Antibiotic Resistance Patterns of Ocular Surface Bacterial Flora

Aghadoost Dawood, M.D.*
Khorshidi Ahmad, Ph.D.**

ABSTRACT

The purpose of this study was to determine the antibiotic susceptibility patterns of ocular surface bacterial flora isolated preoperatively from patients undergoing anterior segment intraocular surgery. This was a prospective observational study, during a 6-month period (from April to December 2004). Lid and conjunctival cultures were obtained in the morning on the day of surgery before application of povidone iodine or topical antibiotic. Bacterial isolates were identified and tested for antibiotic susceptibility using the Kirby-Bauer disc-diffusion technique. There were 264 patients (127 were male); all of them had unilateral eye surgery. Of these 264 eyes, 101 (37.5%) showed bacterial growth. Isolated bacteria in order of frequency were coagulase-negative staphylococci (CNS) (90%), coagulase-positive staphylococci (CPS) (4%), Corynebacterium (5%), gram-negative bacilli (2%), and streptococci (1%). Among the CNS, 95 percent were susceptible to vancomycin, amikacin, and gentamicin. Between 70 percent and 90 percent of the CNS were susceptible to ciprofloxacin, doxycycline, and chloramphenicol. Less than 70 percent of the CNS were susceptible to oxacillin, penicillin, ceftriaxone, tetracycline, erythromycin, and cotrimoxazole. In conclusion, preoperative ocular surface isolates of CNS seems to be most susceptible to vancomycin, amikacin, and gentamicin. (J Infect Dis Antimicrob Agents 2005;22:53-7.)

INTRODUCTION

Postoperative intraocular infection (endophthalmitis) is very rare, but is a devastating complication that usually leads to severe loss of vision or blindness. The reported incidence varies depending on the type of surgery, ranging from 0.05 percent to 0.37 percent.¹ Previous studies have shown that preoperative prophylactic antibiotic use significantly reduces the number of conjunctival bacteria at the time of surgery.²,³ The results of such studies have influenced the practice patterns of eye surgeons for using preoperative topical antibiotics or povidone-iodine.⁴ The optimal choice of preoperative topical antibiotics depends on many factors, including the isolated bacteria, their antibiotic susceptibility and resistance patterns, rapidity of action, rate of penetration, and toxicity. The most

*Department of Ophthalmology, Kashan University of Medical Sciences and Health Services, Kashan, Iran.
**Department of Microbiology, Kashan University of Medical Sciences and Health Services, Kashan, Iran.

Received for publication: May 20, 2005.
Reprint request: Khorshidi Ahmad, Ph.D., Department of Microbiology, Kashan University of Medical Sciences and Health Services, Kashan, Iran.

Keywords: Ocular bacteria flora, antibiotic resistance, endophthalmitis.
common organisms causing bacterial postoperative endophthalmitis are gram-positive cocci, especially coagulase-negative staphylococci (CNS).

Recent changing resistance patterns and new multiresistant strains of ocular surface organisms which resist especially to fluoroquinolones and aminoglycosides needs further investigation. The present study investigated the antibiotic susceptibility of isolated bacteria from patients undergoing intraocular surgery.

**PATIENTS AND METHODS**

All 269 consecutive patients scheduled for anterior segment intraocular surgery at Kashan University, Mattini hospital during 6-month period from April to December 2004 were enrolled in this prospective study after oral informed consent. Patients using topical antibiotics, recently underwent ocular surgery, and those with any systemic diseases affecting immune response such as diabetes mellitus were excluded from the study.

Lower lid margin and inferior fornix conjunctival cultures were obtained from the scheduled eye in the morning on the day of surgery before the application of topical anesthetic, antibiotic or povidone iodine. The patient was asked to look up, and then the lower lid margin and inferior fornix were swabbed using a moistened sterile swab. The culture sample were immediately inoculated onto blood, chocolate, and Eosin-Methylene Blue (EMB) agar plates. Blood culture media were incubated with 5 percent carbon dioxide to enhance microaerophilic bacterial growth. All culture media were incubated at 37°C for at least 10 days, and then bacterial colonies were isolated and identified.

After growth, the isolated organisms were transferred to Tripticase-Soy-Broth (TSB) media to enhance bacterial growth, and then were inoculated onto Muller-Hilton agar for disc diffusion testing. Antibiotic susceptibility testing was performed on all bacterial isolates using the Kirby-Bauer disc diffusion technique. The results of susceptibility testing with each of the 12 antibiotics were interpreted and recorded according to the National Committee for Clinical Laboratory Standards (NCCLS) guidelines. Statistical analysis was performed using the Chi-square test. P values of ≤ 0.05 were considered significant, using EPI software.

