ORIGINAL RESEARCH

A Retrospective Evaluation of Bacterial Etiology of Ear Infections and its Antimicrobial Susceptibility Pattern in Children

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ABSTRACT
Background: An ear infection is among the leading causes of deafness in many low/middle-income countries. Pseudomonas aeruginosa (P.aeruginosa),Klebsiella pneumoniae (K.pneumoniae), Proteus species, Haemophilus influenzae (H.influenzae) and Moraxella are the most common aerobic microbial species isolated from patients with otitis media and otitis externa. The present retrospective study was conducted for evaluating the bacterial etiology of ear infection and its antimicrobial susceptibility pattern in children. **Materials &Methods:** A total of 100 children with ear infections of bacterial etiology were enrolled. Complete demographic and clinical details of all the subjects were obtained. Subjects with ear infection other than that of bacteriological etiology were excluded. Data collection was done by means of a structured questionnaire which was administered to the participants. Before being processed at the central pathology laboratory, the collected specimens were stored in Stuart's transport medium at room temperature. A combination of selective and non-selective media, including chocolate agar (CA), sheep-blood agar, MacConkey agar (MCA), and Sabouraud dextrose agar (SDA), were used to inoculate each specimen. Isolates of bacteria were detected. This was followed by antimicrobial susceptibility testing (AST) using the Kirby-Bauer disc diffusion method.**Results:** Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella spp, Acinetobacter spp and Enterobacter spp. were found in 35 percent, 32 percent, 22 percent, 8 percent and 3 percent of the patients respectively. Staphylococcus aureus was susceptible to gentamicin, ciprofloxacin, clindamycin and erythromycin. Pseudomonas was susceptible to amikacin, gentamicin and ciprofloxacin. Klebsiella spp was susceptible to amikacin, gentamycin and ciprofloxacin. **Conclusion:** The current research indicates that ear infections are caused by several microorganisms that are resistant to drugs. Antimicrobial susceptibility testing is therefore essential for directing physicians in the proper management of ear infections.

Key words: Ear Infection, Antimicrobial, Children

INTRODUCTION

An ear infection is among the leading causes of deafness in many low/middle-income countries. Unfortunately, most patients with ear infections in resource-limited settings delay seeking medical attention; hence, usually present with complications. Bacteria are the leading pathogens of ear infection, whereby, Staphylococcus aureus, Pseudomonas aeruginosa, Proteus mirabilis and Klebsiella species are the dominant bacteria causing ear infection globally. In addition, Candida spp and Aspergillus spp are predominant fungal isolates responsible for ear infections.[1- 3]

Acute otitis media (AOM) is the most common diagnosis worldwide. The Centers for Disease Control and Prevention (CDC) surveillance data showed that

the prevalence of AOM in the United States is increasing (150%). Before the age of two years, 70% of children will have encountered at least one AOM episode. Studies have shown that AOM is the main cause of empiric antibiotic prescription in the United States.[4- 6]

Pseudomonas aeruginosa (P.aeruginosa),Klebsiella pneumoniae (K.pneumoniae), Proteus species,Haemophilusinfluenzae (H.influenzae) and Moraxella are the most common aerobic microbial species isolatedfrompatients with otitis media and otitis externa. Proteus species, P.aeruginosa, K.pneumoniae and Escherichia coli are commonly reported Gram-negative bacteria isolatedfrom ear infection.[7]Beta-lactam drugs, fluoroquinolones and aminoglycosides are most frequently prescribed antibiotics to treat bacterial infections. However, the widespread use of these antibiotics has caused the emergence and spread of resistant bacteria. Currently, increasing trends of antibiotic resistance rates to ear infection are reported worldwide in gram negative bacteria. One of the mechanisms of resistance is synthesis of extended spectrum beta-lactamases (ESBL). They are bacterial enzymes capable of hydrolyzing penicillin, first, second and third-generation cephalosporins, and aztreonam, but not the cephamycins or carbapenems.[8, 9] The present retrospective study was conducted for evaluating the bacterial etiology of ear infection and its antimicrobial susceptibility pattern in children.

MATERIALS & METHODS

The current research was planned for evaluating the bacterial etiology of ear infection and its antimicrobial susceptibility pattern in children. A total of 100 children with ear infections of bacterial etiologic were enrolled. Complete demographic and clinical details of all the subjects were obtained. Subjects with ear infection other than that of bacteriological etiology were excluded. Data collection was done by means of a structured questionnaire which was administered to the participants. When there has been otorrhea from the ear for three to twelve weeks in spite of receiving the recommended antibiotic care, an ear infection is diagnosed. The patient's ear was cleared of the seeping pus using a sterile swab, and new pus was then collected using a different clean swab. Before being processed at the central pathology laboratory, the collected specimens were stored in Stuart's transport medium at room temperature. A combination of selective and non-selective media, including chocolate agar (CA), sheep-blood agar, MacConkey agar (MCA), and Sabouraud dextrose agar (SDA), were used to inoculate each specimen. Isolates of bacteria were detected. This was followed by antimicrobial susceptibility testing (AST) using the Kirby-Bauer disc diffusion method. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software. Univariate analysis was done for evaluation of the level of significance.

RESULTS

A total of 100 children were evaluated. Mean age of the subjects of the present study was 13.9 years. Among these 100 children, 63 children were males while the remaining 37 were females. Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella spp, Acinetobacter spp and Enterobacter spp. were found in 35 percent, 32 percent, 22 percent, 8 percent and 3 percent of the patients respectively. Staphylococcus aureus was susceptible to gentamicin, ciprofloxacin, clindamycin and erythromycin. Pseudomonas was susceptible to amikacin, gentamicin and ciprofloxacin. Klebsiella spp was susceptible to amikacin, gentamycin and ciprofloxacin.

