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HIGHLIGHTS

Re-retinal detachment after silicone oil removal

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Factors having implications on re-retinal detachments after silicone oil removal

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Aim: To investigate factors having implications on re-retinal detachments (reRD) after silicone oil removal (SOR). **Materials and Methods:** A retrospective study of 412 eyes (with attached retina after vitrectomy with silicone oil for rhegmatogenous RD) which underwent SOR was conducted and were followed up for six months after SOR. They were studied for various factors like encirclage, 360° retinopexy, oil emulsification at the time of SOR, duration of oil tamponade and previous retinal surgeries prior to SOR with their implications on reRD after SOR. **Results:** Encirclage, 360 laser barrage, both, emulsification of oil ($P=0.021$, $P=0.001$, $P=0.001$, $P=0.001$, respectively) were associated with lower risks of reRD after SOR whereas duration of tamponade ($P=0.980$) was not. **Conclusion:** Factors like encirclage, 360 retinopexy, their combination, oil emulsification reduced the incidence of re RD after SOR whereas duration of tamponade does not have statistical significant correlation with re RD after SOR.

Key words: Silicone oil removal, encirclage, 360 retinopexy, oil emulsification, silicone oil tamponade

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Silicone oil is utilized as a temporary internal tamponading agent in the management of wide variety of vitreoretinal conditions. Silicone oil removal (SOR) is commonly performed during the postoperative course. One of the major complication of SOR is retinal re-detachment (reRD), the rate of which varies across literature from 5% to up to one third of all eyes undergoing SOR.^[1-4] In the previous decade, several authors have reported techniques and co-incidental factors which may reduce this incidence. However, several areas of ambiguity exist in the literature. For example, regarding encirclage, Jonas *et al.* supported the beneficial effects of an encircling band in reduction of re RD whereas Laidlaw *et al.* and Avitabile *et al.* reported no significant advantage of the encircling band on rates of re-detachment. Laidlaw *et al.* also reported a protective effect of 360° laser retinopexy by reduction in the incidence of re-detachment from 26% to 14%.^[5] The protective effect from a combination of these two techniques, i.e., encirclage and 360° laser retinopexy together has not been reported.

Because of its surface tension, silicone oil provides tamponade across the retinal surface.^[6] When the surface tension decreases the oil globule is emulsified into multiple small globules, which is reported in most cases by the end of 1 year.^[7] In this state it no longer serves the purpose of uniform adequate internal tamponade. On this basis we hypothesize that if retina is attached despite emulsified oil, it has better chances to remain so after oil removal.

These above mentioned factors (encirclage, 360° retinopexy, combination of encirclage and 360° retinopexy, emulsification of oil) and others such as duration of silicone oil tamponade and number of previous retinal surgeries are important to

study, to not only minimize the rates of re-detachment after SOR, but also to help in counseling a patient prior to SOR. This retro-prospective study on patients which underwent SOR was aimed to investigate the effects of these factors on the incidence of re-detachment after SOR.

Materials and Methods

At our center SOR is carried out any time after 4 months post vitrectomy with silicone oil tamponade, although the decision is individualized each time on the basis of the clinical picture.

Ethics committee

An approval of the institutional ethics committee was taken prior to beginning the study.

Subjects were enrolled between December 2005 and December 2008. Patients who had in the past undergone vitrectomy with silicone oil tamponade for rhegmatogenous RD and now were posted for SOR were included. The main conditions for inclusion were attached retinas and clear media which allowed retinal assessment at the time of SOR.

We excluded patients who had undergone vitrectomy with oil tamponade for indications other than rhegmatogenous detachment. Cases which required oil to be removed prior to 4 months of silicone oil tamponade were excluded. Further, data of patients who did not complete a minimum of six months follow-up were not included in the analysis.

Other details obtained from standardized case charts included demographics of the patients, results of the standardized ophthalmic examinations comprising visual acuity assessment, intraocular pressure measurements on noncontact tonometer, slit lamp bio-microscopy and indirect ophthalmoscopy. All details pertaining to the vitrectomy with silicone oil injection surgery, presence of encirclage, 360° laser retinopexy and presence of oil emulsification were recorded.

Patients were followed up on first postoperative day, one week, one month, three months and six months post-surgery.

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At each visit detailed ophthalmic checkup was carried out and the retina was assessed for its anatomical and functional status.

