Original Article

Anatomical and Visual Outcomes of Pars Plana Vitrectomy with Versus Without Internal Limiting Membrane Peeling in Rhegmatogenous Retinal Detachment Associated With Macular Hole

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ABSTRACT

Purpose: To evaluate the anatomical and visual outcomes of Parsplana vitrectomy (PPV) with and without internal limiting membrane (ILM) peeling in rhegmatogenous retinal detachment (RRD) associated with macular hole (MH).

Study Design: Interventional case series.

Place and Duration of Study: Lahore General Hospital from 1st September 2023 to August 2024.

Methods: Eighteen patients with rhegmatogenous retinal detachment (RRD) associated with macular hole (MH) were enrolled in the study. All patients underwent a comprehensive ocular examination, including macular optical coherence tomography (OCT). Twelve patients had a macular hole size of less than 400 µm, while six had a size greater than 400 µm. Group I included nine patients who underwent pars plana vitrectomy (PPV) with internal limiting membrane (ILM) peeling, whereas Group II consisted of nine patients who underwent PPV without ILM peeling.Normality assumption was checked using Shapiro-wilk test and independent t-test test was done for comparison of visual acuity between the two groups.

Results: Out of 18 patients, 10 were males (55.6%). Mean age was 55±7.1 years (range 44-60 years). In Group-I, 90% had closure of MH regardless of size while in Group-II, 40% had MH closure. Change in visual acuity was -1.0733 ± 0.26476 in Group 1 and -0.9244 ± 0.44427 in Group II (0.401).

Conclusion: Peeling of ILMas an adjunct to the PPV for surgical repair of macular hole associated with Rhegmatogenous-retinal-detachment has shown promising results in anatomical outcomes (90% closure rate compared to 40%) without a significant impact on visual acuity.

Keywords: Rhegmatogenous retinal detachment, Macular Hole, Pars Plana Vitrectomy, Internal Limiting Membrane.

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INTRODUCTION

Macular Hole (MH) is thought to involve thickening of the ILM, inward traction from aberrant pre-macular vitreous cortex adhesion, and, in the case of myopic MH, external traction from a posterior staphyloma.[1,2] A MH with RRD is a complex situation which if not operated in time and manged properly can result in an unsuccessful surgical procedure, with a higher

likelihood of reoperation.[3] The reported incidence of RRD with MH is 2.3% to 4%.[4] One of the causes of RRD with macular hole is trauma. It may lead to proliferative vitreoretinopathy (PVR) and poor prognosis.[5,6] The pathogenesis of MH with RRD is multifactorial.[7,8] The peripheral retinal break causes the release of pigment epithelium cells (RPE) that come in contact with the macula and contract while creating traction on the macula, thus leading to the creation of a MH. According to a different idea, a posterior vitreous detachment may cause tangential pressure on the central macula in addition to a peripheral break, which would result in MH.[9,10,11]

In high myopes, the preferred surgical intervention for MH is three ports PPV along with ILM peel.[12,13] Rationale behind the ILM peel is to remove the traction from the MH. In other patients, the effectiveness of ILM peel in treating MH associated with RRD is not well established. Therefore, it is unclear how this technique will affect these individuals' anatomy and function. In this study, we compared macular hole (MH) closure rates and visual acuity (VA) outcomes between treatment approaches for rhegmatogenous retinal detachment (RRD) associated with macular holes.

METHODS

This interventional case series was done at Lahore General Hospital between 1st September 2023 and 30th August 2024. Sample size was calculated with a 90% test power and a 5% level of significance. The estimated sample-size of 18 patients was based on the previously published mean value of best corrected visual acuity (BCVA) ± standard deviation, which was 1.0 ± 0.4 in Group-I and 0.4 ± 0.4 in Group-II.[14]

$$n = \frac{2\,(Z_{\alpha/2} + Z_{\beta})^2\,\sigma^2}{\Delta^2}$$

- n: Sample-size in each group =9
- $Z_{\alpha/2}$: Z-score for significance level (1.96 for 5%) = 1.96.
- Z_{β}: Z score for power (0.84 for 80%) = 0.84.
- σ: Pooled SD = 0.4.
- Δ: Difference in means (effect size) = 0.6.
- Adjusted for 20% dropout: 7×1.2=8.47 \times 1.2 = 8.47×1.2=8.4, round up to 9 participants per group (18 total).