**RESULTS**

During the study, 269 patients underwent anterior segment intraocular surgery, and cultures were obtained from their ocular surfaces. All of them had unilateral eye surgery 127 (47.2%) patients were male and 142 (52.8%) were female. The mean age of patients was 66 years (range: 5-86 years). The characteristics and the rate of isolation are summarized in Table 1. Of the 269 specimens, only 101 (37.5%) showed bacterial growth. CNS were the most commonly isolated bacteria, accounting for 90 percent of positive cultures. Other isolated bacteria included *Staphylococcus aureus* (4%), *Corynebacterium* (3%), gram-negative bacilli (2%), and streptococci (1%).

Figure 1 summarizes the antibiotic susceptibility patterns of CNS in this study. These organisms were highly resistant to penicillin (95.6%), erythromycin (42%), and tetracycline (35%). They were relatively more susceptible to ciprofloxacin, ceftriaxone, chloramphenicol, and doxycycline (70-90%). The susceptibility of CNS to vancomycin, gentamicin, and amikacin was 95 percent. Twenty (22%) of the 91 CNS isolates were resistant to five or more of the 12 tested antibiotics. Figure 2 shows the antibiotic susceptibility patterns of these 20 CNS isolates.

**DISCUSSION**

The major route of postoperative endophthalmitis is lid and conjunctival bacterial flora entrance at the time of operation. One of the methods of reducing the rate of postoperative endophthalmitis is reducing
Table 1. Characteristics of patients and isolated bacteria.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Number of eyes</th>
<th>Positive cultures (%)</th>
<th>Negative cultures (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>11</td>
<td>3 (27.3)</td>
<td>8 (72.7)</td>
</tr>
<tr>
<td>31-60</td>
<td>43</td>
<td>10 (23.3)</td>
<td>33 (76.6)</td>
</tr>
<tr>
<td>&gt;60</td>
<td>215</td>
<td>88 (31)</td>
<td>127 (59)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>127</td>
<td>54 (42.5)</td>
<td>73 (57.5)</td>
</tr>
<tr>
<td>Female</td>
<td>142</td>
<td>47 (33.1)</td>
<td>95 (66.9)</td>
</tr>
<tr>
<td><strong>Eye</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>142</td>
<td>54 (38)</td>
<td>88 (62)</td>
</tr>
<tr>
<td>Left</td>
<td>127</td>
<td>47 (37)</td>
<td>80 (63)</td>
</tr>
</tbody>
</table>

Figure 1. Antibiotic susceptibility patterns of coagulase-negative staphylococci (CNS).

or eliminating bacterial surface organisms. It has been shown that preoperative application of both topical povidone-iodine or antimicrobial agents is effective in reducing the incidence of ocular contamination as measured by the growth of bacterial colonies.\(^3,4,6\) Some surgeons use intraoperative subconjunctival or intraocular infusion of optimal antibiotics.\(^4,7\) For the period to reduce the number of ocular surface bacteria, it is important to characterize their nature and determine their antibiotic susceptibility patterns in patients undergoing intraocular surgeries. This is very important due to the new emergence of bacterial resistance resulting from a widespread and prolonged use of antimicrobial agents.

This study showed that the most common bac-
teria colonizing the ocular surface were CNS which is comparable to other studies.\textsuperscript{8,9} Our results showed that they are most susceptible to vancomycin and aminoglycosides (95%), and most resistant to penicillin (95.6%). 22.5 percent of all isolated bacteria were multi-resistant. This relatively high rate of multi-resistant bacteria is comparable to previous studies which have shown the resistant bacteria as the cause of postoperative endophthalmitis.\textsuperscript{10,11} 75.5 percent of the isolated CNS in this study were susceptible to ceftriaxone. The susceptibility of isolated CNS to tetracycline and erythromycin, the two commonly used topical ointments, was 65 percent and 58 percent, respectively.

Fluoroquinolones are a group of broad-spectrum bactericidal agents used most frequently pre- and postoperatively. 79 percent of isolated CNS were susceptible to ciprofloxacin. One study\textsuperscript{12} showed that 29 percent of CNS isolates from the infected eyes were resistant to three or more antibiotics. Our multi-resistant bacteria were susceptible to amikacin and gentamicin. Surprisingly, they were susceptible to vancomycin only approximately 30 percent. We should consider that there may be some differences between in vitro and in vivo susceptibility of microorganisms to the tested antibiotics.\textsuperscript{13}

Many factors affecting the antibacterial efficacy include frequency, concentration of topical or subconjunctival application, minimal inhibitory concentration of the drug, bioavailability, and rate of its elimination from the tear. Till now, in vitro antibiotic susceptibility testing is the most commonly cited standard, and will continue to guide the clinician in antibiotic selection.

There is a large controversy about the prophylactic effects of reducing the rate of post-operative endophthalmitis, but the use of perioperative prophylactic antibiotics with intraocular surgery is based on the assumption that it reduces the ocular surface normal flora.\textsuperscript{14}

In summary, the isolated CNS from the ocular surface of patients scheduled for anterior segment intraocular surgery in our institute are still susceptible to vancomycin, amikacin, and gentamicin.
References


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