Prevalence and Types of Bacteria Associated With Ocular Infections of Patients Visiting the Optometry Clinic of Federal University of Technology Owerri

Anastasia NneNna Ogu
Federal University of Technology Owerri

Josephat N Okereke
Federal University of Technology Owerri

Sylvia O Anyadoh-Nwadike
Federal University of Technology Owerri

Chukwunonyerem Chika Ogwunga (nonyeogwunga@gmail.com)
Federal University of Technology Owerri https://orcid.org/0000-0001-7839-8272

Research Article

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Abstract

The prevalence and types of bacteria associated with ocular infections were studied using swab samples from ocular infected patients attending the Department of Optometry, Federal University of Technology, Owerri clinic. A total of fifty specimens were collected from patients comprising fourteen males and thirty-six females with ocular infections and analyzed aseptically in the Biotechnology laboratory within thirty minutes of collection. The samples were maintained on peptone broth in test tubes and about 1 ml of the overnight peptone broth culture was transferred into sterile petri dishes containing the culture media (nutrient, blood and macConkey agar). Standard microbiological and biochemical protocols were used for isolation, characterization and identification of the bacterial isolates. All specimens had bacterial growth. Fifty-seven bacterial isolates; 35 Gram positive and 22 Gram negative bacteria were identified. These fell into twelve species; *Bacillus* sp., *Corynebacterium* sp., *Pseudomonas aeruginosa*, *Haemophilus* sp., *Staphylococcus aureus, Lactobacillus* sp., *Klebsiella* sp., *Citrobacter* sp., *Proteus mirabilis*, *Streptococcus pneumoniae*, *Listeria* sp. and *Neisseria* sp. The predominant bacterial species isolated was *Bacillus* sp. 17 (29.8%) while *Streptococcus* sp., *Listeria* sp., and *Neisseria* sp. were the least with 1 (1.8%) each. The prevalence rate of bacteria was higher among the female gender within the age group 21 -30 years. The burden of bacterial infections of the eyes is high. The prevalence and types of bacteria may not be exactly the same in every part of the world. To mitigate the burden of ocular infections, physicians need to comply with etiologic approach of diagnosis and treatment regimen.

Introduction

Bacteria are the major causative agents of ocular infections worldwide as the bacterial pathogens inhabit the ocular surface [1] [2]. They gain access into the eye through different routes and cause infections [3]. Trauma, surgery and systemic diseases are among the contributory factors to ocular infections [4].

Ocular infections are eye conditions, diseases and vision problems; frequently reported clinical manifestations include conjunctivitis, keratitis, blepharitis, hordeolum and dacryocystitis [5].

Previous studies in different countries have reported the prevalence of bacterial isolates among patients with ocular infections. Amsalu *et al*. (2015) [6] reported a prevalence of 143 (50.9%) bacterial isolates with Gram positive cocci as the most common isolates. *Staphylococcus aureus* 30 (21%) was the predominant species followed by coagulase-negative *Staphylococci* (CoNS) 26 (18.2%) and *Streptococcus pneumoniae* 20 (14.0%). A prevalence of 2599 (58.8%) was reported by Bharathi *et al*. (2010) [7] and *Staphylococcus aureus* 697 (26.7%) was the predominant bacteria followed by *Streptococcus pneumoniae* 578 (22.1%), *P. aeruginosa* 218 (8.4%), *Corynebacterium* sp. 207 (7.9%) and *Haemophilus* sp. 153 (5.9%) while a slightly higher prevalence, 462 (61%) was reported in a study by Ramesh *et al*. (2010) [8] with *Staphylococcus aureus* 195 (25%) as the predominant species isolated followed by *Streptococcus pneumoniae* 169 (21.8%) and coagulase- negative *Staphylococci* (CoNS) 142 (18.3%).

In another study by Tewelde *et al*. (2013) [9], a high prevalence of 148 (74.7%) was reported with *S. aureus* 42 (28.4%) as the most frequent bacteria followed by *P. aeruginosa* 31 (21%) and *S. pneumoniae* 20 (13.5%). A similar study by Shahaby *et al*. (2015) [10] reported a prevalence of 70 (78.7%) with *S. aureus* 54 (19.6%) as the predominant bacteria followed by coagulase –negative *Staphylococci* (CoNS) 45 (16.4%) and *B. subtilis* 42 (15.3%) while a higher prevalence of 168 (88%) was reported by Getahun *et al*. (2017) [11] with *Staphylococcus aureus* 96 (50.3%) as the predominant bacteria followed by coagulase- negative *Staphylococci* (CoNS) 64 (33.5%) and *Klebsiella* species 9 (4.7%).

