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Original Research

FACTORS INFLUENCING THE OUTCOMES OF RECURRENT RETINAL DETACHMENT AFTER PARS PLANA VITRECTOMY FOR RHEGMATOGENOUS RETINAL DETACHMENT AT CIPTO MANGUNKUSUMO NATIONAL GENERAL HOSPITAL IN INDONESIA

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ABSTRACT

IIntroduction: Recurrent retinal detachment (re-RD) after primary pars plana vitrectomy (PPV) for rhegmatogenous retinal detachment (RRD) remains a major surgical challenge with often unsatisfactory visual outcomes. This study aims to determine the incidence and identify factors influencing the anatomical and functional outcomes after surgical repair of re-RD.

Methods: This retrospective, descriptive analytical study was conducted between October 2024 and December 2024 at RSUPN Cipto Mangunkusumo Hospital, Indonesia. We reviewed 368 RRD cases that underwent primary PPV between January 2022 and December 2023. Of these, 110 developed re-RD, and 72 cases that underwent at least one repair surgery were included. Detailed data on demographics, clinical status (BCVA, high myopia and lens status), and intraoperative details (number and location of tears, extent of RD, macula and proliferative vitreoretinopathy status, tamponade type, presence of choroidal detachment) were analyzed. BCVA was converted to LogMAR. Outcomes were assessed using paired t-test, Chi-square test, and multivariate logistic regression.

Result: From this study, the incidence of re-RD was 29.9% (110/368). Following repair, the anatomical success rate (retina attached) was 75% (54/72). Multivariate analysis found that undergoing only one repair surgery (OR, 4.90; CI95%, 1.28–18.79; p=0.020) was the only factor significantly associated with better anatomical success. Functional outcomes improved statistically (median LogMAR 1.7 [0.5–2.3] to 1.7 [0.4–3.0]; p<0.001), but only 11.1% (8/72) of patients achieved BCVA of ≥6/60. Multivariate analysis showed macula-on status at the time of re-RD (OR 9.67; p=0.006) was the only significant predictor for better final functional outcomes.

Conclusion: The anatomical and functional outcomes of re-RD management are comparable to reports from other countries. Prognosis is associated with macula status at the time of recurrence and the number of repair surgeries performed.

Keywords: rhegmatogenous retinal detachment, recurrent retinal detachment, anatomical outcome, functional outcome, demographic characteristics

Introduction

The reported incidence of rhegmatogenous retinal detachment (RRD) varies between 6.3 and 17.9 per 100,000 population per year. The incidence of RRD is expected to increase in the future, along with the rising prevalence of myopia and life expectancy, which are the two main risk factors associated with this condition.[1,2] There are 3 types of surgical procedures commonly performed for the management of RRD: pneumoretinopexy (PnR), scleral buckling (SB), pars plana vitrectomy (PPV). The choice of surgical procedure is influenced by many factors, including the number of tears, location of the tears, size of the tears, the presence or absence of proliferative vitreoretinopathy (PVR), the patient's ability to adhere to specific posturing to maximize the function of the intraocular tamponade, lens status, and the experience and preference of the retinal surgeon.[3]

PPV has generally become the standard therapy for RRD patients. Currently, PPV accounts for over 70% of procedures performed for RRD management in the United States. The development of Wide Angle Viewing system technology allows retinal surgeons to find all pathological conditions in the peripheral retina while performing PPV. This contributes to the popularity of PPV and, naturally, affects its success rate.[4] After a complete PPV, aspiration of SRF is performed, followed by retinopexy using endolaser/cryo, and concluded with the administration of an internal tamponade such as gas (SF6/C2F6/C3F8) or silicone oil (SO) to facilitate the process of retinal reattachment to the RPE.[3,4]

In ideal conditions, a detached retina can be reattached to the RPE with a single surgical procedure. However, in reality, approximately 10% of RRD patients will experience the retina detaching again after the first/primary operation, known as recurrent retinal detachment (re-RD).[3] Previous research has identified several factors associated with the occurrence of re-RD after primary PPV, including RD duration, high myopia/posterior staphyloma, lens status, tear located on the inferior, number and size of tears, extent of RRD, macula-off status, PVR severity, type of internal tamponade used, presence of choroidal detachment (CD), and history of other intraocular surgeries such as cataract and glaucoma surgery.[6,7,8,9]

