Patient characteristics and outcome post silicone oil removal at Cicendo Eye Hospital April 2011 - March 2012

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ABSTRACT

Objective: To observe the patient characteristics and complications after silicone oil removal, in vitrectomized patients with SO as an internal tamponade.

Method: This study was designed for observational-descriptive of medical records vitrectomized patients with SO tamponade and subsequent removal in April 2011 to March 2012. Cases were classified into 2 groups between different viscosities (50 1300 cSt and 5500 cSt). Furthermore, each group was then evaluated by anatomic improvement (attachment or redetachment) and complication rates after SO removal (cataract formation, glaucoma, SO emulsification).

Result: The indications for the use of silicone oil were rhegmatogenous retinal detachment in 47 eyes (85.5%), 4 eyes (7.3%) were associated with proliferative vitreoretinopathy (PVR), 4 eyes (7.3%) had vitreous hemorrhage caused by AMD (1 eye) and 3 eyes had proliferative diabetic retinopathy with tractional retinal detachment. Silicone oil removal was done on average 118.87 days for SO 5500 cSt (range from 28 until 360 days) and average 116.25 days for SO 1300 cSt (range from 81 days until 185 days). After silicone oil removal, the retina remains attached in 50 (90.09%) of the eyes, 34% had visual acuity > 6/120 and 7.27 % had Intraocular Pressure (IOP) > 21 mmHg. Comparing 1000 cSt and 5000 cSt silicone oil-filled eyes, redetachment occurred more frequently in the latter group especially in cases with associated PVR.

Conclusion: Rates of anatomical success from this study was 90.09%, but redetachment was found in 9.09% eyes. Several complications were found after SO removal such as cataract formation, glaucoma and SO emulsification.

Keyword: Silicon oil removal, Vitrectomized eyes, Internal tamponade, Complication


INTRODUCTION

Silicone oil is the term used to designate a group of clear inert hydrophobic polymer compounds based on siloxane chemistry of varying viscosities. The length of the polymer determines the viscosity: the silicone oils in current use have viscosity: ranging from 1000 to 12500 cSt. Silicone oil has a refractive index of 1.4035, which is slightly higher than that of the vitreous (1.33). The use of silicone oil as a vitreous substitute was first described by Stone in 1958. Unlike other vitreous substitutes, silicone oil may remain in the eye almost permanently. It has a density of 0.975 – less than that of water – and thus floats on water in the vitreous. It is always found at the top of the vitreous cavity, so superior tears are easily and nearly always closed by silicone oil.

The interfacial tension of silicone oil is high (40 dyn/cm2), but less than that of the gas–water interface (70 dyn/cm2). For this reason, air is often used first to flatten the retina; then the air is replaced with silicone oil to provide a long-term internal tamponade. There is a controversy in ophthalmology about the preferred agent for intraocular tamponade in eyes with proliferative vitreoretinopathy. Recently, European vitreoretinal surgeons have preferred silicone oil, while vitreoretinal surgeons in the United States have preferred perfluoropropane gas.

The Silicone oil study group has published the results of a multicenter randomized controlled trial that compared gas and silicone oil in the treatment of severe PVR. Silicone oil has the advantage of being a permanent tamponade agent and recently further analysis of the silicone study has shown its use to be associated with a better visual prognosis in those with anterior PVR. Unfortunately, silicone oil has significant ocular complications such as cataract formation, glaucoma, perisilicone epiretinal membrane proliferation, emulsification, and keratopathy. These complications are partly related to the duration of intraocular exposure to silicone oil, and once complications appear removal of the oil may not necessarily lead to their reversal. Therefore, there are few hard-and-fast rules about the indications for the use of silicone oil. These will vary from patient to patient and from surgeon to surgeon.
Complications of Vitreous Substitutes

Tissue Toxicity—Silicon oil has been reported to be toxic to the retina and to extract lipophilic substances (such as retinol and cholesterol) from the retina, although many studies had failed to corroborate these findings. Perfluorinated oils and mixtures of silicon oil and perfluorinated oils have all been found to have significant retinal and ocular toxicity.

Cataract—All currently utilized vitreous substitutes, including gases and silicon oils have long been known to cause progression of cataract.

Glaucoma—Compounds that can emulsify can interfere with the function of the trabecular meshwork and lead to glaucoma. This is the second most common cause of vision loss known to occur with silicon oil.

