



## ANATOMICAL AND VISUAL OUTCOMES AFTER SILICONE OIL REMOVAL IN COMPLEX RETINAL DETACHMENT: AN OBSERVATIONAL STUDY AT A TERTIARY CARE CENTER

### Ophthalmology

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### ABSTRACT

**Purpose:** To evaluate the anatomical and visual outcomes, as well as complications, following silicone oil removal (SOR) in cases of complex retinal detachment (RD). **Methods:** This prospective observational study included 60 eyes undergoing SOR after vitreoretinal surgery for complex RD at a tertiary care hospital. Patients were followed at 1 week, 1 month, and 3 months postoperatively. Anatomical success, best-corrected visual acuity (BCVA), intraocular pressure (IOP), and complications were assessed. **Results:** The mean age of participants was 43.8 ± 16.7 years; 63.3% were male. The most common primary pathology was RD with proliferative vitreo-retinopathy (50%). The mean interval between vitrectomy and SOR was 7.15 months. Anatomical success was achieved in 83.3% of cases, while 16.7% developed redetachment. Visual acuity improved in 56.7% of eyes at 3 months, remained stable in 31.6%, and worsened in 11.6%. Cataract progression was the most frequent complication (44.4% of phakic eyes), followed by ocular hypertension (12.9%), corneal decompensation (3.3%), and hypotony (3.3%). **Conclusion:** SOR in complex RD provides favorable anatomical and functional outcomes with an acceptable complication profile. Careful patient selection, timing of oil removal, and vigilant postoperative monitoring are essential to reduce the risk of redetachment and optimize results.

### KEYWORDS

silicone oil removal, retinal detachment, proliferative vitreoretinopathy, visual outcome, complications

### INTRODUCTION

Retinal detachment (RD) is a sight-threatening condition that occurs when the neurosensory retina separates from the retinal pigment epithelium (RPE), interrupting visual processing and leading to progressive vision loss if untreated. Complex retinal detachment is a particularly challenging form of RD, often associated with conditions that complicate standard repair, including proliferative vitreoretinopathy (PVR), proliferative diabetic retinopathy (PDR), ocular trauma, choroidal coloboma, and tractional retinal detachment (TRD) secondary to branch retinal vein occlusion (BRVO). Each of these conditions presents unique challenges for surgical management due to factors such as retinal fibrosis, traction, and proliferative scarring.

Pars plana vitrectomy (PPV), often combined with membrane peeling and/or scleral buckling, has become the gold standard for managing complex RD. Advances in surgical techniques, such as retinectomy and the use of perfluorocarbon liquids, have improved reattachment rates, but a high risk of re-detachment persists in complex cases<sup>[2,3,4]</sup>. To enhance the stability of retinal reattachment, intraocular tamponades, including long-acting gases and silicone oil, are commonly used. Silicone oil, in particular, is frequently employed due to its durability and effectiveness in maintaining retinal attachment postoperatively. However, despite its benefits, long-term silicone oil tamponade can lead to complications such as cataract formation, silicone oil-induced glaucoma, optic atrophy, and band keratopathy. These potential complications necessitate timely silicone oil removal (SOR) once retinal stability is achieved<sup>[5,6]</sup>.

The optimal timing for SOR is generally considered to be between 2 and 3 months after the initial surgery, as studies have indicated that retinal redetachment risk decreases with increasing time post-SOR. Nonetheless, the rate of redetachment following SOR remains variable, with reported rates ranging from 9% to 25% depending on factors such as follow-up duration, patient characteristics, and complexity of the initial detachment<sup>[48-51]</sup>. In Shah et al.'s study, for instance, an anatomical success rate of 87.5% was achieved post-SOR, with a 76.6% rate of visual acuity improvement or stabilization. However, 87.5% of redetachments were observed in cases where silicone oil was removed within six months, highlighting the potential impact of tamponade duration on re-detachment risk<sup>[5]</sup>.

Complex retinal detachment (RD) is characterized by multifactorial pathophysiological mechanisms that complicate management and heighten the risk of poor visual outcomes. A major contributor is proliferative vitreoretinopathy (PVR), where cellular proliferation and fibrotic membrane formation on the retinal surface create tractional

forces that may lead to recurrent detachment<sup>(40)</sup>. Diabetic retinopathy (PDR) adds complexity with ischemia-driven abnormal blood vessel growth on the retina, which contracts and causes tractional RD; this often combines with retinal breaks, creating more difficult detachments to manage. Giant retinal tears and ocular trauma further compound these challenges by introducing additional tractional and inflammatory forces that disrupt the blood-retinal barrier and promote cytokine release, fibrosis, and tractional stress on the retina. The resulting cascade, involving hypoxia and oxidative stress, promotes apoptosis of photoreceptor cells, potentially leading to irreversible vision loss despite surgical intervention<sup>[41,42]</sup>.

