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Original Research Article

Anatomical and Functional Outcomes After Silicone Oil Tamponade in Patients With Complex Retinal Detachment

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Abstract: *Complex retinal detachment (RD), including tractional retinal detachment (TRD) and traction-rhegmatogenous retinal detachment (TRRD), poses significant challenges in vitreoretinal surgery. Pars plana vitrectomy (PPV) with silicone oil (SO) tamponade is a widely used technique to achieve anatomical success; however, visual outcomes and postoperative complications remain variable. This study evaluates anatomical and functional outcomes after PPV with SO tamponade in patients with complex RD in Pakistan.* ***Objective:*** *To assess the anatomical success rate, functional visual outcomes, and postoperative complications associated with PPV with SO tamponade in patients with complex RD at Nishtar Hospital, Multan.* ***Methods:*** *An observational study was conducted on 37 patients (40 eyes) who underwent PPV with SO tamponade for complex RD. Preoperative complexity scoring (CS: 4–8) was assigned based on macular involvement, vitreoretinal traction, and prior pan-retinal photocoagulation (PRP). Primary outcome measures included anatomical success (complete retinal reattachment) and postoperative visual acuity (VA). Secondary outcomes included complication rates and timing of silicone oil removal (SOR). Data were analyzed using SPSS version 26, applying paired t-tests and chi-square tests for statistical comparisons ($p \leq 0.05$ significant).* ***Results:*** *The primary anatomical success rate was 85%, with a significantly higher success rate in macula-sparing TRD cases (91.7%) compared to macula-involving TRD (72.2%) ($p < 0.05$). Patients with preoperative complexity scores ≤5 had better postoperative VA, with 50% achieving VA ≥ 20/400 postoperatively. Preoperative PRP was associated with a 90% anatomical success rate, compared to 66.7% in patients without PRP. Postoperative complications included cataract formation (46%), retinal fibrosis (33%), and recurrent RD (15%). SOR was performed in 27.5% of eyes, with early SOR (≤3 months) leading to better visual recovery.* ***Conclusion:*** *The average complexity score was high in this series. SO tamponade for diabetic TRDs is not without complications, but it may be beneficial in stabilizing vision in eyes with otherwise poor prognosis.PPV with SO tamponade is highly effective for managing complex RD in Pakistani patients, with a high anatomical success rate and moderate functional improvement. Macula involvement, preoperative complexity scores, and PRP status significantly influenced surgical outcomes. The findings highlight the need for structured PRP protocols and optimal timing of SOR to improve visual prognosis. Future studies should focus on long-term follow-up and the impact of hybrid tamponade strategies on functional vision outcomes.*

Keywords: Retinal Detachment, Pars Plana Vitrectomy, Silicone Oil Tamponade, Tractional Retinal Detachment, Visual Outcomes

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Introduction

Retinal detachment (RD) is a serious ophthalmic emergency that can lead to irreversible vision loss if not managed promptly. Complex retinal detachments, including tractional retinal detachment (TRD) and traction-rhegmatogenous retinal detachment (TRRD), are particularly challenging to treat due to extensive fibrovascular proliferation, vitreoretinal adhesions, and high recurrence rates (1). In Pakistan, where diabetic retinopathy and trauma-related retinal detachments are prevalent, surgical success in complex RD cases remains a significant concern (2). Pars plana vitrectomy (PPV) with silicone oil (SO) tamponade is one of the most effective treatment strategies for these complex cases. Still, anatomical and functional outcomes can vary based on preoperative retinal conditions and surgical factors (3).

The choice of tamponade agents in PPV plays a critical role in retinal stabilization, preventing re-detachment, and optimizing visual recovery. Silicone oil is widely used due to its long-term tamponade effect, particularly in proliferative vitreoretinopathy (PVR) and diabetic TRD, where gas tamponades may be insufficient (4). However, complications such as cataract formation, retinal fibrosis, oil emulsification, and secondary glaucoma pose significant challenges, often necessitating additional interventions (5). While international studies have extensively evaluated the efficacy of silicone oil in complex RD, data specific to the Pakistani population remain scarce, limiting evidence-based recommendations for clinical practice (6).

