

Complications of Conventional Scleral Buckling Occuring During and After Treatment of Rhegmatogenous Retinal Detachment

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ABSTRACT

Objective: To identify and determine the frequency of the intra-operative and early postoperative complications of Conventional Scleral Buckling (CSB) as the primary surgical intervention in patients with Rhegmatogenous Retinal Detachment (RRD).

Study Design: A quasi-interventional study.

Place and Duration of Study: Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Postgraduate Medical Institute (PGMI), Hayatabad Medial Complex (HMC), Peshawar, from April 2005 to June 2006.

Methodology: Fifty consecutive patients who underwent CSB and fulfilled the inclusion criteria, were included in the study. Operative details and any intra-operative complications were noted. The patients underwent another detailed clinical examination and pain assessment on the first postoperative day. All the patients were followed-up minimum for 3 months. Postoperative complications were identified and recorded. The data was analyzed on SPSS 12.0 for measures of central tendency and dispersion.

Results: There were 36 male and 14 female subjects. Mean age was 37.18 ± 20.045 years. Encirclement (56%) was the most frequently used CSB technique. Sixteen (32%) patients had at least one intra-operative complication. Intra-operative complications were iatrogenic scleral break (2%), accidental Sub Retinal Fluid (SRF) drainage (8%), choroidal haemorrhage (2%), subretinal haemorrhage (14%), retinal incarceration (2%), vitreous haemorrhage (6%), raised (4%) or very low (2%), intra-operative IOP and hyphema (2%). Postoperative complications included systemic complications (24%), choroidal detachment (8%), vitreous haemorrhage (16%), raised IOP (22%), angle closure (2%), conjunctivitis (4%), orbital cellulitis (2%), suspected endophthalmitis (2%), ocular movement disorders (2%) and explant exposure (6%). Mean refractive change in spherical equivalent was -1.478 ± 0.698 D. Final re-attachment rate was (82%) and final BCVA of $> 6/60$ was achieved in 62% of the subjects in the treated eyes.

Conclusion: CSB is a safe and effective option for treating uncomplicated RRD, but it is associated with certain complications. Sub-retinal bleed was the most common intra-operative complication. Raised IOP was most the common early postoperative complication followed by choroidal detachment.

Key words: Conventional scleral buckling. Rhegmatogenous retinal detachment. Intra-operative complications. Postoperative complications.

INTRODUCTION

Rhegmatogenous Retinal Detachment (RRD) is one of the most time-critical ocular emergencies in clinical practice. Despite recent advances in the field of vitreoretinal surgery, it continues to rob significant number of patients of their vision. Retinal re-attachment surgery has witnessed remarkable evolution over the years. Despite recent advances in vitreoretinal surgery, Conventional Scleral Buckling (CSB) is still thought to be

the most efficacious and cost-effective primary procedure for the treatment of uncomplicated RRD.^{1,2} Principles of scleral buckling include identification of the causative break, closure of the break with an explant or an implant and sealing of the break by creating chorioretinal adhesions with cryotherapy or indirect laser.³ In addition, the surgeon may decide to drain the sub-retinal fluid, perform paracentesis of the anterior chamber or use intravitreal injection of air or gas.³ The efficacy of scleral buckling can be gauged in terms of the anatomical re-attachment rate, visual outcome and the occurrence of complications.⁴

Although, scleral buckling is thought to be a relatively safe procedure especially with a non-drainage approach² but like any other surgical procedure, it is associated with certain complications. Vigilant and timely recognition of these complications and their management is crucial to the success of surgery. These complications can be; intra-operative, early postoperative and late postoperative complications.⁴ The commonly reported complications are; raised Intraocular Pressure (IOP), choroidal and

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ciliary detachment, diplopia and strabismus, refractive changes, endophthalmitis, macular pucker, extrusion or intrusion and swelling or fragmentation of the buckling device, etc.³ The incidence of RRD is not known in NWFP, but the global figures approach to 2100 cases of RRD every year. Retinal detachment surgery is not a very popular surgery among the general ophthalmologist for reasons highlighted by Comer *et al.*⁵ This study was done at the Vitreo Retinal (VR) clinic to serve the dual purpose of clinical research and audit the ongoing surgeries being done at the department. The aim was to identify and determine the frequency of the intra-operative and early postoperative complications of Conventional Scleral Buckling (CSB) as the primary surgical intervention in patients with Rhegmatogenous Retinal Detachment (RRD).

