Silicone oil emulsification in the anterior chamber after vitreoretinal surgery

Dennis J. Light, O.D.

Department of Veterans Affairs, Eastern Colorado Health Care System Eye Clinic, Pueblo, Colorado.

Abstract

BACKGROUND: The use of silicone oil as an endotamponade for the treatment of complicated retinal detachment is common, but long-term complications can occur if the oil is not removed later. This article documents a case of emulsified silicone oil migration into the anterior chamber after vitreoretinal surgery and provides a discussion and review of common anterior segment complications from this condition.

CASE REPORT: A 59-year-old man reported to the eye clinic complaining of a “growth” over his right eye that had increased in size over the last month. Slit lamp examination found a “reverse pseudohypopyon” in the right eye, which was actually emulsified silicone oil that had migrated from the posterior chamber after a previous retinal detachment repair. The patient was referred for surgical removal of this oily obstruction. Although surgical treatment was delayed for 18 months, his vision improved and his intraocular pressure was lowered through surgical and medical management.

CONCLUSIONS: The use of silicone oil as an endotamponade in cases of complex retinal detachment has become common, but it also may lead to postoperative complications if it is not surgically removed later. This case highlights possible complications from the migration of emulsified silicone oil into the anterior chamber and illustrates the importance of follow-up care for every ophthalmic surgical procedure.

Optometry 2006;77:446-449

The use of silicone oil in complex vitreoretinal surgery was first introduced in 1962. Its injection into the vitreous cavity to serve as an endotamponade has become a standard technique and, when combined with vitreoretinal surgery, has been used successfully in the repair of proliferative vitreoretinopathy, proliferative diabetic retinopathy, giant retinal tears, and ocular trauma. Silicone oil has been known to emulsify and migrate into various locations within the globe. Because this can lead to long-term complications, such as corneal decompensation, cataract, and glaucoma, it should be removed after adequate duration of endotamponade.

Case report

A 59-year-old man reported to the eye clinic complaining of a “growth” over his right eye that had increased in size over the last month according to his wife’s observation. He denied any asthenopia but reported that he “had very little vision” in this eye and that “it might have gotten a little worse.”

His medical history included a 35-year history of type 2 diabetes mellitus for which he had taken insulin for the last 15 years. His last A1C hemoglobin test, a measure of the...
Grade 3+ clear sclerosis O.D. and grade dense vitreous debris and hazy O.D. were present. Intraocular pressures by Goldmann applanation tonometry were 18 mmHg O.D. and 13 mmHg O.S. at 10:02 A.M.

Figure 1. A "reverse pseudohypopyon" of emulsified silicone oil droplets in the superior anterior chamber.

amount of glycosylated hemoglobin in the blood and a good estimator of how well the diabetes has been managed over the previous 3 months, was 8.7%. He also had hypertension, rheumatoid arthritis, hyperlipidemia, chronic lower back pain, kidney stones, gallbladder disease, and depression. His medications included insulin novolin, rosiglitazone maleate, and metformin HCL for his diabetes; lisinopril, cyclobenzaprine HCL, hydrochlorothiazide, and metoprolol for his hypertension; gemfibrozil for his hyperlipidemia; and amitriptyline HCL for his depression. He reported no allergies.

Biomicroscopy showed clear and quiet conjunctival tissues OU. The cornea was clear without edema or endothelial striations OU. In the right eye, there was a globule of silicone oil occupying 40% of the superior anterior chamber that would move slightly with head tilt to either shoulder (see Figure 1). The globule filled the entire superior anterior chamber and contacted the corneal endothelium and the anterior iris. It was composed of multiple, small, semifluid oil droplets that gave a "rock candy" appearance to the globule. Gonioscopy findings showed the angle open to the ciliary body inferiorly O.D., but there was no view through the globule to the superior angle. His irides were normal, with no rubecula or indotomous present in either eye. Grade 3+ nuclear sclerosis O.D. and grade 1+ nuclear sclerosis O.S. were present. Intraocular pressures by Goldmann applanation tonometry were 18 mmHg O.D. and 13 mmHg O.S. at 10:02 A.M.

