

## POST-EVACUATION OF SILICONE OIL COMPLICATIONS IN RHEGMATOGENOUS RETINAL DETACHMENT PATIENTS WHO UNDERWENT PARS PLANA VITRECTOMY AT TERTIARY HOSPITAL IN BALI, INDONESIA

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### Abstract

**Introduction:** Pars plana vitrectomy with silicone oil injection has become a standard procedure to treat retinal detachment with complex cases. Considerations related to the use of silicone oil are the need for additional surgical procedures to remove silicone oil after the retinal condition is declared stable or because emulsification of silicone oil has occurred.

**Methods:** An analytical observational study with a cross-sectional approach. Data were collected retrospectively by collecting medical records of patients who underwent silicone oil evacuation in 2021.

**Result:** The research subjects were 23 people, where 52.2% of the subjects were women with a median age of 51 years. Most of the subjects (65.2%) had no complications, with the most complications occurring were secondary glaucoma (13%) and redetached retina (13%). There was no statistically significant difference between visual acuity before and after the evacuation of silicone oil with a P value of 0.202 and there was no statistically significant difference between IOP before and after evacuation of silicone oil with a P value of 0.132.

**Conclusion:** Evacuation of silicone oil is a follow-up action after PPV with SO tamponade. Complications which may arise are detach dan glaucoma. There was no significant difference in visual acuity and IOP before and after SO evacuation.

**Keywords:** Evacuation of silicone oil, rhegmatogenous retinal detachment, postoperative complications

**Cite This Article:** ANDAYANI, Ari. POST-EVACUATION OF SILICONE OIL COMPLICATIONS IN RHEGMATOGENOUS RETINAL DETACHMENT PATIENTS WHO UNDERWENT PARS PLANA VITRECTOMY AT TERTIARY HOSPITAL IN BALI, INDONESIA. International Journal of Retina, [S.l.], v. 6, n. 1, p. 1, feb. 2023. ISSN 2614-8536. Available at: <<https://www.ijretina.com/index.php/ijretina/article/view/221>>. Date accessed: 28 feb. 2023. doi: <https://doi.org/10.35479/ijretina.2023.vol006.iss001.221>.

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## INTRODUCTION

Rhegmatogenous retinal detachment (RRD) is the detachment of the sensory retinal layer from the retinal pigment cell layer which is marked by a break. Pars Plana Vitrectomy (PPV) is a surgical therapy in RRD cases which was first introduced by Robert Machemer in 1972 from his previous therapy, namely the sclera buckle. PPV has several advantages compared to the sclera buckle so that until now it has become a standard procedure in treating RRD, but the sclera buckle is still chosen in some cases. One of the drawbacks of the PPV procedure is the use of intraocular gas or silicone oil (SO) tamponade after vitrectomy surgery which can accelerate the occurrence of cataracts in fuchia patients.<sup>1</sup>

SO (polydimethylsiloxane) was first introduced by Cibis et al in 1962 as a tamponade agent for the treatment of retinal detachment which was later by Haut et al combined with vitrectomy. PPV accompanied by injection of SO is a standard procedure for treating retinal detachment in complex cases such as proliferative vitreoretinopathy (PVR), giant tears, tractional retinal detachment and trauma.<sup>2</sup>

SO considered a better tamponade than gaseous sulfur hexafluoride (SF<sub>6</sub>) and perfluopropane (C<sub>3</sub>F<sub>8</sub>) in eyes with PVR cases, both for anatomical and functional recovery. In addition, SO also does not prevent patients from traveling or staying in certain positions for some time. SO can cause long-term complications, including endothelial decompensation, cataracts, increased eye pressure and secondary glaucoma. Another consideration

related to the use of SO is the need for additional surgical procedures to remove SO after the retinal condition has been declared stable or because emulsification of the retina has occurred SO.<sup>3</sup>

Evacuation of SO is associated with improved vision, but there are also those who say that decreased vision can occur during evacuation of SO associated with repeated retinal detachment, damage to the optic nerve due to glaucoma, hypotonia in the eye, vitreous hemorrhage, and corneal abnormalities.<sup>4</sup>

Based on the description above, retinal detachment patients undergoing PPV surgery and evacuation SO may experience sharp changes in vision and some accompanying manifestations. Until now there is still not much data regarding the impact of evacuation measures SO in Bali, therefore the author wants to do more research on complications after evacuation of SO in rhegmatogenous retinal detachment patients undergoing pars plana vitrectomy at Prof. Dr. IGNG Ngoerah Denpasar in 2021.