METHODOLOGY

This study was conducted at the Khyber Institute of Ophthalmic Medical Sciences (KIOMS), Postgraduate Medical Institute of Hayatabad Medical Complex, Peshawar, from April 2005 to June 2006, initiated after approval of ethical committee. Fifty eyes of 50 consecutive patients with RRD undergoing CSB as primary procedure were included in the study. All those cases of RRD who underwent buckling as a combined procedure with vitrectomy, cases that had scleral buckling as a secondary intervention and patients who could not complete a 3 months follow-up were excluded.

Detailed history and complete ophthalmologic examination including; slit lamp examination of the anterior and posterior segment, indirect ophthalmoscopy and Goldman's three-mirror examination was performed on all the cases. Clinical findings were documented in pre-designed proforma. Relevant pre-operative clinical information including; duration of symptoms, history of trauma, history of any ocular surgery, systemic illnesses, refractive state of the eye and IOP were all noted. Any complication (adverse clinical event) observed during the intra-operative (during surgery) or early post-operative period (with one month of surgery), was noted. Variables concerning retinal detachment, surgical details and status of the surgeon (whether a consultant VR or resident) were all recorded. The defining criteria for serious intra-operative complications included choroidal haemorrhage of any degree, choroidal detachment-more than 1 quadrant, retinal incarceration, iatrogenic retinal break, retinal haemorrhage at macula, vitreous haemorrhage obscuring view of the of the retina during surgery, vitreous loss and critically raised IOP causing central retinal artery closure. Pain on the first post-operative day was measured with a graphic Visual Analogue Scale (VAS). None of the patients had any analgesic at least 9 hours prior to the pain assessment. On the first postoperative day, patients had a complete

ophthalmological examination except refraction. Lid oedema was noted down as mild if only the lid margins were swollen, moderate; if there was an associated moderate swelling of both the eye lids, and severe; if the swelling was severe enough to cause difficulty in opening the eye lids. Chemosis was looked for and noted as mild, if there was mild localized chemosis with localized congestion, moderate if the bulbar conjunctiva was involved and as severe if both the bulbar and palpebral conjunctiva were involved with prolapse of the swollen conjunctiva outside the lid margins. Anterior chamber reaction of + was considered as mild, ++ to +++ as moderate and ++++ as severe reaction. Defining criteria for the identification of serious early post-operative complications included choroidal detachment more than one quadrant, vitreous haze/haemorrhage obscuring fundus details, IOP of > 30 mmHg and infections like endophthalmitis or orbital cellulitis. Follow-up visits were scheduled at 2 weeks, at 30th day and 3 months after surgery. Refraction was done on the second visit and Best Corrected Visual Acuity (BCVA) was noted. During this follow-up period the course and outcome of complications was recorded.

Data were analyzed by using SPSS version 12.0. Frequency distributions, percentages and ratios were calculated. Mean were calculated as measures of central tendency for relevant observations. Statistical level of significance was preset at p-value < 0.05. Chi-square and Fischer exact test were used for testing significance of observed difference for categorical variables. Odd ratio was calculated for the odds of occurrence of complications in relation to the two categories of surgeons.

RESULTS

In all 50 patients with primary RRD, fulfilling the inclusion criteria were included in the study. Mean age of the participants was 37.18 ± 20.045 years with 60% (30) less than 40 years of age. There were 36 (72%) males and 14 (28%) females in the study group. The mean hospital stay in days was 5.12 ± 2.11 days. As regards the refractive status of the eyes with retinal detachment, 18 (36%) eyes were emmetropes, 15 (30%) had myopia (8 eyes with myopia less than 6 diopters and 7 eyes with > 6 diopters of myopia), 10 (20%) had pseudophakia, 3 (6%) had aphakia and 3 (6%) were having astigmatism. Age related macular degeneration and non-proliferative diabetic retinopathy were identified as co-morbidities in one patient each. Besides, these 13 (26%) patients had lattice degeneration in the affected eyes. Mean pre-operative BCVA was Finger Counting (FC) less than 1 m with a mode and median VA of HM. Forty two (84%) eyes of 42 patients were blind with a BCVA of less than 3/60. The base-line pre-operative mean IOP was 9.54 ± 1.982 mmHg. The most common type of retinal

