Safety profile and efficacy of intracameral moxifloxacin for endophthalmitis prevention after uncomplicated phacoemulsification.

Muhammad Saeed Zafar Khan[1], Hafiza Ummara Rasheed[2], Syed Sajjad Hussain[3], Rafia Saeed[4], Amina Saeed[5].
FMH College of Medicine & Dentistry Lahore[1,4,5],
College of Ophthalmology & Allied Vision Sciences, Lahore[2],
Institute of Ophthalmology, Mayo Hospital Lahore[3].

Ophthalmol Pak. - Official Journal of College of Ophthalmology & Allied Vision Sciences

ABSTRACT

Purpose: To evaluate the incidence and safety profile of postoperative endophthalmitis in cases of uncomplicated phacoemulsification with intracameral injection of moxifloxacin.

Methodology: This was a single-centered observational study conducted at the eye department, College of Medicine and Dentistry, FMH, Lahore. All patients underwent uncomplicated phacoemulsification with foldable intraocular lens implant under local anaesthesia. This was followed by intracameral injection of moxifloxacin (0.5mg/0.1ml) at the end of surgery. Prior Ethical approval was obtained from FMH IRB. Wilcoxon Signed Rank was applied to compare pre- and post-operatively visual acuity in patients.

Result: In this study, 101 patients, 54 females (53.5%) and 47 males (46.5%) were included. The average age of patients was 55.38±8.10 years. Among 101 patients, 94 (93.1%) of the patients' corneas were clear, and 7 (6.9%) of the patients had microcysts. Endothelial cell count was measured in patients preoperatively and postoperatively; it was lower postoperatively, and statistical results demonstrated a highly significant difference between pre-operative and post-operative values ($p < 0.001$).

Conclusion: The study results showed that the UCVA improved from day 1 to day 30, with no evidence of postoperative endophthalmitis in cases of uncomplicated phacoemulsification. Endothelial cell count was minimally decreased postoperatively.

Keywords: Prevention, Endophthalmitis, Intracameral, Safety, Efficacy.

How to cite this article: Khan M, Rasheed H, Hussain S, Saeed R, Saeed A. Safety profile and efficacy of intracameral moxifloxacin for endophthalmitis prevention after uncomplicated phacoemulsification. Pak. 2016;16(1): 24-30.

DOI: https://doi.org/10.62276/OphthalmolPak.16.01.240

Correspondence:
Hafiza Ummara Rasheed,
College of Ophthalmology & Allied Vision Sciences, Lahore.
Email: hummararasheed@gmail.com

Received: 17-02-2026
Accepted: 27-02-2026

INTRODUCTION

Phacoemulsification is currently the most popular and largely safe type of cataract surgery, but postoperative endophthalmitis is still its most dangerous side effect and can have serious vision-threatening consequences, including blindness.[1] The risk of infection still poses a problem for ophthalmic surgeons around the world, even though contemporary surgical methods and sterilization procedures have greatly improved results. Endophthalmitis has a low occurrence worldwide between 0.04% and 0.2% but it can have serious clinical outcomes such as severe ocular pain, severe inflammation, and the possibility of irreversible sight loss, all of which can lower a patient's quality of life[2,3].

Endophthalmitis is a severe, acute infection that affects the vitreous in the front and posterior parts of the eye. It most frequently happens following eye surgery or traumatic trauma and might be bacterial, fungal, protozoal, viral, or unusual. For corneal endothelial cells, intracameral antibiotics are usually safe.[4] The most prevalent infections in endophthalmitis differ depending on the category. Bacillus cereus is a major cause of post-traumatic endophthalmitis. Staphylococcus aureus and streptococci are significant causes of endogenous endophthalmitis associated with endocarditis, and coagulase-negative staphylococci and viridian streptococci are the most frequently reported sources of post-cataract endophthalmitis.[5]

The breakdown of the ocular blood barrier and intraocular colonization by pathogens (bacteria/ fungi) are the most important factors in the development of endophthalmitis. In exogenous endophthalmitis, the globe's integrity is disrupted by the precipitating injury or surgery, allowing the bacteria to invade. Rarely, the organisms (often propionibacterium acnes, which is accumulated in the capsular bag following cataract surgery) may be released with YAG capsulotomy, resulting in delayed postoperative endophthalmitis[6] Preventive measures, including preoperative topical antibiotics, povidone-iodine antisepsis of the eyelids and conjunctival sac, and meticulous surgical technique, have led to a significant decrease in the incidence of endophthalmitis.[6] However, postoperative topical medication compliance is frequently neglected in economically disadvantaged third-world nations like Pakistan. The inability to properly follow the postoperative regimen may be caused by the high cost, lack of knowledge, and unavailability of medications in rural pharmacies.[8]

