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Original research article

OUTCOMES OF PRIMARY UNCOMPLICATED RHEGMATOGENOUS RETINAL DETACHMENT REPAIR USING SILICONE OIL TAMPONADE IN VITREORETINAL SURGERY

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Abstract: *In a prospective observational study, we aimed to determine anatomical and functional outcomes, as well as possible complications, following pars plana vitrectomy (PPV) with silicone oil (SO) tamponade for primary, uncomplicated rhegmatogenous retinal detachments. This study was conducted from August 2023 to November 2023. During the study, 32 patients underwent surgical repair through PPV and SO injection. PPV over scleral buckling was chosen when cataracts or vitreous hemorrhages hindered proper fundus visualization. Patients received comprehensive ocular assessments, including best-corrected visual acuity, anterior segment examination, IOP measurements via applanation, and fundus examinations at different intervals: 1 day, one week, one month, and three months. Intraocular pressure exceeding 21 mmHg was defined as increased IOP. Our study included 32 patients (22 men and ten women) of Asian ethnicity who underwent retinal detachment repair by PPV and SO injection. The patients had an average age of 57.8 ± 10.1 years (34–76 years) at the time of intervention. The follow-up period was three months. An anatomical success rate, defined as retinal reattachment three months after SO removal, was achieved in 29 eyes (90.6%). Final best-corrected visual acuity (BCVA) improved 26 looks (81.2%), with a mean gain of 3 Snellen lines. BCVA remained unchanged in 4 eyes (12.5%) and deteriorated in 2 eyes (6.3%), with a mean loss of 2 Snellen lines. During the 3-month follow-up period, 17 eyes (53.1%) experienced increased intraocular pressure (IOP). Out of these, 15 patients had transient ocular hypertension, requiring topical treatment during the immediate postoperative period (within one month). Only one eye (5.9%) required filtrating drainage surgery for IOP control. Notably, no eyes developed optic neuropathy due to elevated IOP during this short-term follow-up. Pars plana vitrectomy (PPV) combined with silicone oil (SO) injection is a safe and effective surgical approach for treating primary uncomplicated rhegmatogenous retinal detachment. Our series indicates that PPV and SO injection lead to good anatomical and functional outcomes, with high reattachment rates and low rates of proliferative vitreoretinopathy. Although cataract formation and elevated intraocular pressure (IOP) are common complications, they can be successfully controlled.*

Keywords: intraocular pressure, uncomplicated primary rhegmatogenous retinal detachment, pars plana vitrectomy, cataract

Introduction

Rhegmatogenous retinal detaching (RRD) happens when the retina's neurosensory layer separates from the retina's pigment epithelium, resulting in subretinal fluid collection near one or more retinal cracks. (Saw et al., 2006). Uncomplicated RRD is called RRD, which is not linked with proliferative vitreoretinopathy (PVR). (Machemer et al., 1991).

Although scleral buckling (SB) has previously been shown to be a successful surgical therapy for primary uncomplicated RRD, it has also been linked to perioperative and postoperative problems. SB has been related to sub-retinal hemorrhaging, retinal arrest, accidental retinal breaks, extrusion, intrusion, or infection of the buckles, extraocular motion issues, anterior segment ischemia, macula distortion, and following surgery, cystoid macular swelling.(Daoudi et al., 2009; Okamoto et al., 2008; Richards and Meyer, 2012).Several of these issues may result in irreversible vision impairment.

With swift developments in equipment and enhanced vitrectomy effectiveness, there seems to be an increasing shift for pars plana vitrectomy (PPV) via gas tamponade in uncomplicated RRD, primarily for the reason that PPV is more straightforward to perform, with a shorter duration of operation than SB, and given that newly certified retina specialists have a great deal of expertise using it (Arya et al., 2006; Azad et al., 2007; Chong and Fuller, 2010; de la Rúa et al., 2008; Ho et al., 2009; Minihan et al., 2001; Sodhi et al., 2008**).** In these circumstances, primary vitrectomy is an appealing option since it provides direct access to the RRD utilizing microsurgical methods, with instant pleasure for the surgeon who observes the retina reattach during surgery. Furthermore, it gives a better esthetic effect while causing fewer issues than SB.(Azad et al., 2007; Ho et al., 2009)

