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*Original Article*

## INCIDENCE OF ENDOPHTHALMITIS AFTER INTRA-OPERATIVE MOXIFLOXACIN INJECTION IN THE CAPSULAR BAG, BEHIND THE INTRA OCULAR LENS, IN PHACOEMULSIFICATION. A RETROSPECTIVE STUDY

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Received: 29/11/2022

Accepted: 2/12/2022

Doi: 10.21608/ejco.2022.280977

**Abstract**

**Purpose:** to evaluate the efficacy and safety of intracapsular moxifloxacin injection at the end of phacoemulsification as a prophylactic measure against early and late endophthalmitis. **Setting:** private eye center, eye Care, Cairo, Egypt. **Methods:** This is a retrospective clinical registry-based study. Data was collected from patients who had phacoemulsification within the capsular bag injection of moxifloxacin at the end of surgery. 0.2 ml of moxifloxacin 0.5% ophthalmic solution was injected into the bag by placing the tip of the cannula under the capsulorhexis edge and directing the drug behind the IOL. **Results:** Data were collected from EMR for 10919 eyes, that underwent phacoemulsification and in the bag moxifloxacin injection between January 2015 and August 2022, 4 cases of early endophthalmitis were reported with an incidence of 0.03%, no cases of late-endophthalmitis, and no cases of toxicity. **Conclusion:** Intracapsular moxifloxacin injection at the end of phacoemulsification is a safe effective prophylactic measure against endophthalmitis.

**Keywords:** *Endophthalmitis, Moxifloxacin, Phacoemulsification***1. Introduction**

Cataract extraction with intraocular lens implantation is the most frequently performed surgery in the world [1]. One of the most feared complications of cataract surgery is endophthalmitis. It usually follows inoculation of the eye by bacteria, fungi, and parasites being less commonly involved, and has been reported to occur at rates of between 0.03% and 0.2% [2]. Postoperative endophthalmitis has been classified into two categories, early-onset that takes place in the first 6 weeks after the surgery and late-onset that takes

place after 6 weeks from the surgery [3]. Despite aggressive therapeutic and surgical intervention, endophthalmitis may result in partial or complete loss of vision, often within a few days of inoculation. The clinical manifestation, as well as the prognosis of endophthalmitis is dependent on the virulence of the organism, the pathogenic load, and the patient's immunity and resistance to infection. Injecting intracameral antibiotics at the end of surgery is a rising measure in prophylaxis against endophthalmitis. Its safety and efficacy

made it a routine step in eye centers worldwide [4-6]. In 2007, the European society of cataract and refractive surgery published a multicenter randomized clinical trial that assessed the efficacy of using the intracameral injection of antibiotics for prophylaxis against endophthalmitis post-cataract surgery, the study included 13598 patients from 24 European centers. This study revealed that intracameral injection of cefuroxime, at the end of cataract surgery was found to decrease the incidence of postoperative endophthalmitis by five folds to 0.07 % [7]. Moxifloxacin as compared to cefuroxime, offers a more potent and broader spectrum anti-

## **2. Patients and methods**

### **2.1. Study Design**

This is a retrospective clinical registry-based study on 10919 eyes that underwent phacoemulsification and intraocular lens implantation between the period of January 2015 and August 2022. Data were collected from patients' electronic files on the system of a private eye center, Eye care, Cairo, Egypt. The study was

### **2.2. Pre-operative**

Proper history taking and examination checking for evidence of periocular infection. A careful ophthalmic examination was done. None of topical preoperative antibiotics were used. Preoperative anti-

### **2.3. Intra-operative**

After application of opsite and speculum excluding the lid margin. Phacoemulsification was done in all cases, with temporal or superotemporal clear cornea incision 2.2mm. A 5-5.5 mm capsulorhexis and stop and chop technique for nucleus removal was used. Bimanual I/A was done. After Intraocular lens implantation in the capsular bag, irrigation aspiration of viscoelastic device and hydration of

