·Clinical Research·

Vitrectomy, lensectomy and silicone oil tamponade in the management of retinal detachment associated with choroidal detachment

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Abstract

• **AIM: To report the results of combined vitrectomy, lensectomy and silicone oil (SO) tamponade in treating primary rhegmatogenous retinal detachment (RRD) associated with choroidal detachment (CD).**

• **METHODS: A retrospective, consecutive and case series study of 21 subjects with concurrent RRD associated with CD was conducted. All subjects underwent a standard three-port 20G pars plana vitrectomy (PPV) with lensectomy and silicone oil tamponade. Mean follow-up time was 8 months (rang from 4 to 19 months). The primary and final anatomic success rate, visual acuity and final intraocular pressure (IOP) were recorded and analyzed.**

• **RESULTS: Of 21 subjects, 8 were women and 13 were men. Age at presentation ranged from 22 to 75 years (mean 57.4 years). The presenting vision ranged from light perception to 0.15. The initial IOP ranged from 3mmHg to 12mmHg (mean 6.2mmHg). All eyes were phakic except one pseudophakic. No intraocular lens was implanted during the primary surgical intervention. Fifteen of 21 (71.4%) eyes had retina reattached after one operation. Six eyes had recurrent inferior retinal detachment due to proliferation. Five of them were successfully reattached after one or more additional operations. Mean IOP at final follow-up was 15.2mmHg (range from 8mmHg to 20mmHg). One case declined for further operation. The final reattachment rate was 95.2%. Visual acuity improved in 19 (90.5%) eyes, was unchanged in 1 (4.8%) eye and decreased in 1 (4.8%) eye.**

• **CONCLUSION: Combination of vitrectomy, lensectomy and silicone tamponade is an effective method in treating RRD associated with CD, reducing the incidence of postoperative hypotony.**

• **KEYWORDS:** choroidal detachment; lensectomy; rhegamatogenous retinal detachment; vitrectomy; silicone oil
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INTRODUCTION

The occurrence of preoperative choroidal detachment (CD) along with primary rhegmatogenous retinal detachment (RRD) is somewhat rare and reported in 2%-4.5% of cases. The surgical reattachment rate has been improved by using vitrectomy [1-5], however, the proliferative vitreoretinopathy (PVR) is still a leading cause of initial surgical failure. The eyes with primary surgical failure are more likely to become silicone oil (SO) dependent due to persistent postoperative hypotony[5]. So Loo *et al*[6] advocated the primary SO tamponade in these entities due to anticipated PVR.

Cataract development or progression is one of the common complications reported after vitrectomy, especially in patients elder than 50 years of age. Removal of lens during primary vitrectomy can offer a better view of the fundus perioperatively, help clear the vitreous base and thus reduce the incidence of reproliferation[7-9].

We retrospectively reviewed 21 subjects with combined RRD and CD who were initially managed with primary vitrectomy along with lensectomy and primary SO tamponade since January 2010. Their anatomic and functional results were analyzed.

SUBJECTS AND METHODS

Subjects Medical records of all subjects with combined primary RRD and CD were retrieved at Chongqing Aier Eye

Hospital between January 2010 and November 2011. The medical ethics committee of the Chongqing Aier Eye Hospital had approved the study protocol and all participants had given informed consent. Subjects with a history of ocular trauma or ocular surgeries other than cataract extraction were excluded from the study. Under this inclusion criteria there were 21 eyes of 21 subjects collected and their medical records were carefully analyzed. All subjects underwent complete preoperative and postoperative examinations including visual acuity testing, slit lamp biomicroscopy, intraocular pressure (IOP) measurement, indirect ophthalmoscope, and ultrasonography.

Methods

Preparation for surgery Patients were given either oral steroids (prednisolone 1mg/kg) treatment for 5-7 days or intravitreal triamcinolone acetonide injection (IVTA 4mg) 3 days prior to operation. One percent prednisolone eye drops six times a day and 1% atropine eye ointment daily were also prescribed preoperatively. All the surgeries were done by one surgeon (Jun-Min Gui).

