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Peeling versus non-Peeling of Internal Limiting Membrane in Management of Rhegmatogenous Retinal Detachment

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Abstract

Background: One of the main causes of eyesight loss in the world today is rhegmatogenous retinal detachment (RRD). RRD has been found to occur in 7.98–18.2 persons per 100,000, with higher prevalence in older patients and males.

Aim of the Work: To compare the morphological and functional outcomes of internal limiting membranes peeling and non-peeling in the context of pressure ulcer prevention in cases of primary radiation kidney disease.

Patients and Methods: This prospective interventional trial included 40 patients' eyes from 40 different with primary (RRD) proliferative vitreoretinopathy (PVR) less than grade C were brought to the Al-Azhar University ophthalmology outpatient clinic. Subsequently, they were organized to undergo pars plana vitrectomy accompanied by silicone oil tamponade. Group 1 consisted of twenty eyes that exhibited ILM peeling, but group 2 did not have any ILM peeling.

Results: At the conclusion of a six-month follow-up, the patients assigned to the ILM peel group exhibited no indications of endometrial stem cell (ERM) in relation to morphological and functional outcomes. However, a sizable portion of patients (20%) 4/20 who had a vitrectomy without ILM peeling experienced ERM six months after the procedure. Nevertheless, the final BCVA result did not differ significantly between both groups in spite of the ILM peel group not having ERM formation.

Conclusion: In order to decrease the necessity for a second vitrectomy after primary RRD surgery, ILM peeling during the procedure is crucial in minimizing the development of macular ERM.

Keywords: Rhegmatogenous Retinal Detachment; Peeling; non-Peeling; Internal Limiting Membrane

1. Introduction

Rhegmatogenous retinal detachment (RRD) remains one of the leading causes of vision loss worldwide.¹

RRD continues to be one of the main global causes of visual loss. One RRD has been found to occur in 7.98–18.2 persons per 100,000, with a higher prevalence in older patients and males. Ten to forty percent of patients with primary RRD need a subsequent operation.^{2,3}

Since 2008, pars plana vitrectomy has become more and more common as a treatment for primary RRD.^{4,5} There has been a rise in the usage of PPV for treating eyes with RRD, according to several research.^{6,7,8,9} According to the Japan Retinal Detachment Registry, 77.8%

of cases of RRD were treated with vitrectomy between 2016 and 2017.^{10,11}

The occurrence of an epiretinal membrane (ERM) and subsequent macular pucker is a common consequence observed after the vitrectomy during rhegmatogenous retinal detachment.¹²

Macular pucker was observed in 15% of the eyes following an excellent pars plana vitrectomy with retinal detachment complicated through proliferative vitreoretinopathy (PVR), as reported by the Silicone Study Group. On certain occasions, these membranes may impede the production of functional output, leading to metamorphopsia. In cases where symptoms are present, additional intervention becomes imperative.¹³

The role of the (ILM) internal limiting membrane in the development of secondary endometrial resection (ERM) after renal replacement surgery is not completely comprehended, despite the fact that posterior vitreous detachment plays a crucial role in the creation of both primary (i.e., idiopathic) and secondary ERMs. Cells that form an ERM are thought to use ILM, which is thought to correlate to the Müller cell's basement membrane, as a kind of scaffold. Should this be accurate, the possibility of ERM and macular pucker would be decreased by elective ILM peeling during PPV for RRD repair. This is evidenced by Nam et al ¹², Aras et al. ¹⁴, and Rao et al. ¹⁵, Who claimed that there was no formation of extraretinal membranes (ERM) in the eyes after PPV and ILM peeling for RRD.