Surgical technique

All patient underwent silicone oil removal through a 3 port pars plana route (Alcon ACCURUS) using a wide angle visualization system by a single surgeon. Adjunct procedures like cataract extraction and membrane peeling if required was performed.

This was followed by fluid air exchange. In cases which had presence of emulsified silicone oil multiple fluid-air and air-fluid exchanges were performed to ensure complete removal of silicone oil globules trapped in the retroiridial plane.

Statistical analysis

Chi square test was used so as to find the statistical significance of the associations of the variables under this study with retinal detachment post SOR.

Table 1: Data of various variables under study

		%
Failed buckling for which vitrectomy with oil tamponade was performed	21	5.67
Encirclage (ENC) done as a part of buckling with vitrectomy	118	31.89
Total encirclages=ENC+failed buckling	139	37.56
Eyes without encirclage	231	62.43
360 endolaser retinopexy	267	72.16
Emulsified oil	162	43.78
Eyes without emulsified oil	208	56.21
Combination of encirclage with 360 retinopexy	118	31.89
Eyes without combination of encirclage and 360 retinopexy	252	68.10
Eyes with more than one surgery prior to SOR	23	6.21
Eyes with tamponade duration 3-6 months	162	43.78
Eyes with tamponade duration more than 6 months	208	56.21

Results

A total of 412 eyes were initially enrolled in the study of which 42 patients did not complete the minimum follow-up of 6 months. Thus 370 eyes were finally included in the study. The average preoperative visual acuity before SOR was 20/200 whereas the average visual acuity post SOR was 20/125. In this study the incidence of reRD after SOR was 47 out of 370 eyes (12.7%).

Patient demographics and study variables

Of the 370 eyes (296 males, 74 females) included in the study, 20 eyes were aphakic and 41 were pseudophakic. At the time of SOR 139 eyes (37.56%) had an encircling buckle and 267 (72.16%) had 360° laser retinopexy [Table 1]. 118 eyes had a combination of these two variables (27.12%). 23 of these 370 eyes had undergone prior retinal surgeries (buckling or vitrectomies) before the vitrectomy with silicone oil injection procedure. At the time of SOR, 162 eyes had silicone oil tamponade for less than six months (4-6 months) with a mean 224 days of tamponade. 208 eyes had tamponade of more than six months (6 months-1 year) with a mean of 302 days. 162 out of 370 eyes (43.78%) had emulsified silicone oil at the time of removal.

Relation between study variables and incidence of re-detachment following silicone oil removal

A. Presence of an encircling element

We found that presence of encircling element has a protective effect with regard to the re-detachment after SOR. 10 out of 139 eyes (6.42%) developed re RD in cases having an encirclage as compared to 37 out of 231 eyes (17.82%) not having an encirclage. This finding was statistically significant ($P=0.021$) [Table 2].

B. 360° laser retinopexy

360° laser retinopexy was also found to have a protective effect on the reRD rates post SOR. 24 out of 267 eyes (8.98%) having a 360° retinopexy developed reRD as compared to 23 out of 103 eyes (22.33%) where 360° retinopexy was not done, this finding was again statistically significant ($P=0.001$).

Table 2: Relation between the study variables and incidence of retinal re-detachment after silicone oil removal

Study factors (total cases 370)	ReRD N=(47 cases)	Risk in %	Chi-square	Odds ratio	95% C.I>
Emulsified oil (162 cases)	10	6.17	$P=0.001$ significant	0.30	(0.14,0.66)
No emulsification (208 cases)	37	17.78			
Encirclage (139 cases)	10	6.42	$P=0.021$ significant	0.41	(0.18,0.89)
No encirclage (231 cases)	37	17.82			
Endolaser retinopexy (267 cases)	24	8.98	$P=0.001$ significant	0.34	(0.18,0.67)
Endolaser to the breaks (103 cases)	23	22.33			
Encirclage with retinopexy (118 cases)	5	4.20	$P=0.001$ significant	0.22	(0.07,0.61)
Without the combination of encirclage with retinopexy (252 cases)	42	16.73			
>1 Surgery (23 cases)	5	21.79	$P=0.192$ not significant	2.02	(0.62,6.18)
1 Surgery prior to SOR (347 cases)	42	12.10			
Less than 6 months (162)	21		$P=0.980$ not significant	1.04	(0.54,2.01)
More than 6 months (208)	26				