The study was approved by the Institutional review board/Ethical review board **(078/LGH/2025)**. Patients of either gender, age ranging from 40 to 60 years and presenting with RRD associated with MH were selected from outpatient department. Patients with a history of trauma, prior scleral buckling, or vitrectomy were excluded. All the selected patients underwent a comprehensive evaluation both before and after surgery. The MH size was measured using optical coherence tomography of the macula, slit lamp examination, and visual acuity was checked using LogMAR. Group-I and Group-II were randomly selected from among the patients. Twelve patients had a macular hole size of less than 400 µm, while six had a size greater than 400 µm.

In both groups, there were 9 patients, of which 6 had RRD, PVR Grade A with MH, 2 had RRD, PVR Grade B with MH and 01 had RRD, PVR Grade C with MH. Measurement of the MH was less than 400-micron meters in 06 patients and was more than 400-micron meters in 03 patients.

Group-I had a PPV with ILM peeling and Group-II underwent PPV without ILM peeling. In PVR Grade A patients, SF6 gas was used as Endotamponade, whereas in PVR Grade B and C patients 5000 CS Silicon oil was used as Endotamponade. The surgery was performed by a single surgeon top avoid bias.

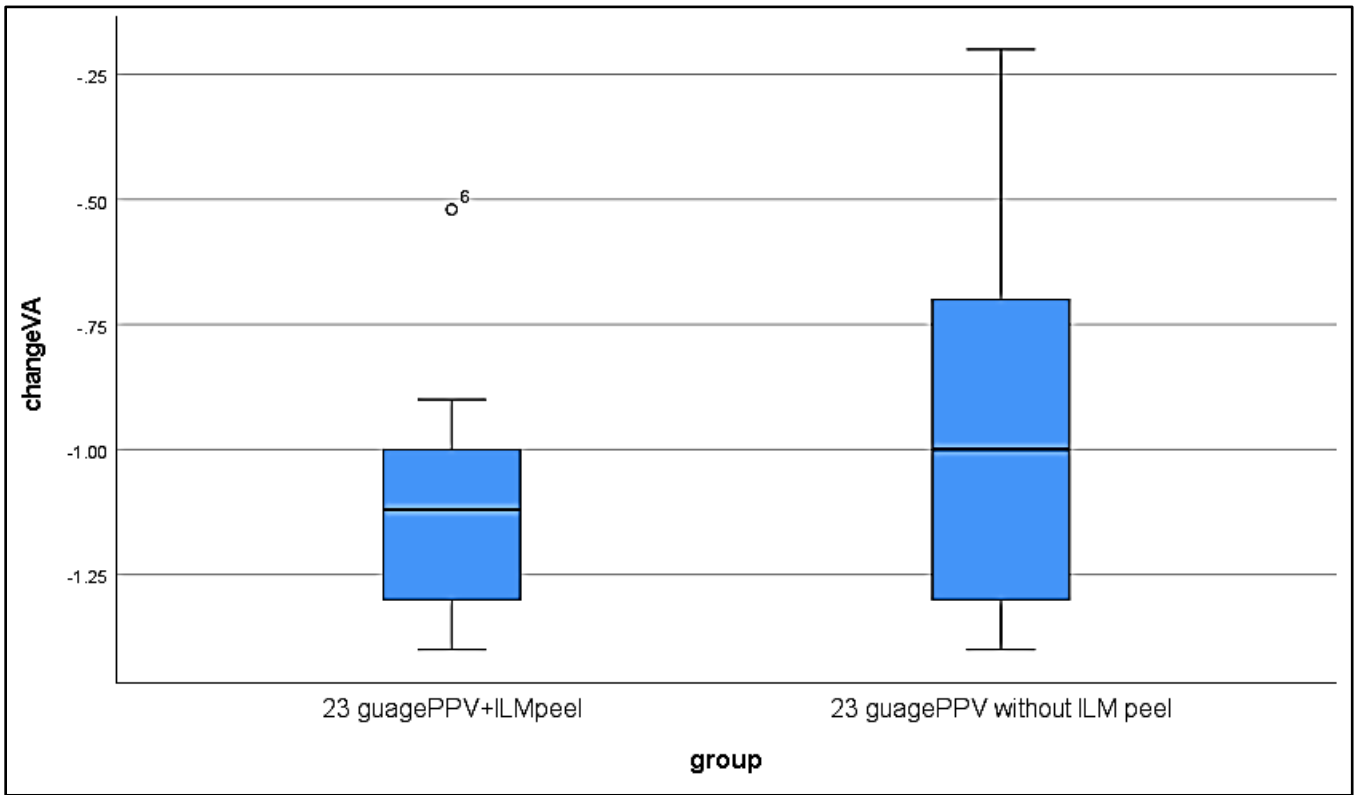
The patients were followed on post-operative day 1, week 2, 1st month, 3rd month and then 6th month. Data collected at 6th month was compared to pre-operative data (visual acuity and OCT). the data was collected and compiled using a self-designed proforma. The data analysis was done with SPSS 22.0 program.