The administration of SF6 or C3F8 gases should be averted in patients residing at high elevations (.1,000 m) because the decrease in atmospheric pressure leads to the development of the intraocular gas bubble as well as a sudden rise of intraocular pressure (IOP), that may culminate in retinal vascular blockages and possibly even eye rupturing through surgical wounds.(Ferrini et al., 2010; Gandorfer and Kampik, 2000; Hanscom and Diddie, 1987; Lincoff et al., 1989; Mills et al., 2001). Cibis implemented silicone oil (SO) for the vitreoretinal procedure, and it was employed for intraocular tamponade because of its buoyant properties and elevated surface tension.(CIBIS et al., 1962). PPV and SO injections effectively treat challenging retinal detachments such as PVR, significant retinal breaks, and abrupt RD (Ivanovska-Adjievska et al., 2012; Morphis et

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al., 2012). No prior trials, to our knowledge, have assessed the safety and effectiveness of PPV with SO tamponade for primary uncomplicated RRD.

Thus, this prospective investigation aimed to compare PPV with SO tamponade in the therapy of primary uncomplicated RRD in terms of morphological and functional effectiveness and its drawbacks.

Methodology

This prospective research was carried out between August 2023 and November 2023. With regard to primary uncomplicated RRD, 32 patients had PPV and SO injections. The institution's review board and the Ethics Committee both approved the project. All patients provided written informed consent.

Whenever cataracts and vitreous hemorrhages impeded good fundus visibility, PPV was chosen over scleral buckling. In individuals with primary RRD residing 1,000 meters above sea level, when SF6 or C3F8 tamponade was impossible to give due to the danger of acute IOP rise, silicone oil was preferred over SF6 or C3F8. After the SO was removed, every participant in this trial was observed for no less than three months.

Specialist surgeons conducted all surgical operations under localized retro bulbar or general anesthesia. All eyes had a thorough vitrectomy, easing vitreous tension around the retinal ruptures and eliminating the anterior vitreous gel surrounding the vitreous base with broad-angle lenses and scleral depression. When complete posterior vitreous separation was not already evident, it was produced, and vitrectomy was performed. The retina's rear portion was pushed down perfluorocarbon liquid before serving an air-fluid interchange with internal drainage of sub-retinal fluid by means of an existing RB or a minor retinotomy. Cryopexy was used to accomplish retinopexy. To avoid pupil block glaucoma following vitrectomy and SO injection in aphakic eyes, an inferior peripheral iridectomy was done. In the end, air and SO were swapped. The eyes had been modestly hypotonic at the final stage of the treatment, as measured by digital pressure.

Patients were encouraged to maintain head posture for 2 to 3 weeks after surgery to achieve proper RB tamponade. For one month after surgery, topically administered antibiotics and steroid drops were given. At various intervals, patients had complete ocular exams involving best-corrected visual acuity, anterior segment examination, IOP measures by application, and fundus inspections: 1 day, one week, one month, and three months.

Means and standard deviations were used to give an overview of continuous variables. Frequencies and percentages were used to show categorical data. To identify statistically significant connections between high intraocular pressure and other factors, a bivariate study utilizing Pearson's test (chi-square) was done. The statistical program SPSS (Version 21.0) was used for statistical analyses.

Results

This investigation involved thirty-two eyes. Table 1 provides a summary of the 32 patients' demographics .

Table 1 Demographic characteristics of study population

Variable	N=32	Percentage
Sex		
Male	22	68.75
Female	10	31.25
Eye		
Right	17	53.12
Left	15	46.87
Age, mean ± SD	57.8 ± 10.1	
High myopia (SE #−6 diopters)		
Yes	5	15.62
No	27	84.37
Diabetes		
Yes	3	9.37
No	29	90.62
Hypertension		
Yes	11	34.37
No	21	65.62
Smoking		
Yes	5	15.62
No	27	84.37
Glaucoma		
Yes	2	6.25
No	30	93.75
Dyslipidemia		
Yes	3	9.37
No	29	90.62
Lens status		
Phakic	18	56.25
Pseudophakic	13	40.62

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Aphakic	1	3.12
Macula		
Off	25	78.12
On	7	21.87

