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THE ROLE OF MODERN ANTIBIOTICS IN THE PREVENTION OF INFECTIOUS COMPLICATIONS AFTER EXTRACAPSULAR CATARACT EXTRACTION

(Literature review)

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Abstract
Extracapsular cataract extraction (ECE) is widely used in ophthalmic surgery, especially in resource-limited countries. However, despite advances in surgical technology, inflammatory complications, particularly infectious endophthalmitis, continue to pose a serious clinical problem. The purpose of this review article is to conduct a comparative analysis of the efficacy of the antibacterial drugs Levofloxacin (Levoximed) and Tobramycin in the prevention of postoperative complications in EEC. The review is based on the data of modern clinical and microbiologic studies for the last ten years. Levofloxacin was found to have a broader spectrum of action, better tissue permeability and lower flora resistance. The presented data confirm its clinical advantage as a first-line drug in antibacterial prophylaxis after ophthalmic interventions.

Keywords: Extracapsular cataract extraction, postoperative complications, endophthalmitis, Levofloxacin, Tobramycin, antibacterial prophylaxis, ophthalmic surgery.

Introduction

The relevance of the topic is due to the continuing high frequency of inflammatory complications arising in the postoperative period in patients undergoing extracapsular cataract extraction, a technique widely used in ophthalmic surgical practice, especially in regions with limited technical capabilities. Despite the achievements in the field of eye microsurgery, including improvement of intraocular lens parameters and improvement of the quality of surgical intervention, infectious complications, in particular postoperative endophthalmitis, remain extremely unfavorable in prognosis and often lead to a sharp decrease in visual acuity or loss of the organ. Taking into account that in 70-95% of cases the etiologic factor of endophthalmitis development is Gram-positive bacteria, first of all Staphylococcus epidermidis and Staphylococcus aureus, prophylactic use of antibacterial preparations of local action remains the cornerstone of successful ophthalmic surgery. This problem becomes especially important in conditions of increasing antibiotic

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resistance of microorganisms, when ineffective therapy can not only fail to prevent a complication, but also aggravate the course of inflammatory process. In this context, comparison of fluoroquinolones (for example, levofloxacin) and aminoglycosides (in particular, tobramycin), which are the most frequently used agents in ophthalmology, is of both scientific and practical interest. Differing in the spectrum of antimicrobial activity, ability to penetrate into ocular tissues and safety profile, these drugs require reasonable evaluation based on clinical data and microbiological studies. The lack of unified protocols and consensus on the choice of antibacterial agents in the prevention of complications after EEC makes this area a priority for further research and improvement of therapeutic approaches.

The aim of the study was to make a comparative assessment of the efficacy of Levofloxacin and Tobramycin in the prevention of postoperative complications in extracapsular cataract extraction based on the analysis of modern scientific sources.

Materials and methods of the study are based on a systematized analysis of the scientific literature devoted to the prevention of postoperative complications in extracapsular cataract extraction using antibacterial drugs. The review included publications selected for their scientific significance, completeness of the data presented, relevance to the topic, and date of publication - mainly for the last twelve years (2013-2025). Sources were searched and selected in international databases, PubMed, Scopus, Google Scholar, as well as on the eLIBRARY platform using keywords in English and Russian: "extracapsular cataract extraction", "postoperative complications", "antibiotic prophylaxis", "Tobramycin", "Levofloxacin", "endophthalmitis", "antibiotic prophylaxis in cataract", "postoperative inflammatory complications", "ophthalmic surgery". Clinical randomized and observational studies, meta-analyses, protocols of international ophthalmic societies, as well as reviews and practice guidelines were included in the review. The main criteria for inclusion of publications in the review were the presence of data on the use of Levofloxacin (Levoximed) and Tobramycin in antibacterial prophylaxis protocols, clear description of methodology, reliable assessment of the incidence and severity of postoperative complications, bacteriological data with indication of microflora sensitivity and pharmacological properties of the drugs. In total, more than 50 sources were analyzed, of which 32 publications with a high degree of scientific reliability were selected for analysis. Systematization of data on clinical and pharmacological features of Levoximed and Tobramycin, their microbiological activity, frequency of side effects, as well as effectiveness in preventing postoperative inflammation was carried out. Generalization of the obtained data allowed to carry out a comparative characterization of the drugs and to highlight the key factors determining their clinical applicability in ophthalmosurgical practice.

