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Application of intracameral moxifloxacin to prevent endophthalmitis in cataract surgery

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前房内给予莫西沙星预防眼内炎在白内障手术中的应用

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摘要

目的:评价在白内障手术中采用前房内应用莫西沙星预防眼内炎的安全性和效果。

方法:选取 2012 年 1-6mo 在我院行白内障手术患者 65 例 65 眼。部分患者手术结束时前房给予莫西沙星,另外一部分作为对照组未使用莫西沙星。对患者术前和术后 logMAR 最佳矫正视力、眼内压、角膜水肿、前房形态进行检查。

结果:共 33 例患者(男 19,女 14)使用了莫西沙星,平均年龄 64.81±11.61(41~82)岁;32 例患者(男 15,女 17)没有使用,平均年龄 65.43±11.10(42-81)岁。患者的年龄(P=0.827)和性别(P=0.396)无统计学差异。术前两组的最佳矫正视力均接近 20/130。术后,莫西沙星组和对照组的最佳矫正视力分别为 20/25 和 20/23(P=0.160)。术前莫西沙星组眼内压为 14.93±2.77(11-21)mmHg,对照组为 15.06±2.42(12-21)mmHg(P=0.850)。术后,两组眼内压均无统计学差异[莫西沙星组:14.06±2.31(10-19)mmHg;对照组:14.03±2.36(10-19)mmHg(P=0.726)]。两组角膜水肿(P=0.623)与前房细胞发生率(P=0.726)均无统计学差异。

结论:白内障手术后给予莫西沙星预防眼内炎是安全而有效的。

关键词:超声乳化;眼内炎;预防;莫西沙星

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Abstract

• AIM: To evaluate the safety and efficacy of intracameral moxifloxacin in preventing endophthalmitis after cataract surgery.

• METHODS: Sixty-five eyes of 65 patients underwent cataract surgery between January and June 2012. Some patients received intracameral moxifloxacin at the end of surgery, while others did not (controls). Pre- and postperative logarithm of the minimum angle of resolution (logMAR) best corrected visual acuity (BCVA), intraocular pressure (IOP), corneal edema, and anterior chamber (AC) status were examined.

• RESULTS: Thirty-three patients (19 males, 14 females); average age, 64.81±11.61y (range: 41-82y) received moxifloxacin and 32 patients (15 males, 17 females); average age, 65.43±11.10y (range: 42-81y) did not. The differences in patient age (P=0.827) and sex (P=0.396) were insignificant. Preoperative BCVA was approximately 20/130 in both groups. After surgery, moxifloxacin and control patients had a BCVA of 20/25 and 20/23, respectively (P=0.160). Preoperative IOP was 14.93±2.77mmHg (range: 11-21mmHg) in moxifloxacin patients and 15.06±2.42mm Hg (range: 12-21mmHg) in controls (P=0.850). After surgery, IOP was not statistically different between two groups (moxifloxacin: 14.06±2.31 (range: 10-19mmHg), controls: 14.03±2.36mmHg (range: 10-19mmHg), P=0.960). Slight differences in corneal edema (P=0.623) and anterior chamber cell (P=0.726) incidences between two groups were not statistically significant.

• CONCLUSION: Intracameral moxifloxacin is safe and effective in preventing endophthalmitis after cataract surgery.

• KEYWORDS: phacoemulsification; endophthalmitis; prophylaxis; moxifloxacin
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INTRODUCTION

Endophthalmitis is a rare, but serious, complication of cataract surgery that can lead to severe visual loss[1,2]. The overall incidence of endophthalmitis after catract surgery is between 0.07% and 0.12%[3]. In order to prevent endophthalmitis, preoperative (topical antibiotic use, 10% povidone-iodine periocular and eyelid scrub, conjunctival 5% povidone-iodine application), perioperative (vancomycine, cefuroxime, and/or moxifloxacin intracameral injection), and postperative (topical antiobitic use) measures are taken[4,5].

Moxifloxacin is a fourth-generation fluoroquinolone that affects a broad spectrum of gram-positive and gram-negative bacteria, as well as atypical and anaerobic pathogens. The ophthalmic solution has a pH of 6.8 and an osmolality of 290mOsm/kg, both of which are comparable to aqueous humor. The ophthalmic preparation is self-preserving, so does not contain preservatives (*e.g.*, benzalkonium chloride) that may be toxic to the corneal endothelium and epithelium. Additionally, moxifloxacin is readily available in its commercial forms and is inexpensive. For those reasons, it is a good candidate for wide-spread intracameral use for preventing postoperative endophthalmitis[6-8]. Here, we evaluate the safety and efficacy of intracameral moxifloxacin use immediately following cataract surgery to prevent endophthalmitis.

