Strabismus Following Scleral Buckling Surgery

Sunil Ganekal¹, Moupia Mukhopadhyay²

ABSTRACT

Purpose: The purpose was to assess the incidence of strabismus, relationship of strabismus with type, and width of the scleral buckle (SB) after SB surgery for retinal detachment.

Methods: Retrospective analysis of 360 eyes of 344 patients, treated for rhegmatogenous retinal detachment with SB surgery between January 2008 and January 2013 was done.

Results: The mean age of patients was 38.45 ± 18.12 years (range: 7-89 years) was detected in 48 out of 344 (13.95%) patients at 6 weeks after SB surgery. Horizontal deviation was the most common type. Incidence of strabismus was higher after repeat SB surgery (4/9, 44.4%) compared to patients who had single SB surgery (44/335, 13.1%) (P = 0.02). Strabismus was observed in 18.5% of patients with implants, compared to 11.3% of patients who received explants (P = 0.02). Strabismus surgery was performed on 2 (4.1%) cases.

Conclusion: Horizontal strabismus is common after SB surgery for repair of retinal detachment. Repeat scleral buckling and use of implants resulted in a higher incidence of strabismus in the post-operative period. Majority of these cases resolve with conservative management.

KEY WORDS: Fresnel prism, scleral buckle, strabismus

INTRODUCTION

Scleral buckling (SB) is an effective surgical technique for repair of retinal detachment.[1] Buckles and encircling bands of various materials and of different sizes are placed beneath the extraocular muscles, in the sclera (implant) or over it (explant), in order to achieve scleral indentation.[2] SB has its share of complications. Extraocular motility restriction and diplopia are some of them.[3]

Although various preventive measures to minimize scarring and fibrosis like careful tissue handling, avoiding muscle disinsertion, and scleral dissection have reduced the incidence of strabismus; it still is a very significant problem (5-25%).[4] Strabismus is transient in most of the cases.[5] Transient motility disturbances immediately following retinal detachment surgery are caused by extraocular muscle swelling and hemorrhage.[5] Recovery period may be 3-6 months.[5] In spite of recovery, long term diplopia may be seen.[6]

Persistent strabismus is caused by decreased vision, direct muscle injury, extraocular motility restriction due to adhesions, muscle fibrosis or scarring involving the buckle material.[7] In some studies, patients who underwent multiple retinal procedures and who had had either a large buckle or encircling band, had an increased incidence of strabismus.[4,8]
Various modalities of treatment have been described. Nonsurgical approaches to treating post-retinal detachment strabismus include occlusion, prism therapy, and botulinum toxin injection. Commonly described surgical intervention includes buckle removal and resection recession surgery based on the deviation either in the buckled eye or fellow eye. Adjustable suture technique is successful in most cases.

This study examines the incidence of strabismus following sclera buckling for retinal detachment surgery and the factors that influence the strabismus, its incidence preventive measures and treatment options.

**MATERIALS AND METHODS**

Retrospective analysis of case records of all patients treated for retinal detachment with SB surgery in our hospital between January 2008 to January 2013. The study protocol adhered to the tenets of the Declaration of Helsinki and was approved by the institutional review board; informed consent was taken from all patients.

Patients with preexisting strabismus, nystagmus, amblyopia, trauma involving orbital walls, myastenia gravis, thyroid related ophthalmopathy, and congenital ocular motility disorder were excluded. Post-operative best corrected visual acuity ≤ counting fingers close to face in either eye, one-eyed patients and those with follow-up of less than 6 months after SB surgery were also excluded from the study.

The analyzed parameters included age, gender, the involved eye, best-corrected visual acuity prior to and after retinal detachment surgery and whether SB surgery was primary or the patient had undergone SB surgery in the same eye before. Patients who underwent surgery in both eyes, the eye with poorer visual acuity was considered for analysis. Hirschberg light reflex test, test for extraocular motility and cover test done in relevant cases to rule out preexisting strabismus.

The sclera buckling (explants/implant) was done according to the standard technique described. The buckling elements used were Mira 276 # (7 mm width), Mira 279 # (9 mm width), Mira 280 # (10 mm width) or Mira 281 # (12.5 mm width) from Mira, Inc. (USA). Details of SB surgery pertaining to the width of SB used and number of muscles under which it was passed was recorded in each patient. Mira 240# (2.5 mm width) encircling band was used in all cases.

At 6 weeks, best corrected visual acuity, complaints of diplopia or cosmetic appearance (deviation of eye) were recorded. Findings of Hirschberg’s test, test for extraocular motility (Figure 1, pursuit test done binocularly with a penlight at a distance of 30-40 cm, testing nine positions of action, starting from primary position), cover test, prism cover test, forced duction test, and treatment given, if any, was recorded. Manifest deviation greater than 1 prism diopter, or any measurable limitation of motility in any direction of gaze was considered abnormal.