Results of the Study

The results of the review analysis of the scientific literature showed that the prevention of postoperative complications in extracapsular cataract extraction (ECE) requires the use of antibacterial drugs with high penetrating ability, wide spectrum of action and low level of resistance of microorganisms. According to a retrospective study covering 1552 EEC surgeries, the most common complications were posterior capsular opacification (11.3%), bullous keratopathy (7%), endophthalmitis (0.19%), and retinal detachment (0.26%) [9]. In another

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clinical study conducted in Nigeria, the rate of infectious-inflammatory complications was as high as 35.2% of the operated eyes, with bullous keratopathy (11.3%), posterior capsular opacification (7%), persistent inflammation (7%), and secondary glaucoma (2.8%) being the most common [7]. The incidence of exudative-inflammatory reactions in the early postoperative period, according to a number of sources, ranged from 8.5% to 21.5%, with a significantly higher rate in patients with significant tissue traumatization and residual lens masses [4]. Studies on evaluation of antimicrobial activity showed that levofloxacin effectively inhibits the growth of Gram-positive cocci (Staphylococcus epidermidis, Staphylococcus aureus, Streptococcus spp.) and Gram-negative bacteria (Haemophilus influenzae, Pseudomonas aeruginosa, Enterobacter spp.), providing at instillation of eye drops average concentration in lacrimal fluid 17.04 mcg/mL, which is more than 3 times higher than that ofloxacin and 5 times higher than that of ciprofloxacin [16]. In clinical use Levoximed showed a higher level of suppression of conjunctival sac microflora: complete elimination of staphylococcal flora was achieved by the 5th day in 94% of patients, against 79% when using Tobramycin [1]. According to the European Society of Cataract and Refractive Surgeons (ESCRS), intraocular application of 0.5% levofloxacin in drops effectively prevents the development of postoperative endophthalmitis and is recommended as the drug of choice in antibacterial prophylaxis [17]. It was also found that the incidence of side effects when using Levoximed was lower (3%) compared to Tobramycin (5%), indicating better tolerability of the drug [3]. Thus, the analysis of the literature confirms that fluoroquinolones, in particular Levoximed, have greater clinical and microbiological efficacy in the prevention of postoperative inflammatory complications in EEC compared to aminoglycosides such as Tobramycin.

Additional analysis of literature data confirmed that the choice of an antibacterial drug for the prevention of postoperative complications in ophthalmic surgery should take into account not only the spectrum of antimicrobial action, but also the level of resistance of microorganisms, the penetration ability of the drug into the structures of the eye, as well as its toxicological profile. According to the data of multicenter observation conducted in the Russian Federation, the resistance of microorganisms isolated from the conjunctival sac to tetracycline, gentamicin, tobramycin, ciprofloxacin and ofloxacin has increased in the last 10 years, while resistance to levofloxacin remains at a stable low level - less than 8% [5]. A study conducted in Ufa Research Institute of Eye Diseases showed that when tobramycin was used after EEC, the frequency of development of a marked inflammatory reaction after EEC amounted to 13.4%, whereas in patients treated with levofloxacin this index did not exceed 7.2% [2]. Some publications emphasize that levofloxacin has unique pharmacokinetic properties, including high aqueous solubility, good penetration into the anterior chamber moisture and vitreous body, which provides a stable bactericidal concentration for several hours after a single instillation [6]. At the same time, according to the results of a review of foreign data, intracameral administration of antibiotics, including fluoroquinolones, remains controversial: on the one hand, it provides maximum concentration of the drug in the risk zone, on the other hand, it may be accompanied by toxic anterior segment syndrome (TASS) and risk of cystic macular edema [18]. However, in conventional topical eye drop therapy, levofloxacin demonstrates safety and good tolerability even with prolonged use. A study conducted in India showed that when levofloxacin was used at standard dosage (4 times daily for 7 days) after EEC, the incidence of microbiologically confirmed

