

RESEARCH ARTICLES

COMPARISON OF INTRAOCULAR PRESSURE BEFORE AND AFTER SILICONE OIL EVACUATION WITH RETINAL DETACHMENT HISTORY IN JAKARTA HOSPITAL

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ABSTRACT

Background: Retinal disorders are the fourth most common cause of blindness in Indonesia and one of them is retinal detachment. Vitrectomy with silicone oil (SO) tamponade is a popular technique for treating it. As a complication of using SO, intraocular pressure (IOP) can increase and usually returns to normal after evacuation of SO. However, in some conditions, such as emulsifying SO, can cause IOP to remain high even after SO evacuation has been carried out. The aim of this study is to determine the comparison of intraocular pressure before and after evacuation of silicone oil in patients with a history of retinal detachment.

Methods: This study is a cross sectional with analytical research. Secondary data was taken from the medical records of patients with a history of retinal detachment who

underwent silicone oil evacuation performed at KMJA Jakarta Hospital.

Results: 39 Respondents aged 23-69 years and 82% are male. The average length of use of SO is 9 months. It was found that the IOP decreased which was not significant in weeks 1-2 after evacuation of SO (p-value=0.098) and also the increase in IOP was not significant in weeks 3-4 after evacuation of SO (p-value=0.184).

Conclusion: There is no significant difference in intraocular pressure before and after evacuation of silicone oil in patients with a history of retinal detachment.

Keywords: Retinal detachment, silicone oil evacuation, intraocular pressure.

INTRODUCTION

The incidence of abnormalities in the retina of the eye in Indonesia reaches 0.13% and is the fourth cause of blindness after cataracts, namely 0.78%, glaucoma 0.20%, refractive errors 0.14%, and other causes under retinal abnormalities as much as 0.10%.^{1,2} One of the most common abnormalities is retinal detachment, which is a condition in which the retinal pigment epithelium or the optic nerve layer is released from the layer beneath it in the eyeball. The detachment of the retinal neurosensory layer can be caused by an accumulation of fluid in the subretinal, due to tears that occur in the retina so that fluid can pass through the tear gaps and enter the back of the retinal layer, namely between the pigment epithelial cells and the retinal layer itself. As a result, the retinal layer will be lifted by the fluid and detached from the pigment epithelial layer. This condition causes the retina or the visual nerves of the eye to be unable to deliver light stimuli to the brain so that visual disturbances can appear in areas where the retinal layer is detached.^{3,4}

Vitreoretinal surgery is a method that can be used to treat retinal detachment and one of the techniques in this surgery is the pars plana vitrectomy surgical technique with gas tamponade or silicone oil. Pars plana vitrectomy surgery allows for reduction of vitreoretinal traction and internal drainage of the subretinal fluid. The use of silicone oil (polydimethylsiloxane) as retinal tamponade has become a standard technique for repairing complex retinal detachments and can be used in the short or long term. The main indication is when superior, posterior, or multiple retinal tears occur; when retinal visualization is obstructed as due to vitreous haemorrhage; and if there is significant proliferative vitreoretinopathy. Silicone oil (SO) also has better results anatomically and functionally compared to the use of gaseous sulfur hexafluoride (SF6) as a tamponade. However, SO also causes long-term complications. Among the complications that can be caused, especially secondary glaucoma, secondary cataract, uveitis, and keratopathy are often a consideration for limiting use in the most severe cases.⁴⁻⁶

In cases of secondary glaucoma complications, this is caused by increased postoperative intraocular pressure (IOP). IOP is the pressure against the wall of the eyeball. This pressure will be normal when the production and drainage of aqueous humor is balanced, whereas in pars plana vitrectomy with silicone oil tamponade it can allow secondary pupillary block, inflammation, and transfer of emulsified and non-emulsified oil into the anterior chamber so that aqueous humor imbalance can occur and cause IOP increases. But the increase in IOP that occurs is reversible because after removal of SO, IOP generally returns to normal in most patients.⁷