## METHODS

This research is an analytic observational study with a cross-sectional approach. Data was collected retrospectively by recording the characteristics and medical record data of rhegmatogenous retinal detachment patients who underwent pars plana vitrectomy surgery and SO evacuation from January to December 2021 at Prof Dr. I.G.N.G Ngoerah Hospital Denpasar. The research data included: gender, age, lens status, laterality, visual acuity before and after the SO evacuation procedure, intraocular pressure (IOP) before and after the SO evacuation procedure, indications for silicone oil (SO) evacuation, additional actions during silicone oil evacuation and complications that occurred after the evacuation of silicone oil. This study meets Declaration of Helsinki,

and it has received an ethical clearance certificate from the Research Ethics Committee of the Faculty of Medicine, Udayana University No. 2421/UNI4.2.2.VII.14/LT/2022.

All data obtained were entered into work tables and analyzed using IBM® SPSS® Statistics 26.0 (International Business Machines (IBM) Corporation, Armonk, NY, USA). Subject characteristic data were analyzed descriptively. Nominal and ordinal categorical scale data are displayed in the form of frequencies and percentages while for numerical scale data in the form of the mean for normally distributed data and the median if the data is not normally distributed. The normality test uses Shapiro-Wilk because the number of research samples is less than 50. Based on the results of the normality test, the research data is not normally distributed so that the analysis of differences visual acuity and IOP pre and post SO evacuation using the non-parametric Wilcoxon Sign Rank Test.

## RESULTS

During the period of January 1<sup>st</sup> 2021 to December 31<sup>st</sup> 2021 there were 23 patients who underwent

silicone oil evacuation at Prof. Dr. IGNG Ngoerah Hospital Denpasar. The characteristics of the research subjects are shown in table 1. Patients were dominated by female at 52.2%. Description of the age of research subjects with a median value of 51 years. As many as 69.6% of research subjects live in Bali. The status of phakic and pseudophakic lenses with the same amount is 47.8%. As many as 73% of study subjects with laterality in the left eye. As many as 69.6% of the study subjects had visual acuity <3/60 for pre-evacuation and 1 month post-evacuation of SO so that the data distribution was not normal. The IOP in the study subjects was the median value of 14 mmHg for pre-evacuation and the mean  $\pm$  SD 14 mmHg  $\pm$  6.42 mmHg for 1 month post evacuation of SO. The indication for SO evacuation in this study was retina reattached >3 months as much as 73.9%. The actions taken were 47.8% in the form of evacuating only SO without any other action. In the subjects of this study, 65.2% did not experience complications after SO evacuation and 13% of subjects experienced complications in the form of redetached retina and secondary glaucoma.

**Table 1. Characteristics of Research Subjects**

Characteristics of Research Subjects	n(%)
Age (median (min-max))	51.00(17.00-62.00)
12-25 yrs	5 (21.7%)
26-45 yrs	6 (26.1%)
46-65 yrs	12 (52.2%)
>65 yrs	0 (0%)
Gender	
Man	11 (47.8%)
Woman	12 (52.2%)
Address	
Bali	16 (69.6%)
Outside Bali	7 (30.4%)
Lens Status	
Phakic	11 (47.8%)
Pseudophakic	11 (47.8%)
Aphakic	1 (4.3%)
Laterality	
Right Eye	6 (26.1%)
Left Eye	17 (73.9%)

VA Pre Evacuation SO	
<3/60	16 (69.6 %)
3/60 - <6/60	1 (4.3 %)
6/60 - <6/18	4 (17.4 %)
6/18 - <6/12	1 (4.3 %)
>6/12	1 (4.3 %)
VA 1 Month Post Evacuation SO	
<3/60	16 (69.6 %)
3/60 - <6/60	5 (21.7 %)
6/60 - <6/18	2 (8.7 %)
6/18 - <6/12	0 (0 %)
>6/12	0 (0 %)
IOP Pre Evacuation SO (median (min-max))	14.00 (7.00-37.00)
<10 mm Hg	1 (4.3 %)
10-21 mm Hg	21 (91.3 %)
>21mmHg	1 (4.3 %)
IOP 1 Month Post Evacuation SO (mean $\pm$ SD)	14.00 $\pm$ 6.42
<10 mm Hg	7 (30.4 %)
10-21 mm Hg	14 (60.9 %)
>21mmHg	2 (8.7 %)
SO Evacuation Indications	
Reattached retina > 3 months	17 (73.9 %)
Redetached retina	4 (17.4 %)
SO Emulsification	1 (4.3 %)
Secondary Glaucoma	1 (4.3 %)
Additional Surgery	
SO evacuation only	11 (47.8 %)
SO Evacuation + Phaco + IOL	8 (34.8 %)
SO Evacuation + retamponade	4 (17.4 %)
Complications	
Without Complications	15 (65.2 %)
Redetached Retina	3 (13.0 %)
Remaining SO in BMD	2 (8.7 %)
Secondary Glaucoma	3 (13.0 %)

