

Prevention and control of proliferative vitreoretinopathy: primary retinal detachment surgery using silicone oil as a planned two-stage procedure in high-risk cases

P Alexander, R Prasad, A Ang, AV Poulson, JD Scott and MP Snead

CLINICAL STUDY

Abstract

Aims For rhegmatogenous retinal detachment, reattachment with a single procedure is associated with better visual outcomes. In the past, silicone oil has been used mostly as a last resort following failed primary surgery. This study evaluates a novel approach to patients at high risk of primary failure, using silicone tamponade as the primary stage of a planned two-stage procedure.

Methods We report a series of 140 eyes that underwent primary surgery for rhegmatogenous retinal detachment. Patients at higher risk of surgical failure (eg giant retinal tear, inability to posture, poor view, uncertainty of location of primary break, primary proliferative vitreoretinopathy (PVR), multiple tears with rolled posterior edges, retinoschisis/detachment, staphyloma with macular hole) were managed by a planned staged procedure using primary silicone oil tamponade. This was followed by silicone removal at a later date.

Results Fifty-four eyes underwent scleral buckling alone, with primary success in 52/54 (96%). Fifty-three eyes underwent vitrectomy and gas, achieving primary success in 50/53 (94%). Thirty-three eyes were classified high risk and managed with primary silicone. Silicone was safely removed in 22/25. In eight eyes, silicone was retained without attempt at removal. In total, primary retinal reattachment

was achieved in 128 of 140 eyes (91.4%). Of these, 124 (97%) did not require long-term tamponade. Only four eyes (2.9%) developed PVR.

Discussion A planned two-stage approach to highrisk cases of retinal detachment using primary silicone oil tamponade followed by silicone removal can achieve a high primary reattachment rate with less than 3% incidence of PVR.

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Introduction

In 1904 the International Congress of Ophthalmology deemed retinal detachment to be untreatable.¹ Since the pioneering work of Gonin, who showed that successful retinal reattachment can be achieved in 66% of cases,² there have been numerous advances in surgical technique including binocular indirect ophthalmoscopy,³ scleral buckling,⁴ pars plana vitrectomy,⁵ perfluorocarbons⁶, and intraocular tamponade with long acting gases⁷ or silicone oil.⁸ Most contemporary reports involving a large number of consecutive cases suggest that a success rate of greater than 90% is achievable, but 10–20% require more than one operation for retinal reattachment (Table 1).

Vitreoretinal Service,
Addenbrooke's Hospital,
Cambridge, UK

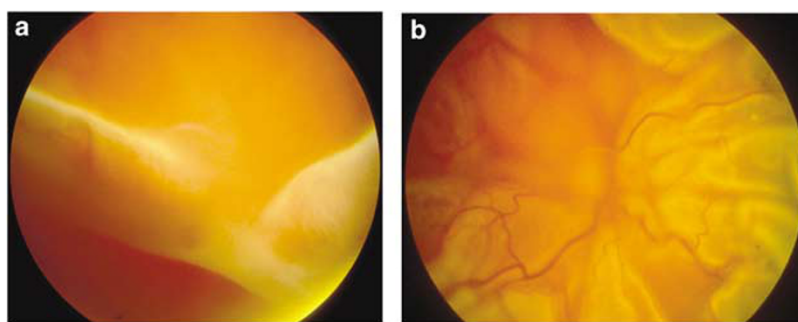
Correspondence: MP Snead,
Vitreoretinal Service,
Addenbrooke's Hospital,
Hills Road,
Cambridge CB2 2QQ, UK
Tel: +44 1223 216701;
Fax: +44 1223 217968.
E-mail: mps34@
cam.ac.uk

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Table 1 Primary success rates from various published series 1973 present

