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Original Research Article

Bacterial conjunctival flora and antimicrobial susceptibility profile in patients undergoing cataract surgery: A hospital-based cross-sectional study

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Abstract

Background: Post-surgical endophthalmitis after cataract surgery is a devastating complication, owing to loss or worsening of vision. Gram-positive bacteria are the most common culprits. The present study aims to determine conjunctival flora in patients undergoing cataract surgery along with their antimicrobial susceptibility profile.
Methods: This study was conducted on 100 patients undergoing cataract surgery, between March 2021 to November 2022. Conjunctival swabs were sent for aerobic culture and sensitivity.
Collected data was entered in MS Excel sheet, and analysed for a Simple percentage method using SPSS version 22.0.
Result: Only 34/100 (34%) swabs yielded bacterial growth whereas 66(66%) were negative. 24/34 (70.6%) were gram positive and 10(29.4%) gram negative. *Staphylococcus aureus* 12/24(50.0%), was most common isolate and 4(16.7%) were Methicillin-resistant. *CoNS* 10(41.7%) was second most common followed by *Streptococcus spp.* 2(8.3%).
Gram positives showed 100% susceptibility to gentamicin and vancomycin. 20% of CoNS, were resistant to chloramphenicol, ciprofloxacin, and moxifloxacin whereas 40% were resistant to Ofloxacin. For *Staphylococcus aureus* 50% were resistant to chloramphenicol and ciprofloxacin and none susceptible to ofloxacin. *Streptococcus spp.* showed 100% in vitro susceptibility to tested antibiotics.
Gram negatives showed 100% susceptibility to gentamicin, ciprofloxacin, polymyxin B, tobramycin, and moxifloxacin. Of 4 (40.0%) isolates of each *Klebsiella pneumoniae* and *Moraxella catarhhalis*, 50% were resistant to ceftazidime. All 2 (100%) isolates of *Escherichia coli* were resistant to ceftazidime.
Conclusion: Lack of antibiotic policy and indiscriminate use may have led to the emergence of resistant strains. Surveillance is essential for monitoring resistance. Antibiotic policy should be introduced to preserve the effectiveness of antibiotics.

Keywords: Endophthalmitis, Cataract, Bacterial flora.

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1. Introduction

Worldwide, cataract surgery is one of the most commonly performed eye operations. In the United States alone nearly 1.5 million surgeries are performed annually. Although infrequent, post-surgical endophthalmitis is one of the most feared complications. Even with appropriate treatment, it leads to partial or complete loss of vision.[1]

Bacterial agents comprise the most common group causing endophthalmitis. 60 to 80% of acute infections are due to gram-positive organisms. The published literature has shown the normal microbiota of conjunctiva and eyelids being responsible for postoperative endophthalmitis. The most frequently isolated *microbe is coagulase-negative Staphylococcus* followed by *Staphylococcus aureus* and *Streptococcus* species. The gram-negative organisms contribute to only 20% of the infections.[2-4]

Studies done previously have shown that cataract surgery provides access to the superficial flora of conjunctiva

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and eyelids to enter the anterior chamber which may lead to infections.[5] Owing to such reasons, ophthalmologists adopt several prophylactic measures to suppress the microorganisms, which could lead to post-surgical endophthalmitis.[6] The choice for the prophylactic topical antibiotic would depend upon the flora and its susceptibility pattern. Till recently, fluoroquinolones are commonly used prophylactic agents although the resistance of the ocular bacterial flora to these antibiotics shows an upward trend.[7] Thus, this study aimed to determine the spectrum of bacterial conjunctival flora and their antimicrobial susceptibility profile in patients undergoing cataract surgery.

2. Material and Methods

This hospital-based cross-sectional study was conducted at Narayan Medical College and Hospital, Bihar between March 2021 to November 2022. The study was approved by the Instituitional Ethics Committee (IEC: NMCH/IEC/2021/49) and adhered to the tenets of the Declaration of Helsinki. A total of 100 patients scheduled for cataract surgery were enrolled in the study after considering the inclusion and exclusion criteria.

2.1. Inclusion criterion

Adult patients aged more than 18 years who have to undergo cataract surgery and who did not have any type of ocular infection or history of contact lens usage.

