

SHORT COMMUNICATION

The role of nystagmus in silicone oil emulsification after pars plana vitrectomy and silicone oil injection for complex retinal detachment

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PURPOSE. *The purpose of this study was to determine whether nystagmus has a role in silicone oil emulsification after pars plana vitrectomy and silicone oil injection for complex retinal detachment.*

METHODS. *A retrospective review was conducted of the clinical and operative records of eight eyes with nystagmus that underwent pars plana vitrectomy and silicone oil injection for repair of retinal detachment associated with proliferative vitreoretinopathy. Three male (37.5%) and 5 female (62.5%) patients were included in this study. The mean age was 36.4 years (range, 19 to 54 years) and the mean follow-up time was 18.3 months (range, 5 to 49 months).*

RESULTS. *Three eyes underwent combined lensectomy and vitrectomy. During the initial postoperative period, retinal attachment was obtained in 6 (75%) patients. Two of eight eyes required further surgery. Silicone oil emulsification occurred in all eyes to different degrees in the 1- to 3-month postoperative period. No inverse hypopyon was observed in any of patients. Three of eight eyes developed open angle glaucoma due to silicone oil emulsification before the silicone oil removal. In these patients, intraocular pressure was controlled successfully by medical therapy. Silicone oil removal was performed before the planned time because of early emulsification. After the removal of silicone oil, two of three eyes had established open angle glaucoma and medical therapy was maintained. After the removal of silicone oil, recurrent retinal detachment developed in two eyes and one of them developed phthisis bulbi.*

CONCLUSIONS. *Silicone oil emulsification may develop earlier than expected in patients with nystagmus who underwent pars plana vitrectomy combined with silicone oil injection. (Eur J Ophthalmol 2008; 18: 150-4)*

KEY WORDS. *Emulsification, Nystagmus, Silicone oil*

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INTRODUCTION

Nystagmus is a broad term for a variety of ocular tremors and defined as a repetitive and rhythmic movement of the eyes. Nystagmus can be congenital or acquired. Congenital nystagmus is a developmental anomaly of the central nervous system. Acquired nystagmus occurs as a result of disease of the inner ear, vestibular nerve, brainstem,

cerebellum, or cerebral centers for ocular function (1). After the underlying pathologic condition responsible for nystagmus has been identified and treated, nystagmus may persist (2).

Silicone oil has been used since the early 1960s in the management of complicated retinal detachments (3). It now has an established role in the treatment of rhegmatogenous detachments associated with proliferative

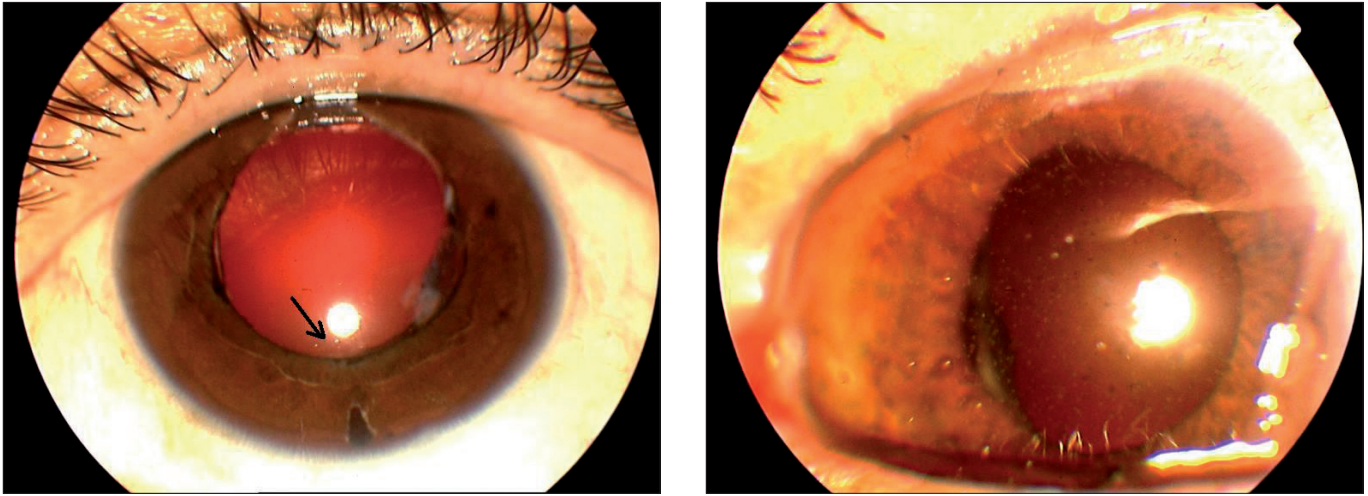


Fig. 1 - Emulsified silicone oil droplets are seen in the anterior chamber. The arrow indicates emulsified silicone oil droplets.

