

# TOPICS IN Ocular Antiinfectives

## Treating Bacterial Conjunctivitis in the Age of Resistance

Nisha Acharya, MD, MS

*The rise of resistance to our most potent antibiotics is a serious concern for all of society, not just medicine. With respect to ophthalmology, however, it is not entirely clear how the growth of resistance will affect practice.*

The advent of topical fluoroquinolones was a watershed event in ophthalmology. Before topical fluoroquinolones, we had no broad spectrum antibiotics, and corneal ulcers were typically treated in tertiary care centers. Treatment often required multiple fortified antibiotics to ensure adequate coverage and potency, and the antibiotics used frequently had to be compounded (and were therefore often nonpreserved). Patients with bacterial keratitis were often treated in a hospital setting, which allowed for safe, efficient, and frequent dosing of nonpreserved drugs (Figure 1).

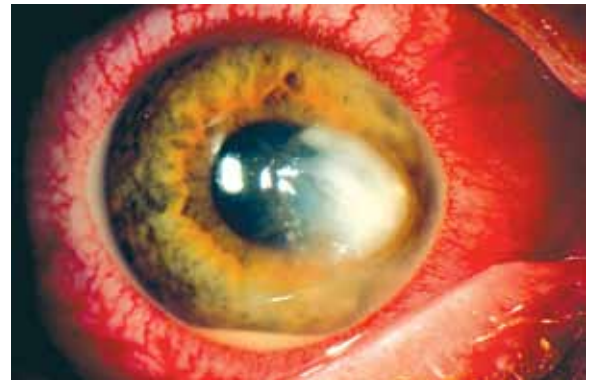
Before fluoroquinolones, corneal ulcers were commonly cultured because

there was no ophthalmic antibiotic that was effective against both Gram positive and Gram negative organisms. If the organism was unknown, the choice was culture or treat with at least two drugs.

The topical fluoroquinolones changed everything. These potent, broad spectrum antibiotics could be picked up at the corner drugstore. They were covered by insurance, preserved against contamination, and did not require refrigeration, so patients could treat themselves at home. And the new fluoroquinolones were active against the great majority of common ocular pathogens.

### Resistance

Recent surveillance studies show that a significant fraction of ocular isolates are becoming resistant to one or more of commonly used antibiotics.<sup>1,2</sup>



**FIGURE 1** Bacterial keratitis. Even in an age of rising resistance, topical fluoroquinolones will remain a mainstay of empirical treatment.

Methicillin resistant *Staphylococcus aureus* (MRSA) in particular is a major concern, in part because reports in the systemic literature tell of MRSA infections with poor outcomes. While there is evidence that both MRSA and other resistant organisms are being cultured from a growing proportion of ocular isolates, it is by no means equally clear whether this has affected clinical outcomes.

**TARGET AUDIENCE** This educational activity is intended for ophthalmologists and ophthalmologists in residency or fellowship training.

### LEARNING OBJECTIVES

Upon completion of this activity participants will be able to:

1. Make evidence-based clinical judgments about the use of vancomycin in the prophylaxis and treatment of confirmed or suspected resistant bacteria.
2. Use data from major surveillance studies to plan appropriate strategies for surgical prophylaxis and empirical antibiotic selection.
3. Discuss the changes necessary to adapt clinical practice to changes in antibiotic resistance patterns among ocular isolates.

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“Resistance” is strictly a laboratory term—it is measured in vitro. Whether infection with “resistant” organisms translates directly to poorer clinical outcomes in ophthalmology is an open question. There is a bias toward reporting cases of infection with resistant organisms that turn out badly—those cases of infection with resistant organisms that respond readily to fluoroquinolones or other common antibiotics are of much lower interest and less likely to be reported.<sup>3</sup> Simply because a strain is “resistant” does not necessarily mean it will cause more serious disease or will not respond to antibiotic.<sup>4</sup> So, while all physicians have reason to be concerned about the rise of antibiotic resistance in the laboratory, in the end it is patient outcomes that matter.