Keratopathy—Chronic exposure of the corneal endothelium to silicon oil and related compounds is known to damage the endothelial cells and can lead to corneal decomposition, pain from bullous keratopathy, and blindness.

It is common practice to remove silicone oil after a period of time to reduce its well-known complications such as glaucoma, cataract, and keratopathy. Various surgical techniques have been described for silicone oil removal (SOR). The anterior or posterior approach is generally selected according to the lens status of the patient. Thus, the aim of this study was to evaluate the influence of a temporary silicone oil (SIO) tamponade on intraocular pressure (IOP), visual acuity, cataract formation, emulsification of SO, and PVR incidence after removal of SO tamponade.

METHODS

This study is observational descriptive study. The data obtained from medical record of vitreoretinal surgery patient at Cicendo Eye hospital from April 2011 to March 2012. Several vitreoretinal surgeries using silicone oil as a tamponade were included in this study. The cases then classified into 2 groups based on the viscosities of the SO (1300 cSt and 5500 cSt). Total amount of 55 patients participate in this study. Patients who did not come to control again after SO injection and incomplete patient’s medical record was excluded from this study.

RESULTS

There were 55 vitrectomized eyes with SO tamponade and subsequent removal SO from April’11 to March’12, included 37 male patients (67.3 %) and 18 female patients (32.7 %). The mean age of the patients at the time of surgery was 47.9 years old, with the range between 14 until 78 years old.

The silicone oil uses indication were found Rhegmatogenous Retinal Detachment in 47 eyes (85.5%), 4 eyes (7.3%) were associated with proliferative vitreoretinopathy (PVR), 4 eyes (7.3%) had vitreous hemorrhage caused by wet-Age Macular Degeneration, and 3 eyes had proliferative diabetic retinopathy with tractional retinal detachment. Prior to silicone oil removal, the retina was attached in all eyes, except two patients were diagnosed by retinal redetachment. Twenty nine percent had visual acuity (VA) ≥ 6/120 and 52% had IOP ≥ 21 mmHg. After silicone oil removal, the retina remained attached in 50 eyes (90.9 %), 34% had VA ≥ 6/120 and 7.27 % had IOP ≥ 21 mmHg. The final VA <6/120 was associated with initial VA< 6/120. There is no specific factor associated significantl with final IOP ≥ 21 mmHg. Comparing 1000cs (OR = 32.2 95%CI 7.4–140.2) and use of 5000cs silicone oil-filled eyes (OR = 7.9 95% CI 1.9–32.2).

This study found that silicone oil removal was done on average 118.87 days for SO 5500cSt (range from 28 until 360 days) and average 116.25 days for SO 1300 cSt (range from 81 days until 185 days). There is no significant difference in duration day of SO removal between 1300 cSt and 5500cSt.

Figure 1  Characteristics patients based on gender between SO1300 cSt and SO 5500 cSt
DISCUSSION

Early complications of silicone oil injection are primarily confined to the anterior segment and can be limited by preventing the anterior migration of oil. When such anterior migration is not prevented, irreversible silicone keratopathy occurs as often as 50% followed by an average of 8.5 months. Rate of anterior segment complications described in literature range from 34.5% to 100% regarding cataract formation, and from 1.5% to 27.7% regarding to elevated IOP. These results are comparable with our study findings (cataract formation were 30.9% and IOP elevation were 10%). Corneal abnormalities are relatively frequent complications associated with both silicone oil and extended gas tamponade.

Regarding these numbers, this study rates definitely unrepresentative within the lower segment (keratopathy: 1.8%) and this may be assumed caused by the anterior chamber IOL from the patients. Treatment for minimizing the incidence of post-operative keratopathy include maintaining a patent inferior peripheral iridectomy and early removal of silicone oil, particularly when found an silicone oil-corneal contact. Most of clinical studies suggest that long-term silicone oil tamponade is associated with cataract formation. One likely mechanism is impaired metabolic exchange across the posterior lens capsule. Another possible mechanism is direct toxicity of the oil itself. Faulkner, et al. found 64.7% cataract formation rates in silicone oil insertion. This results different with our findings (cataract formation 39.5%) and most of them were caused by SO 5500cSt. Silicone oil as a direct cause of cataract formation is a controversial issue that is difficult to evaluate.