Dilated fundus examination findings were remarkable for dense vitreous debris and haze O.D. Because of the cloudiness of the media, a limited view of the fundus was available O.D., and unfortunately, fine retinal detail could not be viewed. A red reflex was present in all quadrants.

This patient had emulsified silicone oil in the anterior chamber of the right eye after retinal detachment repair 1 year previously. He was referred to a vitreoretinal specialist for evaluation and surgical removal of the emulsified silicone oil. The decision to remove the emulsified silicone oil surgically was based on the patient's desire to improve his cosmetic appearance (remove "the growth"), improve the reduction of visual acuity, decrease the elevated intraocular pressure, remove the presence of corneal touch, and remove the cataract.

Unfortunately, this patient had unstable angina associated with poorly controlled hypertension causing him to cancel his surgical procedure. He returned for care 1 year later, and at that time his vision had decreased to light perception O.D., and his intraocular pressure had risen to 28 mmHg O.D. He was prescribed 0.2% brimonidine tartrate twice a day O.D., which lowered the intraocular pressure to 18 mmHg O.D.

His surgery was delayed again after he suffered a transient ischemic attack that warranted further cardiac and carotid artery evaluations. Six months later, however, he underwent successful surgical removal of the silicone oil O.D. with phacoemulsification and posterior chamber intraocular lens implantation. One day postoperatively, vision had improved to 4/160 O.D. Although there was considerable corneal edema likely from endothelial cell loss and dysfunction from the silicone oil contact. His intraocular pressure was 13 mmHg O.D. Fundus examination findings showed extensive panretinal photocoagulation with areas of fibrosis, attenuated vessels, ghost (sclerotic) vessels, and moderate optic nerve pallor O.D. Believed to have resulted from previous diabetic optic neuropathy.

At his 6-month postoperative visit, vision had improved to 20/150 O.D. The cornea O.D. continued to show mild edema without endothelial striation. The posterior chamber intraocular lens implant O.D. was centered and clear. The intraocular pressure was 16 mmHg O.D. on 0.2% brimonidine tartrate bid.

Discussion

Silicone oil often is placed in the vitreoretinal cavity as an aid in the repair of proliferative vitreoretinopathy, proliferative diabetic retinopathy, recurrent retinal detachments, giant retinal tears, macular hole, viral retinitis, and traumatic retinal injuries. It has a density lower than water and much greater surface tensions, making it an effective intraocular
The use of silicone oil as a tamponade has a few advantages compared with long-lasting gases used for similar purposes. Unlike the gas-filled eye, which leaves the patient with no useful vision, silicone oil is transparent (it does not mix with intraocular fluids or blood) and permits the patient to see after proper refraction. The use of silicone oil eliminates the need for face-down positioning during healing, and it allows for high altitude and air travel (gas expands at higher altitudes). Perhaps its biggest advantage is that it does not dissolve, allowing for longer-acting tamponade in the repair of very complicated retinal detachments.

This permanence of silicone oil in ocular tissue has associated risks. Over time, silicone oil has a tendency to emulsify and break into smaller oil droplets, which have a propensity to leak through very small openings. The droplets may egress surgical incision sites or migrate through anatomically compromised areas such as through broken zonules. Migration has been observed in phakic, aphakic, and pseudophakic eyes, and has been documented from eyelid to optic nerve. Emulsification of silicone oil to some degree has been reported to occur in 56% to 100% of cases over a period of months to years. Multiple factors may contribute to silicone oil emulsification, including the use of low viscosity silicone oils (higher viscosity oils restrict mechanical emulsification), residual fluid in the vitreous cavity, and hemorrhage or leakage of other blood constituents from the breakdown of the blood-aqueous barrier after surgery. Anterior segment complications associated with the use of silicone oil include alterations of corneal structure or integrity, increased intraocular pressure, and development or progression of cataract.