The management of post PPV recurrent retinal detachment usually involves revitrectomy with or without SB + internal tamponade. The majority of patients will achieve an anatomical outcome of retinal reattachment in a single repair surgery (Single Surgery Retinal Reattachment/SSRR), while the rest require more than one repair surgery. Anbiya V et al.[10] reported that out of 118 patients with recurrent retinal detachment, 92 patients underwent one repair surgery with anatomical success in 76 patients (82.61% of 92), 24 patients underwent two repair surgeries with anatomical success in 11 patients (45.83% of 24), and 2 patients underwent three repair surgeries without achieving anatomical success. Bai JX et al. [11] reported an SSRR of 75% out of 20 recurrent retinal detachment patients who underwent repair surgery consisting of revitrectomy without retinectomy or SB. Enders P et al.[12] found that recurrent retinal detachment patients have a 21–26% risk of redetachment each time they undergo a repair surgery.

The functional outcome for recurrent retinal detachment patients remains unsatisfactory even when anatomical reattachment has occurred and there has been a statistically significant improvement in Best-Corrected Visual Acuity (BCVA) compared to before the repair surgery. Anbiya et al.[10] reported that only 5.9% of patients had a final BCVA of ≥20/60, 28.81% of patients had a final BCVA between <20/30 and 20/200, and the remaining 65.25% of patients had a final BCVA of <20/200. Better results were reported by Pournaras et al.,[13] who found that 29% of 56 recurrent retinal detachment patients who underwent multiple repair surgeries had a final BCVA of ≥20/40.

Cipto Mangunkusumo National General Hospital is a national referral hospital that receives RRD patient referrals from all over Indonesia, both undergoing primary and secondary vitrectomy. To date, no research has been conducted on the outcomes of re-RD management at this hospital.

Methods

This retrospective, descriptive analytical study was conducted at the Vitreoretina Division, Department of Ophthalmology, Cipto Mangunkusumo National General Hospital between October 2024 and December 2024 after the protocol received approval from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia (No. KET-1581/UN2.F1/PPM.00.02/2024). The medical records reviewed were from January 2022 to December 2023. The inclusion criteria for the study subjects are as follows: patients who experienced re-RD after primary PPV for RRD and had undergone at least one repair surgery to reattach the retina. Meanwhile, patients who have these characteristics were excluded from the study: patients who received primary PPV elsewhere, those with a history of trauma, cases of Tractional RRD (TRRD) or Exudative Retinal Detachment, and cases with incomplete data.

The data used were secondary data obtained from both manual and electronic patient medical records. The data collection process involved identifying patients with an RRD diagnosis (ICD-10 code H.33.0) and primary PPV procedure (ICD-9 code 14.73) via the electronic records system. The list was then filtered to isolate the re-RD cases. For each included patient, the researcher collected detailed information, including demographic data (age, gender); clinical data before primary PPV (duration of RD, response time, BCVA, high myopia status, lens status); intraoperative data during primary PPV (number and location of tears, extent of RD, macula status, PVR status, type of internal tamponade, and presence of CD); clinical data at the time of re-RD (duration of re-RD, BCVA, lens status); intraoperative data during the first re-operation (number and location of tears, extent of RD, macula status, PVR status, type of internal tamponade, and presence of CD); the total number of re-operations; and the BCVA at the last follow-up.

For analysis, BCVA measurements were converted to their LogMAR equivalent for statistical purposes. The LogMAR denotation for visual acuity will be: Counting Fingers: 1.7 LogMAR; 1/300: 2.0 LogMAR; 1/∞: 2.3 LogMAR; No Light Perception (NLP): 3.0 LogMAR. Qualitative data were presented as proportions, while quantitative data were presented as the mean ± standard deviation. The mean BCVA at initial presentation and at the onset of re-RD will be compared with the mean BCVA at the last follow-up using the paired t-test. To identify factors influencing outcomes, clinical and intraoperative variables of re-RD patients were compared between groups with better and poorer anatomical/functional outcomes using the unpaired t-test (for numerical variables) or the Chi-square test (for categorical variables). Finally, all statistically significant variables were subjected to multivariate logistic regression. Statistical significance was defined as a p-value <0.05.

