

## Original Article

# Posttraumatic Endophthalmitis: Responsible Microorganisms and Rate of Resistance

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### Abstract

**Purpose:** To identify the microorganisms responsible for the posttraumatic endophthalmitis and evaluate their resistance to seven antibiotics.

**Patients and Methods:** Aqueous and vitreous samples were obtained from 49 patients who underwent vitrectomy for posttraumatic endophthalmitis and were inoculated into blood agar, chocolate agar, and Sabouraud agar media. Susceptibility testing was performed using the Kirby-Bauer disk diffusion method for seven antibiotics (vancomycin, ceftazidime, ciprofloxacin, oxacillin, azithromycin, imipenem, and rifampin).

**Results:** Twenty patients (40.8 %) had intraocular foreign bodies. The cultures were positive in 19 patients (38.8 %). In all patients (except for one case), one species was isolated. The most frequent isolated microorganism was staphylococcus epidermidis in 9 patients (47.4 %), followed by staphylococcus aureus, bacillus species, streptococcus viridans, streptococcus pneumonia, enterococcus, diphtheroid species, and pseudomonas aeruginosa. No case with fungal growth was found. Microorganisms showed higher sensitivity to different antibiotics. All gram-positive cocci were sensitive to vancomycin and 71.4 % were sensitive to ceftazidime or rifampin. All gram-positive bacilli were sensitive to vancomycin, ciprofloxacin and azithromycin. The gram-negative bacillus (pseudomonas) was sensitive to ceftazidime, ciprofloxacin, imipenem, and rifampin.

**Conclusion:** No single antibiotic was effective against all groups of bacteria present in patients undergoing vitrectomy for posttraumatic endophthalmitis. The conventional intravitreal regimen (vancomycin + ceftazidime) seems to be still valuable in treatment of bacterial endophthalmitis among this group of patients.

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## Introduction

Posttraumatic endophthalmitis is one of the most devastating complications of penetrating globe injuries<sup>1-14</sup>. Many studies have demonstrated that the microorganisms responsible for posttraumatic endophthalmitis are different from those responsible for other types of endophthalmitis and have evaluated their antibiotic sensitivity<sup>1-14</sup>.

The present study was performed to identify the microorganisms responsible for posttraumatic endophthalmitis and evaluate their resistance to seven antibiotics (vancomycin, ceftazidime, ciprofloxacin, oxacillin, azithromycin, imipenem, and rifampin) in a group of Iranian patients.

## Patients and Methods

In this cross-sectional study, approved by the institutional ethics committee of Eye Research Center, Farabi Eye Hospital, Tehran, Iran, 49 patients who underwent vitrectomy for posttraumatic endophthalmitis from October 2012 to December 2013 in Farabi Eye Hospital, Tehran, Iran, were included. All patients or their caregivers gave a written consent before entering the study. Farabi Eye hospital is a specialized referral eye hospital. The patients with a history of intravitreal antibiotic injection before vitrectomy were excluded from the study. The study and data collection were in accordance with the principles of the Declaration of Helsinki. The diagnosis of posttraumatic endophthalmitis was based on history of penetrating globe injury as well as symptoms of ocular pain and redness, hypopyon in the anterior chamber, and vitreous reaction.

Complete ophthalmologic examinations were performed for all patients preoperatively. B-scan ultrasonography was also performed for all patients to document vitreous involvement

and diagnose associated pathologies.

In the operating room, undiluted aqueous and vitreous samples were obtained from patients. All patients underwent pars plana vitrectomy followed by the intravitreal injection of 2.25 mg ceftazidime and 1mg vancomycin at the end of the operation. The presence or absence of the intraocular foreign body (IOFB) was recorded. The samples were inoculated into blood agar, chocolate agar, and Sabouraud agar media. The first two media were incubated in 37 ° centigrade (C) to show bacterial growth. The third medium was incubated without cycloheximide in room temperature (25 °C) to show fungal growth. The growth of the same organism on two or more culture media or confluent growth on at least one solid media was considered as the criteria for positive culture<sup>6</sup>.

Susceptibility testing was performed using the Kirby-Bauer disk diffusion method for seven antibiotics (vancomycin, ceftazidime, ciprofloxacin, oxacillin, azithromycin, imipenem, and rifampin). These antibiotics were selected due to their availability and possible sensitivity of the prevalent microorganisms in endophthalmitis.

