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Original Article

A cost minimization analysis of intracameral cefuroxime and moxifloxacin in cataract surgery

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Abstract

Aim: In this study, we aim to perform Cost Minimization Analysis of cefuroxime and moxifloxacin, which have proven to have a similar efficacy in the prophylaxis of endophthalmitis after cataract surgery.

Material and Methods: The records of 1097 patients who had undergone cataract surgery and intracameral antibiotic (cefuroxime, moxifloxacin) injection in 2018 were evaluated retrospectively. Patients undergoing cataract surgery were divided into two groups according to the type of antibiotic injected into the anterior chamber. Group 1 consisted of patients who received intracameral 1mg/0.1ml cefuroxime and Group 2 consisted of patients who received intracameral 500 µg /0.1ml moxifloxacin. In the postoperative period, patients in both groups received topical antibiotic drops containing 0.5% moxifloxacin and steroid drops containing 0.1% dexamethasone for 7 days.

Results: The Group 1 consisted of 213 (19.4%) patients, of which 97 (45.5%) were male and 116 (54.5%) were female, while Group 2 consisted of 884 (80.6) patients, of which 439 (49.7%) were male, and 445 (50.3%) were female (p=0.280). The groups were similar in terms of age and gender distribution of the patients. There was no significant difference in terms of the posterior capsule rupture development between the two groups (p=0.692).BCVA was statistically significant before and after surgery in both groups. None of the patients in both groups developed endophthalmitis. The cost of the drugs used in the first group was 3 times higher than the second group.

Conclusion: The antibiotics injected to the anterior chamber during cataract surgery have similar effectiveness, moxifloxacin injection to the anterior chamber was found to be more advantageous in terms of cost, compared to the use of disposable cefuroxime.

Keywords: Cataract surgery; intracameral antibiotic; cost.

INTRODUCTION

Cataract surgery is one of the frequently performed surgeries in the world and Turkey. According to 2008 data, approximately 15 million cataract surgeries are performed all over the world every year (1). Endophthalmitis and toxic anterior segment syndrome (TASS) are among the rare complications of cataract surgery (2). Although the rate of endophthalmitis development after cataract surgery is approximately 0.02-0.12%, it is the most intimidating complication for ophthalmologists (3,4). It was proven in the previous studies that antibiotic administration to the anterior chamber in the prophylaxis of endophthalmitis after a cataract surgery significantly reduces endophthalmitis and TASS formation (5-8). Intracameral injection of antibiotics such as cefuroxime, vancomycin and moxifloxacin can be used. Studies have shown that intracameral cefuroxime and moxifloxacin have similar efficacy in the prophylaxis of endophthalmitis after cataract surgery (5-8).

In this study, we aim to perform Cost Minimization Analysis of cefuroxime and moxifloxacin, which have proven to have a similar efficacy in the prophylaxis of endophthalmitis after cataract surgery.

MATERIAL and METHODS

In the study, the records of 1097 patients who had undergone cataract surgery and intracameral antibiotic (cefuroxime, moxifloxacin) injection in Sakarya Yenikent

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State Hospital, Ophthalmology Clinic in 2018 were evaluated retrospectively. Approval of the Sakarya University Faculty of Medicine, Ethics Committee was obtained for the study within the framework of the ethical principles stated in the Declaration of Helsinki. (IRBN:71522473/050.01.04/142) Patients with a history of uveitis, corneal endothelial disease and pseudoexfoliation, patients who take prostaglandin analogue medication, and patients with a surgical history were not included in the study. In addition, patients who underwent extracapsular cataract surgery and who were sutured on the wound site for various reasons were also excluded from the study.

Data such as age, gender, demographic characteristics of the patients, and the type of antibiotic administered during cataract surgery, perioperative and postoperative surgical complications were screened from the patient records retrospectively. Preoperative and postoperative 1st day, 1st week and 1st month controls of the patients were performed. In the follow-ups, best corrected visual acuity (BCVA) and biomicroscopic examinations, and cell density in the anterior chamber examination and fundus examination with a +90D lens were performed.

The cell density in the anterior chamber was graded according to the following values. Degree 0/trace amount: 0-4 cells, degree +1:5-10 cells, degree +2:11-20 cells, degree +3:21-50 cells, degree +4:51 or more cells (9).