Intraoperative procedures like intracameral broad-spectrum antibiotics provide an alternate and workable treatment because of these various aspects. Additionally, an intracameral injection of antibiotics the the end of surgery gives the medicine a direct and rapid bactericidal concentration in the eye. Furthermore, moxifloxacin is a derivative of a fourth-generation fluoroquinolone. Because of its wide range of pathogen coverage and demonstrated effectiveness and safety on the cornea's endothelium, it has become the most practical choice. In 2007, the European Society of Cataract and Refractive Surgeons (ESCRS) Randomized Controlled Trial documented that using cefuroxime intracamerally at the end of surgery resulted in a significant reduction in postoperative endophthalmitis. Cefuroxime must be diluted several times before being injected into the eye; hence, it cannot be used immediately. In contrast, a self-preserving formulation of a novel medication such as moxifloxacin can be utilized. Furthermore, its level in ocular tissues rises quickly because of its strong aqueous penetration. In its preservative-free form, it is freely sold commercially. Therefore, it is appropriate for intracameral use after surgery due to all these features.[9,10] Good visual outcomes following intracameral moxifloxacin for prophylaxis against endophthalmitis have been described in several trials from Southeast Asia, particularly Pakistan. Anwar et al. found that topical and intracameral moxifloxacin were equally effective in lowering infection rates after phacoemulsification, with few adverse effects.[4] The safety of intracameral moxifloxacin on endothelial cell counts and intraocular pressure was verified by S. Riaz et al.[11]

METHODOLOGY

This observational analytical study was conducted at the Eye Department of the FMH College of Medicine & Dentistry, Fatima Memorial Hospital, Lahore, Pakistan, over six months. A total of 101 subjects were randomly selected using a simple random sampling technique from patients presenting with decreased visual acuity and diagnosed as visually significant senile cataract. The anonymity and confidentiality of all participants were strictly maintained. Prior approval from the Institutional Review Board (IRB) and Ethics Committee was obtained before the commencement of the study. The sample size of 101 was calculated using the World Health Organization (WHO) sample size calculator, assuming a 95% confidence level, an anticipated population proportion of 0.03 based on the published incidence of postoperative endophthalmitis, and an absolute precision of 0.05. All patients underwent detailed preoperative ophthalmic examination, including uncorrected visual acuity (UCVA), slit-lamp biomicroscopy, intraocular pressure (IOP) measurement by applanation tonometry, and fundus evaluation where media clarity permitted. The inclusion criteria comprised patients aged 40–75 years with age-related cataracts of grades I–III according to the Lens Opacities Classification System (LOCS III). Patients with hypermature or Morgagnian cataracts, prior ocular surgery, glaucoma, uveitis, corneal opacities, or systemic contraindications were excluded from the study. All surgeries were performed by a single experienced surgeon to eliminate inter-surgeon variability. The standard phacoemulsification technique was employed using a corneolimbal incision, capsulorrhexis, hydrodissection, phacoemulsification of the nucleus, and aspiration of cortical matter, followed by implantation of a foldable posterior chamber intraocular lens (PCIOL) within the capsular bag. At the conclusion of the surgery, 0.1 mL of preservative-free Moxifloxacin 0.3% (Vigamox®, Alcon, USA) was injected intracamerally through the side port using a 27-gauge cannula. No other intraocular antibiotic was administered. Postoperatively, all patients were examined on day 1, week 1, and day 30.

Parameters assessed included UCVA, IOP, corneal clarity, and anterior chamber (A/C) reaction

graded as mild, moderate, or severe, wound integrity (sealed or leaking), and any evidence of endophthalmitis. Endophthalmitis was operationally defined as the presence of severe ocular pain, lid edema, hypopyon, marked anterior chamber reaction, vitritis, and a sudden decline in vision confirmed clinically and by B-scan ultrasonography.

