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Original Article

Outcomes of Silicone Oil Removal After Pars Plana Vitrectomy at A Tertiary Eye Hospital, Nepal

Ashma Manandhar,[1] Eli Pradhan,[2] Sanjita Sharma,[2] Sushma Duwal,[2] Raba Thapa[2]
[1]Department of Vitreoretina, Biratnagar Eye Hospital, Rani, Biratnagar, Morang, Nepal
[2]Department of Vitreoretina, Tilganga Institute of Ophthalmology, Gaushala, Kathmandu Nepal

ABSTRACT

Introduction: Silicone oil is used in complicated retinal detachment since many decades. It is associated with many complications so, silicone oil removal is to be done once the retina is attached. Retinal re-detachment is the most serious complication after its removal.

Objective: To evaluate the surgical outcomes and ocular complications after silicone oil removal in cases of rhegmatogenous retinal detachment.

Methodology: It was a hospital-based observational study conducted after ethical clearance among the patients that underwent silicone oil removal between 2018 January to 2018 December at Tilganga Institute of Ophthalmology. Consecutive sampling technique was used for the study. Inclusion criteria were patients undergoing silicone oil removal for the first time with or without cataract surgery during the study duration. Exclusion criteria were cases with retinal detachment noted at the time of silicone oil removal, patient younger than 18 years, scleral thinning at the site of sclerotomy, use of silicone oil tamponade other than 1000 centistoke. Visual acuity, intraocular pressure, retinal re-detachment, corneal complications were evaluated in this study

Result: Total 88 eyes of 88 patients (67.1% male) were included in this study. Mean age of the patient was 62 years with standard deviation of 3.4 years (range 37-75 years). Anatomically success was obtained in 75 (85.2%) cases. Best corrected visual acuity was improved in 43 (48.86%). Complications after oil removal were re-detachment of retina in 13 (14.8%), ocular hypotony two (2.27 %), ocular hypertension three (3.40%), corneal decompensation eight (9.09%).

Conclusion: This study showed an overall improvement in post-operative visual acuity after silicone oil removal but anatomical success may not match the functional success in all cases. Retinal re-detachment remained the most common complication after the silicone oil removal.

Key words: Ocular hypertension; ocular hypotension; retinal detachment; silicone oil.

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Corresponding Author
Dr. Ashma Manandhar
Department of Vitreoretina,
Biratnagar Eye Hospital,
Rani, Biratnagar, Morang, Nepal.
E-mail: ashmamanandhar1984@gmail.com

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INTRODUCTION

Silicone oil (polydimethylsiloxane) is a linear synthetic polymer made of repetitive siloxane (Si-O) units and is chemically similar to silicone rubber, except that silicone oil polymer chains are not cross-linked and are shorter than those of silicone rubber (Kreiner et al., 1987). It was first introduced by Paul Cibis in the 1960s as an intraocular tamponade (Cibis et al., 1962). Since then, it has been used in complicated vitreoretinal surgeries such as complicated retinal detachment (RD), proliferative vitreoretinopathy, ocular trauma, and endophthalmitis (Cibis et al., 1962; Scott, 1975).

Despite its utility, long-term presence of silicone oil in the eye leads to complications such as cataract, glaucoma, and corneal decompensation. Therefore, it needs to be removed once it has fulfilled its purpose as a tamponade (Falkner-Radler et al., 2010).

There are only a few tertiary eye care hospitals in Nepal having comprehensive vitreoretinal services. Therefore, many patients with retinal detachment present to the hospital when the condition is already complicated; consequently, most of them undergo retinal detachment surgery with silicone oil injection as a tamponade. There are only a few studies from Nepal evaluating the outcomes and complications of silicone oil removal. In a study by Shah et al., from western part of Nepal, anatomical success after silicone oil removal was achieved in 87.5% of the cases with vision improvement or stabilisation in 76.6% of cases (Shah et al., 2018). To date, no study from Nepal has specifically evaluated the risk factors for retinal re-detachment following silicone oil removal. Hence, authors aimed to fill this gap by evaluating the anatomical success, functional success and complications after silicone oil removal.

