Original Article

Phaco-emulsification in completely vitrectomized eyes: Intraoperative analysis of modified phaco sleeve

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Purpose: The purpose was to evaluate the results of modified sleeve in phacoemulsification of cataract in completely vitrectomised eyes, **Materials and Methods:** Twenty-five previously completely vitrectomized eyes of 23 patients having visually significant cataract were *included*. After through evaluation they underwent phaco-emulsification by phaco chop with a modified sleeve via temporal clear corneal incision. The modified sleeve was made by creating a small round port of approximate 1 × 1 mm size at the proximate end of the sleeve in line with the already existing ports. This port faced the posterior capsule while performing phacoemulsification. Patients were observed for any intraoperative complications. **Result:** The most common indication for pars plana vitrectomy in our study group was vitreous hemorrhage due to diabetic retinopathy [13 out of 25 eyes (52%)]. Intraoperative findings included miosis [seen in 3 (12%) eyes] and posterior capsular plaque [seen in 2(8%) eyes]. No other significant intraoperative complications (posterior capsular tear, dropped nucleus) were observed. Average effective phaco time was 33 sec. (±15.11). **Conclusion:** Though cataract surgery in postvitrectomized eyes is a challenging situation, modified sleeve prevents anterior chamber fluctuation and avoids complications arising out of it, making the surgery safe.

Key words: Modified phaco sleeve, phaco-chop, phaco-emulsification, vitrectomy

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Cataract is a frequent complication of vitreous surgery after few months or years. Cataract surgery is a challenge in previously vitrectomized eyes. Phaco-emulsification technique of cataract removal is proved to be safe in vitrectomized eyes.[1-3]

However zonular weakness and fluctuations in the anterior chamber depth account for the surgical difficulties.[1] Lack of vitreous support and stretched zonular apparatus of the lens render the posterior capsule excessively mobile during cataract surgery in postvitrectomized eyes. A sudden change in anterior chamber depth in these cases occurs due to disparity between fluid inflow and outflow.

Anterior chamber maintainer (ACM) and irrigating chopper have been recommended in the routine phacoemulsification procedure to prevent anterior chamber fluctuation.[4] ACM requires an additional paracentesis opening into the cornea. Irrigating chopper has been used in microincisional cataract surgery by cold phaco technology. The issue of wound burns persists because of the "naked" phacoemulsification needle.[5] *Akahoshi* modified micro flow sleeve into three and multiport and have proved increased infusion rate in the anterior chamber during routine phacoemulsification.[6] However, the literature on prevention of anterior chamber fluctuation in postvitrectomized eyes cataract surgery is sparse. To render the anterior chamber stable in these cases, we modified the phaco-sleeve by creating an additional opening in between already existing openings.

In this prospective, noncomparative, observational, and interventional study, we analyzed intraoperative performance of the modified sleeve in phaco-emulsification of postvitrectomized eyes.

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Materials and Methods

Twenty-five eyes of 23 patients who had undergone complete vitrectomy having visually significant cataract were thoroughly evaluated for cataract surgery. Demographic details, indications of pars plana vitrectomy (PPV), duration between PPV, and phaco-emulsification surgery were noted. Preoperative evaluation included visual acuity, slit-lamp examination, intraocular pressure by applanation tonometer, keratometry and A-scan biometry.

All cataract surgeries were performed under local peribulbar anesthesia by a single surgeon. Preoperative dilatation of pupil was achieved using 0.8% tropicamide and phenylephrine 5% combination. A side port was made on the side as required. Ttrypan blue was injected under the air. Extra trypan blue was washed with balanced salt solution (Equasol, Contacare Ophthalmics and Diagnostics, Vadodara). Visco-elastic (2% hydroxypropyl methyl cellulose,Appavisc, Appasamy ocular devices, Puducherry), was injected through the side port with 23G blunt tip canula. A 3.2 mm clear corneal temporal incision was made. Continuous curvilinear capsulorhexis was made using capsulorhexis forceps under viscoelasctic. The size of rhexis was kept approximately 5.5 mm. Hydrodissection was performed with B.S.S. Cases having posterior polar cataract, hydrodelineation was done. The nucleus was chopped by "phaco-chop" method using sharp chopper to break into multiple small pieces which were emulsified .A zero-degree phaco tip was used in all cases. The settings for "phaco-chop" (Galaxy phacoemulsifier, Appasamy Associates) were phaco power 60-90% [depending on the grade of the nucleus], vacuum 250 mmHg and aspiration flow rate of 32 cc/min. The modified sleeve was used, in which a port of the size 1 × 1 mm was created at the proximate end of the infusion sleeve in the

line with the already existing ports [Fig. 1]. The port faced the posterior capsule through out the procedure. Parameters for chop method were not changed until the last nuclear fragment was emulsified. Phacoemulsification was performed in the capsular bag.

