Factors influencing anatomic and visual results in primary scleral buckling

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PURPOSE. *To identify the factors influencing anatomical and visual results in cases of rhegmatogenous retinal detachment undergoing primary scleral buckling.*

METHODS. *A retrospective study of 233 eyes of 226 patients was done. The data were evaluated by univariate analysis and stepwise logistic regression analysis.*

RESULTS. *Retinal reattachment was achieved with primary scleral buckling in 197 eyes (84.5%). The extent of retinal detachment, preoperative proliferative vitreoretinopathy (PVR), preoperative visual acuity and relative afferent pupillary defects were identified as influencing anatomical results, by univariate analysis. The predictive roles of extent of retinal detachment (P<0.0001) and preoperative PVR (P=0.0085) were shown to be significant by stepwise logistic regression. As well as the above factors, the patient's age, the duration of symptoms and the status of the macula were predictors of visual results, by univariate analysis. Stepwise logistic regression analysis confirmed the predictive roles of preoperative visual acuity (P < 0.0001) and the extent of retinal detachment (P=0.0089).*

CONCLUSIONS. *Cases with a larger extent of retinal detachment, more advanced preoperative PVR and poorer preoperative visual acuity have less favorable anatomical and functional results. (Eur J Ophthalmol 2000; 10: 153-9)*

KEY WORDS. *Scleral buckling, Retinal detachment, Prognostic factors*

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INTRODUCTION

Scleral buckling is the most common technique employed for primary management of retinal detachment (RD). Improvements in surgical techniques have resulted in an increased anatomical success rate. However, operation fails in some cases, proliferative vitreoretinopathy (PVR) being the leading cause (1-3). Attempts have been made to identify the factors contributing to the failure of retinal reattachment surgery, and these include: aphakia (1, 4, 5), pre-operative vision (6-9), extent of retinal detachment (1,6-10), PVR before surgery (1, 3, 6, 10-12), large retinal breaks (3-5, 8, 10, 13), undetected breaks (1, 9, 12), preoperative vitreous hemorrhage (5, 6), and pre-operative choroidal detachment (7, 8, 12, 13). This study also assessed the results of primary repair of retinal detachment with scleral buckling and identified some factors influencing the anatomical and functional results. To the best of our knowledge, the effects of preoperative factors on the visual results after retinal detachment surgery have not been widely reported.

PATIENTS AND METHODS

The records of all cases of spontaneous rhegmatogenous retinal detachment undergoing scleral buckling from September 1993 to August 1996 were reviewed. Cases who had their primary repair elsewhere, those referred for additional surgery, and those with components of traction RD were excluded. Cases with post-

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operative follow-up less than six months were not included in this study.

All patients were evaluated by at least two physicians before surgery. Best corrected preoperative visual acuity (VA) was measured using a standard Snellen chart. Relative afferent pupillary defect (RAPD) was detected. External examination, slit-lamp examination, and intraocular pressure were obtained. A thorough retinal examination was made, with the binocular indirect ophthalmoscope using scleral depression and, when necessary, the Goldmann three mirror lens. A retinal drawing was done in each case. The extent of retinal detachment was rated according to the number of detached quadrants. PVR was classified according to the Retina Society classification. Further examination of the retinal periphery was done in the operating room after the patient had been anesthetized. Final VA was determined the same way as preoperative VA and cases were divided into four groups: 20/20 - 20/40, 20/50-20/100, 20/200-20/400, and counting fingers or worse.

The preoperative factors evaluated for possible effects on anatomical and visual results included: age, duration of symptoms before surgery, preoperative VA, RAPD, macular detachment, lens status, detection of retinal break, extent of retinal detachment and grading of PVR. Results were analyzed with respect to VA and anatomical status of retina at the last follow-up.

Statistical methods

Statistical analysis was carried out in two stages. In the first stage, univariate analysis using Spearman's rank correlation, Wilcoxon's rank test and chi-square analysis were used to establish the relationships between preoperative variables and the anatomical and visual results. The variables were identified as significant at a level of ≤ 0.05. In the second stage, the variables found to be significant in univariate analysis were analyzed with multiple logistic regression, using the SPSS Program Package.

Surgical techniques

All eyes underwent scleral buckling with an encircling element. A solid silicone tire was used as an episcleral buckle and an encircling band 240 was placed as well. All retinal breaks were treated with cryopexy. Subretinal fluid was drained in most cases.