## Topical Administration

In ophthalmology almost all drugs are administered either onto or into the eye, so we are able to deliver high—sometimes extremely high—antibiotic concentrations compared to the “reasonably achievable serum concentrations” that are used to determine in vitro resistance to systemic infectious agents. The result is that a drop administered hourly directly onto a bacterial ulcer may yield drug concentrations at the site of action far above the minimum inhibitory concentration (MIC), even if that specific organism’s MIC would technically classify the isolate as “resistant.” So without breakpoints to determine susceptibility/resistance to topically applied drug, the use of systemic breakpoints to determine the resistance status of an

ocular infection is problematic.

Furthermore, even in the case of systemic infection, the fact that an organism is “resistant” to a given drug does not necessarily mean that that drug will not cure the infection. Physicians who deal with systemic infectious disease have something called the “90/60 rule,” which has been repeatedly validated. It holds that infections due to susceptible organisms respond to therapy approximately 90% of the time, while infections due to resistant isolates respond about 60% of the time. So, in vitro susceptibility testing, while useful, is far from being a foolproof predictor of clinical outcome, even in the systemic world.

While the 90/60 rule and clinical experience both tell us that most patients get better whether the organism

## Topics in Ocular Antiinfectives, Issue 26

### STATEMENT OF NEED

Ophthalmologists face numerous challenges in optimizing their competencies and clinical practices in the realm of preventing, diagnosing, and treating ocular infections and their sequelae; these challenges include:

- The widespread “off-label” use of topical ophthalmic antibiotics to prevent and treat serious and sight-threatening infections—given the reality that the most widely used topical antibiotics in ophthalmology have FDA approvals restricted to bacterial conjunctivitis.
- The escalating levels of multi-drug resistance in common ocular pathogens.<sup>1</sup>
- The emergence and increasing prevalence of once-atypical infections that may require diagnostic and treatment techniques relatively unfamiliar to comprehensive ophthalmologists.<sup>2</sup>
- The introduction of new and potentially more efficacious and/or safe ophthalmic antiinfectives.<sup>3</sup>
- The introduction of new and potentially more accurate diagnostic techniques for ophthalmic infections.<sup>4</sup>
- Widespread discussion over the efficacy and safety of novel or alternative delivery techniques and vehicles for prophylactic ophthalmic antibiotics (including but not limited to intracameral injection and topical mucoadhesives).<sup>5,6</sup>
- Increased understanding of the inflammatory damage caused by ocular infections and the best ways to prevent/alleviate inflammation without fueling the growth of pathogenic organisms.

Given the continually evolving challenges described above, *Topics in Ocular Antiinfectives* aims to help ophthalmologists update outdated competencies and narrow gaps between actual and optimal clinical practices. As an ongoing resource, this series will support evidence-based and rational antiinfective choices across a range of ophthalmic clinical situations.

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**DISCLAIMER** Participants have an implied responsibility to use the newly acquired information to enhance patient outcomes and professional development. The information presented in this activity is not meant to serve as a guideline for patient care. Procedures, medications, and other courses of diagnosis and treatment discussed or suggested in this activity should not be used by clinicians without evaluation of their patients' conditions and possible contraindications or dangers in use, applicable manufacturer's product information, and comparison with recommendations of other authorities.

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## CORE CONCEPTS

- ▶ The broad spectrum activity of the topical fluoroquinolones enabled empirical monotherapy to become the standard treatment for most bacterial keratitis.
- ▶ Fluoroquinolone resistance has developed among common ocular pathogens, including *S. aureus*, but the clinical implications of this are not yet clear.
- ▶ In systemic infections, 90% of susceptible isolates respond to treatment, but 60% of resistant isolates also respond to treatment (the "90/60 rule").

that caused their infection was labeled "resistant" or "susceptible," it is worth asking whether patients with "resistant" isolates have the same outcomes as patients with isolates that tested "susceptible." In one study of 42 patients with culture-confirmed bacterial keratitis, a correlation was found between MIC and the size of the scar or infiltrate at 3 months—higher MICs correlated with slightly greater scarring.<sup>5</sup> In the same study, however, MIC was not correlated with 3-month acuity or time to epithelialization. However, this study, in which I took part, had limited power due to the small sample size. Prospectively collected data from the NIH-funded Steroids for Corneal Ulcer Trial is expected to provide more information on the correlation between antibiotic susceptibility and clinical outcomes.