break was a horse shoe tear found in 16 (32%) of the cases. There were 6 (12%) cases who presented with dialysis, out of which 5 (10%) had a history of blunt trauma. The primary break could not be found in 10 (20%) cases. As regards the number of breaks, the break was found to be single in 29 (58%) cases, two breaks in 4 (8%) and multiple breaks in 7 (14%) cases. In 47 (94%) cases the macula was found to be detached whereas, in only 3 (6%) patients the macula was still attached at the time of presentation. The most frequently presented Proliferative Vitreoretinopathy (PVR) grade was, grade “C”, found in 26 (52%) patients followed by grade “B” in 21 (42%) cases. Three (6%) eyes were having grade “A” PVR. The surgery was performed by a consultant in 12 (24%) cases and a trainee medical officer (4th year resident) in rest of the 38 (76%) cases. Forty-one (82%) of the surgeries were performed under general anaesthesia and 9 (18%) under local anaesthesia. Twenty-two (44%) had encirclement, 10 (20%) had radial or segmental buckle whereas, 18 (36%) had encirclement combined with radial or segmental buckle. Sub-retinal fluid was drained in majority of the cases i.e. 48 (96%) patients, while only 2 patients were managed by a non-drainage procedure. Air was used for internal tamponade in 3 (6%) cases. Muscle dis-insertion was done in 3 (6%) cases to achieve proper placement of the plomb.

Intra-operative complications were identified in 16 (32%) cases whereas, 34 (68%) patients had no such complications. Scleral break (iatrogenic), choroidal haemorrhage, retinal incarceration, hyphema and low IOP occurred in 1 (2%) each. Sub-retinal bleed was noted in 7 (14%), vitreous bleed in 3 (6%) and high IOP in 2 (4%) cases. The identified serious intra-operative complications were; choroidal haemorrhage (n=1, 2%), retinal incarceration (n=1, 2%) and raised IOP (n=2, 4%). The overall frequency of any serious intra-operative complication was 4 (8%). The occurrence of intra-operative complications was stratified against various variables. The details are given in Table I. In the early postoperative period few complications occurred in almost all eyes. Therefore they were grouped as “early postoperative ocular features” including lid oedema, conjunctival chemosis and AC reaction. Mild, moderate and severe lid edema was present in 24 (48%), 13 (26%) and 4 (8%) cases respectively. Mild, moderate and severe conjunctival chemosis was present in 32 (64%), 13 (26%) and 2 (4%) cases respectively. Anterior chamber reaction was mild in 38 (76%), moderate in 4 (8%) and severe in 1 (2%) case. Besides these, other early postoperative complications occurred in 16 (32%) patients, while in 34 (68%) patients, no complications were observed besides the early postoperative ocular features. Systemic complications like nausea and vomiting occurred in 12 (24%) cases while, urinary retention in 1 (2%) case. The most

Table I: Stratified analysis of the occurrence of intra-operative complications.

Characteristics	Occurrence of intra-operative complications		
	Yes	No	p-value (two sided)
Type of buckling procedure			
Local buckling	8 (36.36%)	14 (63.64%)	Chi-square 1.28 p=0.527
Encirclement	4 (40%)	6 (60%)	
Encirclement with additional local buckling	4(22.22%)	14 (77.78%)	
Pre-operative characteristics			
Myopia	3 (20%)	12 (80%)	Chi-square 2.21 p=0.331
Pseudophakia and aphakia	4 (28.57%)	10 (71.43%)	
Others (all other refractive states)	9 (42.86%)	12 (57.14%)	
Extent of retinal detachment			
= or < 2 quadrants	9 (42.86%)	12 (57.14%)	Chi-square 3.63 p=0.163
= or < 3 quadrants	2 (13.33%)	13 (86.67%)	
Total (including more than 3 quadrants)	5 (35.71%)	9 (64.29%)	
Surgeon status			
Consultant	2 (16.67%)	10 (83.33%)	Fischer exact p=0.292
Resident (TMO)	14 (36.84)%	24 (63.16%)	Odds ratio 2.97

TMO=Trainee medical officer.

common complication in the early postoperative period was raised IOP which was present in 11 (22%) eyes. Vitreous bleed was present in 8 (16%) eyes, choroidal detachment in 4 (8%) conjunctivitis occurred in 2 (4%) while angle closure glaucoma, orbital cellulites, strabismus and endophthalmitis was present in 1 (2%) eye each.