All data were recorded on a predesigned Performa and entered into SPSS version 25.0 (IBM Corp., Armonk, NY, USA) for statistical analysis. Descriptive statistics, including mean ± standard deviation (SD) for continuous variables like age, and frequency and percentage for categorical data, were calculated. Wilcoxon signed-rank tests were used to compare pre- and postoperative visual acuity. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

In this study, a total of 101 participants were enrolled, comprising 54 females (53.5%) and 47 males (46.5%). The average age was 55.38±8.10 years, ranging from 39 to 80 years. IOP was measured at day 1, day 7, and day 30; the average IOP was 13.57±1.65, 12.97±2.05, and 12.61±1.78, respectively. Among 101 patients, 94(93.1%) of patients' cornea was clear, and 07 (6.9%) of patients had microcysts. Endothelial cell count was measured in patients preoperatively and postoperatively; it was lower postoperatively, and statistical results demonstrated a highly significant difference between pre-operative and post-operative values ($p < 0.001$), as shown in Table No 1

Uncorrected visual acuity was observed at day 1, day 7, and day 30 as shown in Figure No. 1. At Day 1, the most common UCVA value was 0.3 (25.7%), followed by 0.4 (21.8%) and 0.5 (24.8%). By Day 7, UCVA was improved like with 0.3 becoming the dominant value (37.6%), while poorer acuity levels

decreased. After one month at day 30, 0.1 was the most frequent (42.6%), and 0.0 appeared in 19.8% of participants. Overall, the graph demonstrates a progressive improvement in UCVA across the three follow-up periods.

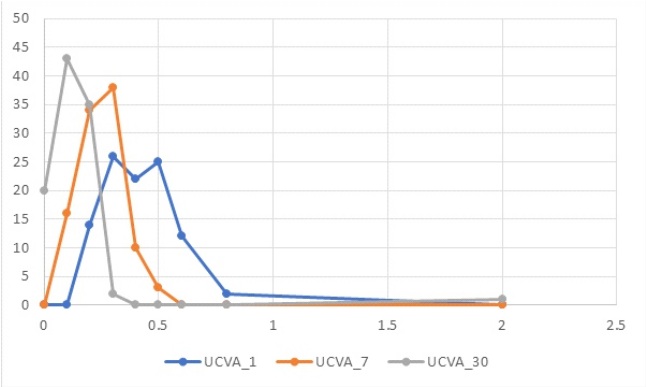

Figure No. 01: Visual Acuity Trends Across Follow-up Visits

A/c reaction was found normal in 66(65.3%) of patients, mild in 29(28.7%) of patients, and moderate in 6(5.9%) of patients, as shown in Figure No. 2.

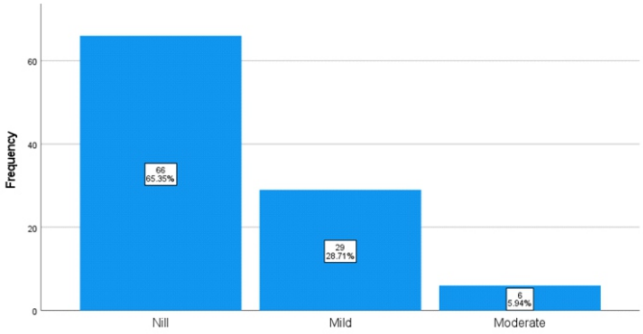

Figure No. 02: A/c Reaction Among Study Participants

Table No. 01: Comparison between endothelial cell counts Pre-op and Post-op

	Minimum	Maximum	Mean	Std. Deviation	P-value
Endothelial cell counts pre-op	1782	26158	3080.13	3205.885	<0.001
EC Post op	1690	3310	2548.45	337.408	

DISCUSSION

The present study demonstrated favorable postoperative outcomes among the enrolled participants. A clear postoperative cornea was observed in the vast majority of patients (93.1%), with only a small proportion showing microcyst (6.9%), indicating generally good corneal recovery and minimal early epithelial complications. On postoperative day 1, 93 eyes (35%) developed postoperative corneal oedema; the majority of patients had focal corneal oedema (25.6%), which dropped to 3.8% on postoperative day 7.[15] Kausar et al. found a similar pattern of findings, with 44% of patients having postoperative corneal oedema and 24.7% of patients having focal corneal oedema.[16]

We observed significant postoperative improvements in visual outcomes and intraocular parameters among patients who underwent the procedure. The results demonstrate a progressive improvement in uncorrected visual acuity, stable postoperative intraocular pressure, and minimal corneal complications, indicating that the procedure is safe and effective. After surgery, the physiological stability of aqueous outflow has been demonstrated by the slight decrease in IOP from day 1 to day 30. Previous studies have shown similar results, with surgical IOP declining when the anterior chamber depth returned to normal and early inflammatory alterations decreased.[17]