The statistical analysis was performed using SPSS version 20 (Armonk, NY: IBM Corp.). The qualitative data were presented as numbers (percentages) and the quantitative data were presented as mean ± standard deviation (range). The chi-square test was used to evaluate the relationship between the presence of intraocular foreign body (IOFB) and positive culture, type of the isolated microorganism, or rate of resistance to each antibiotic. The level of significance was considered 0.05.

## Results

Forty-nine patients including 43 males (87.8 %) and 6 females (12.2 %) with the

mean age of  $34.06 \pm 11.36$  years (range: 5-67) entered the present study. Twenty patients (40.8 %) had intraocular foreign bodies. The bacterial cultures were positive in 19 patients (38.8 %). No case with a fungal growth was observed. In 18 patients (94.7 %), one species and in one patient (5.3 %), two species were isolated. Fourteen positive bacterial cultures (73.7 %) were isolated from the vitreous, 3 cultures (15.8 %) from the aqueous and 2 cultures (10.5 %) from both vitreous and aqueous.

The isolates included 15 (78.9 %) positive cultures of gram-positive cocci, 3 (15.8 %) positive cultures of gram-positive bacilli, and one (5.3 %) positive culture of gram-negative microorganisms. The most frequent isolated microorganism was staphylococcus epidermidis in 9 patients (47.4 %), followed by staphylococcus aureus, streptococcus viridans, and bacillus species (each in 2 patients (10.5 %)), streptococcus pneumonia, enterococcus, diphtheroid species, and pseudomonas aeruginosa (each in one patient (5.3 %)).

The results of the antibiotic sensitivity testing of the isolated species are summarized in table 1. Microorganisms had higher sensitivity to different antibiotics. All gram-positive cocci were sensitive to vancomycin and 71.4 % were sensitive to ceftazidime or rifampin. All gram-positive bacilli were sensitive to vancomycin, ciprofloxacin and azithromycin. The gram-negative bacillus (pseudomonas) was sensitive to ceftazidime, ciprofloxacin, imipenem, and rifampin.

There was no significant association between the presence of intra ocular foreign body and positive culture ( $P = 0.88$ ) and also between the presence of intra ocular foreign body and type of the isolated microorganism ( $P = 0.56$ ). In addition, there was no significant association

between the presence of intra ocular foreign body and the rate of resistance to each antibiotic ( $P = 0.38, 0.31, 0.91, 0.46, 0.84, 0.06, \text{ and } 0.59$  for vancomycin, ceftazidime, ciprofloxacin, oxacillin, azithromycin, imipenem, and rifampin, respectively).

### Discussion

The present study evaluated the causative microorganisms for the posttraumatic endophthalmitis and their resistance to seven antibiotics.

The rate of positive culture in the present study (38.8 %) was compatible with another recent study by Rishi et al.,<sup>3</sup> who found (41 %) positive cultures among patients with posttraumatic endophthalmitis. However, the rate was lower than the rate reported by Kunimoto et al.,<sup>2</sup> who found (62.1 %) positive cultures. The technique of sampling and laboratory settings as well as epidemiologic differences between sample populations could be responsible for this difference.

In the present study, the prevalence of microorganisms responsible for the posttraumatic endophthalmitis showed some similarities with previous studies indicating that streptococcus, staphylococcus, and bacillus species are more prevalent in positive cultures<sup>1-2</sup>. In a large series by Kunimoto et al.,<sup>2</sup> similar to our study, the most prevalent microorganisms were coagulase-negative staphylococci. In our study, the proportion of the gram-positive organisms and staphylococcus epidermidis isolates were 94.7 % and 47.4 %, respectively. The significance of these findings remains unclear and requires larger studies. However, detected microorganisms could be influenced by sample populations.

