European Journal of Ophthalmology / Vol. 9 No. 2, 1999 / pp. 120-124

Bacteriological profile of ophthalmic infections in an Israeli hospital

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ABSTRACT: Aim. *To find the optimal antibiotic treatment for ophthalmic infections in an Israeli hospital.*
Methods. *In a retrospective study from our laboratory, which serves as both a primary and secondary referral center, we analyzed the bacteriological profile and the antibiotic sensitivity of ophthalmic infections using the computerized laboratory reports of 331 consecutive ophthlamic bacteriological cultures from patients with various ophthalmic infections.*
Results. *Microbiological growth was obtained in 113 samples (34.1%). The most commonly isolated organism was coagulase-negative staphylococcus (19.5%), followed by coagulase-positive staphylococcus (16.8%), Enterobacteriaceae (14.2%),* Pseudomonas aeruginosa *(13.3%), and streptococcal species (8.9%).* Pseudomonas *species were the most common isolates from the lacrimal pathways (20.0%). Streptococci were the most common isolates cultured from the conjunctiva (27.3%). Coagulase-positive staphylococcus was the most common isolate from corneal ulcers (33.3%), and coagulase-negative staphylococcus from the vitreous (30.8%). The overall antibiotic sensitivity of common ophthalmic pathogens was similar to that reported from other parts of the world.*
Conclusions. *Although essentially similar to previous series, this report from the Middle East differs as follows. Firstly,* Pseudomonas *species were the most common isolates from the lacrimal pathways. Secondly, the overall rate of streptococcal isolates was lower than in previous reports. Thirdly, streptococcal species were rarely isolated from corneal samples. Although other studies from the region have described the causative organisms of ocular infections in specific ocular sites, this is the first study from the Middle East to summarize the full bacteriological profile of ocular infections in one medical center. (Eur J Ophthalmol 1999, 9: 120-4)*

KEY WORDS: Bacteriology, Antibiotics, Ophthalmic infections

Accepted: February 2, 1999

INTRODUCTION

The bacteriological profile of ophthalmic infections is an essential basis for deciding on optimal antibiotic treatment, as the distribution of various ophthalmic pathogens and their sensitivity to antibiotic treatment vary from one geographical region to another. In addition, different organisms may be involved in various ocular and orbital infections (1-4).

The present study was designed to analyze the bacteriological profile and the antibiotic sensitivity of ophthalmic infections in an Israeli hospital, in order to estabilish the most appropriate antibiotic treatment for ophthalmic infections in this part of the world. Although other studies from the region have already described the causative organisms of ocular infections in specific ocular sites (5, 6), this is the first study from the Middle East to summarize the full bacteriological profile of ocular infections in one medical center.

1120-6721/120-05$02.50/0

METHODS

Between March 1992 and December 1995, 331 consecutive ophthalmic bacteriological cultures from patients with various ophthalmic infections were obtained in the Department of Ophthalmology and analyzed in the Laboratory of Microbiology, Rambam Medical Center, Haifa, Israel which serves as a primary as well as a secondary referral medical center. The computerized laboratory reports of these cultures were analyzed retrospectively.

The data from the laboratory reports included the site of infection, the type of isolate, and its sensitivity to commonly used ophthalmic antibiotics. Microbiological specimens were obtained in a standard way using the guidelines set out in the Clinical Microbiology Procedures Handbook (7) and were cultured on standard culture media according to the recommendations in the same manual. Antibiotic sensitivity was determined using disks containing the commonly used ophthalmic antibiotics, as recommended in the Handbook.

