CASE REPORT

Silicone oil pupil block glaucoma in a pseudophakic eye

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SUMMARY

Intravitreal silicone oil achieves an effective endotamponade in patients with complex retinal detachments. Silicone oil displacement into the anterior chamber risks glaucoma and endothelial failure. We describe a 52-year-old patient with pseudophakia with silicone oil endotamponade presenting with visual loss and intraocular pressure of 60 mm Hg. Inferior YAG iridotomy was undertaken to repatriate silicone oil to the posterior segment. Despite normal intraocular pressure, acute corneal oedema occurred postiridotomy, resolving spontaneously over 2 weeks. Pupil block glaucoma secondary to silicone oil requires a management approach based on an understanding of silicone oil fluidics. Careful selection of inferior laser iridotomy site is critical to effectively reverse pupil block. Anterior migration of silicone oil in patients with pseudophakia is rare. We offer an hypothesis to explain unanticipated transient corneal oedema following silicone oil displacement from the anterior chamber. Clinicians must discuss the possibility of transient or permanent endothelial failure preoperatively in this patient group.

BACKGROUND

Intravitreal silicone oil injection creates an effective endotamponade in patients with complex retinal detachments involving proliferative vitreoretinopathy, advanced diabetic retinopathy and giant retinal tears.¹ Silicone oil displacement into the anterior chamber risks complications: glaucoma, corneal endothelial failure and cataract formation.² We present a rare case of acute pupil block glaucoma in a pseudophakic eye with silicone oil endotamponade.

CASE PRESENTATION

A 52-year-old man presented with a 4 h history of reduced vision and severe pain in his left eye. He suffered left-sided blunt ocular trauma 40 years previously. A year prior to presentation he had undergone uncomplicated left phacoemulsification surgery with intraocular lens implantation, and 4 months previously had undergone pars plana vitrectomy, with silicone oil endotamponade and 360° scleral buckle. Prior to the vitrectomy procedure, he had presented with a 3-month history of visual loss with visual acuity of 6/60 OS. Fundal examination revealed chronic total retinal detachment with proliferative vitreoretinopathy preoperatively. Increasing numbers of silicone oil bubbles had been documented from the second postoperative week, progressively accumulating in the anterior chamber. They eventually coalesced to form a single bubble during the third postoperative month.

Visual acuity on this acute presentation, 4 months following pars plana vitrectomy, was 'no perception of light'. There was a left relative afferent pupillary defect, circumciliary injection, corneal oedema with intraocular pressure (IOP) of 60 mm Hg. Acetazolamide 500 mg intravenously and 500 mg orally, timolol 0.5%, dexamethasone 0.1% and pilocarpine 2% were administered. The following day, visual acuity improved to 'counting fingers'. Corneal oedema had resolved and IOP was 30 mm Hg (figure 1A, B).

Silicone oil pupil block glaucoma was diagnosed. An inferior nd:YAG laser peripheral iridotomy was performed within an iris crypt superior to the junction of oil meniscus with corneal endothelium in a region of formed anterior chamber. Immediate superior displacement of silicone oil was noted with aqueous migrating inferiorly through the iridotomy, forming the anterior chamber and breaking pupil block (figure 1C, D). Frequent topical dexamethasone was started with cessation of ocular hypotensive drugs.

The patient suffered no ocular pain overnight, but vision had dropped to 'hand movements' the following morning. IOP was measured at 15 mm Hg OS. Generalised corneal oedema was present with Descemet's membrane folds. The configuration of silicone oil and aqueous within the anterior chamber remained unchanged (figure 2A).

Two weeks later, visual acuity had improved to 6/36, equivalent to recorded visual acuity following retinal detachment surgery. IOP was 5 mm Hg, without ocular hypotensive agents. Corneal oedema had resolved (figure 2B). Gonioscopy revealed evidence of inferior angle recession secondary to significant blunt trauma (figure 2C), but no peripheral anterior synechiae, or evidence of silicone oil emulsification was identified. The silicone oil endotamponade was maintained and the patient remained under ophthalmic follow-up.

DISCUSSION

Silicone oil is intended to remain within the vitreous cavity creating an effective retinal endotamponade.¹ Silicone oil biocompatibility relies on aqueous occupying the anterior chamber, preventing corneal endothelial toxicity and glaucoma.³ The integrity of the zonular/capsular bag complex and high surface-tension of silicone oil prevents its anterior migration, independent of posture.⁴ Silicone oil has a lower specific gravity than aqueous humour (5000 centistokes silicone oil=0.98; aqueous=1.002–1.004)⁵; when occupying the same cavity, aqueous will always remain dependent. Damage to the zonular/capsular bag complex introduces communication between the

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Figure 1 Anterior segment photographs of patient with silicone oil pupillary-block glaucoma. (A) Circumciliary injection is present with mild chemosis and conjunctival recession from previous circumferential buckle surgery. New vessels are evident on the superior and inferior iris (white arrow). The cornea appears clear. The patient is pseudophakic; the anterior capsulorrhexis margin is demonstrated superiorly. There is a central, circular interface of silicone oil seen within the anterior chamber centered on the pupil (margin is defined by white arrowheads); note the specular light reflex on the superior iris. (B) Silicone oil (white arrowheads) is forming the central anterior chamber (white arrow). There is 360° of peripheral iridocorneal endothelial apposition with gonioscopy failing to reveal any angle structures (not shown). (C) An inferior Nd:YAG laser peripheral iridotomy has been fashioned at the previous junction of silicone oil, iris and endothelium within an iris crypt (white arrow; compare with (A)). Mild iris bleeding is noted. (D) The communication has permitted anterior migration of aqueous through the inferior iridotomy, displacing the silicone oil globule superiorly (white arrowheads), opening the pupillary margin to aqueous and breaking pupillary block. Note deepening of anterior chamber due to presence of aqueous (white arrow).