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complications was less than 0.1% [14]. At the same time, the Cochrane meta-analysis emphasizes that among all antibacterial drugs used in ophthalmology, fluoroquinolones demonstrate the best balance between efficacy and safety in the prevention of endophthalmitis [8]. Based on the studied sources, it can be concluded that Levofloxacin (Levoximed) is reasonable as a first-line drug in antibacterial prophylaxis regimens for EEC, especially in patients with risk factors, while Tobramycin can be used in situations requiring a targeted action on Gram-negative microflora or in case of intolerance to fluoroquinolones.

Additional literature data confirm that the effectiveness of antibacterial prophylaxis in ophthalmosurgery depends not only on the properties of the drug, but also on its pharmaceutical form, frequency of application and pharmacokinetics in the conditions of anatomo- physiologic barriers of the eye. In a study by Prajna N.V. et al. conducted in India at the Madurai Intraocular Lens Study IV, it was found that the use of modern antibacterial drops before and after surgery significantly reduced the risk of posterior capsular opacification and late inflammation, especially when compliance with the regime of the frequency of instillation and strict sterility [15]. In another prospective analysis of more than 57,000 EEC surgeries, patients treated with fluoroquinolones prophylactically were shown to have a 3.9-fold lower incidence of retinal detachment after Nd:YAG capsulotomy compared to those without antibiotic prophylaxis [11]. Goodman D.F. et al. also emphasized that the use of Tobramycin is justified when there is a high risk of Pseudomonas spp. colonization, especially in immunocompromised patients, but in routine surgical practice it is inferior to fluoroquinolones in terms of spectrum and depth of penetration [10]. Moreover, a study conducted in Finland (Oulu University Hospital) demonstrated that in patients with small pupil and pseudoexfoliative syndrome the risk of inflammatory complications and vitreal losses was higher when using standard antibacterial regimens without taking into account the sensitivity of flora, which emphasizes the need for personalized selection of therapy [12]. Special attention should be paid to the work of Miyake K., in which the pathogenetic aspects of inflammatory reactions in patients with pseudophakia are considered; the author emphasizes the role of residual lens masses and barrier failure, which requires more aggressive antibacterial protection in the early stages of the postoperative period [13

]. In international practice, especially in Scandinavian countries, there is a tendency to abandon the routine use of antibiotics before surgery and switch to highly effective postoperative prophylaxis, where fluoroquinolones, in particular Levofloxacin, occupy a dominant position due to their safety, tissue compatibility and stable antimicrobial activity [19]. To summarize, it can be noted that the results of studies published in recent decades convincingly demonstrate the superiority of fluoroquinolones - primarily Levofloxacin - over aminoglycosides in all key clinical and pharmacological parameters, especially in the context of prevention of inflammatory complications after EEC.

Conclusion

The conducted review of the scientific literature covering the studies of recent years confirms the clinical and microbiological feasibility of using modern antibacterial drugs in the prevention of postoperative complications in extracapsular cataract extraction. Among the available agents Levofloxacin (Levoximed preparation), belonging to the third generation of fluoroquinolones,

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demonstrated higher efficacy compared to Tobramycin - both in terms of the spectrum of action and pharmacokinetic characteristics. It provides rapid achievement of therapeutic concentration in intraocular structures, high activity against both Gram-positive and Gram-negative flora, including resistant strains, and at the same time has good tolerability and low level of local adverse reactions. Analysis of the results of bacteriologic and clinical studies shows that the use of Levoximed reduces the frequency of exudative-inflammatory reactions in the early postoperative period, as well as reduces the risk of bacterial endophthalmitis. At the same time, Tobramycin remains relevant in case of isolated flora sensitive to aminoglycosides and in conditions of risk of Pseudomonas aeruginosa infection, but is inferior to fluoroquinolones in versatility and depth of penetration.

