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Clinical outcomes of 23-gauge pars plana vitrectomy for the management of posterior capsule rupture in phacoemulsification.

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Abstract

Aim: This study is to investigate the clinical outcomes of 23-gauge Pars Plana Vitrectomy (23G PPV) for the management of Posterior Capsule Rupture (PCR) with vitreous loss in phacoemulsification immediately.

Methods: Clinical data of 1571 cases (2356 eyes) performed phacoemulsification for cataracts only between March 2012 and February 2016 in Chinese Navy General Hospital were analysed retrospectively. The postoperative Best Corrected Visual Acuity (BCVA) and complications of the eyes suffered PCR with vitreous loss in single age-related cataract surgery settled by two treatment methods were compared. In surgery, 75 eyes suffered PCR with vitreous loss, 33 eyes out of 1134 eyes (between March 2012 and February 2014) were adopted the conventional method to settle the PCR with vitreous loss (group A), and 42 eyes out of 1222 eyes (between March 2014 and February 2016) adopted 23G PPV immediately to settle the PCR with vitreous loss (group B). The patients were followed up from 4 months to 48 months after operation, and then the postoperative visual acuity and complications were compared between two groups.

Results: The rate of PCR with vitreous loss was 2.91% in group A, and was 3.44% in group B, the difference was not statistically significant (P>0.05). The final average BCVA (the treatment of postoperative complications were finished) was 0.4 ± 0.32 in conventional method group A, and was 0.6 ± 0.21 in group B, and the difference was statistically significant (P<0.05). For postoperative complications, there was statistically significant difference between the two groups in terms of short-term postoperative complications and long-term severe complications (P<0.01).

Conclusion: The postoperative complications were significantly reduced in treatment of PCR with vitreous loss in phacoemulsification by 23G PPV immediately, and the postoperative outcomes were satisfactory.

Keywords: Phacoemulsification, Posterior capsule rupture, Vitreous loss, Complication, 23-Gauge pars plana vitrectomy.

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Introduction

Posterior Capsule Rupture (PCR) with vitreous loss is a serious complication in phacoemulsification for cataract that will cause serious consequences. Notwithstanding the surgical technique and equipment progressively improved, PCR is still difficult to avoid due to the difference of the patient's own situation and the experience of surgeons [1]. The patient's own condition includes eye and systemic risk factors. Ocular risk factors contain deep eye socket, high myopia, small pupil, shallow anterior chamber, capsule exfoliation syndrome etc. Systemic risk factors contain severe obesity, Marfan syndrome, diabetes, high blood pressure. The experience of surgeons is more important compared to the patient's own situation. The incidence of PCR with vitreous loss is about 3.6%-4.4% [2-4]. For experienced surgeons the incidence could be reduced to as low as 0.68% [5], however, it could be up to 19% if the surgeon is in the learning phase [6].

PCR with vitreous loss should be actively managed. The conventional method was using the vitrectomy system comes with the ultrasound emulsification instrument to perform anterior vitrectomy across the main corneal incision, under perfused from secondary incision. However, this method may lead to poor postoperative vision and a variety of complications such as corneal matrix edema, vitreous hemorrhage, uveitis and even infectious endophthalmitis. From March 2014, 23-gauge Pars Plana Vitrectomy (23G PPV) was adopted in the treatment of the PCR with vitreous loss in our hospital, and the patient expressed satisfaction with the postoperative effect. To investigate the clinical outcomes of 23G PPV for the management of PCR with vitreous loss in phacoemulsification immediately, the study was performed. To this end, in this study, retrospective analysis was performed to unravel the merits of 23G PPV.

Materials and Methods

Patients

Clinical data of 1571 cases (2356 eyes) performed phacoemulsification for single cataracts between March 2012 and February 2016 in Chinese Navy General Hospital were analysed retrospectively. Inclusion criteria: the patients performed phacoemulsification for single cataracts and suffered PCR with vitreous loss in surgery. Exclusion criteria: the patients have glaucoma, corneal leukoplakia, lens dislocation, combined anterior and posterior segment surgery or postoperation of vitrectomy. There were 75 eyes suffered PCR with vitreous loss in surgery. Among them, 33 eyes out of 1134 eyes (between March 2012 and February 2014) adopted the conventional method to settle the PCR with vitreous loss were taken as group A. In this group, 20 were male and 13 were female, aged 63-87 y, with preoperative visual acuity of CF-0.2. In addition, 42 eyes out of 1222 eyes (between March 2014 and February 2016) adopted 23G PPV immediately to settle the PCR with vitreous loss were defined as group B, including 30 males and 12 females, aged 58-89 y, with preoperative visual acuity of HM-0.2. The study was approved by the Ethics Committee of Beijing Navy General Hospital. Informed consent was taken from patients before the study.