### **2.4. Post-operative**

All patients were given the same postoperative routine topical medications, in the form of topical moxifloxacin antibiotic 3 times per day for 7 days, topical dexamethasone 6 times per day for 7

days, as well as being commercially available as a self-preserved ophthalmic solution. It can be injected directly or diluted in the operative room [8]. Moxifloxacin, a fourth-generation fluoroquinolone. Moxifloxacin has a broad spectrum of coverage, with activity against both Gram-positive and Gram-negative bacteria, including *Pseudomonas aeruginosa*. After injection of moxifloxacin, it remains bactericidal for a much longer time than cefuroxime, even at low injection concentrations. Other advantages of moxifloxacin for ophthalmic use include its pH, tonicity, and lack of preservative [9-11].

approved by the ophthalmology dep., Cairo university scientific committee. All study procedures adhered to the principles outlined in the Declaration of Helsinki. In each case the preoperative, operative, and postoperative measures were standardized.

sepsis with topical povidone-iodine (PI) 10 % used to clean the periocular skin and a 5% solution instilled in the conjunctival sac.

self-sealing clear corneal incisions, 0.2 ml of moxifloxacin 0.5% ophthalmic solution (VIGAMOX® 5 mg/ml eye drops solution, Novartis) drawn directly from the preservative moxifloxacin bottle, is injected in the capsular bag by placing the tip the 27G cannula below the capsulorhexis edge and getting the moxifloxacin behind the IOL. All surgeries were done by the same experienced surgeon Y.S.M.

days to be gradually withdrawn over 6 weeks. Patients were examined first day postoperatively, then after one, four, and eight weeks as a routine visit and were informed of symptoms of postoperative

endophthalmitis and instructed to get back to the hospital immediately whenever symptoms appear. During follow-up period any suspicious case of endophthalmitis was meticulously evaluated and pars plana vitrectomy was done when indicated. In each visit, a routine examination was

### **2.5. Statistical analysis**

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Data was summarized using mean, standard deviation, minimum and maximum for quantitative variables and frequencies (number of cases) and relative

### **3. Results**

In this retrospective study 10919 eyes that underwent phacoemulsification were included, with 53% females and 47% males, ages ranging between 24-78 years old with mean age, of 64 years old. All cases had their phacoemulsification at the same private eye center. 25 eyes had posterior capsule rupture (PCR) and vitreous loss, properly managed with 3-piece IOL implantation in the sulcus (0.2%). 4 cases of postoperative endophthalmitis have been documented, all early onset with signs of anterior chamber reaction noticed on the first day post-operative, in the form of cells and flare +3 with hypopyon. With an incidence of 0.03663 %, (p-value < .001). 3 out of the 4 patients were females with an incidence of 75% and 1 male with 25%. All cases had an intraoperative complication of posterior capsule rupture, and vitreous loss. None of the patients with

### **4. Discussion**

Endophthalmitis is the most feared post-operative complication for the most popular eye surgery, phacoemulsification. Several measures are taken in every surgery as prophylaxis against endophthalmitis, starting from treating any signs of ocular surface infection promptly and sterilizing the conjunctival sac 3 mins before surgery

performed in the form of UCVA, BCVA, IOP, corneal examination, anterior chamber examination, and posterior segment examination. Any signs of corneal edema and any signs of anterior chamber reaction were documented.

frequencies (percentages) for categorical variables. Correlations between quantitative variables were done using the Pearson correlation coefficient (Chan, 2003) [12]. P-values less than 0.05 were considered statistically significant.