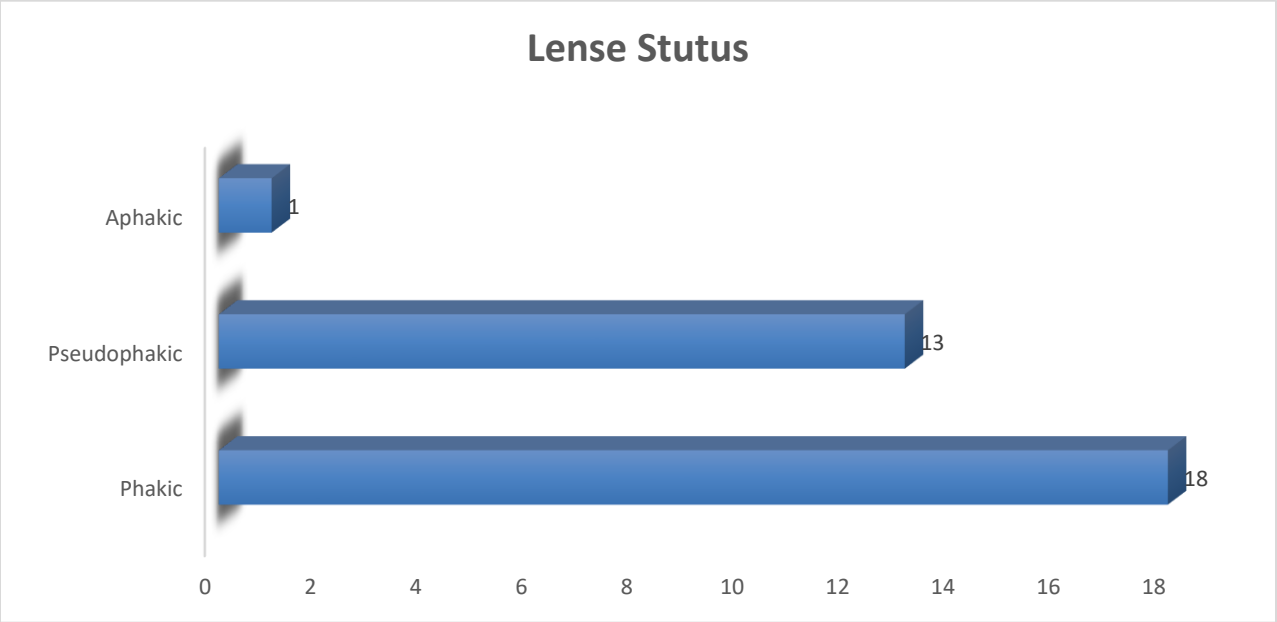

Figure 1 shows the type of lens present in the study population.

There was a three-month follow-up period. A total of 32 individuals of Asian origin—22 men and ten women—who had PPV and SO injections performed to heal retinal detachments participated in our research. When the patients were treated, their ages ranged from 34 to 76, averaging 57.8 ± 10.1 years. 9.37% enrolled in the study had diabetes, 15.62% were smokers, 34.37% were hypertensive, and 6.25% had glaucoma. Other details of participant demographics are summarized in Table 1.

Twenty-nine eyes (90.6%) had a structural efficacy characterized by retinal reattachment three months following SO removal. Twenty-six eyes (81.2%) rose in their complete best-corrected visual acuity (BCVA), with a mean increase of 3 Snellen lines. Given a mean decrease of two Snellen lines, BCVA worsened in two cases (6.3%) and stayed constant in four patients (12.5%). Proliferative vitreoretinopathy (PVR) in 1 eye (3.12%) and the emergence of new RB following SO extraction in 1 eye (3.1%) were the causes of failures (Table)

Before operation, IOP ranged from 5 to 28 mmHg, with a mean of 13.47 ± 6.4 mmHg. In 17 eyes (53.1%), intraocular pressure (IOP) rose over the 3-month monitoring phase. While 15 eyes, or 46.8%, did not suffer an increase in IOP. Sixteen of these 17 patients developed temporary ocular hypertension, which required topical therapy within one month following surgery. For IOP management, just one eye (5.9%) needed filtrating drainage operation. Apart from a past diagnosis of glaucoma, which was strongly related to a higher IOP after surgery (P = 0.029), baseline and perioperative variables were identical between individuals who weren't experiencing a rise in IOP compared with those who had. Throughout this brief monitoring, neither eye acquired optic neuropathy primarily due to high IOP.

Variable	N=32	Percentage
Heavy perfluorocarbon liquid (PFCL)		
Yes	29	90.62
No	3	9.37
Endolaser	18	56.25
Cryotherapy	7	21.87
Endolaser + cryotherapy	7	21.87
peripheral iridotomy		
Yes	1	3.12
No	31	96.87

Table 3 summarizes complications following surgery. During follow-up examinations, SO was discovered in the anterior chamber of one eye (3.12%) and macular pucker in one eye (3.12%). One eye (3.12%) acquired PVR, necessitating further surgery. During the follow-up, there was no endophthalmitis, choroidal, subretinal, or bleeding from the vitreous following SO removal.