SUBJECTS AND METHODS

This study protocol was approved by the local ethics committee. All study conduct adhered to the tenets of the Declaration of Helsinki.

Subjects A total of 65 eyes of 65 patients (34 males, 31 females) were retrospectively examined. All patients had undergone standard of care cataract surgery between January and June 2012. Intracameral moxifloxacin was used at the end of surgery in some patients (moxifloxacin group), but not in others (control group). Patients who had intraoperative complications were excluded from analyses. Patients with ocular or systemic diseases known to affect vision were also excluded.

Ocular Examinations and Procedures Preoperative and postoperative ocular examinations included measurement of uncorrected visual acuity, best corrected visual acuity (BCVA), and intraocular pressure (IOP). Slit-lamp biomicroscopy and fundus examination were also performed. In particular, anterior chamber status (*i.e.*, cell and flare) was noted. Follow-up time after cataract surgery was 1y and patients were examined 1d, 1wk, 1, 3, 6mo, and 1y following surgery. Pre- and postoperative (1st week) findings were compared.

All surgeries were performed by a single surgeon (Cetinkaya S). Before surgery, a 0.5% moxifloxacin eye drop was administered every 10min until 4 drops had been placed. Additionally, the eyelid and periocular area were scrubbed with a 10% povidone-iodine solution. Under subtenon anesthesia, a 2.8 mm clear corneal incision was made and the anterior chamber was filled with a dispersive viscoelastic ubstance. After creating a continuous curvilinear capsulorhexis, hydrodissection and hydrodelination were performed and a sideport entrance was made. The nucleus was removed using a "divide and conquer" technique (Sovereign® Compact Phacoemulsification System, AMO, Santa Ana, CA, USA). Cortex was aspirated with coaxial irrigation/aspiration. The capsular bag was filled with a cohesive viscoelastic substance and a foldable monofocal posterior chamber intraocular lens (IOL; Acriva, VSY, Turkey) was implanted into the capsular bag through an injector. The viscoelastic material was completely aspirated and globe entrances were closed using stromal hydration.

Patients in the moxifloxacin group received 250 μg moxifloxacin in 0.050 mL (undiluted 0.5% moxifloxacin) *via* injection into the anterior chamber. Control patients did not have any agent intracamerally injected for endophthalmitis prophylaxis. The moxifloxacin injection was prepared by withdrawing 0.10 mL from a new bottle of a commercially available topical solution (Vigamox 0.5%, Alcon Laboratories, Fort Worth, TX, USA) under sterile conditions. After surgery, all patients used topical 0.5% moxifloxacin four times a day and a topical steroid (prednisolone acetate 1%, Pred forte, Allergan) six times a day for 1wk. Use of the topical steroid was tapered over the next 3wk.

Statistical Analysis Data are presented as mean±standard deviation. Differences in categorical data and means of continuous parameters were tested for statistical significance using Chi-square tests and independent *t*-tests, respectively. All statistical analyses were performed using commercially available statistical software (SPSS version 22, SPSS, Inc., Chicago, IL, USA). Statistical significance was defined as $P<0.05$.

RESULTS

The mean age of all 65 subjects (34 males, 31 females) was 65.12±11.28y (range: 41-82y). The 33 subjects [19 males (58%), 14 females (42%)] in the moxifloxacin group had a mean age of 64.81±11.61y (range: 41-82y) and the 32 subjects [15 males (47%), 17 females (53%)] in the control group had a mean age of 65.43±11.10y (range:

Table 1 Preoperative and postoperative subject characteristics

Parameters	Moxifloxacin (n=33)	Control (n=32)	P
Age (a)	64.81±11.61 (range: 41-82)	65.43±11.10 (range: 42-81)	0.827
Sex			
M	19 (58%)	15 (47%)	0.396
F	14 (42%)	17 (53%)	
Preoperative logMAR BCVA	0.81±0.20 (range: 0.40-1.00)	0.82±0.15 (range: 0.40-1.00)	0.798
Postoperative logMAR BCVA	0.10±0.10 (range: 0.00-0.30)	0.07±0.08 (range: 0.00-0.30)	0.160
Preoperative IOP(mmHg)	14.93±2.77 (range: 11-21)	15.06±2.42 (range: 12-21)	0.850
Postoperative IOP(mmHg)	14.06±2.31 (range: 10-19)	14.03±2.36 (range: 10-19)	0.960
Corneal edema	2 (6%)	3 (9%)	0.623
Anterior chamber reaction	4 (12%)	3 (9%)	0.726

Data are presented as mean±standard deviation where applicable. logMAR: Logarithm of the minimum angle of resolution; BCVA: Best corrected visual acuity; IOP: Intraocular pressure.