RESULTS

Eighteen patients with a mean age of 55 ±7.1 years (range 44-60 years) were operated on. Among these, 10 (55.6%) were male while 8 (44.4%) were female. Shapiro-wilk test revealed p-values greater than 0.05 for both groups (ILM Peel: p = 0.399; No ILM Peel: p = 0.189), confirming a normal distribution of the data.MH closure rates were higher in Group-I (90%) than in Group-II (40%). Mean pre-operative visual acuity was 1.96±0.71 and post-operative visual acuity was 0.96±0.62. Mean change in visual acuity in Group I was -1.07±0.26 and in group II was -0.92±0.15 (p value >0.05). The mean change in visual acuity between the Group-I and Group-II was not statistically

Table 1: *Independent Samples t-test showing insignificant difference of change in visual acuity between the two groups.*

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	sig.	t	df	sig. (2-Tailed.)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Change VA	Equal variances assumed	2.487	.134	-.864	16	.401	-.14889	.17239	-.51435	.21657
	Equal variances not assumed			-.864	13.046	.403	-.14889	.17239	-.52119	.22341



Graph 1: Box plot showing the median Change in VA for Group-I and Group-II.

significant (Table 1). Median change in visual acuity is shown in graph 1.

DISCUSSION

Our results showed 90% MH closure in patients who underwent PPV with ILM and 40% in patients with PPV alone without ILM peel. According to prior work by Shiode et al, muller cells must be stimulated for the MH to close.[15] The ILM flap created during peeling provides a scaffold that facilitates Müller cell activation, proliferation, and migration, contributing to MH closure. These Müller cells release growth factors that promote tissue repair and hole closure. This suggests that even standard ILM peeling may stimulate Müller cell activity in the surrounding area, aiding in MH closure.

Group-I and Group-II in this study had anatomical success rates of 90% and 40%, respectively. Using LogMAR, the best corrected visual acuity in Group-I was -1.07 ± 0.2, while in Group-II it was -0.92 ± 0.44. The difference between the two groups was not statistically significant (p-value0.401). According to Iwasaki et al, we found better anatomical and functional outcomes in the Group-I (ILM peeling).[16] Similarly, in Bottoni et al, study, the ILM peeling

group showed improvement in terms of visual acuity, however, the result was not statistically significant (P=0.085).[17]

In another study, peeling of ILM had better experience with anatomical outcomes of 94% even for MH as large as 650µm. Similarly, Ch'ng et al, reported 86.6% anatomical success in the patients who underwent ILM peeling.[19]

By eliminating residual tractional forces across the macula, ILM peeling in cases of RRD associated with MH can improve anatomical outcomes.[20,21]This implies that in the presence of ongoing RD, ILM peeling raises the likelihood of MH closure. However, the limited sample size restricts the validity of any statistical conclusion.

We are unable to extrapolate the results of this study to a broader population because it is a single hospital-based study, and all the surgeries are carried out by a single retinal surgeon on a small number of patients. However, the fact that all the patients who were part of the study finished the follow-ups, and that the same optical coherence tomography (OCT) was employed throughout the trial are good aspects of our research. Given the rarity of the disease entity, our research could aid vitreoretinal surgeons in making decisions. It is recommended to conduct more research with bigger sample sets to more accurately evaluate how ILM peeling affects visual results.

CONCLUSION

This study concludes that during 23-gauge PPV, improvement in visual acuity between patients treated with ILM peeling (Group-I) and those not treated with ILM peeling (Group-II) ($p > 0.05$) was not statistically significant.However, MH closure rates were notably higher in the Group-I, (90%) than the Group-II, (40%). This suggests that ILM peeling may enhance anatomical outcomes without significantly affecting functional (visual) outcomes. Additionally, smaller MH s (<400 µm) was more common among the study population (66.7%).

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Patient's Consent: Researchers followed the guide lines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board **(078/LGH/2025)**.

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