vitreoretinopathy (PVR), giant retinal tears, proliferative diabetic retinopathy, cytomegalovirus retinitis, and ocular trauma (4-8). However, the use of silicone oil is associated with emulsification, which can lead to vision-threatening complications such as silicone keratopathy and secondary glaucoma.

This study was undertaken to determine whether nystagmus has a role in silicone oil emulsification after pars plana vitrectomy and silicone oil injection for complex retinal detachment.

MATERIALS AND METHODS

A retrospective review was conducted of the clinical and operative records of eight eyes with nystagmus that underwent pars plana vitrectomy and silicone oil injection for repair of retinal detachment associated with PVR at Firat University Medical Center between 2001 and 2006. All surgeries were performed by one of the authors (T.Y.).

All patients underwent full pre- and postoperative dilated ophthalmologic examination, including visual acuity testing, applanation tonometry, lens grading, and funduscopic examination. Baseline PVR was graded according to the Retina Society classification system (9). All patients had congenital horizontal pendular nystagmus with different amplitudes.

All eyes underwent standard three-port pars plana vitrectomy with epiretinal membrane peeling under conventional plano-convex and wide-field panoramic visualization. A

2.5 mm encircling silicone band (No. 240 band, Mira[®], Inc., Waltham, MA, USA) was placed to support the vitreous base. A small amount of perfluorocarbon liquid (PFCL) (OFTADECAL NE[®], perFluoro Decaline, Tecno Instruments srl, Milano, Italy) was injected to flatten the posterior retina, allowing assessment of residual tractional elements and aiding removal of residual membranes as previously described (10). As the retina became increasingly mobile, additional PFCL was then injected up to the level of any anterior breaks, stabilizing the retina for peripheral dissection of anterior PVR. A lensectomy was performed if lens opacity was found to limit intraoperative visualization. Endophotocoagulation along the margin of the retinal breaks was then performed, followed by air-fluid exchange and injection of 1000 centistoke silicone oil (PDMS[®], Silicone oil, polydimethylsiloxane, M CROMED srl, Roma, Italy). In patients with aphakia, an iridectomy at the 6 o'clock position was performed.

RESULTS

Three male (37.5%) and 5 female (62.5%) patients were included in this study. The mean age was 36.4 years (range, 19 to 54 years) and the mean follow-up time was 18.3 months (range, 5 to 49 months). Three eyes underwent combined lensectomy and vitrectomy. During the initial postoperative period, retinal attachment was obtained in 6 (75%) patients. Two of eight eyes required further surgery.

Silicone oil emulsification occurred in all eyes to a different degree in the 1- to 3-month postoperative period (Fig. 1). No inverse hypopyon was observed in any patient. Three of eight eyes developed open angle glaucoma due to silicone oil emulsification before the silicone oil removal. In these patients, intraocular pressure was controlled successfully by medical therapy. Silicone oil removal was performed (between 3 and 6 months) before the planned time because of early emulsification. After the removal of silicone oil, two of three eyes had established open angle glaucoma and medical therapy was maintained.

After the removal of silicone oil, recurrent retinal detachment developed in two eyes and one of them developed phthisis bulbi.

DISCUSSION

Silicone oil, introduced into vitreoretinal surgery by Cibis and associates, has been used in the treatment of complex retinal detachments for many years (3). Silicone oil is a chemically stable material and does not undergo chemical modification in the human eye (11). It has been shown that silicone oil is superior to sulfur hexafluoride (SF_6) and comparable to perfluoropropane (C_3F_8) as a tool for retinal tamponade in cases with PVR (4, 12). The advantages of silicone oil are that it permits long-term retinal tamponade, promotes more normal intraocular pressure, reduces the incidence of rubeosis iridis by compartmentalizing the eye, permits earlier visual rehabilitation, does not require strict prone positioning after surgery, and allows air travel early after surgery (13).