The decision to remove silicone oil requires balancing the risks of oil-related complications with the risk of recurrent RD. Reported redetachment rates after SOR range between 9% and 33%. Outcomes depend on underlying pathology, timing of oil removal, and surgical technique.

This study evaluates anatomical and visual outcomes after SOR in cases of complex RD at a tertiary care hospital in India, and compares findings with existing literature.

### Methods

This was a prospective observational study conducted at SMS Medical College, Jaipur, from January to October 2023.

### Inclusion Criteria:

Patients with complex RD (RD with PVR grade C2–D3, GRT, PDR, TRD secondary to BRVO, ocular trauma).

### Exclusion Criteria:

\* Simple RD, RD secondary to uveitis, or prior vitreoretinal surgery with SF6, C3F8, or scleral buckling.

### Surgical Technique:

Standard 23-gauge PPV was performed for silicone oil removal, followed by multiple air-fluid exchanges. Combined phacoemulsification with IOL implantation was performed when cataract significantly impaired visualization.

### Follow-up:

Patients were evaluated at 1 week, 1 month, and 3 months. Assessments included BCVA (Snellen), IOP (applanation tonometry), slit-lamp and fundus examination, OCT, and B-scan when required.

### Outcomes:

**Primary outcome:** Anatomical success (retina attached at 3 months

without additional surgery).

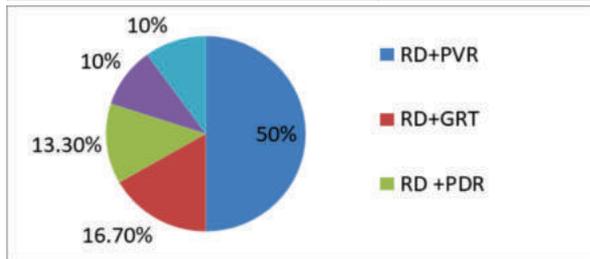
**Secondary Outcomes:** BCVA change, IOP variations, postoperative complications.

Statistical analysis was performed using paired t-tests, with  $*p < 0.05$  considered significant.

**RESULTS**

A total of 60 eyes of 60 patients were included, with a mean age of  $43.8 \pm 16.7$  years; 63.3% were male and 36.7% were female.

Diagnosis	Frequency
RD+PVR	30
RD+GRT	10
RD+PDR	8
TRD secondary to BRVO	6
Ocular trauma	6
Total	60



Pie Chart distribution of study participants according to diagnosis

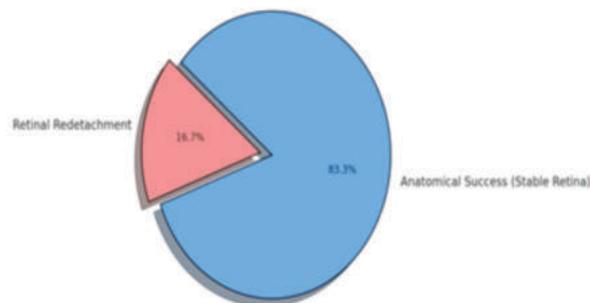
The most common primary pathology was retinal detachment with proliferative vitreoretinopathy (50%).

The mean interval between pars plana vitrectomy and silicone oil removal (SOR) was 7.15 months (range, 3–15 months).

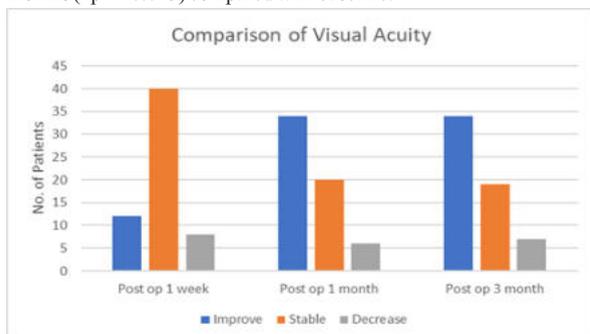
Mean	7.15 months
Median	6.00 months
Standard deviation	3.458 months
Minimum	3 months
Maximum	15 months

At final follow-up, anatomical success was achieved in 83.3% of eyes, while 16.7% developed recurrent detachment.

