Original Article

Evaluation of Factors Responsible for Raised Intraocular Pressure Following Phacoemulsificationn

***Kamal MN**

Background: *This study was designed to analyze the risk factors resulting in high intraocular pressure (IOP),which was accepted as IOP higher than 22 mmHg, following uncomplicated phacoemulsification.* ***Materials and Methods:*** *The records of 812 eyes of 584 patients who underwent uncomplicated phacoemulsificationwere evaluated. There were 330 men and 254 women ranging between the age of 26 and 89 years (65.4 ± 9.8years). The preoperative, postoperative first day (day 1), first week (day 7), and first month (day 30) IOPvalues were analyzed. Data on history of diabetes, glaucoma, pseudoexfoliation (PXF), incision site, capsularstaining with trypan blue, and surgeon were recorded. A multinomial regression analysis was performedto analyze the relationship of the factors with postoperative high IOP.* ***Result:*** *The mean IOP was 15.6 ± 4.3mmHg preoperatively. Postoperatively that were changed to 19.7 ± 9.0 mmHg at day 1, 12.7 ± 4.5 mmHgat day 7, and 12.8 ± 3.7 mmHg at day 30. The factors such as surgeon, presence of PXF, diabetes, surgicalincision site, and trypan blue were not related to the postoperative high IOP (P > 0.05, in all). The onlyfactor that related to high IOP at all visits was glaucoma (P < 0.005).* ***Conclusion:*** *According to our results,preoperative diagnosis of glaucoma seems to be the only factor to affect the postoperative IOP higher than22 mmHg.*

Keywords: Glaucoma, Intraocular Pressure, Phacoemulsification.

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Introduction

Intraocular pressure (IOP) may rise even after uncomplicated cataract surgery which might need intervention[1,2]. The response in IOP to phacoemulsification is biphasic, with a transient immediate rise followed by a modest long-term decrease[3-5]. Postoperative IOP usually peaks 5–7 h after surgery and returns to normal levels in 1–3 days[3,6,7]. Although transient, the elevated IOP can cause ocular pain, may increase the risk of sight threatening complications such as retinal vascular occlusion, progressive field loss in advanced glaucoma, and anterior ischemic optic neuropathy in susceptible patients[8,9]. Several risk factors such as glaucoma, viscoelastic agent, and surgical procedure for postoperative IOP rise have been identified[3,10]. Our aim in this study was to analyze the risk factors that might result in IOP rise following uneventful phacoemulsification.

Dr. Md. Nahid Kamal, Associate Professor, Dept. of Ophthalmology, Ad-din Sakina Women's Medical College, Jashore.

***Correspondence:** nahid.kamal@yahoo.com

Materials and Methods

We retrospectively evaluated the records of 812 eyes of 584 consecutive patients, who underwent uncomplicated clear corneal incision phacoemulsification surgery in our clinic between May 2014 and July 2020. There were 330 men and 254 women ranging between the age of 26 and 89 years (65.4 ± 9.8 years). All the surgical procedures were performed by two surgeons (RAY and SS). All the patients had peribulbar anesthesiaand uncomplicated phacoemulsification surgery via 2.80 mm corneal incision placed superiorly. Single temporal side port incisions were made to allow access of a second instrument. Dispersive viscoelastic was used to fill the anterior chamber. Continuous curvilinear capsulorhexis was performed routinely. In mature cataracts before performing capsulorhexis, trypan blue was used to dye the capsule. During phacoemulsification, a stop and chop or phaco-chop technique was used. The capsule was filled with a cohesive viscoelastic and a foldable posterior chamber intraocular lens was

implanted in the capsular bag. Viscoelastic was thoroughly removed via irrigation/aspiration (I/A), and a rock and roll technique was used for the removal of viscolelastic behind the IOL.

The preoperative as well as postoperative first day, first week, and first month visit IOP values were measured by non-contact tonometer and recorded. IOP was grouped as normal (≤22 mmHg) and high (≥22 mmHg). All the glaucoma patients were primary open angle glaucoma. Patients that suffer from other types of glaucoma were excluded from the study. Patients who were receiving antiglaucomatous medication also continued to receive the same medication before and after surgery. None of the patients was given prophylactic medication before the surgery. Antiglaucoma drugs that incite more inflammation like prostaglandin analogs were stopped 2 weeks before surgery and an antiglaucoma drop that does not incite inflammation was prescribed. An antiglaucoma drug that does not incite inflammation was prescribed and continued for 1 month after surgery. In addition, acetazolamide was notgiven after the surgery.