2.2. Exclusion criterion

Patients with evidence of ocular infection or recent ocular trauma or on antibiotics were excluded from the study.

The patient's details were taken in the written proforma only after written informed consent was taken. A slit lamp examination was performed on each patient to find out any evidence of infection or inflammation. A conjunctival swab sample from the pre-operative eye was taken by rubbing them over the lower conjunctival sac from medial to lateral canthus and back again. All precautionary measures were taken to avoid contact with the cornea, eyelid margin, or eyelashes while taking the swab. The swabs were then transported to the medical laboratory for microbiological examination. The collected swab samples were inoculated on bacteriological culture media (blood agar and chocolate agar). Inoculated bacteriological (37ºC) media were incubated for 48 hours and microbial colonies were identified after isolation as per standard microbiological procedures. The antibiotic susceptibility testing of the isolated microorganisms was determined by the Kirby–Bauer disc-diffusion method.

2.3. Statistical analysis

Collected data was entered in the MS Excel sheet, and analysed using SPSS (Statistical Package for Social Studies) for Windows version 22.0. The type of microbe and antibiotic sensitivity were analysed using descriptive statistics represented as frequencies and percentages using the Simple percentage method.

3. Result

In this study, the subjects belonged to the age group of 35 to 86 years with a mean age of 60 years, with a male predominance 55(55%) compared to female 45(45%). Out of 100 (100%) patient's conjunctival swabs only 34 (34%) yielded bacterial growth whereas 66(66%) was negative for any Microbial growth. Among 34 culture positives, 24 (70.6%) were gram positive and 10(29.4%) were gram negative. Out of 24(100%) gram positive bacteria, the most common bacterial isolate from was *Staphylococcus aureus* 12(50.0%), in which 4(16.7%) were Methicillin resistant. *CoNS* 10(41.7%) was the second most common organism followed by *Streptococcus spp.* 2(8.3%). (**Table 1**)

Table 1: Microbial flora of conjunctiva

S. No.		Bacteria	% (n)
1	Gram Positive Cocci	*Staphylococcus aureus*	50.0 (12)
2		*CoNS*	41.7 (10)
3		*Streptococcus spp.*	8.3 (2)
4	Gram Negative Bacilli	*Klebsiella pneumoniae*	40.0 (4)
5		*Moraxella catarrhalis*	40.0 (4)
6		*Escherichia coli*	20.0 (2)

A total of twenty-four gram positive isolates were found. They were tested for antimicrobial susceptibility against Gentamicin, Chloramphenicol, Ciprofloxacin, Ofloxacin, Moxifloxacin, and Vancomycin. All the 24 (100%) isolates were susceptible to Gentamicin and Vancomycin. Of the 10 (41.7%) isolates of *CoNS*, 20% were resistant to both Chloramphenicol, Ciprofloxacin, and Moxifloxacin whereas 40% were resistant to Ofloxacin. For *Staphylococcus aureus* 50% were resistant to Chloramphenicol and Ciprofloxacin. Whereas, none was susceptible to Ofloxacin. All the isolated *Streptococcus spp.* showed 100% in vitro susceptibility to all the tested antibiotics. (**Figure 1**-**Figure 3**)

A total of ten gram negative isolates were found. They were tested for antimicrobial susceptibility against Gentamicin, Tobramycin, Ciprofloxacin, Moxifloxacin, Ceftazidime, and Polymyxin B. All the 10 (100%) isolates were susceptible to Gentamicin, Ciprofloxacin, Polymyxin B, Tobramycin, and Moxifloxacin. Of the 4 (40.0%) isolates of *Klebsiella pneumoniae* and 4 (40.0%) isolates of *Moraxella catarhhalis*, 50% were resistant to ceftazidime. All the 2 (100%) isolates of *Escherichia coli* were resistant to Ceftazidime. (**Figure 4**-**Figure 6**)