Nevertheless, it is important to remember that ILM peeling might be difficult when there is a detached retina, particularly when there is also a detached macula. In eyes with good vision, potential accidental harm sustained during peeling may outweigh the possible benefit of reducing macular pucker in the future. It is thought that additional variables, such as coexisting PVR and vitreous hemorrhage, predispose eyes to the establishment of ERM following RRD surgery. When evaluating the positive impacts of ILM peeling, these variables can, therefore, operate as confounding variables. Therefore, it is imperative to take into account any potential confounding factors prior to recommending ILM peeling for all normal RRD cases. ^{16 17}

The objective of this study is to investigate the morphological and functional implications of internal limiting membrane peeling and non-peeling during pars plana. In cases of primary rhegmatogenous retinal detachment, vitrectomy is performed.

2. Patients and methods

This prospective interventional study involved a sample of 40 individuals with primary retinal dystrophy (RRD) of grade c or below (PVR). These patients were scheduled to have pars plana vitrectomy with silicon oil tamponade.

They were divided into 2 groups:

Group A: Twenty individuals had pars plana vitrectomy (PPV) on twenty of their eyes without having their internal limiting membranes (ILM) peeled.

Group B: The operation performed on twenty eyes of twenty patients was PPV with ILM peeling.

Inclusion criteria:

Patients with primary renal failure (RRD) have a PVR grade of less than c.

Exclusion criteria:

The observed cases include recurrent retinal detachment (RRD), significant posterior vitreous retinopathy (PVR) of grade c or higher, tractional and exudative retinal detachment, open or closed angle glaucoma, proliferative diabetic retinopathy, diabetic maculopathy, corneal or lens opacities, prior endothelial retinopathy, and a history of trauma or uveitis.

Method:

All participants had comprehensive history collection, preoperative and postoperative assessments, Best corrected visual acuity (BCVA) testing utilizing a LogMar chart, intraocular pressure measurement employing a goldmann applanation tonometer, and anterior segment examination utilizing a slit lamp. Indirect ophthalmoscopy was employed to conduct a biomicroscopic fundus examination utilizing 90 D and 78 D lenses.

Preoperative retinal imaging employing spectral domain optical coherence tomography (OCT) with the presence of a macula on retinal detachment (RD), as well as during the third and sixth month after the surgery.

Postoperative

Silicone oil extraction was conducted during the third month following the surgical procedure, in conjunction with phacoemulsification and intraocular lens (IOL) implantation for all eyes affected by phakic conditions. A spectral domain (SD) optical coherence tomography (OCT) scan was conducted on all eyes without the use of silicone oil, one month following the initial surgery. The OCT parameters that were looked at were the central macular thickness (CMT), the presence or lack of extraretinal deposits (ERM), and the dimples in the retina.

Statistical Analysis

The researchers recorded baseline parameters and conducted statistical analysis on the postoperative anatomical and ocular outcomes. The Statistical Software for the Social Sciences (SPSS) program was used to look at the data in this study. Numbers and ratios were used to show the qualitative variables. The mean as well as the standard deviation (SD) were used to show the quantitative variables. A p-value greater than 0.05 means that the results are significant, while a p-value less than 0.05 means that the results are not significant

3. Results

Table 1. Comparing the demographic information of groups 1 and 2

		GROUP 1	GROUP 2	TEST-VALUE	P-VALUE	SIG.
		No.=20	No.=20			
AGE	Mean±SD	47.5±13.54	52.35±11.67	-1.214•	0.232	NS
	Range	19-67	21-67			
GENDER	Female	9 (45%)	8 (40%)	0.102*	0.749	NS
	Male	11 (55%)	12 (60%)			

P-value>0.05: Non significant; P-value<0.05: Significant; P-value<0.01: Highly significant

*: Chi-square test; •: Independent t-test

In our study, the patients had been divided into two groups: group 1 consisted of 9 girls and 11 males, whereas group 2 had 8 females and 12 males. In terms of demographic information (age and gender), group 1's mean age is 47.5, while group 2's mean age is 52.35. The observed differences do not exhibit statistical significance (p-value>0.05) among the two groups.