All data were entered to SPSS software (Statistical Package for the Social Sciences, version 10.0, SPSS Inc, Chicago, IL, USA). and the changes in IOP were compared with paired Student's t-test. Data on prior history of glaucoma, pseudoexfoliation (PXF), incision site, anterior capsular staining, and surgeonwere recorded. The relation of these factors with postoperative high IOP at each visit (days 1, 7, and 30) were evaluated using multinomial regression analysis. The level of significance was set at <0.05.

Result

The mean preoperative IOP was 15.6 ± 4.3 mmHg (ranged from 7 to 36 mmHg). At day 1, the IOP increased significantly to 19.7 ± 9.0 mmHg (ranged between 6 and 58 mmHg; P <0.001, 95% CI −4.68 to −3.52). The mean IOP was 12.7 ± 4.5 mmHg (ranged between 6 and 37 mmHg) at day 7, and 12.8 ± 3.7 mmHg (ranged between 6 and 34) at day 30. Compared to the preoperative values, days 7 and 30 IOP values were significantly low (P < 0.001, 95% CI 2.54–3.17 for day 7, and 2.47–3.03 for day 30). At day 1, the high IOP was detected in 249 (30.7%) eyes with a mean of 30.7 ± 7.5 mmHg. At day 7, the number of patientswith high IOP decreased to 26 eyes (8.8%). Similarly, at day 30only 16 (1.2%) eyes had the high IOP.The incidences of high IOP with possible associated factorsare shown on Table-I. Diabetes was present in 100 eyes (12.3%),PXF was observed in 77 eyes (9.5%), and glaucoma in 60 eyes(7.4%).

Table I: The distribution of IOP values as normal (≤22 mmHg) or high (>22 mmHg) at each visit (day 1, day 7, and day 30) according to the investigated factors such as surgeon, pseudoexfoliation (PXF), glaucoma, PXF and glaucoma, diabetes(DM), incision [so: Superior oblique, t: Temporal], trypan dye [1: Present; 2: Absent]

IOP										
		Day 1			Day 2			Day 30		
		≤22	≥22	*p*	≤22	≥22	*p*	≤22	≥22	*p*
Surgeon	RAS	342	155	0.374	478	19	0.187	490	07	0.360
	SS	221	94		308	07		309	06	
PFX	1	514	221	0.660	711	24	0.633	723	12	0.372
	2	49	28		75	02		76	01	
Glaucoma	1	533	219	0.004	733	19	0.001	745	07	<0.001
	2	30	30		53	07		54	06	
PFX&Glaucoma	1	552	239	0.491	766	25	0.435	779	12	0.702
	2	11	10		20	01		20	01	
DM	1	493	219	0.783	688	24	0.321	700	12	0.477
	2	70	30		98	02		99	01	
Incision	SUP	242	93	0.088	324	11	0.685	330	05	0.487
	INF	321	156		462	15		469	08	
Trypan	1	540	229	0.053	746	23	0.257	760	09	0.098
	2	20	20		40	03		41	02	

The relation of associated factors with high IOP was evaluated using multinominal regression analysis. P = probability value.

In 477 eyes (58.7%), Trypan blue was used in 43eyes (5.3%.).With the multinomial regression analysis, none of the factors. was related to the high IOP postoperatively (P < 0.05), except glaucoma. Glaucoma was the only factor related

to high IOP values during the postoperative period (P = 0.004 at day 1, 0.001 at day 7, and < 0.001 at day 30). Of the 60 glaucomatous eyes, all were receiving the glaucoma medication. The IOP was high in 30 eyes (51.7%) in the first day, in 7 eyes (12.1%) in the first week, and in 6 (10.3%) patients in the first month.

Discussion

Transient IOP rise may be observed in the early postoperative period after uneventful cataract surgery[11-13]. In this study, we retrospectively evaluated the risk factors that might affect the IOP rise following uncomplicated phacoemulsification surgery. The IOP measurements were recorded at the postoperative days 1, 7, and 30. We accepted 22 mmHg as the cut-off point for high IOP. Thirty percent of all eyes had high IOP at day 1. Among all the factors such as surgeon, diabetes, PXF, glaucoma, incision site, and trypan blue use, the only factor related to postoperative high IOP values was glaucoma (P ≤ 0.001).