RESULTS

Out of 331 bacteriological samples, microbiological growth was obtained in 113 (34.1%). The positive cultures yielded 105 bacterial and eight fungal isolates. Mixed flora was recovered from the following

TABLE I - ORGANISMS ISOLATED FROM 113 OPHTHALMIC CULTURES

Organism	**No. (%)**
Coagulase-negative staphylococcus	22 (19.5)
Coagulase-positive staphylococcus	19 (16.8)
Enterobacteriaceae (*Escherichia coli, Klebsiella, Enterobacter, Serratia, Proteus*)	16 (14.2)
Pseudomonas aeruginosa	15 (13.3)
Streptococci (α-hemolytic, β-hemolytic streptococci, *Streptococcus pneumoniae*)	10 (8.9)
Fungi (*Candida albicans, Candida parapsilosis, Mucor* species, *Fusarium* species)	8 (7.1)
Diphtheroids	7 (6.2)
Enterococci	6 (5.3)
Haemophilus influenzae	3 (2.7)
Other bacteria (spore-forming bacilli, Citrobacter, and other unidentifiable bacteria)	7 (6.2)

TABLE II - DISTRIBUTION OF MOST COMMON ORGANISMS IN COMMON SITES OF OPHTHALMIC INFECTIONS

Organism	**Lacrimal pathways (%)[a]**	**Conjunctiva (%)[b]**	**Corneal ulcer (%)[c]**	**Vitreous (%)[d]**
Number of isolates in each tissue[e]	20	11	36	13
Coagulase-negative staphylococcus	2 (10.0)	1 (9.1)	8 (22.2)	4 (30.8)
Coagulase-positive staphylococcus	3 (15.0)	2 (18.2)	12 (33.3)	0 (0)
Enterobacteriaceae	1 (5.0)	1 (9.1)	5 (13.9)	2 (15.4)
Pseudomonas aeruginosa	4 (20.0)	1 (9.1)	4 (11.1)	2 (15.4)
Streptococci	3 (15.0)	3 (27.3)	1 (2.8)	1 (7.7)
Other microorganisms	7 (35 0)	3 (27.3)	6 (16 7)	4 (30.8)

[a] Seventeen patients with chronic dacryocystitis and two with nasolacrimal duct obstruction without cystitis.
[b] Purulent conjunctivitis.
[c] Three contact lens wearers; two patients with previous steroid therapy four with previous antibiotic therapy.
[d] Six patients with postoperative bacterial endophthalmitis; one with traumatic endophthalmitis; six with posterior pars plana vitrectomy without endophthalmitis, from whom routine intraoperative bacteriological cultures were obtained for another study (8).
[e] There were 33 isolates from other sites (see text).

sites: two from the conjunctiva, three from corneal ulcers, two from contact lens fluid, two from the vitreous, and one from an unknown source.

The most commonly isolated organisms were coagulase-negative staphylococci (19.5%) and coagulase-positive staphylococci (16.8%). The prevalence of all isolates is shown in Table I. *Pseudomonas* species were the most common organisms isolated from the lacrimal pathways. Streptococci were the most common isolates from the conjunctiva. Coagulase-positive staphylococcus was the most common isolate cultured from corneal ulcers, and coagulase-negative staphylococcus in the vitreous. The distribution of common ophthalmic pathogens in various sites of ophthalmic infections is shown in Table II. Not included in the table, because of the small number of isolates, were eight cases of contaminated contact lens fluid, five of infected eyeball prostheses, one case of blepharitis, and 18 cases of unknown source due to incomplete reports.

The sensitivity of the common ophthalmic organisms to various antibiotics was tested. Coagulase-negative staphylococcus was sensitive to aminoglycosides (amikacin and tobramycin) and cefazolin in 72.7% of cultures and to quinolones (ofloxacin and ciprofloxacin) in l00%. Coagulase-positive staphylococcus was sensitive to cefazolin in 94.7% of the cultures, to aminoglycosides in 84.2-89.5%, and to quinolones in 100%. Enterococcus was 100% sensitive to cefazolin, aminoglycosides, and quinolones.

Pseudomonas aeruginosa was 100% sensitive to piperacillin, cefazolin, and quinolones and was sensitive to aminoglycosides in between 86.7% (gentamicin and tobramycin) and 100% (amikacin) of cultures. Streptococcal species were sensitive to cefazolin in 60% of cultures, 100% sensitive to aminoglycosides, and sensitive to quinolones in 90-100% of cultures.