Patients undergoing cataract surgery were divided into two groups according to the type of antibiotic injected into the anterior chamber. The Alcon Infiniti System (Alcon, Fort Worth, TX) was used in all cases, and surgeries were performed by the different surgeons. Group 1 consisted of patients who received intracameral 1mg/0.1ml cefuroxime (Aprokam, Thea, France), and Group 2 consisted of patients who received intracameral 500 µg /0.1ml moxifloxacin (Vigamox, Alcon, USA). In the postoperative period, patients in both groups received topical antibiotic drops containing 0.5% moxifloxacin and steroid drops containing 0.1% dexamethasone for 7 days.

After cataract surgery, intracameral cefuroxime was administered to each patient (one box for each patient). After opening its sterile package, cefuroxime was filled in a 5 ml sterile injection syringe, then a little more than 0.1ml of cefuroxime was filled into tuberculin injector, a sterile 23G cannula was inserted on the tip, then excess drug, and air was removed to prepare a 1 mg/ml drug. At the end of the surgery, it was injected into the anterior chamber from the side-port.

Moxifloxacin was used as one box for each patient. After opening its sterile package, a little more than 0.1 ml of Moxifloxacin was filled into tuberculin injector, and a sterile 23G cannula was inserted on the tip, then excess drug and air was removed to prepare a 500 µg/0.1ml drug. At the end of the surgery, it was injected into the anterior chamber from the side-port. Then, the same vial was given to the patient for postoperative topical use.

Vials containing moxifloxacin and cefuroxime were obtained from the hospital pharmacy. The prices of Aprokam and Vigamox were calculated based on drug prices in January 2019 and the costs per patient were calculated according to this [Vigamox, 7 Turkish Liras (TL), Aprokam, 14 TL].

Statistical Analysis

SPSS (version 18.0, SPSS Inc, Chicago, IL, USA) program was used for statistical analysis. Numerical data were expressed as mean ± standard deviation (SD). Descriptive analysis was performed on numerical data of patients and Kolmogorov-Smirnov test was used for analysis of the normal distribution. The parametric Student t test was used to compare the independent variables with the normal distribution, and the non-parametric Mann-Whitney U analysis was used for the analysis of those who did not show normal distribution. A statistical significance level of $p<0.05$ was used.

RESULTS

In the study, 1097 eyes of 1097 patients were evaluated. The Group 1 consisted of 213 (19.4%) patients, of which 97 (45.5%) were male and 116 (54.5%) were female, while Group 2 consisted of 884 (80.6) patients, of which 439 (49.7%) were male, and 445 (50.3%) were female (p=0.280). The mean age of the patients in Group 1 was 70.93±10.22 years, and the mean age of the patients in Group 2 was 68.36±9.28 years (p=0.08). The groups were similar in terms of age and gender distribution of the patients. When perioperative complications were evaluated, posterior capsule rupture (PCR) was observed in 5 (2.3%) of the patients in Group 1 and 17 (1.9%) of the patients in Group 2. There was no significant difference in terms of the PCR development between the two groups (p=0.692).

BCVA was 0.32±0.12, and 0.28±0.16 in Group 1 and 2 before cataract surgery, respectively. At the postoperative 1st month, BCVA was 0.72±0.24 in Group 1 and 0.78±0.14 in Group 2. BCVA was statistically significant before and after surgery in both groups.

The anterior chamber cell count on the 1st day after cataract surgery was 1.86±0.52 in Group 1 and 1.97±0.58 in Group 2 (p=0.512). On the 1st week follow-up, the anterior chamber cell count was 0.86±0.34 in Group 1 and 0.94±0.42 in Group 2 (p=0.492). Statistical evaluation could not be performed on the 1st month control examination since the anterior chamber cell count was 0. None of the patients in both groups developed endophthalmitis.

According to the antibiotic price analysis per patient, the cost per patient in Group 1 was 21 TL (Aprokam, 14 TL+ Vigamox 7 TL) and 7 TL in Group 2 (Vigamox 7 TL). The cost of the drugs used in the first group was 3 times higher than the second group.

DISCUSSION

The cost of moxifloxacin usage per patient was found to be lower in our study, in which we performed a cost analysis of intracameral cefuroxime and moxifloxacin in the prophylaxis of endophthalmitis after cataract surgery.