The normality test for visual acuity data using the Shapiro-Wilk found that the data were not normally distributed, so a different test was carried out using the Wilcoxon Signed Rank Test. Based on the results of the Wilcoxon Signed Rank Test calculation, a P value of 0.202 was obtained, which indicated that there was no statistically significant difference between visual acuity before and after silicone oil evacuation.

**Table 2. Differences Between Visual Acuity Before and After Silicone Oil Evacuation**

	Means	std. Deviation	Z	p.s
<b>VA Pre Evacuation SO</b>	<b>1.6957</b>	<b>1.18455</b>		
<b>VA 1 Month Post Evacuation SO</b>	<b>1.3919</b>	<b>.65638</b>	<b>-1,276</b>	<b>.202</b>

The normality test for IOP data using Shapiro-Wilk found that the data were not normally distributed, so a different test was carried out using the Wilcoxon Signed Rank Test. Based on the results of the Wilcoxon Signed Rank Test calculation, a P value of 0.132 was obtained, where this shows that there is no statistically significant difference between intraocular pressure before and after evacuation of silicone oil.

**Table 3. Differences Between Intra Ocular Pressure Before and After Silicone Oil Evacuation**

	Means	std. Deviation	Z	p.s
<b>TIO Pre Evacuation SO</b>	2.0000	.30151	-1,508	.132
<b>TIO 1 Month Post Evacuation SO</b>	1.7826	.59974		

## DISCUSSION

This study was an observational study with a cross-sectional approach, with data obtained retrospectively from January 1<sup>st</sup> to December 31<sup>st</sup> 2021, 23 RRD patients who underwent SO evacuation were assessed and the complications and characteristics of the patients who underwent the procedure were assessed. Data on the characteristics of the research sample as a whole can be seen in Table 1. The research sample was grouped based on gender, found that there were more women, namely 52.2%. This is in line with research by Leeuwen, et al (2020) where the incidence of rhegmatogenous retinal detachment is higher in women. Research conducted by Yu et al (2016), obtained more male samples, but not too different from women, namely 53%. Meanwhile, another study by Jia et al (2020) found a male sample of 62.7%. This difference can be caused by several factors including geographical conditions, ethnicity, and also the size of the study sample. Based on age, the median age of the sample was 51 years with an age range of 46-65 years of 52.2%. This was also reported by Triwijayanti, et al (2019) of the 77 cases included in the study, 53.25% of the samples were dominated by people over 50 years of age who underwent SO evacuation. It is known that retinal detachment is more common in people over 50 years of age, and 66% of retinal detachment patients are older than 50 years, with the highest rate in the age range of 50-59 years.<sup>5,6,7,8</sup>

Lens status in the subjects of this study obtained the same number of phakic and pseudophakic,

namely 47.8% with the most laterality in the left eye of 73.9%. Research conducted by Lam et al, (2008) stated that the proportion of patients with pseudophakia did not differ much from fackia, namely 37.4% compared to 38.8%. The pseudophakic condition during the SO evacuation procedure can be caused by the possibility that the patient's lens condition has advanced cataracts, requiring cataract extraction when performing a vitrectomy.<sup>9,10</sup>

The visual acuity in this study that we describe is the visual acuity before and after the silicone oil evacuation procedure. 69.6% had visual acuity <3/60 both in the subject before the action or after the silicone oil evacuation was carried out. From research conducted by Ghoraba, et al (2021) it was found that 54% of the sample had visual acuity <1/60 before the SO evacuation was carried out and 65% in the range of 1/60 to 3/60. In this study, there was no statistically significant difference in visual acuity between before and after SO evacuation. This was also reported by Ghoraba, et al (2021) where there was no significant relationship between visual acuity before and after SO evacuation. The condition of visual acuity that did not differ between before and after SO evacuation was probably caused by several things, including the long waiting time for surgery, the condition of retinal damage which was quite severe when the pars plana vitrectomy was to be performed. The same results were also reported by Soheilian et al (2006) where visual acuity before evacuation of SO <3/60 was 71% and