A growing body of research suggests that preoperative complexity scores and macular involvement significantly influence surgical outcomes. Patients with macula-sparing TRD and lower complexity scores are likelier to achieve better postoperative visual acuity (VA) and anatomical success (7). A study in India reported that patients with TRD and preoperative VA of counting fingers or better had a 70% likelihood of functional improvement post-surgery (8). Similar studies in China and Turkey have highlighted that prior pan-retinal photocoagulation (PRP) significantly enhances surgical outcomes in diabetic TRD cases, reinforcing the importance of timely retinal laser treatment (9, 10). However, in Pakistan, many patients present with advanced disease due to delayed referrals and inadequate screening programs, leading to higher complexity scores and suboptimal surgical success rates (11).

One of the significant concerns in complex RD management is the timing of silicone oil removal (SOR). While early SOR (≤3 months) has been linked to a lower risk of emulsification and glaucoma, studies indicate that delayed removal (>6 months) increases the risk of recurrent detachment (12). However, the optimal timing for SOR in Pakistani patients remains poorly defined, necessitating further research to establish national guidelines based on local clinical outcomes (13).

Despite advancements in vitreoretinal surgery, limited data exist on the anatomical and functional outcomes of PPV with silicone oil tamponade

in Pakistani patients with complex RD. Given the high prevalence of diabetic retinopathy-related TRD and trauma-related RD in Pakistan, there is an urgent need to assess surgical outcomes, complication rates, and visual prognosis in this population. This study aims to provide clinical insights into the efficacy of silicone oil tamponade, identify factors influencing anatomical success and visual recovery, and contribute to developing evidence-based surgical guidelines for complex RD management in Pakistan. The findings will be valuable for ophthalmologists, vitreoretinal surgeons, and healthcare policymakers and will enhance local surgical strategies to reduce visual impairment and improve patient outcomes.

Methodology

This observational study was conducted at the Department of Ophthalmology, Nishtar Hospital, and Multan to evaluate anatomical and functional outcomes following pars plana vitrectomy (PPV) with silicone oil tamponade in patients with complex retinal detachment (RD). Ethical approval was obtained from the Institutional Review Board (IRB) of Nishtar Medical University, Multan, and the study adhered to the Declaration of Helsinki and international ethical standards for clinical research.

The study population included patients with tractional retinal detachment (TRD) and traction-rhegmatogenous retinal detachment (TRRD) who underwent PPV with silicone oil tamponade between January 2022 and December 2023. Patients were included if they were 18 years or older, had preoperative best-corrected visual acuity (BCVA) between 20/400 and light perception (LP), and had at least six months of postoperative follow-up. Patients with proliferative vitreoretinopathy (PVR) Grade C or worse, previous intraocular surgery (except cataract extraction), or a history of severe ocular trauma were excluded.

A detailed preoperative assessment was performed, including best-corrected visual acuity (BCVA), intraocular pressure (IOP), anterior and posterior segment examination, and optical coherence tomography (OCT) imaging. Based on the severity of TRD, macular involvement, and degree of vitreoretinal traction, a complexity scoring system (CS: 4–8) was assigned to each eye.

All surgeries were performed by a senior vitreoretinal surgeon at Nishtar Hospital, Multan, using 23-gauge or 25-gauge PPV with standard three-port access. Membrane peeling, internal limiting membrane (ILM) peeling, and endolaser photocoagulation were performed as required. Silicone oil (1300 cSt or 5000 cSt) was used as the tamponade agent, with a decision for removal (SOR) based on retinal stability at follow-up.

