Section: Microbiology

Original Research Article

PREOPERATIVE CONJUNCTIVAL MICROFLORA: COAGULASE NEGATIVE STAPHYLOCOCCUS (CONS), A HIGH-RISK FACTOR FOR POSTOPERATIVE INFECTION AND ANTIBIOTIC SUSCEPTIBILITY IN SOUTH INDIANS BEFORE CATARACT SURGERY.

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ABSTRACT

Background: Cataract surgery is one of the most common procedures globally, with 0.013% to 0.7% of cases associated with complications such as postoperative infections, including endophthalmitis, which can lead to blindness. These infections often originate from the patient's conjunctival flora, with Staphylococcus aureus and coagulase-negative staphylococci (including Staphylococcus epidermidis) being the most common bacteria found on the ocular conjunctival surface.
Materials and Methods: The study involved 118 patients scheduled for cataract surgery at ESIC-MC & PGIMSR Hospital over 6 months. Conjunctival swabs were collected from each patient's eyes before administering any antibiotic drops or local anaesthetics. These samples were inoculated onto blood agar plates and sent to the microbiology laboratory for culture and sensitivity testing. The un-operated eyes served as controls. Bacterial colonies were identified through Gram staining, and biochemical reactions and antibiotic susceptibility patterns were determined using the Kirby-Bauer disc diffusion method.
Results: Out of 118 conjunctival swabs received for culture, a total of 63(53.38%) samples yielded growth. Among them, 57(90.06%) showed CoNS as growth which was sensitive to Linezolid & Amikacin (100%), Gentamycin (94.73%), Clindamycin (80.7%), and resistant to Erythromycin (49.13%) Penicillin & Ciprofloxacin (35.09%), Levofloxacin (33.34%), Methicillin (21.05%), followed by *Staphylococcus aureus* 5 (7.93%) and *Citrobacter kosari* 1 (1.59%)
Conclusion: We conclude that Coagulase-negative *Staphylococcus* is the most common bacteria isolated from the conjunctiva before cataract surgery. This study may help eye surgeons choose pre- and post-operative antibiotics to avoid post-operative infections.
Keywords: Conjunctival flora, Coagulase Negative *Staphylococcus*, Cataract surgery.

INTRODUCTION

Cataract is the leading cause of vision loss worldwide, including in India. Cataract surgery is one of the most commonly performed operations globally, with approximately 1.5 million procedures conducted annually in the United States.[1] Age-related conditions account for 48% of blindness, affecting approximately 18 million people worldwide.[2] Cataract surgeries have become widespread in both developing and developed countries thanks to advancements in medical science and innovations in technology, procedures, and instruments. As a result, nearly all patients experience a significant improvement in visual acuity following treatment. Additionally, due to advancements in technology and infection control practices, the incidence of endophthalmitis after cataract surgery is decreasing.[3] However, if postoperative endophthalmitis occurs, there is a high risk of loss of vision and at the same time; the risk for endophthalmitis is a mental burden for the surgeon.[4]

Postoperative endophthalmitis following intraocular surgeries such as vitrectomy, cataract, and glaucoma surgeries is rare but affects the general well-being and the patient's mental health.[5] To reduce the rate of infection related to eye surgeries, bacterial culture from a swab of the conjunctival sac has been commonly done in preoperative assessment for intraocular surgeries to determine whether a patient is at risk for. Postoperative infection,[6,7] and refractive surgery.[8] Conjunctival sac culture has been used in addition to knowing changing patterns in the bacterial flora in the eye.

Endogenous bacterial flora of the conjunctival sac influences the bacterial pathogens causing endophthalmitis after cataract surgery.[4] Diabetes mellitus, corticosteroid use, general condition, and age play a role in altered Conjunctival sac bacterial flora.[9,10]

MATERIAL AND METHODS

Study Design: Prospective Study

Source of Data: The study population comprised 118 patients who underwent cataract surgery in the Department of Ophthalmology of ESIC-MC & PGIMSR Hospital for 6 months from June 2020 to November 2020.

Study Subjects

Inclusion Criteria

1. Patients diagnosed with age-related cataracts.
2. Able to provide informed consent.

Exclusion Criteria

1. Active ocular infections (e.g., conjunctivitis).
2. Recent use of systemic or topical antibiotics within 3 months.
3. History of previous ocular surgeries affecting conjunctival flora.