Table 2. Comparing the risk variables, degree of retinal detachment, macular statues, and quantity of retinal cracks between groups 1 and 2.

		GROUP 1	GROUP 2	TEST VALUE*	P-VALUE	SIG.
		No.=20	No.=20			
RISK FACTORS	No myopia	12 (60%)	16 (80%)	1.905	0.168	NS
	Myope	8 (40%)	4 (20%)			
EXTENT OF RETINAL DETACHEMENT	2 quadrants	4 (20%)	3 (15%)	0.195	0.907	NS
	3 quadrants	7 (35%)	7 (35%)			
MACULAR STATUS	4 quadrants	9 (45%)	10 (50%)	0.000	1.000	NS
	On	2 (10%)	2 (10%)			
NUMBER OF RETINAL BREAKS	Off	18 (90%)	18 (90%)	4.762	0.190	NS
	1 retinal breaks	4 (20%)	10 (50%)			
	2 retinal breaks	13 (65%)	8 (40%)			
	3 retinal breaks	2 (10%)	2 (10%)			
		4 retinal breaks	1 (5%)	0 (0%)		

P-value>0.05: Non significant; P-value<0.05: Significant; P-value<0.01: Highly significant

*: Chi-square test

There were 8 cases of myopia In Group 1 and Group 2, there were four cases, with The observed differences do not exhibit statistical significance (p-value>0.05) among the two groups when it came to myopia as a risk factor. The observed differences do not exhibit statistical significance (p-value>0.05) was seen among the two groups with respect to the degree of retinal detachment, macular state, or the quantity of retinal fractures.

Table 3. Comparing group 1 with group 2 in terms of BCVA before surgery, at the first, third, and sixth months.

BCVA (LOGMAR)		GROUP 1	GROUP 2	TEST -VALUE•	P-VALUE	SIG.
		No.=20	No.=20			
PREOPERATIVE	Mean±SD	1.63±0.46	1.62±0.49	0.083	0.935	NS
	Range	0.3-1.78	0.18-1.78			
AT FIRST MONTH	Mean±SD	0.55±0.15	0.49±0.16	1.177	0.246	NS
	Range	0.3-0.78	0.3-0.78			
AT THIRD MONTH	Mean±SD	0.78±0.2	0.68±0.18	1.514	0.138	NS
	Range	0.48-1	0.48-1			
AT SIXTH MONTH B	Mean±SD	0.38±0.18	0.32±0.15	1.171	0.249	NS
	Range	0.18-0.78	0.18-0.6			
REPEATED MEASURE ANOVA TEST		105.066	102.295			
P-VALUE		<0.001 (HS)	<0.001 (HS)			

P-value>0.05: Non-significant; P-value<0.05: Significant; P-value<0.01: Highly significant

•: Independent t-test

Based on the LogMar chart, it can be observed that the mean best corrected visual acuity values for both groups pre to surgery were 1.6, indicating that there was no statistically significant disparity between them. The statistical analysis reveals that there is no significant difference in the mean best corrected visual acuity between the groups at one, three, and six months after surgery (p-value>0.05).

The preoperative, The initial month, subsequent month, and final month postoperative mean BCVA values in the same group revealed a very statistically significant difference (p-value<0.01), with the mean BCVA for group 1 being 1.63 preoperatively and 0.38 at the sixth month postoperatively.

Table 4. Comparing the OCT results for CMT at the third and sixth months between groups 1 and 2

OCT FINDINGS CMT		GROUP 1	GROUP 2	TEST VALUE•	P-VALUE	SIG.
		No.=20	No.=20			
AT THIRD MONTH (UM)	Mean±SD	210.05±15.33	198.6±12.56	-1.252	0.018	S
	Range	186-236	189-207			
AT SIXTH MONTH (UM)	Mean±SD	218.9±24.58	197.05±12.84	3.524	0.001	HS
	Range	185-264	17-206			
REPEATED MEASURE ANOVA TEST		1.927	0.182			

P-VALUE

0.069 (NS)

0.67 (NS)

P-value>0.05: Non significant; P-value<0.05: Significant; P-value<0.01: Highly significant

•: Independent t-test

At the third month following surgery, there was a statistically significant difference in the two groups' CMTs: group 1's mean CMT was (210 um), whereas group 2's was (198 um).