The frequency of serious early postoperative complications was 8 (16%). Serious early postoperative complications were; choroidal detachment greater than one quadrant (n=1, 2%), vitreous haemorrhage obscuring fundus view (n=2, 4%), IOP greater than 30 mmHg (at any point during the follow-up, n=3, 6%), endophthalmitis (n=1, 2%) and orbital cellulitis (n=1, 2%). Explant related complications are usually given as late complications, but since they were observed with in one month of the surgery they were categorized as early postoperative complications and were found in 3 (6%) cases. Out of the 3 cases one developed orbital cellulitis and the explant had to be removed. The other one developed medial rectus restriction and the explant had to be removed again. The third patient had minimal exposure of the explant and till the last follow-up, did not require any surgical intervention.

All the variables against which the occurrence of complications was compared, were re-grouped into larger categories to allow the application of appropriate statistical tests of significance. The details are summarized in Table II. The mean Graphic Visual analogue (GRVA) score for early postoperative pain was 7.00 ± 1.35, categorized as moderate degree of pain. Postoperative intensity of pain was found to be

Table II: Stratified analysis of the occurrence of early postoperative complications.

Characteristics	Occurrence of early postoperative complications		
	Yes	No	p-value (two sided)
Type of buckling procedure			
Local buckling	4 (18.18%)	18 (81.82%)	Chi-square 3.51 p=0.173
Encirclement	4 (40%)	6 (60%)	
Encirclement with additional local buckling	8 (44.44%)	10 (55.56%)	
Pre-operative characteristics			
Myopia	5 (33.33%)	10 (66.67%)	Chi-square 1.42 p=0.492
Pseudophakia and aphakia	6 (42.86%)	8 (57.14%)	
Others (all other refractive states)	5 (23.81%)	16 (76.19%)	
Extent of retinal detachment			
= or < 2 quadrants	5 (23.81%)	16 (76.19%)	Chi-square 3.51 p=0.173
= or < 3 quadrants	5 (33.33%)	8 (57.14%)	
Total (including more than 3 quadrants)	6 (42.86%)	10 (83.33%)	
Surgeon status			
Consultant	2 (16.67%)	10 (83.33%)	Fischer exact p=0.292
Resident (TMO)	14 (36.84%)	24 (63.16%)	

TMO=Trainee medical officer.

associated with the type of buckling procedure, occurrence of early postoperative complications and rise of IOP. Details are summarized in Table III.

Mean pre-operative IOP was found to be 9.54±1.982 mmHg, while, mean postoperative IOP on the first postoperative day was 17.88±7.003 mmHg. Postoperative significant change in the refractive state of the eye was observed in all patients. Myopia was induced in 8 (16%) patients, while myopic astigmatism was induced in 42 (84%) patients. Mean pre-operative spherical equivalent was -3.25 D (0.00 to -16.00 D) while, mean postoperative spherical equivalent was -4.14 D (-0.00 to -18.63 D). Mean refractive change in terms of change in the spherical equivalent was -1.478 D±0.689 D. Mean induced cylindrical error was -1.24 D±0.804 D. Final anatomical re-attachment rate at 3-month was 82% (n=41). The most common cause failure to re-attach was PVR. Thirty-one (62%) patients achieved a final BCVA of 6/60 or better, while 8 (16%) had a BCVA of

Table III: Intensity of early postoperative pain and associated factors.

Associated factors	Pain		p-value (two sided)
	Moderate GRVA score 3.1-7	Severe GRVA score 7.1-10	
Occurrence of early post-operative complications			
Yes	5	11	Fischer exact p=0.001
No	28	6	
Type of buckling procedure			
Local buckling	19	3	Chi-square 7.26 p=0.026
Encirclement	5	5	
Encirclement + local buckling	9	9	
Post-operative IOP			
Normal	30	3	Fischer exact p=0.004
Raised	3	8	

IOP: Intraocular pressure, GRVA: Graphic visual analogue

6/18 and 14 (28%) patients had a BCVA of <3/60. Mean gain in VA (in terms of lines) was 4.64 lines or steps.

