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Profile of Bacterial Pathogens and Antibiotic Susceptibility of Ear Infection in National Hospital Abuja, Nigeria

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ABSTRACT

Background: Ear infection is a common problem in children and adults globally. It can lead to the development of hearing impairment with attendant consequences on learning, communication and social life. Life-threatening complications such as meningitis, brain abscess and even, ear tumour, can result from the untreated or poorly treated ear infection.

Aim: To determine the bacteriologic profile and antimicrobial susceptibility pattern of ear infection from patients seen at National Hospital Abuja (NHA).

Methods: This is a retrospective study conducted at NHA. Laboratory data of processed ear swab samples of patients who were clinically diagnosed of having an ear infection at NHA were extracted, reviewed and analyzed from February 2015-December 2016.

Results: Out of a total of 195 ear swab samples of patients analysed within the study period, 157 grew bacterial pathogens giving an infection prevalence of 80.5%. The prevalence of ear infection was higher in males (57.1%) than females. The highest cases of ear infection (64.3%) were found in children aged 10 years and below. Of the patients who had the ear infection, 150 (95.5%) had a single bacterial infection, while 7(4.5%) had mixed infection. Of the total of 170 bacterial pathogens isolated, 97 (57.1%) were gram-negative bacteria. Staphylococcus aureus was the most predominant isolates, followed by Pseudomonas aeruginosa, Proteus spp, Klebsiella pneumonia, and Escherichia coli. The predominant bacterial pathogens were generally highly susceptible to ciprofloxacin, imipenem, meropenem, amikacin and gentamycin. Staphylococcus aureus was particularly susceptible to aminoglycosides, ampicillin-sulbactam, ceftazidime, carbapenems, ciprofloxacin and chloramphenicol.

Conclusion: The prevalence of ear infection was very high in this study. The susceptibility spectrum of Staphylococcus aureus, the most common cause of ear infection in this study offers hope of successful treatment in our setting. Concerted efforts in instituting good antibiotics prescription and for a regular monitoring of antibiotics susceptibility pattern are essential in preventing the emergence of multidrug-resistant organisms.

Key Words: Profile, Bacterial Pathogens, Ear Infection, National Hospital, Abuja

INTRODUCTION

Ear Infection is an inflammation of the ear and one of its commonest symptoms is ear discharge. It is a common reason for a hospital visit, and for a need for antibiotics [1]. Ear infection is a common problem for both children and adults [2]. Although it can be caused by viruses and fungi, the majority of cases are caused by bacteria [2,3,4]. About 65-330 million people suffer from ear infection globally and significant hearing impairment develops in 60% of this population [2]. In addition, it can lead to the development of complications such as meningitis, brain abscess, tumour in the middle ear, post aural swelling and aural sinus complications [5]. The health and economic burden of ear infection are also huge especially in Africa and other developing nations where the disease prevalence has been estimated to be as high as 11% [6]. The type, frequency and antimicrobial resistance pattern of bacterial etiologic agents from ear infection vary among populations due to variability in geography, local antimicrobial prescribing practices and prevalence of resistant bacterial strains [5, 7, 8]. Various studies have identified Pseudomonas aeruginosa (P. aeruginosa), Staphylococcus aureus (S. aureus), Proteus mirabilis (P. mirabilis), Klebsiella pneumonia (K. pneumonia), and Escherichia coli (E.coli) as the commonly isolated organisms from cases of ear infection [5, 9, 10, 11, 12]. In Abuja, there is a dearth of data on bacterial causes of ear infection and their antimicrobial susceptibility pattern. This study is aimed at closing this information gap.

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MATERIALS AND METHODS

This was a laboratory-based descriptive study conducted between February 2015 and December 2016 at the Medical Microbiology Laboratory of National Hospital, Abuja, Nigeria. The laboratory records of patients' ear samples processed within the study period were extracted, reviewed and analyzed. In our laboratory, ear swab samples aseptically collected from patients with various ear infections are directly inoculated on Blood, Chocolate and MacConkey agar plates without delay. The blood agar and McConkey agar plates are incubated at 35-37°C for 24 hours aerobically, while the chocolate plates are incubated at 35-37°C for 24 hours under 5% CO2 in a candle jar. All bacterial isolates are identified using standard bacteriological methods [13,14]. Antibiotic susceptibility testing is carried out on the isolates using the Kirby Bauer method and in accordance with the recommendations of the Clinical and Laboratory Standards Institute for disc diffusion tests [15].