Retinal Redetachment vs Anatomical Success Rate after SOR



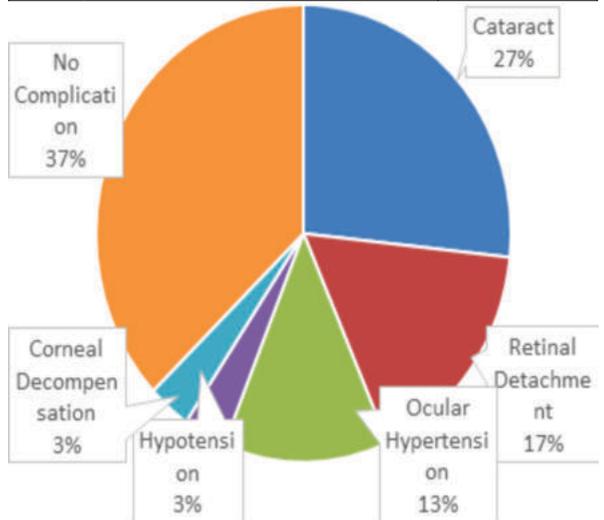
Visual acuity at 3 months improved in 56.7% of eyes, remained stable in 31.6%, and worsened in 11.6%. A statistically significant rise in intraocular pressure was observed at 1 month ( $*p = 0.005$ ) and 3 months ( $*p = 0.013$ ) compared with baseline.



Visual acuity	Post op 1 week	Post op 1 month	Post op 3 month
Improve	12(20%)	34 (56.7%)	34 (56.7%)
Stable	40(66.7%)	20 (33.3%)	19 (31.6%)
Decrease	8 (13.3 %)	6(10%)	7(11.6%)
Total	60(100%)	60(100%)	60(100%)

The most frequent postoperative complication was cataract progression in phakic eyes (44.4%), followed by retinal redetachment (16.7%), ocular hypertension (12.9%), hypotony (3.3%), and corneal decompensation (3.3%)

Complication	Percent
Cataract progression	26.66 %
Retinal detachment	16.7 %
Ocular hypertension	12.9 %
Hypotension	3.33 %
Corneal decompensation	3.33 %
No complication	37.08 %



**DISCUSSION**

Current study was prospective observational study conducted at the Upgraded Department of Ophthalmology .S.M.S.Medical collage and Hospitals , Jaipur ,Rajasthan . This study aim to study anatomical and visual outcomes after Silicon Oil Removal in eyes with history of complex retinal detachment. A total of 60 patients with 60 eyes were enrolled in this study.

**Demographic Characteristics**

In our study, the mean age of participants was  $43.8 \pm 16.74$  years, with 46.7% aged 18–40 years, 33.3% aged 41–60 years, and 20% above 60 years, highlighting a wide age range where retinal detachment presentation and outcomes may differ. Males comprised 63.3% of cases, reflecting the male predominance commonly reported in retinal detachment due to risk factors like trauma and systemic conditions. The most frequent diagnosis was RD with proliferative vitreoretinopathy (50%), followed by RD with giant retinal tear (16.7%), RD with proliferative diabetic retinopathy (13.3%), tractional RD secondary to branch retinal vein occlusion (10%), and RD following ocular trauma (10%).

**Anatomical Outcome:**

In our observational study, we observed a rate of retinal redetachment of 16.7% after silicone oil removal in cases of complex retinal detachment. This rate falls within the reported range of 9% to 25% in the literature, indicating variability across different studies. This variation can be attributed to several factors, including differences in patient populations, surgical techniques, duration of follow-up, and criteria for defining redetachment.

**Comparison with Previous Studies:**

-Tavares et al. (2015): Tavares et al. reported a redetachment rate within a similar range to our study, emphasizing the complexity and variability of outcomes in retinal surgery.

- Shah R et al. (2018): Similarly, Shah R et al. observed variations in redetachment rates post-silicone oil removal, highlighting the need for standardized criteria and longer-term follow-up to accurately assess surgical outcomes.

- Saleh et al. (2012): Saleh et al., in their Retina publication, also noted a range of redetachment rates, underscoring the importance of comprehensive post-operative monitoring and management strategies.