Ocular infections if not treated, can damage the structures of the eye thereby causing visual impairments and blindness [12]. Despite the fact that the eye is hard and protected by the continuous flow of tears containing antibacterial compounds, once inflammation and scarring occur may not be easily resolved as a result of the infection and immediate management will be required [13].

This study is therefore done to determine the prevalence and types of bacteria associated with ocular infections in order to come up with baseline data that will be useful for medical practitioners as well as the unassuming populace on the presence and abundance of such organisms. This is expected to aid empirical treatment of the infections.

The specific objectives of the study include to;

- Isolate and identify ocular bacterial pathogens from study subjects
- Determine the prevalence of the pathogens among study subjects
- Assess age as a risk factor in ocular bacterial infections.
- Determine if gender is an important risk factor in ocular bacterial infections.

Methodology

Materials and Methods

Location of Study:

This research was carried out using ocular patients attending the Department of Optometry, FUTO clinic, within the time of the study.

Ethical permission and informed consent:

Ethical permission was sought and obtained from the ethical committee of School of Health Technology, Federal University of Technology, Owerri.

The research subjects' informed consent was obtained prior to recruitment for the study.

Sample collection and preparation:

A total of fifty (50) samples were collected from out-patients with different types of ocular infections using sterile swab sticks. The swab sticks were used to collect the samples aseptically from the conjunctival sac, labeled appropriately and taken to the Biotechnology laboratory within 30 minutes of collection for investigations.

Interviewee and interviewer administered questionnaires were used to collect other data.

Isolation and Characterization of organisms:

The samples were maintained on peptone broth in test tubes and about 1 ml of the overnight peptone broth culture was transferred into sterile Petri dishes containing the culture media (nutrient, blood and macConkey agar). The spread plate culture technique as described by Ogbulie *et al*. (2001) [14] was adopted for the isolation of the organisms.

Characterization/Identification of Isolates:

Gram staining and other appropriate biochemical tests like Indole, citrate utilization, oxidase, coagulase, motility, hemolysin, sugar fermentation and catalase tests were carried out as described by Cheesborough (2004) [15].

Statistical analysis

Frequencies and percentages were calculated for study variables. Other statistical tools used were Analysis of Variance (ANOVA) and T- test to make inferences from data.

Results

Bacteria Identification

A total of fifty (50) patients with ocular infections were recruited for this study, out of these were 14 males and 36 females. Out of the fifty (50) samples cultured, fifty-seven (57) bacterial isolates were identified. The cultural, morphological characteristics and biochemical identification of the bacteria isolated from ocular infections are summarized (Table 1). The most frequently isolated bacteria were Gram positive 35 (61.4%) and Gram negative 22 (38.6%). The cultural, morphological characteristics and biochemical identification of the bacteria isolated from ocular infections are summarized in Table 1.

Frequency of isolated bacteria.

The predominant bacterial species isolated was *Bacillus* sp. 17 (29.8%) while *Streptococcus* sp., *Listeria* sp., and *Neisseria* sp. were the least with 1 (1.8%) each (Table 2).

Table 2
Frequency of Bacterial isolates from patients with Ocular Infections

Bacterial Isolates	Number Isolated	Frequency (%)
Gram positive:		
Bacillus sp.	17	29.8
Corynebacterium sp.	8	14.0
Staphylococcus sp.	5	8.8
Lactobacillus sp.	3	5.3
Streptococcus sp.	1	1.8
Listeria sp.	1	1.8
Total	**35**	**61.4**
Gram negative:		
Pseudomonas sp.	8	14.0
Haemophilus sp.	7	12.3
Klebsiella sp.	2	3.5
Citrobacter sp.	2	3.5
Proteus sp.	2	3.5
Neisseria sp.	1	1.8
Total	**22**	**38.6**

Relationship between age, sex and bacterial load of patients affected with ocular infections

The relationship between age, sex and bacterial load in ocular infections are shown in (Table 3). A total of 14 males and 36 females were recruited as study subjects with ocular infections under 5 distinct age groups. Age group 21–30 years was the highest in number with 12 females and 8 males while age group 41–50 years was the least with 2 females and 1 male. The prevalence rate of bacteria was higher among the female gender within the age group 21–30 years while the least occurrence was among the age group 41–50 years. The total viable count for both the male and female were 2.5×10^3 and 7.6×10^3 respectively while age group 21–30 years had the highest viable count, the age group 41–50 years had the lowest viable count. However, there was no significant difference across the age group and between the sexes.