However, in a study in a journal published by The Royal College of Ophthalmologists in 2019 with the research title Silicone Oil Removal: Post-operative complications, by evaluating a total of 101 eyes of 99 patients and having evacuated SO in all 101 eyes of the respondent, it was stated that ocular hypertension is the second highest complication after cataract surgery, which means that intraocular pressure can remain high even after SO evacuation is performed. This may be caused by the long duration of tamponade installation. As in developed countries removal of silicone oil is usually done 6-8 weeks after the tamponade is placed. Whereas in developing countries, tamponade evacuation is often done more than 12 weeks after insertion which will make the risk of silicone oil emulsification higher. If emulsification has occurred, the silicone oil droplets will be able to penetrate into the intraocular space such as the subretinal space, anterior chamber, trabeculum, or cornea which will result in toxicity to that segment, keratoplasty, or intraocular pressure that does not go down after evacuation and instead getting taller.⁵⁻⁷

Based on the description above, the researcher found a phenomenon to conduct research at the Jakarta Aini Eye Clinic (KMJA) at Jakarta Hospital as one of the hospitals that provides vitreoretinal surgical treatment and this study will discuss the comparison of intraocular pressure before and after SO prevention measures are taken in patients with a history of retinal detachment.

RESULTS

Table 1. Distribution of samples by age

Respondent Characteristics	Category	Frequency (N)	Percentage (%)
Age	12-25 Years (Teenager)	1	2.6
	26-45 Years (Adult)	14	35.9
	46-64 Years (Elderly)	23	59
	> 65 Years (Old)	1	2.6
	Male	28	71.8
	Female	11	28.2

METHODS

This research is an analytic observational using cross sectional method with the aim of knowing the comparison of IOP before and after SO extraction. Intraocular pressure was measured using a non-contact airpuff tonometer and taken before evacuation (IOP pre-SO evacuation), in the 1st to 2nd week (IOP post-SO evacuation week 1-2) after evacuation, also in the 3rd-4th week range (IOP post-SO evacuation weeks 3-4) after SO evacuation. This study excluded patients with a history of glaucoma, ocular hypertension, and patients with incomplete data.

The data was taken from all medical records of patients with a history of retinal detachment who underwent SO tamponade removal surgery from January 2019 to November 2021 and the operation was performed by an ophthalmologist at KMJA Hospital Jakarta, South Jakarta. The sampling technique was by consecutive sampling, that is, every patient who met the inclusive criteria would be the subject of the study.

The total medical records of patients with a history of retinal detachment at KMJA Hospital Jakarta during the period from January 2019 to November 2021 were 70 medical records and after screening based on inclusion and exclusion criteria, a total of 39 data were obtained for further analysis.

The data that has been obtained and processed will then be analyzed univariately and bivariately using data processing software IBM SPSS statistics version 25. Therefore, in this study the Wilcoxon non-parametric test will be carried out as an alternative test to the Paired Sample T-Test because the data is not normally distributed. In this study, researchers used a 95% confidence interval with an α value of 5% so that if the p value <0.05 , the results of statistical calculations show that there is a significant difference in intraocular pressure in each group.

ETHICAL APPROVAL

Has obtained permission for research ethics from the Health Research Ethics Committee (KEPK) of the Faculty of Medicine UIN Syarif Hidayatullah Jakarta number B-049/F12/KEPK/TL00/10/2022

Table 2. Intraocular pressure mean

	Mean (mmHg)	Minimum (mmHg)	Maximum (mmHg)
IOP pre SO evacuation	15.413	5.3	33.3
IOP post SO evacuation in weeks 1-2	14.677	5.3	34.7
IOP post SO evacuation in weeks 3-4	17.728	8.3	44

Table 3. IOP post SO evacuation compared to IOP Pre SO evacuation

Description	Category	Frequency (N)	Percentage (%)
Weeks 1-2	Decrease	27	69.2
	Increase	11	28.2
	Same	1	2.6
Weeks 3-4	Decrease	16	41
	Increase	21	53.9
	Same	2	5.1

Table 4. Comparison of IOP Pre SO evacuation vs IOP Post SO evacuation

Description	Mean Difference (mmHg)	P Value
Weeks 1-2	0.74	0.098
Weeks 3-4	2.32	0.184