after evacuation with visual acuity  $<3/60$  SO was 66%.<sup>11</sup>

For intraocular pressure in this study, a median value of 14 mmHg was obtained in the subjects before the silicone oil evacuation was carried out and with an average value of 14 mmHg in the subjects after the silicone oil evacuation was carried out. Triwijayanti, et al (2019) reported for intraocular pressure before evacuation of silicone oil with a range of 9-21 mmHg of 67.53%. One month after the evacuation of silicone oil, 57.14% did not experience a change in IOP. In this study, there was no significant difference between intraocular pressure between before and after evacuation of silicone oil. Goezinne, et al (2007) reported that 8.5% increased intraocular pressure after evacuation of silicone oil. Budenz, et al (2001) found that patients who underwent SO evacuation alone for the reason of lowering IOP had a tendency for IOP to remain high after evacuation and even required additional glaucoma surgery. There are several factors that can cause IOP to remain high after SO evacuation. First, there is edema in the trabecular meshwork due to postoperative inflammation. Second, the mechanical impact of the balanced salt solution (BSS) during the SO evacuation action can divide the SO droplet into smaller droplets, which are more likely to obstruct the trabecular meshwork.<sup>5,12,13,14</sup>

The indications for evacuation of SO may vary in each case. In this study, for the most indications, retina reattached  $> 3$  months was 73.9%, while Triwijayanti, et al (2019) reported that for the most indications that SO evacuation was done, there was SO emulsification of 57.14%. Another study by Choudary, et al (2012) reported that an increase in IOP was the most indication for SO evacuation. SO evacuation is usually done wisely to avoid complications that can occur. Usually scheduled 3-6 months after SO implantation. However, in some cases SO evacuation can be associated with hypotonia or redetachment. This becomes complex

and requires further evaluation. In line with this research, where the retina reattached for more than 3 months is one of the indications for SO evacuation.<sup>4,5,15,16</sup>

When evacuation of SO is carried out, other additional measures can also be taken. In this study, 47.8% were evacuated only from SO, 34.8% were accompanied by phacoemulsification and intraocular lens implantation, and 17.4% were accompanied by retamponade due to the subject's retina being redetached. This is in line with research from Triwijayanti, et al (2019), namely 55.84% of cases were only evacuated by SO and 31.16% were evacuated by SO accompanied by phacoemulsification and intraocular lens implantation. The longer the duration of SO implantation in the eye, the risk of developing cataracts and glaucoma will increase. In some cases, the short-term duration of SO can also cause cataracts either due to the mechanical or toxic effects of SO. In this study, there were samples that underwent SO evacuation and phacoemulsification at the same time, but the researchers did not discuss the status of the lens's cloudiness level due to limitations with data and analysis of the lens's cloudiness level.<sup>5</sup>

Each action of course can cause complications. In this study, the most complications that we experienced were retinal redetached and secondary glaucoma. Retinal redetached was diagnosed based on the results of posterior segment examination using a 78D lens on a slit lamp. The secondary glaucoma was diagnosed when an IOP  $>21$ mmHg measured by a handheld tonometer. Both of this complications were evaluate 1 month after the SO evacuation. But in this study, most of the SO evacuation procedures did not cause complications, namely 65.2%. The most complications experienced were retinal redetached and secondary glaucoma, each of 13.0%. This was also reported by Triwijayanti, et al (2019),

where 65.03% did not experience complications and the most reported complication was secondary glaucoma (16.88%). A meta-analysis study by He, et al (2018) states that the condition of PVR before vitrectomy surgery and OS implantation is not a risk of redetached, but the formation of PVR after evacuation of SO can be the main cause of redetached retina. This is in line with this study which found the condition of redetached retina, but indeed the researchers did not assess the degree of PVR in this study.<sup>5,17</sup>

## CONCLUSION

The research subjects in this study had an age with a median of 51 years with the majority of subjects being in the age range of 46-65 years, female and living in Bali with the majority of phakic and pseudophakic lens status. Most of the subjects only had SO evacuation performed without any other additional measures. The most complications that arise are redetached retina (13.0%) and secondary glaucoma (13.0%), however most patient did not experience any complications at all (65.2%). There was no significant difference in visual acuity and IOP between before and after SO evacuation. Demographic factors such as occupation and clinical characteristics such as the type of SO, lens opacities status and longer follow-up time to determine patient progress to minimize complications that may occur.