- C. Combination of 360° retinopexy with encircage
When endolaser retinopexy and encircage were present in combination it was observed that 5 out of 118 eyes (4.20%) developed reRD as compared to 42 out of 252 eyes (16.73%) not having the combination of encircage with 360° retinopexy, this finding was again statistically significant ($P=0.001$), thus underlining the beneficial effect of combination of encircage with 360° retinopexy in prevention of reRD post SOR.
- D. Emulsified oil
Ten eyes out of 162 eyes (6.17%) with emulsified oil developed re RD as compared to 37 out of 208 eyes (17.78%) without emulsification. This finding being statistically significant ($P=0.001$) supported the idea of lesser incidence of re RD post SOR in the presence of emulsified oil.
- E. Duration of tamponade
Regarding the duration of tamponade it was observed that removal of silicone oil at less than six months (3-6 months) post vitrectomy was associated with 21 reRDs out of 162 eyes as compared to 26 reRD out of 208 eyes when SOR was performed after 6 months and this was not statistically significant $P=0.980$. This finding suggested that the duration of tamponade does not have a significant role to play in the prevention of reRD post SOR.

Discussion

We noted that at six months following SOR, 87.3% of eyes had attached retinas, which is similar to that reported by the silicone oil study group (86%)^[1] and also with other recent reported case series (72%-91%).^[2,3,5,8]

Presence of an encircling element has been shown to support the vitreous base, ensure meticulous removal of the peripheral vitreous during vitrectomy as well as decrease the traction at the vitreous base.^[4,9] Jonas *et al.* have put forth that absence of an encircling band is a significant risk factor in re-detachments following SOR. In their study they had performed encircage in cases of proliferative vitreoretinopathy. They have also proposed that absence of an encircling band in the absence of an inferior retinotomy may predispose to a retinal re-detachment since circumferential buckling of the equator may release slight traction on the remnants of the vitreous base, Avitabile *et al.*^[10] in their study found that encircage increases the time of surgery and causes distortion of the shape of the eye and axial lengthening and did not statistically reduce the rate of detachment after silicone oil removal.

360° retinopexy laser treatment may close occult breaks or may act as a fire break against the posterior migration of an anterior RD^[5] and reduce the incidence of retinal re-detachment.^[11,12] Avitabile *et al.*^[10] and Tufail *et al.*^[13] in their case series have found that retinal detachment after silicone oil removal can be prevented by 360° laser retinopexy.

In this study we have also looked into the combination of encircage and 360° laser retinopexy on the incidence of reRD. The combination of encircage and 360° laser retinopexy as a variable governing the incidence of reRD post SOR in the preoperatively attached retinas has been looked into for the first time.

Silicone oil acts as an internal tamponade by approximation

of the neurosensory retina to the retinal pigment epithelium. In the state of emulsification silicone oil may not serve the purpose of adequate internal tamponade. In the present study the emulsified oil as a variable in relation to the incidence of reRD post SOR was looked into for the first time. On the basis of results we hypothesize that if the retina is attached in the presence of emulsified oil then it is more likely to remain attached when the oil is removed.

We also observed that the duration of the tamponade did not seem to have an effect on the incidence of re RD after SOR ($P=0.980$). Our finding is similar to a few case series where in the timing of silicone oil removal did not seem to affect the anatomic success rate^[1,2,4,14,15] in contrast to Scholda *et al.*^[3] where in they found that a shorter duration of oil tamponade a risk factor for retinal re-detachment.

The strengths of our study are that it is the largest data reported for reRD post SOR in rhegmatogenous RD. The variables of encircage and endolaser retinopexy as a combination and presence of emulsification at the time of SOR was looked at for the first time. The limitation of our study was its partial retrospective nature.

Conclusion

There are no definite guidelines so as to make the decision of SOR in a way which will result in less incidence of reRD. While the surgeons differ in approach on the decision for silicone oil removal, trying to understand the prognostic factor will help in counseling of the patient and increase the predictability of the retinal status post SOR. In the present study, we have identified a subgroup carrying a high risk factor for retinal re-detachment post SOR. It seems that endolaser retinopexy, encircage and their combination, presence of emulsification at the time of SOR can predict lesser incidence of reRD after SOR. Duration of the tamponade did not seem to have a statistical significant correlation with retinal re-detachment after SOR.

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