RESULT

Out of 195 patients' ear swab samples processed within the study period, 157 (80.5%) yielded bacterial growth. Ninety-seven (61.8%) of the patients who had bacterial ear infection were males, while 60 (38.2%) were females (Table 1). One hundred and one (64.3%) of the individuals with ear infection were in the age group 0-10 years, 11 (7.0%) in the age group 11-20 years, and 11 (7.0%) in the age group 21-30 years (Table 1). Of the 157 individuals who had an ear infection, 150 (95.5%) had single bacterial infections, while 7 (4.5%) had mixed bacterial infections (Table 1).

A total of 170 (87.2%) bacterial isolates were obtained from the 195 processed ear swab samples. Ninety-seven (57.1%) of the bacterial isolates were Gram-negative bacteria, while 73 (42.9%) were Gram-positive bacteria. Sixty-nine (40.6%) of the bacterial isolates were S. aureus, 61 (35.9%) P. aeruginosa, 13 (7.7%) proteus spp, 11 (6.5%) K. pneumonia, 5 (2.9%) E. coli, and 11 (6.4%) were others (Table 2).

The sensitivity of meropenem and ampicillin/sulbactam to S. aureus was 100% respectively, while amikacin was 91.9%, imipenem 91.7%, ciprofloxacin 78.4%, gentamycin 78%, and chloramphenicol 73.3% (Table 3). The sensitivity of imipenem to P. aeruginosa was 100%, while gentamycin was 88.4%, ciprofloxacin 86.4%, meropenem 78.4%, and amikacin 73.0% (Table 3). For Proteus spp, meropenem was 100% sensitive, imipenem 87.5%, ciprofloxacin 81.8%, and amikacin 66.7% (Table 3). All the K. pneumoniae isolates were susceptible (100%) to meropenem and imipenem, while susceptible to amikacin and ciprofloxacin were 85.7% and 50% respectively (Table 3). Also, all the E. coli isolates were susceptible (100%) to ciprofloxacin, gentamycin, amikacin, and meropenem, while 75% of the isolates were susceptible to chloramphenicol (Table 3). In addition, Providentia spp was 100% sensitive to ciprofloxacin, imipenem, amikacin, meropenem and ceftazidime, while it was 50% susceptible to chloramphenicol or ampicillin-sulbactam (Table 3).

Furthermore, the susceptibility of Enterococcus spp was 100% to ciprofloxacin, amikacin, gentamycin and augmentin (Not shown). The sensitivity of the various tested antibiotics to Morganella morgani (M. morgani) was as follows: amikacin (100%), imipenem (100%), ceftazidime (50%), gentamycin (50%), ciprofloxacin (0%), ceftriaxone (0%), augmentin (0%), chloramphenicol (0%) (Not shown). Citrobacter freundii (C. freundii) was 100% susceptible to ciprofloxacin, ceftazidime and chloramphenicol respectively, but was 50% susceptible to amikacin, none was sensitive to gentamycin or ceftriaxone (Not shown). With the exception of clindamycin and ciprofloxacin which recorded sensitivity of 0% to Streptococcus spp, 100% sensitivity was recorded for augmentin, gentamycin and chloramphenicol (Not shown). The sensitivity of the antibiotics tested against Coagulase -Negative Staphylococcus showed 100% to gentamycin, 100% to cefuroxime and 0% to either azithromycin or chloramphenicol (Not shown).

Table 1.
Distribution of Ear Infection by Age, Gender and Nature of Infection

Age (years)	No. (%)
0-10	101 (64.3)
11-20	11 (7.0)
21-30	11 (7.0)
31-40	8 (5.1)
41-50	4 (2.6)
51-60	2 (1.3)
≥61	2 (1.3)
Unspecified	18 (11.4)
Total	**157 (100)**
Gender	**No.(%)**
Male	97 (57.1)
Female	60 (42.9)
Total	**157 (100)**
Nature of Infection	**No. (%)**
Single Bacterial Aetiology	150 (95.5)
Mixed Bacterial Aetiology	7 (4.5)
Total	**157 (100)**

No.= Number of cases of Ear infection, %=percentage of cases of Ear infection

Table 2.
Frequency of Isolates from ear infection

Isolates	No. (%)
S. aureus	69 (40.6)
P. aeruginosa	61 (35.9)
Proteus spp	13 (7.7)
K. pneumoniae	11 (6.5)
E. coli	5 (2.9)
Providentia spp	3 (1.8)
Enterococcus spp	2 (1.2)
C. freundii	2 (1.2)
M. morgani	2 (1.2)
Streptococcus spp	1 (0.5)
CNS	1 (0.5)
Total	170 (100)

No.= Number isolates, %=percentage of isolates, CNS=Coagulase Negative Staphylococci

Table 3.
Antibiotic Susceptibility Pattern of the predominant Isolates of Ear Infection

