ORIGINAL ARTICLE

OCULAR INFECTIONS: RATIONAL APPROACH TO ANTIBIOTIC THERAPY

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ABSTRACT

Background: Isolation of common pathogens involved in ocular infection and their in-vitro susceptibility to commonly used ocular antibiotics, as well as the trends in antibiotic resistance developed by these pathogens were investigated.
Material/Methods: All patients with suspected bacterial ocular infections presenting between march 2010 and feb 2011 were examined under slit lamp microscope and samples were collected by using aseptic techniques. All samples were processed for direct microscopy, culture and identification by standard methods. Susceptibility testing was done by Kirby-Bauer method as per CLSI guideline.
Results: Out of 116 patients with ocular infections 130 samples were collected, from which 38 different organisms were isolated. Gram-positive cocci 21 (55%), gram-negative cocco-bacilli 5(31%) and gram-negative bacilli 12 (32%) were isolated. *Coagulase negative Staphylococci* (37%) and *Pseudomonas* species (21%) were the most commonly-isolated. Gatifloxacin has highest efficacy (89%) against all isolates. Majority of gram positive cocci were susceptible to vancomycin, gatifloxacin, cefazolin, gram negative cocco-bacilli to amikacin, tobramycin, fluoroquinolone and gram negative bacilli to gatifloxacin.
Conclusion: Majority of ocular infection is caused by gram positive organisms which were susceptible to vancomycin followed by gram negative organisms susceptible to amikacin, fluoroquinolone, gram negative cocco-bacilli to amikacin and tobramycin, and gatifloxacin effective against both type of organisms. The information provided in this article help the clinician in formulating rationale-based empirical antibiotic treatment of bacterial ocular infections.

Keywords: antibiotic susceptibility pattern, bacteria, ocular infection.

INTRODUCTION

Infection of the eye leads to conjunctivitis, keratitis, endophthalmitis, dacryocystitis, blephritis, infections of eye lid, microbial scleritis, canaliculitis, preseptal cellulitis, orbital cellulitis, endophthalmitis and panophthalmitis etc., which are responsible for increased incidence of morbidity and blindness worldwide.[1,2,3] Normally the eye is impermeable to most environmental agents. Continuous tear flow, aided by the blink reflex, mechanically washes substances from the ocular surface and prevents the accumulation of microorganisms. In addition, lysozyme, lactoferrin, secretory immunoglobulins, and defensins, which are present at high levels in tears, can specifically reduce bacterial colonisation of the ocular surface.[4,5]

However in some circumstances, infectious agents gain access to the posterior segment of the eye following one of three routes: (i) as a consequence of intraocular surgery[6,7] (ii) following a penetrating injury of the globe; [8]or (iii) from haematogeous spread of bacteria to the eye from a distant anatomical site. Although uncommon, endophthalmitis can also result from keratitis, an infection of the cornea with potential complications.[9] Bacterial keratitis is one of the most threatening ocular infections. *Pseudomonas aeruginosa* and *Staphylococcus aureus* frequently cause severe keratitis that may lead to progressive destruction of the corneal epithelium and stroma.[10,11] Successful treatment of ocular infection, including bacterial keratitis, requires multiple administrations of antibacterial agents to maintain drug concentration in the corneal tissue high enough and for a sufficient period of time to have a useful antibacterial effect.[12] Besides, in the case that the pathogen is not yet known, the choice of antimicrobial agents is commonly made empirically. Where there is access to microbiology facilities are available and organism has been identified, the effective

antimicrobial should be chosen according to susceptibility testing.

MATERIAL & METHODS

130 samples were collected from patients having ophthalmic infections attending ophthalmic OPD and admitted in ophthalmic ward in tertiary care hospital during march 2010 to feb 2011. They were examined clinically for presence of ophthalmic infection, followed by the slit-lamp examination. After ocular examinations using standard techniques[13,14] specimens were collected. Swabbing the lid margins with sterile broth-moistened cotton swabs in cases of eyelid infections, corneal swab and corneal scraping in case of corneal ulcer, conjunctival swab by wiping a broth-moistened swab across the lower conjunctival cul-de-sac in case of conjunctivitis, purulent material in cases of dacryocystitis was collected from everted puncta by applying pressure over the lacrimal sac area and vitreous fluids were collected in case of endophthalmitis. The obtained specimens were inoculated directly onto the blood agar (Aerobic incubation), chocolate agar (5-10% CO_2), nutrient agar, macconkey agar, liquid media such as brain heart infusion broth. Primary inoculation was done at the site of sample collection in OPD or ward. Culture media were kept in an incubator at 37° C for 18- 24 hr. Gram's staining was performed from all samples for presumptive diagnosis. In vitro susceptibility testing was performed by Kirby-Bauer disc diffusion method and interpreted using Clinical and Laboratory Standards Institute's.[15] The antibacterial agents (Hi-media Laboratories Pvt. Ltd., Mumbai, India) used were amikacin, tobramycin, gentamicin, cefazolin, cephotaxime, ceftazidime, ciprofloxacin, norfloxacin, ofloxacin, gatifloxacin, chloramphenicol and vancomycin. The standard American Type Culture Collection (ATCC) bacteria (*Staphylococcus aureus* ATCC 25923, *Ps. aeruginosa* ATCC 27853, *Escherichia coli* ATCC 25922) were used for quality control.

