

INTRACAMERAL ANTIBIOTICS IN HIGH-VOLUME CATARACT SURGERY



How this pharmaceutical approach can streamline operations and mitigate risks.

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Intracameral (IC) antibiotics have become essential in cataract surgery, particularly for the prevention of postoperative endophthalmitis (Figure), a rare but sight-threatening complication. This article explores the evolution of IC antibiotic use, its current application in practice, data on its effectiveness, its operational impact in high-volume settings, and potential future developments.

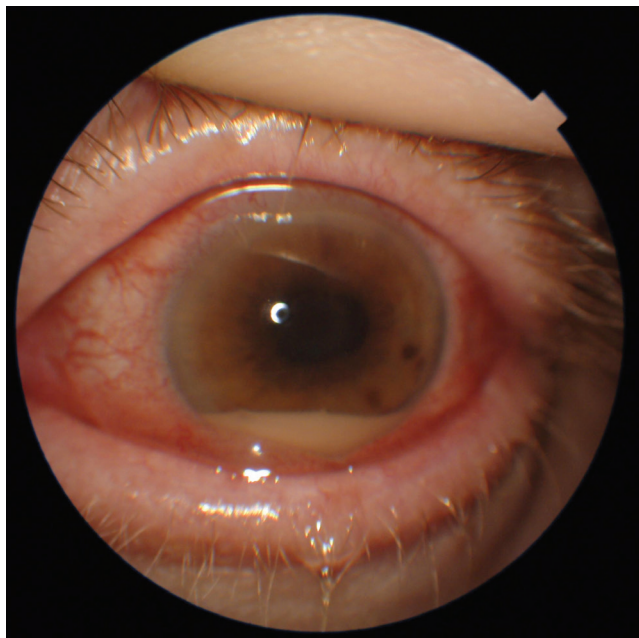


Figure. An eye with endophthalmitis.

EVOLUTION AND ADOPTION OF IC ANTIBIOTICS

Previously, systemic antibiotics were the primary method for preventing postoperative infection. Studies, however, have shown that administering antibiotics directly into the anterior chamber at the end of cataract surgery more effectively reduces the incidence of postoperative endophthalmitis.

Cefuroxime was one of the first IC antibiotics to be widely used. Its popularity grew following a 2007 ESCRS trial that demonstrated a fivefold reduction in endophthalmitis rates with IC cefuroxime.^{1,2} Since then, antibiotics such as moxifloxacin and vancomycin have been introduced. IC antibiotics are now used routinely in many parts of the world, but the choice of agent varies based on factors such as availability, cost, and local microbial flora. Moxifloxacin is used predominantly in India, whereas vancomycin is more common in Australia and the United States.³

Despite the widespread adoption of IC antibiotics, controversy persists regarding their necessity, particularly given modern aseptic surgical techniques and the overall low incidence of endophthalmitis.³⁻¹⁰

EFFICACY OF IC ANTIBIOTICS

Key Clinical Trials and Findings

Numerous studies have documented the efficacy of IC antibiotics in preventing postoperative complications such as endophthalmitis (Table). In addition to the aforementioned landmark ESCRS trial,^{1,2} a noncontrolled retrospective observational study conducted by Montan

TABLE. INCIDENCE OF INFECTIOUS POSTOPERATIVE ENDOPHTHALMITIS AFTER CATARACT SURGERY ACROSS MULTIPLE EUROPEAN STUDIES

Reference	Country	Publication Year	Period	Total n	IPOE n	IPOE rate	IPOE Rate With IC Antibiotics	IPOE Rate Without IC Antibiotics
Romero ¹¹	Spain	2006	2001-2004	7,268	25	0.344%	0.055% (cefazolin)	0.63%
ESCRS ¹² (9 EU countries)	Multiple	2007	2003-2005	15,971	20	0.12%	0.05% (cefuroxime)	0.35%
Yu-Wai-Man ¹³	UK	2008	2000-2006	36,743	35	0.095%	0.046% (cefuroxime)	0.139%
Garat ¹⁴	Spain	2009	2002-2007	18,579	31	0.167%	0.047% (cefazolin)	0.422%
Garcia-Saenz ¹⁵	Spain	2010	1999-2008	13,652	42	0.30%	0.590% (cefuroxime)	0.043%
Barreau ¹⁶	France	2012	2003-2008	5,115	36	0.704%	0.044% (cefuroxime)	1.238%
Friling ¹⁷	Sweden	2013	2005-2010	464,996	135	0.029%	0.027% (various)	0.39%
Rodriguez-Caravaca ¹⁸	Spain	2013	1998-2012	19,463	44	0.23%	0.039% (cefuroxime)	0.59%
Beselga ¹⁹	Portugal	2014	2005-2011	15,689	6	0.038%	0.00% (cefuroxime)	0.26%
Rahman and Murphy ²⁰	Ireland	2015	2007-2011	8,239	5	0.061%	0.061% (cefuroxime)	
Lundstrom ²¹	Sweden	2015	2001-2010	692,786	244	0.035%	0.03% (various, 99% cefuroxime)	0.43%
Creuzot-Garcher ²²	France	2016	2005-2014	6,371,242	6,668	0.105%	0.046%-0.111% (cefuroxime)	0.080%-0.46%
Daien ²³	France	2016	2010-2014	2,434,008	1,941	0.08%	0.06% (cefuroxime)	0.09%