RESULTS

A total of 233 eyes of 226 patients were inlcuded in this study. The patients' age ranged from 6 to 85 years (mean 48.7 years); 83 (36.7%) were female. Retinal reattachment was achieved with primary scleral buckling in 197 eyes (84.5%). Of the 36 cases without anatomical success after the first operation, reoperations included buckle revision, pars plana vitrectomy and internal tamponade on 27 eyes and the overall retinal reattachment rate reached 96.1%. Nine patients refused reoperation. Therefore the role of the preoperative factors on visual results after primary scleral buckling was evaluated in 206 cases. Factors influencing the anatomical and functional results of the reoperated cases were not studied.

The cases were divided into two groups according to age: less than 65 years and 65 years or older. There were 201 patients less than 65 years (86.3%) and 32 aged 65 or more (13.7%). The two groups were compared for possible effects on the anatomical and visual results. Univariate analysis showed no significant difference between the two groups considering anatomical results. Those aged less than 65 years had significantly better visual results than those aged 65 years or more ($P=0.005$).

Decreased central vision was the most common presenting symptom. The other symptoms included visual field defects, flashing and floaters. The cases were divided into three groups according to the duration of symptoms before surgery: 1-7 days, 8-30 days and more than 30 days. These subgroups were compared for the effect on anatomical and visual results. Univariate analysis showed that the duration of symptoms had no significant effect on the anatomical results but the relationship between the duration of symptoms and the visual results was significant ($P<0.0001$), cases with a longer duration of symptoms having worse functional results.

RAPD was positive in 86 cases before surgery. The cases with negative RAPD were compared with the cases having definite RAPD. In univariate analysis, positive RAPD showed a significant negative relationship with anatomical ($P=0.05$) and visual ($P=0.0008$) results.

There were 169 phakic and 8 pseudophakic eyes; the remaining 56 were aphakic. Because the pseudophakic cases were so few, they were ignored and the remaining eyes were divided into two subgroups according to the lens status, one group consisting of the phakic cases and the other group consisting of aphakic cases. The two groups showed no significant difference as regards anatomical and visual results.

Of 233 cases, 199 (85%) eyes had preoperative PVR grade B. There were only three cases of PVR A and the remaining 31 (13.3%) were grade C. The cases of PVR A or B were compared with the cases of PVR C on the basis of the anatomical and visual results. Univariate analysis showed a significant relationship between preoperative PVR and anatomical success (P<0.0001). The cases with more advanced PVR had less favorable anatomical results. The effect of preoperative PVR on visual results was also significant (P=0.0015) and the cases with preoperative PVR C had worse final VA.

No retinal breaks were observed in 61 cases before surgery. These cases were compared to the cases with one or more retinal breaks for the effect on the anatomical and visual results, but no significant difference was noted.

The macula was attached in 43 cases before surgery. The cases were divided into two subgroups and the possible predictive effect of the preoperative status of the macula on anatomical and visual results was evaluated. Univariate analysis showed that a preoperative detached macula had no significant effect on the anatomical results but was a strong predictor of negative visual outcome (P<0.0001).

The extent of retinal detachment ranged from one to four quadrants. So cases were divided into four subgroups according to the extent of RD. Univariate analysis showed a strong negative relationship between the extent of RD and both anatomical and visual success (P<0.0001). A greater extent of RD was significantly associated with negative anatomical and visual results.

Univariate analysis showed that the effect of preoperative VA on both anatomical (P=0.0031) and visual results (P<0.0001) was significant.

Multivariate analysis (stepwise logistic regression analysis) was performed to identify which of the factors detected in univariate analysis were independently predictive of anatomical and visual results. Two factors, the extent of RD and preoperative PVR in order of significance, were influential on the anatomical results (Tab. I). Multivariate analysis also identified preoperative VA and the extent of RD as predictive factors for visual results (Tab. II).

DISCUSSION

The goal of retinal detachment surgery is to reattach the retina permanently and to restore central and peripheral vision. The anatomical and functional success rate in our series is compatible with previous studies. Univariate analysis showed that the presence of RAPD preoperative PVR, the extent of retinal detachment, preoperative VA and the preoperative status of the macula were significantly correlated with the anatomical results after primary scleral buckling. Of these, the extent of RD and the degree of preoperative PVR were confirmed by multivariate analysis as predictive factors for the anatomical results. This analysis indicated that the patient's age, the duration of retinal detachment before surgery, the presence of RAPD, preoperative PVR, preoperative status of the macula, the extent of RD, and preoperative VA significantly influenced functional results. Multivariate analysis confirmed preoperative VA and extent of RD as independent predictors of functional results.

