Risk Factors of Retinal Redetachment after Treatment of Rhegmatogenous Retinal Detachment

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Abstract

Purpose: To study the incidence of retinal redetachment and potential associated risk factors in primary rhegmatogenous retinal detachment (RRD) surgery.

Methods: This is a retrospective observational study in which medical data were collected from electronic medical records of all eyes diagnosed with rhegmatogenous retinal detachment who underwent surgery between January 2020 and December 2022 at Thammasat eye center. Overall, 320 new cases undergoing surgical procedure for rhegmatogenous retinal detachment were included in this study. Collected data included sex, age, onset, macular status, lens status, proliferative vitreoretinopathy (PVR) grading, location and number of retinal tears, type of tamponade, surgical procedure, pars plana vitrectomy (PPV) gauge, ability to be in a face-down position after surgery, and occurrence of retinal redetachment at 28 days after surgery. The result of each variable factor on retinal redetachment was assessed using the Chi-square test for categorical variables (sex, macular status, lens status, PVR grading, location of the tear, type of tamponade, surgical procedure, PPV gauge, ability to be in a face-down position after surgery), an independent t-test for normal distribution continuous variables (age, onset, number of tear), and the Man-Whitney U-test for other distributions. The level of statistical significance was set at $p<0.05$. Finally, multiple logistic regression analysis and odds ratios (95% CI) were used to identify risk factors for retinal redetachment after surgery.

Results: This study included individuals with ages ranging from 7 to 86 years, with a mean age of 57.51 (±13.72) years. The gender distribution of the study sample showed that 213 (66.6%) cases were male and 107 (33.4%) cases were female. Of the total cases, 231 (72.2%) achieved retinal attachment, while 89 (27.8%) experienced retinal redetachment. The results of both univariate and multivariate logistic regression analysis indicated that there were statistically significant associations between a higher rate of retinal redetachment and the following factors: being in the pneumatic retinopexy group, having PVR grade C, and being in the no face-down position group. The risk of retinal redetachment in the pneumatic retinopexy group was found to be 7.588 times higher than the combined PPV with Scleral buckling procedure (SBP) group (Adj. OR = 7.588, 95% CI 2.264-25.433, p=0.001). Similarly, the risk of retinal redetachment in the PVR grade C group was 8.068 times higher than the PVR grade A group (Adj. OR = 8.068, 95% CI 2.612-24.921, $p<0.001$). Lastly, the risk of retinal redetachment in the no-face-down position group was found to be 14.809 times higher than the face-down position group (Adj. OR = 14.809, 95% CI 2.992-73.296, p=0.001).

Conclusion: The retinal redetachment rate was 27.8%. And the risk factors for retinal detachment after primary RRD surgery were technique of surgery (pneumatic retinopexy), preoperative retinal detachment status (PVR grade C) and face position after surgery (no face-down position).
Keywords: retinal redetachment; primary RRD surgery; risk factor of retinal detachment.
Ethics: This study was approved for ethical research in humans with the human research ethics committee of Thammasat university, Thailand (Research ID: MTU-EC-OP-0-036/66)

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Introduction

Rhegmatogenous retinal detachment (RRD) is a separation of the neurosensory retina from the underlying retinal pigment epithelium. It is caused by tears on the retinal surface that allow fluid to pass from the vitreous cavity to the subretinal space[1]. Rhegmatogenous retinal detachment can occur at any age. The peak prevalence is in people aged 60 to 70 years. It affects men more than women, and caucasians more than africans [2]. The global incidence of RRD is about 1 in 10,000 people a year[2-3]. If this disease goes on without treatment, it can cause permanent blindness in the affected eye and decrease quality of life. The goal of RRD management is to achieve anatomical retinal reattachment. There are several different operations available that can be used singly or in combination, for example : laser photocoagulation or cryoretinopexy for scar induction around the retinal break, scleral buckling procedure or pars plana vitrectomy to decrease vitreous traction on the retina surface[4]. 5,6,11,18,19,20,31

Despite early diagnosis and treatment, the prognosis and success rate for rhegmatogenous retinal detachment management could be variable among patients. Therefore, it is crucial to identify individuals who are at preoperatively high risk of retinal redetachment after retinal detachment surgery. Several factors have been identified in previous studies as potential causes of retinal redetachment postoperatively. These include the extent of the area detachment, the number of breaks, the severity of proliferative vitreoretinopathy (PVR), lens status (phakic, pseudophakia, aphakia), myopia, inflammation, retinal and choroidal atrophy, both vitreous and retinal hemorrhage, vitreous loss, and the failure to identify all retinal breaks preoperatively[5,18,19,20]. From several studies, PVR is one of the most important causes of surgical failure in the treatment of RRD[6,11,19,22,31].