Result

A total of 368 cases were diagnosed with RRD and underwent primary PPV. After reviewing all these cases, the researcher identified 110 cases that experienced re-RD. From 110 identified cases, 38 cases were excluded, detailed as follows: 27 cases had not yet undergone repair, 4 cases were not repaired due to poor prognosis, 2 cases refused repair surgery, 2 cases were panuveitis/exudative RD, and 1 case each of TRRD, trauma, and primary failure. This left 72 cases included in this study. The demographic and clinical characteristics of the patients at the time of RRD and Re-RD are presented in Table 1. The mean follow-up period was 497.75±167.98 days.

Table 1. Demographic and Clinical Characteristics

Demographic and clinical characteristics	During RRD	During Re-RRD
Age (mean ± SD, year)	48.83 ± 14.06	
Gender (Men : Women)	45 : 27	
Duration of Symptoms (median, min-max, days)	14.00 (1.00 - 365.00)	
Respond Time (median, min-max, days)	19.00 (3.00 - 271.00)	27.50 (0.00 - 469.00)
Duration (median, min-max, days)	40.50 (8.00 - 391.00)	101.00 (8.00 - 743.00)
BCVA (median, min-max, LogMAR)	1.70 (0.00 - 2.30)	1.70 (0.50 - 2.30)
High myopia, n (%)	25 (34.7)	
Lens, n (%)		
Phakic	54 (75.0)	24 (33.3)
Pseudophakic	17 (23.6)	44 (61.1)
Aphakic	1 (1.4)	4 (5.6)
Number of Tears, n (%)		
Single	53 (73.6)	47 (65.3)
Multiple	16 (22.2)	4 (5.6)
None	3 (4.2)	21 (29.2)
Tear Location, n (%)		
Inferior	18 (25.0)	30 (41.7)
Superior	26 (36.1)	4 (5.6)
Nasal	4 (5.6)	5 (6.9)
Temporal	13 (18.1)	12 (16.7)
Multiple	8 (11.1)	1 (1.4)
No Tear	3 (4.2)	20 (27.8)
Extent of RD, n (%)		
1 Quadrant	2 (2.8)	0 (0.0)
2 Quadrant	30 (41.7)	42 (58.3)
3 Quadrant	14 (19.4)	5 (6.9)
4 Quadrant	26 (36.1)	25 (34.7)
Macula Status, n (%)		
Macula On	13 (18.1)	10 (13.9)
Macula Off	59 (81.9)	62 (86.1)
PVR, n (%)		
Present	39 (54.2)	58 (80.6)
Absent	33 (45.8)	14 (19.4)
Type of Internal Tamponade, n (%)		
SF6 Gas	3 (4.2)	2 (2.8)
C3F8 Gas	6 (8.3)	3 (4.2)
Silicone Oil	63 (87.5)	67 (93.1)
Choroidal Detachment, n (%)		
Present	2 (2.8)	2 (2.8)
Absent	70 (97.2)	70 (97.2)

Anatomical Outcomes

At the final follow-up, the anatomical outcomes showed the retina was attached in 54 (75%) cases and detached in 18 (25%) cases. Sixty-one cases underwent 1 repair surgery with anatomical success (retina attached) in 49 cases (80.3% of 61), six cases underwent 2 repair surgeries with a 50% anatomical success rate, four cases underwent 3 repair surgeries with anatomical success in 1 case (25% of 4) and one case underwent 5 repair surgeries, with 100% anatomical success.

The relationship between demographic and clinical characteristics of RRD and Re-RD and the final anatomical outcome of the retina is illustrated in Table 2 (categorical variables) and Table 3 (numerical variables).

