



Manuscript ID ZUMJ-2404-3349

DOI 10.21608/ZUMJ.2024.284405.3349

Original Article

Intraocular Pressure Changes after Phacoemulsification with Posterior Vitreous Tap in Cataractous Eyes with Shallow Anterior Chamber

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Submit Date 2024-04-25

Accept Date 2024-05-26



Abstract

Background: Phacoemulsification is the standard method for cataract extraction. Patients with shallow anterior chamber are associated with more difficult surgical manipulations and increased risk of intraoperative complications. Posterior vitreous tap can be done before phacoemulsification to achieve suitable depth of anterior chamber making surgery easier with fewer incidences of complications. The aim of the work is to evaluate postoperative changes of intraocular pressure following phacoemulsification with posterior vitreous tap in shallow anterior chamber.

Methods: This is a prospective randomized controlled study included twelve patients with immature senile cataract associated with shallow anterior chamber who undergone phacoemulsification with posterior vitreous tap. Intraocular pressure was measured in all patients before surgery, 1 week, 1 month, 3 months and 6 months after the surgery. The collected data was statistically analyzed and presented in suitable charts and tables. **Results:** All patients showed reduction in intraocular pressure after the surgery with mean intraocular pressure 16.41 ± 3.41 mmHg preoperative, compared to 12.47 ± 2.41 mmHg postoperative at 6 months, which is statistically significant.

Conclusions: Posterior vitreous tap during phacoemulsification in cataractous eyes with shallow anterior chamber has been shown to be effective for considerable reduction in intraocular pressure after the surgery in such eyes without considerable risks regarding vitreous or retinal traction.

Keywords: Phacoemulsification; Intraocular pressure; Shallow Anterior Chamber; Posterior Vitreous tap

INTRODUCTION

Phacoemulsification is the standard method of cataract extraction with increased safety compared to other methods. It employs improved surgical techniques with improvement in wound construction, nucleus removal, implantation of foldable intraocular lenses. Phacoemulsification has favorable outcomes as shorter recovery time, sutureless wounds, decreasing incidence of intraoperative and postoperative complications [1].

Transient increase of the intraocular pressure (IOP) may be experienced after phacoemulsification due to incomplete removal of viscoelastic materials, post-operative administration of steroid,

postoperative inflammatory response, any residual lensmatter, or pigmentary dispersion. Topical anti-glaucoma in the postoperative period or modifying the medications with known glaucomatous patients may be needed [2].

The shallow anterior chamber is an important risk factor for the development of significant complications during cataract surgery as posterior capsule rupture, vitreous loss, capsulorhexis extension, iris trauma, prolapse and endothelial injury. So, Anterior chamber depth should be considered preoperatively [3].

Patients with shallow anterior chamber are commonly associated with peripheral iridocorneal touch, which may progress to angle closure. With

advancing age, crystalline lens thickness increases with forward movement of iris-lens diaphragm, which may cause pupillary block and development of primary angle closure glaucoma [4].

Phacoemulsification in shallow anterior chamber has been shown to be effective in IOP reduction and deepening the anterior chamber due to backward movement of iris and increased aqueous drainage from trabecular meshwork [4].

In the early first postoperative day, the IOP may not decrease significantly or even increase due to the associated transient postoperative IOP rise which increases with pre and intraoperative shallow anterior chamber. But with follow-up in the next weeks, significant improvement in IOP is usually noticed [4].

Many techniques are used to deepen anterior chamber which include limited anterior vitrectomy or vitreous tap, injecting of cohesive viscoelastic material, and AC maintainer.

Posterior vitreous tap can be applied during phacoemulsification with shallow anterior chamber. Methods include aspiration of small amount of vitreous using automated vitrectomy handpiece with repetition of tap if still shallow anterior chamber. Other methods include needle aspiration of the vitreous, but using a vitreous cutter carries a lower risk for vitreous traction [5].

Noh and Kim conducted a study, in 2019, for acute angle closure management by performing phacoemulsification in one group and combined phacoemulsification with limited anterior vitrectomy in the other group. They concluded that there was significant postoperative improvement in visual acuity and IOP in both groups but with no cases of posterior capsular tear in combined group surgery compared to two cases in the first group [6]. In this study, Patients with cataractous lenses and shallow anterior chamber are enrolled. The aim of the work is to assess the postoperative change of intraocular pressure after combining posterior vitreous tap with phacoemulsification.

METHODS

This is a prospective randomized controlled study included twelve eyes with shallow anterior chamber and immature cataract. Patients with mature cataract, previously known history of ocular trauma, any anterior or posterior segment pathology were excluded.

Patients enrolled in this study are attendees to the outpatient clinics of ophthalmology department in Zagazig University Hospitals and were admitted to

the ophthalmology department for cataract surgery. Informed consent was obtained from all involved subjects. The study design and methodology were approved by the IRB (Institution Review Board) unit of Zagazig University. The study was done according to the code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Full Ophthalmic assessment was performed to all patients, including history taking, visual acuity assessment, slit lamp and fundus examination, intraocular pressure measurement using Goldmann Applanation tonometer and measurement of anterior chamber depth using non-contact ocular biometry (IOL Master 500[®], Carl Zeiss Meditec AG, Germany, 2018).