More work needs to be done in this area, as there are hints that MIC levels may be correlated with outcomes. What we need is something like the 90/60 rule for ophthalmology. The 90/60 rule for systemic illness was distilled from a large number of good studies; we lack this kind of data in ophthalmology.

### Responding to Resistance

What does this tell us about managing patients? Should we return to culturing patients to cull out those with

resistant organisms? While culture and sensitivity results are useful, they are still impractical for most office-based ophthalmologists. And even if the physician takes specimens for culture, it is still necessary to start treatment of corneal ulcers immediately, well before culture results can come back. Thus, our broad spectrum antibiotics, our fluoroquinolones, will remain a mainstay of empirical treatment, at least for the foreseeable future.

When patients do not respond, then culture or referral to a hospital or university center becomes appropriate. Failure to respond to empirical treatment can mean that the causative organism is a resistant bacterium, or it can mean that organism is not a bacterium at all—it may be a fungus or a parasite. Hopefully, as physicians become more aware of the possibility of resistance, they will have a lower threshold for referral.

### Presumed Resistance?

We know that patients from certain settings, including hospitals and nursing homes, have high prevalence levels of resistant organisms. Should that fact change the way we treat their bacterial keratitis? There are different ways of thinking about this, and reasonable people can look at the evidence and come to different conclusions.

Because I work in an academic center, I culture all ulcer patients before treating them. Typically, I would treat the patient at high risk of MRSA like other patients: culture and begin empirical therapy with a fluoroquinolone. Then, if the patient was not responding and the culture results indicated a resistant *S. aureus* infection, I would consider changing.

It is useful to remember, however, that there is a good chance the infection is something other than MRSA; and, even if it is MRSA, many MRSA infections will respond to topical fluoroquinolone treatment. In addition, the drug of choice for treating MRSA is vancomycin, which is quite toxic and has to be compounded. So rather than unnecessarily expose the patient to a toxic drug, I prefer to reserve vancomycin for cases where I think it is necessary.

That said, the jury is out on whether to start these patients on vancomycin. Colleagues whom I respect at my own institution would start these patients on vancomycin and then switch to something else if necessary when the culture results came in. At this point, all MRSA ocular isolates are sensitive to vancomycin, which makes it a very valuable member of our armamentarium.<sup>1</sup> My personal preference, however, is to reserve it for cases where the ulcer is not responding to a fluoroquinolone.

### Fourth Generation Fluoroquinolones

While there are differences among the fluoroquinolones, those differences are small compared to the differences between fluoroquinolones and other drug classes. Among the fluoroquinolones, the fourth generation fluoroquinolones—gatifloxacin, moxifloxacin, and besifloxacin—have been shown to have excellent Gram positive coverage and good coverage of Gram negative organisms. Because the fourth generation agents work by inhibiting two bacterial enzymes, topoisomerase IV and DNA gyrase, resistance is somewhat less likely to occur, as two mutations are required for an organism to acquire resistance. So, the fourth generation may be preferred to earlier fluoroquinolones.

Among the fourth generation agents, moxifloxacin has been associated with the highest levels of tissue penetration.<sup>6</sup> Besifloxacin, the newest of the topical fluoroquinolones, and the only one not previously used in systemic or animal medicine, has the lowest MICs against MRSA and other resistant organisms.<sup>7,8</sup> But these are not clinical comparisons, and, in fact, all of the topical fourth generation fluoroquinolones can mount a good theoretical argument in its favor. What they lack is clinical trial data to back them up.