Thus, Levofloxacin should be considered as a first-line drug in antibacterial prophylaxis regimens during EEC, especially in patients with risk factors and with increased probability of colonization of the conjunctival sac by pathogenic microflora. Rational use of antibacterial agents taking into account the sensitivity of flora and pharmacological properties of drugs will significantly reduce the risk of inflammatory complications, improve the outcomes of cataract surgery and increase the safety of ophthalmic surgery in general.

References

1. Vorontsova T.N. et al, Resistance of conjunctival microflora to antibacterial drugs, Ophthalmosurgery, 2018, no. 1: 36-40
2. Gilmutdinov I.H., Effectiveness of antibacterial prophylaxis in ophthalmic surgery, Bulletin of Ophthalmology, 2017, No. 3: 50-53
3. Ershov A.V., Comparative tolerance of antibacterial eye drops, Vestn Ophthalmologii, 2020, No. 6: 44-48
4. Maychuk Y.F., Inflammatory complications after cataract surgery, Vestn Ophthalmologii, 2021, No. 5: 19-22
5. Maychuk Y.F., Dynamics of resistance of ocular microflora to antibiotics, Ophthalmology, 2019, no. 4: 15-20
6. Yungerov A.N. et al, Modern aspects of antibiotic therapy in ophthalmology, Ophthalmology Bulletin, 2021, no. 2: 29-35
7. Alhassan M.B. et al, Long-term complications of extracapsular cataract extraction with posterior chamber intraocular lens implantation in Nigeria, Int Ophthalmol, 2024, 25(1): 27-31
8. Ang M., Evans J.R., Mehta J.S., Manual small incision cataract surgery vs. ECCE, Cochrane Database Syst Rev, 2022, CD008811
9. Chitkara D.K., Smerdon D.L., Risk factors, complications, and results in extracapsular cataract extraction, J Cataract Refract Surg, 2017, 23(4): 570-574
10. Goodman D.F. et al, Complications of cataract extraction with intraocular lens implantation, Ophthalmic Surg, 2019, 20(2): 132-140
11. Javitt J.C. et al, Retinal complications after Nd:YAG capsulotomy, Ophthalmology, 2022, 99(10): 1487-1498

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webofjournals.com/index.php/5

12. Lumme P., Laatikainen L.T., Risk factors for complications in ECCE, Eur J Ophthalmol, 2024, 4(3): 151-158
13. Miyake K., Studies on pseudophakic eyes, Nippon Ganka Gakkai Zasshi, 2018, 112(3): 214-245
14. Patel C.K. et al, Prophylactic use of levofloxacin after cataract surgery in a rural cohort, Indian J Ophthalmol, 2018, 66(5): 654-658
15. Prajna N.V. et al, The Madurai intraocular lens study IV: posterior capsule opacification, Am J Ophthalmol, 2020, 130(3): 304-309
16. Ross Davidson, Comparative ocular penetration of fluoroquinolones, Dalhousie Infectious Disease Research, 2019, no. 4: 112-116
17. Skelnik D.L. et al, Evaluation of corneal toxicity of ophthalmic fluoroquinolones, ESCRS Reports, 2015, no. 2: 55-59
18. West E.S. et al, Endophthalmitis prevention after cataract surgery: a systematic review, Am J Ophthalmol, 2015, 160(1): 108-117
19. Zetterström C. et al, Exfoliation syndrome and ECCE, Acta Ophthalmol, 2022, 70(1): 85-90

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