The following complications are associated with the use of silicone oil: cataract progression, corneal decompensation, development of secondary glaucoma, fibrinoid reaction, hypotony, optic nerve and retinal toxicity, macular pucker, prolapse in the anterior chamber, and presence of subretinal silicone oil (12, 13). To reduce the risk of these complications, use of silicone oil has been suggested as a temporary endotamponade, with removal of the oil when it is no longer needed for attachment of the retina or inner homeostasis of the eye (14).

The term emulsification is used to describe tiny intraocular droplets of silicone oil. Emulsification of silicone oil has been reported in as few as 0.7% and in as many as 56% of oil-filled eyes (15, 16). Silicone oil emulsification is a key factor in the complications of silicone oil use as an in-

traocular tamponade. Silicone keratopathy, cataract formation, and silicone retinopathy have been attributed to silicone oil toxicity and its physiochemical properties (17). Silicone oil droplets generated by emulsification may enter the anterior chamber through an intact zonular framework and droplets have been found in the trabecular meshwork, iris, ciliary body, retina, and optic nerve (16). Silicone oil droplets can enter the anterior chamber angle and may lead to refractory glaucoma. Vision-threatening complications may result from silicone oil emulsification and may occur over a spectrum of the postoperative period; removal of oil may not reverse its toxic effects (18). The mechanism of silicone oil induced toxicity remains unclear (17).

Emulsification is defined as a dispersion of fine liquid particles in another liquid medium and results from shearing forces between the two mediums, causing droplets to be pinched off into the other medium due to surface tension (19). Droplets start at the interface of the two liquids and give rise to an emulsion (19). Low molecular weight components such as phospholipids, proteins, and ions are likely to influence the emulsification process; however, their role in vivo is not known (18).

Emulsification of silicone oil when used as an ocular endotamponade is an event that is not unknown but differs in frequency and severity from product to product, patient to patient, surgery to surgery, center to center, and time to time (20). Viscosity and purity of silicone oil, surface tension agents, and fraction of silicone oil also affect the emulsification (11, 21). The period of emulsification can also be affected by inflammation, the presence of liquified vitreous, hemorrhage, damage of blood-retina barrier, and aphakia (22). There were some contributory factors to emulsification in our five cases. Two cases had retinal re-detachment and three were aphakic. The significance of these contributors could not be evaluated properly because of the small number of cases.

For the emulsification to progress, kinetic energy is required and may be counteracted by surface agent stabilizers (17). Previous studies have examined the effects of mechanical energy on emulsification: vortex-shaking and rotational orbital shaking (21, 23-25). Continuous kinetic energy input has been reported to further segregate the droplets, as confirmed in studies by increasing emulsification with duration of phacofragmentation (26, 27). Studies emphasize that characteristics of the kinetic energy influence the emulsification. Therefore the type and the speed of the nystagmus may also influence the emulsification of

silicone oil. In our study, the relationship between these parameters and the start of emulsification was not analyzed statistically because of insufficient data.

The beginning of emulsification of silicone oil has been reported in some studies at 4.3 to 5 months (28, 29). It was reported that emulsification could begin after a period of 2 months in cases with retinotomy (24). In our patients, silicone oil emulsification occurred in all eyes to different degrees between 1 and 3 months postoperatively. The tamponade effect of emulsified silicone oil is reduced because of the change in the surface tension (22). Therefore early emulsification of silicone oil may reduce the achievement of the surgery in these patients. On the basis of our findings the removal of silicone oil should not be delayed in patients with nystagmus because silicone oil emulsification may occur before a period of 4 months. We thus conclude that silicone oil emulsification may occur earlier than expected in patients with nystagmus who underwent pars plana vitrectomy combined with silicone oil injection. Our study has some limitations. The number of patients

included in the study was relatively small. We preferred low viscosity silicone oil (1000 cs) in the surgery because of easier surgical handling and removal from the vitreous cavity. We do not know the role of nystagmus in high viscosity silicone oil (5000 cs) emulsification.

In conclusion, our data suggest that patients with nystagmus who undergo pars plana vitrectomy combined with silicone oil injection must be followed carefully due to silicone oil emulsification. Silicone oil removal in these patients must be carried out earlier than in patients without nystagmus.

Proprietary interest: None.

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