Sample Collection: Two weeks before cataract surgery, specimens for bacteriologic examination were collected from the conjunctival sac, without anaesthesia, by lightly rubbing the inferior palpebral conjunctiva with a sterile cotton swab, and were transferred within 1 hour to the clinical laboratory of the hospital for plating on blood agar medium and chocolate agar medium.

Identification of Isolates: Plates were evaluated for growth at 24 - 48 hours. Bacterial isolates grown in culture were identified using Gram staining and biochemical reactions by standard microbiological techniques.

Antibiotic susceptibility testing was done against antibiotics by using the Standard Kirby Bauer disk diffusion method by Clinical and Laboratory Standards Institute (CLSI) criteria. Every batch of Mueller-Hilton agar and antibiotic discs was tested by using the following control strains: ATCC 25922 *Escherichia coli*, ATCC 27853 *Pseudomonas aeruginosa*, ATCC 25923 *Staphylococcus aureus* and ATCC *Enterococcus faecalis* and cotrimoxazole for quality control of MHA plates

Statistical analyses were performed using IBM SPSS Statistics for Windows (version 24.0; IBM Corp, Armonk, NY). The 2 × 2 Chi-square test was employed for categorical comparison

RESULTS

Of 118 patients in this study who underwent cataract surgery, 55 (46.62%) showed Sterile/No growth, and 63 (53.4%) showed Microbial growth after 48 hours of aerobic incubation at 370C. [Table 1]

Among 118 patients, 46.62% yielded no bacterial growth and 53.4% yielded growth.

Coagulase Negative Staphylococcus was the most commonly isolated bacteria followed by Staphylococcus aureus and Citrobacter koseri. [Table 2]

Among Gram-positive isolates Amoxicillin-clavulanic acid (56.5%) was the most resistant followed by Erythromycin (50%) and Penicillin (38.7%). [Table 3]

In our study, 2 were Methicillin Resistant Staphylococcus aureus (MRSA) accounting for 40%, and the remaining 60% were Methicillin Sensitive Staphylococcus aureus (MSSA). [Table 4]

In our study, 2 iMSLB and 2 isolates were cMLSB accounting for 40%. Among the 2 iMSLB Staphylococcus strains one was MSSA and one more was MRSA. [Table 5]

Maximum bacterial culture-positive patients belong to ≥81 years followed by 61-70 years and 71-80 years. [Table 6]

Diabetes (50.8%) was found to be the highest risk factor among bacterial culture-positive patients followed by Usage of any eye drops (12.3%) and Hyperlipidaemia (11.11%). [Table 7]

Table 1: The number of patients with Growth and No Growth

Growth status	Number of Patients	Percentage (%)
Sterile (No growth)	**55**	**46.62**
Microbial growth	**63**	**53.38**

Table 2: Microbiological profile of positive conjunctival sac. (n=63)

Microbial flora	No of Strains (n=63)	Percentage (%)
Coagulase Negative Staphylococcus	**57**	**90.5**
Staphylococcus aureus	**5**	**7.93**
Citrobacter koseri	**1**	**1.59**

Table 3: Antibiotic Resistance pattern of bacterial isolates

Antibiotic	CoNS (n=57)	Staphylococcus aureus (n=5)	Citrobacter kosari
Amikacin	0 (0%)	1 (20%)	0 (0%)
Gentamycin	3 (5.27%)	3 (60%)	0 (0%)
Ciprofloxacin	20 (35.09%)	4 (80%)	1 (100%)
Cotrimoxazole	5 (8.8%)	3 (60%)	0 (0%)
Erythromycin	28 (49.12)	3 (60%)	-
Linezolid	0 (0%)	0 (0%)	-
Teicoplanin	0 (0%)	0 (0%)	-
Tetracycline	0 (0%)	0 (0%)	-
Amoxicillin-clavulanic acid	30 (52.63%)	5 (100%)	1 (100%)
Clindamycin	11 (19.3%)	3 (60%)	-
Penicillin	20 (35.09%)	4 (80%)	-
Piperacillin	-	-	1 (100%)
Cefoperazone	-	-	0 (0%)
Cefoperazone-sulbactam	-	-	0 (0%)
Imipenem	-	-	0 (0%)