- Robert F Lam et al. (2023): Robert F Lam et al.'s study contributes to the understanding of redetachment rates and reinforces the variability seen across different patient cohorts.

- Tangpontirak et al. (2022): Tangpontirak et al.'s recent study further emphasizes the need for longer follow-up periods to confirm redetachment rates and assess the durability of surgical outcomes.

### Visual Outcomes

Our study's findings regarding visual acuity outcomes post-silicone oil removal in complex retinal detachment cases align with and extend upon the literature, including studies by Tavares et al. (2015), Shah R et al. (2018), Saleh et al. (2012), Robert F Lam et al. (2023), and Wico W Lai et al. (2014). Notably, a significant percentage of patients experienced improved visual acuity at the 1-month and 3-month follow-ups, mirroring trends observed by Tavares et al. (2015) and Shah R et al. (2018). Stability in visual function was also common, in line with findings from Robert F Lam et al. (2023) and Wico W Lai et al. (2014). While a minority of patients showed decreased visual acuity, as also seen in studies like Saleh et al. (2012), this decline can be attributed to pre-operative factors, such as the severity of retinal detachment and patient-specific variables. Collectively, our study reinforces the efficacy of silicone oil removal in improving visual outcomes while acknowledging the variability based on individual patient characteristics, pre-operative visual acuity, and duration between vitreoretinal surgery and oil removal. A tailored post-operative approach is essential for optimizing patient outcomes, considering these findings alongside the time between surgery, with a mean interval of 9.63 months and a wide range from 3 to 15 months in our cohort.

### Discussion On Diagnosis And Timing Of Silicone Oil Removal Surgery:

In our study, the timing of silicone oil removal surgery in cases of complex retinal detachment, with a mean time of 7.15 months and a median of 6.00 months, aligns with findings from previous literature. For instance, Tavares et al. (2015) and Shah R et al. (2018) also reported similar ranges of silicone oil tamponade duration in complex cases like those involving RD with proliferative vitreoretinopathy (PVR) and giant retinal tears (GRT), where prolonged tamponade is often necessary for retinal stability. Our data, with a shorter mean and more condensed range compared to Saleh et al. (2012), suggests that factors such as surgical techniques and disease severity, particularly in RD with PVR and GRT, play a significant role in determining the timing of removal. Robert F Lam et al. (2023) and Tangpontirak et al. (2022) emphasized the importance of individualized decision-making based on the patient's response and retinal status, which our findings support, particularly in the context of varying diagnoses like RD with proliferative diabetic retinopathy (PDR) or trauma. Overall, our results contribute to the growing evidence that the timing of silicone oil removal is influenced by diagnosis-specific factors and patient outcomes, aligning well with trends observed in previous studies.

### Complications Following Silicone Oil Removal:

In our study on cases of retinal detachment, we observed a varied distribution of diagnoses, each influencing the timing and management of silicone oil removal surgery. The most common diagnoses were retinal detachment with proliferative vitreoretinopathy (RD+PVR) in 30 cases, retinal detachment with giant retinal tear (RD+GRT) in 10 cases, retinal detachment with proliferative diabetic retinopathy (RD+PDR) in 8 cases, tractional retinal detachment secondary to branch retinal vein occlusion (TRD secondary to BRVO) in 6 cases, and retinal detachment due to ocular trauma in 6 cases. These conditions present distinct challenges in post-operative care, affecting the decision-making process for silicone oil removal, which in our study occurred at a mean interval of 7.15 months, with a wide range from 3 to 15 months. Diagnoses like RD+PVR and RD+GRT often require extended tamponade to stabilize the retina, thus extending the time before oil removal, while conditions like RD+PDR or TRD secondary to BRVO may necessitate closer monitoring for disease progression. Traumatic retinal detachment cases also require careful consideration of ocular healing and inflammation resolution before silicone oil removal. Clinical decision-making regarding timing is complex and must account for each patient's retinal stability, risk of

redetachment, and overall visual function. Further research into optimal timing based on specific diagnoses and the outcomes of early versus delayed removal strategies could provide more robust evidence-based guidelines to enhance patient care and surgical outcomes.

### CONCLUSION

Silicone oil removal in cases of complex retinal detachment yields good anatomical and functional outcomes, though complications such as cataract and ocular hypertension are common. The timing of oil removal and careful patient selection are crucial to minimize the risk of redetachment. Larger multicenter studies with longer follow-up are warranted.

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