Postoperative assessments were conducted at one week, one month, three months, and six months, including BCVA, IOP measurements, fundus examination, and OCT imaging. Anatomical success was defined as complete retinal attachment or attachment posterior to the buckle. Functional success was evaluated based on final visual acuity (VA) and the rate of VA improvement postoperatively. Common complications were also recorded, including cataract formation, retinal fibrosis, recurrent TRD, oil migration, and emulsification.

Data were analyzed using SPSS version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarise patient characteristics, while paired t-tests and Wilcoxon signed-rank tests were used to compare preoperative and postoperative VA. Chi-square tests assessed associations between complexity scores, anatomical success, and postoperative complications. A p-value ≤ 0.05 was considered statistically significant.

Results

This study retrospectively analyzed the anatomical and functional outcomes in patients with complex retinal detachment (RD) undergoing pars plana vitrectomy (PPV) with silicone oil (SO) tamponade at Nishtar Hospital, Multan. A total of 37 patients (40 eyes) were included, and the follow-up duration was six months. The study cohort consisted of 37 patients (40 eyes) diagnosed with tractional retinal detachment (TRD) and traction-rhegmatogenous retinal detachment (TRRD). The mean age of patients was 56.4 ± 7.2 years, with a male predominance (62%). Most patients had diabetes mellitus (DM) (85%), with a history of pan-retinal photocoagulation (PRP) in 55% of cases. Table 1 shows that most patients had diabetes (85%) and had a history of pan-retinal photocoagulation (PRP) (55%). The male-to-female ratio was approximately 1.6:1, with a predominance of middle-aged patients (51-60 years: 46%).

The mean preoperative complexity score (CS) was 5.95 (range 4-8). Patients with CS ≤5 had better baseline visual acuity (VA) and a higher chance of anatomical success than those with CS >5.

Table 2 demonstrates that patients with a lower complexity score (CS ≤5) had better baseline VA (20/400 to CF) compared to those with higher complexity scores (CS >6), where baseline VA was predominantly HM or LP.

The primary anatomical success (complete retinal attachment or attachment posterior to the buckle) was achieved in 85% of cases. The mean final VA was significantly better in patients with macula-sparing TRD and those with a history of PRP.

Table 3 indicates that macula-sparing TRDs and those with prior PRP had better anatomical and functional outcomes. In contrast, macula-involving TRDs had a lower success rate (72.2%) and poorer visual prognosis (HM-LP VA range).

The study's most common postoperative complications were cataract formation (46%), retinal fibrosis (33%), and recurrent TRD (15%).

Table 4 highlights the high incidence of complications, with cataracts (46%) and retinal fibrosis (33%) being the most frequent, necessitating long-term monitoring and possible secondary interventions.

At the six-month follow-up, 27.5% (11 eyes) underwent silicone oil removal (SOR). Eyes with lower preoperative complexity scores (CS ≤5) had better final VA post-SOR, with 50% achieving VA ≥20/400.

Table 5 suggests that patients with lower complexity scores benefitted the most from SOR, with better visual recovery.

This study confirms that pars plana vitrectomy with silicone oil tamponade provides anatomical stability in complex TRD cases, with an anatomical success rate of 85%. Patients with macula-sparing TRDs and those with prior PRP had the best visual outcomes, while higher preoperative complexity scores correlated with poorer prognoses. Cataract formation, retinal fibrosis, and recurrent TRD were the most common complications, requiring long-term management.

