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RETINAL DISORDERS

Avoiding retinal slippage during macular translocation surgery with 360 retinotomy

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Abstract
Purpose To describe a surgical technique to avoid retinal slippage.
Method An audit was carried out on a consecutive series of 75 consecutive cases of macular translocation for age-related macular degeneration (MT360). We encountered two cases of slippage, which led to a change in technique.
Result No further cases of slippage were encountered. We were able to perform an exchange of perfluorocarbon liquid with air or directly with silicone oil.
Discussion Retinal slippage is caused by the presence of aqueous in the infusion tubing. Meticulous removal of all aqueous from the infusion system and vitreous cavity can eliminate this complication.

Keywords Retinal slippage · Perfluorocarbon air exchange · Perfluorocarbon fluid · Silicone oil · Macular translocation surgery

Introduction

Slippage of retina is a complication of the repair of giant retinal tears (GRT) [1]. Mathis et al. have made the observation that slippage occurs less readily with a direct exchange perfluorocarbon liquid (PFCL) for silicone oil [1]. In the past, we have demonstrated in a model eye chamber that the silicone oil preferentially makes contact with the PFCL and excludes aqueous from the interface in order to achieve lower surface energies [2]. The aqueous effectively stayed above the oil despite its higher specific gravity. As a result of our observation with the model, we recommended firstly filling the vitreous cavity as completely as possible before the exchange with silicone oil, and secondly passing a flute needle through the oil into the PFCL in order to promote the contact between the two liquids.

Macular translocation using 360° retinotomy (MT360) routinely involves the creation of a giant retinal tear at or close to the ora serrata [3]. The long length of retina and the large circumferential extent (360°) increase the likelihood of slippage occurring during the injection of silicone oil. We describe a simple method of exchange of PFCL with silicone which we have found useful in a consecutive series of cases treated with MT360.

Material and methods

A consecutive series of 75 cases of MT360 were studied. For the first 29 cases, the surgery was described previously [4]. To briefly summarise, we performed a phacoemulsification, vitrectomy following induction of posterior vitreous detachment where necessary, induced retinal detachment by infusion via a 41-gauge flexible needle and double lumen cannula (Dutch Ophthalmic Research Centre International b.v., The Netherlands), excised the underlying choroidal neovascular membrane, rotated the retina, injected PFCL to re-attach the retina, and carried out endolaser followed by a direct PFCL and silicone oil exchange.

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Results

Two of the 75 cases developed slippage. It occurred with case 15 and 30 despite seemingly filling the eye as full as possible with PFCL prior to the exchange. In each case, the silicone oil had to be removed and the retina rotated again. In case 30, further complication occurred when the retina became incarcerated and prolapsed through one of the sclerotomies.

An analysis of our technique showed possible causes of the slippage. Firstly, we might not have passed the flute needle through the silicone oil to the PFCL, and there might have been a film of aqueous between the two liquids. Secondly, we thought we had achieved a total fill of the eye with PFCL, when in fact we might not have, in retrospect. The balance salt solution (BSS) infusion ensured that the fill was only up to the sclerotomies; once the PFCL injection cannula was removed, the infusion of BSS would displace any PFCL above the sclerotomies out of the vitreous cavity (Fig. 1). As the top surface of the PFCL bubble is dome-shaped, there would be a rim of aqueous circumferentially around the meniscus. We also injected the silicone oil at the 3-way tap and via an infusion cannula. This infusion cannula itself contained a column of up to 0.2 ml of BSS. When silicone oil was injected, this column of BSS in the infusion cannula was pushed into the vitreous cavity. Any amount of BSS in the vitreous cavity if displaced posteriorly could have caused the slippage (Fig. 2).

From case 30 onwards, we resolved to eliminate all the BSS from the system. The changed method involves paying special attention to the last part of the injection of PFCL. We used a normal 20-gauge cannula to inject PFCL; we disconnected the infusion of BSS; we positioned on an open sclerotomy uppermost such that all aqueous had a chance to escape freely; and most importantly, we ensured that the infusion cannula was filled completely with PFCL up to the 3-way tap (Fig. 3). We then injected silicone oil via the 3-way tap and performed the direct exchange with PFCL as per normal.

From case 30 onwards, we did not experience any further complication of slippage. So confident had we become of the exchange procedure that we performed some of the latter cases with PFCL exchange with air successfully without slippage.

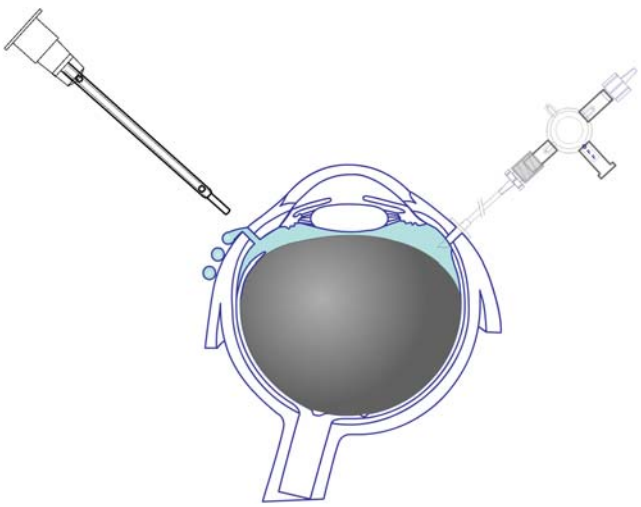

Fig. 1 Schematic diagram showing BSS infusion ensured that the fill of PFCL can only be up to the sclerotomies. Once the PFCL injection cannula was removed, the infusion of BSS would displace any PFCL above the sclerotomies out of the eye cavity