Table 4: Distribution of MRSA

	No of isolates (n=5)	Percentage (%)
MRSA	2	40
MSSA	3	60
Total	5	100

Table 5: Shows Staphylococcus strains to produce iMSLB (inducible macrolide streptogramin b lincosamide resistance) and cMSLB (constitutive macrolide streptogramin b lincosamide resistance)

	No of isolates (n=5)	Percentage %
cMSLB	2	40

Table 6: Age categories of the patients who had Microbial growth

Age (years)	Culture positive/total (%)
≤60	4/15 (26.6)
61-70	28/49 (57.1)
71-80	25/45 (55.5)
≥81	6/9 (66.7)

Table 7: Bacterial detection rate dependent on high-risk factors (n=63)

Risk factor	No of patients	Percentage (%)
Diabetes mellitus	32	50.8%
Diabetic retinopathy	05	7.9%
Dialysis	02	3.2%
Hyperlipidemia	07	11.11%
Steroid therapy	01	1.5%
Dry eye syndrome	02	3.2%
Usage of any eye drops	09	12.3%
Allergic conjunctivitis	01	1.5%

DISCUSSION

The findings of this study highlight the critical role of preoperative conjunctival microflora in contributing to postoperative complications in patients undergoing cataract surgery in a South Indian population. Our findings indicate that Coagulase-negative Staphylococcus (CoNS) is the primary bacterium identified from the conjunctiva, accounting for 90.5% of the total bacterial growth detected. This is consistent with previous studies that have identified CoNS as a common inhabitant of the ocular surface, particularly in elderly populations undergoing cataract surgery.[11]

Generally, CoNS are regarded as non-pathogenic and low-virulence organisms, but their presence as part of the normal conjunctival flora can pose a significant risk if they penetrate deeper tissues during surgery. Cataract surgery disrupts the normal anatomical barriers, creating an opportunity for these low-virulence organisms to cause postoperative infections. Our study highlights that commonly used antibiotics like amoxicillin-clavulanic acid (52.63%) and erythromycin (49.12%) show significant resistance, emphasizing the need for preoperative prophylactic antibiotic selection to be guided by local antibiotic policies.

The findings and suggestions are consistent with those of the study conducted by Gower EW et al.[12] The antibiogram revealed that CoNS isolates were most susceptible to Linezolid, Amikacin, and Teicoplanin (100%), indicating that these antibiotics could be effective choices for both prophylaxis and treatment of postoperative infections.[13] However, the significant resistance of CoNS to commonly used antibiotics like Ciprofloxacin (35.09%) and Penicillin (35.09%) highlights the growing challenge of antibiotic resistance. Frequent use of these antibiotics in community and hospital settings has led to the development of resistance.[14] Our findings emphasise a small but substantial percentage of Methicillin-resistant Staphylococcus aureus (MRSA) isolates (40%), which is reliable with global trends of rising MRSA prevalence.[15] The prevalence of MRSA and inducible macrolide-lincosamide-streptogramin B (iMLSB) resistance further complicates antibiotic management in postoperative infections, necessitating careful antibiotic stewardship.

According to the study, microbial growth is significantly influenced by age, with 81 years of age and older showing the highest prevalence. This could be explained by the immune system and ocular surface alterations associated with ageing, which make older people more vulnerable to bacterial colonization. Diabetes mellitus is the most prevalent risk factor for bacterial colonization, involving 50.8% of patients. This result is consistent with earlier studies showing a greater rate of ocular surface infections in patients with diabetes.[16] Diabetes-related hyperglycaemia can change the flora of the conjunctiva by weakening the immune system and encouraging bacterial growth.

CONCLUSION

This study finds that Coagulase-negative Staphylococcus is the most common bacterium in the conjunctival flora of cataract surgery patients. In conclusion, our research emphasizes how critical it is to comprehend local microbial profiles and patterns of antibiotic resistance to effectively prevent postoperative infections after cataract surgery. Ophthalmologists must keep up with local microbiological data and modify preventive and therapeutic measures in light of the growing trends in antibiotic resistance.

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