Early Intraocular Pressure Elevation After Cataract Surgery in Healthy Eyes

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ABSTRACT

Purpose: To determine the frequency of IOP elevation following cataract extraction in early postoperative period and its association with age and type of surgery.

Methodology: This was an observational study conducted at department of ophthalmology, MTI-Hayatabad Medical Complex, Peshawar from October 2022 to April 2024. Patients undergoing cataract surgery, age 50-80 years of either gender with no other ocular comorbidity were recruited. The frequency of elevated intraocular pressure (IOP) of > 30 mmHg within 24 hours after surgery was determined. The IOP spike was stratified according to gender, age and type of cataract surgery.

Result: A total of 171 eyes of 171 participants were recruited in this study. Mean age of the participants was 62.92±7.78 years and 107 (62.6%) were males. The mean preoperative IOP was 14.05±4.26mmHg while the mean postoperative IOP was 15.94±5.19mmHg. Five (2.9%) participants had IOP elevation of more than 30mmHg within 24 hours of surgery. Type of surgeries performed were extracapsular cataract extraction (ECCE) in 23 (13.4%), manual small incision cataract surgery (MSICS) in 58 (33.9%) and phacoemulsification in 90 (52.6%) participants. The early postoperative IOP was significantly less in phacoemulsification 0 (0%) group as compared to MSICS (n=4, 80%) and ECCE (n=1, 20%) group (p=0.047).

Conclusion: The frequency of IOP elevation within 24 hours of cataract surgery with IOL implantation in healthy Asian eyes was low. Older age and MSICS have more risk of postoperative IOP spikes.

Keywords: Intraocular pressure, Cataract, Phacoemulsification, Cataract Extraction..

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INTRODUCTION

Globally, cataract is the second leading cause of visual impairment and the most common treatable cause of blindness.[1] Phacoemulsification, extracapsular cataract extraction (ECCE) and manual small incision cataract surgery (MSICS) are commonly performed procedures. Although cataract surgery has been reported to be safe in almost 95% of cases yet a few complications have been reported.[2] Some of the early post-operative complications include endo-epithelial corneal edema, inflammation, hemorrhagic complications and rise in intraocular pressure (IOP).[3] Early postoperative IOP elevation following cataract surgery is a common adverse event, and might represent up to 88% of early postoperative complications.4 The risk factors for IOP elevation after cataract surgery include residual viscoelastic material, resident's performed surgery, pre-existing glaucoma, pseudo-exfoliation syndrome, axial length over 25 mm, tamsulosin use, and topical steroid application in steroid responders.[4] Although, IOP elevation can occur anytime in early postoperative period after cataract surgery but the first 3-7 hours after surgery are crucial.[5] If not controlled in time, postoperative IOP spikes can cause pain, corneal edema, glaucomatous optic nerve damage and rarely anterior ischemic optic neuropathy.[6] IOP spikes as well as large IOP fluctuations have been shown to increase the risk of retinal and choroidal ischemia.[7] Not every IOP spike is harmful to the eye but a report suggests that IOP greater than 30 mmHg reduces the ocular blood flow and can cause optic nerve ischemia.[8]

In healthy eyes, IOP of greater than 30 mmHg has been reported in 20% cases after cataract surgery which is quite significant.[6] Timely management of IOP rise can prevent the irreversible optic nerve damage and hence preserve the vision of our patients. Unfortunately, this problem has been overlooked in our population and we may be missing these patients regularly. To determine the actual burden of this problem we need to have our own data and only then a definitive treatment strategy can be devised. Although several previous studies have examined the effects of cataract extraction on intraocular pressure,[6] yet none to our knowledge has been conducted on south Asian eyes. European and central Asian eyes are different from the south Asian (e.g. lens parameters and iris inflammatory response to cataract surgery) and their relative risk of angle closure and the potential IOP response after cataract surgery is different than each other.[9] This is why we designed this study to address this problem in our population. The purpose of this study is to determine early IOP elevation following cataract extraction and intraocular lens (IOL) implantation in south Asian eyes and its association with age and type of cataract surgery.