Surgical procedures

As for the surgical procedure, briefly, once PCR was found in group A, the operation immediately stopped. If PCR appeared in nuclei lentis emulsification process, viscoelastic agent was injected into anterior chamber, vitreous prolapsed was cut off from incision, and vitreous and residual nuclear were separated using viscoelastic agent. The small nuclei lentis block was delivered from the incision, once the nuclei lentis blocks were big, height of infusion bottle were reduced, the residual nuclei lentis was removed by phacoemulsification again, and then anterior vitreous and residual lens tissue were cut off using the vitrectomy system comes with the ultrasound emulsification instrument. Perfusion was performed from the secondary incision, viscoelastic agents was injected into anterior chamber again, Intraocular Lens (IOL) was implanted at ciliary sulcus, the viscoelastic agents was suctioned after miosis, and anterior chamber was recovered. If PCR appeared in suctioned cortex or polished posterior capsule process, viscoelastic agents were injected into anterior chamber, the vitreous prolapsed was cut off from incision, then anterior vitreous and lens cortex were cut off, and IOL was implanted at ciliary sulcus in the same way as above. If PCR appeared in implanted IOL process, the IOL was adjusted to ciliary sulcus, the vitreous was cut off in anterior chamber, and then give myotic. When PCR was found in group B, the operation immediately stopped, viscoelastic agents were injected into anterior chamber and 3 ml lidocaine was injected for retrobulbar anesthesia, then 23G PPV was performed using ACCURUS (Alcon, US) with cutting rate of 1000-2500/min and negative pressure of 200-600 mmHg, anterior vitreous was cut off with residual nuclei lentis blocks and cortex lentis. Check up and cut off the intravitreal lens tissue implant IOL in the capsular bag, or in ciliary sulcus, or in ciliary sulcus by suspension after observing the condition of anterior and posterior capsule carefully.

Statistical analysis

SPSS13.0 software package (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. The preoperative visual acuity of two groups was tested by two sets of independent sample data rank sum test (Mann-Whitney U test). The age and postoperative visual of two groups were contrasted by two sets of independent samples data t test. The rates of posterior capsule rupture with vitreous loss and the postoperative complications of two groups contrasted by c^2-test. $P<0.05$ was considered as statistically significant difference.

Results

Baseline characteristics

In order to understand the baseline characteristics of the study, the patient's demographic data and clinical data were collected. The average age was 73 ± 4.85 y old in group A, and was 75 ± 7.23 y old in group B. There was no significant difference between the two groups (Table 1, $P>0.05$). The incidence of PCR with vitreous loss was 2.91% in group A, and was 3.44% in group B, the difference between the two groups was not statistically significant (Table 1, $P>0.05$). At the same time, the preoperative visual acuity of the two groups had no statistically significant difference (Table 2, $P>0.05$). These results indicated that the two sets of baseline data were comparable.

IOL implantation condition

In group A, 32 eyes were implanted IOL in ciliary sulcus, 1 eye was not implanted IOL first time, and implanted IOL in ciliary sulcus by double loop suture fixation through vitrectomy secondly. Among 32 eyes which were implanted IOL in ciliary sulcus, two IOL fell into vitreous cavity, and implanted IOL in ciliary sulcus by double loop suture fixation through vitrectomy secondly. In group B, 8 eyes were implanted IOL in capsular bag, 33 eyes were in ciliary sulcus, and 1 eye was implanted IOL in ciliary sulcus by single loop suture fixation.

Postoperative complications and settlement

In order to study the postoperative complications of the two groups, the subjects were followed up and the relevant information were collected. All patients of two groups had not endophthalmitis and explosive choroidal hemorrhage. For short term complications, there were 16 eyes with short term corneal stromal edema in group A and only 4 eyes in group B. The difference between the two groups was significant (Table 3, $P<0.05$). Similarly, for short-term high IOP (<1 W), the frequency of occurrence in the group A was significantly higher than that in group B ($P<0.05$). The probability of long-term severe complications in group A was as high as 45%, which was significantly higher than that in group B (7%).

These results suggested that the postoperative complications can significantly reduce in treatment of PCR with vitreous loss in phacoemulsification by 23G PPV immediately compared to conventional methods.

Postoperative visual acuity

In order to understand the posterior vision recovery, the postoperative visual acuity of the subjects was evaluated. After the surgery, all complications were controlled completely, the average best corrected visual acuity was 0.4 ± 0.32 in group A, and was 0.6 ± 0.21 in group B, the difference between the two groups was statistically significant (P<0.05) (Table 4). The results showed that the group B had a better therapeutic effect compared to group A.

