

## Retinal re-detachments after removal of silicone oil: Frequency and timings in a retrospective clinical study

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### Abstract

**Objective:** To analyse anatomical outcome after removal of silicone oil endotamponade in complicated cases of retinal detachment with reference to frequency and timings, and to study factors affecting the outcome.

**Methods:** The retrospective study was conducted at one public-sector and one private-sector hospital in Karachi, and comprised data related to patients who underwent pars plana vitrectomy with silicone oil endotamponade for complicated retinal detachment and subsequent removal of silicone oil between 1996 and 2015. The surgery had been carried out by both active and passive methods. Outcome variable was retinal re-detachment. Timings and frequency of re-detachment were noted and regression analysis for pre-dictive factors was carried out.

**Results:** The study comprised 355 eyes relayed to as many patients. Of the total, 239(67.30%) were males and 116(32.70 %) were females. Overall mean age was 43.29± 17.15years. Mean duration of silicone oil endotamponade was 5±1.34 months. Indications of injection were retinal detachment complicated by proliferative vitreoretinopathy in 290(81.69%) eyes and proliferative diabetic retinopathy in 65(18.31%). Retinal re-detachment was seen in 51(14.36%) cases. Among them, 15(29.41%) were seen on the table, and 40(78%) within the first 3 months. Duration of silicone oil tamponade, technique of removal, type of silicone oil used and number of previous surgeries had no predictive value on anatomical outcome ( $p>0.05$  each).

**Conclusion:** Re-detachment of retina is still a major clinical issue after the removal of silicone oil despite current advances in vitreoretinal surgery.

**Keywords:** Silicone oils, Retinal detachment, Proliferative vitreoretinopathy. (JPMA 69: 1822; 2019)

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### Introduction

Silicone oil (SO) has a well-established role in vitreoretinal surgery and is successfully used in the management of complicated retinal detachments (RD).<sup>1,2</sup> In order to minimise complications associated with long-term use, SO is removed once retinal status appears stable.<sup>3</sup> Removal of silicone oil (ROSO) is associated with serious complications that include re-detachment of retina, hypotony, expulsive haemorrhage, vitreous haemorrhage and unexplained visual loss.<sup>4,5</sup> Residual vitreo-retinal traction, especially at vitreous base and re-proliferations, are most likely reasons for retinal re-detachment. It is most commonly seen during the first 10 days post-ROSO, and is reported in 2% to 40% cases.<sup>6-11</sup> ROSO through pars plana by active method has been one of the commonest methods performed. Trans conjunctival sutureless vitrectomy (TCSV) is a safe and effective technique, which makes sutureless active and passive three-port ROSO possible, and obviates the need for conjunctival peritomy and stitching of scleral ports.<sup>12,13</sup>

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The current study was planned to review the frequency and timing of the re-detachment of retina post-ROSO and to discuss the risk factors for this still unresolved complication in vitreoretinal surgery.

### Patients and Methods

The retrospective study was conducted at one public-sector and one private-sector hospital in Karachi, and comprised data related to patients who underwent pars plana vitrectomy with silicone oil endotamponade for complicated retinal detachment and subsequent ROSO between 1996 and 2015. These surgeries were performed by a single surgeon at the Department of Ophthalmology, Dow University of Health Sciences, Karachi, and at the private-sector Hashmani Hospital, Karachi. Approval of institutional review boards was obtained after which data was collected. All patients had signed an informed consent form for the procedure and for permission to use data for scientific documentation. Using non-probability convenience sampling, all consecutive cases performed during the study period were included. The sample size calculation was carried out in line with literature.<sup>14,15</sup>

Medical records were reviewed for age, gender, ophthalmic history, preoperative and postoperative visual acuities (VAs), intraocular pressure (IOP), notes of

anterior segment and fundus examinations, and intraoperative or postoperative complications. Also noted were aetiology of complicated retinal detachment, number of prior vitreoretinal surgery, duration of tamponade, type of silicone oil used, type of primary pathology, active or passive method of ROSO, timing of re-detachment of retina and final anatomical status of retina at a minimum follow-up of six months.

Indications for performing ROSO were evidence of emulsification of SO (EOSO), persistent increased IOP on full medical treatment, presence of SO in the eye for more than 3-6 months and decreased vision postoperatively due to increasing lens opacities. Data related to patients with complicated retinal detachments secondary to proliferative vitreoretinopathy (PVR) and proliferative diabetic retinopathy (PDR), which are the two conditions commonly dealt with in practice. Patients with other pathologies causing complicated retinal detachments that needed SO injections were excluded. Only-eyed and high-risk patients and those with <5mmHg IOP were not encouraged for ROSO.