### Surveillance Studies

Large surveillance studies like ARMOR and Ocular TRUST are important because they tell us what is happening among the bacteria with which we live.<sup>1,2</sup> Large in size and strong in methodology, these studies give us vital information

about how common bacteria react to antibiotics in vitro, but they stop short of providing direct clinical information.

ARMOR, the most recent of these studies, drew isolates from geographically diverse centers and from both academic and community settings. ARMOR found that 39% of 200 *S. aureus* cultures were MRSA.<sup>1</sup> What this says is that, even when you look at community centers and diverse geographic areas, the prevalence of resistance is fairly high.

Knowing this may make office-based clinicians more likely to refer patients who are not responding to empirical therapy to settings where they can be cultured. Bacterial resistance is not the only cause for a poor initial response. Not all ulcers are bacterial—fungal or parasitic infections will also be non-responsive to fluoroquinolone therapy. Culture is the one way to get to the bottom of the problem.

### Conclusion

The growth of bacterial resistance is an important problem for both human and veterinary medicine. That said, its

impact on the day-to-day practice of ophthalmology has, so far, been quite small. It is important for all of us to monitor resistance—via surveillance studies and clinical reports—and make informed decisions based on the best evidence available. Rather than reacting in fear to the latest report of in vitro findings, however, it is important to also weigh the clinical evidence. Much of our current therapeutic practice remains highly effective. It should be changed only in response to solid evidence that a different way will provide greater benefit for patients.

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## The ARMOR Study and What It Means

*Penny Asbell, MD, MBA, FACS*

*Broad in scope and solid in its methodology, the ARMOR study provides us with current and reliable data on antibiotic resistance among ocular isolates in the US. This information gives us insights into optimal treatment of current patients and a basis for designing future antibiotic strategies.*

Ancient Chinese wisdom teaches: “Know yourself, know your enemy, and you need not fear the result of a hundred battles.” In our battle against bacterial infections, surveillance studies are important tools that help us know our enemies, the pathogenic bacteria. Typically conducted over a specific time span and covering a country, a region,

or the whole world, surveillance studies provide us with critical information regarding the susceptibility of specific bacterial species. From this we can determine resistance trends and adjust our antibiotic strategies accordingly.

In the best surveillance studies, the results are based on analysis of a large number of isolates from a multiplicity of sites, ensuring that the results are not swayed by any one particular sample or small group of cases.

### Ocular TRUST

Although we have abundant surveillance information on systemic infections, broad based studies of ocular isolates are rare.<sup>1-6</sup> The majority of ocular infection studies fall into the category of either case reports or small retrospective case series from a single institution.

The Ocular Tracking Resistance in the United States Today (Ocular TRUST) study, the first nationwide longitudinal ocular surveillance program, was conducted in both 2005 and 2006 to determine the in vitro susceptibility of *Staphylococcus aureus*, *Streptococcus pneumoniae*, and *Haemophilus influenzae* ocular isolates to commonly used ophthalmic antibiotics.<sup>7</sup>

One of the most important findings of the study was a high level of multidrug resistance among methicillin-resistant *S. aureus* (MRSA). In fact, trimethoprim was the only tested agent that retained good activity against MRSA.<sup>7</sup> This is consistent with another study on *S. aureus* ocular isolates that reported an increasing prevalence of MRSA strains resistant to multiple antibiotics—including all fluoroquinolones tested.<sup>8</sup>