Silicone oil is toxic to the cornea. Specular microscopic studies have shown the main corneal complication to be endothelial cell damage including decreased cell density, pleomorphism, and necrosis. If allowed to enter the anterior chamber, silicone oil will eventually lead to corneal endothelial cell damage, edema, or band keratopathy. Rates of keratopathy after silicone oil injection have been reported to range from 4.5% to 63%. As seen in this case report, corneal edema may not always be present on initial presentation, even if there is significant corneal touch and presumed endothelial damage. Silicone oil in the anterior chamber may act as a physical barrier and interfere with corneal homeostasis. When the oil is removed later, damaged endothelium may allow for excess stromal hydration and lead to corneal edema.

The prevalence of elevated intracocular pressure after silicone oil injection has been reported to range from 1.5% to 48%. Silicone oil in the vitreous cavity may push the iris or lens forward resulting in pupillary block or direct angle obstruction. Emulsified silicone oil also may fill the anterior chamber, infiltrate the trabecular meshwork, and increase the aqueous outflow. Outflow in this case is affected initially through direct obstruction, although histologic studies have shown that silicone damages the outflow pathway with a loss of cellularity and fibrosis. Foreign body granuloma containing macrophages laden with oil also may develop. Clinically significant increased intracocular pressure after silicone oil injection usually can be controlled by topical antiglaucoma medications and is reversible in most patients after oil removal.

By preventing the anterior migration of silicone oil from the vitreous cavity, the risk of damage to the cornea and development of elevated intracocular pressure can be reduced. A prophylactic inferior peripheral iridotomy may be placed at the time of silicone injection. The buoyancy of the silicone oil coupled with the inferior placement of the iridotomy encourages a natural flow of aqueous from the posterior chamber into the anterior chamber. This helps prevent pupillary block and indirectly limits the access and migration of silicone oil into the anterior chamber.

Cataracts can develop in nearly all eyes in which silicone oil remains in situ for a few months, and up to 60% of lenses that appear relatively clear at the time of silicone oil removal will also develop a clinically significant cataract after 2 years. Obstruction of normal metabolic exchange at the silicone-lens interface results in cataract formation. Cataract formation may be delayed by the early removal of silicone oil, but it is considered to be almost unavoidable.

The reported incidence of alterations to the corneal structure or integrity, increased intraocular pressure, and cataract progression show a varied range of occurrence. This variation can be attributed to a number of factors including sample size, viscosity of silicone oil used, the duration of silicone oil endotamponade, the presence of inferior iridotomy, and previous surgical history.

Surgical removal of silicone oil significantly increases the likelihood of improved visual acuity and reduces the risk of keratopathy, secondary glaucoma, and cataract progression. The timing of silicone oil removal remains controversial, but in most cases, removal is recommended 2 to 3 months after surgery or as soon as a stable retinal situation is achieved. This can be difficult to assess. Clinical signs include a quieting of inflammation, a whitening of any epiretinal membrane formation, and, most important, a lack of change in the appearance or configuration of the retina. Contraindications for removal are unclear but include the presence of profound hypotony. In any case, there is an increased risk of retinal detachment after oil removal. Most retinal redetachments occur within the first 3 months after removal of silicone oil. Six months after oil removal, a retinal redetachment becomes unlikely.

Summary

The use of silicone oil as an endotamponade in cases of complicated retinal detachment has become increasingly...
common, but it has been associated with alterations to the corneal structure or integrity, increased intraocular pressure, and cataract progression. Surgical removal of the silicone oil reduces the risk of these complications and significantly increases the likelihood of improved visual acuity. Removal is recommended as soon as the tamponade effect is no longer needed. This case shows the importance of follow-up care for every ophthalmic surgical procedure. The optometrist should be familiar with the technique and materials used during ophthalmic surgery and be aware of the clinical signs of potential complications.

Acknowledgments

The author acknowledges Robert Newcomb, O.D., Gregory Kiracofe, O.D., and Wilbur Meiklejohn, O.D., for their contributions to this case report.

References