Surgeries were performed under general anaesthesia. In phakic eyes with lens opacities, cataract surgery with or without intraocular lens implantation was performed as combined procedure with ROSO. Scan ultrasound was performed to evaluate the status of retina in patient with media opacities prior to surgery.

After localised incision of overlying conjunctiva, 3 sclerotomy ports were made with 20G MVR knife through pars plana, 3-3.5mm from the limbus depending on the eye was phakic, pseudophakic or aphakic. Active aspiration, both for 1000cs and 5000cs SO, was carried out using Associate (D.O.R.C. International, Holland), Pulsar 2 (Optikon, Italy), Accurus/ Consetellation (Alcon Laboratories, Fort Worth, Texas, United States) vitrectomy machines. Binocular ophthalmoscope microscope (BIOM) wide-angle viewing system (Oculus, Inc., Wetzlar, Germany) was used from 2009 onwards. Complete ROSO was ensured with 3-4 spells of fluid-air exchange. Any epiretinal membrane (ERM) seen at the posterior pole as a result of peri-silicone oil fibrosis was removed in the course of the procedure. Vitreous base was inspected with external scleral depressor. Residual vitreous base, if present, was removed with vitreous cutter. Retina was inspected for its anatomical stability, and 2-3 rows of 360-degree intraoperative endo-photocoagulation were performed behind visible scars of the previous surgery in all cases as part of the procedure. At the end of the procedure, vitreous cavity was left half-filled with air. Sclerotomy ports and conjunctiva were then closed with 6/0 vicryl.

Passive ROSO was carried out by TCSV technique. For ROSO of 1000cs, SO used was 23G system and, for 5000cs SO, 20G TCSV non-valved cannulae (D.O.R.C. International, Holland) were used. SO egressed through two superior cannulae. Last bubble of SO was made to egress after temporary closure of one of the superior ports temporarily by trocar. The rest of the procedure was not different from what was done during active aspiration method except that at the end of the procedure no stitches were applied to either conjunctival or scleral ports.

In case of re-detachment of retina on table, repeat surgery was carried out that involved removal of visible proliferative tissues, and other necessary procedures including retinotomies and retinectomies (RR) whenever needed. SO was again used during the process of surgery in all the cases.

After ROSO, patients were followed on 1st postoperative day, after a week, after 1 month and then at 3-6 months' interval. On each visit best-corrected visual acuity (BCVA) and IOPs were documented. Anatomical status of retina, whether attached or detached, was noted in all patients. Minimum follow-up period was 6 months.

Data was analysed using SPSS 21. Numerical variables were expressed through means and standard deviations (SDs), and categorical variables were expressed by frequencies and percentages. Snellen's VA was converted to logarithm of minimum angle of resolution (Log MAR) for statistical analysis. Student's t-test and Pearson's Chi-square test were used for statistical analysis depending upon the nature of the independent variables. Regression analysis was carried out to study the predictive values of independent variables on the final anatomical status of retina.  $P < 0.05$  was considered statistically significant.

## Results

The study comprised 355 eyes relayed to as many patients. Of the total, 239(67.30%) were males and 116(32.70%) were females. Overall mean age was  $43.29 \pm 17.15$  years. Mean follow-up period was  $8 \pm 2$  months.

Table-1: Timings of 51 retinal re-detachments in 355 cases of removal of silicone oil (ROSO).

Timing	Number of Cases	Percentage	Cumulative Percentage
On table during ROSO	15	29.41	29.41
1st month	13	25.49	54.90
3 months	12	23.53	78.43
12 Months	4	07.84	86.27
Between 2 to 5 years	7	13.73	100
Total retinal re-detachments	51	100	100

Table-2: Complications in cases of removal of silicone oil (ROSO).

Complications	Number (%)
Dislodged cannulae	11 (03.10%)
Retinal re-detachment	51 (14.36%)
Intraoperative bleeding	09 (02.54%)
Expulsive haemorrhage	02 (00.56%)
Sub-conjunctival Haemorrhage	25 (07.02%)
Choroidal Detachment/Haemorrhage	06 (01.69%)
Hypotony	07 (01.97%)
Macular Pucker	13 (03.66%)
Persistent sub-macular fluid	02 (00.56%)
Optic atrophy	08 (02.25%)
Remnants for fine silicone oil bubbles	17 (05.35%)
Unexplained loss of vision	03 (00.84%)
Band keratopathy	06 (01.69%)
Secondary Glaucoma	41 (11.55%)
Rubeosis Iridis	04 (01.13%)
Phthisis bulbi	03 (00.84%)

Table-3: Regression Analysis Outcome Variable - Retinal Re-detachment in 355 cases of removal of silicone oil (ROSO).

