Journal of Animal and Veterinary Advances 11 (13): 2323-2326, 2012
ISSN: 1680-5593

The Anatomical and Functional Outcomes of 23-Gauge Transconjunctival Sutureless Vitrectomy in Pseudophakic Retinal Detachment: A Prospective Interventional Study

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Abstract: The purpose of this study is to evaluate the anatomic and functional outcomes of 23-gauge Transconjunctival Sutureless Vitrectomy (TSV) in primary reatment of uncomplicated pseudophakic Retinal Detachments (RD). In this prospective noncomparative interventional study, 32 eyes of 32 patients with RD after cataract surgery with phacoemulsification were evaluated. Primary pseudophakic RDs with macular detachment and proliferative vitreoretinopathy stage B or less were included in the study. The 23-gauge TSV, perfluorocarbon liquid injection followed by air exchange, endolaser photocoagulation and sulfur hexafluoride gas (20%) injection were applied to all eyes. Mean follow-up time was 9.3 months (range, 6-12 months). Retinal reattachment with a single operation was achieved in 93.75% of eyes and with additional surgery, the retina was reattached in 100% of eyes. Preoperative visual acuity was <20/200 in all eyes (range, hand motions to 20/400). Postoperative visual acuity was 20/40 or better in 15 eyes (46.88%) and 20/50 and 20/200 in 12 eyes (37.50%). No sutures were required to close the scleral and conjunctival openings. Postoperative complications were Transient hypotony in 2 eyes (6.25%) macular pucker in 2 eyes (6.25%) and cystoid macular edema in 2 eyes (6.25%).

Key words: 23-gauge, transconjunctival sutureless vitrectomy, pseudophakic retinal detachment, sulfur, hexafluride gas, air exchange

INTRODUCTION

Retinal Detachment (RD) is one of the serious complications of cataract surgery that threatens visual acuity and occurs in approximately 0.4-1.0% of eyes after cataract surgery with phaco emulsification (Haddad *et al*., 2002; Olsen and Olson, 2000). The 20-gauge Primary Pars Plana Vitrectomy (PPV) with or without scleral buckling are the most commonly used techniques in the treatment of primary pseudophakic RD (Lois and Wong, 2003; Stangos *et al*., 2004). The advent of new microsurgical instruments, wide-angle viewing apparatus and Perfluorocarbon Liquids (PFCL) have increased the scope of primary PPV in the treatment of pseudophakic RD.

The recent evolution in the PPV technique with minimal invasive surgery and faster patient recovery is 23-gauge Transconjunctival Sutureless Vitrectomy (TSV) (Eckart, 2005). Several researchers have reported successful anatomic and visual outcomes with 23-gauge TSV in eyes with different vitreoretinal disorders (Sanisoglu *et al*., 2011; Romano *et al*., 2012; Wu *et al*., 2011). However, there is limited experience in pseudophakic RD. The purpose of this study was to report the preliminary results of 23-gauge TSV in the management of primary pseudophakic RD.

MATERIALS AND METHODS

The 32 consecutive patients (32 eyes) were recruited in the period between Feburary, 2007 and May, 2011 in the Department of Ophthalmology at Renmin Hospital of Wuhan University. All patients suffered retinal detachment after cataract surgery with implantation of an intraocular lens. Inclusion criteria were RD occurring after cataract extraction with phacoemulsification and posterior chamber Intraocular Lens (IOL) implantation; macular detachment; Proliferative Vitreoretinopathy (PVR) grade A or B (Anonymous, 1983). The patients with signs of PVR higher than grade B, proliferative diabetic retinopathy, uncontrolledv glaucoma or uveitis, vitreous bleeding, giant tear, anterior chamber IOL, presence of posteriorly dislocated lens fragments, a history of any other intraocular surgery except cataract extraction were excluded. Eyes that had been operated due to traumatic and congenital cataracts were excluded as well. The possible merits and risks of the treatment were explained to the patients and an informed consent was obtained in accordance with the Helsinki Declaration prior to inclusion in the study.