Table 5. Distribution of IOP post SO evacuation categories

Category	IOP Post SO Evacuation in Weeks 1 - 2 Category		IOP Post SO Evacuation in Weeks 3 - 4 Category	
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)
Low (<10 mmHg)	11	28.2	4	10.3
Normal (10-21mmHg)	21	53.8	26	66.7
High (>21mmHg)	7	17.9	9	23.1

DISCUSSION

Characteristics of Respondents

The number of respondents in this study consisted of 1 patient eye (2.6%) aged 12-25 years (adolescents), 14 eyes (35.9%) from patients aged 26-45 years (adults), 23 eyes (59%) were from patients aged 46-64 years (elderly), and 1 eye (2.6%) was from patients aged 65 years and over (elderly). The age range of the respondents is from 23 years

to 69 years with an average age of 47 years. There are other studies that also show similar analysis results regarding the average age of patients undergoing SO evacuation, namely in the study of Reda Issa et al (2020) the average age obtained is 47.2 years.⁵

In this study, the majority of respondents were male. There were 28 eyes (71.8%) from male patients and 11 eyes (28.2%) from female patients. Based on these results, it can be concluded that more male than female patients with a

history of retinal detachment who underwent SO tamponade evacuation.

These results are consistent with a study conducted by Ramzi Amin et al (2011) entitled "Management and Surgical Results of Patients with Giant Retinal Tear at Cicendo Eye Hospital Bandung" which stated that out of 22 retinal detachment patients who were the subject of the study, 18 patients (82%) were male and female as many as 4 patients (18%). Apart from that, a journal entitled "Retinal Detachment" written by Scott Fraser and David Steel (2010) explains that rhegmatogenous retinal detachment affects men more often than women.^{8,9}

Comparison of intraocular pressure before SO evacuation and after SO evacuation

Based on the data obtained, it was found that 27 respondents experienced a decrease in IOP in weeks 1-2 after SO evacuation, 11 respondents had higher intraocular pressure after SO evacuation in weeks 1-2 compared to before SO evacuation was carried out, and 1 respondent had the same IOP. Before and after SO evacuation in weeks 1-2. Even though there were more respondents with decreased IOP, the p-value obtained was 0.098, so $p > 0.05$, which means that there was no significant difference between IOP before evacuation of SO and after evacuation of SO in weeks 1-2.

In theory, after the silicone oil is removed from the intraocular, the material in the vitreous space will decrease and will affect the entire contents of the eyeball, namely the pressure against the wall of the eyeball will decrease or increase. In addition to this, the results from the post-evacuation SO IOP data in weeks 1-2 already illustrate this, where the eyes of patients undergoing SO evacuation predominantly experienced a decrease in IOP, even when compared to the number of respondents that experienced an increase in IOP or that had no change in IOP between pre and post SO evacuation results were not significant. A similar study conducted by Reda et al (2020) also explained that there was a decrease in IOP after SO evacuation was carried out and in this study the IOP rate decreased significantly.⁵

As a breakdown of the IOP data post-evacuation of SO in weeks 1-2, there were 11 respondents that had low IOP values (< 10 mmHg), and 2 of them were included in a state of oculi hypotonia, namely IOP values < 6.5 mmHg.¹⁰ According to Daniel et al (2020), postoperative transient hypotonia is indeed one of the complications that can occur after evacuation of silicone oil, with incidence rates ranging from 5-40% of the total cases studied. This research journal also explains that an IOP of less than 6 mmHg can cause choroidal detachment, but in cases of eyes that are removed, this is usually transient and can heal spontaneously within 1 week with topical steroid drugs.^{11,12}

In addition, low IOP can be caused by increased outflow of intraocular fluid through the subretinal space through the exposed retinal pigment epithelium, in other words, the anatomical target of managing retinal detachment using silicone oil tamponade has not been achieved or it can also be caused by retinal redetachment. Based on a journal entitled "Removal of Silicone Oil: Prognostic Factors and Incidence of Retinal Redetachment" it was reported that anatomical success after SO evacuation was achieved in 167 of 173 eyes (96.5%) and only about the remaining 6 eyes (3.46%) who experiencing retinal detachment.¹³ As a comparison, the results of studies in other journals state that the incidence of retinal redetachment is 4.08%.¹¹ Even though it's not a big number, minimizing it by ensuring that the anatomical target is achieved is important and can be known by carrying out several other supporting examinations besides IOP examination. Examination of visual acuity, visual field, to funduscopy examination and also eye ultrasound is considered to be able to help enforce the achievement of anatomical targets after SO evacuation. However, in this study the data from these examinations were not listed so that it could not be compared with the data from IOP measurements.¹⁴