Surgical procedure and follow –up Surgical technique included standard three-port 20G pars plana vitrectomy, drainage of suprachoroidal fluid, lensectomy or phacoemulsification if there was a dense nuclear sclerosis cataract, membrane peeling if existed, endodrainage of subretinal fluid with perfluorocarbon liquids, retinotomy or retinectomy when needed, identification of retinal breaks, retinopexy with endophotocoagulation or cryopexy, inferior peripheral iridectomy was done if the lens capsular was not preserved or the preserved capsular was not intact, SO (5000 centistokes) tamponade. Scleral buckling procedure was not performed. Drainage of suprachoroidal fluid was performed prior the insertion of infusion canula modified from the method described by Loo [6]. Balanced saline solution was injected into the centre of the vitreous cavity to raise the intraocular pressure through either the upper temporal or upper nasal quadrant 3mm posterior to the limbus using a 27-gauge needle. Sclerotomy was then made in the opposite superior quadrant 3mm from the limbus, extending no further than the suprachoroidal space. The positive pressure within the vitreous cavity permitted drainage of the yellowish effusion fluid *via* the second incision. Intravitreal injection of saline solution can be repeated until there was no yellowish fluid coming out. A 4mm long infusion cannula was then inserted *via* a routine inferotemporal sclerotomy, and checked for penetration of the pars plana epithelium. The sclerotomies in two upper quadrants were then re-entered with the micro-vitreoretinal blade, to penetrate the pars plana epithelium. Postoperatively, all subjects were required to take a prone or facedown position for one week and oral steroids were tapered down for 2 weeks; topical steroids were continued for 4 weeks. Anatomic success was defined as total retinal reattachment, and functional success, as improvement in best corrected visual acuity of two or more lines at the last follow-up. The mean follow-up was 8 months ranged from 4 to 19 months.

RESULTS

Twenty one eyes of 21 subjects were included in the study. Table 1 summarizes the clinical manifestations and treatment courses of these subjects. Eight were female and 13 were male. Age at presentation ranged from 22 to 75 years (mean 57.4 years). The presenting vision ranged from light perception to 0.15. The initial IOP ranged from 3 to 12mmHg (mean 6.2mmHg). The duration of retinal detachment estimated from symptom presentation ranged from 1 to 150 days (median 30 days). The causative retinal breaks were maluar holes in 8 of 21 (38.1%) eyes, posterior break outside the macular area in 3 of 21 (14.3%) eyes; size of break larger than 2 disc diameters in 8 of 21 (38.1%) eyes; Eleven of 21 (52.4%) eyes were high myopia (greater than -6 diopters) and 6 of 8 (75.0%) eyes with macular hole were associated with high myopia. Eleven of 21 (52.4%) eyes presented with grade C PVR. All eyes were phakic except that case 15 was pseudophakic. All phakic lenses were opacified with different severity. The lens was removed by pars plana lensectomy in 15 subjects and by phacoemulsification in 3 subjects (case 5, 8 and 13) who had obvious nuclear sclerosis cataract. Intraocular lens of case 15 was also removed. None of the subjects had intraocular lens implantation during the primary surgical intervention.

Fifteen of 21 (71.4%) eyes had retina reattached after one operation. Six eyes had recurrent inferior retinal detachment due to postoperative proliferation (case 2, 6, 7, 11, 16, and 18). Five of them were successfully reattached after one (case 6, 16, 18) or more additional operations (case 2, 7). Case 11 declined for further operation. The final reattachment rate was 95.2%. Visual acuity improved in 19 (90.5%) eyes, was unchanged in 1 (4.8%) eye and decreased in 1 (4.8%) eye. Mean IOP at final follow-up was 15.2mmHg (ranged from 8 to 20mmHg). Case 19 developed the second glaucoma one month after operation due to SO migrating into the anterior chamber as a result of closure of inferior peripheral iridectomy. His IOP was 57mmHg and the vision was no light perception at that time and the SO was removed immediately. His vision restored to 0.05 at final follow-up.

Table 1 Functional and anatomic status after combination of vitrectomy, lensectomy and silicone oil tamponade for retinal detachment associated with choroidal detachment