Preoperative evaluation included age, sex, duration of macular detachment best-corrected Snellen visual acuity,

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slit-lamp biomicroscopy examination Intraocular Pressure (IOP) and detailed fundus examination. Axial length and refractive status measurements were obtained from the patients' medical records.

All operations were performed by an experienced surgeon under local anesthesia. The microcannulae (DORC International, Zuidland, Holland) were inserted obliquely with the help of the insertion trocars in the inferotemporal, superotemporal and superonasal quadrants. The overlying conjunctiva was pulled aside with forceps during the entrance of the insertion trocar in order to avoid the alignment between conjunctival and scleral incisions. The infusion cannula was placed in the inferotemporal quadrant and plugs were used to temporarily close the other entry sites. A cutting rate of 1500 cuts min^{-1} and a vacuum level of 450 mmHg were used during PPV. The bottle height was set at 40 cm. Peripheral Vitreous was removed during PPV. Peripheral manipulations were performed by using wide-angle viewing system with scleral depression by an assistant. Following PPV, the infusion line was removed while the microcannula was held in place with forceps. A PFCL (Perfluoronoctane) was then injected slowly up to the anterior break to flatten the retina. The infusion line was replaced and switched to air to perform a complete PFCL-air exchange.

A viscoelastic solution (Sodium Hyaluronate 1%) was injected into the anterior chamber through a paracentesis to avoid air passage to the anterior chamber. Endolaser photocoagulation (532 nm) was applied around the retinal break (s) and to the degenerative retina area. Then the superonasal microcannula was removed and sulfur hexafluoride gas (20%) was injected through the infusion line. After removing the superotemporal microcannula, the inferotemporal microcannula and infusion line were removed en bloc while injecting gas. The conjunctiva overlying the sclerotomy was slightly displaced to disrupt the alignment between both entry sites and an antibiotic and corticosteroid combination was injected into the subconjunctival space. The viscoelastic solution was left in the anterior chamber at the end of the operation. All patients were postured face down for 3 h postoperatively thereafter the patients were postured on the opposite side of the breaks. Posturing was maintained for 7-10 days. Patients were examined daily until discharge and thereafter 1, 3 and 6 months and 1 year after surgery. Each postoperative examination included measurements of best-corrected Snellen visual acuity, slit-lamp examination Intraocular Pressure (IOP) and fundus examination. Main outcome measures were retinal reattachment rate, visual acuity Intraocular Pressure (IOP) and intraoperative and postoperative complications.

RESULTS AND DISCUSSION

Of 32 patients, 15 were men and 17 were women. Mean age was 62.32 years (range, 28-72 years). Mean follow-up time was 9.3 months (range, 6-12 months). Preoperative characteristics including intraocular lens, refractive status, vitrous loss or laser capsulotomy and detection of hole of patients are shown in Table 1. Preoperative visual acuity was Hand Motions (HM) in 25 eyes (78.13%), 20/400 in 5 eyes (15.63%) and 20/800 in 2 eyes (6.25%). Mean duration of macular detachment was 7.1 days (range, 1-23 days). Anterior vitrectomy with sulcus-fixated IOL implantation had been performed in 5 eyes (15.63%) with posterior capsule rupture and vitreous loss complicating the phacoemulsification procedure. About 11 eyes (34.38%) with posterior capsule opacity had neodymium:YAG (Nd:YAG) laser capsulotomy. The remaining 9 eyes (50.00%) had intact posterior capsule. Mean axial length was 25.5±2.3 mm and 4 eyes had pathologic myopia with an axial length of 29 and 30 mm. Single operation success was achieved in 30 (93.75%) of 32 eyes. In 1 eye, retinal redetachment due to a new inferior break which was observed at postoperative 3 weeks was successfully treated with reoperation using retinocryopexy and scleral buckling. In a second patient redetachment was associated with the development of PVR with reopening of the previous retinal break 28 days after primary vitrectomy. In a second procedure, researchers removed these epiretinal membranes by 23-gauge TSV system. The retina reattached after injection of perfluorocarbon liquids, endolaser photocoagulation and fluid gas exchange.