## CORE CONCEPTS

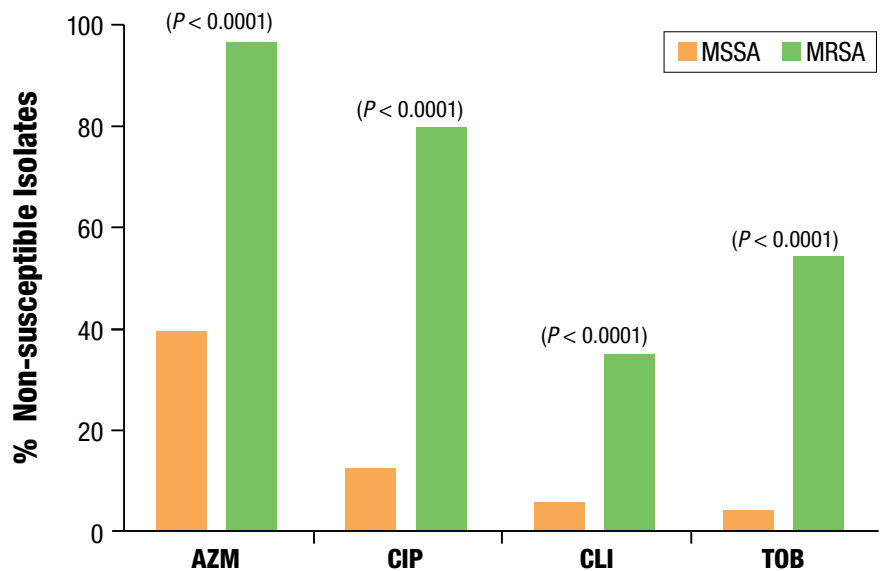
- Surveillance studies report the susceptibility patterns of ocular isolates in a given region over a preset time frame. This data can and should be used to guide antibiotic selection for surgical prophylaxis and empirical treatment.
- Antibiotic resistance has become more prevalent among ocular isolates, particularly *S. aureus* and CNS.
- The prevalence of MRSA among *S. aureus* isolates has been rapidly increasing. Multidrug resistance is common in MRSA isolates, and methicillin resistance has become an indicator of probable fluoroquinolone resistance.
- Among drugs frequently used in ophthalmology, only trimethoprim and vancomycin (particularly the latter) are highly active against MRSA.

### The ARMOR Study

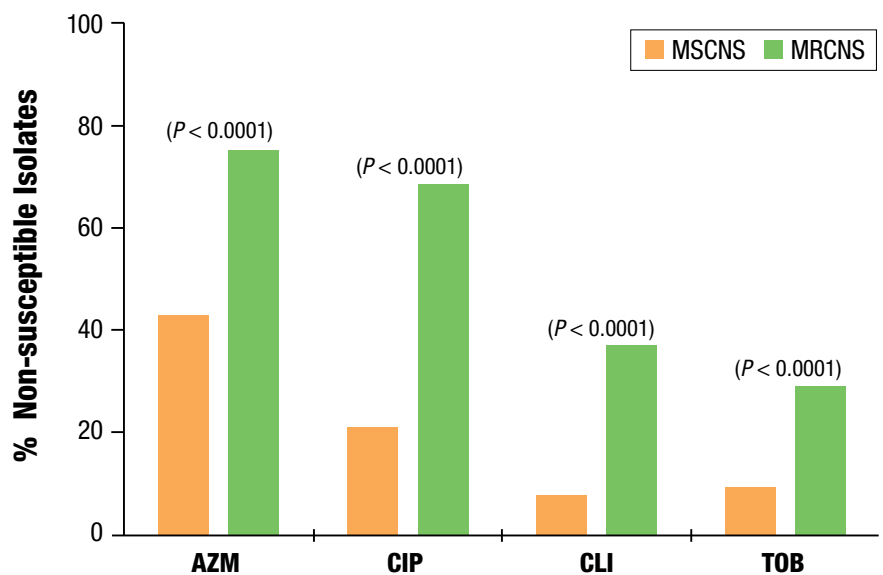
Following up on the Ocular TRUST work, the Antibiotic Resistance Monitoring in Ocular Microorganisms (ARMOR) surveillance study was initiated in 2009. In this nationwide study, the susceptibility profiles of common ocular pathogens, including *S. aureus*, coagulase-negative staphylococci (CNS), *S. pneumoniae*, *H. influenzae*, and *Pseudomonas aeruginosa*, was determined against representative classes of antibiotics.<sup>9</sup>

In ARMOR study, a total of 592 ocular isolates were analyzed. While the results demonstrated the broad spectrum activity of fluoroquinolones, they also showed a significant level of fluoroquinolone resistance, particularly among *S. aureus* and CNS (Figures 1 and 2).