Table 3: Complications Following PPV with SO Injection

Variable	N	Percentage
Formation of cataract	13/16	81.25
Raised IOP	17	53.1
Macular pucker	1	3.12
So, in the anterior chamber	1	3.12
PVR	1	3.12
SO-induced keratopathy	0	0
Subretinal hemorrhage	0	0
Hyphema	0	0
Vitreous hemorrhage after SO removal	0	0
the emergence of new RB following SO extraction	1	3.12
Choroidal effusion/hemorrhage	0	0

Discussion

Scleral buckling, vitrectomy, and pneumatic retinopexy, done individually or in conjunction, are the main treatment options for primary RRD. Choosing SB is a multifaceted decision that considers the number and location of retinal breakages, the dimensions of the eye, and the known problems associated with SB. PPV, on the other hand, has been linked to issues including cataract development, glaucoma, and endophthalmitis. (Snead, 1993)

Even though new researches comparing PPV versus SB for treatment of uncomplicated RRD found no significant differences in primary reattachment outcomes between the two groups (Soni et al., 2013), PPV with C3F8 or SF6 gas tamponade is currently the therapy preference for managing a primary uncomplicated RRD.**,(**Arya et al., 2006; Chong and Fuller, 2010; Saw et al., 2006; Sodhi et al., 2008**).** No documented prospective research has measured PPV with SO injection in primary uncomplicated RRD. As a result, we carried out this prospective study to assess the morphological and functional results and complications of PPV with SO injection in chosen individuals with primary uncomplicated RRD.

The anatomical success rate in our research was 90.6%, equivalent to earlier studies published utilizing SB or PPV with gas injection in simple RRD, where the anatomical effectiveness ranged from 80% to 100%.(Azad et al., 2007; Heussen et al., 2011; Morphis et al., 2012; Soni et al., 2013) The final BCVA was enhanced by 81.2% in our study. The final BCVA got better at 81.2% of individuals. Our findings are consistent with those of Miller and colleagues.(Miller et al., 2008)**.**Cataract development, higher IOP, and band keratopathy are all common problems linked with PPV and SO injection. (Snead, 1993) .Endophthalmitis is a significant consequence that can arise with SO tamponade or following SO removal. However, we did not see this in our study.(Daoudi et al., 2009; Richards and Meyer, 2012).Cataract development is a common consequence following PPV in several trials. (Abrams et al., 1997; Stern, 1992)

Cataract following vitrectomy is mainly caused by the loss of the retrolental vitreous, which directly interacts with the lens and the gas or SO.(Heimann et al., 1996)

Postoperative cataract development occurred in 81% of our study's eyeballs that remained phakic following vitrectomy. Our findings are consistent with earlier reports for PPV using gas tamponade, indicating that up to 98% of elderly patients having PPV will acquire clinically severe cataracts two years after surgery(Almony et al., 2012). Following vitreoretinal surgeries involving or excluding SO injection, raised IOP has been seen, which can contribute to the onset of secondary glaucoma.(Barr et al., 1993; Gedde, 2002)

Except for a past diagnosis of glaucoma, which was substantially related to a higher IOP in the postoperative period in our research, baseline and intraoperative variables were identical between individuals who did not have a rise in IOP and those who did. . Similarly, Nguyen et colleagues discovered that individuals having previous glaucoma were more inclined to experience an increase in postoperative IOP.(Nguyen et al., 1992)

It is difficult to determine the actual probability of glaucoma following SO injection. IOP increases have been found to vary between 8% and 56%.(Barr et al., 1993; Muether et al., 2011) Increased IOP was seen in 53.1% of the eyes in our research, and it happened predominantly during the very first month following surgery. This was comparable to the findings of Muether et al., who discovered elevated IOP in 51.7% of the individuals treated with PPV. (Muether et al., 2011)

A handful of case reports have lately documented severe eyesight loss following SO usage with no apparent cause.(Christensen and la Cour, 2012; Herbert et al., 2006; Williams et al., 2008) This problem did not appear in our study.

Conclusion

To treat primary uncomplicated Rhegmatogenous retinal detachment, pars plana vitrectomy (PPV) coupled with silicone oil (SO) injection is a safe and successful surgical method. According to our findings, PPV and SO injections result in good anatomic and functioning results, including elevated reattachment incidences and minimal instances of proliferative vitreoretinopathy. Although cataract development and increased intraocular pressure (IOP) are typical consequences, they are manageable.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.

Approved by the department Concerned.

Consent for publication

Approved

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Conflict of interest

The authors declared an absence of conflict of interest.

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Data acquisition, analysis.

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