The median of best corrected visual acuity before surgery was 20/100. Owing to the gas endotamponade median visual acuity decreased to 20/400 at the time of discharge. At the 1 month interval, the gas endotamponade was totally absorbed in all cases. Median visual acuity increased to 20/80. After 6 months, median visual acuity was 20/40 but 4 patients did not missed the control examination at this interval. Median visual acuity 1 year after primary vitrectomy was 20/30.

Table 1: Characteristics of 32 pseudophakic eyes with retinal detachment

Characteristics	No. of eyes
Posterior intraocular lens	32
Vitreous loss	5
YAG capsulotomy	11
Myopia(>-6.0D)	14
Detection of hole	
No hole of preoperatively	7
No hole according to Lincoff preoperatively	6
No hole intraoperatively	2
A additional hole intaoperatively	5

Final visual acuity was better than preoperative visual acuity in all eyes. Postoperative visual acuity was 20/40 or better in 15 eyes (46.88%) and between 20/50 and 20/200 in 12 eyes (37.50%). Mean IOP was 11.43 mm Hg (range, 7-17) before the operation, 11.8 mm Hg (range, 8-21) at day and 17.1 mm Hg (range, 10-27) at month 1 after the operation.

In 7 eyes no breaks were detected preoperatively. In a further 6 eyes preoperative localisation of the break did not comply with the rules of Lincoff (Lincoff and Gieser, 1971) but corresponding breaks were found intraoperatively. In all but 2 eyes vitrectomy and the use of perfluorocarbon liquid revealed the causative retinal break. In a further 5 eyes an additional break not seen in the preoperative examination could be identified. No major intraoperative complications were encountered and conversion to conventional 20-gauge PPV was not required in any eye. Intraocular manipulations were easily performed and no sutures were required to close the scleral and conjunctival openings. No clinically significant intraocular inflammation was observed in the postoperative period due to the viscoelastic solution left in the anterior chamber. Postoperative complications were transient hypotony in 2 eyes (6.25%), macular pucker in 2 eyes (6.25%) and cystoid macular edema in 2 eyes (6.25%).

Pars plana vitrectomy offers a number of advantages to the retinal surgeon in the management of pseudophakic retinal detachments (Bartz-Schmidt *et al*., 1996). It eliminates media opacities in the anterior and posterior segment. It allows for easy localisation of retinal holes and removalof vitreoretinal traction and it facilitates more precise treatment of retinal breaks by endolaser. Recently, the new advance in the PPV technique with minimal invasive surgery and faster patient recovery is 23-gauge Transconjunctival Sutureless Vitrectomy (TSV) (Eckart, 2005). Several researchers have reported successful anatomic and visual outcomes with 23-gauge TSV in eyes with different vitreoretinal disorders (Sanisoglu *et al*., 2011; Romano *et al*., 2012; Wu *et al*., 2011). However, there is limited experience in pseudophakic RD with this new technique.

In this prospective study, retinal reattachment with a single operation using 23-gauge TSV was achieved in 93.75% of eyes with pseudophakic RD and with additional surgery, the retina was reattached in 100% of eyes. Single operation and final anatomic success with primary 20-gauge PPV have been reported in 63-98 and 92-100% of eyes with pseudophakic RD, respectively (Stangos *et al*., 2004; Campo *et al*., 1999; Ahmadieh *et al*., 2005). In addition, the single operation and final success rates compare favorably with the anatomic outcomes of other surgical procedures used in the management of pseudophakic RD (Stangos *et al*., 2004; Campo *et al*., 1999; Tornambe *et al*., 1991). Therefore, the preliminary results suggest that 23-gauge TSV may be an alternative surgical procedure in the treatment of selected cases of pseudophakic RD.