Antibiotics	Isolates											
	S. aureus		P. aeruginosa		Proteus spp		K. pneumoniae		E. coli		Providentia spp	
	T	%S	T	%S	T	%S	T	%S	T	%S	T	%S
Gentamycin	50	78.0	43	88.4	9	55.5	8	50.0	2	100	-	-
Azithromycin	16	50.0	-	-	-	-	-	-	-	-	-	-
Ciprofloxacin	37	78.4	59	86.4	11	81.8	10	50.0	2	100	1	100
Amikacin	37	91.9	37	73.0	9	66.7	7	85.7	1	100	1	100
Cefuroxime	42	57.1	-	-	3	33.3	3	33.3	1	0.0	-	-
Chloramphenic	30	73.3	31	3.2	6	16.7	8	37.5	4	75.0	2	50.0
Ceftriazone	19	52.6	10	60.0	5	20.0	3	33.3	-	-	-	-
Augmentin	46	69.6	30	3.3	8	37.5	6	16.7	2	0.0	-	-

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Imipenem	12	91.7	5	0.0	8	87.5	9	100	-	-	1	100
Amp-Sulb	4	100	3	33.3	2	50.0	-	-	-	-	2	50.0
Meropenem	4	100	14	78.6	3	100	2	100	2	100	1	100
Ceftazidime	1	100	52	67.3	7	28.6	5	40.0	4	50.0	1	100
Clindamycin	55	67.3	-	-	-	-	-	-	-	-	-	-
Erythromycin	31	32.3	-	-	-	-	-	-	-	-	-	-

Chloramphenic: Chloramphenicol, Amp-Sulb: Ampicillin-Sulbactam

DISCUSSION

The prevalence of ear infection in this study was 80.5%. This agrees with the findings in previous studies [16, 17].

Furthermore, Gram-negative bacteria were also the dominant (57.1) isolates of ear infection, compared to the Gram-positive bacteria. This finding is also similar to findings in other studies [2, 4, 10, 12].

Single bacterial infection of the ear was seen in the majority (95.5%) of our patients. This observation was supported by other researchers elsewhere [5, 9,12].That ear infection was more common in males (61.8%) than females in this study corroborates the reports from previous studies [2, 12]. This is, however, in contrast with the reports of female preponderance in some studies [4, 9, 10, 18, 19] or no significant difference between males and females with ear infections in others [20, 21]. The observed variations in this study and those of others may be due to differences in ear cleaning habits of the different populations studied.

Children in the age group of 0-10 years accounted for the highest number of patients with an ear infection (64.3%). This finding has been documented in previous studies [2,4,12,22]. The shorter, wider and horizontal posturing of the Eustachian tubes in children, together with their propensity to develop frequent upper respiratory tract infections would explain why ear infections are common in this age group [23].

S. aureus was the most predominant (40.6%) isolate, followed by P. aeruginosa (35.9%), Proteus spp (7.7%), K. pneumonia (6.5%), and E. coli (2.9%). These findings agree with those of other studies where S. aureus was the commonest isolate, followed also by P. aeruginosa [21, 24-26]. In contrast, however, in studies done in Ibadan, Abeokuta and Jos, the most predominant isolated bacterial pathogen was P. aeruginosa, followed by S. aureus and Proteus spp [10,12,27]. The effect of climate and geography have been put forward to explain the variability in bacterial isolates in different settings [7].

The predominant bacterial isolates in this study were generally highly susceptible to imipenem, meropenem, amikacin, gentamycin and ciprofloxacin. The high level of susceptibility of S. aureus to amikacin and gentamycin in this study has also been previously documented [26]. P. aeruginosa was found to be highly sensitive to amikacin, ciprofloxacin, gentamycin and ceftazidime, a finding similar to what was reported in a study in Ibadan [12].

In this study, the resistance observed to the more commonly prescribed antibiotics in this environment (including chloramphenicol, cefuroxime, ceftriaxone, augmentin and erythromycin) by most of the predominant isolates may be explained by the inappropriate and indiscriminate abuse of these antibiotics, which made it possible for resistance to emerge.

CONCLUSION

S. aureus was the commonest isolated bacterial pathogen, followed by P. aeruginosa, Proteus spp, K. pneumonia and E. coli. These common bacterial isolates were also highly susceptible to ciprofloxacin, imipenem, meropenem, amikacin and gentamycin. The favourable susceptibility of these bacteria to commonly prescribed antibiotics in this setting offers hope in the successful treatment of ear infection. Despite this, there is a need to institutionalized antimicrobial stewardship programs, and periodic monitoring of trends in antimicrobial resistance. These efforts should prevent the emergence of multidrug-resistant bacteria that are capable of complicating an otherwise simple infection.

We, however, recognised that this study, being retrospective in designy was limited by some missing clinical details about the studied population.

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