## REFERENCES

1. American Academy of Ophthalmology Staff. 2019-2020. *Retina and Vitreous*. AAO. San Fransisco. p. 451-459.
2. Schwartz SG, Flynn HW, Jr., Lee WH, Wang X. Tamponade in surgery for retinal detachment associated with proliferative vitreoretinopathy. *Cochrane Database Syst Rev*. 2014(2):CD006126.
3. Issa, R., Xia, T., Zarbin, M.A., Bhagat, N. 2019. Silicone Oil Removal: Post-operative CComplications. *Eye*. 2020(34) 537-543. <https://doi.org/10.1038/s41433-019-0551-7>.
4. Choudhary MM, Saeed MU, Ali A. Removal of silicone oil: prognostic factors and incidence of retinal redetachment. *Retina*. 2012;32(10):2034-8.
5. Triwijayanti et al. The Evaluation of Silicon Oil Evacuation Procedure In Cipto Mangunkusumo Hospital Indonesia. *International Journal of Retina*, [S.l.], v. 2, n. 1, feb. 2019. ISSN 2614-8536.
6. Leeuwen, R. V., Haarman, A.E.G., Put, M.A.J., Klaver, C.C.W., Los, L.I. Association of Rhegmatogenous Retinal Detachment Incident with Myopia Prevalence in the Netherlands. *Jama Ophthalmol*. 2021; 139 (1):85-92. doi:10.1001/jamaophthalmol.2020.5114
7. Yu Y, An M, Mo B, Yang Z, Liu W. Risk factors for choroidal detachment following rhegmatogenous retinal detachment in a chinese population.
8. Jia LY, Sun YX, Zhang YP, Ma K. Risk Factors of Recurrent Retinal Detachment Following Surgical Treatment for Rhegmatogenous Retinal Detachment: A Retrospective Study. *Risk Manag Healthc Policy*. 2020 Dec 30;13:3165-3171. doi: 10.2147/RMHP.S288777BMC Ophthalmol. 2016 Aug 9;16:140. doi: 10.1186/s12886-016-0319-9.

9. Lam RF, Cheung BT, Yuen CY, Wong D, Lam DS, Lai WW. Retinal redetachment after silicone oil removal in proliferative vitreoretinopathy: a prognostic factor analysis. *Am J Ophthalmol.* 2008 Mar;145(3):527-533. doi: 10.1016/j.ajo.2007.10.015. Epub 2008 Jan 11. PMID: 18191093.
10. Murray, T.G., Villegas, V.M. (2021). Phacovitrectomy. In: Jain, A., Natarajan, S., Saxena, S. (eds) *Cutting-edge Vitreoretinal Surgery*. Springer, Singapore. [https://doi.org/10.1007/978-981-33-4168-5\\_40](https://doi.org/10.1007/978-981-33-4168-5_40)
11. Ghoraba HH, Leila M, Shebl M, Abdelhafez MA, Abdelfattah HM. Long-Term Outcome After Silicone Oil Removal in Eyes with Myopic Retinal Detachment Associated with Macular Hole. *Clin Ophthalmol.* 2021 Mar 8;15:1003-1011. doi: 10.2147/OPHTH.S298565
12. Goezinne F, La Heij EC, Berendschot TT, Liem AT, Hendrikse F. Risk factors for redetachment and worse visual outcome after silicone oil removal in eyes with complicated retinal detachment. *Eur J Ophthalmol.* 2007;17(4):627-37.
13. Pastor S (2001) Cyclophotocoagulation: A report by the American Academy of Ophthalmology. *Ophthalmology* 108(11):2130–2138
14. Budenz DL, Taba KE, Feuer WJ et al (2001) Surgical management of secondary glaucoma after pars plana vitrectomy and silicone oil injection for complex retinal detachment. *Ophthalmology* 108:1628-1632
15. Choudhary MM, Choudhary MM, Saeed MU, Ali A. Removal of silicone oil: prognostic factors and incidence of retinal redetachment. *Retina.* 2012;32(10):2034-8
16. Abu-Yaghi, N. E., Gharbieh, Y. A. A., Al-Amer, A. M., AlRyalat, S. A. S., Nawaiseh, M. B., Darweesh, M. J., Alkukhun, L. R., Abed, A. M., Saleh, O. A., Ababneh, O. H. 2020. Characteristics, Fates and Complications of Long Term Silicone Oil Tamponade After Pars Plana Vitrectomy. *BMC Ophthalmology.* 20:336. <https://doi.org/10.1186/s12886-020-01608-5>
17. He, Y., Zeng, S., Zhang, Y., Zhang, J. 2018. Risk Factors for Retinal Redetachment After Silicone Oil Removal: A Systemic Review and Meta-analysis. *Ophthalmic Surgery, Lasers & Imaging Retina.* 49(6):416-424. doi: 10.3928/23258160-20180601-06



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