**Figure 1**: Scleral Buckle placed below medial rectus of the right eye. Six weeks postoperatively, shows right exotropia in primary gaze, restriction in adduction in right eye
Management options given were prisms in spectacles or Fresnel prisms and strabismus surgery based on the degree of deviation. The patients were examined prior to SB surgery. After SB surgery, any strabismus was evaluated once at final post-operative checkup, which is done after 6 weeks in our hospital. Those with motility problems were called for review after 5-6 months as transient strabismus is known to resolve by then.[1] All the above mentioned parameters were recorded at each follow-up visit. Additional note was made about the resolution of presenting complaints if any. All the data from the proformas were transferred to a Microsoft Access data sheet. These data were analyzed by the SPSS version 16.0 software. Statistical significance was done with Fisher’s exact test for two proportions.

**RESULTS**

Overall, records of 360 eyes of 344 patients were analyzed. The mean age of patients was 38.4 ± 18.1 years (range: 7-89 years). There were 267 males and 77 females. 16 patients had bilateral retinal detachment for which SB was done. 197 operations were performed on right eyes and 163 on left eyes. 109 eyes had previous cataract extraction. There were 251 phakic eyes (69.72%), 8 aphakic (2.22%), and 101 pseudophakic (28.05%) eyes. Circumferential Mira 276, 279, 280 or 281 solid silicone implants or explants were used. In all cases, a 2.5 mm wide encircling band (Mira 240) was placed over the segmental buckle to augment the buckle effect. Explants were used in 202 eyes and 158 eyes required an implant.

Strabismus was detected in 48 of 344 (13.95%) patients at 6 weeks follow-up. The chief complaints of the patients at presentation are shown in Table 1. More than half of the strabismic patients did not have any significant ocular motility problems. Of the 12 patients who complained of diplopia, 8 had persistent diplopia and 4 patients had only intermittent diplopia. These patients were seen at the end of 6-8 months postoperatively and persistent strabismus was noted in 16 patients (4.65%).

Number of patients with restriction of extraocular movements was noted from the records. Horizontal deviation was the commonest, noted in 36 patients. Six patients had vertical deviation and 6 patients had combined horizontal and vertical deviation.

Totally, 47 of our 48 patients had an SB in direct proximity to one or more of the recti. Restriction in ocular movement in the direction away from the rectus muscle was seen in 29 out of 48 patients (60.41%), suggestive of tethering of the muscle. In 15 patients (31.2%), restriction of motility occurred in the direction of action of the muscle, indicating possible mechanical restriction due to the buckle. In 4 patients, direction of restricted ocular movement was unrelated to the position of the buckle. The range of visual acuity in patients after SB surgery is shown in Table 2.

In total, 335 patients had primary SB surgery and 44 (13.1%) developed strabismus; patients had undergone repeat SB surgery and 4 (44.4%) of them had developed strabismus (P = 0.02). In the unilateral SB surgery group (n = 228), strabismus was observed in 18.5% (28/151) of patients with implants, compared to 11.3% (20/177) of patients who received explants (P = 0.02). Interestingly, no strabismus was seen in any of the patients who underwent bilateral surgery. Buckle width (≠276 to ≠281) did not influence the incidence of occurrence of strabismus when the buckle was placed under one, two or three muscles (P = 0.597, P = 0.504, P = 0.561 respectively).

The average angle of horizontal deviation was 25.8 ± 13.4 PD (exotropia 15 to 50 PD, esotropia 20 PD to 8 PD) and, the average angle of vertical deviation was 6.9 ± 3.9 PD (3 to 15 PD). Prisms (Figure 2) were prescribed for 11 patients. At the end of 6 months follow-up, 6 patients continued with prisms and 5 patients could fuse in primary gaze or downgaze without prisms. Two patients underwent strabismus surgery, resection, and hang back recession was done in both the patients without removal of the buckle.

<table>
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<tr>
<th>Table 1: Presenting complaints in cases with strabismus after scleral buckling surgery</th>
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<td><strong>Complaints</strong></td>
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<tr>
<td>Diplopia</td>
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<tr>
<td>Deviation of the eye</td>
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<tr>
<td>Both of the above</td>
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<td>None</td>
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Of the remaining 35 patients, restriction of motility decreased in 27 patients whereas 8 patients continued to have the same amount of motility restriction.

**DISCUSSION**

The incidence of persistent strabismus after SB surgery was 4.65% in our study. Similar incidence was quoted by Fison and Chignell. A higher incidence has been reported in some other studies.

Studies conducted by Sewell et al. showed 19 out of 138 patients (13.76%) with strabismus and that by Frey and Weecker et al. noted an even higher incidence. This is because earlier, disinsertion and faulty repositioning of extraocular muscles was common, which led to a higher incidence of strabismus. None of the muscles were disinserted or inadvertently ruptured during surgery in our study.