Case	Sex	Age (a)	Eye	Duration of RD	Grade C PVR	Break (Location/size)	Myopia (>-6D)	IOP (Preop/Postop)	Preop steroid	Initial BCVA	Final BCVA	Change of VA	Follow-up (month)	Anatomic outcome
1	F	44	LE	30	No	AEQ/large	Yes	6/15	oral	0.04	0.12	Improved	8	Retina flat SO removed
2	F	55	RE	150	Yes	AEQ/small	Yes	6/10	oral	FC	0.08	Improved	5	Retina flat SO removed
3	M	52	RE	1	No	AEQ/small	Yes	12/19	oral	HM	0.04	Improved	19	Retina flat SO removed
4	M	66	RE	30	Yes	AEQ/small	No	4/17	Oral	0.04	0.4	Improved	5	Retina flat SO removed
5	M	59	LE	10	No	PEQ/MH	Yes	6/16	Oral	HM	0.04	Improved	15	Retina flat SO removed
6	F	48	LE	30	No	PEQ/MH	No	7/20	Oral	HM	FC	Improved	7	Retina flat SO removed
7	M	44	RE	20	Yes	PEQ/small	No	8/15	Oral	HM	FC	Improved	15	Retina flat SO present
8	F	67	LE	6	Yes	PEQ/MH	Yes	6/20	Oral	HM	HM	Unchanged	8	Retina flat SO present
9	M	48	RE	7	No	PEQ/MH	Yes	7/15	Oral	FC	0.1	Improved	14	Retina flat SO present
10	M	62	RE	7	No	PEQ/MH	Yes	5/12	Oral	HM	0.06	Improved	11	Retina flat SO present
11	M	69	LE	30	No	PEQ/MH	Yes	4/8	Oral	HM	LP	Decreased	5	Retina detached SO present
12	F	64	LE	30	Yes	PEQ/MH	Yes	8/11	Oral	FC	0.06	Improved	4	Retina flat SO present
13	F	55	RE	30	No	AEQ/large	No	9/16	Oral	0.15	0.4	Improved	6	Retina flat SO removed
14	F	56	LE	20	Yes	PEQ/MH	No	4/15	Oral	LP	FC	Improved	5	Retina flat SO present
15	F	68	RE	60	Yes	PEQ/large	Yes	4/13	Oral	HM	0.06	Improved	6	Retina flat SO present
16	M	22	RE	120	Yes	PEQ/large	Yes	5/15	Oral	0.05	0.2	Improved	7	Retina flat SO removed
17	M	55	RE	7	No	AEQ/small	No	4/18	IVTA	0.04	0.15	Improved	7	Retina flat SO removed
18	M	59	LE	30	Yes	AEQ/large	No	3/20	Oral	HM	0.05	Improved	7	Retina flat SO removed
19	M	75	LE	30	Yes	EQ/large	No	7/17	IVTA	HM	0.05	Improved	5	Retina flat SO removed
20	M	67	LE	60	Yes	EQ/large	No	9/13	IVTA	HM	0.15	Improved	4	Retina flat SO present
21	M	70	LE	20	No	AEQ/large	No	6.5/15	IVTA	FC	0.1	Improved	4	Retina flat SO present

AEQ: Anterior to the equator; BCVA: Best-corrected visual acuity; EQ: Equator; F: Female; FC: Finger counting; HM: Hand motion; IOP: Intraocular pressure; LE: Left eye; M: Male; PEQ: Posterior to the equator; PVR: Proliferative vitreoretinopathy; RE: Right eye; RD: Retinal detachment; SO: Silicone oil.

DISCUSSION

Previously reported risk factors for CD in RRD subjects included high myopia, aphakia, pseudophakia, and advanced age [10]. Myopia higher than -6 diopters consisted of 52.4% of eyes in our cases series. Kang *et al* [11] demonstrated that incidence of RRD associated with macular hole carries a higher rate of CD. In our series, Eight of 21 (38.1%) eyes with combined primary RRD and CD were associated with macular holes, which is much higher than those reported, 1% or less of RRD were associated with macular holes [12]. The another striking characteristic of causative retinal breaks in our series is the size of breaks, eight of 21 (38.1%) eyes were associated with the size of break larger than 2 disc diameters, which was similar to the study by Jarrett[13].

The mechanism of CD associated with RRD is not clear. Most authors agree that hypotony induced by the RRD is likely to be the initial step. Hypotony is quite commonly seen in cases of RRD, and may be due to diminished aqueous production or possibly to increased outflow *via* the retinal pigment epithelium. The fall in intraocular pressure could lead to vasodilatation in the choroid, breakdown of the blood-ocular barrier and transudation of fluid into the extravascular space. Resulting choroidal and ciliary body detachment would lead to a further reduction in aqueous production, and thus a vicious cycle is produced [2,4,6]. Fluid exchange between the vitreous and the subretinal space will depend first on the size of the retinal hole, and the state of the vitreous over the hole is another important factor influencing fluid exchange through a retinal hole. The vitreous occlusion of the retinal hole may prevent the fluid movement from the vitreous into the subretinal space [14]. Kang *et al* [11] explained that the high incidence of CD observed in RRD subjects with macular hole might be associated with the location of the retinal break and the posterior vitreous detachment (PVD). The vitreous gel tends to retract to the vitreous base when there is a PVD, thus when RRD is associated with a posterior break or macular hole (consisted of more than half in our series), there would be more fluid enter the subretinal space, resulting in hypotony and CD. Based on that assumption, it is easier to understand why advanced age is also a risk factor for CD, because PVD develops as aging.