Table 1: Bacteriological profile

Bacteriological profile	Number	Percentage
Staphylococcus aureus	35	35
Pseudomonas aeruginosa	32	32
Klebsiella spp	22	22
Acinetobacter spp	8	8
Enterobacter spp.	3	3
Total	100	100

Table 2: Antibiotic susceptibility pattern

Antibiotic	Staphylococcus aureus	Pseudomonas aeruginosa	Klebsiella spp	Acinetobacter spp	Enterobacter spp.
Amikacin	NA	22	18	5	2
Gentamicin	31	22	12	6	1
Ciprofloxacin	28	15	16	8	1
Amoxicillin/clavulanic acid	NA	NA	10	0	2
Ceftriaxone	NA	NA	12	1	1
Cefotaxime	12	NA	13	5	2
Clindamycin	30	NA	NA	NA	NA

Erythromycin	20	NA	NA	NA	NA

DISCUSSION

Otitis media or infection of the middle ear is a leading cause of healthcare visits and an important cause of preventable hearing loss, particularly in developing countries. Each year, 11% of the population suffer from acute otitis media, while 5% people suffer from chronic suppurative otitis media, with 50% and 22.6% of these cases happening in children below 5 years respectively. Otitis media is a frequent occurrence in children under 5 years of age and a common reason for antibiotic prescription in young children. Otitis media poses a serious health concern in developing countries with an undeniable effect on overall health of children and a likely effect on parents' social and emotional health. Paediatric acute ear infections can often present with a confusing picture of an irritable child with fever and as such require a high index of suspicion on part of the clinician. Otitis media can sometimes result in sequelae like persistent tympanic membrane perforation, hearing loss and occasionally dire complications like neck abscesses, mastoiditis, meningitis and labyrinthitis. Hearing loss may delay speech and language development, impair scholastic performance and interfere with gainful employment in later life. The chronic variety is often overlooked and under diagnosed due to its painless nature.[10- 12]

A total of 100 children were evaluated. Mean age of the subjects of the present study was 13.9 years. Among these 100 children, 63 children were males while the remaining 37 were females. Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella spp, Acinetobacter spp and Enterobacter spp. were found in 35 percent, 32 percent, 22 percent, 8 percent and 3 percent of the patients respectively. Staphylococcus aureus was susceptible to gentamicin, ciprofloxacin, clindamycin and erythromycin. Pseudomonas was susceptible to amikacin, gentamicin and ciprofloxacin. Klebsiella spp was susceptible to amikacin, gentamycin and ciprofloxacin. Tadesse B et al identified bacterial pathogens related to ear infection and to assess antibacterial susceptibility of isolated organisms. A cross-sectional study was conducted on 152 children from April 2018 to July 2018 at selected health facilities. All pediatric patients having ear discharge were included. Convenient sampling technique was used to collect clinical and demographic data using standard questionnaires after child care-takers signed the consent. Bacterial isolates were characterized based on colony appearance, Gram reaction, culture characteristics, and biochemical tests after inoculating on appropriate culture media. Antibacterial susceptibility testing was performed using the disc diffusion method according to the criteria of the Clinical and Laboratory Standards Institute (CLSI). Among 152 children included, 115(75.6%) of them demonstrated pathogenic bacterial growth. Staphylococcus aureus 41(27%) was the most frequently isolated pathogen, followed by Proteus mirabilis 19 (12.5%). Of the total isolates, 11.2 and 7.3% were resistant to gentamicin and ciprofloxacin respectively. Over three-fourth (85.2%) of the isolates were resistant to ampicillin. More than two-third of the isolates were resistant to both penicillin (71.4%) and trimethoprim-sulphamethoxazole (72.0%). S. aureus is the most commonly isolated bacterial pathogen from ear discharge among children.[13]Wasihun AG et al identified bacterial isolates and determine their drug susceptibility patterns from patients who had ear infection. Of the total of 162 patients with ear discharges, 68.5 % were from rural areas, 71 % with chronic infection, 54.9 % referred cases and 67.3 % of them had decreased hearing status. Pathogens were isolated from 157 (98.2 %) of the patients with a total of 216 isolates. Staphylococcus aureus 46 (28.4 %), Proteus mirabilis 39 (24.1 %), Pseudomonas aeruginosa 27 (16.7 %), Klebsiella spp. and Haemophilus influenzae 18 (11.1 % each) were the dominant bacteria. Out of the individuals with ear infection, single and mixed bacterial infection was seen among 185 (90.7 %) and 59 (39.5 %) respectively. Age group of 0–5 years ($p = 0.02$), chronic patients ($p = 0.042$) and referred cases ($p = 0.045$) showed high bacterial isolates. High resistance was seen to most antibiotics. Ciprofloxacin, Gentamicin Norfloxacin and Erythromycin were effective against isolated bacteria. The overall multi drug resistance rate of bacteria in this study was 74.5 %. Prevalence of bacteria associated with otitis media and multidrug resistance was very high in the study area. Ciprofloxacin, gentamicin, norfloxacin and erythromycin can be used to treat otitis media.[14]

CONCLUSION

The current research indicates that ear infections are caused by several microorganisms that are resistant to drugs. Antimicrobial susceptibility testing is therefore essential for directing physicians in the proper management of ear infections.

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