The main objective of this study is to identify the incidence of retinal redetachment after primary surgery and potential associated risk factors. We retrospectively analyzed the clinical characteristics and surgical techniques of rhegmatogenous retinal detachment cases in Thammasat Eye Center from January 2020 to December 2022.

Material and Method

The current study is a retrospective observational investigation that involved the collection of medical data from electronic medical records of all eyes diagnosed with rhegmatogenous retinal detachment and underwent surgical intervention at Thammasat eye center between January 2020 and December 2022. The study received ethical approval from the hospital's ethics committee and adhered to the principles outlined in the Declaration of Helsinki. A total of 320 cases were included in the analysis. Patients with previous vitreoretinal surgery, tractional retinal detachment, or exudative retinal detachment were excluded. Collected data included sex, age, onset, macular status, lens status, PVR grading, location and number of retinal tears, type of tamponade, surgical procedure, PPV gauge, ability to be in a face-down position after surgery, and occurrence of retinal redetachment at 28 days after surgery. The rationale for selecting the 28th day as the measurement point is based on the Key Performance Indicator (KPI) set by the Department of Ophthalmology at Thammasat University.

All the surgeries were performed by experienced vitreoretinal surgeons at the Thammasat eye center. The surgical technique was chosen by the surgeon’s discretion. All data were analyzed using SPSS version 23.0. For continuous variables, results are presented as means, standard deviation (SD), median and range, while for categorical variables numbers (n) and percentages have been used. In the case of expected cells less than 5 for more than 25%, we use the Fisher exact test instead.

The result of each variable factor on retinal redetachment was assessed using the Chi-square test for categorical variables (sex, macular status, lens status, PVR grading, location of the tear, type of tamponade, surgical procedure, PPV gauge, ability to be in a face-down position after surgery), an independent t-test for normal distribution continuous variables (age, onset, number of tear), and the Man-Whitney U-test for other distributions. The level of statistical significance was set at $p<0.05$. Finally, multiple logistic regression analysis and the odd ratio (95% CI) were used to identify risk factors for retinal redetachment after surgery.

Results

In this study, a total of 320 cases were included, out of which 231 (72.2%) achieved attachment, while as 89 (27.8%) experienced redetachment (Figure 1). The demographic profile and clinical characteristics of the patients are shown in Table 1. The age ranged from 7 to 86 years, and the mean age was 57.51 (±13.72) years. The 60–79 age group accounted for 46.9% (150 cases). Of the 320 cases, 213 (66.6%) were male and 107 (33.4%) were female. The onset of symptoms varied from 1 day to 3 years; the median onset was 14 days. The macular-off group

was found in 261 (87.3%) cases, while the macular-on group, which by definition implies that the retinal detachment did not involve the macular area, was found in 38 (12.7%) cases. Regarding the lens status, 237 (74.1%) cases were phakia, 79 (24.7%) cases were pseudophakia, and 4 (1.3%) cases were aphakia. The distribution of PVR grading among the cases were as follows: PVR grade B was observed in 200 (67.3%) of the cases, followed by PVR grade C in 53 (17.8%) of the cases, and PVR grade A in 44 (14.8%) of the cases. The superior location of the tear was observed in 169 (60.4%) of the cases, while inferior location was found in 65 (23.2%) and the combination of the superior and inferior location was found in 46 (16.4%) of the cases. A single retinal tear was found in 163 (57.6%) of the cases and groups of multiple breaks were found in 120 (42.4%) of the cases. Gas (C_3F_8) was used in 237 (74.5%) of the cases, also silicone oil (SO) in 45 (14.2%), heavy silicone oil (HSO) in 24 (7.5%), and no tamponade in 12 (3.8%) of the cases. For surgical procedures, PPV was used in 207 (64.7%) of the cases, pneumatic retinopexy in 74 (23.1%), combined PPV with SBP in 29 (9.1%), and SBP in 10 (3.1%) of the cases. For instrument size, the 23 gauge group was most used in 140 (74.1%) of the cases whereas the 25 gauge used in 42 (22.2%), and the 20 gauge used in 7 (3.7%) of the cases respectively. At last, the face-down position can be done in 298 (96.1%) of the cases in spite of the no face-down position can be done only 12 (3.9%) of the cases.