Unit	Date	Number of cases	Technique	Primary success rate (%)	Source
London	1973	452	Buckles only	75	Chignell <i>et al</i> ²⁴
Iowa	1973	863	Buckles only	76	Rachal and Burton ²⁵
San Francisco	1979	1008	Buckles only	84	Grizzard <i>et al</i> ²⁶
Orebro	1981	590	Buckles only	65	Tornquist and Tornquist ²⁷
Helsinki	1981	352	Buckles only	Unknown	Laatikainen <i>et al</i> ²⁸
Oklahoma	1984	662	Buckles only	91	Wilkinson and Bradford ²⁹
Madras	1989	601	Buckles only	86	Sharma <i>et al</i> ³⁰
Moorfields	1997	153	All	80	Sullivan <i>et al</i> ³¹
Cambridge	1997	160	All	90	Comer <i>et al</i> ³²
Cambridge	2004	110	Buckles only	99	Ung <i>et al</i> ¹⁶
Berlin	2006	512	All	71	Heimann <i>et al</i> ¹⁷

**Figure 1** (a) and (b) A planned two-stage procedure is required to achieve primary reattachment in high-risk cases.

Proliferative vitreoretinopathy (PVR) is quoted as the commonest cause of final failure to reattach the retina.⁹ The pathogenesis of PVR is complex and many studies have investigated the risk factors for its development.^{10–13} We suggest, however, that one of the major principal causes of PVR is failed primary surgery.¹⁴ Retinal reattachment with a single procedure is associated with a better visual outcome and reduced morbidity,¹⁵ and success therefore in primary surgery is of immense importance. Despite this, primary reattachment rates have only been assessed by a few series involving large numbers of cases. Algorithms for the management of different subgroups and the refinement of case selection have led to reports of up to 99% success for primary scleral buckling surgery.¹⁶ The success of more complex cases that may require an internal approach have shown a similar but less dramatic improvement in this challenging subgroup of cases. Most series report a primary failure rate of 10–20% (Table 1) and the use of silicone has been reserved by some surgeons as a last resort procedure following failed primary surgery. Many of these may require permanent tamponade and may be associated with a poor visual prognosis.

This study reports the use of silicone in a similar group of cases, but significantly as the primary tamponade agent in cases of retinal detachments with a high risk of

primary failure (Figure 1). The aim of such an approach for high-risk cases was to improve the chances of primary reattachment, and to thereby reduce or avoid the use of silicone oil as a secondary salvage tamponade, where the risks of safe removal are unpredictable.

Methods

All patients under the care of a single surgical team who underwent primary surgery for rhegmatogenous retinal detachment during a single year (January to December 2003) were included in the study. Pre-operative assessment included indirect ophthalmoscopy and slit-lamp biomicroscopy of the vitreous, posterior hyaloid membrane, and retina of both eyes. Patients with high-risk characteristics (Table 2) were managed with primary silicone oil tamponade single port. Pars planar vitrectomy was performed under indirect ophthalmoscopic control with direct silicone exchange; 5700 centistoke silicone oil was used in all cases. Adjunctive scleral buckling was performed in cases with inferior retinal breaks or primary PVR at presentation. Retinal breaks were treated with monitored transscleral cryotherapy. Silicone oil was removed as a staged second procedure at least 3 months later.

Table 2 High-risk categories

Giant tear	Multiple/rolled tears in >2 quadrants
Anticipated inability to posture	Retinoschisis detachment
Poor or compromised view	Coloboma breaks
Uncertainty of primary break	Large, ragged inferior breaks
PVR (>C2) at presentation	Staphyloma with macular hole

Patients without any high-risk characteristics were managed with conventional scleral buckling or two-port vitrectomy under indirect control with gas tamponade. All surgical procedures were conducted under general anaesthetic. All patients had follow-up for at least 12 months.

The primary outcome measures were the retinal reattachment rate at 12 months following primary repair, and the incidence of proliferative vitreoretinopathy.