The extent of retinal detachment was a significant predictor of both anatomical and functional results. A greater extent of retinal detachment was associated with a lower anatomical and functional success rate. The effect of the extent of detachment on retinal reattachment surgery was significant in most previous studies (1, 6-10, 12).

More advanced preoperative PVR (grade C vs grade A or B) reduced the chance of retinal reattachment in both univariate and multivariate analysis in our series. These findings are in contradiction with the results of the study by Girard et al (8), who found that PVR grade A before surgery was a strong predictor for severe postoperative PVR whereas grade C was not. They explained this with this assumption that PVR grade A represented an immature form of the disease with a potential for aggravation. Other studies, however, correlate with ours and indicate that preoperative high-grade PVR is associated with an increased risk of postoperative PVR and results in retinal rede-

TABLE I - PRE-OPERATIVE VARIABLES AND ANATOMICAL RESULTS AFTER PRIMARY SCLERAL BUCKLING

Variable	Pre-op. number %	Anatomical reattachment number %	p Value (univariate analysis)
Age (years)			
<65	(201) 86.3	(170) 84.6	1.0000
>65	(32) 13.7	(27) 84.4	
Duration			
1-7 days	(20) 8.6	(20) 100	0.0840
8-30 days	(104) 44.6	(89) 85.6	
> 30 days	(109) 46.8	(88) 80.7	
RAPD			
no	(147) 63.1	(130) 88.4	0.05
yes	(86) 36.9	(67) 77.9	
Lens status			
phakic	(169) 72.5	(145) 85.7	0.23
aphakic	(56) 24	(44) 78.6	
PVR			
A, B	(202) 86.7	(179) 88.6	<0.0001
C	(31) 13.3	(18) 58.1	
Detection of break			
no	(61) 26.2	(47) 77	0.0929
yes	(172) 73.8	(150) 87.2	
Macula on			
yes	(43) 18.5	(42) 97.7	0.162
no	(190) 81.5	(155) 81.6	
Extent of RD (quadrants)			
1	(32) 13.7	(32) 100	<0.0001
2	(73) 31.3	(67) 91.8	
3	(62) 26.6	(55) 88.7	
4	(66) 28.3	(43) 65.2	
Pre-op VA			
20/20 - 20/40	(28) 12	(27) 96.4	0.0031
20/50 - 20/100	(19) 8.2	(19) 100	
20/200 - 20/400	(48) 20.6	(45) 93.8	
CF or worse	(138) 59.2	(106) 76.8	
MULTIPLE REGRESSION ANALYSIS			
			p value
1. Extent of RD			<0.0001
2. PVR			0.0085