Though over 90% of the final reattachment rates can be reached in concurrent RRD associated with CD when treated with primary vitrectomy [2-6], still there is a higher rate of postoperative hypotony. Sharma *et al* [5] reported 3 of 5 eyes after initial surgical failure had to keep oil due to hypotony. Primary SO tamponade have a good result in treating central macular hole detachments in highly myopic eyes and complicated retinal detachment[15-17]. Loo *et al*[6] advocated the primary SO tamponade in treating concurrent RRD associated with CD due to anticipated PVR, especially in those subjects with myopic eyes who are at considerable risk of surgical failure. Although postoperative hypotony was not mentioned in their series (13 cases), oil was left *in situ* in 5

eyes and the risk of redetachment was thought to be too high in two eyes. We advocated the primary lensectomy or phacoemulsification in combination with primary vitrectomy and SO tamponade as we believe this triple procedure might further improve the surgical outcome in this disease entities. Actually many experienced vitreoretinal surgeons have already advocated complete removal of the crystalline lens in phakic subjects in order to accomplish the surgical goals of complete retinal reattachment with removal of proliferative membranes [7,8]. Cataract development and progression are one of the common complications after pars plana vitrectomy (PPV) in phakic eyes. The reported incidence of new or progression of preexisting lens opacities after vitrectomy is up to 80% within a 2-year follow-up period, depending on the series [18]. Most cases in our series have already presented cataract of different severity due to old age or inflammation. When primary RRD concurrent with choroidal detachment, the choroidal tissues are often thickened. Though drainage of suprachoroidal fluids through the pars plana incision can flatten the detached choroid, the thickened choroid tissues may persist for a period. So even the SO is fully filled by the end of surgeries, the volume of SO at follow-up observation is often not enough. When lens is removed, it leaves more space for SO fill. With lens removal and extensive vitreous dissection, the incidence of postoperative hypotony could be reduced. All but one eyes (case 11) in our series had normal IOP at last follow-up. Subjects who had SO presented except case 11 all had well-attached retina and had no signs of oil emulsification. These subjects would just like to keep oil as long as there is no SO-related complications such as oil emulsification, intraocular pressure elevation, *etc.* Lensectomy is helpful for another reason for this type of cases. In case of an excessive choroidal detachment preventing the initial safe insertion of a pars plana infusion cannula, anterior chamber infusion and lensectomy *via* the limbal approach allows anterior vitrectomy through the same approach, followed by drainage of suprachoroidal fluid and the safe insertion of a pars plana infusion cannula for the completion of the vitrectomy *via* the pars plana approach subsequently. However, it should weigh carefully the pros and cons of removing the crystalline lens in young subjects, especially when the accompanied choroidal detachment is not extensive and PVR is not severe.

By using vitrectomy, the diseased vitreous with its mitogenic and chemotactic stimuli can be removed, and the suprachoroidal fluid can be drained through the pars plana sclerotomy, but the underlying pathological changes, such as vasodilatation in the choroid, breakdown of the blood-ocular barrier will usually persist for a long period after operation. Sharma *et al* [5] in a pilot study showed even treated with primary vitrectomy, preoperative steroids treatment may still be necessary. The major disadvantage of preoperative systemic steroid treatment is that it may delay the surgical time and has the potential systemic side effects. Intravitreal triamcinolone acetonide injection has been widely used for various conditions such as diffuse diabetic macular edema, pseudophakic cystoid macular edema, chronic prephthisical ocular hypotony and uveitis, and as a tool in assisting vitrectomy [19,20]. Duan *et al* [21] in a pilot study showed preoperative IVTA might be better than oral steroid treatment in both controlling the ocular inflammation and avoiding the systemic side effects. In our series, case 17, 19, 20, 21 were given IVTA treatment 3 days preoperatively. All these eyes were successful in reattaching the retina after one operation. No adverse effects were found intraoperatively and postoperatively in these cases. These limited uncontrolled results suggested that a controlled clinical trial may be necessary to determine whether preoperative IVTA is better than oral steroids treatment and the optimal interval between the IVTA treatment and vitrectomy.

One of the complications of SO tamponade in apakic eyes is the second glaucoma duo to migration of SO into the anterior chamber, mostly caused by the closure of inferior peripheral iridectomy [22]. To prevent this complication, subjects shall be required to keep a prone or facedown position for a long period until it can be sure that the peripheral iridectomy would not be closed. Preservation of anterior capsule during par plana lensectomy may also prevent this complication and simplify the future PCIOL placement[7].

Our retrospective results based on this small cases series suggested that combination of primary vitrectomy and lensectomy and SO tamponade is an effective method in managing primary RRD associated with CD, reducing the incidence of postoperative hypotony, especially in elder subjects or in subjects with an already existed opacity of lens. A randomized controlled clinical trial may help to elucidate the necessity of this combined treatment.

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