Table 3
Viable bacterial count according to age group and sex

Viable bacterial count (cfu/ml)	Age groups (years)					Total viable count (cfu/ml)
	10–20	21–30	31–40	41–50	Above 50	
Male	1	8	3	1	1	2.5×10^3
female	6	12	7	2	9	7.6×10^3
Total viable count, TVC (cfu/ml)	1.4×10^3	3.8×10^3	2.5×10^3	5.0×10^2	1.9×10^3	1.0×10^4
Mean viable count (cfu/ml)	2.0×10^2	1.9×10^2	2.5×10^2	1.7×10^2	1.9×10^2	1.0×10^3

$P > 0.05$

There is therefore no significant difference in viable count among the age groups.

$P > 0.05$

There is also no significant difference in viable count between male and female subjects

Discussion And Conclusion

Results revealed that all 50 specimen had bacterial growth, this may imply that bacteria are associated with most eye infections. Earlier studies have also implicated various bacteria species in different ocular infections [11]; [6]; and [10]. Bacteria have also been known to be versatile and ubiquitous [14]; [16]. One of the isolate in this study *Pseudomonas aeruginosa* is also a known recalcitrant organism [15]; [16].

In this study, Gram positive and Gram negative bacteria were isolated as causative agents of ocular infections with Gram positive bacteria having a prevalence of 61.4% while Gram negative bacteria had a prevalence of 38.6%. This was in agreement with a previous study by Amsalu *et al*. (2015) [6] where a prevalence of 61.5% for Gram positive bacteria and 38.5% for Gram negative bacteria was reported and also a higher prevalence of 168 (88%) for Gram positive bacteria and lower prevalence of 23 (12%) for Gram negative bacteria was also reported by Getahun *et al*. (2017) [11]. The predominant bacterial isolates were *Bacillus* sp. 17 (29.8%) followed by *Corynebacterium* sp. 8 (14.0%) and *Pseudomonas* sp. 8 (14.0%). This finding does not agree with previous studies as *Staphylococcus* sp. was the predominant isolate reported by Tewelde *et al*. (2013) [9], Shahaby *et al*. (2015) [10], Ramesh *et al*. (2010) [8], Getahun *et al*. (2017) [11], Amsalu *et al*. (2015) [6] and Bharathi *et al*. (2010) [7]. Gram positive *bacilli* are known to cause 22.6% of conjunctivitis cases according to a study by Iwalokun *et al*. (2011) [17] where *Corynebacterium* sp. 25 (16.1%) was the predominant Gram positive *bacilli* followed by *Bacillus* sp. 10 (6.5%) while *P. aeruginosa* 15 (9.7%) was the most commonly isolated Gram negative bacteria. However,

Tewelde *et al*. (2013) [9] reported that predominant pathogens may not be exactly the same in all areas of the world.

The prevalence rate of bacteria was higher among the age group 21- 30 years. This is the peak of youth, this finding therefore becomes worrisome and calls for early intervention. However, the prevalence of ocular infections was not statistically significantly associated with age.

In this study, females were observed to be more infected than their male counterpart. This corroborates the study by Lewallen *et al*. (2009) [18] who reported that feminine gender was significant risk factor for some eye diseases. However, the prevalence was not found to be statistically associated with sex in this study.

In conclusion, this study has revealed baseline data of types and prevalence of bacteria in ocular infections. According to Aklilu *et al*. (2018) [19], knowledge of the prevalence and type of bacteria associated with ocular infections helps for prompt diagnosis and commencement of appropriate treatment, proper management of such infections by ensuring patients and health care workers constantly wash their hands to avoid cross- infection, limitation of hospital- acquired infection by healthcare workers. It is also expected to arm health educators for proper development and teaching of appropriate infection control policy with regular reinforcement and review. These are expected to help curb the menace of bacterial infections of the eye.

Declarations

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Conflicts of interest:

We unequivocally declare that there is no real or perceived conflicts of interest.

Availability of data and material:

All data and materials used were indicated.

Code availability

Not applicable

Authors' contributions:

All author contributed substantially to the manuscript and approved the final submission.

Ethics approval:

Ethical permission was sought and obtained from the ethical committee of School of Health Technology, Federal University of Technology, Owerri.

Consent to participate:

The research subjects' informed consent was obtained prior to recruitment for the study.

Consent for publication:

Not applicable

Authors' contributions:

All author contributed substantially to the manuscript and approved the final submission.

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Tables

Due to technical limitations, Table 1 is only available as a download in the Supplemental Files section.

Supplementary Files

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- Table1.docx