As indicated in table 1, no single antibiotic was effective against all groups of bacteria. Vancomycin was effective against all gram-

**Table 1: The number of the isolated species that were sensitive or resistant to different antibiotics in the antibiotic sensitivity test**

Microorganism	Vancomycin	Ceftazidime	Ciprofloxacin	Oxacillin	Azithromycin	Imipenem	Rifampin
<b>Staph. epidermidis</b>							
	9	6	6	6	2	6	7
Sensitive	0	3	3	3	7	3	2
Resistant							
<b>Staph. aureus</b>							
	2	2	1	0	2	1	2
Sensitive	0	0	1	2	0	1	0
Resistant							
<b>Strep. viridans</b>							
	2	2	1	2	2	1	1
Sensitive	0	0	1	0	0	1	1
Resistant							
<b>Bacillus species</b>							
	2	0	2	0	2	0	0
Sensitive	0	2	0	2	0	2	2
Resistant							
<b>Strep. pneumonia</b>							
	1	1	1	1	1	1	0
Sensitive	0	0	0	0	0	0	1
Resistant							
<b>Enterococcus</b>							
	1	0	1	0	0	1	1
Sensitive	0	1	0	1	1	0	0
Resistant							
<b>Diphtheroid species</b>							
	1	0	1	0	1	1	1
Sensitive	0	1	0	1	0	0	0
Resistant							
<b>Pseudomonas</b>							
	0	1	1	0	0	1	1
Sensitive	1	0	0	1	1	0	0
Resistant							

Staph.: staphylococcus, Strep.: streptococcus

positive cocci and bacilli, similar to the study by Chhabra et al.,<sup>1</sup>. Ceftazidime, ciprofloxacin, imipenem, and rifampin were effective against pseudomonas. Although the present study did not examine the in vivo effectiveness of these drugs, but a combination of vancomycin and ceftazidime, ciprofloxacin, imipenem, or rifampin might be an effective empiric antibiotic therapy for the treatment of posttraumatic bacterial endophthalmitis. Due to the sensitivity of some gram-positive organisms to the ceftazidime, the conventional intravitreal antibiotic regimen in our center (vancomycin + ceftazidime) seems still valuable for treatment of posttraumatic bacterial endophthalmitis.

As indicated in table 1, about 50 % of the isolated species were resistant to oxacillin or azithromycin. Due to this weak sensitivity, it seems that oxacillin and azithromycin are not suitable drugs for the treatment of posttraumatic bacterial endophthalmitis. Moreover, 26.3 % of the isolated species were resistant to ciprofloxacin. So, the monotherapy with ciprofloxacin does not seem to be sufficient for the treatment of posttraumatic endophthalmitis.

Although fungal and actinomyces-related organisms were not found in the isolates of this study, they have been a considerable part of the isolates in some other studies. For example in the a study by Kunimoto et al.,<sup>2</sup> fungi and actinomyces-related organisms accounted for 14.4 % and 5 % of the isolates, respectively. Lack of these organisms in our series might be due to low sample size. In addition, fungi are more prevalent in the isolates from warmer climates<sup>1-2</sup>. So, milder climate in our country might cause less probability of the infection with these organisms. Despite these findings and explanations, fungi and actinomyces-related organisms should be suspected in all

cases of posttraumatic endophthalmitis and related cultures should be performed in these settings.

The main limitations of our study were low sample size, cross-sectional design, lack of in vivo studies and unavailability of the other antibiotics susceptibility testing methods. In addition, the cases in this study were derived from a referral center, with possible different microbiological spectrum and lower antibiotic sensitivity than general population. Furthermore, the cases with severe endophthalmitis that led to evisceration before vitrectomy were not included in the present study.

In our series of posttraumatic endophthalmitis, gram-positive organisms, especially staphylococcus epidermidis, were more prevalent than other organism in the culture-positive specimens and no single antibiotic was effective against all groups of causative bacteria. Based on our results it seems that a combination of vancomycin, ceftazidime, ciprofloxacin, imipenem, or rifampin might be an effective empiric antibiotic therapy for the treatment of posttraumatic bacterial endophthalmitis.

### Conclusion

No single antibiotic was effective against all groups of bacteria present in patients undergoing vitrectomy for posttraumatic endophthalmitis. The conventional intravitreal regimen (vancomycin + ceftazidime) seems to be still valuable in treatment of bacterial endophthalmitis among this group of patients.

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## Footnotes and Financial Disclosures

### Conflict of interest:

The authors have no conflict of interest with the subject matter of the present study.