

ORIGINAL ARTICLE

BACTERIAL PROFILE AND ANTIBIOGRAM OF OTITIS MEDIA
AMONG CHILDREN IN YEMEN

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Background: Otitis media is a worldwide disease and is higher in developing countries, particularly among the low socioeconomic levels of the society. The aim of the study is to identify the bacterial etiologic agents of otitis media (OM) and their antibiotics sensitivity patterns among children in Specialized Sam Paediatric Centre (SSPC) and Al-Mamoon Diagnostic Medical Centre (AMDC), in Sana'a city. **Methods:** A cross-sectional study was done in SSPC and AMDC from January to October 2015. A total of 150 patients who had ear pus discharge and clinically diagnosed as OM were included in this study. Samples of ear discharge were collected, bacteriologically tested by standard methods and bacterial strains were identified using biochemical testes. Questionnaire was administered on patients or parents that cover the age, gender and the duration of symptoms. **Results:** A total of 150 children with OM, their age ranged from below 1–15 years (85 males and 65 females). Children less than 5 years of age were 100 and 50 with age ranged from 6–15 years. Bacterial isolates were *Staphylococcus aureus* (44%), *Pseudomonas aeruginosa* (12.67%), *Enterococcus species* (12.67%), and *Streptococcus pneumoniae* (10%). Bacterial culture revealed that, *Staphylococcus aureus* sensitivity to cefotaxime and azithromycin was 98%, to amoxicillin-clavulanic acid was 92% and it was 85% to gentamicin. *Pseudomonas aeruginosa* sensitivity to cefotaxime was 100%, to azithromycin and gentamicin was 98% and it was 80% to cefaclor. *Enterococcus* sensitivity to amoxicillin-clavulanic acid was 85%, to azithromycin was 80%, and it was 75% to cefotaxime, and gentamicin. **Conclusion:** The most common microorganism isolated was *Staphylococcus aureus* followed by *Pseudomonas*, *Enterococcus species*, and then *Streptococcus pneumoniae*. The most effective antibiotics were cefotaxime, amoxicillin-clavulanic acid, azithromycin and gentamicin. Therefore, knowledge of antimicrobial susceptibility test is essential for guiding appropriate antibacterial therapy.

Keywords: Otitis media; Bacterial isolates; Antibiotic sensitivity; Children

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INTRODUCTION

Otitis media is an inflammatory disease of the mucosal lining of the middle ear cavity and middle ear cleft and it is a worldwide disease. The frequency is higher in developing countries, particularly among patients from low socioeconomic levels in these societies, where poor nutrition, inadequate sanitation, and absence of health education are present and common.^{1–5} Otitis media is one of the most common illnesses in infants and children, the peak incidence occurs in children between 6 and 24 months of age.^{6,7} It is commonly caused by the build-up of fluid behind the eardrum, because of a blockage to the Eustachian tube, which is shorter and more horizontal than adults and is made up of more flaccid cartilage that may impair its opening.^{8,9} Bacterial infections of the middle ear normally come from the upper respiratory tract, which enter the ear through the Eustachian tube, the principal portal of entry to the ear.⁹

Infection can extend from middle ear to vital structures around leading to more serious and life threatening complications like; mastoid abscess, facial nerve palsy, hearing loss, lateral sinus thrombosis, meningitis and intracranial abscess.¹⁰ Hearing loss, in

children in the developing countries may cause long-term effects, on early communication, auditory processing as well as on language, psychosocial, intellectual and educational development.¹¹ Otitis media is among the most common causes of childhood visits to the physician and causes an enormous economic burden to the society in terms of cost of medications, surgical procedures, and absenteeism from school, or day care.¹² In OM, the bacteria may be aerobic such as *Pseudomonas aeruginosa*, *Echerichia coli*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Proteus spp.*, *Klebsiella spp.* or anaerobic bacteria such as *Bacteroides*, *Peptostreptococcus* and *Propionibacterium* or mixed organisms.^{4,13–15}