Then from the IOP data after evacuation of SO weeks 1-2 it was also found that high IOP rates were in 7 respondents studied (17.9%). Referring to several journals, high IOP after evacuation of SO is often caused by SO emulsification that occurs by using SO tamponade over the recommended time as a risk factor.

Furthermore, as a result of statistical calculations to find out the comparison of IOP before evacuation of SO and after evacuation of SO in weeks 3-4, based on Table 3, it was found that 16 respondents experienced a decrease in IOP, 21 respondents experienced an increase in IOP, and 2 respondents had the same IOP value between before evacuation of SO compared to after evacuation of SO at 3-4 weeks. Different from the results of the comparison of IOP before and after evacuation of SO in weeks 1-2 where more respondents experienced a decrease in IOP, in the comparison of IOP before and after evacuation of SO in weeks 3-4 more respondents experienced an increase in IOP. However, as shown in Table 4, the p-value obtained was 0.184, that is, $p > 0.05$, so that the difference in IOP between before and after SO evacuation in weeks 3-4 was not significant.

There were similar results showing that the incidence of increased IOP was higher in the 3rd to 4th week than in the first 2 weeks after SO evacuation was carried out, namely in research by Mei Chi Tsui et al (2020). The study entitled "Silicone Oil Removal After Extended Tamponade in Proliferative Diabetic Retinopathy-A Long Range of Follow-up" explains that an increase in IOP after elimination of SO can occur in several phases, namely the early postoperative phase (within 2 weeks after evacuation of SO),

the phase late-onset postoperative (more than 2 weeks to 4 weeks after evacuation of SO), and prolonged postoperative phase (more than 4 weeks after evacuation of SO). Based on the results of this study, it was found that 2 eyes (2.7%) experienced an increase in IOP immediately after surgery or in the early postoperative phase, followed by 10 eyes (10.8%) who experienced an increase in IOP in the late-onset postoperative phase, while for the prolonged postoperative phase there were no reported cases of increased IOP.¹⁵

In Table 5. the IOP data in weeks 3 and 4 after evacuation of SO shows that the number of respondents that had low IOP numbers decreased from the previous 11 respondents in the first 2 weeks after evacuation of SO to 4 respondents and none were classified as in a state of ocular hypotonia, and the number of respondents with normal IOP increased from 21 to 26 eyes. However, respondents with high IOP numbers also increased from 7 to 9 respondents.

While in the early post-evacuation period, elevated IOP may be secondary to pupillary block, migration of emulsified SO droplets into the anterior chamber, postoperative inflammation and/or steroid treatment-induced IOP elevation after SO evacuation. If emulsification has occurred, even though SO evacuation has been carried out, the impact of SO that has undergone emulsification can still be present in the patient's eyes. However, there is literature suggesting that if emulsified SO only causes inflammation of the trabecular meshwork or leaves only small droplets, both of these can gradually disappear spontaneously over time and eventually IOP and other anatomical functions of the eye can return to normal.¹⁶

However, if in the later period or late onset after evacuation of SO, the increase in IOP persists, a secondary glaucoma can be suspected due to the continued effects of SO emulsification such as persistent pupillary block, synechiae angle closure, rubeosis iridis, further infiltration of droplets into the in the trabecular meshwork causing extensive trabecular damage and finally obstruction of the outflow of aqueous humor occurs so that the IOP remains high.^{17,18}

CONCLUSION

Based on the results of this study it can be concluded that evacuation of SO tamponade in patients with a history of retinal detachment did not cause any significant difference in IOP between before and after SO evacuation was performed.

CONFLICT OF INTEREST

No conflicts of interest.

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