At six months postoperative, there was a significant statistical difference (p-value<0.01) in the mean CMT between the two groups, with group 1's mean being 218um and group 2's being 197um.

At three and six months postoperatively, The observed differences do not exhibit statistical significance among the groups with relation to CMT (p-value>0.05).

Table 5. Comparing the CME findings at the third and sixth months for groups 1 and 2.

OCT FINDINGS CME		GROUP 1	GROUP 2	TEST	P-VALUE	SIG.		
		No.=20	No.=20	VALUE*				
AT THIRD MONTH	No CME	15 (75%)	18 (90%)	2.073	0.355	NS		
	CME	4 (20%)	1 (5%)					
	Pocket of SRF	1 (5%)	1 (5%)					
AT SIXTH MONTH	No CME	15 (75%)	19 (95%)	4.471	0.107	NS		
	CME	4 (20%)	0 (0%)					
	Pocket of SRF	1 (5%)	1 (5%)					
CHI-SQUARE TEST		0.000	1.027					
P-VALUE		1.000 (NS)	0.598 (NS)					

P-value>0.05: Non significant; P-value<0.05: Significant; P-value<0.01: Highly significant

*: Chi-square test

Regarding the occurrence of cystoid macular edema in each group and At the third and sixth months post-surgery, a comparison was made among both groups, The observed differences do not exhibit statistical significance (p-value>0.05).

Table 6. Comparison of OCT findings for ERM in the third and sixth months between groups 1 and 2.

OCT FINDINGS ERM		GROUP 1	GROUP 2	TEST	P-VALUE	SIG.
		No.=20	No.=20	VALUE*		
AT THIRD MONTH	No ERM	16 (80%)	20 (100%)	4.444	0.035	S
	ERM	4 (20%)	0 (0%)			
AT SIXTH MONTH	No ERM	16 (80%)	20 (100%)	4.444	0.035	S
	ERM	4 (20%)	0 (0%)			
CHI-SQUARE TEST		0.000	0.000			
P-VALUE		1.000 (NS)	1.000 (NS)			

P-value>0.05: Non significant; P-value<0.05: Significant; P-value<0.01: Highly significant

*: Chi-square test

Regarding the presence of ERM, The observed differences do not exhibit statistical significance (p-value>0.05) among any of the groups at the third and sixth months after surgery. However, there is a statistically significant difference (p-value<0.05) between the two groups at these same times because, in group 1, there was evident ERM in four cases at these times, whereas, in group 2, there was no ERM at those same times.

Table 7. Comparing group 1 and group 2 in terms of OCT determining the distribution of IS/ OS layers at the third and sixth months

OCT FINDINGS IS/OS LAYER DISRUPTION		GROUP 1	GROUP 2	TEST-VALUE*	P-VALUE	SIG.
		No.=20	No.=20			
AT THIRD MONTH	Disrupted	5 (25%)	3 (15%)	0.625	0.429	NS
	Intact	15 (75%)	17 (85%)			
AT SIXTH MONTH	Disrupted	5 (25%)	2 (10%)	1.558	0.212	NS
	Intact	15 (75%)	18 (90%)			
CHI-SQUARE TEST		0.000	0.229			
P-VALUE		1.000 (NS)	0.632 (NS)			

P-value>0.05: Non significant; P-value<0.05: Significant; P-value<0.01: Highly significant

*: Chi-square test

The observed differences do not exhibit statistical significance (p-value>0.05) in the IS/OS disruption at the third and sixth month post-operatively among the two groups, nor within each group.