METHODOLOGY

This was a hospital-based observational study done at Tilganga Institute of Ophthalmology from 2018 January to 2018 December 2018 after ethical clearance. Ethical approval for the study was obtained from Institutional review committee of Tilganga Institute of Ophthalmology (TIO-IRC Reference number: 09/2017; dated 2018.01.05). All the cases of rhegmatogenous retinal detachment with silicone oil tamponade, who underwent silicone oil removal for the first time during the study duration were included in the study. Those who had retinal detachment at the time of oil removal, scleral thinning at the site of sclerotomy, patient younger than 18 years, use of silicone oil tamponade other than 1000 centistoke (cSt) were excluded from the study. Patient's predisposing factors for retinal detachment prior to pars plana vitrectomy (like high myopia, ocular trauma), presence or absence of macular involvement, proliferative vitreoretinopathy (PVR) grading, detachment duration, best corrected visual acuity (BCVA), and lens status and tamponade after oil removal were recorded.

All patients had ocular examinations before and after silicone oil removal and at each follow-up visit of 1st post-operative day, 14th post-operative day, 30th post-operative day, 90th post-operative day and 180th post-operative day. These examinations included BCVA testing using a Snellen visual acuity chart and then was converted to LogMAR, measurement of intraocular pressure by applanation tonometry, slit lamp biomicroscopy and fundus examination with direct (90 D lens), indirect ophthalmoscopy

using 28D lens was done.

The criteria for silicone oil removal were stable and completely attached retina at two subsequent visits with or without ultrasound Bscan. Those who had significant cataract underwent small incision cataract surgery or phacoemulsification along with silicone oil removal on the same sitting.

Anatomical success was defined as complete retinal reattachment at six months (180th post-operative day) follow-up. The BCVA was considered improved or deteriorated, if the difference between the baseline and final was ≥0.1 LogMAR. Ocular hypotension was defined as intraocular pressure less than 8 mmHg in two separate occasions. Ocular hypertension was defined as IOP more than 25 mmHg in two separate occasions.

Before surgery, procedure was explained to the patient, written consent was obtained followed by retrobulbar anaesthesia (2 ml lidocaine+2ml bupivacaine) using a standard 4 ml Atkinson needle. In all the cases, pars plana approach was used for silicone oil removal. In cases of cataract, phacoemulsification or small incision cataract surgery with intraocular lens implantation surgery was done, followed by silicone oil removal. A pars plana entry with 23-gauge (G) valved trocar in the inferotemporal quadrant for infusion, superior nasal (right eye) or superotemporal (left eye) quadrant for light pipe at 4 mm from the limbus in phakic patients and 3.5 mm in pseudophakic and aphakic patient was performed.

Incision with 20-G micro-vitreoretinal blade (MVR) in superotemporal (right eye) or superonasal quadrant (left eye) was made and silicone oil was removed manually using 20-G syringe. For patients with emulsified silicone oil particles in the anterior chamber, a side-port incision into the anterior chamber was made using a 15-degree knife and oil was removed. After oil removal, retina was examined under microscope with the use of light pipe and Binocular Indirect Ophthalmo-Microscope (BIOM) in all quadrant and scleral depression was done to examine anterior part of retina in all quadrants. All the ports were closed with 8-0 polyglactin (vicryl) suture.

The IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, N.Y., USA) was used to perform statistical analyses. For statistical purposes visual acuity was converted to logarithm of the minimum angle of resolution (logMAR). A modified scale was used to assign non- numerical visual acuities to logMAR scores of 1.7, 2.0, 2.3, and 3.0 for "counting fingers", "hand movements", "perception of light", and "no perception of light" respectively. Paired t-test was used to compare preoperative and post-operative visual acuities. Bivariate logistic regression was carried out to examine the association and the results were presented as odds ratio.

RESULT

Eighty-eight eyes of 88 patients were included in the study, out of which 59 (67%) were male. Mean age of patients was 62 years with standard deviation (SD) of 3.4 years (range 37-75 years). Eyes undergoing silicone oil removal, 47 (53.41%) were pseudophakic. The mean time of silicone oil extraction was 6.28 months (range 3-12 months) after its placement (Table 1).

Table1: Baseline demographics of patients undergoing silicone oil removal.

Baseline characteristics		Mean value ± standard deviation / number of patients	Overall %
Age (years)	Mean	62 ± 3.4	
Gender	Male	59	67.1%
	Female	29	32.9%
Eye	Right	64	72.73%
	Left	24	27.27%
Macular status	Macula on	10	11.4%
	Macula off	78	88.6%
Lens status	Phakia	25	28.41%
	Pseudophakia	47	53.41%
	Aphakia	16	18.18%
PVR changes	Less than grade C	8	9.1%
	More than grade C	80	90.9%
Diagnosis association with RRD	Trauma	26	29.54%
	Myopia	19	21.6%
Silicone oil tamponade (months)	Mean	6.28 ± 4.48	
Silicone oil removal along with cataract surgery		37	42.04%
BCVA (Log MAR) Mean	Baseline	2.41 ± 1.14	
	Last follow-up	2.32 ± 1.67	

Anatomical success was observed in 75 (85.2%). Best corrected vision improved in 43 (48.9%) (Table 2).