Bivariate analysis found that cases without high myopia (OR, 3.25; CI95%,1.08–9.80; p=0.032) and cases undergoing 1 repair surgery (OR, 4.90; CI95%,1.28–18.79; p=0.023) were statistically more likely to achieve a better final anatomical outcome (retina attached). However, after performing multivariate logistic regression analysis on the two variables, it was found that only the number of repair surgeries variable was significantly related to the final anatomical outcome of the retina (OR, 4.90; CI95%, 1.28–18.79; p=0.020).

Functional Outcomes

There is a statistically significant improvement in BCVA across all Re-RD cases that underwent 1 or more repair surgeries, from a median LogMAR of 1.7 (0.5–2.3) at the time of Re-RD to a median LogMAR of 1.7 (0.4–3.0) at the final follow-up (p<0.001; post hoc Wilcoxon). Despite the improvement in BCVA, only 8 cases had a final BCVA of ≥6/60 (11.1%), and the remaining 64 cases (89.9%) had a final BCVA of <6/60 at the final follow-up.

The relationship between demographic and clinical characteristics during RRD and Re-RD and the final functional outcome is illustrated in Table 4 (categorical variables) and Table 5 (numerical variables). Bivariate analysis found that macula status at Re-RD (OR, 9.67; CI95%,1.91–48.89; p=0.011) and LogMAR BCVA at RRD (p=0.034) had a statistically significant relationship with the final functional outcome. Further multivariate logistic regression analysis on these two variables found that only macula-on status at the time of Re-RD had a significant relationship with a better final functional outcome (OR, 9.67; CI95%,1.91–48.89; p=0.006).

Discussion

Anatomical Outcomes

After undergoing one or more repair surgeries, 54 (75%) of the Re-RD cases we studied achieved an anatomical outcome of retina attached. This result is relatively similar to the findings of Pournaras et al.[13] (≈80%) and Ambiya et al.[10] (73.7% anatomical success). Better results were reported by Enders et al[12] (99.1%), Sigler et al.[11] (87.8%), Mancino et al.[15] (93.9%), and Alkin et al.[16] (96.6%). Several factors can explain these differences, such as the inclusion criteria and the repair surgery techniques used in those studies. Studies with superior anatomical outcomes either included cases that had undergone scleral buckling (SB) during primary RRD as subjects (Enders et al.[12], Mancino et al.[15], Alkin et al.[16]) or used narrower inclusion criteria, such as Alkin et al.[16], who only studied inferior Re-RD cases. Our study included Re-RD cases with a history of PPV for primary RRD and did not restrict the area of detachment, suggesting the cases in our study were likely of higher complexity. Sigler et al.[11] assessed anatomical and functional outcomes in Re-RD cases performed with Two-Port Pars Plana Vitrectomy under Silicone Oil, a surgical technique different from ours, making direct comparison difficult. The Single Surgery Retinal Reattachment (SSRR) rate in our study was 80.3% (49/61). This is higher than the 64.4% (76/118) reported by Ambiya et al.[10]

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Table 2. Relationship Between Demographic and Clinical Characteristics at RRD and Re-RD with Anatomical Outcomes of Retina at Final Follow-up (Categorical Variables)