endophthalmitis had any uncontrolled systemic illness, two patients had controlled diabetes. All four cases of endophthalmitis were managed according to the endophthalmitis vitrectomy study (EVS) [13], and after consulting the retina team, three cases were treated by intravitreal antibiotic injections, vancomycin and Cef-tazidime (Fortum) to cover the gram-positive and negative bacteria, one case improved markedly after one intravitreal injection and the other two we had to repeat the injection twice before showing improvement, and the fourth case, vitrectomy was made as a primary measure for the treatment of endophthalmitis with the combined injection of intravitreal antibiotics. All four cases showed improvement. No cases of late-onset endophthalmitis were documented, and no signs of anterior chamber toxicity were seen.

by using 3-5% betadine for the elimination of the conjunctival flora, the most common source of organisms responsible for endophthalmitis, in addition to sterilization of the operative theatre environment and the instruments used, and putting an Opsite drape to exclude the lid margin from the operative field is an essential step [4-6].

Since the ESCRS study in 2007 showed that intracameral cefuroxime decreases the incidence of endophthalmitis by 5-fold, the use of intracameral antibiotics became an increasingly adopted protocol for prophylaxis against postoperative endophthalmitis [7]. The use of intracameral moxifloxacin 5mg/ml as an alternative has gained popularity as shown in multiple studies, due to easier preparation and wide spectrum than cefuroxime. The volume injected into the AC varies from 0.1 to 0.4 ml. The efficacy depends on the amount, and concentration of the drug as well as clearance time. Injecting the drug into the capsular bag allows slower washout, hence higher concentration, and longer bactericidal effect [8-11]. The most commonly used product in Egypt is VIGAMOX® 5 mg/ml eye drops solution, (Novartis) or Fortymox 5mg/ml eye drops solution (Orchidia). In our retrospective study, we evaluated the efficacy and safety of injecting moxifloxacin in the capsular bag at the end of the surgery, so the drug is injected below the capsulorhexis edge to be directed behind the intraocular lens. We collected data from 10919 eyes, the incidence of postoperative endophthalmitis was 0.036635%, to be compared to 0.03-0.3% incidence of endophthalmitis without the use of moxifloxacin intracameral and 0.01-0.05% with intracameral moxifloxacin, as shown in a literature review published in 2021 by Grzybowski et al [14]. Also, in 2019 a grand study was made, data was collected for 2 million eyes that underwent cataract extraction and has shown the incidence of postoperative endophthalmitis to be 0.02% after intracameral moxifloxacin injection in more than one million cataract extraction cases and in cases of phacoemulsification to be 0.01% in 293

232 eyes [15]. Our results also meet the study published in 2007 by O'Brien et al [8] in concern of efficacy of moxifloxacin as a prophylactic measure against endophthalmitis, and Espiritu et al [10] in 2007. Regarding the safety of moxifloxacin, published papers agree with our results of the safety on moxifloxacin on the corneal endothelium and the uveal tissue [10-11]. In our study, no cases of toxicity were documented that imply the safety of moxifloxacin on the corneal endothelium and uveal tissue, and the same results were elaborated by Lane et al [11] in 2008 they studied the safety of prophylactic intracameral moxifloxacin in cataract surgery and by Espiritu et al [10] as well where they found that intracameral injection of 0.2 ml of moxifloxacin 0.5% safe on the corneal and uveal tissue with no reported cases of toxicity in their studies. A case report has been published for moxifloxacin anterior segment toxicity which was explained by the faulty high-dose injection of moxifloxacin [16]. The rationale of injecting the drug in the lens capsule behind the intraocular lens can add more value than injecting the drugs in the anterior chamber. It prolongs the duration of maintenance of effective intraocular antimicrobial concentrations after cataract surgery, as the drug will not be washed out quickly as being in the anterior chamber. It will as well guard against late-onset endophthalmitis that takes place primarily in the lens capsule, in addition to keeping the drug with low concentration in contact with the endothelium. So we suggest that keeping the drug behind the lens acts as a slow delivery mechanism by releasing the drug slowly to the anterior chamber.

## 5. Conclusion

*Intracapsular moxifloxacin injection at the end of phacoemulsification is a safe effective measure in prophylaxis against early and late endophthalmitis.*

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