4. Discussion

After undergoing vitrectomy for retinal detachment due to rhegmatogenous (RRD), the occurrence of epi retinal membrane (ERM) development on the macula remains a prevalent postoperative issue. The technique of ILM peeling has been employed in primary RRD surgery as a preventive measure against the formation of

epiretinal membranes after the surgery.¹⁸

The ILM facilitates cell division in a supportive capacity. Histological examination of the outer layer of peeling ILMs has revealed the presence of myofibroblasts, glial cells, and hyalocytes attached to the ILM's surface. It has been suggested that glial cells and hyalocytes interact to encourage the growth of an ERM. Therefore, by more thoroughly eliminating surviving cells

located on the outer layer of the retina and eliminating the substrate required for their growth, ILM peeling may prevent ERMs in two ways.¹⁹

Our research sought to determine how ILM peeling affected people with RRD's ability to prevent the development of ERM. Additionally, we investigated if ILM peeling had any positive effect on improving visual acuity. The primary objective of our study was to compare the occurrence of ERM development after vitrectomy between two groups: Group 1, which had primary RRD without ILM peeling, and Group 2, which had ILM peeling.

After a six-month follow-up period, none of the participants in the ILM peel groups participating in this study suffered ERM. However, a sizable fraction of patients (20%) who had a vitrectomy with no ILM peel experienced ERM six months after the surgery. Nevertheless, the final BCVA result did not reveal a significant difference between the two groups despite the ILM peel group not exhibiting ERM formation.

Numerous research conducted in recent years has examined the occurrence of endometrial resection (ERM) formation and the potential benefits of the preventive intraluminal membrane (ILM) peeling in individuals with recurrent renal failure (RRD).

The occurrence of ERM in the non-peeling group exhibited a greater proportion compared to Heo et al.²⁰, which was 6.1 %, and Martinez-Castillo et al.²¹, which was 8.97 %. However, our results were lower than Akiyama et al.¹ (47.7%), Rao et al.²² (34.3%), and Forlini et al.²³ (31%) of the non-peeling group developed ERM. Similarly, Nam and Kim¹² showed a result of 21,5%, which is close to our results (20%). In our study, we didn't report any ERM postoperatively in the ILM peeling group at the end of the six months. This result was better than that of Rao et al.²², who found that 3.3 % (1/30) in the peeling group developed ERM.

Based on an analysis of prior research, it can be inferred that the use of ILM peeling has a notable impact on reducing the occurrence of ERM development following surgery in instances of primary RRD.

There were studies that showed better BCVA in the ILM peeling group^{12,23,4,14} other studies showed worse BCVA for ILM peeling group.^{1,4,22} Studies have demonstrated identical visual results between the two approaches ^{24,25} which agrees with our study.

The presence of an intact ellipsoid zone was shown to be correlated with improved BCVA, which aligns with the findings of Odobina et al., who observed that eyes with a clearly visible normal ellipsoid zone had superior postoperative BCVA.³

Both groups experienced a decrease in postoperative BCVA due to macula off RD. This is consistent with research that has shown that despite the use of advanced surgical methods to successfully cure retinal detachment (RD) with a high degree of anatomical accuracy, the visual outcomes are still degraded mostly due to irreversible functional impairment after the macula becomes detached.

Cases with multiple retinal breaks and multiple detached quadrants were associated with more ERM development, which agrees with a study done by Heo et al., who clarified that this occurs as a result of RPE cells dispersing more easily through a bigger break or RD.²⁰

4. Conclusion

The peeling of the intraocular membrane (ILM) during vitrectomy for primary retinal detachment (RRD) holds considerable significance in the prevention of post-operative macular extraretinal morphogenesis (ERM), hence diminishing the need for additional vitrectomy procedures. Nevertheless, the visual outcomes were determined to be comparable to those reported in the non-intraluminal membrane (ILM) peeling vitrectomy..

Disclosure

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