A modified air-assisted silicone oil removal from the anterior chamber

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Abstract:
Silicone oil (SO) is a commonly used tamponading agent in retinal detachment surgeries. Inadvertent anterior migration of SO and complete anterior chamber (AC) oil fill in an aphakic or pseudophakic eye is occasionally encountered. This can cause secondary glaucoma with very high intraocular pressure and pain. In this scenario, an urgent silicone oil removal (SOR) is warranted. Since SO is buoyant, in the supine position, it tends to rise anteriorly. Hence, removal of SO trapped in the AC will invariably lead to further migration of oil from the posterior segment into the AC to replace the volume removed. Simultaneous replacement of AC volume is necessary to prevent this. We describe a modified technique of partial SOR that employs air to prevent recurrent migration of SO into AC.

Keywords:
Oil removal, secondary glaucoma, silicone oil

Introduction

Complex retinal detachment surgeries need silicone oil (SO) tamponade for a longer duration. The migration of SO into the anterior chamber (AC) is a known complication. It may occur in cases of aphakia or in cases with inadequate capsular or zonular support. SO in AC can cause corneal decompensation and secondary glaucoma. The management of secondary glaucoma in an aphakic eye filled with SO following a complex retinal detachment surgery has been a daunting task for vitreoretinal surgeons due to various reasons. At times, it can even be an emergency if the AC gets completely filled with SO, resulting in very high intraocular pressure (IOP) with severe pain. Complete silicone oil removal (SOR) can alleviate pain and reduce IOP but can increase the risk of retinal redetachment, especially if this happens in the early postoperative period. Partial SOR from the AC is a promising alternative; however, the existing techniques may not prevent recurrent migration of SO into AC. We suggest a modified technique of partial SOR from the AC, which not only removes SO from AC but also prevents migration of SO into AC and, at the same time, poses no additional risk of retinal redetachment.

Surgical technique

Under aseptic precautions, two small side port incisions are made at 10 and 2 clock positions. The tip of an AC maintainer is connected to the 2-clock side port. The other end of it is connected to the infusion tubing from the vitrectomy machine (Constellation, Alcon, US). Once the tip is seen in AC, filtered air with an infusion pressure of 40 mmHg is allowed to flow through the tubing and enter the AC. The other side port is used for partial SOR using an extractor. The maximum suction pressure is kept at 600 mmHg and controlled in a linear fashion. As SO is removed from one side port, air fills the AC from the other side port [Figure 1]. This prevents further undue migration of SO into the AC from behind. Once most of the SO is removed from the AC, the cannula of the extractor syringe is carefully moved...
to a peripheral location of AC to completely remove the final remnants of SO [Figure 2]. The air infusion pressure can be increased to 50 mmHg for a while, and a blunt cannula or a spatula can be used to depress the lower lip of the side port incision to evacuate the final remnants of SO [Supplementary Video 1]. An inferior peripheral iridotomy (PI) can be made, or an existing PI can be enlarged in an air-filled AC if needed. The next important step is to secure the side port with 10-0 nylon sutures to avoid any air leak. Facedown positioning is recommended for a week following the procedure.

Results

We have performed this technique in five patients. All our patients were aphakic. The mean IOP at the time of presentation was 52 ± 4 mm Hg, and the mean IOP on the 1st postoperative day was 23 ± 3 mmHg. The mean follow-up period was 5 ± 1 month. There has been no recurrent migration of SO into the AC till the last follow up visit. The retina was found to be attached at the last visit in all five patients.