METHODOLOGY

This was a cross-sectional study conducted at the department of ophthalmology, MTI-Hayatabad Medical Complex, Peshawar from October 2022 to April 2024. The ethical approval of this study was taken from hospital ethical committee (Ref. No. 793/HEC/B&PSC/2022) before starting the study. The sample size was determined to be 171 eyes, based on an anticipated 20% incidence of IOP exceeding 30 mmHg in the early postoperative period after cataract surgery6, with a 95% confidence interval and an absolute precision of 6%. Those patients who were booked for cataract surgery, of either sex, and aged between 50-80 years were included. Patients with history of eye trauma, pseudo-exfoliation syndrome or prior intraocular surgery were excluded. Patients with intraoperative complications e.g. posterior capsular rupture, vitreous loss, dislocation of intraocular lens or suprachoroidal hemorrhage were also excluded. The participants were recruited through consecutive non-probability sampling technique. Informed consent was taken from participants meeting our inclusion criteria. A thorough ocular examination of all the participants was done that included assessment of visual acuity using Snellen's chart, detailed anterior segment examination using slit lamp, intraocular Pressure (IOP) measurement using Goldmann applanation tonometer and ocular fundus examination using 78D condensing lens. Postoperative IOP was recorded within the first 24

hours after the cataract surgery. All the data was recorded on a predesigned proforma. Those participants with raised IOP postoperatively and were not responding to medical treatment were referred to glaucoma surgeon for further management.

Surgical Technique:

Extracapsular Cataract Extraction (ECCE): A clear corneal partial thickness limbal incision was made with a steel blade. The anterior chamber entry was created with 2.8mm keratome. Anterior chamber was maintained by injecting viscoelastic and an anterior capsulotomy was done with a cystotome. The incision was enlarged using scissor and the nucleus was freed after dialing and hydrodissection. Lens was removed using pressure at the 6 and 12 o'clock limbus positions. Manual irrigation/aspiration of cortical material was performed with simcoe cannula. Intraocular lens (IOL) was inserted into the posterior chamber followed by wound closure with interrupted 10-0 nylon monofilament suture.

Manual Small Incision Cataract Surgery (MSICS): A fornix based conjunctival flap was made and the bleeding vessels were cauterized. A partial thickness scleral incision was created 3mm posterior to limbus. The tunnel was made by advancing crescent knife in the sclera until limbus was reached. Anterior chamber was maintained by injecting viscoelastic and an anterior capsulotomy was done with a cystotome. The incision was enlarged using scissor and the nucleus was freed after dialing and hydrodissection. Lens was removed through the tunnel by applying slight pressure on posterior lip of tunnel. Manual irrigation/aspiration of cortical material was performed with simcoe cannula. Intraocular lens (IOL) was inserted into the posterior chamber followed by wound closure by opposing the conjunctiva gently by diathermy cautery.

Phacoemulsification: A 3.2 mm corneal tunnel was created using a steel keratome. The anterior chamber was maintained with viscoelastic material. A circular continuous capsulorhexis was performed and after hydrodissection, a phacoemulsification tip was used to remove the lens nucleus. The residual cortical material was removed by irrigation and aspiration. A foldable posterior chamber IOL was implanted in the capsular bag. The viscoelastic was aspirated and the incision was closed by stromal hydration.

Data Analysis Procedure: Data was analyzed using IBM Corp. (2019). IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY. Continuous variables like age, time since surgery, IOP, best corrected visual acuity was analyzed for mean and standard deviation (SD). For categorical data like detection of IOP changes, frequency and percentages were calculated. For finding association between categorical variables, the chi-square test was used. A p-value of 0.05 or less was considered significant. Age and gender stratification were done to find the effect modifiers.

RESULTS

The study was conducted on 171 eyes of 171 participants with a mean age of 62.92±7.78 years. Males were more 107 (62.6%) and the mean preoperative IOP was 14.05±4.26 mmHg. The mean postoperative IOP was 15.94±5.19mmHg. Mean time since surgery was 19.60±2.36 hours. Five (2.9%) patients had elevation in intraocular pressure more than 30mmHg. Phacoemulsification was the most common surgical technique performed (n=90, 52.63%). Table 1 shows the baseline demographics of our study participants.

Table-1: Baseline Demographics of Study Participants.