Independent Variables	Odd's Ratio	95% CI	p Value
Age	1.001	0.983 - 1.018	0.949
Gender	0.947	0.501 - 1.793	0.868
Aetiology of retinal detachment, PVR or PDR	0.923	0.751 - 1.135	0.449
Number of previous vitreo-retinal surgeries	1.35	0.622 - 2.936	0.447
Duration of SO in the Eye	1.125	0.940 - 1.346	0.200
Active or Passive ROSO	1.088	0.925 - 1.279	0.308
Viscosity of SO, 1000 cs or 5000 cs	0.834	0.258 - 2.545	0.763

PVR: Proliferative Vitreoretinopathy

PDR: Proliferative diabetic retinopathy

SO: Silicone Oil

ROSO: Removal of silicone oil, Centri-stroke (cs).

Mean interval between SO injection and its removal was  $5 \pm 1.34$  months. Overall, 24(6.76%) patients had 2 or more prior VR surgeries. Mean number of VR surgery was  $1.08 \pm 0.33$ . Besides, 16(4.50%) eyes were aphakic, 54(15.21%) were phakic and 270(80.28%) were pseudophakic. Most common indication of SO injection was retinal detachment complicated by PVR in 290(81.69%) eyes and PDR in 65(18.31%) eyes. In 304(85.63%) eyes, 1000cs SO was injected and in 51(14.37%) eyes 5000cs SO was injected. Most common indication for ROSO was EOSO and secondary glaucoma in 193(54.37%) cases. Other indications of ROSO included duration of SO in the eye for  $>3-6$  months in 135(38.03%) patients and presence of cataracts 27(07.60%) in the siliconised eyes. ROSO was carried out by passive method in 189 (53.24%) cases; 115 (32.39%) by 23-gauge TCSV and in 74 (20.85%) eyes by 20-gauge TCSV. In 166 (46.76%)

cases, ROSO was carried out by active aspiration.

ROSO was combined with phacoemulsification with intraocular lens (IOL) in 35(9.86%), extracapsular cataract extraction (ECCE) with IOL in 12(3.38%), and lensectomies in 5(1.41%) cases. These included 27(07.60%) such eyes with cataract and 15(4.23%) with early lens opacities in patients aged  $>50$  years.

Mean preoperative Log MAR VA was 1.87 (SD  $\pm 1.07$ ), which improved to postoperative Log MAR VA's 1.35 (SD  $\pm 0.97$ ) ( $p=0.000$ ). The preoperative VAs of 20/200 or better in 141(39.71%) cases improved to postoperative VAs of 20/200 or better in 223(62.82%) cases ( $p=0.0000$ ). Mean preoperative and postoperative IOPs were 13 mmHg (SD  $\pm 5.24$ ) and 17 mmHg (SD  $\pm 6.02$ ) respectively ( $p=0.000$ ). Overall, 7(1.97%) cases had IOP of 5.0mmHg or less, and were defined as patients having hypotony, while (11.55%) had persistent raised IOP of 25mmHg or more after ROSO and were defined as secondary glaucoma.

Retinal re-detachment was seen in 51(14.36%) cases, and 15(29.4%) re-detachments were seen on the table during ROSO. These eyes were re-operated after relieving identifiable proliferative elements and SO reinjection of 5000cs in the same operating session (Table-1). Final retinal attachment after repeated surgery was achieved in 340(95.77%) cases, 8(2.25%) cases were surgical failure, and 7(1.97%) refused further intervention and were lost to follow-up (Table-2).

On regression analysis, independent variables did not show statistically significant predictive values (Table-3).

## Discussion

Complications such as glaucoma, cataracts and keratopathy are associated with use of SO and are partly related to length of time SO is retained in the eye.<sup>16-18</sup> In 1985 Gonvers<sup>16</sup> introduced the concept of SO as a temporary tamponade agent. Most physicians now aim to remove SO from eyes with attached retina with secure chorio-retinal scars without any evidence of traction on the retina on clinical examination.<sup>8</sup> Timings for ROSO have been variably reported from three to six months to one year in literature.<sup>7-10,12,13,16-18</sup> In the current study, patients were advised ROSO at 3 months. The relationship of re-detachment of retina with the duration of SO tamponade is not clear. Scholda et al.<sup>18</sup> showed relationship of re-detachment to shorter duration of SO tamponade. In other series there was no association between length of oil retention and incidence of recurrent retinal detachment after ROSO.<sup>4,5,19</sup> Mean duration of SO tamponade in our series was 5 months and it did not have any predictive value for retinal re-detachment (odds ratio [OR] 1.125; Confidence Interval

[CI]:0.940 - 1.346; p=0.200). Teke et al.<sup>20</sup> in 2014, Tavares et al.<sup>21</sup> in 2015 and Rhatigan et al.<sup>22</sup> in 2018 have reported similar observations.