Through cortical clean up was done by irrigation aspiration probe (I/A probe). Modified sleeve was attached at the tip of I/A probe. Parameters were vacuum 350 cc and aspiration flow rate 33 cc. A bottle height of 60 cm was kept above patient's head. A single piece hydrophobic foldable intra-ocular lens (IOL) was injected into the capsular bag using injector system. Residual viscoelastic was removed with the help of I/A probe from the anterior chamber and behind the IOL. Stromal hydration of the side port and the main incision was done with BSS. Patients having wound burn were tested for leakage with fluorescein strip. Subconjunctival injection of gentamycin and dexamethasone 0.25 ml each was given at the end of the procedure. Preoperative and intraoperative observations were entered in an Excel sheet.

In one patient having anterior capsular catch with zonular dehiscence, during the procedure, an endocapsular ring was placed in the bag to stabilize the weakened zonular apparatus. A thick posterior capsular plaque was removed by performing posterior capsulorhexis by capsulorhexis forcep.

Results

The average age of the study patients was 65.88 years (±14.3). About 52% of study group were women compared to 48% men. The average interval between pars plana vitrectomy (ppv) and phacoemulsification was 19.8 months (± 15.51). *The most common indication for vitrectomy was vitreous hemorrhage secondary to diabetic retinopathy (n = 13, 52%). Retinal detachment (n = 4, 16%) macular hole (n = 2, 8%) and vitreous hemorrhage (n = 6, 24%) were other indications of ppv.*

The significant intraoperative findings included intra-operative miosis [seen in 3 (12%) eyes], posterior capsular plaque [seen in 2 (8%) eyes], and one eye (4%) each had anterior capsular catch, anterior chamber fluctuation and wound burn. Nineteen eyes (76%) did not have any intra-operative problems. The iris and posterior capsule was unusually mobile but kept stretched due to flow of fluid from the port that faced the posterior capsule. None of the eyes developed posterior capsular tear, dropped nucleus fragment or iris trauma. Nucleus chopping was difficult because of the deep anterior chamber. For the initial chop, the phaco tip was kept almost 90° to the nucleus. For the subsequent chopping maneuvers, the angle was reduced to 40--50. Considering the zonular weakness in every case, rotation of the nucleus was done after the first crack. One patient had a zonular dehiscence during the procedure. Endocapsular ring of the size 12.5 mm was placed in the bag.

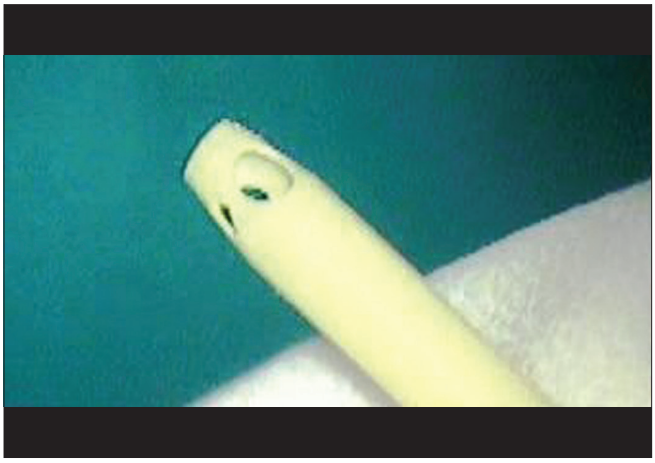

Figure 1: Modified sleeve

The anterior chamber was maintained through out the irrigation and aspiration of the cortex.

No pupillary expanding devices were required. In a patient having wound burn, Siedel's test at the incision site was negative.

Average effective phaco time was 33 seconds (±15.11).

Discussion

Cataract formation and progression is a common event after pars plana vitrectomy in phakic eyes. Risk factors for the development of cataract following pars plana vitrectomy include older eye, intraoperative lens touch, silicone oil injection, use of intraocular gas tamponade and postvitrectomy uveitis.

Extracapsular cataract surgery with nuclear expression is difficult in postvitrectomized eyes.[7] Phaco-emulsification technique for cataract removal offers better control of the fluid dynamics and intraocular pressure, minimizing the risk of hypotony.[3]

Intraoperatively in vitrectomized eyes, there is a risk of zonular dehiscence, anterior chamber (A.C.) fluctuation and risk of miosis of the pupil. Various techniques have been designed for the nucleus management in phaco-emulsification. These techniques have been advocated to reduce the zonular stress, anterior chamber fluctuation and ultrasound time and energy during nucleus emulsification. Deep anterior chamber during phaco is common in vitrectomized eyes.[8] Anterior chamber fluctuation during phacoemulsification causes intraoperative complications in vitrectomized eyes. The presence of vitreous avoids these complications in nonvitrectomized eyes. To prevent these complications, we think additional flow of fluid in the anterior chamber during the shallow phase of fluctuation is essential without changing the technique, parameters, and bottle height during the phacoemulsification.

The flow study conducted by the author with two circular diametrically opposed ports with a bottle height of 60 cm above patient's eye has shown a collection of fluid 100 ml; however with the modified sleeve, it increased to 110 ml per min. Another interesting observation during the flow study was that with occlusion of one of the ports the flow through other port was increased. Modified three-port and multiport sleeve developed by *Akahoshi* has demonstrated the flow of fluid from an additional port stretches and deepen the capsular bag decreasing the risk of the posterior capsular rupture.[6] *Mackool* developed an infusion sleeve having two hollow sleeves surrounding the vibrating phaco needle. The outer sleeve is compressible and the inner noncompressible.