Characteristics		N=171
Age, mean (SD) in years		62.92 (7.78)
Preoperative IOP, mean (SD) in mmHg		14.05 (4.26)
Time since surgery, mean (SD) in hours		19.6 (2.36)
Postoperative IOP, mean (SD) in mmHg		15.94 (5.2)
Gender, n (%)	Male	107 (62.6%)
	Female	64 (37.4%)
Preoperative Visual Acuity (LogMAR units), n (%)	Better or equal to 0.5	14 (8.19)
	Worse than 0.5	157 (91.81)
Type of Surgery, n (%)	ECCE	23 (13.45)
	MSICS	58 (33.92)
	Phacoemulsification	90 (52.63)

N = total sample size, SD = standard deviation, IOP = intraocular pressure, n = frequency, % = percentage, LogMAR = logarithm of minimal angle of resolution, ECCE = extracapsular cataract extraction, MSICS = manual small incision cataract surgery.

Table 2 shows the association of IOP spike with gender, age of participant and the type of surgery performed. The early postoperative IOP was significantly less in phacoemulsification 0 (0%) group as compared to MSICS (n=4, 80%) and ECCE (n=1, 20%) group (p=0.047).

Table -2: Association of IOP Spike with Gender, Age of Participant, and Type of Surgery.

Characteristics (N=171)		Preoperative IOP <30mmHg	Preoperative IOP =30mmHg	P-Value*
Gender, n (%)	Male	104 (97.2)	3 (2.8)	0.62
	Female	62 (96.88)	2 (3.2)	
Age in years, (%)	50 - 60	81 (98.78)	1 (1.22)	0.003
	61 - 70	54 (100)	0 (0)	
	71 - 80	31 (88.57)	4 (11.43)	
Type of Surgery, n (%)	ECCE	22 (95.65)	1 (4.35)	0.047
	MSICS	54 (93.1)	4 (6.9)	
	Phacoemulsification	90 (100)	0 (0)	

* = chi-square test was performed (when the expected count was < 5 in 25% of the cells then the Fisher exact test was applied), IOP = intraocular pressure, N = total sample size, n = frequency, % = percentage, ECCE = extracapsular cataract extraction, MSICS = manual small incision cataract surgery.

DISCUSSIOEarly intraocular pressure (IOP) elevation following cataract surgery is a well-known and significant clinical concern.[10] If not controlled, post operative spike in IOP may cause pain, corneal edema, optic nerve damage and anterior ischemic optic neuropathy.[11] This study explores the incidence, associated factors, and implications of early postoperative IOP elevation in a cohort of healthy eyes, using data from a study of 171 eyes. Cataract surgery, though generally safe and effective, can trigger a transient increase in IOP. In this study, 2.9% of patients experienced a notable elevation in IOP within the first 24 hours after surgery. The mean IOP across all patients was 15.94 mmHg. The elevation in IOP was observed approximately 19.6 hours post-surgery on average, indicating that the pressure spike tends to occur fairly early in the postoperative period. This early onset necessitates vigilant monitoring during the initial hours after cataract surgery, particularly in patients who may be at higher risk.

Age emerged as a significant factor associated with postoperative IOP elevation. The study's findings suggest that older patients are more susceptible to this complication. Specifically, 80% of the cases of elevated IOP occurred in patients aged 71 to 80 years. This is a striking statistic that highlights the need for particular attention to older individuals undergoing cataract surgery. In a study by Tien yin wong, increasing age was reported to be significantly associated with raised post-operative IOP.12 Similarly a few other studies also reported positive correlation between age and postoperative IOP elevation.[13] However Asaoka et al reported a negative association of IOP with age.[14] The age-related predisposition could be attributed to several factors, including age-associated changes in the trabecular meshwork, which might impair aqueous humor outflow, and a generally higher likelihood of underlying ocular comorbidities that may exacerbate the IOP response to surgery.[15]

Type of surgery also emerged as a significant factor associated with early post-operative elevation in IOP. This study suggest that phacoemulsification surgery was negatively associated with early postoperative IOP elevation while MSICS and conventional ECCE patients were more susceptible to this complication. This was similar to results obtained in a study by Onakpoya Oh et al that reported a slight decrease in IOP in phacoemulsification in early post op period.[16] Their study also reported a mean elevation of IOP at 1st postop day in MSICS and conventional ECCE group. Sengupta et al. in a study comparing IOP changes after MSICS versus phacoemulsification also reported a similar increase in IOP at 1st day post-operative period in the MSICS group.[17] The decrease in IOP in the 1st day post-operative period in Phacoemulsification may be due to Smaller wound size, Increased aqueous outflow through the trabecular meshwork,[18] the activation of IL-1a, Endothelial leukocyte-adhesion molecule