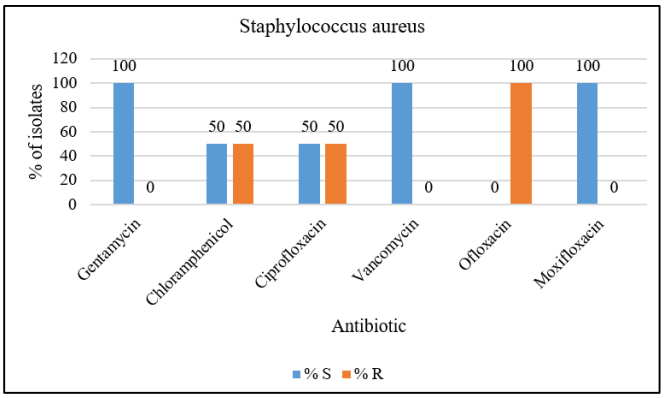

Figure 1: Susceptibility pattern of *Staphylococcus aureus* isolates (*n* = 12)

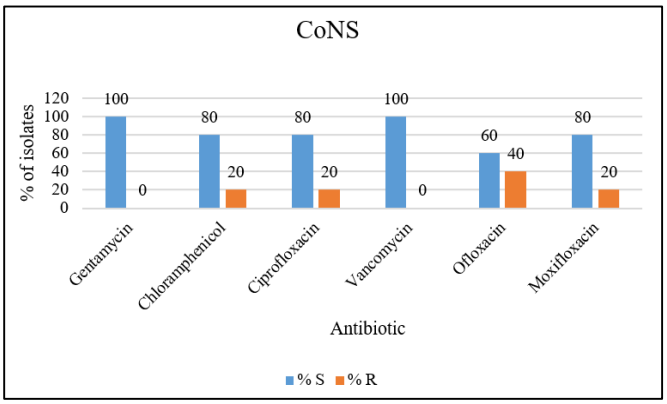

Figure 2: Susceptibility pattern of *CoNS* isolates (*n* = 10)

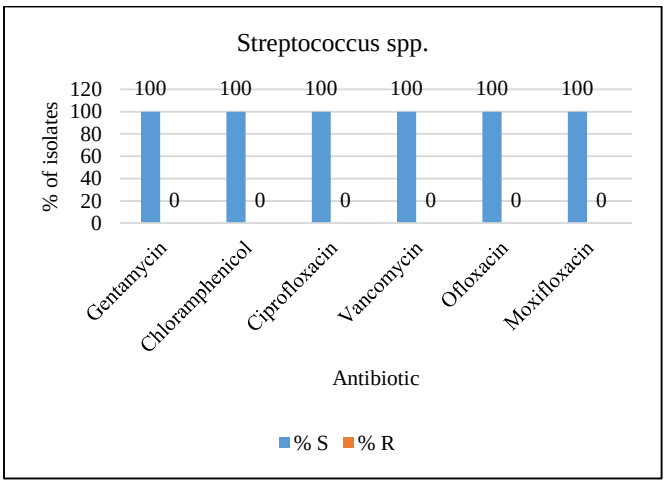

Figure 3: Susceptibility pattern of *Streptococcus spp.* isolates (*n* = 2)

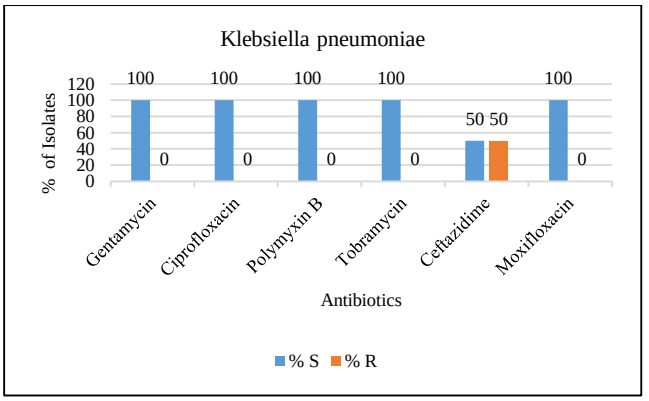

Figure 4: Susceptibility pattern of *Klebsiella pneumoniae* isolates (*n* = 4)