RESULTS

Of the 38 isolated organisms, gram-positive cocci accounted for 21(55%), gram-negative cocco-bacilli for 5(31%) and gram-negative bacilli for 12(32%). Coagulase-negative Staphylococci (37%), *Pseudomonas* spp. (21%), *Acinetobacter spp* and *Staphylococci aureus* were 13%, *Klebsiella spp.* 7%, *Enterococci* spp., *Streptococci spp.* and *E.coli* were 3% were the common isolated organisms.

As shown in table I, gatifloxacin has highest efficacy (89%) against all isolates, 90% of gram-positive cocci, 80% of gram negative cocco-bacilli , 92% of gram negative bacilli. The coverage of vancomycin against gram-positive was 95%. Amikacin had good coverage against gram-negative bacilli 83%. Gram negative cocco-bacilli have 80% susceptibility to all fluoroquinolone, amikacin and tobramycin. Susceptibility of other bacterial isolates were shown in table 1.

Table 1: (%) of susceptible bacterial isolates to various antibiotics

Name of the bacterial isolates	(%) of susceptible bacterial isolates to various antibiotics.											
	Amikacin	Tobramycin	Gentamicin	Cefazolin	Cephotaxime	Ceftazidime	Norfloxacin	Ciprofloxacin	Ofloxacin	Gatifloxacin	Chloramphenicol	Vancomycin
Staphylococcus aureus	80	80	80	80	80	60	60	60	60	80	80	100
Coagulase negative staphylococci	71	36	50	71	57	43	43	50	50	93	71	93
Enterococci spp.	..	..	0	0	0	..	0	0	0	0	100	100
Streptococci spp.	0	0	100	100	100	..	100	100	100	100	100	100
Acinetobacter spp.	80	80	60	0	80	60	80	80	80	80	60	0
Pseudomonas aerusinosa	88	50	63	0	75	75	88	88	88	88	63	0
E.coli	100	0	0	0	0	100	100	0	100	100	100	0
Klebsiella spp.	67	33	67	0	67	67	67	67	67	100	67	0

DISCUSSION

In present study *Coagulase negative staphylococci* were predominant isolates followed by *Pseudomonas aeruginosa, Staphylococcus aureus, Acinetobacter spp.* In *S*tudies conducted by Savitri sharma et al,[20] Usha Gopinathan et al[21] and B L Sherwal et al.[22] has shown similar results. Among the other gram negative bacilli *E.coli* and *Klebsiella spp.* contributes 3% and 7% respectively.

Gatifloxacin had highest efficacy 89% against all isolates, which contributes 90% of gram-positive cocci, 80% of gram negative cocco-bacilli, 92% of gram negative bacilli. Whereas in the study done by Khosravi A D et al[23] gentamycin had good coverage 74.5% against gram-positive cocci, 82.6% to gram-negative bacilli. In present study coverage of vancomycin for gram-positive was 95%, amikacin for gram-negative bacilli 83% and fluoroquinolones, amikacin and

tobramycin for gram negative cocco-bacilli 80%. *Staphylococci aureus* had 100% susceptibility to vancomycin and 80% to the cefazolin, cefotaxime, amikacin, tobramycin, gentamycin and gatifloxacin, chloramphenicol and 60% to ciprofloxacin and ofloxacin in present study. Whereas in the study done by Khosravi A D et al[23] all the isolates of *S. aureus* were resistant to Vancomycin. *Coagulase negative staphylococci* was mostly susceptible (93%) to vancomycin and gatifloxacin in present study. Whereas in the study done by Khosravi A D et al amikacin had excellent coverage against *S. aureus* and coagulase negative staphylococci. *Pseudomonas aeruginosa* was mostly susceptible (88%) to amikacin and most of fluoroquinolone followed by ceftazidime 75%. Whereas in the study done by Khosravi A D et al[23], Tobramycin was the most effective antibiotic against *Pseudomonas* spp.

Vancomycin is a glycopeptide; it inhibits early stages in cell wall mucopeptide synthesis and it exhibited greatest potency against ocular gram-positive isolates. We found greatest coverage of gatifloxacin and amikacin against gram-negative isolates. Ciprofloxacin and ofloxacin were introduced earlier and have been widely used since 1990, whereas gatifloxacin's usage has started in recent years. In addition to methoxy side chain at the C-8 position, gatifloxacin carries a methyl group on the piperazinyl ring. There was a slight decrease in all pathogens' susceptibilities to ciprofloxacin and ofloxacin, with a subsequent increase in the efficacy of gatifloxacin. The relationship between antibiotic use and resistance is complex. Improper selection of antibiotics, inadequate dosing and poor compliance to therapy may play as important a role in increasing resistance.[24] Pattern of antibiotic susceptibility may be various in different geographical areas. So an attempt should be made to identify the ocular pathogen and performing susceptibility testing. It should be borne in mind that these are in-vitro results and do not always mirror the clinical response to antibiotics due to a variety of reasons including direct topical delivery, corneal penetration of an antibiotic and host factors. [20]

CONCLUSION

Majority of ocular infections are associated with bacterial etiology, which was more due to gram-positive organisms than gram negative organism. Most of the gram-positive organisms were susceptible to vancomycin and cefazolin, whereas gram-negative organisms were susceptible to amikacin and gatifloxacin. Gatifloxacin also had good coverage against both the type of bacterial isolates also. So the information provided in this article would aid the clinician in formulating rationale-based decisions in the empirical antibiotic treatment of bacterial ocular infections that cause major public health problems.

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