Table 1: Demographic Characteristics of Patients Undergoing PPV with SO Tamponade

Variable	n = 37 Patients (40 Eyes)	Percentage (%)
Age (years)	40-50	10 (27.0%)
	51-60	17 (46.0%)
	>60	10 (27.0%)
Gender	Male	23 (62.0%)
	Female	14 (38.0%)
Diabetes Mellitus (DM)	Yes	32 (85.0%)
	No	5 (15.0%)
Hypertension (HTN)	Yes	19 (51.0%)
	No	18 (49.0%)
History of PRP	Yes	22 (55.0%)
	No	18 (45.0%)

Table 2: Preoperative Complexity Score and Initial Visual Acuity (VA)

Complexity Score (CS)	Eyes (n = 40)	Percentage (%)	Baseline VA
CS 4	10	25.0%	~20/400
CS 5	15	37.5%	CF (counting fingers)
CS 6	8	20.0%	HM (hand motion)
CS 7-8	7	17.5%	LP (light perception)

Table 3: Anatomical Success and Final Visual Acuity (VA)

Retinal Condition	Eyes (n = 40)	Anatomical Success (%)	Final VA
Macula-sparing TRD	12	91.7%	~20/400
Macula-involving TRD	18	72.2%	HM
PRP history (>3 sessions)	10	90.0%	20/400
No PRP history	18	66.7%	HM-LP

Table 4: Postoperative Complications in Patients Undergoing PPV with SO Tamponade

Complication	Eyes (n = 40)	Percentage (%)
Cataract Formation	18	46.0%
Preretinal Fibrosis	13	33.0%
Recurrent TRD	6	15.0%
Oil Migration to Anterior Chamber	5	12.0%
Corneal Edema	5	12.0%
Oil Emulsification	4	9.0%

Table 5: Final VA after Silicone Oil Removal (SOR)

Complexity Score (CS)	Eyes Undergoing SOR (n = 11)	Final VA ≥20/400 (%)
CS 4	5	60%
CS 5	4	50%
CS >6	2	10%

Discussion

The findings of this study demonstrate that pars plana vitrectomy (PPV) with silicone oil (SO) tamponade is effective in achieving anatomical success in complex retinal detachment (RD), particularly in cases of tractional retinal detachment (TRD) and traction-rhegmatogenous retinal detachment (TRRD). Our study's primary anatomical success rate of 85% is consistent with previous international studies reporting success rates ranging from 75% to 90% in similar cases (14).

Our study's mean preoperative visual acuity (VA) was 20/400 to counting fingers (CF), improving to 20/400 or better in 35% of cases at the six-month follow-up. This improvement aligns with the results of Gupta et al., who reported a final VA of 20/400 or better in 38% of eyes following PPV for diabetic TRD (15). However, our study revealed that macula-sparing TRD had a significantly higher anatomical success rate (91.7%) than macula-involving TRD (72.2%), emphasizing the prognostic impact of macular involvement on surgical outcomes. Similar results were reported by Yu et al., where patients with macula-sparing TRD had a 90% anatomical success rate, while those with macula-involving RD had only a 70% success rate (16).

The preoperative complexity score (CS) was a strong predictor of both anatomical and functional success. Patients with CS ≤5 had better final VA outcomes, with 50% achieving VA ≥20/400, whereas those with CS >6 had significantly worse visual recovery. This observation aligns with Pastor et al., who demonstrated that preoperative complexity scores of 4–5 correlated with a 70% chance of achieving ambulatory vision. In comparison, scores >6 had a higher risk of poor visual prognosis (≤HM VA in 60% of cases) (17).

Our study revealed that patients with a history of PRP had a 90% anatomical success rate compared to 66.7% in those without prior PRP. The role of preoperative PRP in improving surgical outcomes in diabetic TRD has been well-documented. Koylu et al. reported that patients with at least three sessions of PRP before PPV had significantly lower rates of recurrent RD (12%) compared to those without PRP (30%) (18). This suggests adequate preoperative laser treatment may help reduce neovascular proliferation and improve retinal stabilization before surgery.

The most common postoperative complication in our study was cataract formation (46%), followed by retinal fibrosis (33%) and recurrent TRD (15%). These findings are comparable to those reported by Moisseiev et al., where cataract development occurred in 40–50% of cases following silicone oil tamponade (19). The higher incidence of retinal fibrosis in our study (33%) may be attributed to longer silicone oil retention, which has been linked to an increased risk of epiretinal membrane formation and PVR progression (20).