DISCUSSION

This study intended to identify the intra-operative and early postoperative complications of CSB done as a primary procedure for the management of RRD. A total of 50 patients were included in the study. The study group comprised of younger subjects with a mean age of 37.18±20.045 years. These results are comparable with local and other studies from the developing countries, which have reported a mean age of 38-48 years.⁶⁻¹⁰ Various demographic, genetic and social factors like escalating violence could be responsible for this presentation. This finding bears important public health implications and demands urgent consideration by all those concerned with eye care. There were more males than females in the study population with a male; female ratio of 2.57:1. This finding is again consistent with the other local studies.⁶⁻⁸ The mean duration of symptoms was 101.70 days (3 months and 12 days) which is almost three times the duration reported by Tewari *et al.* from India.⁹ Eighty-four percent of the patients had a VA of < 3/60 in the affected eye with a median VA of HM (range PL-6/36). Studies from this region have reported similar pattern of pre-operative visual acuity.⁶⁻¹⁰ In 94% of the cases, the macula was found to be detached. Thompson *et al.* found the macula to be detached in 54% (n=409/757) of cases, whereas, the frequency of macula-detached RD was 98% in the study by Ahmedieh *et al.*^{10,11} The finding is again consistent with the earlier results signifying late presentation. The most frequently presented PVR grade was grade “C” found in 26 (52%) of the patients. Tewari *et al.* reported 5% frequency of extensive PVR whereas, Thompson *et al.* reported it to be 12.5%.^{9,11} Yorston and Jalali documented grade “C” PVR to be presented in 33% of the eyes in South Africa, 32% in Andhra Pradesh, 18% in Kenya and 13% in Iran versus 4% in Cambridge and 6% in San Francisco.¹² The higher proportion of advance PVR in this study, relates to the delayed presentation. Jan *et al.* commented, that delayed presentation of RRD with high grade PVR and detached macula all these facts may indicate poorly accessible, unaffordable and inadequate services available to retina patients in the province.¹³

In conventional scleral buckling the trend is to perform minimal segmental buckling with out drainage as it has been shown to be associated with optimal outcome and minimal complications.² However, it demands considerable degree of accuracy in localizing the break and placement of buckle which requires expertise and time consuming pre-operative and per-operative assessment. In this series of patients, all the cases had cryo-application and majority had SRF drainage. This is in contrast to the concept of minimal segmental surgery

with non-drainage.^{2,14} There is a well-known tendency for the novice VR surgeons to perform drainage as it results in immediate on-the-table re-attachment of the retina. As most of the surgeries were performed by a resident, it is likely that the aforementioned logic could have been at play.

Intra-operative complications were identified in 32% (n=16) of the cases, while the corresponding figure reported by Thompson *et al.* was 14.4%.⁴ The higher rate of intra-operative complications could be because of the complicated nature of the RRD itself (extensive bullous detachments requiring SRF drainage, and higher proportion of pseudophakic/aphakic RRD) and frequent encirclement used for its management. Moreover, the complication rate is known to be affected by the status or expertise level of the surgeon. In this study, a surgery was three times more likely to be complicated by intra-operative complication when done by a resident than by a VR consultant. The difference was not statistically significant in this study, because of the smaller sample size, but Comer *et al.* have shown it to a significant association.⁵ Sagong and Chang concluded in their study, that beginners in the field of vitreoretina can achieve better surgical outcome by carefully selecting the uncomplicated eyes for surgery.¹⁵ The 8% (n=4) frequency of serious intra-operative complications in this study was also comparable with study by Comer *et al.*⁵

The rate of iatrogenic scleral perforation while passing the buckle sutures, retinal incarceration and raised pre-operative IOP were comparable to those reported by Hilton,³ Tewari *et al.*⁹ and Thompson *et al.*⁴, but the rates of intra-ocular haemorrhage (retinal, choroidal, vitreous) were much higher. This could be the cause higher rate of SRF drainage, without use of point cautery, but with 25 G needle and the fact that most of the time it was done by a trainee.