Table 2: Anatomical and functional outcome of patients undergoing silicone oil removal.

Anatomical outcome	Number (Percent)
Anatomically success	75 (85.23)
Anatomical failure	13 (14.77)
Functional outcome	
Improved	43 (48.9)
Same	19 (21.6)
Deteriorated	26 (29.5)

Most of the patients had improvement in vision at the last follow-up (Table 2). After oil removal vision was improved in 43 (48.9 %) cases, but it was not statistically significant (Paired t-test 0.630) when compared to those who had no improvement. Low post-operative vision was due to optic atrophy, corneal decompensation and macular scar.

Post-operatively ocular hypotony was noted in two cases (2.3%) and three cases (3.4%) had ocular hypertension at six months of silicone oil removal (Figure 1).

Balanced salt solution was the most common vitreous substitute used after oil removal accounting for 43 eyes (48.9%), in 23 eyes (26.1%) air was used and in 22 eyes (25.0%) intraocular gas was used as intraocular tamponade. In cases of re-detachment after silicone oil removal, 92.3% (12 out of 13) were observed to have detachment within three months of silicone oil removal.

Patient undergoing cataract surgery along with silicone oil removal was 37 (42.04%). There was no statistical correlation between retinal detachment after combine surgery (silicone oil removal and cataract surgery) (Chi-square test p = 0.77) but preoperative trauma had statistically significant relation with detachment (Fisher exact test p = 0.002) (Table 3).

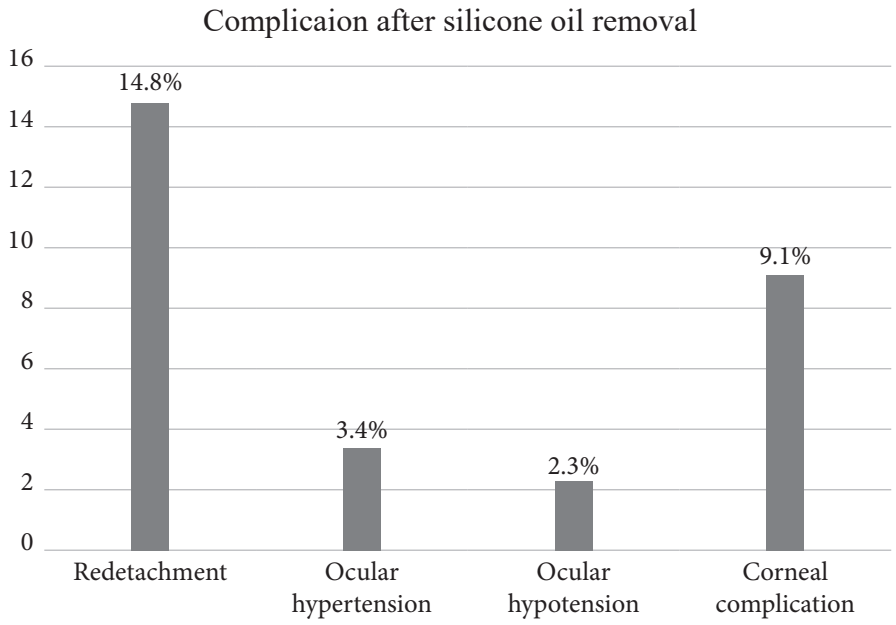

Figure 1: Complications noted after silicone oil removal.

Table 3: Distribution of attached retina by different variables.

Risk factors		Number and percent of attached, n (%)	p-value
Age (years)	<50	39 (77)	0.05
	>50	49 (91.8)	
History of trauma	Yes	26 (65.4)	0.002
	No	62 (93.5)	
Buckle	Yes	50 (88)	0.4
	No	38 (81.6)	
Cataract and SOR	Yes	37 (86.5)	0.78
	No	51 (81.3)	
Total		**88 (85.2)**	

Table 4: Odds of attachment of retina by different variables.