		Anatomical Outcome of Retina				p value	OR (CI 95%)
		Attached		Detached			
		n	%	n	%		
Gender	Male	35	77.8	10	22.2	0.482[a]	1.47 (0.50 - 4.36)
	Female	19	70.4	8	29.6	Reference	
High Myopia	No	39	83.0	8	17.0	**0.032[a]**	**3.25 (1.08 - 9.80)**
	Yes	15	60.0	10	40.0	Reference	
Lens Status (RRD)	Phakic	39	72.2	15	27.8	0.531[b]	0.56 (0.14 - 2.22)
	Aphakic	1	100.0	0	0.0	1.000[b]	
	Pseudophakic	14	82.4	3	17.6	Reference	
Number of Tears (RRD)	Multiple	12	75.0	4	25.0	1.000[b]	1.50 (0.11 - 21.31)
	Single	40	75.5	13	24.5	1.000[b]	1.53 (1.13 - 18.38)
	No Tear	2	66.7	1	33.3	Reference	
Location of Tear (RRD)	Multiple	6	75.0	2	25.0	1.000[b]	1.50 (0.08 - 26.86)
	Superior	20	76.9	6	23.1	1.000[b]	1.67 (1.13 - 21.73)
	Inferior	12	66.7	6	33.3	1.000[b]	1.00 (0.08 - 13.37)
	Temporal	11	84.6	2	15.4	0.489[b]	2.75 (0.16 - 46.79)
	Nasal	3	75.0	1	25.0	1.000[b]	1.50 (0.06 - 40.63)
	None	2	66.7	1	33.3	Reference	
Extent of RRD	4 Quadrant	19	73.1	7	26.9	1.000[b]	
	3 Quadrant	10	71.4	4	28.6	1.000[b]	
	2 Quadrant	23	76.7	7	23.3	1.000[b]	
	1 Quadrant	2	100.0	0	0.0	Reference	
Macula Status (RRD)	Macula on	13	100.0	0	0.0	0.029[b]	
	Macula off	41	69.5	18	30.5	Reference	
PVR Status (RRD)	Present	28	71.8	11	28.2	0.495[b]	0.69 (0.23 - 2.03)
	Absent	26	78.8	7	21.2	Reference	
Type of Tamponade	Silicone Oil	46	73.0	17	27.0	0.563[b]	
during Primary PPV	C3F8	5	83.3	1	16.7	1.000[b]	
	SF6	3	100.0	0	0.0	Reference	
Choroidal Detachment	Absent	52	74.3	18	25.7	1.000[b]	
during Primary PPV	Present	2	100.0	0	0.0	Reference	
Lens Status (Re-RD)	Phakic	18	75.0	6	25.0	1.000[b]	1.00 (0.32 - 3.15)
	Aphakic	3	75.0	1	25.0	1.000[b]	1.00 (0.09 - 10.63)
	Pseudophakic	33	75.0	11	25.0	Reference	
Number of Tears (Re-RD)	Multiple	3	75.0	1	25.0	1.000[b]	0.71 (0.06 - 8.70)
	Single	34	72.3	13	27.7	0.553[b]	0.62 (0.17 - 2.18)
	No Tear	17	81.0	4	19.0	Reference	
Location of Tear (Re-RD)	Multiple	1	100.0	0	0.0	1.000[b]	
	Superior	4	100.0	0	0.0	1.000[b]	
	Inferior	19	63.3	11	36.7	0.345[b]	0.43 (0.16 - 1.62)
	Temporal	10	83.3	2	16.7	1.000[b]	1.25 (0.19 - 8.13)
	Nasal	4	80.0	1	20.0	1.000[b]	1.00 (0.09 - 11.59)
	None	16	80.0	4	20.0	Reference	
Extent of Re-RD	4 Quadrant	11	73.3	4	26.7	1.000[b]	0.69 (0.10 - 4.72)
	3 Quadrant	5	100.0	0	0.0	0.524[b]	
	2 Quadrant	30	71.4	12	28.6	0.710[b]	0.63 (0.12 - 3.38)
	1 Quadrant	8	80.0	2	20.0	Reference	
Macula Status (Re-RD)	Macula on	10	100.0	0	0.0	0.057[b]	
	Macula off	44	71.0	18	29.0	Reference	
PVR Status (Re-RD)	Present	44	75.9	14	24.1	0.739[b]	1.26 (0.34 - 4.64)
	Absent	10	71.4	4	28.6	Reference	
Type of Tamponade	Silicone Oil	51	76.1	16	23.9	0.435[b]	3.18 (0.19 - 53.91)
during Repair PPV	C3F8	2	66.7	1	33.3	1.000[b]	2.00 (0.05 - 78.25)
	SF6	1	50.0	1	50.0	Reference	
Choroidal Detachment	Absent	53	75.7	17	24.3	0.440[b]	3.12 (0.19 - 52.57)
during Repair PPV	Present	1	50.0	1	50.0	Reference	
Number of repar surgery	1	49	80.3	12	19.7	**0.023[b]**	**4.90 (1.28 - 18.79)**
	≥2	5	45.4	6	54.5	Reference	