VA = Visual Acuity; CF = Counting fingers; RD = Retinal detachment

TABLE II - PRE-OPERATIVE VARIABLES AND VISUAL RESULTS AFTER PRIMARY SCLERAL BUCKLING

Variable	Number %	20/20 20/40	20/50 20/100	20/200 20/400	CF or worse	p value (univariate analysis)
Age (years)						
<65	(177) 85.9	(48) 27.1	(37) 20.9	(57) 32.2	(35) 19.8	0.0049
>65	(29) 14.1		(5) 17.2	(13) 44.8	(11) 37.9	
Duration						
1-7 days	(20) 9.7	(14) 70	(2) 10	(3) 15	(1) 5	<0.0001
8-30 days	(92) 44.7	(26) 28.3	(23) 25	(25) 27.2	(18) 19.6	
>30 days	(94) 45.6	(8) 8.5	(17) 18.1	(42) 44.7	(27) 13.1	
RAPD						
no	(133) 64.6	(42) 31.6	(28) 21.1	(37) 27.8	(26) 19.5	0.0008
yes	(73) 35.4	(6) 8.2	(14) 19.2	(33) 45.2	(20) 27.4	
PVR						
A-B	(181) 87.9	(47) 26	(40) 22.1	(60) 33.1	(34) 18.8	0.0015
C	(25) 12.1	(1) 4	(2) 8	(10) 40	(12) 48	
Lens status						
phakic	(148) 71.8	(37) 25	(31) 21	(52) 35	(28) 19	0.31
aphakic	(50) 24.3	(10) 20	(9) 18	(15) 30	(16) 32	
Detection of break						
no	(49) 23.8	(8) 16.3	(7) 14.3	(18) 36.7	(16) 32.7	0.1256
yes	(157) 76.2	(40) 25.5	(35) 22.3	(52) 33.1	(30) 19.1	
Macula on						
yes	(42) 20.4	(26) 61.9	(13) 31	(3) 7.1	—	<0.0001
no	(164) 79.6	(22) 13.4	(29) 17.7	(67) 40.9	(46) 28	
Extent of RD						
1	(32) 15.5	(18) 56.3	(9) 28.1	(4) 12.5	(1) 3.1	<0.0001
2	(67) 32.5	(18) 26.9	(20) 29.9	(21) 31.3	(8) 11.9	
3	(58) 28.2	(9) 15.5	(10) 17.2	(22) 37.9	(17) 29.3	
4	(49) 23.8	(3) 6.1	(3) 6.1	(23) 46.9	(20) 40.8	
Pre-op. VA						
20/20 - 20/40	(27) 13.1	(20) 74.1	(6) 22.2	(1) 3.7	—	<0.0001
20/50 - 20/100	(19) 9.2	(10) 52.8	(7) 36.8	(2) 10.5	—	
20/200 - 20/400	(45) 21.8	(12) 26.7	(10) 22.2	(19) 42.2	(4) 8.9	
CF or worse	(115) 55.8	(6) 5.2	(19) 16.5	(48) 41.7	(42) 36.5	

MULTIPLE REGRESSION ANALYSIS

	p value
Pre-op. VA	p<0.0001
Extent of RD	0.0089

VA = Visual Acuity; CF = Counting fingers; RD = Retinal detachment

tachment (3, 9, 12).

The effect of preoperative PVR on the final visual results was shown to be significant by Greven et al (9). In our study, however, this relationship was significant only by univariate analysis. The effect of preoperative VA on the anatomical results was also signfiicant only by univariate analysis. In a multivariate analysis of anatomical success of retinal detachments treated with scleral buckling, preoperative vision less than 0.3 was one of the predictors of surgical results (6). Preoperative VA was the most significant predictor of visual results in our series. This was compatible with the findings of Sharma et al (7) and Girard et al (8). In the study by Greven et al (9), investigating factors influencing anatomical and visual results of pseudophakic retinal detachment, initial visual acuity was a significant predictor of both. In a study to determine the factors influencing the final visual results after scleral buckling, Girard et al (15) showed that preoperative VA less than 0.4 was a predictor of visual failure.

Univariate analysis showed that the preoperative status of the macula was predictive of both anatomical and visual results. A detached macula was a highly significant predictor of negative postoperative visual results. The effect of a preoperative detached macula on the anatomical results was less significant ($P=0.01$ vs $P<0.0001$). Girard et al (15) showed that low or high macular detachment for more than seven days was a predictor of visual failure. Greven et al (9) found that eyes with macular detachment had a poorer visual prognosis. Macular status was a significant factor for predicting the anatomical failure of retinal reattachment surgery by univariate analysis in the study by Sharma et al (7).

RAPD gives a measure of mass retinal response. Its role of RAPD as a predictor of retinal detachment surgery results has not been studied. We found RAPD was influential on both the anatomical and visual results by univariate analysis and its effect was more pronounced on visual than anatomical results ($P=0.0008$ vs $P=0.05$).

Univariate analysis showed the duration of symptoms was a predictor of visual results. In cases in which symptoms had been present for one week or less, the rate of retinal reattachment was 100%, and 70% of the patients gained VA of 20/40 or better. In cases with symptoms lasting more than one month, only 8.5% gained the same level of VA. Yoshino et al (5), found that duration of retinal detachment in aphakic cases longer than one month was associated with an increased risk of PVR. Retinal detachment for longer than three months predisposed the aphakic patients to PVR in the study by Nagasaki et al (13). Longer duration of symptoms before presentation was also a negative prognostic indicator for reattachment and visual prognosis in the study by Greven et al (9).

Age over 65 years was a predictor of less chance of retinal reattachment and poorer visual prognosis in the study by Greven et al (9). Girard et al (15) showed that age 71 years or more was a predictor of visual failure. In our study, univariate analysis showed age was predictor of visual results.

In conclusion, this study set out to identify same preoperative factors influencing the anatomical and functional results in eyes undergoing primary scleral buckling. The extent of retinal detachment, preoperative VA, and the presence of preoperative PVR were the most significant factors.

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