IOP gradually decreased from day 1 to day 30 while being within normal ranges. Several studies show that some patients experience an early postoperative IOP peak in the first eight to twenty-four hours, which is followed by stabilization and frequently a slight net decrease by one to three months. Several cohorts reveal a decreased mean IOP at 30-90 days compared with baseline; however, the timing and amplitude vary with age, axial length/myopia status, and glaucoma history.[18]

The endothelial cell count showed a statistically significant decrease postoperatively. Although endothelial loss is expected after intraocular

procedures, the postoperative mean remained within clinically acceptable ranges, implying that most patients maintained adequate endothelial reserve to sustain corneal clarity. However, the reduction highlights the need for careful surgical technique and patient selection in procedures affecting the corneal endothelium. In comparison to another study, the endothelial cell density declined considerably postoperatively in all groups across the follow-up period. But as the follow-up period drew to a close, the amount of change diminished.[19] A significant reduction in endothelial cell density was observed. The mean preoperative count of 2236 cells/mm2 declined to 1597 cells/mm2 at the three-month follow-up. Although endothelial loss is an unexpected consequence of phacoemulsification.[20] The statistically significant drop in endothelial cell count seen in the present study ($p<0.001$) remained within clinically acceptable ranges postoperatively. This association is aligned with data from modern literature, where endothelium loss following phacoemulsification or other intraocular surgeries normally varies between 3-15% during the early postoperative period.[21]

Visual recovery showed a positive trajectory over time. UCVA steadily improved from day 1 to day 30, reflecting the natural recovery period and stabilization of refractive outcomes. The increase in better acuity levels (0.1 and 0.0) at one month demonstrates effective visual rehabilitation. Furthermore, most patients showed either normal or mild anterior chamber reaction, suggesting low levels of postoperative inflammation and overall good tolerance to surgery. In contrast, no statistically significant difference was identified between the groups with respect to corneal feeling and visual outcomes on postoperative day 30. Uncorrected visual acuity was better in the phacoemulsification group than in the manual SICS group on postoperative day 1, day 7, and day 30.[22]

UCVA indicated a consistent improvement from day 1 to day 30, with a greater number of patients achieving LogMar 0.1 and 0.0 by one month. This tendency fits with data from multiple major studies, which demonstrate considerable enhancement in both UCVA and BCVA within the first postoperative month following simple cataract or anterior segment surgery.[23]

CONCLUSION

The study results showed that the UCVA improved from day 1 to day 30, with no evidence of postoperative endophthalmitis in cases of uncomplicated phacoemulsification. Endothelial cell count was minimally decreased postoperatively.

Conflict Of Interest: None to declare

Ethical Approval: The study was approved by the Institutional Review Board / Ethical Review Board Reference No. FMH/08/10/2025-IRB-1787 Dated 02.12.2025, FMH College of Medicine & Dentistry, Lahore.

Authors' Contributions:

Muhammad Saeed Zafar Khan: Concept, Design, Literature search, Manuscript review.

Hafiza Ummara Rasheed: Data Acquisition, Statistical Analysis.

Syed Sajjad Hussain: Manuscript editing, Manuscript review.

Rafia Saeed: Manuscript preparation, Manuscript review.

Amina Saeed: Literature search, Manuscript editing

REFERENCES

1. Shi SL, Yu XN, Cui YL, Zheng SF, Shentu XC. Incidence of endophthalmitis after phacoemulsification cataract surgery: a Meta-analysis. Int J Ophthalmol. 2022;15(2):327-35.

2. Barry P, Seal DV, Gettinby G, Lees F, Peterson M, Revie CW, et al. ESCRS study of prophylaxis of postoperative endophthalmitis after cataract surgery: Preliminary report of principal results from a European multicenter study. J Cataract Refract Surg. 2006;32(3):

407-10.

3. Lalitha P, Rajagopalan J, Prakash K, Ramasamy K, Prajna NV, Srinivasan M. Postcataract endophthalmitis in South India incidence and outcome. Ophthalmology. 2005;112(11):1884-9.

4. Anwar F, Qamar N, Bashir A, Ghaffar MT, Bokhari MH. Efficacy of Intracameral Moxifloxacin Versus Topical Moxifloxacin in Preventing Acute Endophthalmitis after Cataract Surgery by Phacoemulsification. J Ayub Med Coll Abbottabad. 2024;36(2):256-9.