Although the effectiveness of the antibiotic is the most important factor in determining the antibiotic for prophylaxis of endophthalmitis, the ease of administration, reliability, cost, medical legal problems of using the antibiotics should not be ignored.

In a retrospective study that reviews 16,264 cataract surgeries in the US, it has been reported that intracameral antibiotic use (cefuroxime/moxifloxacin/vancomycin) reduced the rate of endophthalmitis to 0.14 per 1000 patients over a 5-year period (10). The American Society of Cataract and Refractive Surgery (ASCRS) reported in 2014 that the distribution of intracameral antibiotic use was 33% moxifloxacin, 37% vancomycin and 26% cefuroxime (11).

Cefuroxime, which is the most commonly used agent in the prophylaxis of endophthalmitis, is effective in the majority of gram-positive cocci, which is common especially in the flora of conjunctiva and eyelashes, in part of anaerobic bacteria, and in gram-negative bacteria, especially in Escherichia coli, Proteus and Klebsiella genus. In a multicenter study of the European Society of Cataract and Refractive Surgery (ESCRS), 4.92 times less endophthalmitis has been reported in patients who underwent intracameral cefuroxime injection (11).

Moxifloxacin, another agent used in the prophylaxis of endophthalmitis, is a fourth generation fluoroquinolone, which is the most effective fluoroquinolone against gram (+) bacteria and has an effect against gram (-) bacteria, equivalent to other fluoroquinolones. Eye drop form of moxifloxacin (Vigamox, Alcon, USA) had FDA approval for the treatment of bacterial conjunctivitis. Although intracameral use of moxifloxacin in the prophylaxis of endophthalmitis is out of its indication, many surgeons worldwide prefer it. Haripyria et al., in their retrospective study investigating 600.000 patients, reported that endophthalmitis was four times less in patients who received intracameral moxifloxacin injection (7).

Moxifloxacin has some advantages over cefuroxime in intracameral administration for the prophylaxis of endophthalmitis. Moxifloxacin has a broader antibacterial activity and is more effective against the main pathogens that cause postoperative endophthalmitis. The effect of cefuroxime is time dependent and when it is given as a single dose bolus, its activity takes time and it can be diluted in the anterior chamber during this time. This may cause is to show less activity. Moxifloxacin, however, has a dose-dependent effect and shows more rapid bactericidal effect when administered intracamerally (13).

In the ASCRS report, it has been noted that surgeons who did not prefer intracameral antibiotic use had reservations about the development of toxic anterior segment syndrome, and that unapproved antibiotics or the antibiotics prepared in operating room conditions were intimidating for these surgeons. In this respect, the use of disposable cefuroxime, which has been launched in 2012, is more advantageous compared to moxifloxacin for intracameral use. In spite of this, it has also been reported that 47% of the surgeons used antibiotics such as unapproved moxifloxacin of cefuroxime prepared in the operating conditions in the absence of commercially approved products (11).

A meta-analysis on the efficacy cost analysis of intracameral cefuroxime and moxifloxacin examined different prophylaxis regimens and reported that intracameral cefuroxime had the best cost-effectiveness ratio (8). However; most of the publications evaluated in this meta-analysis have reported methodological restrictions. The direct cost comparison was difficult because of the publications in different countries, there were a small number of publications related to moxifloxacin, and authors had to make assumptions in some publications (8).

In their study on the cost of antibiotics for prophylaxis of endophthalmitis, Sharifi et al. evaluated the topical/subconjunctival/intracameral use of different antibiotics compared to intracameral cefuroxime (14). Intracranial cefuroxime had a cost-effectiveness of $1403 per patient for each endophthalmitis prevented. In addition, intracameral moxifloxacin had to be 4.87 times more effective to achieve the cost effectiveness provided by intracameral cefuroxime (14). The intracameral cefuroxime used in their study has been prepared in operating room conditions and one box has been used for four patients. In our study, however, disposable cefuroxime preperate was used. Therefore, the results were not similar.

CONCLUSION

In conclusion, although the antibiotics injected to the anterior chamber during cataract surgery have similar effectiveness, moxifloxacin injection to the anterior chamber was found to be more advantageous in terms of cost, compared to the use of disposable cefuroxime.

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