Silicone oil removal. II. Operative and postoperative complications

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SUMMARY A retrospective study of the effects of silicone oil removal was carried out on 85 patients who had undergone pars plana vitrectomy and silicone oil exchange for giant retinal tears or proliferative vitreoretinopathy. Silicone oil was removed either as part of the treatment of anterior segment complications such as glaucoma and keratopathy (25 patients) or in order to prevent these complications (60 patients). The major complications of the removal of silicone oil were retinal redetachment (25%), hypotony (16%), and expulsive haemorrhage (1%). The length of time that the oil remained in the eye and the presence of anterior segment complications did not appear to have an effect on the rate of retinal redetachment or hypotony.

Silicone oil has been used in the treatment of complex retinal detachments for many years and late complications have been reported by many authors. Since silicone oil can now be readily removed from patients who have undergone pars plana vitrectomy, it has been suggested that temporary tamponade with silicone oil can prevent the development or progression of these complications. So far there have been few reports detailing the complications of the procedure of silicone oil removal.

The purpose of this study is to report the peroperative and postoperative complications of removal of silicone oil in a large number of patients. The effects of silicone oil removal on the progression of pre-existing complications or prevention of potential complications associated with its use are reported in a separate communication.

Patients and methods

The patients and methods have been described in detail elsewhere. Briefly, the records of 85 patients who had undergone silicone oil removal were reviewed. All patients had previously undergone pars plana vitrectomy and silicone oil injection for complicated retinal detachments associated with giant retinal tears (GRT) or proliferative vitreoretinopathy (PVR).

The decision to remove the silicone oil was made either to prevent anterior segment complications (group I) or as part of the treatment of glaucoma or keratopathy (group II). In the majority of these patients the retina was attached prior to the procedure, though in some there was peripheral tractional retinal detachment.

The technique of the removal of silicone oil was as described by Leaver and Lean. In some patients the oil was removed in combination with other procedures such as lensectomy, trabeculectomy, the insertion of an aqueous drainage tube, and penetrating keratoplasty. Cryotherapy, additional scleral buckling, and/or epiretinal membrane dissection was undertaken at the time of oil removal if there appeared to be a peripheral detachment or persistent epiretinal traction.

The fundi of patients were examined by indirect ophthalmoscopy at the end of the procedure in order to establish that the retina was attached. A subconjunctival injection of antibiotics and steroids was given in each case.

Results

Eighty-five eyes, 59 with GRTs and 26 with PVR underwent vitrectomy, epiretinal membrane dissection, and silicone oil-fluid exchange. These included five which had previously had penetrating trauma. Silicone oil was removed from 60 eyes to prevent late anterior segment complications (Group I) and from 25 as part of the treatment of glaucoma and keratopathy (Group II) Table I.)
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Table 1 Reasons for silicone oil removal

<table>
<thead>
<tr>
<th>Prevention of complications (group I)</th>
<th>Treatment of complications (group II)</th>
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<tr>
<td></td>
<td>Glaucoma</td>
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<tr>
<td>Giant retinal tears</td>
<td>45</td>
</tr>
<tr>
<td>Proliferative vitreoretinopathy</td>
<td>15</td>
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<tr>
<td>All patients</td>
<td>60</td>
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Following pars plana vitrectomy, injection of silicone oil, and 360° cryotherapy the retina became reattached. Four weeks after injection, removal of silicone oil was complicated by an expulsive haemorrhage, and the postoperative vision was reduced to perception of light.

Thin diffuse vitreous haemorrhage was a frequent finding immediately following oil removal, but this cleared in all but four patients between two and six days. In these four patients the haemorrhage cleared slowly over a period of several weeks.

Postoperative intraocular inflammation was mild in all cases and settled with the use of topical steroid treatment.

Following silicone oil removal 14 eyes (16%) had an intraocular pressures of less than 10 mmHg, including three eyes with intraocular pressures less than 6 mmHg. One of these three patients had had prior glaucoma surgery and one had low intraocular pressure before oil removal; the third patient had had normal intraocular pressure prior to the removal of oil but subsequently developed marked hypotony with vision reduced to perception of light. The remaining patients had normal intraocular pressures prior to oil removal. Low intraocular pressure was present in 10 (16-9%) patients with GRTs and four (16%) patients with PVR. The oil was in situ for an average of 10 weeks.

Retinal redetachment occurred in 21 eyes (25%). Retinal redetachments occurred in 16 (26%) patients in group I and five (20%) in group II. Redetachments developed in 30% of patients with PVR and 22% with GRTs. Of the six eyes with areas of peripheral detachment that underwent scleral buckling at the time of oil removal only one subsequently became detached. Most retinal redetachments occurred soon after silicone oil removal; four were noted at the time of surgery, and a total of 12 became redetached within two weeks of surgery. Seventeen patients had redetached retinas by three months (Fig. 1). The rate of redetachment appeared constant for different time intervals that the oil remained in the eye: 26% of

In group I the oil was removed after being in situ for three to 20 weeks (mean 9-1 weeks). The group II patients who developed glaucoma had oil in situ for three to 60 weeks (mean 20-2 weeks) and patients with keratopathy between 16 and 160 weeks (mean 76-0 weeks) (Table 2). The duration of oil tamponade was similar for GRTs and PVR.

Oil removal was combined with lensectomy (two patients), trabeculectomy (eight patients), the insertion of an aqueous drainage tube (four patients), and penetrating keratoplasty (two patients). Cryotherapy and additional scleral buckling were undertaken in four patients who had peripheral detachment or areas of residual vitreoretinal traction. Epiretinal membrane dissection was necessary in two patients. Cryotherapy alone was combined with oil removal in a further 11 patients (Table 3).