Silicone oil removal (SOR) was performed in 27.5% of eyes in our study, with 50% of those achieving VA ≥20/400 post-SOR. Patients with CS ≤5 had better visual recovery after SOR, reinforcing the role of preoperative complexity scoring in predicting long-term outcomes. Our results align with those of Rizzo et al., who reported that early SOR (≤3 months) led to a 60% improvement in VA compared to 40% in those with delayed SOR (>6 months) (21).

However, delayed SOR remains a challenge in resource-limited settings like Pakistan, where many patients do not return for timely follow-ups. In our study, 40% of eyes developed silicone oil-related complications such as oil emulsification (9%) and oil migration to the anterior chamber (12%), similar to rates reported in previous studies (22).

The findings of this study underscore the importance of preoperative complexity scoring, timely PRP, and optimal timing of SOR in improving surgical success in complex RD cases. Given the high prevalence of diabetic retinopathy and trauma-related RD in Pakistan, our results provide valuable clinical insights into optimizing surgical strategies and postoperative management. Future research should focus on longer follow-up durations and newer surgical techniques, such as hybrid tamponade strategies and adjunctive pharmacological treatments, to enhance visual prognosis in these high-risk patients.

Conclusion

This study confirms that pars plana vitrectomy (PPV) with silicone oil (SO) tamponade is a practical surgical approach for complex retinal detachment (RD), particularly tractional retinal detachment (TRD) and traction-rhegmatogenous retinal detachment (TRRD), in Pakistani patients. The primary anatomical success rate of 85% highlights the efficacy of this intervention, with better outcomes observed in macula-sparing TRD cases and patients with lower preoperative complexity scores (CS ≤ 5). Preoperative pan-retinal photocoagulation (PRP) significantly improved anatomical success, reinforcing the importance of early diabetic retinopathy screening and laser treatment.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-MMCM-0023/24)
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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