anterior and posterior chambers, permitting anterior silicone oil migration on supination.⁴ Complete silicone oil occlusion of the pupillary margin produces pupil block with arrest of aqueous outflow⁴; aqueous accumulates dependently in the posterior chamber and the efficacy of endotamponade is lost concurrently.

Silicone oil endotamponade in patients with aphakia carries a high risk of pupil block⁶; prophylactic inferior surgical iridectomy is therefore advised.⁶ Phakic and patients with pseudophakia have a much lower risk of pupil-block given the presumed structural integrity of the zonular/capsular bag complex.² Silicone oil pupil block glaucoma in a patient with pseudophakia is rare, but has been previously reported.^{4 7 8} In the reported patient, blunt trauma or cataract surgery may have resulted in subclinical sectoral zonular loss, and extensive vitreous base excision⁴ may have permitted displacement of silicone oil in this patient.

Immediate medical reduction of IOP with oral and topical agents is required. Face-down posturing may be attempted to repatriate dependent aqueous into the anterior chamber⁴ but cannot be sustained. Definitive management involves inferior laser peripheral iridotomy or surgical iridectomy.^{4 7} Careful positioning of iridotomy at the inferior limit of the silicone oil meniscus is critical to safety (minimising risk of inadvertent corneal

endothelial damage)⁴ and efficacy; inferior iridotomy permits anterior migration of dependent posterior segment aqueous, displacing silicone oil superiorly beyond the pupil margin, breaking pupil block⁴ (figure 1C, D). A larger pupil reduces the risk of recurrent pupil block in this context; mydriatics are suggested.

Corneal oedema results from a loss of corneal deturgescence due to increased hydrostatic pressure from the aqueous and/or corneal endothelial dysfunction.⁹ Silicone oil is directly toxic to endothelial cells, and prevents diffusion of nutrients through aqueous displacement.⁹ Long-term anterior chamber silicone oil can result in *permanent* corneal decompensation requiring penetrating or endothelial keratoplasty.^{10–12} This patient suffered *transient* corneal oedema following displacement of silicone oil from the anterior chamber, a phenomenon described rarely elsewhere.¹³ Our hypothesis to explain this observation is that silicone oil increases endothelial permeability,¹⁴ exposed only on interface change from silicone oil to aqueous, resulting in corneal oedema. Silicone oil within the anterior chamber may prevent corneal hydration even in the presence of significant corneal endothelial dysfunction.

Gonioscopy is critical in silicone oil filled eyes with raised IOP as silicone oil emulsification may result in trabecular block.²

Figure 2 Anterior segment photographs of patient with silicone oil pupillary-block glaucoma. (A) There is generalised corneal oedema (white arrow), although this appears to be more prominent centrally on this image. Descemet's membrane folds are present. Silicone oil configuration (white arrowheads) within the anterior chamber is similar to figure 1D, remains formed and pupil block remains broken. There is no hyphaema. (B) The cornea is clear, with 6 mm dilated pupil and large/patent inferior peripheral iridotomy (white arrow). The anterior capsulorrhexis margin and intraocular lens reflex are visible. A silicone oil globule is present superiorly (white arrowheads). Iris bleeding has settled, but new vessels persist. (C) Gonioscopy of the inferior drainage angle demonstrates angle recession (limits defined by white arrows). Emulsified silicone oil is not demonstrated in the trabecular meshwork, and no pathological new vessels are demonstrated in the drainage angle.

Emulsified silicone oil may only be evident on gonioscopy, most commonly in the superior drainage angle.

This case illustrates important principles of silicone oil fluidics to understand the mechanism of pupil block glaucoma. Careful selection of inferior laser iridotomy site at the inferior limit of the silicone oil meniscus is critical to effectively and safely reverse pupil block.^{4 7} Anterior migration of silicone oil in patients with pseudophakia is rare, but prophylactic iridotomy/iridectomy may be considered where zonular loss is likely.

Learning points

- ▶ Migration of silicone oil into the anterior chamber risks corneal endothelial failure and glaucoma.
- ▶ Silicone oil pupil block glaucoma may cause acute pain and visual loss, more likely in the setting in aphakia, but possible in phakic or patients with pseudophakia with zonular damage (previous surgery or trauma).
- ▶ Careful selection of inferior laser iridotomy site at the inferior silicone oil meniscus is critical to effectively and safely reverse silicone-oil pupil block.
- ▶ Transient corneal oedema may occur following any procedure which aims to displace silicone oil from the anterior chamber, perhaps due to direct endothelial toxicity exposed on endothelial interface change from oil to aqueous.
- ▶ Clinicians must discuss the possibility of transient or permanent corneal oedema with patients prior to any procedure which aims to displace silicone oil from the anterior chamber.

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