43±5.05	11.31±5.25	11.5±4.97	0.863
Lens status (%)				
Aphakic/pseudophakic	33 (29.4)	15 (38.5)	18 (24.7)	0.16
Phakic	76 (67.9)	24 (61.5)	52 (71.2)	
Missing	3 (2.7)		3 (4.1)	
Eyes with attached macula# (%)	17 (15.3)	5 (12.8)	12 (16.7)	0.591
Eyes with visible retinal breaks# (%)	68 (58.3)	22 (56.4)	46 (63)	0.492
Number of breaks in each eye#	1.56±0.95	1.37±0.89	1.65±0.97	0.284
Type of retinal breaks#				
Atrophic hole(s)	24	3 (7.7%)	21 (28.8%)	0.040
Horseshoe tear(s)	16	5 (12.8%)	11 (15.1%)	
Dialysis	15	8 (20.5%)	7 (9.6%)	
Mixed	6	3 (7.7%)	3 (4.1%)	
Total	61	19	42	
RD extent (quad)*	2.82±0.94	2.84±0.96	2.81±0.93	0.879

*Data presented as: Mean±SD. #Data presented as: Number (%). $P < 0.05$ were considered significant. RD, retinal detachment; IOP, intraocular pressure; RAPD, relative afferent papillary defect; Group N, narrow band group; Group W, wide tire group; VA, visual acuity; SD, standard deviation; logMAR, logarithm of the minimum angle of resolution

Table 2. Postoperative corrected visual acuity, data presented as (mean±SD) logMAR

	Total	Group N	Group W	P
1 month	1.23±0.78	1.27±0.80	1.21±0.76	0.734
3 months	1.06±0.68	0.96±0.75	1.10±0.68	0.451
6 months	0.85±0.54	0.62±0.39	0.95±0.57	0.062
12 months	0.78±0.62	0.63±0.44	0.85±0.69	0.347

SD, standard deviation; logMAR, logarithm of the minimum angle of resolution; Group N, narrow band group; Group W, wide tire group

encircling element indents the globe for 360 degrees and creates a permanent buckle that counteracts centripetally directed vitreous forces. Most surgeons use a wide buckle in addition to a narrow band for encircling buckles.^[12,17,18] Encircling buckling is generally indicated in eyes with vitreous traction for 360 degrees, multiple retinal breaks in different quadrants and also when there are no identifiable breaks whatsoever.^[8] The latter is regarded as a poor prognostic factor,^[8,10] thus the surgeon must make all efforts to detect the causative break(s) preoperatively. However, this goal may not be achieved in all cases. As intraoperative searching is sometimes futile, Lincoff and Geiser offered rules for predicting the causative retinal break considering the configuration and location of subretinal fluid.^[21]

In up to 17.7% of cases with RRD, the retinal break cannot be found despite all efforts.^[20] In the present study, breaks were not found in a large percentage of eyes. The high rate of unseen breaks can be due to the preference of the surgeon for placing segmental buckles in eyes with visible single retinal breaks (which were excluded from the study). Our relatively lower reattachment rates can be accounted by the exclusion of simple RD cases with a single retinal break.

Conventional scleral buckling is an effective surgical technique for primary management of uncomplicated RRDs with unseen retinal breaks and clear media. In cases with no visible retinal breaks, one may choose to place a buckle following Lincoff's rules or place an encircling element. When the latter is chosen, it is customary to use a wide tire for 360 degrees, or use a segmental tire to the extent of detachment under a narrow encircling band.^[9]

In some studies, results of PPV have not been better than scleral buckling for treatment of RRDs without detectable breaks.^[9,22,23] Griffith reported 66% single operation success rate with 360° scleral buckling anterior to the equator, cryotherapy and subretinal fluid drainage in patients without visible breaks.^[8] The success rate of combined PPV and scleral buckling has been reported to be 75-100% in pseudophakic RD with undetectable breaks.^[10,11] Wu et al reported a success rate of 75% with scleral buckling surgery alone in similar cases.^[23]

The chief drawback to encircling SB is induced myopia.^[17] Other complications of scleral buckling include higher order aberrations, infection, intrusion

or extrusion of the buckling elements, strabismus, glaucoma, persistent ocular pain, increased IOP and reduced ocular blood flow with encircling buckles especially wide elements.^[14-16,18] Wide buckles, as opposed to narrow bands, are difficult to apply, take more time to be placed, may cause long-term discomfort and cosmetic complaints and above all, increase the risk of orbital tissue injury particularly to the rectus muscles.^[12] Eye movements are also more limited with wide buckles and occasionally wide buckle placement necessitates muscle disinsertion.^[17] Overall, wide buckle surgery is complicated, invasive and more time consuming than narrow buckle placement. Furthermore the risk of infection in the space between the band and the tire element will be obviated by the application of a narrow band alone.

We previously reported on the preservation of the superior conjunctiva during encircling buckling in patients at risk of future glaucoma or those already with filtering blebs.^[19] A narrow band can obviously facilitate the technique.

It is logical to think that most eyes without visible retinal breaks have small intrabasal breaks, so it seems that a narrow band adequately supporting the vitreous base will provide sufficient tamponade for such breaks. Narrow bands placement is also much simpler, less time consuming, associated with less distortion of globe anatomy and less orbital tissue manipulation than placement of wide tires. Theoretically, these advantages must be associated with a reduced complication rate of exposure as well as motility disorders. Kocaoglan, using encircling band #240 in cases with unseen breaks as a primary surgery, managed to achieve a success rate of 62.2%, which is similar to the rate observed in the current study.^[22]

When there are visible intrabasal retinal breaks, the attachment of vitreous base collagen fibers to the region around the break can theoretically hinder the free flow of fluid from vitreous cavity through the break, and these detachments are generally low-lying. This can be assumed as a partial internal tamponade, from which the surgeon can benefit by placing narrow bands for buckling intrabasal breaks. This internal tamponade will obviate the need for wide indentation to support a break. With the above logic in mind, we used narrow bands in eyes with visible intrabasal breaks.

It should be noted that the two groups of eyes in the present study were similar with respect to their preoperative factors such as macular involvement, duration of macular detachment, RD extent and percentage of cases without visible retinal breaks. At one year, the anatomic and functional results were similar between the two groups. More frequent cryotherapy and subretinal fluid drainage during the operation in the wide buckle group may point to the presence of a selection bias for the type of surgery with possibly more

low lying RDs in the narrow band group. This seems to be a bias in patient selection with more complex cases tackled by wide buckle surgery. The height of RD was not adequately addressed in the records and has not been included as a factor in this study, which is one of the inevitable limitations of retrospective studies.

In summary, we used narrow band placement not only in cases with unseen breaks, as previously reported,^[22] but also in eyes with intrabasal retinal breaks. We compared the anatomic and functional results with a concomitant group of patients for whom a wide tire had been placed in addition to the narrow band. We found no advantage in terms of anatomic and functional results with placement of a wide tire in these cases. Retinal break types were shown to be a chief determinant of success rate. However, their visibility did not seem to affect the outcome. The results must surely be reassessed through a randomized clinical trial. However, we believe that selected cases of low-lying RDs with intra basal breaks or without visible breaks can be managed by only narrow scleral buckling surgery.

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