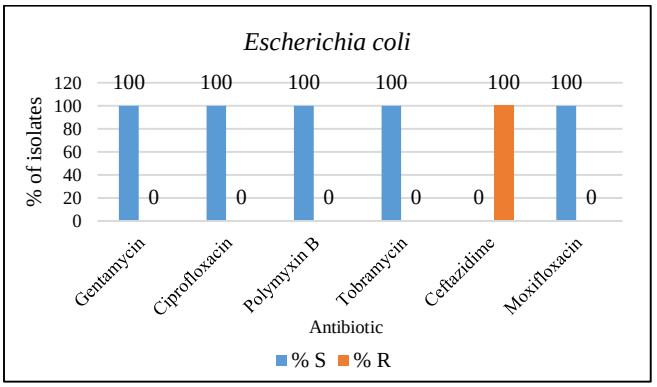

Figure 5: Susceptibility pattern of *Escherichia coli* isolates (*n* = 2)

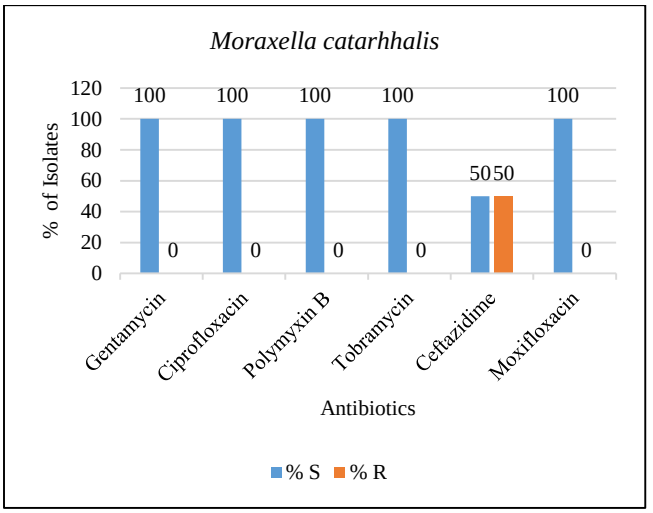

Figure 6: Susceptibility pattern of *Moraxella catarhhalis* isolates (*n* = 4)

4. Discussion

The bacterial isolates are becoming increasingly resistant to antibiotics making it crucial to outlay the superficial bacterial ocular flora and its susceptibility pattern. It guides the treating surgeon on the most appropriate prophylactic antibiotic for cataract surgeries.[8,9]

In the present study, out of the positive conjunctival swab culture reports, the gram positive constituted 24 (70.6%) and gram negative was 10(29.4%). Other studies also reported similar data.[10] In a study done by Jiang et al. Gram-positive cocci accounted for the highest proportion, 91.54% (757/827).[11]

In this study, *Staphylococcus aureus* 12(50.0%) was the most common bacteria isolated from the conjunctival swab sample, in which 4(16.7%) were methicillin-resistant. *CoNS* 10(41.7%) constituted the second most common bacterial isolate followed by *Streptococcus spp.* 2(8.3%). (**Table 1**) This is contrary to other studies where *CoNS* formed the most common bacteria isolated from conjunctival sample. In the study by Kadambari et al., *Coagulase-negative Staphylococcus* formed 41.5% as opposed to *Staphylococcus aureus* (9.6%) of the isolates.[12]

In yet another study by Jiang *et al*. *CoNS* (52.12%), formed the most common microbe isolated.[11] In the study by Shuo Xu and Hong Zhang T, the most commonly isolated bacteria was *CoNS* (64.92%), surpassing *Staphylococcus aureus* (5.76%).[13] The commonest flora isolated was *Coagulase-negative Staphylococcus* in 51% as evidenced by Purnima and Nhuchhe in their study done on 100 patients.[14]

With regards to sensitivity patterns for *Staphylococcus aureus*, all 12(100%) were susceptible to Gentamycin, Vancomycin, and Moxifloxacin whereas only 6(50%) showed sensitivity to Chloramphenicol and Ciprofloxacin. None of the isolates showed in vitro susceptibility to Ofloxacin.

Similarly, with regards to sensitivity patterns for *CoNS*, all 10 (100%) were susceptible to vancomycin & gentamycin and 8(80%) were susceptible to Chloramphenicol, ciprofloxacin and moxifloxacin. The lowest susceptibility was for ofloxacin where only 6(60%) were susceptible in a study by Terence *et al*. almost identical sensitivity patterns were noticed.[15] Fluoroquinolones are among the most common antibiotics used in cataract surgery prophylaxis. We found more susceptibility to newer quinolones compared to older quinolones like ofloxacin. The reason might be due to the prolonged and unguided use of antibiotics or self-medication.