(ELAM)-1 expression and potentially IOP-lowering stress response induced in TM cells by ultrasound.[19] The transient rise in IOP in early postoperative period in non-glaucomatous eyes following MSICS and ECCE could be attributed to large incision size, stronger trauma leading to release of serum proteins and iris pigments into anterior chamber, direct damage to trabecular meshwork, type of viscoelastic material, cataract surgical technique used, wound closure technique causing decreased outflow of aqueous through trabecular meshwork.[20]

In contrast, the data did not show a significant gender difference in the incidence of IOP elevation. The distribution of cases between male and female patients was nearly proportional to their representation in the study population, with 60% of IOP elevations occurring in males and 40% in females. These figures align with the overall gender distribution of the study, where 62.6% of the participants were male and 37.4% were female. This suggests that gender does not play a substantial role in influencing the risk of early postoperative IOP elevation, at least in a cohort of otherwise healthy individuals. Patients with a BCVA worse than 0.5 Log MAR were more likely to experience an increase in IOP postoperatively. This finding may imply that eyes with poorer preoperative visual acuity, which could indicate underlying ocular issues, are more prone to postoperative IOP spikes. However the finding was not statistically significant.

Early IOP elevation after cataract surgery is a multifactorial issue that is influenced by age, visual acuity, and the timing of postoperative assessment. Although gender does not appear to significantly impact the risk, older patients and those with poorer preoperative visual acuity should be closely monitored in the early hours following surgery. Prompt detection and management of elevated IOP can prevent potential complications, ensuring better visual outcomes and preserving the long-term health of the eye. This study highlights the need for tailored postoperative care strategies to address the specific risks associated with early IOP elevation, particularly in vulnerable patient populations. There are some limitations of this study like smaller sample size, not exploring the relation of spikes with surgical time and surgeon's experience, and single center results. We recommend addressing these factors with multicenter study participants for more robust conclusions.

CONCLUSION

IOP spikes within 24 hours of cataract surgery with IOL implantation in healthy Asian eyes was low. Older age was positively associated with early postoperative spikes while phacoemulsification surgery was a safer technique in this regard. Understanding the associated variables may help us in preventing and managing this transient but detrimental complication.

Conflict of Interest: None to declare

Ethical Approval: The study was approved by the Hospital Research & Ethical Committee (IREB) via Ref No. 793/HEC/B&PSC/2022 dated 16-06-2022.

Author Contributions:

Farhana Ramzan: Literature search, Data acquisition, Data analysis, Manuscript preparation, Manuscript editing, Manuscript review.

Yousaf Jamal Mahsood: Concept, Design, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.

REFERENCES

1. Song P, Wang H, Theodoratou E, Chan KY, Rudan I. The national and subnational prevalence of cataract and cataract blindness in China: a systematic review and meta-analysis. Journal of global health. 2018;8(1). https://doi.org/10.7189/jogh.08-010804.
2. Lundström M, Barry P, Henry Y, Rosen P, Stenevi U. Visual outcome of cataract surgery; study from the European Registry of Quality Outcomes for Cataract and Refractive Surgery. J Cataract Refract Surg. 2013 May;39(5):673-9. http://doi.org/10.1016/j.jcrs.2012.11.026.Epub 2013Mar 14. PMID: 23499065.
3. Wang J, Su F, Wang Y, Chen Y, Chen Q, Li F. Intra and post-operative complications observed with femtosecond laser-assisted cataract surgery versus conventional

phacoemulsification surgery: a systematic review and meta-analysis. BMC ophthalmology. 2019 Dec;19:1-8. https://doi.org/10.1186/s12886-019-1190-2.