All patients were operated by one surgeon. The procedure was preceded by topical application of mixture of phenylephrine 2.5% and cyclopentolate 0.5% three times, ten minutes apart to achieve suitable pupillary dilatation. Povidone-iodine 5% solution is applied to the conjunctival sac for 30 seconds before initiating surgery. Posterior vitreous tap and phacoemulsification were done using Orтели Catarhex 3[®] surgical platform (Oertli Instrumente AG[®], Berneck, Switzerland, 2022).

Posterior vitreous tap was employed by performing a sutreless self-sealing pars plana sclerotomy, using 23-Gauge trocar, measured 4 mm from limbus, then, aspiration of small amount of vitreous (about 0.1-0.2 ml) using automated vitrector with high vitrectomy cut rate (2000 cut per minute) and low vacuum (120 mmHg) for three seconds. No vitreous aspiration more than 0.2 ml was done to avoid excessive deepening of the AC or softening of the globe.

After posterior vitreous tap, cataract surgery was initiated by clear corneal main incision using ophthalmic blade keratome 2.8 mm then anterior chamber filling with 2% hydroxypropyl methylcellulose dispersive viscoelastic (OcuCoat[®], Bausch + Lomb, Rochester, USA). Continuous curvilinear capsulorhexis was then performed, followed by hydrodissection, hydro-delineation and two clear corneal side ports using ophthalmic blade 15°.

Phacoemulsification was done using phaco chop technique under parameters phaco power 50%, vacuum 300 mmHg, aspiration flow rate 28 ml / min., then bimanual aspiration of residual cortex and implantation of foldable single-piece acrylic hydrophilic intraocular lens. Corneal incisions were sealed by stromal hydration using sterile saline

solution.

Postoperative medication for all patients included topical moxifloxacin 0.5% antibiotic drops (VIGAMOX®, Alcon Laboratories Inc, USA) and topical prednisolone acetate 1% drops (PRED FORTE®, Allergan Inc, USA) 4 times per day for 2 weeks, topical tobramycin 0.3% + dexamethasone 0.1% ointment (TobraDex®, Alcon Couvreur, Belgium) for 2 weeks, plus Oral levofloxacin 500 mg antibiotic (Tavanic®, Sanofi-Aventis, Germany) for 5 days (figures 1, 2).

Follow-up was done at 1 week, 1 month, 3 months and 6 months after the surgery with assessment of postoperative intraocular pressure using Goldmann Applanation tonometer and assessment of best corrected visual acuity using LogMAR chart. Any patient who failed to follow up at 2 consecutive visits of follow-up was excluded from the study.

Statistical Analysis

Data collected and outcome measures coded, entered, and analyzed using Microsoft Excel software. Data were fed to the computer and analyzed using IBM SPSS (Statistical Package for the Social Sciences) software package version 20.0.

(Armonk, NY: IBM Corp). Qualitative data were described using numbers and percentages.

The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation, median and interquartile range (IQR). The significance of the obtained results was judged at the 5% level. The Chi-square test was used for categorical variables to compare between different groups. One-way ANOVA test was used for normally distributed quantitative variables, to compare between more than two studied groups. A P-value is considered significant if <0.05 at confidence interval 95%.

RESULTS

Analysis of the demographic data of the operated 12 patients revealed that mean age was 61 ± 7.45 years old with 8 male patients (66.7%) and 4 female patients (33.3%).

All patients in the study showed significant improvement in LogMAR best-corrected visual acuity (BCVA) and the intraocular pressure.

Table (1) Comparison between preoperative and postoperative data

	LogMAR BCVA (Mean ± SD)	IOP in mmHg (Mean ± SD)
Preoperative	1.12 ± 0.2	16.41 ± 3.41
1 week Postoperative	0.63 ± 0.17	14.87 ± 2.44
1 month Postoperative	0.45 ± 0.23	13.32 ± 2.54
3 months Postoperative	0.38 ± 0.07	12.87 ± 2.71
6 months Postoperative	0.3 ± 0.05	12.47 ± 2.41
Test	5.18	4.651
P-Value	0.001*	0.001*