Among these two species, a large proportion of the isolates were found to



**FIGURE 1** Non-susceptibility of methicillin susceptible *Staphylococcus aureus* (122 isolates) and methicillin resistant *S. aureus* (78 isolates) to antibacterial agents. Agents tested include: azithromycin (AZM), ciprofloxacin (CIP), clindamycin (CLI), and tobramycin (TOB). Source: Reference 9.



**FIGURE 2** Non-susceptibility of methicillin susceptible coagulase-negative staphylococci (CNS) (68 isolates) and methicillin resistant CNS (76 isolates) to antibacterial agents. Agents tested include: azithromycin (AZM), ciprofloxacin (CIP), clindamycin (CLI), and tobramycin (TOB). Source: Reference 9.

be fluoroquinolone resistant (39% of 200 *S. aureus* and 52.8% of 144 CNS). Also, multidrug resistance was very common: 11.5% of *S. aureus* and 6.3% of CNS isolates were resistant to 5 out of the 6 tested antibiotic classes, including the widely used beta-lactams, fluoroquinolones, aminoglycosides, and macrolides.<sup>9</sup>

### ARMOR Study Strengths

As one of the few major surveillance studies of ocular isolates, ARMOR adds substantially to our information about ocular infections. Study isolates were collected from 34 health centers throughout the United States, including major eye centers, private practices,

academic medical centers, and community hospitals. This variety of the healthcare settings was chosen to ensure representativeness of the sampled ocular infections. The results give us a good snapshot of the ocular infectious agents and their susceptibilities in the United States in 2009.

Another strength of the ARMOR study was its methodology: The isolates were sent to a central, independent, and highly regarded laboratory in Virginia, where all the testing was performed. Since all isolates were tested in the same laboratory using established protocols, the results are more consistent and reliable than they could be if done at multiple institutions.

### Analysis of Resistance

The *in vitro* determination of the “susceptibility” or “resistance” is based on the minimum inhibitory concentration (MIC), typically the concentration that inhibits the growth of 90% of the isolates (MIC<sub>90</sub>). Isolates are categorized as “susceptible,” “intermediate,” or “resistant” to a given drug based on whether the MIC of that drug is above or below the reasonably achieved antibiotic plasma level when administered orally (or parenterally).

Since the organism reacts differently in the human body, where host defense mechanisms are also working against the infection, *in vitro* results do not reflect exactly what happens *in vivo*. Furthermore, antibiotics used in eyecare may be more effective than their systemic counterparts against organisms that are labeled “resistant” *in vitro* because topical ophthalmic antibiotics have immediate access to the site of infection, particularly when the conjunctiva or cornea is involved. Topical antibiotics can achieve very high effective ocular concentrations.

This may contribute to the common clinical finding that ocular infections clear readily when treated with a topical antibiotic that the laboratory has labeled “resistant.” So although an isolate may be called “resistant,” this frequently fails to predict its response to topical therapy.

### Lessons from ARMOR

No antibiotic works against every bacterium all the time, and broad spectrum antibiotics should never be used as a substitute for clinical judgment. Clinicians should always look for risk factors associated with the presence of resistant organisms and select an antibiotic accordingly. For example, when a patient is not responding to an antibiotic, it may be an indication that the organism is resistant and that it is time to consider using a different antibiotic agent that might be more effective. Ocular cultures and culture of contact lenses and/or contact lens case are also important to determine etiology of serious ocular infections.

Another valuable finding of the ARMOR study is that if the pathogenic organism is resistant to one drug, it is very likely to be resistant to the entire antibiotic class and perhaps to other classes as well. This implies that randomly switching to second drug simply because it is different may not work. Treating a suspected resistant organism requires thoughtful consideration, which may include taking cultures and perhaps even consultation with an infectious disease specialist.