Our results indicate that short-term postoperative IOP was higher in eyes with primary open angle glaucoma than in nonglaucomatous eyes (P ≤ 0.001). In another study, glaucoma was reported as a risk factor for pressure rise after phacoemulsification and the incidence of substantial elevation in IOP was similar between the eyes with primary open angle glaucoma and those with pseudoexfoliative glaucoma[14]. Tong and Miller retrospectively investigated the preoperative and postoperative IOP measurements of 385 consecutiveeyes having uneventful phacoemulsification[15]. Patients with preoperative diagnosis of glaucoma had significantly higher IOP at postoperative first week. Yasutaniet al[14]. also mentioned that a substantial increase in IOP occurred in approximately 13% of the eyes with open angle glaucoma 1 day after phacoemulsification surgery.

In our study, PXF with normal IOP was not significantly correlated with high IOP even in the early postoperative period after uneventful phacoemulsification. Also in two studies, it has been reported that there was no significant difference in the IOP after phacoemulsification in eyes with and without PXF[16,17]. On the other hand, a long-term lasting reduction in mean IOP occurred in PXF eyes[18-21]. Damji et al.[21] demonstrated that in the 2 year follow-up, the patients with PXF have a greater IOP lowering effect following phacoemulsification thanthose without, and the authors concluded that this effect was correlated with the volume of irrigating fluid utilized at the time of surgery. In addition to these results, Cimetta and Cimetta[18] operated a group of 39 open angle, nonglaucomatous eyes with cataract and PXF syndrome and a control group of open angle, nonglaucomatous eyes with cataract, using a standard phaco technique along with bimanual anterior capsule PXF material aspiration. Phacoemulsification with anterior capsule PXF material aspiration significantly reduced the mean diurnal IOP in the PXF group lasting one year postoperatively. In another retrospective comparative study, 1122 eyes with PXF, 240 with glaucoma and 882 without glaucoma underwent uneventful phacoemulsification. A long-term reduction in mean IOP occurred in PXF eyes with or without glaucoma[19]. However, IOP rise in the early postoperative period was noted after phacoemulsification in nonglaucomatous eyes with PXF and IOP control was advised[22-24]. This early IOP rise may be due to severe inflammation after cataract surgery in eyes with PXF due to pathological iris vessels with an increased permeability for protein. In addition, there were eyes with an elevated IOP without inflammation in the PXF group in whichthe mechanism of IOP rise could not be identified[23]. However, in this study, with or without glaucoma, we did not observeany relation of PXF to high IOP.Anterior capsular staining with trypan blue in our studywas not associated with high IOP at any postoperative visit(P > 0.05). In a preliminary study, 25 eyes of 25 patients with aunilateral mature or hypermature cataract, trypan blue dye wasused to stain the anterior capsule. Adverse reactions related tothe dye such

as raised IOP were not observed in the immediatepostoperative period or at the end of the mean follow-up of 3months[25]. In a comparative study, phacoemulsification of 82patients who had white mature cataract in one eye and senilecataract in the other were operated. Trypan blue dye wasused in the white mature cataract and not used in the felloweye. Postoperative IOP was not significantly different in thetwo groups[26]. In a previous study[15], wound construction,anesthesia type, the eye operated on, patient age, and sexdid not significantly influence the postoperative pressurechange. Similarly, in this study, there was no correlationbetween history of diabetes, surgeon, and incision site (P >0.05). Surgeon's experience was reported as an importantfactor for the postoperative IOP rise. The mean pressure risein eyes operated by experienced surgeons was about half thepressure rise in eyes operated by beginners, as beginners often perform intraocular surgery in a more traumatizing mannerthan experienced surgeons. In our study, there was no relationbetween high IOP and surgeon. This was most probably related to the similar experience of two surgeons in present series. As for the incision site, a study that compares temporalsclerocorneal or clear corneal incision, postoperative IOP wassignificantly higher in the sclerocorneal tunnel group than in the clear corneal incision group[27,28]. In our group, all surgeries were performed via clear corneal incision, so we are unable to compare with different types of incision. In conclusion, our study demonstrated that following uneventful phacoemulsification, the diagnosis of glaucoma was the only risk factor for IOP higher than 22 mmHg. On the other hand, according to our results, PXF was not a risk factor for high IOP. We believe that patients who have glaucoma are at risk, and should be monitored closely for high IOP following phacoemulsification surgery.

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