Reported series in literature do not have a uniform technique for ROSO and vary from manual aspiration through pupil to two-port pars plana infusion and active manual or vitrectomy machine-assisted three-port aspiration.<sup>17,18</sup> Two-port and three-port pars plana techniques have been reported to have similar incidence of retinal re-detachments.<sup>23</sup> In the present series, ROSO was carried out by both active and passive methods through three-port pars plana surgery as both these methods are commonly used for ROSO.<sup>24,25</sup> ROSO by passive method is very cost-effective in resource-restricted country like Pakistan where reusable instruments are commonly used to reduce cost, especially in repeat surgeries.

The major complication of ROSO is retinal re-detachment, which has reported incidence between 2% and 40%.<sup>10,22</sup> The current study encountered re-detachments in 51(14.36%) cases. This is despite the fact that we applied 360° laser application intraoperatively in all cases as a part of the procedure. Laser photocoagulation has been reported to decrease the incidence of re-detachment after ROSO.<sup>5,13,26</sup> The figure of 51 (14.36%) re-detachments in this large study is close to figures reported for re-detachments in other large studies by Nagpal et al.<sup>19</sup> (12.7%) in 2012 and by Teke et al.<sup>20</sup> (13.2%) in 2014.

Possible mechanisms for re-detachment after ROSO could be opening of pre-existing breaks, occult retinal detachment or a new break formation.<sup>26</sup> In the current study, 27/189 eyes (14.29%) that had passive ROSO with TCSV technique developed re-detachments. Although this is not a comparative study, we did not see any significant difference in the group that had ROSO performed by active aspiration in which 24/166(14.46%) patients developed re-detachment of retina. On regression analysis, technique of ROSO, active or passive, did not have any predictive value on anatomical outcome (OR: 1.088; CI:0.925 - 1.279;p=0.308).

Re-detachments seem to be a complication of early postoperative period and are seen in the first 50 days in up to 75% cases.<sup>6</sup> Reason for rapidity of re-detachment might be persistent traction that had been counteracted by oil before ROSO.<sup>8,26</sup> Risk of re-detachment decreases steeply with increasing time and is unlikely after 3 to 5.5 months.<sup>6,8</sup> In the current study, 15/51(29.41%) re-detachments were seen on-table during ROSO, and 13(25.49%) in the first month postoperatively. At 3

months this figure increased to 40(78.43%). Seven (13.73%) re-detachments in our series were seen between 2 and 5 years. Time of retinal re-detachment is statistically independent of the method of silicone oil removal, refractive error, VA before silicone oil removal, type of anaesthesia, gender and age of patients.<sup>6</sup>

In our series age, (p=0.949) and gender (p=0.868) did not have any predictive value on anatomical outcome, and similar to findings by Nagpal et al.,<sup>19</sup> we did not find significant predictive value of numbers of previous VR surgeries on the outcome variable (p=0.447). Aetiology of retinal detachment has been reported as risk factor.<sup>20</sup> In our series, eyes with PVR (290) were far more than eyes with PDR (65). Although this risk factor has no significant predictive value (p=0.449) in the present study, its interpretation does not reflect our clinical impression of PVR being a higher risk factor. Although the present study pertains to common conditions of PVR and PDR,<sup>5</sup> we believe that these results could be applied to other clinical conditions in which SO is used. This includes complicated retinal detachments caused by trauma, viral retinitis, macular hole in highly myopic eyes, chronic and persistent macular holes, colobomatous retinal detachment, chronic uveitis with hypotony, in patients who have to be airborne and in patients who cannot maintain correct postoperative positioning, such as children, old, and mentally compromised patients.<sup>24,27</sup> Additionally, viscosity of SO used did not have any predictive value over anatomical outcome (p=0.763). This finding correlates well with literature.<sup>28</sup>

In terms of limitations, the retrospective nature of the study. It only reports ROSO in eyes that had SO injected in retinal detachments complicated by PVR and PDR. It is not a detailed comparative study comparing active and passive methods of ROSO. However, large number of cases, uniformity of the surgical skills, no predictive value of different techniques on outcome variable mentioned in the text are strong points for the generalisability of the study.

## Conclusions

Most of re-detachments occurred during the first 3 months postoperatively. None of independent variables studied had any influence on the anatomical outcome. Residual VR traction, especially at the vitreous base, and re-proliferations could be reasons for retinal re-detachment.

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**Conflict of Interest:** None.

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