In a previous study in Yemen, *Staphylococcus aureus* was the most common isolate (43.4%) and followed by *Pseudomonas aeruginosa* (29.3%).¹⁶ Otitis media is the most frequent reason for outpatient antibiotic therapy in children.¹⁷ The resistance profile of microorganisms may differ according to the difference in geographical locations, local policy of antimicrobial prescribing practices and prevalence of resistant bacterial strains. In addition, random use of antibiotics, short course of use, low dose, and changes in bacterial

flora in the middle ear cavity leads to widespread antimicrobial resistance.¹⁸ The suspected microorganisms causing infection have to be empirically covered enough by antibiotic. The aim of the study is to identify the bacterial etiologic agents of otitis media infections and their antibiotic resistance patterns among child patients presenting to Specialized Sam Paediatric Centre and Al-Mamoon Diagnostic Medical Centre Sana'a city Yemen. This study provides data concerning the bacterial resistance profile, which is expected to support physicians in empirical therapy, and setting therapeutic protocols.

MATERIAL AND METHODS

A cross-sectional descriptive study was carried out in Specialized Sam Paediatric Centre and Al-Mamoon Diagnostic Medical Centre during ten months from January to October 2015. Both centres provide service to the community through outpatient clinics and laboratory departments and receive patients from Sana'a city, surrounding areas and sometimes from other governorates, beside referred cases from private clinics. One hundred and fifty patients with ear pus discharge clinically diagnosed of otitis media were included in the study. While patients who had received antibacterial therapy within 7 days prior to specimen collection were excluded. Short questionnaire was administered on patients, parents, or guardian that contains the age, gender and the duration of symptoms.

Outer ear was first cleaned by normal saline and then ear swab/discharge specimens were collected, which obtained from each patient having the disease. All ear swab specimens were transported to the laboratory and analysed within one hour of collection. Inoculated onto Blood, Chocolate and MacConkey agar (HI Media). The Blood and MacConkey agar plates were incubated aerobically while chocolate agar was incubated under 5% CO₂ atmosphere at 37 °C for 24–48 h. All positive cultures were recognized by their specific appearance on their own media, gram-staining reaction and confirmed by the pattern of biochemical reactions using the standard method.¹⁹ Growing bacterial colonies were recognized by standard bacteriological techniques (Barow and Teltham, 2003)²⁰, and disc susceptibility test performed by the BSAC method (Andrews, 2009)²¹.

The study was approved by Specialized Sam Paediatric Centre Medical and Al-Mamoon Diagnostic Medical Centre Corporation. Verbal consents were taken from the parents and caregivers of children involved in the study.

The collected data was processed manually and by using the Statistical Package for Social Sciences

program version 20 for Windows (IBM Corp, Armonk, NY, USA). Results were formulated in tables and calculated in frequencies and percentages.

RESULTS

The total number of children with otitis media was 150 patients, their age ranged from below 1–15 years and mean age with standard deviation was 3 years±2.1 years. Males were 85; females were 65 and the ratio of males to females was 1.31: 1. Children below 5 years of age were 100 patients and the remaining 50 were between 6–15 years old as shown in table-1. The pattern of bacterial isolates was *Staphylococcus aureus* (44%), *Pseudomonas aeruginosa* (12.67%), *Enterococcus species* (12.67), *Streptococcus pneumonia* (10%), *Proteus species* (7.33%) and *Enterobacter species* (5.33%) and mixed bacteria (6%) table-2. *aeruginosa* (12.67%), *Enterococcus species* (12.67%), and *Streptococcus pneumonia* (10%). Bacterial culture revealed that, sensitivity of *Staphylococcus aureus* to cefotaxime and azithromycin was 98%, to amoxicillin-clavulanic acid was 92% and it was 85% to gentamicin. *Pseudomonas aeruginosa* sensitivity to cefotaxime was 100%, to azithromycin and gentamicin was 98%, and it was 80% to cefaclore. *Enterococcus* sensitivity to amoxicillin-clavulanic acid was 85%, to azithromycin was 80%, and it was 75% to cefotaxime, and gentamicin. *Streptococcus pneumonia* sensitivity to cefotaxime, azithromycin, amoxicillin-clavulanic acid, and gentamicin was 100%. Sensitivity of *Proteus species* strains to cefotaxime, amoxicillin-clavulanic acid was 100%, and it was 75% to gentamicin as shown in table-3.