42-81y). These slight differences in age (P=0.827) and sex (P=0.396) between study groups were not statistically significant. There was also no difference between groups in preoperative BCVA or IOP, which was approximately 20/130 (P=0.798) and 15 mm Hg (P=0.850) in both groups.

After cataract surgery, IOP averaged approximately 14 mm Hg in both groups (P=0.960). The moxifloxacin group had a BCVA of 0.10±0.10 (Snellen: 20/25, range: 0.00-0.30), which was slightly worse than in the control group [0.07±0.08 (20/23), range: 0.00-0.30, P=0.160], but this difference was not statistically significant. Corneal edema was observed in 2 (6%) subjects in the moxifloxacin group (2 mild cases) and in 3 (9%) subjects in the control group (2 mild cases, 1 moderate case). Anterior chamber cells (1+) were observed in 4 (12%) subjects in the moxifloxacin group and in 3 (9%) subjects in the control group. These slight differences in corneal edema (P=0.623) and anterior chamber cell (P=0.726) incidences were not statistically significant. Flare was not seen in any patient at any time point examined. These findings are summarized in Table 1.

DISCUSSION

Cefuroxime and vancomycine can be used intracamerally for prophylaxis of endophthalmitis. However, moxifloxacin has some advantages over these agents. Cefuroxime and vancomycine are packaged in vials and require dilution before injection into the anterior chamber. This dilution must be done properly otherwise toxic anterior segment syndrome (TASS) can occur[9-11]. However, moxifloxacin can be used in its undiluted form, eliminating the possibility of dilution errors. Additionally, moxifloxacin is effective on a broader spectrum of microorganisms than cefuroxime and vancomycine. Cefuroxime eliminates bacteria in a time-dependent manner, but moxifloxacin efficacy is dose-dependent. Even if a high concentration of moxifloxacin is used for a short period of time, pathogen eradication may still occur. Moxifloxacin has been shown to have an intracameral half-life of one hour and a minimum inhibitory concentration (MIC) of 32 μg/mL to kill 90% of highly resistant *Staphylococcus epidermidis* (methicillin-resistant) bacterium. Therefore, an initial 150 μg/mL dose of moxifloxacin is needed to attain the MIC 90[12-15].

Intracameral moxifloxacin has been previously shown to reduce the risk of postoperative endophthalmitis. Arshinoff and Bastianelli[16] reported only one case of endophthalmitis in 35000 patients who received intracameral moxifloxacin. Matsuura *et al*[14] examined 18 000 patients and reported that an intracameral moxifloxacine dose between 50 and 500 μg/mL decreases the risk of endophthalmitis by 3-fold. Additionally, severe complications, including TASS and corneal endothelial cell loss, were not observed. Shorstein *et al*[17] reported only one case of endophthalmitis out of 1890 eyes that received intracameral moxifloxacin immediately following surgery. Finally, Friling *et al*[18] reported a postoperative endophthalmitis rate of 0.029% (n=6897 cases) when intracameral moxifloxacin was administered. In our study also, we did not encounter any postoperative endophthalmitis cases.

Moxifloxacin has an acceptable retinal safety profile, as shown in animals administered 5 to 500 μg/mL intravitreal moxifloxacin[19]. Additionally, Ekinci Koktekir and Aslan[5] reported that the risk of anterior and posterior segment complications did not increase when 250 μg moxifloxacin in 0.050 mL was administered intracamerally after cataract surgery. Similar results were found by Espiritu *et al*[20] and Lane *et al*[8] The latter study included the following safety parameters: visual acuity, IOP, endothelial cell count, corneal pachymetry, corneal clarity, corneal edema, and anterior chamber status (*e.g.*, cells and flare)[8]. Our safety results are in agreement. We did not observe prominent corneal edema or anterior chamber reactions. Additionally, visual outcomes and IOP were similar in patients who received

intracameral moxifloxacin and those that did not. In conclusion, intracameral moxifloxacin for prophylaxis of endophthalmitis following cataract surgery is both safe and effective.

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