These sleeves have been demonstrated to decrease the leakage of the fluid from the incision site reducing the surge.

The author has compared the performance of modified sleeve and an original sleeve in phacoemulsification of nonvitrectomized eyes. The subjective assessment of the anterior chamber stability was no different in both the groups. However, the author realized the importance of an additional flow while performing phacoemulsification in vitrectomized eyes. It adds safety to the procedure.

A major concern while performing phacoemulsification in vitrectomized eyes is fluctuation in the anterior chamber. It is because of loss of vitreous support that the capsular bag shows more excursions. Keeping the bottle height low and reduced phaco-parameters has been said to avoid A.C. fluctuation.[3,9] Sachdev and coauthors reported 16% (12 out of 75) eyes had fluctuation in A.C. depth in phacoemulsification by chop method in postvitrectomized eyes,[10] while Diaz *et al*. observed that 26% (6 out of 23 eyes) patients had sudden changes in the anterior chamber.[11] In our study, only one patient (4%) had fluctuation in the A.C. This fluctuation occurred at the beginning of phacoemulsification after introduction of phaco-probe in the A.C. when we noticed air bubble trapped in the infusion line. Less fluctuation of A.C. in our study could be because of additional flow of fluid from the port created on the inferior aspect of the sleeve which takes care in the shallow phase of the fluctuation of A.C. The height of the infusion bottle did not require to be adjusted at any point during the study and parameters did not require to be changed in any step of the phacoemulsification. However, modification of the parameters would not have affected the intraoperative performance of the modified sleeve. Rotating the standard sleeve so that one of the two ports faces the posterior capsule may have prevented the anterior chamber fluctuation. However, this would have lead to the repulsion of the lens fragment from the phaco tip and damage to the corneal endothelium due to flow of fluid hitting it.

An anterior capsular catch phenomenon was observed in one (4%) patient in the study group. It was seen typically while removing the last fragment of the nucleus when we noticed zonular weakness on the nasal side. It was difficult to decide on the table whether zonular weakness caused anterior capsular rim catch or capsular catch caused zonular dehiscence. An endocapsular ring was placed in the bag to support the weakened zonules and phacoemulsification was done safely. Loss of vitreous support and zonular weakness in postvitrectomized eyes leads to sudden changes in the anterior chamber and excessively mobile capsular bag. A chance of anterior capsular rim being caught in the phaco-tip or during irrigation and aspiration of the cortex is enhanced. Little doubt in mind regarding zonular dehiscence one must place an endocapsular ring, as late in-the-bag spontaneous dislocation of intraocular lens has been reported in the literature in patients having history of pars plana vitrectomy.[9]

As observed by others[3,8,10,11] we also observed primary posterior capsular fibrosis (12%). It was seen in the form of a plaque-shaped area on the posterior capsule. In some cases these plaques were removed by vacuum polishing of the posterior capsule (Vacuum = 5 mm of Hg and aspiration flow rate = 5 cc/min) and in some they were removed by posterior capsulorhexis.

Intraoperative small pupil was observed in 12% cases. We did not use any of the pupil expanding measures. Performing phaco-emulsification was not a problem in any case. A reduced excursion of the iris diaphragm, because of less fluctuation of the anterior chamber, kept the pupil semidilated. Additional flow of fluid from the hole on the inferior aspect of sleeve also helped the pupil to remain dilated. Another reason could be that the chopping maneuvers require manipulation at a lesser depth compared to the divide and conquer technique which needs trenching at depths greater than 80% of the nuclear depth.[7] No iris trauma or sphincter tear was observed during phacoemulsification of cataract in these cases. Wound burn occurred in one patient. This particular patient had a grade 4 cataract and the effective phaco-time was 45 seconds. However, this patient did not require wound suture as wound leak was not observed on Siedel's test.

In our case series, none of the patients developed posterior capsular tear or fragment drop during the procedure. This again confirms safety of the procedure but has a few limitations. Being noncomparative with other methods of nuclear division like divide and conquer it carries less weight age. *On Medline search, outcome of modified sleeve developed by Akahoshi and Mackool in postvitrectomized eyes has not yet been reported. Therefore, we could not compare our findings.* The study was carried out at a single center and a single surgeon was involved , which omits the comparison in skills and the surgical techniques. We recommend a comparative, randomized control trial in postvitrectomized eyes with and without the modified sleeve.

Conclusion

Cataract surgery in postvitrectomized eyes is a challenging situation. Though visual rehabilitation in these patients is limited by retinal comorbidity, it is necessary to understand intraoperative difficulties while operating these patients. Anterior chamber fluctuation is a major concern in these patients. We feel that a fluctuating anterior chamber can cause posterior capsular catch, anterior rim catch, and a miotic pupil. These can be avoided without changing the parameters of routine phacoemulsification by creating a small port on the inferior aspect of the sleeve, which will help keeping the anterior chamber formed throughout the procedure.

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