The results of both univariate and multivariate logistic regression analysis indicated that there were statistically significant associations between a higher rate of retinal redetachment and the following factors: being in the pneumatic retinopexy group, having PVR grade C, and being in the no face-down position group (Table 2). The risk of retinal redetachment in the pneumatic retinopexy group was found to be 7.588 times higher than in the combined PPV with SBP group (Adj. OR = 7.588, 95% CI 2.264-25.433, p=0.001). Similarly, the risk of retinal redetachment in PVR grade C was 8.068 times higher than in PVR grade A (Adj. OR = 8.068, 95% CI 2.612-24.921, p<0.001), and the risk of retinal redetachment in PVR grade B was 1.438 times higher than in PVR grade A (Adj. OR = 1.438, 95% CI 0.556-3.721, p=0.454). Lastly, the risk of retinal redetachment in the no-face-down position group was found to be 14.809 times higher than in the face-down position group (Adj. OR = 14.809, 95% CI 2.992-73.296, p=0.001).

Figure 1: Proportions of surgical outcome after rhegmatogenous retinal detachment surgery

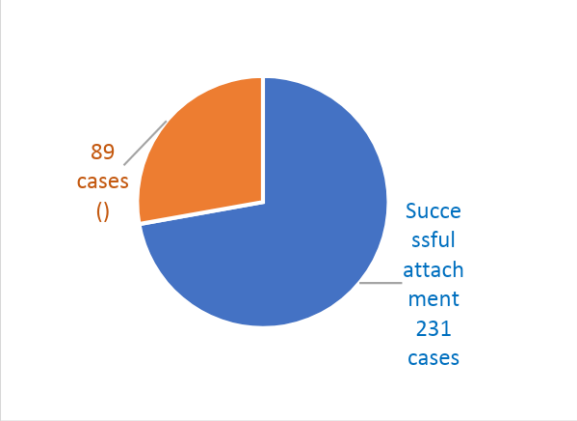

Table 1: Baseline characteristics of the subjects (n=320)

Characteristics	Total (n=320)		Redetachment (n=89)		Successful attachment (n=231)		p-value
	n	%	n	%	n	%	
Sex (n=320)							0.128
Female	107	33.4%	24	27.0%	83	35.9%	
Male	213	66.6%	65	73.0%	148	64.1%	
Age (years) (n=320)							0.318
<40	34	10.6%	13	14.6%	21	9.1%	
40-59	126	39.4%	35	39.3%	91	39.4%	
60-79	150	46.9%	40	44.9%	110	47.6%	
≥80	10	3.1%	1	1.1%	9	3.9%	
Onset (days) (n=288)							0.541
Mean ± SD	37.77	± 91.98	40.47	± 88.17	36.71	± 93.61	
Median (IQR)	14.0	(7-30)	14.0	(7-60)	14.0	(7-30)	
Macular status (n=299)							0.822
on	38	12.7%	11	13.4%	27	12.4%	
off	261	87.3%	71	86.6%	190	87.6%	
Lens status (n=320)							0.411
Aphakia	4	1.3%	2	2.2%	2	0.9%	
Pseudophakia	79	24.7%	24	27.0%	55	23.8%	
Phakia	237	74.1%	63	70.8%	174	75.3%	
PVR grading (n=297)							0.031*
A	44	14.8%	9	11.1%	35	16.2%	
B	200	67.3%	50	61.7%	150	69.4%	
C	53	17.8%	22	27.2%	31	14.4%	
Location of tear (n=280)							0.991
superior	169	60.4%	48	60.0%	121	60.5%	
inferior	65	23.2%	19	23.8%	46	23.0%	
superior+inferior	46	16.4%	13	16.3%	33	16.5%	
Number of tear (n=283)							0.502
1	163	57.6%	43	54.4%	120	58.8%	
>1	120	42.4%	36	45.6%	84	41.2%	
Type of tamponade (n=318)							0.918
gas	237	74.5%	66	75.9%	171	74.0%	
heavy silicone oil	24	7.5%	6	6.9%	18	7.8%	
silicone oil	45	14.2%	11	12.6%	34	14.7%	
no	12	3.8%	4	4.6%	8	3.5%	
Instrument size (n=189)							0.890
20 G	7	3.7%	1	2.9%	6	3.9%	

Characteristics	Total (n=320)		Redetachment (n=89)		Successful attachment (n=231)		p-value
	n	%	n	%	n	%	
23 G	140	74.1%	27	77.1%	113	73.4%	
25 G	42	22.2%	7	20.0%	35	22.7%	
Surgical procedure (n=320)							<0.001*
SBP	10	3.1%	3	3.4%	7	3.0%	
Pneumatic retinopexy	74	23.1%	41	46.1%	33	14.3%	
PPV, PPV+PEIOL	207	64.7%	41	46.1%	166	71.9%	
PPV+SBP	29	9.1%	4	4.5%	25	10.8%	
Face down position (n=310)							<0.001*
yes	298	96.1%	76	88.4%	222	99.1%	
no	12	3.9%	10	11.6%	2	0.9%	

p values for mean data were calculated with the use of Man-Whitney U- test, for percentages with the use of Chi-square test or Fisher's exact test, * Significant at p-value < 0.05