Discussion

SO is widely used as a tamponading agent in retinal detachment surgeries. It is generally removed after 3–6 months following the primary surgery. However, it is retained for a longer duration in complex cases. Despite postoperative prone positioning and usage of heavy molecular weight silicone tamponade, SO can, at times, migrate into AC through the pupillary aperture in an aphakic or pseudophakic eyes without adequate capsular support. Small SO bubbles may not cause any significant rise in IOP, but a larger bubble can cause rise in IOP owing to trabecular meshwork blockade. The risk of secondary glaucoma is especially high if SO is emulsified. Inferior PI is routinely performed along with the primary vitreoretinal surgery when SO is expected to enter AC and cause secondary glaucoma. The rationale behind inferior PI is to provide maximum chances for aqueous to enter AC as SO tends to float upward and fill AC from the superior aspect. However, if the AC is completely filled with SO, even an inferior PI may not help in establishing an aqueous outflow path. Patients present with the sudden rise of IOP to very high levels with severe pain. It is an emergency, which necessitates SOR, either complete or partial. Complete SOR through pars plana approach followed by a refill of SO may alleviate pain and reduce IOP, but it may also increase the risk of retinal redetachment, especially if this happens in the early postoperative period. Partial SOR from AC is a promising alternative, but the existing techniques may not fully serve the purpose. Douglas et al. used viscoelastic material to evacuate SO through a 12-o clock side port as an outpatient procedure. However, the retained viscoelastic material can cause inflammation and increase in IOP. Karaca et al. suggested that polyacrylamide can be safely retained in AC as a viscoelastic to prevent SO migration into the AC. Soliman and Smiddy used a large bore 19 gauge needle to passively evacuate SO; however, the procedure cannot ensure complete SOR from AC and cannot prevent further migration of SO into the AC. Lee et al. used air infusion and active aspiration to remove SO from AC. However, the authors also used fluid and viscous material to remove the final remnants of SO from AC. The 30-gauge (G) cannula with an infusion pressure of 25 mmHg may not maintain the chamber adequately. Any fluid/viscous material, if used through AC to evacuate SO may seep through the zonules and enter the posterior segment, thereby increasing the risk of retinal redetachment.

In our modification, we use an AC maintainer instead of a 30G needle with an infusion pressure of 40 mm Hg, which maintains the chamber very well and also mechanically pushes the SO toward...
the extractor port. Simultaneous replacement of AC volume as SO is removed from the eye is essential to prevent continuous migration of SO into the AC from the posterior segment. In doing so, we have found that it would be prudent to use air flowing in through an AC maintainer to replace the evacuated SO as the dynamic properties of air are best suited for this maneuver. First, the high surface tension of air ensures that the entering air stays as a single bubble in the AC and does not break up into multiple small bubbles, which may then migrate behind the pupil. Second, the air being lighter than SO tends to stay above SO in the supine position of the patient on the operating table, unlike balanced salt solution or viscoelastic material, which have higher specific gravity than SO and may slip behind the SO bubble. Third, the lesser viscosity of air and higher flow through a larger bore AC maintainer (in contrast to a smaller bore 30 G cannula) ensure that the process of volume replacement is near-instantaneous and thus there is the prevention of SO migrating anteriorly from the posterior segment.

Further, to remove the final remnants of SO, which tend to escape from the extractor port, we move the position of the extractor port to the periphery and increase the air infusion pressure to 50 mm Hg for a while, which helps in removing it effectively. We believe AC stability is better achieved in our modification. This greatly aids in protecting corneal endothelial cells. Furthermore, in our modification, near complete evacuation of SO from AC is achieved without using any fluid or viscous material. Air leak at the end while removing the AC maintainer can be avoided by preplaced sutures. Kymionis et al. have reported that Descemet membrane detachment (DMD) is a rare complication following SOR from AC.[5] However, in our case series of five patients, we did not have DMD or any other significant corneal problems. Endothelial cell loss due to SOR from AC is a known complication, which ranges from 7% to 14%.[6,7] The complications and long-term effects of SOR from AC need to be evaluated in a larger case series with longer follow-up periods.

To conclude, the use of air entering the AC through a self-retained AC maintainer with the simultaneous aspiration of SO from the AC is a safe and effective method to restore the AC, relieve the pupillary block and to treat secondary glaucoma while ensuring minimal disturbance in the posterior segment without any compromise on the retinal status.

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Conflicts of interest
There are no conflicts of interest.

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