Table-1: Distribution of bacterial otitis media among children according to age and sex (n=150)

Age group	Males (%)	Females (%)	Total (%)	p value
<5 years	58 (38.67)	42 (28)	100 (66.67)	.641186
6–15 years	27 (18)	23 (15.33)	50 (33.33)	
Gender	85 (56.67)	65 (43.33)	150 (100)	.020921

Chi-square is 0.2172. P-value <0.05 is statistical significance

Table-2: Frequency of isolated bacterial species from ear swabs of children with otitis media (n=150)

Single bacteria isolated	No	%
<i>Staphylococcus aureus</i>	66	44
<i>Pseudomonas aeruginosa</i>	19	12.67
<i>Enterococcus species</i>	19	12.67
<i>Streptococcus pneumonia</i>	15	10
<i>Proteus species</i>	11	7.33
<i>Haemophilus influenza</i>	8	5.33
<i>Enterobacter species</i>	7	4.67
<i>Klebsilla species</i>	5	3.33
Mixed bacteria isolated		
<i>Staphylococcus aureus</i> + <i>Klebsilla species</i>	3	2
<i>Staphylococcus aureus</i> + <i>Enterobacter species</i>	3	2
<i>Staphylococcus aureus</i> + <i>Pseudomonas aeruginosa</i>	3	2

Table-3: Sensitivity patterns to antibiotics of isolated bacterial species from ear swabs of children with otitis media (n=150)

Bacteria isolated	No.	Percentage of sensitivity patterns of bacteria							
		CTX	AZM	AMC	GEN	CTZ	CDX	CEC	CLR
<i>Staphylococcus aureus</i>	66	98	98	92	85	83	82	80	70
<i>Pseudomonas aeruginosa</i>	19	100	98	nil	98	20	0	80	nil
<i>Enterococcus species</i>	19	75	80	85	75	50	40	Nil	nil
<i>Streptococcus pneumonia</i>	15	100	100	100	100	50	100	Nil	nil
<i>Proteus species</i>	11	100	nil	100	75	nil	nil	Nil	nil
<i>Haemophilus influenza</i>	8	100	82	100	20	100	40	45	42
<i>Enterobacter species</i>	7	100	90	84	100	82	40	43	50
<i>Klebsilla species</i>	5	100	80	93	100	41	34	30	36

Abbreviations: CTX- cefotaxime, AZM- azithromycin, AMC- amoxicillin-clavulanic acid, GEN- gentamicin, CTZ- co-trimoxazol, CDX- cefadroxil, CEC- cefaclor, CLR- clarithromycin

DISCUSSION

Otitis media is a worldwide disease, the frequency is higher in developing countries, particularly among the low socioeconomic levels of the society.² In this study, males were 85 and females were 65 with ratio of 1.31: 1. This is similar to Al-Alousi M *et al*¹⁶ study in Yemen, as well as to Flagas *et al*²² and Zakzouk and Hajjaj² studies that revealed males are more commonly affected with otitis media than females. This may be explained by the differences between males and females in anatomic, lifestyle, behavioural, socioeconomic status and the role of sex hormones in the regulation of the immune system.²² In addition, the gender bias was still evident in our country as well as in some other countries where girls are given less health care than boys. In our study, 150 children were below 5 years of age while 50 children were between 6–15 years. This agrees with studies that stated acute otitis media was the most common illness needing medical therapy for children below 5 years and by age three years, 50–85% of children will have had acute otitis media.^{6,10,23}