Variables	Odds ratio	p-value
Visual acuity of operated eye (Log Mar)	1.38	0.269
Duration of Silicone Oil (months)	1.11	0.418
Number of eyes	88	

Since the dependent variable (attached/ detached) was dichotomous and the independent variables: visual acuity of operated eye and duration of silicone oil in the operated eye were continuous in nature, bivariate logistic regression was carried out to examine the association. The results are presented as odds ratio and the significance level (Table 4). Results show that odds ratio for attachment of retina do not change significantly for both the variables. This concluded that no significant association exists between duration of silicone oil as well as vision before silicone oil removal with attachment of retina.

DISCUSSION

In this study anatomical success was obtained in three fourth of the patients and functional outcome was improvement in vision of about half the patients. Most common complication noted following silicone oil removal was re-detachment of retina.

Silicone oil is used in complicated rhegmatogeneous retinal detachment for many decades. But due to its complications, it needs a second surgery for its removal and is usually removed after three months (Nagpal et al., 2012). In this study mean time of silicone oil

tamponade at the time of its removal was 6.28 ± 4.48 months. Most common recommendation for its removal is 3-6 months but each eye needs to be evaluated on individual basis. (Bassat et al., 2000; Krzystolik et el., 2000) but the authors of this study opted for late removal because most of patients in present study had PVR changes greater than grade C, which contributed to the decision of late silicone oil removal.

In this study the duration of silicone oil was not found to be a risk factor for anatomic failure similar to other studies (Nagpal et al., 2012; Jonas et al., 2001). But some other studies showed that shorter tamponade duration had lower anatomical success than longer tamponade duration (Tan et al., 2012; Scholda et al., 2000). The possible reason might be due to use of silicone oil in wide range of complicated retinal detachment cases.

After silicone oil removal, anatomical success in this study was 85.23% which was similar to study from Nepal and India (Shah et al., 2018; Nagpal et al., 2012). Reported rate of anatomical success has been shown to occur in 72-96% in various studies (Teke et al., 2014; Jonas et al., 2001; Velikay-Parel et al., 2011; Al-Wadani et al., 2014; Dhalla et al., 2014; McCuen et al., 1985).

This wide variation might due to marked differences in the number of eyes studied, use of oil in different types of retinal detachment and duration of follow-up after silicone oil removal (Falkner-Radler et al., 2011; Teke et al., 2014; Jonas et al., 2001; Velikay-Parel et al., 2011; Al-Wadani et al., 2014; Dhalla et al., 2017).

The most serious complication encountered following silicone oil removal is the recurrence of detachment. In this study detachment rate was found to be 14.8%, similar to studies from Nepal and India (Shah et al., 2018; Nagpal et al., 2012). The reported rate of re-detachment is 0-33% (Falkner-Radler et al., 2010; Bassat et al., 2000; Jonas et al., 2001; Dhalla et al., 2017; McCuen et al., 1985; Casswell et al., 1987; Hutton, 1984). This variation might be due to different follow-up period in different studies. Duration of follow-up of patients after silicone oil removal is important as in a report by Jonas et al., retinal re-detachment after silicone oil removal was 50% within the first 18 days, and 75% occurred within the first 50 days after silicone oil removal. (Jonas et al., 2001) In this study also, 12 (92%) cases of re-detachments occurred within three months after silicone oil removal.

Favourable functional outcome was seen in 43 eyes (14.77%) although the difference in mean of best corrected pre- and post-operative visual acuity was not statistically significant ($p = 0.63$) which was similar to another study from Nepal (Shah et al., 2018). and the possible reason might be due to poor preoperative visual acuity.

In this study history of trauma had significant statistical correlation with the rate of re-detachment similar to study by Jia et al., (2020) which might be due to severe damage of various ocular structures during trauma.

Cataract surgery and silicone oil removal was not found to have any relation with rate of re-detachment in this study ($p = 0.78$), which was similar to study by Huang et al., (2022). This might be due to cataract surgery done in anterior segment of eye.

CONCLUSION

Anatomical success was achieved in majority of the cases following silicone oil removal. Visual improvement was found in almost half of the patients although overall gain was limited. Most common complication following silicone oil removal was re-detachment of retina which was observed in early post-operative period in most of the cases, so frequent follow-up of patients during this period is recommended. A history of trauma was identified as a significant risk factor for re-detachment.

Limitation of this study was the small number of patients, with only patients of rhegmatogenous retinal detachment was included in the study. Strength of the study is its prospective nature, conducted at a tertiary eye hospital from central Nepal where patients come from all over the Nepal.

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