[a]Pearson Chi-Square Test
[b]Fisher Test

Table 3. Relationship Between Demographic and Clinical Characteristics at RRD and Re-RD with Anatomical Outcomes of Retina at Final Follow-up (Numerical Variables)

		Mean±SD or Median (min - max)	p value	Mean difference (CI95%)	Mean rank
Age (years)	Attached (n=54)	50.48±13.90	0.883[a]	6.59 (-0.93 - 14.12)	
	Detached (n=18)	44.00±14.00			
Duration of symptoms (days)	Attached (n=54)	14.00 (1.00 - 365.00)	0.391[b]		1905.50
	Detached (n=18)	17.50 (3.00 - 365.00			722.50
BCVA at RRD (LogMar)	Attached (n=54)	1.70 (0.00 - 2.30)	0.087[b]		1845.00
	Detached (n=18)	1.85 (0.30 - 2.30)			783.00
Respond time RRD (days)	Attached (n=54)	19.50 (3.00 - 271.00)	0.198[b]		2070.00
	Detached (n=18)	16.50 (6.00 - 192.00)			558.00
Duration of RRD (days)	Attached (n=54)	41.00 (8.00 - 391.00)	0.825[b]		1988.00
	Detached (n=18)	40.00 (13.00 - 371.00)			640.00
Duration of Re-RD (days)	Attached (n=54)	96.50 (12.00 - 743.00)	0.902[b]		1980.50
	Detached (n=18)	127.00 (8.00 - 366.00)			647.50
BCVA at Re-RD (LogMAR)	Attached (n=54)	1.70 (0.50 - 2.30)	0.456[b]		2022.50
	Detached (n=18)	1.70 (0.50 - 2.00)			605.50
Respond time Re-RD (days)	Attached (n=54)	27.50 (0.00 - 469.00)	0.730[b]		1997.50
	Detached (n=18)	22.50 (0.00 - 308.00)			630.50

[a]Unpaired T-test results are reported with mean±SD, p value, and mean difference (CI95%)

[b]Mann-Whitney test results are reported with median (minimum - maximum), p value, and mean rank

Table 4. Relationship Between Demographic and Clinical Characteristics at RRD and Re-RD with Functional Outcomes (BCVA) at Final Follow-up (Categorical Variables)