DISCUSSION

Successful treatment of a bacterial infection depends on identification of the causative organism and its antibiotic sensitivity. Until this laboratory work-up is complete, broad-spectrum antibiotics, are usually employed with or without surgical debridemen (2, 3). Local antibiotic sensitivity differs in various parts of the world (3, 4). There have been reports from North America, Europe, and Asia (1, 2, 4, 9, 10), but not from the Middle East. Thus, it was important for us to find out whether suggested antibiotic regimens based on information from outside our region were efficient for treating ocular infections in Israel.

In previous series, confirmed microbiological growth ranged between 69% and 84% (2, 9, 11), compared with 34.1% in the present study. This low recovery rate may be attributable to the fact that when patients arrive at our hospital many of them are already receiving antibiotic therapy so the false-negative portion of negative cultures was significantly higher than in other reports. It should be noted that most of the patients considered came from a selected group suffering from severe ophthalmic infections frequently refractory to initial antibiotic treatment, who were referred to this hospital by ophthalmologists elsewhere.

A recent major study by Schlegel et al (1) evaluated the variability of bacterial flora in cultures from the conjunctiva, cornea, vitreous, aqueous humor, and ocular foreign bodies. The commonest pathogens were streptococci (36.1%) and coagulase-positive staphylococci (35.6%). The present study differs in that streptococci were much less common, accounting for only 10 (8.9%) of all isolated species (Tab. I). Apart from that, the bacteriological profile was quite similar: coagulase-negative staphylococcus was isolated in 19.5% of the positive cultures, coagulase-positive staphylococcus in 16.8%, Enterobacteriaceae in 14.2%, and *Pseudomonas aeruginosa* in 13.3%.

Different organisms may be involved in various ocular and orbital infections. Acute bacterial dacryocystitis is usually due to a gram-positive organism, *Staphylococcus aureus* being the prime pathogen. Streptococcal infections are less frequent (12). Our study differs in the fact that *Pseudomonas* species were the most common isolate, followed by coagulase-positive staphylococcus and streptococci. In general, there is a low rate of bacterial recovery in acute dacryocystitis (12), and antibiotic therapy has to be empirical in many cases. The recommended treatment is either penicillin or cephalosporin active against penicillinase-producing staphylococci (12). Because of the higher prevalence of *Pseudomonas*, we changed our initial antibiotic treatment for acute dacryocystitis to piperacillin in combination with aminoglycosides or quinolones. Apart from antibiotic treatment, although dacryocysto-

rhinostomy was not used in the present study, this procedure done by the nasal route in the acute stage of dacryocystitis may offer a rapid and permanent cure.

Acute bacterial conjunctivitis is most frequently caused by *Streptococcus pneumoniae, Streptococcus pyogenes*, and *Haemophilus influenzae*, or by *Staphylococcus aureus* and *Staphylococcus epidermidis* (13). Although streptococci and staphylococci were the leading organisms isolated from conjunctival cultures in this series, other organisms that are not often formed in the conjunctival sac, such as Enterobacteriaceae and *Pseudomonas*, were also isolated.

The organisms most frequently isolated from corneal ulcers were coagulase-positive staphylococci, coagulase-negative staphylococci, Enterobacteriaceae, and *Pseudomonas* species. These findings are in accordance with previous series (14-18) although, unlike in previous reports, streptococcal species were rarely isolated. We found ciprofloxacin and ofloxacin were both effective against all isolates. Our report therefore supports the tendency to use quinolones as initial single-drug therapy for bacterial corneal ulcers (3, 12). The relatively low rate of streptococcal isolates justifies this approach too.

Postoperative bacterial endophthalmitis is usually caused by coagulase-negative staphylococcus, originating in most cases from the patient's own external flora or from airborne contamination (19). Our study is in line with previous series, as this was the most common organism recovered from positive vitreal cultures. It was sensitive to vancomycin, the recommended treatment against gram-positive bacteria. Other isolates were sensitive to the combination of vancomycin with amikacin or ceftazidime (20).

Although the prevalence and antibiotic sensitivity profiles of isolates in ophthalmic infections were in essence similar to previous series from other parts of the world, this report from the Middle East differs in that, firstly, *Pseudomonas* species were the most common isolates from the lacrimal pathways. Secondly, the overall rate of streptococcal isolates was lower than previously reported. Thirdly, streptococcal species were rarely isolated from corneal samples.

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