Table 1. *Comparison of the age and the rate of PCR with vitreous loss between groups A and B.*

	Group A (n=33)	Group B (n=42)	t/χ^2	P
Age (a)	73 ± 4.85	75 ± 7.23	1.365	0.176*
Rate of PCR with vitreous loss	33/1134 (2.91%)	42/1222 (3.44%)	0.587	0.443#

*t test; #χ^2 test

Table 2. *Comparison of the preoperative visual acuity between groups A and B.*

	n	HM	CF	0.06~0.08	0.1~0.2	Z	P
Group A	33	0	4	11	18	0.707	0.699
Group B	42	2	6	15	19		

Table 3. *Comparison of the postoperative complications between group A and group B.*

Complications	Group A (n=33)	Group (n=42)	B	χ^2	P
Temporal corneal stroma edema					
Yes	16	4		14.345	0
No	17	38			
Temporal high IOP≤ 1 w					
Yes	17	2		21.355	0
No	16	40			
Long term serious complications*					
Yes	15	3		14.871	0
No	18	39			

*Long term serious complications in conventional method group include permanent high IOP(>1 w, 5 eyes), dropped nuclear fragment or large cortex lentis fragment (3 eyes), Corneal endothelial decompensation (1 eye), vitreous hemorrhage (2 eyes), choroidal detachment (2 eyes), intraocular lens loss (2 eyes). In group B include permanent high IOP (>1 w, 1 eye), and vitreous hemorrhage (1 eye).

Table 4. *Comparison of postoperative visual acuity between groups A and B.*

	n	BCVA after surgery	t	P
Group A	33	0.4 ± 0.32	3.258	0.0017
Group B	42	0.6 ± 0.21		

Discussion

With the perfection of technology and the improvement of equipment, the phacoemulsification for cataract has been very mature. Because of its advantages such as short operation time, less injury, faster postoperative recovery, less complications, and so on, it has become a routine cataract surgery. PCR in phacoemulsification for cataract is the most common complication. Improper settlement of the complication may lead to serious consequences, such as explosive choroidal hemorrhage, nuclei lentis fell into the vitreous cavity in surgery, secondary glaucoma, corneal endothelium decompensation, vitreous hemorrhage, retinal tear, retinal detachment, choroidal detachment and IOL shedding [7-12].

PCR can occur in every part of the operation, while in the process of emulsification nuclei lentis and suction cortex lentis relatively the occurrence of PCR is common [13]. The method to deal with the PCR is the key to reduce postoperative complications and improve postoperative visual acuity. The PCR, if it is just a small hole without vitreous body prolapses and was found in time, the settlement maybe simple relatively by using viscoelastic agent. However, PCR with vitreous loss is more complex for settlement. Traditional methods are usually performed using the vitrectomy system comes with the ultrasound emulsification instrument to cut off anterior vitreous and residual lens tissue, under perfused from secondary incision. As the eye closes poor, IOP can't maintain, which may lead to explosive choroidal hemorrhage in surgery. The water flows in anterior chamber perfused from secondary incision not only damage the corneal endothelium, but also affect the doctor's field of vision. At the same time, because of residual lens and vitreous mix round, it is difficult to observe capsular clearly and remove residual lens tissue completely, which may cause phacoanaphylactic glaucoma, uveitis and cystoid macular edema etc. The lens tissue felling into the vitreous cavity cannot be observed and removed. The repeated operation in anterior chamber for a long time may damage the corneal endothelial cells, which may cause corneal stroma edema and even corneal endothelial decompensation after surgery. If the prolapsed vitreous body cannot be cut off completely, the residual prolapsed vitreous body may organize and pull retina, which can lead to serious complications such as retinal tear and detachment [14]. Because of the fear of IOL dislocated, the viscoelastic agent in the anterior chamber is not suctioned completely, which result in the short-term postoperative high IOP.

Eckardts [15] firstly reported clinical application of minimally invasive vitrectomy system (23G PPV) in 2005, from which the vitrectomy entered a minimal invasive era. The 23G PPV is performed by direct puncture across the conjunctiva with trocar cannula, and its advantage lies in minimal invasion, shorter operation time and less complications. The complications are caused by puncture, such as peripheral retina tear, basal vitreous traction, retinal or vitreous tissue obstructs puncture, and retinal dialysis. Because appropriate hardness surgical instruments get in and out eye ball through trocar cannula, and high speed cutting, so there is no obvious distraction between vitreous body and retina [16,17]. It is a unique advantage for 23G PPV performed to settle the PCR with vitreous loss in phacoemulsification immediately. In 23G PPV, the eye closes well relatively, the doctor can observe the residual lens tissue, vitreous and capsule clearly, then can remove the residual lens tissue and prolapsed vitreous body, including the lens tissue which fell into the vitreous cavity completely [18]. At the same time, the IOP can be maintained relatively stable in surgery, which can avoid the explosive choroidal hemorrhage and other serious complications, and corneal tissue is almost not damaged. It is easy for implantation of IOL in the capsular bag by vitrectomy head or lighting head auxiliary support if the posterior capsule was reserved more, and the stability of IOL can be observed better [19]. In recent years, we adopted 23G PPV in the treatment of the PCR with vitreous loss in phacoemulsification immediately to obtain better postoperative vision because of the less postoperative complications and good stability of IOL. If the conditions permit, it is a very wise choice to perform 23G PPV to settle the PCR with vitreous loss in phacoemulsification immediately, which can reduce the postoperative complications obviously and achieve satisfactory postoperative.

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Disclosures

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All authors declare no non-financial competing interests.

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