		Final BCVA				p value	OR (CI 95%)
		≥6/60		<6/60			
		n	%	n	%		
Gender	Male	5	11.1	40	88.9	1.000	1.00 (0.22 - 4.56)
	Female	3	11.1	24	88.9	Reference	
High Myopia	No	6	12.8	41	87.2	0.705	1.68 (0.31 - 9.03)
	Yes	2	8.0	23	92.0	Reference	
Lens Status (RRD)	Phakic	3	5.6	51	94.4	0.016	1.14 (0.03 - 0.67)
	Aphakic	0	0.0	1	100.0	1.000	
	Pseudophakic	5	29.4	12	70.6	Reference	
Number of Tears (RRD)	Multiple	1	6.3	15	93.8	1.000	
	Single	7	13.2	46	86.8	1.000	
	No Tear	0	0.0	3	100.0	Reference	
Location of Tear (RRD)	Multiple	0	0.0	8	100.0	-	
	Superior	4	15.4	22	84.6	1.000	
	Inferior	2	11.1	16	88.9	1.000	
	Temporal	2	15.4	11	84.6	1.000	
	Nasal	0	0.0	4	100.0	-	
	None	0	0.0	3	100.0	Reference	
Extent of RRD	4 Quadrant	2	7.7	24	92.3	0.206	0.08 (0.00 - 1.90)
	3 Quadrant	0	0.0	14	100.0	0.125	
	2 Quadrant	5	16.7	25	83.3	0.345	0.20 (0.01 - 3.76)
	1 Quadrant	1	50.0	1	50.0	Reference	
Macula Status (RRD)	Macula on	3	23.1	10	76.9	0.151	3.24 (0.67 - 15.77)
	Macula off	5	8.5	54	91.5	Reference	
PVR Status (RRD)	Present	3	7.7	36	92.3	0.456	0.47 (0.10 - 2.12)
	Absent	5	15.2	28	84.8	Reference	
Type of Tamponade	Silicone Oil	7	11.1	56	88.9	1.000	
during Primary PPV	C3F8	1	16.7	5	83.3	1.000	
	SF6	0	0.0	3	100.0	Reference	
Choroidal Detachment	Absent	8	11.4	62	88.6	1.000	
during Primary PPV	Present	0	0.0	2	100.0	Reference	
Lens Status (Re-RD)	Phakic	1	4.2	23	95.8	0.244	0.23 (0.03 - 1.99)
	Aphakic	0	0.0	4	100.0	1.000	
	Pseudophakic	7	15.9	37	84.1	Reference	
Number of Tears (Re-RD)	Multiple	0	0.0	4	100.0	1.000	
	Single	5	10.6	42	89.4	0.695	0.71 (0.15 - 3.31)
	No Tear	3	14.3	18	85.7	Reference	
Location of Tear (Re-RD)	Multiple	0	0.0	1	100.0	1.000	
	Superior	0	0.0	4	100.0	1.000	
	Inferior	4	13.3	26	86.7	1.000	0.87 (0.17 - 4.39)
	Temporal	1	8.3	11	91.7	1.000	0.52 (0.05 - 5.61)
	Nasal	0	0.0	5	100.0	1.000	
	None	3	15.0	17	85.0	Reference	
Extent of Re-RD	4 Quadrant	0	0.0	15	100.0	0.150	
	3 Quadrant	1	20.0	4	80.0	1.000	1.00 (0.07 - 14.64)
	2 Quadrant	5	11.9	37	88.1	0.608	0.54 (0.09 - 3.30)
	1 Quadrant	2	20.0	8	80.0	Reference	
Macula Status (Re-RD)	Macula on	4	40.0	6	60.0	**0.011**	**9.67 (1.91 - 48.89)**
	Macula off	4	6.5	58	93.5	Reference	
PVR Status (Re-RD)	Present	7	12.1	51	87.9	0.678	1.78 (0.20 - 15.82)
	Absent	1	7.1	13	92.9	Reference	
Type of Tamponade	Silicone Oil	8	11.9	59	88.1	1.000	
during Repair PPV	C3F8	0	0.0	3	100.0	-	
	SF6	0	0.0	2	100.0	Reference	
Choroidal Detachment	Absent	8	11.4	62	88.6	1.000	
during Repair PPV	Present	0	0.0	2	100.0	Reference	
Number of repar surgery	1	8	13.1	53	86.9	0.344	
	≥2	0	0.0	11	100.0	Reference	

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There is a consensus among current researchers that the presence of severe PVR at the time of Re-RD is strongly associated with anatomical failure after repair surgery (Pournaras et al.[13], Ambiya et al.[10], Enders et al.[12,] Alkin et al.[16]). Ambiya et al.[10] found a relationship between PVR Grade C at Re-RD and the risk of anatomical failure (OR, 2.49; CI95%,1.02–6.09; p=0.045). Our study used a simple PVR present/absent criterion at Re-RD, and we found no significant relationship between the PVR risk factor and the final anatomical outcome. Interestingly, Ambiya et al.[10] also used the same PVR criteria as ours (PVR present/absent) in their study, where they similarly found no significant relationship between PVR presence with the final anatomical outcome.

The only factor associated with the final anatomical outcome in our study was the number of repair surgeries. Multivariate analysis showed that cases undergoing 1 repair surgery had a significantly higher probability of achieving anatomical success at the final follow-up (OR, 4.90; CI95%,1.28–18.79; p=0.020). This result is similar to the finding by Ambiya et al.[10] (OR, 6.48; CI95%,2.51–16.69; p<0.001). A different result was reported by Pournaras et al.[13], who did not find an influence of the number of repair surgeries on the final anatomical outcome, despite reporting a higher number of repair surgeries (mean 4, range 2-10). Further study with a larger sample size is needed to address this difference.