Emulsification is considered as a complication of vitreous substitution surgery with silicone oil, since it has been demonstrated that once divided into small droplets, it may penetrate the sub retinal space, or migrate into the anterior chamber and contact the trabeculum meshwork and cornea, and this is possibly responsible for retinal toxicity, failed retinal detachment, keratopathy and glaucoma. In a study of 150 eyes with complicated retinal detachment, Lederman and Schubert found that emulsification of SO occurred in 1% of eyes at 1 month, 11% at 3 months, 85% at 6 months, and 100% at 1 year.

This study found that emulsification SO was occurred in 10 patients (18.8%), nine of them were emulsified SO to anterior chamber and only one had keratopathy caused by anterior migration of the silicone oil to the corneal endothelial.

![Figure 2](image-url) Visual acuity post SO removal between SO 1300 cSt and SO 5500 cSt

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Patient and Retinal Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
<td>SO 5500 (40 eyes)</td>
</tr>
<tr>
<td>Indication for surgery</td>
<td></td>
</tr>
<tr>
<td>Regmatogen retinal detachment</td>
<td>32</td>
</tr>
<tr>
<td>RRD + PVR</td>
<td>4</td>
</tr>
<tr>
<td>VH</td>
<td>0</td>
</tr>
<tr>
<td>TRD</td>
<td>2</td>
</tr>
<tr>
<td>RRD + TRD</td>
<td>2</td>
</tr>
<tr>
<td>SO removal (days/average)</td>
<td></td>
</tr>
<tr>
<td>Complication</td>
<td></td>
</tr>
<tr>
<td>IOP increasing</td>
<td>4 (10%)</td>
</tr>
<tr>
<td>Emulsification</td>
<td>6 (15%)</td>
</tr>
<tr>
<td>Cataract occurrence</td>
<td>13 (32.5%)</td>
</tr>
<tr>
<td>Redetached</td>
<td>4 (10%)</td>
</tr>
</tbody>
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From all subjects, 12 patients (21.8%) were already pseudophakic, 11 eyes had lens extraction at the time of SO removal, and three were already aphakic. Of the remaining phakic patients (29 eyes), 17 eyes (39.5%) developed some degree of lens opacities and subsequently requiring cataract surgery.

Four patients with SO 5500 cSt had IOP increasing at the time of presentation to this unit in association with prolonged insertion of silicone oil. Following silicone oil removal, intraocular pressure returned to the normal range on topical beta blockers only.

It found 10 patients (18.8%) had SO emulsification, nine of them was emulsified SO to anterior chamber and only one had keratopathy caused by anterior migration of the silicone oil to the corneal endothelial.
timing for the silicone oil removal still remain unknowns and recommendations range from 3 to 6 months of sustained retinal attachment. This is important for scheduling re-examination of the patients. Falkne, et al therefore recommended close meshed controls after silicone oil removal-post operatively, within the first week, every 2 weeks within the first 3 months, every 3-6 weeks within the following 3 months and afterwards every 6 months. This redetachment after silicone oil removal, can be discovered early and brought under control in time. Incompletely attached retina can be stabilized without silicone oil reinstallation by using extensive laser photocoagulation, encircling band, or intraocular gas tamponade.

The recent study found that silicone oil removal were done about 3 months (range 116 - 118 days), and retinal redetachment was found in 5 eyes (9.09%) which occurred varied from 33 days until 344 days after SO removal. Retarded patients more high in the SO 5500 cSt, probably caused by severe PVR. This results different from study conducted by Jonas, et al. which found 57 of 225 (25.3%) patients with retinal detached after removal of silicone oil. Proliferative Vitreo Retinopathy (PVR) is the major complication of retinal detachment surgery, remains an unsolved problem. Some authors have argued that silicone oil itself may contribute to the development of reproliferation.

There are several limitation in this study including : a) This is retrospective study that insufficient to measure the outcomes after SO removal patients; b) Unmeasured intraocular pressure with the standard equipment (tonometry shaetz or plantation Goldman) may bias our results; c) There were several drop out patients who didn’t controlled again after SO injection, then almost one third of SO removal patients from the data base conducted in this study.

CONCLUSION

Rate of anatomical improvement from this study was 90.09% (the retina remain attached in 50 of the eyes), but redetachment was found in 9.09% eyes. Several complications were found after SO injection such as: cataract formation, glaucoma, and SO emulsification. Based on literature and several studies, some authors recommend not to search for standard criteria for the timing of silicone oil removal, but to evaluate every single case individually. The underlying diseases in previous procedures determine the stability of the retina.

REFERENCES