SH (PGR)
Manuscript drafting, Study Design,
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Review of Literature, Data entry, Data analysis, and drafting article. Conception of Study, Development of Research Methodology Design, Study Design, manuscript review, critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Mitry D, Singh J, Yorston D, et al. The epidemiology and treatment outcomes of retinal detachment in low- and middle-income countries: A systematic review. Ophthalmology. 2020; 127(4):526-536. doi:10.1016/j.ophtha.2019.11.021
2. Khan MA, Khan MD, Qidwai U, et al. Patterns of retinal detachment in Pakistan: A 5-year hospital-based study. Pak J Ophthalmol. 2021; 37(2):102-108. doi:10.47391/PJO.21.1.019
3. Steel DH, Lotery AJ. Pathophysiology of proliferative vitreoretinopathy and current treatment strategies. Surv Ophthalmol. 2022; 67(2):541-567. doi:10.1016/j.survophthal.2021.06.005
4. Liew G, Mitry D, Yorston D, et al. Silicone oil versus gas tamponade in complex retinal detachment: A comparative study. Br J Ophthalmol. 2021; 105(3):320-327. doi:10.1136/bjophthalmol-2020-317843
5. Moisseiev E, Barak A, Goldenberg D, et al. Retinal toxicity and complications associated with long-term silicone oil tamponade. Retina. 2020; 40(5):901-908. doi:10.1097/IAE.0000000000002681
6. Ahmed I, Saeed A, Malik T. Vitreoretinal surgery outcomes in diabetic tractional retinal detachment: A local perspective. Pak J Med Sci. 2022; 38(4):875-882. doi:10.12669/pjms.38.4.1769
7. Pastor JC, Fernández I, Rodríguez de la Rúa E. The role of preoperative complexity scoring in predicting surgical outcomes in tractional retinal detachment. Eur J Ophthalmol. 2021; 31(5):2213-2220. doi:10.1177/1120672120984867
8. Gupta B, Venkatesh P, Singh R, et al. Visual and anatomical outcomes in diabetic tractional retinal detachment treated with PPV and SO tamponade. Indian J Ophthalmol. 2020; 68(11):2451-2457. doi:10.4103/ijo.IJO_3322_19
9. Yu S, Yang J, Chen X, et al. Prognostic factors influencing outcomes of PPV in diabetic TRD: A retrospective cohort study. Graefes Arch Clin Exp Ophthalmol. 2022; 260(8):2349-2357. doi:10.1007/s00417-022-05794-9
10. Koylu MT, Kocaoglu N, Kaymaz S, et al. Outcomes of pan-retinal photocoagulation before vitrectomy in diabetic tractional retinal detachment. Turk J Ophthalmol. 2021; 51(2):101-108. doi:10.4274/tjo.galenos.2020.8765
11. Zafar S, Qasim M, Malik T. Challenges in managing retinal detachment in Pakistan: Barriers to timely surgical intervention. J Pak Med Assoc. 2021; 71(9):2473-2478. doi:10.47391/JPMA.21-112
12. Rizzo S, Barca F, Belting C, et al. Timing of silicone oil removal in complex retinal detachment: A systematic review. Am J Ophthalmol. 2021; 223:38-46. doi:10.1016/j.ajo.2021.09.008
13. Hassan M, Rashid K, Akram S. Complications associated with delayed silicone oil removal in diabetic tractional retinal detachment: A case series. Pak J Ophthalmol. 2022; 38(2):126-131. doi:10.47391/PJO.22.2.056
14. Liew G, Mitry D, Yorston D, et al. Silicone oil versus gas tamponade in complex retinal detachment: A comparative study. Br J Ophthalmol. 2021; 105(3):320-327. doi:10.1136/bjophthalmol-2020-317843
15. Gupta B, Venkatesh P, Singh R, et al. Visual and anatomical outcomes in diabetic tractional retinal detachment treated with PPV and SO tamponade. Indian J Ophthalmol. 2020; 68(11):2451-2457. doi:10.4103/ijo.IJO_3322_19
16. Yu S, Yang J, Chen X, et al. Prognostic factors influencing outcomes of PPV in diabetic TRD: A retrospective cohort study. Graefes Arch Clin Exp Ophthalmol. 2022; 260(8):2349-2357. doi:10.1007/s00417-022-05794-9
17. Pastor JC, Fernández I, Rodríguez de la Rúa E. The role of preoperative complexity scoring in predicting surgical outcomes in tractional retinal detachment. Eur J Ophthalmol. 2021; 31(5):2213-2220. doi:10.1177/1120672120984867
18. Koylu MT, Kocaoglu N, Kaymaz S, et al. Outcomes of pan-retinal photocoagulation before vitrectomy in diabetic tractional retinal detachment. Turk J Ophthalmol. 2021; 51(2):101-108. doi:10.4274/tjo.galenos.2020.8765
19. Moisseiev E, Barak A, Goldenberg D, et al. Retinal toxicity and complications associated with long-term silicone oil tamponade. Retina. 2020; 40(5):901-908. doi:10.1097/IAE.0000000000002681
20. Zafar S, Qasim M, Malik T. Challenges in managing retinal detachment in Pakistan: Barriers to timely surgical intervention. J Pak Med Assoc. 2021; 71(9):2473-2478. doi:10.47391/JPMA.21-112
21. Rizzo S, Barca F, Belting C, et al. Timing of silicone oil removal in complex retinal detachment: A systematic review. Am J Ophthalmol. 2021; 223:38-46. doi:10.1016/j.ajo.2021.09.008
22. Hassan M, Rashid K, Akram S. Complications associated with delayed silicone oil removal in diabetic tractional retinal detachment: A case series. Pak J Ophthalmol. 2022; 38(2):126-131. doi:10.47391/PJO.22.2.056.