5. Durand ML. Endophthalmitis. Clin Microbiol Infect. 2013;19(3):227-34.

6. Simakurthy S, Tripathy K. Endophthalmitis. StatPearls. Treasure Island (FL)2025.

7. Ciulla TA, Starr MB, Masket S. Bacterial endophthalmitis prophylaxis for cataract surgery: an evidence-based update. Ophthalmology. 2002;109(1):13-24.

8. Jadoon Z, Shah SP, Bourne R, Dineen B, Khan MA, Gilbert CE, et al. Cataract prevalence, cataract surgical coverage and barriers to uptake of cataract surgical services in Pakistan: the Pakistan National Blindness and Visual Impairment Survey. Br J Ophthalmol. 2007;91(10):1269-73.

9. Lane SS, Osher RH, Masket S, Belani S. Evaluation of the safety of prophylactic intracameral moxifloxacin in cataract surgery. J Cataract Refract Surg. 2008;34(9):1451-9.

10. Haripriya A, Chang DF, Namburar S, Smita A, Ravindran RD. Efficacy of Intracameral Moxifloxacin Endophthalmitis Prophylaxis at Aravind Eye Hospital. journal of ophthalmology. 2016;123(2):302-8.

11. Riaz S, Jahangir S, Hamza U, Raza I. Effect of Intracameral Moxifloxacin on Endothelial Cell Count and Endophthalmitis Prophylaxis After Cataract Surgery: Effect of Intracameral Moxifloxacin. pakistan biomedical journal 2024.

12. Haripriya A, Chang DF, Namburar S, Smita A, Ravindran RD. Efficacy of intracameral moxifloxacin endophthalmitis prophylaxis at Aravind Eye Hospital. Ophthalmology. 2016;123(2):302-8.

13. Anwar F, Qamar N, Bashir A, Ghaffar MT, Bokhari MH. Efficacy of intracameral Moxifloxacin versus topical Moxifloxacin in preventing acute endophthalmitis after cataract surgery by phacoemulsification. Journal of Ayub Medical College Abbottabad. 2024;36(2):256-9.

14. Barry P, Seal DV, Gettinby G, Lees F, Peterson M, Revie CW, et al. ESCRS study of prophylaxis of postoperative endophthalmitis after cataract surgery: preliminary report of principal results from a European multicenter study. Journal of Cataract & Refractive Surgery. 2006;32(3):407-10.

15. Liovic Milec M, Sekelj S, Konjevic-Pernar S. Postoperative Corneal Edema After Phacoemulsification. Southeastern European medical journal. 2022;6(1):113-20.

16. Kausar A, Farooq S, Akhter W, Akhtar N. Transient Corneal Edema After Phacoemulsification. J Coll Physicians Surg Pak. 2015;25(7):505-9.

17. Jamil AZ, Iqbal K, Rahman FU, Azam Mirza K. Effect of Phacoemulsification on Intraocular Pressure. Journal of the College of Physicians and Surgeons Pakistan. 2011; 21(6):347-50.

18. Parag A. Gokhale, Emory Patterson. Elevated IOP After Cataract Surgery. glaucoma today 2007;207.

19. A Sallam M, A Zaky K. Effect of anterior chamber depth on corneal endothelium following phacoemulsification among

patients with different axial lengths. international ophthalmology. 2025;45(1).

20. Ahmad M, BAHGAT M, ABUELEINEN K, Elshahed K. The Effect of Phacoemulsification Surgery on Corneal Endothelium. Benha Medical Journal. 2022.

21. Hwang HB, Lyu B, Yim HB, Lee NY. Endothelial Cell Loss after Phacoemulsification according to Different Anterior Chamber Depths. J Ophthalmol. 2015;2015:210716.

22. Dole K, Baheti N, Deshpande R, Kulkarni S, Shetty R, Deshpande M. Comparative study of anatomical and functional recovery of eye along with patient satisfaction score after small-incision cataract surgery and phacoemulsification cataract surgery. Indian J Ophthalmol. 2022;70(11):3942-7.

23. Zhu X, Ye H, He W, Yang J, Dai J, Lu Y. Objective functional visual outcomes of cataract surgery in patients with good preoperative visual acuity. Eye (Lond). 2017;31(3):452-9.