Results

A total of 140 eyes of 131 consecutive unselected patients underwent surgical repair for primary rhegmatogenous retinal detachment. Fifty-four eyes underwent primary repair with scleral buckling alone, with primary reattachment in 52 cases (96.3%). Fifty-three eyes underwent vitrectomy with gas tamponade (with or without scleral buckling) and primary success was achieved in 50 cases (94.3%).

Thirty-three eyes were classified as high risk and, therefore, had planned primary silicone oil tamponade. The second stage was carried out in 25 eyes and was safely achieved in 22 cases. The mean time between primary surgery and silicone removal was 7.9 months (range 3–18 months).

Silicone was not removed from eight eyes for a variety of ophthalmic and general medical reasons. Three eyes had primary macular hole detachment associated with high myopia, posterior staphyloma, and myopic chorioretinal atrophy with a poor prognosis for central vision. Although all were successfully re-attached with restoration of peripheral vision, silicone removal was not considered to offer any visual benefit to the patient. One eye had a total detachment and no further surgery was attempted. A further three eyes had persistent shallow inferior retinal detachments precluding silicone oil removal. In the remaining patient, primary retinal reattachment was successfully achieved, and removal of silicone oil was offered, but the patient declined. In this subgroup of eight cases, two had elevated intraocular pressure requiring continuing hypotensive treatment.

One of these patients also developed silicone oil emulsification. No patients developed keratopathy.

In total, primary retinal reattachment was achieved in 128 eyes of 140 (91.4%). Of these, 124 cases (97%) did not require long-term tamponade. Only four eyes (2.9%) developed PVR.

Discussion

This study showed an overall success rate of 91% in an unselected consecutive series of patients undergoing primary surgery for rhegmatogenous retinal detachment including giant retinal tear, schisis, posterior breaks, and primary PVR. By adopting a planned two-stage approach to the management of cases judged to be at high risk of primary surgical failure, the incidence of PVR was reduced from greater than 10%¹⁷ to less than 3%.

Despite its proven effectiveness as an intraocular tamponade,¹⁸ silicone oil has often been considered a last resort following failure of primary retinal reattachment surgery. Its use in primary reattachment procedures has been restricted to cases of giant retinal tears, although good results with silicone oil for macular hole detachments in staphylomas of highly myopic eyes have also been reported.^{19,20} Our study demonstrates that by adopting a planned two-stage approach using silicone oil in other high-risk categories, an improved primary reattachment rate can be achieved compared to that reported in other series involving similar cases. Using this approach the option to remove the silicone can be exercised at a later stage and in a planned manner. Silicone oil was retained in eight patients, four of whom had complete retinal reattachment. In one case, silicone was retained because of patient choice. In three cases, removal of silicone was not indicated or attempted because of poor central visual prognosis. None of these patients developed keratopathy. Two had elevated intraocular pressures requiring long-term treatment and one of these patients also demonstrated silicone oil emulsification.

The Silicone Study Group used randomised prospective multicentre trials to compare silicone oil with gas tamponade in the treatment of rhegmatogenous retinal detachment with PVR. They were designed to test the hypothesis that the improved anatomical results of silicone might be offset by its complications. However, evidence from the Silicone Study Group has been useful in establishing that most of the complications described previously in association with silicone oil are caused by the pathological process of PVR rather than the silicone itself.²¹ Silicone Study Report 2 showed that intraocular tamponade (either silicone or C3F8) had no influence on the incidence of keratopathy.²² Keratopathy and blindness were more frequent in eyes randomised to

receive SF6.¹⁸ Chronic intraocular pressure elevation was more prevalent in eyes randomised to silicone oil than C3F8, but was uncommon (8 vs 2%, $P < 0.05$).²³

In conclusion, we report the selected use of silicone as a planned two-stage approach to primary rhegmatogenous retinal detachment repair in patients at high risk of primary surgical failure. Reattachment rates are higher than in previously reported series, rates of PVR are low, and the need for long-term silicone oil tamponade is minimised.

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