* Statistically highly Significant

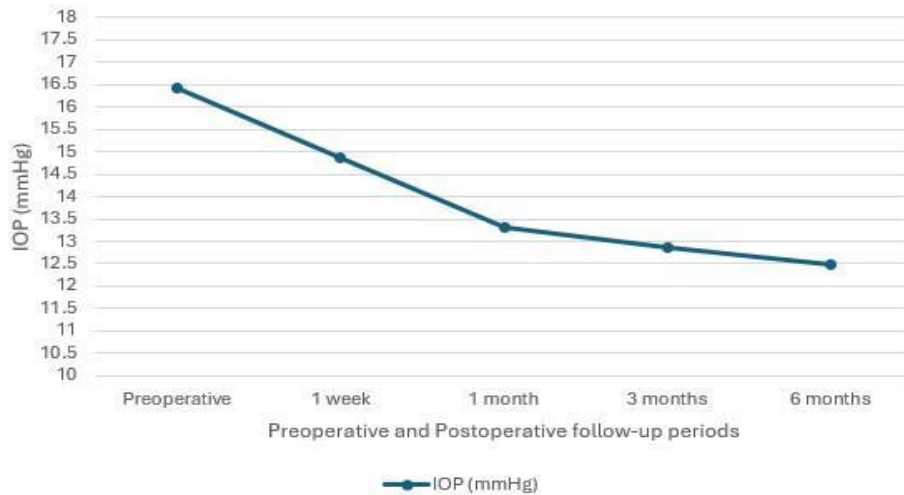


Figure 1: Preoperative and postoperative follow-up periods



Figure 2: Posterior vitreous tap

DISCUSSION

Our study is a randomized controlled clinical trial that evaluated the procedure of posterior vitreous tap to be performed before phacoemulsification in eyes with shallow anterior chamber and its effect to achieve suitable anterior chamber depth reducing

the risk of intraoperative complications and subsequent significant improvement in postoperative BCVA and IOP.

Posterior vitreous tap has been shown to be a safe method without noticed risks regarding vitreous or retinal traction. In our study, no cases showed any

signs of retinal breaks or detachment during the postoperative follow-up period. Only one case was complicated by posterior capsular rupture without vitreous loss and the IOL was stable.

Another case showed intraoperative subluxation of the capsular bag that was efficiently managed by implantation of capsular tension ring with central stabilization of the bag and IOL.

Multiple other studies were conducted to evaluate similar techniques for deepening the anterior chamber during phacoemulsification with shallow anterior chamber.

Chang in 2001 described a technique of pars plana vitreous tap using vitrector probe without irrigation to deepen AC that was achieved in all cases with no complications for cataract surgery or vitreous tap [5].

Cayatopa et al, in 2021, performed central pars plana vitrectomy with phacoemulsification in shallow anterior chamber. They reported significant improvement in postoperative LogMAR BCVA and IOP. Preoperative mean \pm SD LogMAR BCVA was 0.89 ± 0.6 that improved after 1 month to 0.5 ± 0.6 , 6 months 0.3 ± 0.3 , 9 months 0.1 ± 0.1 and 1 year to 0.05 ± 0.1 . Also, Preoperative mean \pm SD IOP was 22.09 ± 2.4 mmHg that improved after 1 day to 14.55 ± 2.9 , 1 month to 12.94 ± 2.04 , 6 months to 12.01 ± 1.2 , 9 months to 12.2 ± 1.9 and 1 year to 11.34 ± 1.13 mmHg that was statistically significant (Pvalue < 0.001) which is similar to our results [7].

Chalam et al, in 2005, performed limited anterior vitrectomy in cases undergoing phacoemulsification with positive vitreous pressure. They reported reduction of positive vitreous pressure that may increase risk of intraoperative complications and facilitated further surgical steps by sufficient deepening of the AC and pupil stretching with viscoelastic injection. No vitreous incarceration or adhesions were noted due to usage of small-sized sclerotomy [8].

In 2018, Miura et al, performed combined phacoemulsification and anterior vitrectomy for management of acute angle closure to reduce crystalline lens thickness that causes anterior iridocorneal apposition and limited core vitrectomy to deepen the Anterior chamber to facilitate phacoemulsification.

Surgeries were performed within six hours of diagnosis of acute angle closure with administration of preoperative intravenous mannitol or oral acetazolamide to reduce IOP. A 25G Pars plana sclerotomy is made 3.5 mm posterior to limbus with introduction of vitreous cutter at high cut rate (1500

cuts / min) and vacuum (300 mmHg) then cataract surgery is performed, and no suturing was needed.

They reported a significant reduction in IOP with preoperative IOP mean \pm SD was 51.8 ± 13.1 mmHg that improved to 18.3 ± 8.5 mmHg on 1st postoperative day. One case required secondary IOL implantation in ciliary sulcus 2 weeks later due to zonular dialysis in first surgery and a second case required goniosynechialysis 1 week later. Retinal hemorrhage was reported in one case and papilledema in two cases [9].

Xiang et al., in 2021, conducted a study to manage acute angle closure with phacoemulsification and vitreous tap but the tap was done using 27-gauge needle inserted through pars plana 3.5 mm from limbus to aspirate a small amount of vitreous. They also concluded significant improvement in IOP from 54.43 ± 5.33 mmHg preoperative to 15.59 ± 2.35 mmHg at the final follow-up visit without the need for any antiglaucoma treatment [10].

In conclusion, our study showed that phacoemulsification with posterior vitreous tap is considered to be a safe method to deepen the anterior chamber during phacoemulsification without associated significant risks and with significant improvement in BCVA and IOP.

Multiple other studies with larger sample sizes are needed to further validate the safety and efficacy of this procedure.

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To Cite:

Gamal, M., Zaki Hanifa, H., El Nady, A., Al-Naimy, M. Intraocular Pressure Changes after Phacoemulsification with Posterior Vitreous Tap in Cataractous Eyes with Shallow Anterior Chamber. *Zagazig University Medical Journal*, 2024; (1653-1658): -. doi: 10.21608/zumj.2024.284405.3349