Functional Outcomes

The functional outcome we found was a statistically significant overall improvement in BCVA from a median LogMAR of 1.7 (0.5–2.3) at Re-RD to a median LogMAR of 1.7 (0.4–3.0) at the final follow-up (p<0.001; post hoc Wilcoxon). Despite the statistically significant improvement, only 8 cases had a final BCVA of ≥6/60 (11.1%), and the remaining 64 cases (89.9%) had a final BCVA of <6/60. Multivariate logistic regression analysis found that only macula-on status at the time of Re-RD was significantly associated with a better final functional outcome (OR, 9.67; CI95%,1.91–48.89; p=0.006).

Overall, the functional outcome found in our study is lower compared to the results reported by Pournaras et al.[13], Ambiya et al.[10], and Alkin et al.[16] Pournaras et al.[13] reported BCVA improvement from 1.4 LogMAR at Re-RD to 0.9 LogMAR at final follow-up, with 16 (29%) cases achieving a final BCVA of ≥20/40. They also found that PVR status at Re-RD played a significant role in final BCVA. This considerable difference is due to differences in the analyzed subjects. Pournaras et al.[13] only analyzed final functional outcomes of cases that achieved a good or attached anatomical outcome, unlike our study which analyzed functional outcomes for all cases, regardless of whether the retina was attached or detached. This is reflected in their baseline BCVA of 1.4 LogMAR, which is lower than the 1.7 LogMAR at Re-RD in our study.

Ambiya et al.[10] reported a statistically significant BCVA improvement from 1.79(±0.46) LogMAR at Re-RD to 1.32(±0.60) LogMAR at final follow-up. About 5.9% (7/118) of cases had BCVA of ≥20/60; 28.81% (34/118) had BCVA of <20/60–20/200, and 65.25% (77/118) had BCVA of <20/200.

Multiple tears was the only risk factor with a statistically significant relationship to the final functional outcome (OR,0.24; CI95, 0.06–0.96; p=0.044). It's evident that although the BCVA at Re-RD was relatively similar to ours, the improvement was greater than in our study. Furthermore, the number of cases with a final BCVA of ≥20/200 (34.7%) was higher than the 11.1% we found. This difference can be explained by further examination of the clinical picture of Re-RD cases in both studies. Our study showed macula-off status in 86.1% of cases, compared to 51% in Ambiya et al.'s[10] study. This difference in the proportion of macula-off cases at Re-RD may also explain why we found a significant relationship between macula-off status and final functional outcome, while Ambiya et al.[10] did not.

Alkin et al.[16] conducted a retrospective analysis of 59 Re-RD cases, divided into 2 groups based on the initial RRD procedure: the SB group and the PPV group. All cases subsequently underwent 23G PPV. The functional outcome showed a statistically significant BCVA improvement in both groups. The SB group improved from 1.77±0.66 LogMAR (Re-RD) to 1.29±0.81 LogMAR at final follow-up (p<0.001). The PPV group improved from 1.51±0.41 LogMAR to 1.14±0.54 LogMAR at final follow-up (p<0.001). A final functional outcome of BCVA of ≥20/200 was achieved in 41.9% of cases in the SB group and 35.7% in the PPV group. Multivariate logistic regression analysis indicated that macular involvement and an increased number of repair surgeries were significant factors contributing to a poorer functional outcome. The final functional outcome in the PPV group of Alkin et al.'s[16] study was better than ours. We believe this difference is due to the relatively large difference in baseline BCVA (1.51±0.41 LogMAR in Alkin et al.[16] compared to 1.7(0.5–2.3) LogMAR in our study). Additionally, the proportion of macula-off cases at baseline was greater in our study (86.1% compared to 67.8%).

We acknowledge the high variability of the clinical features found in our study, reflected by the many clinical variables with non-normal distributions, which created a limitation in the statistical analysis of these clinical variables. Our study also lack the documentation of severity of PVR. Nonetheless, this research provides a broad overview of the final outcomes (anatomical and functional) of Re-RD management following PPV for RRD, as well as the factors influencing the prognosis.

Conclusion

The anatomical and functional outcomes of Re-RD found in this study are similar to equivalent research conducted elsewhere. Repeated Re-RD surgery is associated with a higher rate of anatomical failure and macula-on status at the time of Re-RD is associated with a better functional outcome following repeated Re-RD surgery. Further research with a larger number of cases is required to reduce data variability.

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