### Empirical Treatment

When presented with a serious ocular infection, clinicians need to begin treatment immediately, either without culture or before the culture results are back. In surgical prophylaxis, antibiotics are routinely used off-label to decrease the risk of infection. In both these circumstances, we have to treat or provide prophylaxis without knowing the potential pathogen(s). For these cases, surveillance data can be of tremendous help in making rational choices.

Local hospitals are required to publish their yearly antibiogram, a report on all organisms tested in the hospital's laboratory over that year and their susceptibility to common antibiotics. This antibiogram has good information about what is happening among the local pathogenic microflora, but it is skewed by the fact that the organisms are all

collected from hospitalized patients. Also, many doctors today—particularly ophthalmologists—have no hospital association and thus have no access to antibiogram data. Surveillance studies, such as ARMOR, can be used to help doctors select antibiotics for their patients.

Fluoroquinolones are routinely used topically in prophylaxis and treatment of ocular infections. The ARMOR study has confirmed their broad spectrum activity, and they remain an appropriate choice for empirical treatment.

Besifloxacin, a fluoroquinolone developed only for topical use, has lower MIC<sub>90</sub> values against many significant pathogens—including MRSA—than the other fluoroquinolones, suggesting that besifloxacin may be more potent against those organisms.<sup>10</sup> Studies of besifloxacin, however, can't use the term “resistant organisms” because, unlike other fluoroquinolones, besifloxacin has never been used as a systemic drug.

Thus, the plasma levels achievable by oral administration have not been established, and thus there are no breakpoints established to determine whether an isolate is “susceptible” or “resistant” to besifloxacin *in vitro*. That said, susceptibility testing is based on MICs, and, as noted, besifloxacin tends to have lower MICs, especially to resistant organisms.<sup>10</sup> Besifloxacin offers a new antibiotic option for treatment of ocular infections, and possibly for surface prophylaxis as well.

### Rising MRSA Levels

The prevalence of antibiotic resistance is increasing, with MRSA in the forefront. Indeed, MRSA accounts for a significant fraction of the growing resistance. This is worrisome because multiple drug resistance—in particular fluoroquinolone resistance—is common in MRSA isolates.<sup>7-9</sup> Once considered primarily a nosocomial infection, MRSA has recently been found to be more associated with community than hospital settings.<sup>11,12</sup>

When planning cataract surgery for a patient from a nursing home who may

have recently had some other kind of non-ocular infection, it is good practice to consider the possibility of MRSA, which may require an antibiotic other than a fluoroquinolone to decrease the risk of serious postoperative infection.

In the ARMOR study, all the ocular isolates, including MRSA, were susceptible to vancomycin.<sup>9</sup> Vancomycin is not available as a topical drop, although it can be compounded into an eye drop or prepared for subconjunctival injection. Despite its efficacy, vancomycin is toxic to the ocular surface, which has largely restricted its use to serious ocular infections.

Whether or not to use vancomycin for surgical prophylaxis is a decision each physician must make. While vancomycin is toxic, must be compounded, and there is always the concern that frequent use will lead to resistance, some physicians believe the risk/benefit ratio favors vancomycin prophylaxis.

### Novel Antibiotics Needed

The ARMOR and Ocular TRUST studies warn us that the finding of in vitro antibiotic resistance has been increasing rapidly in ocular isolates. To prevent further development of resistance, we should begin now to avoid antibiotic overuse.

Constantly evolving to meet the chemical challenges we create, pathogenic bacteria can develop resistance to any antibiotic agent. In the case of MRSA, methicillin resistance has become an indicator of probable multidrug resistance. To better combat existing and future resistant organisms, we will need both more surveillance studies

and new antibiotic agents with novel mechanisms of action.