"no" from type of tamponade mean doing only simple scleral buckle procedure 10 cases and no ability to perform operation 2 cases
SBP = Scleral buckle procedure
PPV = Pars plana vitrectomy
PEIOL = Phacoemulsification with intraocular lenses

Table 2: Factors associated with retinal redetachment after treatment of rhegmatogenous retinal detachment

Factor	Crude OR	95%CI		p-value	Adj.OR (n=290)	95%CI		p-value
Surgical procedure								
SBP	2.679	0.482	14.893	0.260	-	-	-	-
Pneumatic retinopexy	7.765	2.457	24.541	<0.001*	18.936	4.607	77.837	<0.001*
PPV, PPV+PEIOL	1.544	0.509	4.681	0.443	2.669	0.731	9.747	0.137
PPV+SBP	ref				ref			
Face down position (n=310)								

yes	ref				ref			
no	14.605	3.130	68.152	0.001*	16.095	3.175	81.583	0.001*
PVR grading (n=297)								
A	ref				ref			
B	1.296	0.583	2.883	0.525	1.438	0.556	3.721	0.454
C	2.760	1.107	6.883	0.029*	8.068	2.612	24.921	<0.001*

* Significant at p-value < 0.05

ref = the best outcome factor using for comparing to other interesting factors

Discussion

This study provides detailed information on the onset of symptoms, macular status, lens status, PVR grading, location of the tear, number of the tear, type of tamponade, surgical procedure, instrument size, and ability in a face-down position in a population of patients aged 7 to 86 years who present with rhegmatogenous retinal detachment (RRD) without previous vitreoretinal surgery. In this study, we attempt to find associated factors of RRD that could guide the surgeon to evaluate the risk of surgical failure. Based on our analysis of three years worth of data, we found that the incidence of RRD was higher in males than females, in line with previous studies[12,13,14,15,16].

Several studies have implied that age is a prognostic factor that predicts surgical outcome in RRD surgery[20,21]. Wong et al. [22] reported that older age was a negative factor for success in RRD surgery. Cheng et al. [23], who investigated surgical outcomes for RRD in high myopic eyes, reported that young age was the only significant factor for anatomical success using multivariate analysis. However, some studies found that age is not a risk factor for failure in RRD surgery[18]. In this study, we found no association between age and the risk of retinal redetachment.

Previous investigators have indicated that proliferative vitreoretinopathy (PVR) is the most predictive factor in the eye at presentation for retinal redetachment[11,19]. In p ur study we utilized the updated classification of retinal detachment with proliferative vitreoretinopathy as a reference in 1991 for PVR grading[7] and similarly found a significant association between PVR grading and the risk of retinal redetachment. Preoperative PVR grade C still result in unfavorable surgical outcomes when compared with PVR grade A and B obviously. According to multiple studies, the retinal redetachment rate of pneumatic retinopexy is around 25.6-46%[24-28]. In our study, it was even higher, at 55.41% but other surgical procedures such as pars plana vitrectomy and scleral buckle procedure both still result in higher anatomical success rate than pneumatic retinopexy. The potential benefits of face-down positioning after RRD surgery have been evaluated in previous studies[8-10]. Recent studies also showed a comparable reattachment rate to that published in prior studies in which postoperative head positioning had

been impacted on the rate of reattachment of retina[29-30]. In our study, we found that the no face down positioning after surgery group is associated with a higher redetachment rate.

However, our study has several limitations. First, this study was a retrospective, single-center study design, which led to some missing data. Second, there was no long-term data; the retinal redetachment cut-off point in this study is only 28 days after surgery (this arbitrary duration was concomitantly used for clinical quality indicator research in this center, which contributed to the feasibility of this study from a data collecting perspective). Third, the preoperative PVR grading was recorded by multiple ophthalmologists, which may limit the accuracy of the documentation and standardization of grading . Fourth, there was an extremely long onset of symptoms in some cases, which could have been caused by a variety of factors, including poor self-awareness in patients, difficulty accessing healthcare, miscommunication in elderly patients, etc. Lastly, we did not separate primary failure from secondary failure, and we found two inoperable cases that were included in the redetachment group.

Conclusions

In conclusion, this retrospective study showed the rate of RRD was higher in males than females, which is comparable with the current literature. The retinal redetachment rate was 27.8%. And the risk factors for retinal detachment after primary RRD surgery were pneumatic retinopexy, PVR grade C and no face-down position after surgery. From our results, we can inform our patients about the risk of recurrence in retinal detachment surgery and emphasize the importance of adhering to postoperative positioning.

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