4. Grzybowski A, Kanclerz P. Early postoperative intraocular pressure elevation following cataract surgery. Current Opinion in Ophthalmology. 2019;30(1):56–62. http://doi: 10.1097/ICU.0000000000000545.
5. Grzybowski A, Kanclerz P. Do we need day-1 postoperative follow-up after cataract surgery? Graefe's Archive for Clinical and Experimental Ophthalmology. 2018;257(5):855–61. https://doi.org/10.1007/s 00417-018-04210-0.
6. Todorović M, Šarenac Vulović T, Petrović N, Todorović D, Srećković S. Intraocular pressure changes after uneventful phacoemulsification in early postoperative period in healthy eyes. Acta Clinica Croatica. 2019;58(3.):467-72. https://doi. org/10.20471/acc.2019.58.03.10.
7. Onakpoya OH, Adeoye AO, Adegbehingbe BO, Badmus SA, Adewara BA, Awe OO, Udonwa PA. Intraocular pressure variation after conventional extracapsular cataract extraction, manual small incision cataract surgery and phacoemulsification in an indigenous black population. Pan African Medical Journal. 2020 Jun 23;36(1).https://doi. org/10.11604/pamj.2020.36119.16942.
8. Tan B, MacLellan B, Mason E, Bizheva K. Structural, functional and blood perfusion changes in the rat retina associated with elevated intraocular pressure, measured simultaneously with a combined OCT+ ERG system. PloS one. 2018 Mar 6;13(3):e0193592. https://doi. org/10.1371/journal.pone.0193592.
9. Wang D, Amoozgar B, Porco T, Wang Z, Lin SC. Ethnic differences in lens parameters measured by ocular biometry in a cataract surgery population. PloS one. 2017 Jun 27;12 (6):e0179836. https://doi. org/10.1371/journal.pone.0179836.
10. Zetterström, C. and Eriksson, A. (1994) 'Changes in intraocular pressure following phacoemulsification and implantation of a posterior chamber lens', European journal of Implant and Refractive Surgery, 6(1), pp. 50–53. doi:10.1016/s0955-3681(13)80247-x.
11. McCulley TJ. Ischemic optic neuropathy and cataract extraction: What do I need to know?. Oman J Ophthalmol. 2012;5(3):141-143. doi:10.4103/0974-620X.106090.
12. Wong TY. Effect of increasing age on cataract surgery outcomes in very elderly patients. Bmj. 2001 May 5;322(7294):1104-6.https://doi. org/10.1136/bmj.322.7294.1104.
13. Desai P, Minassian DC, Reidy A. National cataract surgery survey 1997–8: a report of the results of the clinical outcomes. British Journal of Ophthalmology. 1999 Dec 1;83(12):1336-40.https://doi. org/10.1136/bjo.83.12.1336.
14. Asaoka R, Obana A, Murata H, et al. The Association Between Age and Systemic Variables and the Longitudinal Trend of Intraocular Pressure in a Large-Scale Health Examination Cohort. Invest Ophthalmol Vis Sci. 2022;63(11):22. https://doi. org/10.1167/iovs.63.11.22.
15. Miyazaki M, Segawa K, Urakawa Y. Age-related changes in the trabecular meshwork of the normal human eye. Jpn J Ophthalmol. 1987;31(4):558-569. PMID: 3448324.
16. Onakpoya OH, Adeoye AO, Adegbehingbe BO, et al. Intraocular pressure variation after conventional extracapsular cataract extraction, manual small incision cataract surgery and phacoemulsification in an indigenous black population. Pan Afr Med J. 2020;36:119. https://doi. org/10.11604/pamj.2020.36.119.16942.
17. Sengupta S, Venkatesh R, Krishnamurthy P, et al. Intraocular Pressure Reduction after Phacoemulsification versus Manual Small-Incision Cataract Surgery: A Randomized Controlled Trial. Ophthalmology. 2016;123(8): 1695-703. https://doi.org/10.1016/j.optha.2016.04.014.
18. Meyer MA, Savitt ML, Kopitas E. The effect of phacoemulsification on aqueous outflow facility. Ophthalmology. 1997;104(8):1221-7. https://doi. org/10.1016/S0161-6420(+7)30154

-7.

19. Wang N, Chintala SK, Fini ME, Schuman JS. Ultrasound activates the TM ELAM-1/IL-1/NF-kappaB response: a potential mechanism for intraocular pressure reduction after phacoemulsification. Invest Ophthalmol Vis Sci. 2003;44(5):1977-81.https://doi.org/10.1167/iovs.02-0631.

20. Bömer TG, Lagrèze WD, Funk J. Intraocular pressure rise after phacoemulsification with posterior chamber lens implantation: effect of prophylactic medication, wound closure, and surgeon's experience. Br J Ophthalmol.1995; 79(9):809-13.https://doi.org/10.1136/bjo.79.9.809.