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## EXAMINATION QUESTIONS TOPICS IN OCULAR ANTIINFECTIVES, ISSUE 26

This CME program is sponsored by the University of Florida College of Medicine and supported by an unrestricted educational grant from Bausch + Lomb, Inc. **DIRECTIONS:** Select the one best answer to each question in the Exam (Questions 1-10) and in the Evaluation (Questions 11-16) below by circling one letter for each answer. Participants must score at least 80% on the questions and complete the entire Evaluation section on the form below. The University of Florida College of Medicine designates this activity for a maximum of 1.0 AMA PRA Category 1 Credit™. There is no fee to participate in this activity. You can take the test online at <http://cme.ufl.edu/ocular>.

- When a lab reports an ocular isolate "susceptible" to a particular drug, it means that
  - The MIC is greater than a reasonably achievable serum drug concentration
  - The MIC is lower than a reasonably achievable serum drug concentration
  - The MIC is greater than the expected aqueous humor drug concentration
  - The MIC is lower than the expected aqueous humor drug concentration
- According to the 90/60 rule
  - 60% of isolates will be resistant
  - 60% of susceptible isolates will fail to respond to treatment
  - 90% of susceptible isolates will fail to respond to treatment
  - 90% of susceptible isolates will respond to treatment
- Topical drug delivery facilitates
  - Achieving high drug concentrations at the site of action
  - Rapid MIC testing
  - Drug interactions
  - All of the above
- At this point, what proportion of ocular *S. Aureus* isolates respond to vancomycin?
  - < 5%
  - 40%
  - 60%
  - 100%
- In the ARMOR study, what proportion of *S. Aureus* isolates were MRSA?
  - 0.9%
  - 19%
  - 39%
  - 99%
- What were the major findings of the ARMOR 2009 surveillance study?
  - High prevalence of antibiotic resistance
  - Increasing levels of MRSA
  - Presence of multidrug resistance
  - All of the above
- What proportion of CNS isolates reported in the ARMOR study were fluoroquinolone-resistant?
  - 19%
  - 52.8%
  - 49%
  - 39.3%
- In the ARMOR study, all MRSA isolates tested were susceptible to:
  - Besifloxacin
  - Moxifloxacin
  - Azithromycin
  - Vancomycin
- All of the following are reasons why vancomycin is *not* routinely used in prophylaxis except:
  - Vancomycin is toxic
  - Overuse may foster development of resistance
  - Vancomycin is ineffective against MRSA
  - Vancomycin has to be compounded
- Which antibiotic was found to have retained a high degree of activity against MRSA in the ocular TRUST study?
  - Trimethoprim
  - Besifloxacin
  - Azithromycin
  - Moxifloxacin

## EXAMINATION ANSWER SHEET TOPICS IN OCULAR ANTIINFECTIVES, ISSUE 26

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### ANSWERS:

- |            |             |
|------------|-------------|
| 1. A B C D | 6. A B C D  |
| 2. A B C D | 7. A B C D  |
| 3. A B C D | 8. A B C D  |
| 4. A B C D | 9. A B C D  |
| 5. A B C D | 10. A B C D |

### EVALUATION:

1=Poor 2=Fair 3=Satisfactory 4=Good 5=Outstanding

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  - Objective 2: 1 2 3 4 5
  - Objective 3: 1 2 3 4 5
- Rate the overall effectiveness of how the activity:
  - Related to my practice: 1 2 3 4 5
  - Will influence how I practice: 1 2 3 4 5
  - Will help me improve patient care: 1 2 3 4 5
  - Stimulated my intellectual curiosity: 1 2 3 4 5
  - Overall quality of material: 1 2 3 4 5
  - Overall met my expectations: 1 2 3 4 5
  - Avoided commercial bias/influence: 1 2 3 4 5
- Will the information presented cause you to make any changes in your practice? Yes No
- If yes, please describe: \_\_\_\_\_
- How committed are you to making these changes?
  - 1 2 3 4 5
- Are future activities on this topic important to you?
  - Yes No

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