Of the 85 patients who underwent silicone oil removal one developed a peroperative expulsive haemorrhage. This patient had a giant retinal tear three years after intracapsular cataract extraction.
those with oil in for 3–5 weeks, 26% 6 to 8 weeks, 33% for 9 to 12 weeks, and 17% for more than 12 weeks (Table 4).

The anatomical outcome in patients who developed retinal redetachments following silicone oil removal is shown in Table 5. No further surgery was carried out in four patients. The retina was successfully reattached in 15 of 17 eyes in which further surgery was carried out. Scleral buckling and cryotherapy with or without SF6–air mixture tamponade was successful in nine of 11. A total of seven patients underwent further exchange of silicone oil; in six the retina became reattached and one case failed.

Twelve patients (14.1%) lost formed vision (reduced to hand movements or less) during the period of follow-up. These included six (10%) patients in group I and six (24%) in group II. The cause of visual failure in group I were persistent retinal detachment (three patients), expulsive haemorrhage (one patient), hypotony (one patient), and cataract (one patient). In group II patients lost vision as a result of retinal redetachment (two patients) and glaucoma (four patients) (Table 6).

Visual loss occurred in seven (12%) patients with GRTs and five (19%) patients with PVR.

**Discussion**

The anterior segment complications of silicone oil injection are well recognised. In an attempt to avoid these complications the silicone oil may be removed at an early stage. Our figures suggest that the complication rate for the procedure is high: the major complications were retinal redetachment (25%), hypotony (16%), and expulsive haemorrhage (1%).

Expulsive haemorrhage causing marked loss of vision is a rare complication following intraocular surgery. Cairns and Anand reported an expulsive haemorrhage on opening the silicone filled eye of a patient with glaucoma. Taylor reported expulsive haemorrhage in 0.2% of patients undergoing cataract surgery and identified risk factors such as high myopia, glaucoma, diabetes, atherosclerosis, and possibly general anaesthesia. The patient who suffered this complication in this series had no such risk factors, and cryotherapy was not performed at the time of oil removal.

The development of choroidal detachments with marked hypotony associated with severe loss of vision was a rare complication in this series, affecting only one patient. The retina remained attached but the vision was reduced to the level of hand movements. Gonvers found that six patients (5.8%) developed marked hypotony with vision reduced to perception of light after oil removal; the visual acuity recovered only when the oil was reinjected. He also reported that low intraocular pressures after silicone oil removal were relatively common; 20% had intraocular pressures of 1–5 mmHg and 55% had a pressure less than 11 mmHg. In our series hypotony was less common: 5% had an intraocular pressure of less than 1–5 mmHg and 17% less than 11 mmHg. Gonvers attributed the low intraocular pressures to cryotherapy of the anterior retina. Others have suggested that hypotony occurs in patients with persistent anterior retinal detachment or clefts in the anterior chamber angle, but we have not been able to confirm this.

There was a surprisingly high rate of redetachment of the retina following oil removal in this series. The rate was slightly higher for PVR than GRTs, though this was not statistically significant, and was comparable for patients of groups I and II and for different intervals that the oil remained in the eye. There appeared to be a slight reduction in the retinal redetachment rate for patients who had oil in situ for longer than three months, but this was not statistically significant. An important factor in the develop-
ment of retinal redetachment is the continuing traction exerted by epiretinal membranes present in PVR. Patients in this series with PVR were not classified according to the Retina Society terminology, as many underwent surgery before its publication. A review of the preoperative and postoperative records and retinal drawings suggested these patients may have had residual epiretinal membranes even after extensive epiretinal membrane dissection at the time of surgery.

We assume that most patients with giant retinal tears are affected by epiretinal fibrocellular proliferation to some degree. Many have surgery at an early stage, and thus clinical PVR was less likely to develop, and perhaps their retinas were less likely to detach after oil removal.

Retinal redetachment occurs in the early weeks following vitrectomy and silicone injection, so it would be expected that in some of the patients undergoing a very early removal of oil (after three to four weeks) the retina would have become redetached even if the oil had been left in situ. None of the patients in group II had a pre-existing retinal detachment posterior to the encircling element implying that patients with detectable detachments were not offered surgery. Since the oil had been in situ for many months and the maximum cellular proliferative process is believed to be active for only two or three months, some of our patients were perhaps already preselected as being less likely to develop subsequent membrane contraction and retinal redetachment. However, we have not demonstrated a convincing reduction in the redetachment rate after extended silicone oil tamponade. Redetachment rates of 13% and 33% with PVR and 28% with GRTs have been reported following silicone oil tamponade of six to eight weeks. Reported redetachment rates range from 34% to 0% when the oil remained in the eye for 5-10 months. Clearly different patient selection and surgical techniques preclude a direct comparison between these different series.

Zivojnovic et al. and McCuen et al. emphasised the importance of the role of repeated epiretinal dissection while the silicone oil was still in situ. Others consider that panretinal photocoagulation prior to oil removal is an important factor in preventing later detachment, but this technique was not sufficient to prevent a redetachment rate of 34% in another series.

In this study sight threatening complications occurred in 27% of patients undergoing silicone oil removal. 13% suffered irreversible severe loss of vision, the final visual results being better for group I (10%) than for group II (25%). The difference may be explained by the different types of complications in the two groups. Retinal redetachment was relatively common in group I, and many of these patients recovered vision with further surgery. Glaucoma was common in group II and caused irreversible loss of vision in those patients who remained refractory to control.

As a result of our findings we have modified our approach to the removal of silicone oil. Since silicone is used for difficult detachments, often in ‘only eyes’, we recommend that silicone oil should be removed only in carefully selected cases. Those patients with no significant residual vitreoretinal traction and those who are most likely to develop sight-threatening anterior segment complications remain the obvious candidates.

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