The occurrence of intra-operative complications did not show any statistically significant association with the type of CSB, status of the surgeon, pre-operative characteristics like pseudophakia, myopia and extent of retinal detachment probably, because in this study, the sample was too small to detect any statistically significant association.

Early postoperative ocular features of lid edema, conjunctival chemosis and mild AC reaction have been known to be common associations of CSB.³ This was highlighted by the results of this study as well. CSB, especially when performed under general anaesthesia is known to be associated with certain systemic complications.³ This study identified nausea and vomiting in 12 and urinary retention in one patient.

The frequency of choroidal detachment, vitreous haze/haemorrhage, raised intra-ocular pressure and ocular movement disorders, was found to be comparable with those reported by Hilton and Ahmedieh *et al.*^{3,10} Thompson

et al. have reported lower frequency of occurrence for the above mentioned complications.⁴ The frequency of conjunctivitis, orbital cellulitis, endophthalmitis and explant related complications was higher than the other contemporary studies.^{3,4,9,10} The single case of endophthalmitis in this study was not a culture proven endophthalmitis and responded to the conservative management. Three cases of explant exposure are higher than expected frequency for such a small sample. All 3 cases had a segmental silicone sponge explant, out of which two had an encirclement with the segmental sponge and as reported earlier segmental explant are more likely to be exposed especially if made of silicone sponge material.^{3,16-19}

Pain is one of the most frequently experienced, unavoidable and un-desirable accompaniment of any surgical procedure. It not only causes a considerable distress to the patient directly, but is also responsible for a cascade of pathophysiological affects which can be of any degree and demand specific management protocols. CSB (because of the tissue dissection) needed for explant placement and cryotherapy is known to cause considerable degree of pain. This study aimed at assessing the degree of pain without any analgesia on the first postoperative day. The finding of mean pain score as of moderate degree is consistent, with that reported earlier.²⁰ In this study, the intensity of pain was found to be higher and statistically significant in cases of occurrence of complications, rise of IOP and encirclements.

Postoperative changes in refractive state of the eye are usual after all types of CSB.²¹ This study found a myopic and myopic astigmatic shift in the refractive state of the operated eye. Mean change in refraction was found to be comparable with the results reported by other studies.^{10,22}

Final anatomical re-attachment rate at 3 months with a single procedure was 82% (n=41). Banaee *et al.* reported anatomical re-attachment rate of 89.3% after primary surgery at 6 months of follow-up.²³ Thompson *et al.* reported a re-attachment rate of 77.1% with a single procedure.⁴ Schwartz *et al.* reported it to be 82% after one procedure.¹ The results of this study are comparable with the aforementioned as well as the local studies.⁶⁻⁸

Sixty two percent of patients achieved a final BCVA of 6/60 or better, whereas 16% had a BCVA of 6/18. Mean gain in VA (in terms of lines) was 4.64 lines. These results are comparable with these studies, despite the late presentation and higher frequency of macula-off detachments that are known to affect the final visual outcome.^{3,24}

Based on the results of this study, it is recommended that training on CSB surgery should be provided to all trainees, to lower the frequency of skill-related operative complications. There should be a regular audit of all

surgical procedures, taking into account the complications and outcome of surgery. The feedback from the audit needs to be given to the trainees and the supervisors for improving the surgical management and training. Selection of cases for CSB should be based on a realistic analysis concerning, likely benefit for the patient. In cases where CSB is likely to fail because of advance PVR or other complicating factors, then primary vitrectomy should be the preferred choice.²⁵

CONCLUSION

CSB was associated intra-operative complications which include iatrogenic scleral break, accidental SRF drainage, choroidal haemorrhage, retinal or sub-retinal haemorrhage (most common intra-operative complication), retinal incarceration, vitreous haemorrhage, raised and hyphema. Early postoperative complications included choroidal detachment, sub-retinal haemorrhage, vitreous haemorrhage, raised IOP (most common ocular complication), angle closure, conjunctivitis, orbital cellulitis, suspected endophthalmitis, ocular movement disorders and explant exposure.

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