Multiple surgeries have been associated with an increased risk of strabismus. In a study conducted by Price and Pederzolli, the incidence of strabismus after primary SB surgery was 6.1% whereas it was 19.2% after zre-surgery. Similar results were reported in other studies.

In our study, restricted ocular rotation in the direction away from the rectus muscle with underlying SB occurred in 29 out of 48 patients (60.41%), suggestive of tethering of the muscle. In 15 out of 48 patients (31.2%), restriction of motility occurred in the direction of action of the muscle, indicating mechanical restriction secondary to the buckle. In the study by Spencer et al. in 84% of those with some restriction, the motility defect correlated with the site of explant. In their study, restriction of muscle was more likely in the direction away from the buckle, similar to our results. Fison and Chignell found 66.67% patients had restriction away from the buckle and 33.33% patient had mechanical restriction due to the buckle. However, Price and Pederzolli and Smiddy et al. found no consistent correlation between the muscle beneath which an explant was placed and the direction of deviation (Table 3).

In our study, there was no statistical significance between incidence of strabismus and buckle width, although theoretically we would expect significant strabismus where wider buckle has been used. Sewell et al. found that a significantly greater number of patients had muscle imbalance if a large volume of silicon material was placed beneath one or more recti muscles. Majority of the patients in the present study received the 279# buckle and few patients received 276# and 281# buckles. Use of 281# (12.5 mm) buckle is on the decline as its width is used for posteriorly situated breaks and vitrectomy is preferred to SB in such cases. With advances in viewing systems and small gauge vitrectomy, there is a decline in the usage of SB in favor of pars plana vitrectomy for the repair of rhegmatogenous retinal detachments.
We did not find statistical significance between incidence of strabismus and number of muscles involved with the buckle. Meticulous tissue handling in the absence of disinsertion and rupture of muscles, has led to probably less fibrosis and scarring, resulting in decreased incidence of restrictive strabismus. Wolff\cite{18} have shown that careless or inaccurate closure of periocular tissue (i.e. Tenon’s fascia and conjunctiva) contribute to the risk of restrictive strabismus. Wright\cite{19} found adhesions formed between extraocular muscles and orbital connective tissue or sclera can lead to restrictive strabismus. Majority of patients had buckle under one or two muscles. This is probably because when retinal pathologies like horseshoe tears and lattices are located in multiple quadrants, it would require buckle to be placed under 3 or 4 muscles; in such cases, however, SB is frequently abandoned in favor of vitrectomy.

In our study, there was statistically significant increase in strabismus in implant group as compared to explant group. As we found no definite influence of the width of buckle or number of muscles involved with the buckle on incidence of strabismus, their role as confounding factors in the above correlation is ruled out. The increase in strabismus in implant group could be explained by the fact that SB by implant technique necessitates extensive scleral dissection for creation of lamellar scleral bed. This triggers adhesion formation between sclera, orbital connective tissue, and extraocular muscles, leading to restrictive strabismus. Fibrotic changes may occur in the muscles due to excessive stretching.\cite{4}

Wolff have shown that scleral dissection below extraocular muscles increases incidence of strabismus.\cite{18} In explant technique, no such scleral dissection is done as the SB is placed over the episcleral tissue. We did not find any study comparing the incidence of strabismus where Mira solid silicon buckle were used as implant and explan. Sewell \textit{et al.}\cite{13} in their study divided buckling materials into two groups: (a) Large group which included Mira 276#, 277#, 279#, and 8 mm sponge and (b) smaller group included smaller sponges, encircling bands, and preserved sclera. They did not find statistically significant increase in the incidence of strabismus in either group. This could be attributed to the fact that muscle disinsertion and repositioning was done in their study in both implant and explant group, which in itself induces excessive scarring and fibrosis of muscles. Use of various buckling materials could also be a confounding factor.

Majority of patients who had strabismus did not complain of diplopia. This may be due to poorer vision of the affected eye. These data support the findings of Spencer \textit{et al.}\cite{17} In our study, the most common mode of treatment was prisms. 11 out of 13 patients (84.6%) were treated with prisms at 6 weeks follow-up. Wadell\cite{20} and Arruga\cite{21} also have mentioned that patients with relatively small deviations can benefit with prisms in glasses. In our series, 6 out of 11 patients (54%) still required prisms at 5 months to 8 months follow-up. In the study by Fison and Chignell,\cite{12} 47% of patients continued to require prisms for post-operative strabismus.

In conclusion, our study found that the width of SB material and the number of extraocular muscles involved with the buckle do not influence the incidence of post-operative strabismus. There was statistically significant increase in the incidence of strabismus with reoperations. However, most of post-surgical strabismus could be treated with prisms.

\textbf{REFERENCES}

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How to cite this article: Ganekal S, Mukhopadhyay M. Strabismus following scleral buckling surgery. J Vis Sci 2015;1(1):2-7.

Financial Support: None; Conflict of Interest: None