Abbreviations: EU, European Union; IC, intracameral; IPOE, infectious postoperative endophthalmitis.

et al in Sweden showed that the endophthalmitis rate dropped from 0.26% to 0.065% with the use of IC cefuroxime.²⁴

Other retrospective studies and meta-analyses have reinforced these findings. IC antibiotics have significantly lowered infection rates across various settings and populations.³⁻¹⁰ In the United Kingdom, Spain, France, and South Africa, endophthalmitis rates have been consistently lower in cohorts treated with IC antibiotics compared to those not receiving these drugs.³⁻¹⁰

Risks Associated With IC Antibiotics

Adverse events after the IC administration of antibiotics are rare. They include toxic anterior segment syndrome—particularly with improper dosing or compounding errors—and hemorrhagic occlusive retinal vasculitis (HORV) after vancomycin use.^{25,26}

DRUG CHOICE

Again, the choice of prophylactic IC antibiotic varies globally, but the agents most commonly used are cefuroxime, moxifloxacin, and vancomycin.

Cefuroxime

The ESCRS Study provided substantial evidence supporting the use of IC cefuroxime.^{1,2}

Moxifloxacin

Moxifloxacin is a fourth-generation fluoroquinolone that exhibits potent, concentration-dependent activity against gram-positive and gram-negative bacteria as well as atypical organisms. Increasing fluoroquinolone resistance among coagulase-negative staphylococci, however, is a concern.

One randomized controlled trial analyzed the use of moxifloxacin, but the study involved a small number of surgeries.²⁷ Several retrospective

studies have reported a low relative risk of endophthalmitis in patients treated with IC moxifloxacin compared to those who did not receive IC antibiotic prophylaxis. Large retrospective studies have shown a benefit in patients receiving IC moxifloxacin regardless of the type of cataract surgery performed. IC moxifloxacin is typically administered without dilution or at a dose of 500 mg. In India, moxifloxacin hydrochloride is widely used for IC antibiotic prophylaxis.^{3,10}

Vancomycin

IC vancomycin has been widely used by cataract surgeons worldwide. Large retrospective studies have reported a significant reduction in the incidence of endophthalmitis with IC vancomycin. In 2014, however, severe cases of bilateral ischemic retinal vasculitis following IC vancomycin were documented, and cases of HORV

associated with IC vancomycin have since been reported.²⁵

HORV is characterized by painless vision loss and specific ophthalmic findings after an otherwise uneventful postoperative period.²⁶ The HORV Task Force has documented cases of HORV following IC vancomycin and highlighted the challenges of diagnosing and managing these cases.

OPERATIONAL CHALLENGES AND BENEFITS IN HIGH-VOLUME SETTINGS

In high-volume surgical centers, the use of IC antibiotics presents both operational challenges and benefits.

The preparation and administration of these antibiotics must be meticulously managed to ensure patient safety and adherence to protocols. For example, preparing IC antibiotics such as cefuroxime requires strict aseptic conditions and adherence to compounding guidelines to prevent contamination and dosage errors. Dedicated pharmacy support and rigorous training for surgical staff are necessary. The need for single-use syringes and the potential for antibiotic shortages can strain resources.

The use of IC antibiotics can have a positive impact on patient throughput. The agents' effectiveness in preventing infection reduces the need for additional postoperative care and readmissions due to endophthalmitis. The drugs' efficiency not only enhances patient outcomes but can also improve overall workflow and the capacity of high-volume surgical centers.

Incorporating IC antibiotics into standard practice helps mitigate the risk of postoperative infection, which can have severe consequences for patients and legal implications for health care providers. The potential for adverse reactions, however, necessitates careful patient selection and monitoring.

POTENTIAL DEVELOPMENTS IN THE USE OF IC ANTIBIOTICS

New antibiotics are being developed that offer a broader spectrum of

activity and have lower resistance potential. Additionally, advances in drug delivery systems, including sustained-release formulations, may enhance both the efficacy and safety of IC antibiotics.

Ongoing research into the genetic and microbial factors associated with endophthalmitis may pave the way for more personalized prophylactic strategies. For example, optimizing antibiotic selection based on a patient's specific microbial flora and resistance profiles could improve clinical outcomes.

Another potential advance is the integration of IC antibiotics with other prophylactic measures, such as enhanced perioperative antiseptic protocols and advanced surgical techniques. A holistic approach combining these strategies could further reduce infection rates and enhance patient safety.

Greater collaboration and consensus-building among international ophthalmology societies could help standardize IC antibiotic practices globally. Such efforts could ensure that patients worldwide benefit from the latest evidence-based strategies for the prevention of endophthalmitis.

ADVANCING IC ANTIBIOTICS IN CATARACT SURGERY

The introduction of IC antibiotics has reduced the incidence of endophthalmitis after cataract surgery. Although controversies and challenges persist, the evidence strongly supports the efficacy of IC antibiotics in preventing postoperative infection. Ongoing research and innovation are expected to yield even more effective and safer prophylactic strategies, further enhancing patient outcomes and operational efficiency, particularly in high-volume surgical settings. ■

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