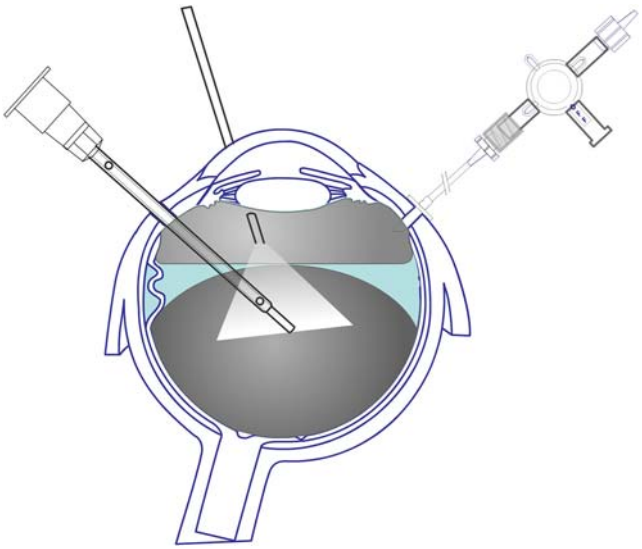

Fig. 2 Schematic diagram showing there may have a film of aqueous between the PFCL and silicone oil that can lead to slippage of the retina

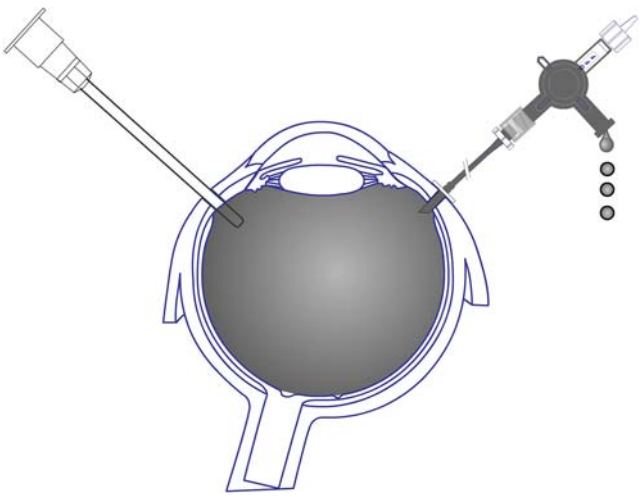

Fig. 3 Schematic diagram showing that by turning off the infusion of BSS and by filling the vitreous cavity totally with PFCL including the cannula, we ensured that there was no aqueous in the system, thus eliminating slippage as a possible complication. Note; it may be advisable to leave one of the sclerotomy ports opened and in the uppermost position, so that any aqueous can be displaced out of the eye by the PFCL

Discussion

Since its introduction in the 1990s, PFCL has greatly enhanced vitreoretinal surgery and especially the management of giant retina tear, ensuring that the retina goes out to length [5–9]. It is indispensable for MT360, but slippage can be associated with poor surgical technique. Slippage involves the posterior displacement of aqueous under the retina [10], and can give rise to retinal folds or, in the case of MT360, displacement of the fovea from its desired location.

Silicone oil injection can be performed either as a direct exchange with PFCL, or alternatively, after an exchange of PFCL for air; the silicone can then be injected into an air-filled vitreous cavity. Some surgeons believe the later manoeuvre can ensure a more complete fill of the vitreous cavity [11]. However, an exchange of PFCL for air can give rise to slippage, as has been previously pointed out. The main reason is that there is often a residual amount of BSS above the PFCL. Meticulous 'drying' of the retinal edge has been recommended [12]; otherwise the incoming air bubble could displace any of the BSS in the anterior vitreous cavity under the retina, and be pushed posteriorly to cause slippage.

A direct exchange of PFCL for silicone oil is less likely to cause slippage [1]. The reason for this has been elucidated in our model eye study [2]. For slippage to occur, however, there must be aqueous in the system. By turning off the infusion of BSS, and by filling the vitreous cavity totally with PFCL including the cannula and up to the 3-way tap, we ensured that there was no aqueous in the system, thus eliminating slippage as a possible complication. The exchange worked equally well either as a direct PFCL and silicone oil exchange or via the intermediary step of an air exchange.

With MT360 surgery, the giant retinal tear was iatrogenic. The retina was mobile and the incision was close to the ora serrata, such that there was never any concern about filling the vitreous cavity beyond the retinal edge. Our technique for avoiding slippage relied on eliminating all the aqueous. If it was applied to a spontaneous giant retinal tear associated with proliferative vitreoretinopathy, it would be necessary firstly to remove epi- or subretinal membranes; otherwise, the stiffened retina could overcome the interfacial tension of the PFCL and gain access to the subretinal space.

MT360 is a complex surgery, involving many surgical steps and potentially many complications. Others have shown that the result of surgery could be improved by climbing a learning curve [13]. We believe advances are made from little steps. We have found our simple technique for eliminating BSS from the system to be effective in preventing slippage, not only in cases of MT360 but also in cases of spontaneous GRT and in PVR where relieving retinotomies are necessary.

Conclusion

Slippage can be prevented by a total fill of the vitreous cavity with PFCL, and by the meticulous removal of all aqueous from the infusion system.

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