In our study, the frequency of bacterial isolates was *Staphylococcus aureus* (44%), *Pseudomonas aeruginosa* (12.67%), *Enterococcus species* (12.67%), *Streptococcus pneumonia* (10%) and *Proteus spp.* (7.33%). This is nearly in agreement with a previous study in Yemen by Al-Alousi M *et al*¹⁶ that revealed *Staphylococcus aureus* was the most common isolate (43.4%) and followed by *Pseudomonas aeruginosa* (29.3%). A study in Ethiopia by Woku and Bekel²⁴ also showed that the bacteria identified from positive ear swabs were *Staphylococcus aureus* 24 (20.5%), *Pseudomonas aeruginosa* 17 (14.5%), *Klebsilla species* 10 (8.5%), *Proteus species* 7 (6.0%), *Enterobacter species* 4 (3.4%), *Escherichia coli* 3 (2.6%), *Citrobacter species* 2 (1.7%), and *Providentia species* 2 (1.7%). A study in Iran by Etehad, *et al*²⁵ showed that the prevalence of the *Staphylococcus aureus* was 48.69%. In studies by Elmanama AA⁹ and Gul *et al*²⁶ revealed that the prevalence of *Pseudomonas aeruginosa* was (23%), *Staphylococcus aureus* (18%), and *Proteus spp.* (17%). As well as in studies from India,²⁷ Nigeria,²⁸ and Pakistan¹³ showed that the most prevalent microorganism was *Pseudomona*. In a study by Orji and dike,²⁹ the most

common isolated bacteria was *Pseudomonas aeruginosa* (44%), *Staphylococcus aureus* (17%), and *Proteus mirabili=s* (15%). The most and least sensitive bacteria were *Klebsilla Spp* and *Escherichia coli* respectively.

In this study, Bacterial culture revealed that, sensitivity of *Staphylococcus aureus* to cefotaxime and azithromycin was 98%, to amoxicillin-clavulanic acid was 92% and it was 85% to gentamicin. *Pseudomonas aeruginosa* sensitivity to cefotaxime was 100%, to azithromycin and gentamicin was 98%, and it was 80% to cefaclor. *Enterococcus species* sensitivity to amoxicillin-clavulanic acid was 85%, to azithromycin was 80%, and it was 75% to cefotaxime, and gentamicin. *Streptococcus pneumonia* sensitivity to cefotaxime, azithromycin, amoxicillin-clavulanic acid, and gentamicin was 100%. Sensitivity of *Proteus species* strains to cefotaxime, amoxicillin-clavulanic acid was 100%, and it was 75% to gentamicin. In Woku and Bekel study,²⁴ Amikacin (90.0%) and Gentamycin (89.1%) had high level of antibacterial effect on all identified bacterial species. In a study by Gul *et al*,²⁶ found sensitivity of *Pseudomonas aeruginosa* strains to ceftazidime and imipenem was 100%, to ciprofloxacin 92%, and to amikacin and gentamicin 85%. *Staphylococcus aureus* sensitivity to methicillin and vancomycin was 100%, to ciprofloxacin 91%, to sulbactam-ampicillin 73%, and to gentamycin and trimethoprim-sulfamethoxazole 63%. Sensitivity of *Proteus* strains to ciprofloxacin was 100%, to ceftazidime 90%, and to imipenem and gentamicin 70%. On other hand, all isolates were highly resistance to ampicillin (87.5%), oxacillin (84.0%), ceftriaxone (82.8%), cephalotin (81.4%), and penicillin G (73.8%).

The findings of our study compared to the findings of other studies, it was clear that microbial profile and antimicrobial susceptibility test pattern of OM has been changing with due course of time because of geographical difference, variance in-patient population studied and local antimicrobial prescribing practices. In addition indiscriminate and random antibiotic use and irregular follow-up of patients are the factors responsible for increasing emergence of antimicrobial resistance.¹⁸

CONCLUSION

Staphylococcus aureus strains were the most common isolates, followed by *Pseudomonas aeruginosa*. The most effective antibiotics were cefatoxime followed by amoxicillin-clavulanic acid then azithromycin and gentamicin. However, proper information of antibacterial susceptibility of microorganisms will contribute to rational antibiotic usage and successful treatment for otitis media hence reducing the risk factors associated with otitis media and its complications.

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AUTHORS' CONTRIBUTION

Both the authors contributed equally in the preparation of manuscript.

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