All the isolated *Streptococcus spp*. showed 100% in vitro susceptibility to all the tested antibiotics.

All the 10 (100%) gram negative isolates were susceptible to Gentamicin, Tobramycin, Ciprofloxacin, Moxifloxacin, and Polymyxin B. Of the 4 (40.0%) isolates of *Klebsiella pneumoniae* and 4 (40.0%) isolates of *Moraxella catarhhalis*, 50% were resistant to ceftazidime. All the 2 (100%) isolates of Escherichia coli were resistant to ceftazidime. A study done by Terrence *et al.*, showed that culture isolates showed maximum susceptibility to moxifloxacin and gentamycin similar to the present study.[15]

In the study done by Mamah *et al*., 76% of gram positive cultures and 90% of gram negative cultures were susceptible to gentamicin as compared to 100% in the present study and 68% of cultures were susceptible to moxifloxacin as compared to 94% in the current study. According to one of the studies, Ofloxacin showed 82% in vitro susceptibility for the gram positive culture isolates as compared to < 50% in this study.[16]

In a study conducted by Lin *et al*., *Moraxella catarrhalis* accounted for only 1.2% of culture-positivity in contrast to 11.76% in the present study. Furthermore, 35% of *Staphylococcus aureus* were MRSA in comparison to 16.7% in the present study.[17]

All MRSA isolates were susceptible to Vancomycin which is comparable to the present study. Lemaire *et al.*, in their study, reported that 82.5% of all isolates were susceptible to Moxifloxacin as compared to 94.11% in the present study and found Moxifloxacin to be highly effective against MRSA.[18]

In the study done by Manente *et al.*, 81.8% of Gram-positive bacteria were isolated as compared to 91.54% documented in the study by Jiang *et al.*, These isolates showed high susceptibility to vancomycin and moxifloxacin similar to the present study.[11,19]

A study done by Terrence *et al.* showed that culture isolates showed maximum susceptibility to moxifloxacin and gentamycin similar to the present study.[15]

The other gram-positive bacteria isolated was *Streptococcus spp.* which showed high susceptibility 2(100%) and no resistance to gentamycin, chloramphenicol, ciprofloxacin, vancomycin, ofloxacin and moxifloxacin. *Streptococcus* spp. is also the second most common organism isolated from endophthalmitis patients, post-cataract surgery.

Kurniawan *et al.* studied 101 cases of streptococcus endophthalmitis over a 15-year period and found that 87.1% of the infection occurred postoperatively, and cataract surgery was the most commonly performed operation.[20]

Many studies have shown that gram negative bacteria have high susceptibility for fluoroquinolones which correlates with our finding. In the present study gram negative organisms have shown resistance to Ceftazidime.

5. Conclusions

1. Conjunctival sac flora was dominated by Gram-positive cocci, mainly *Staphylococcus aureus, Coagulase negative Staphylococcus,* and *Streptococcus spp.*
2. *S. aureus* was the most common preoperative conjunctival bacteria followed by *CoNS.*
3. Patients need prophylactic therapy before undergoing the cataract surgery to minimize entry of

bacteria during surgery which may lead to post-operative ocular infection.

4. Decision on the choice of antibiotic would need identification and antimicrobial sensitivity testing. Antibiotics are often prescribed empirically as culture and susceptibility tests need 48 to 72 hours.
5. Lack of uniform antibiotic policy and indiscriminate antibiotic use may have led to the emergence of resistant bacterial strains. In addition, regular surveillance is essential for monitoring locality-wise resistance patterns.
6. An effective national and state-level antibiotic policy and draft guidelines should be introduced to preserve the effectiveness of antibiotics and for better patient management.

6. Limitations

1. It is a single-centre study, with a small sample size.
2. The comorbidities were not considered.
3. This is a hospital-based study which is not a true representation of the community.

7. Source of Funding

None.

8. Conflict of Interest

None.

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