In the present study, final visual acuity was better than preoperative visual acuity in all eyes. Postoperative visual acuity was 20/40 or better in 15 eyes (46.88%) and between 20/50 and 20/200 in 12 eyes (37.50%). In previous studies in which primary 20-gauge PPV was performed in the treatment of pseudophakic RD visual acuity of 20/40 or better has been reported in 11-88% of eyes (Lois and Wong, 2003; Campo *et al*., 1999; Ahmadieh *et al*., 2005; Brazitikos *et al*., 2005). The visual results are also comparable with the visual outcomes of other surgical procedures used in the management of pseudophakic RD (Campo *et al*., 1999; Ahmadieh *et al*., 2005; Brazitikos *et al*., 2005). There are several advantages of 23-gauge TSV over conventional 20-gauge PPV including less operation time, absence of suture-related irritation or local inflammatory reaction at the sclerotomy sites, absence of limbal stem cell damage due to conjunctival dissection insignificant corneal surface and astigmatic changes in the early postoperative period, faster postoperative recovery and increased patient comfort (Sanisoglu *et al*., 2011; Romano *et al*., 2012; Wu *et al*., 2011). In addition, the potential advantages of 20-gauge PPV without scleral buckling over conventional scleral buckling are expected to be the advantages of 23-gauge TSV. These are less operation time, accurate diagnosis of breaks controlled drainage of subretinal fluid and no postoperative axial length changes. Therefore if a primary PPV is appropriate in the management of pseudophakic RD, it may be logical to perform it with a 23-gauge TSV system.

Anterior or posterior capsular fibrosis small capsulorrhexis, cortical remnants, poor pupillary dilation, small IOL diameter, formation of moisture droplets on the posterior surface of the IOL and optical aberrations secondary to IOL itself make the PPV more difficult in pseudophakic eyes when compared with the primary RD (Yoshida *et al*., 1992). The indication of 23-gauge TSV can be extended to pseudophakic RD and favorable outcomes may be obtained by paying special attention to the above issues. The possible risks of the TSV system were postoperative vitreous incarceration leading to anterior vitreoretinal traction and late period retinal tear or detachment, endophthalmitis and hypotony. Postoperative RD, transient or severe hypotony, shallow choroidal detachment, endophthalmitis have been reported in studies in which 23-gauge TSV was performed for different vitreoretinal disorders (Romano *et al*., 2012; Cekic *et al*., 2011; Kim *et al*., 2007). Retinal redetachment (6.25%) due to a new break, transient hypotony (6.25%) macular pucker (6.25%) and cystoid macular edema

(6.25%) postoperative complications encountered in the series. Despite peripheral vitreous removal which increases the risk of postoperative hypotony, an IOP of <5 mm Hg and choroidal detachment were not observed in any eye. This may be due to the injection of a viscoelastic solution (sodium hyaluronate 1% in the series) into the anterior chamber and also, due to the use of intravitreal gas injection. Residual peripheral vitreous which is pushed towards the sclerotomies by intravitreal gas may serve as a plug and prevent leakage even in eyes with peripheral vitreous removal. The primary limitations of this study are the small number of patients, selection of cases without severe PVR and lack of comparison with other surgical procedures used in the management of pseudophakic RD. In conclusion, primary 23-gauge TSV system appears to be effective and safe in the management of uncomplicated pseudophakic RD. Faster postoperative recovery and increased patient comfort make this surgical procedure a good alternative to other procedures used in the management of pseudophakic RD.

CONCLUSION

In this study, 23-gauge sutureless vitrectomy resulted in higher single surgery and final anatomic success rates in primary treatment of noncomplicated RDs in pseudophakic eyes with commensurate increase in visual acuity. Primary 23-gauge TSV system appears to be an effective and safe procedure in the treatment of uncomplicated pseudophakic RD.

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