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TRENDS IN THE RESISTANCE PATTERN OF BACTERIAL PATHOGENS OF OTITIS MEDIA IN IBADAN, NIGERIA.

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ABSTRACT

Otitis media, an inflammation of the middle ear, is a common illness in childhood, and also one of the most frequent reasons for outpatient antimicrobial therapy. This study was undertaken to determine the bacterial etiology of otitis media in our environment and their pattern of antibiotic susceptibility. Between November 2009 and March 2011, ear swabs collected from 132 patients with clinical diagnosis of acute otitis media and chronic suppurative otitis media were subjected to bacteriological analysis. The bacterial pathogens isolated were tested against ten antibiotics using standard bacteriologic techniques.

A total of 142 isolates were recovered from the 132 patients involved in this study. The most frequently isolated organism in acute otitis media and chronic suppurative otitis media was *Pseudomonas aeruginosa*, (43.7%), followed by *Klebsiella* species (31.0%), *Proteus* species (14.1%), *Escherichia coli* (7%), *H.influenzae* (2.8%) and *Staphylococcus aureus* (1.4%). Generally, high resistance rates were recorded against many of the antibiotics tested. However, ciprofloxacin demonstrated the highest susceptibility rates for *P.aeruginosa* (77.4%) and *Klebsiella* species (59.1%). All the pathogens demonstrated nil susceptibility towards cefixime except *E.coli* where the susceptibility rate was 40%. In conclusion, determination of the susceptibility pattern of bacterial pathogens of otitis media is of utmost importance to its effective management.

Key words: Otitis media, bacterial pathogens, resistance pattern

INTRODUCTION

Otitis media (OM) is the inflammation of the middle ear, which may be caused by bacteria, fungi or viruses. There are three types of otitis media, and these are, acute purulent otitis media, otitis media with effusion and chronic suppurative otitis media (1). Acute bacterial infection of the middle ear normally originates from an upper respiratory tract infection with the bacteria entering by the auditory (Eustachian) tube, which is the principal portal of entry of pathogens into the ear (2).

Chronic suppurative otitis media (CSOM) is defined as a chronic inflammation of the middle ear and mastoid cavity, which presents with recurrent ear discharges through a tympanic perforation (3). Effusion of OM may be serous, mucoid or purulent (4). Otitis media may be associated with infection or may be sterile. The sterile variety is usually called serous OM and is often attributed to allergy, but may also occur

from numerous other potential sources including radiation treatment or virus (5,6).

Otitis media is very common in childhood and is almost always accompanied by a viral upper respiratory infection (URI) with a peak incidence between 4–7 years of age (7). Seventy-five percent of children experience at least one episode by their third birthday. Almost half of these children will have 3 or more ear infections during their first 3 years. The reason for the higher frequency in these populations is the anatomic differences in skull base and Eustachian tube and biologic susceptibility (8). Although OM is primarily a disease of infants and young children, it can also affect adults (9). Furthermore, the incidence is higher in males than in females (10).

The significant risk factors in OM include socioeconomic status, cultural, seasonal, and age factors, as well as family history of middle ear disease (11).

The most common bacterial pathogens of OM are *Streptococcus pneumoniae*, *Hemophilus influenzae* and *Moraxella catarrhalis* (12). Other pathogens responsible for OM are *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* species, *Pseudomonas aeruginosa* and *Proteus* species (13). The types of pathogens involved in OM have also been found to be dependent on geographical location (14). The aim of this study was therefore to determine the bacterial etiology of OM in this environment and their susceptibility pattern to the available antibiotics.

MATERIALS AND METHODS

This is a laboratory-based study carried out between November 2009 and March 2011 at the Medical Microbiology Laboratory of University College Hospital (UCH), Ibadan, Nigeria.

One hundred and thirty-two ear swabs which were collected from patients with clinically diagnosed acute otitis media and chronic suppurative otitis media at the otolaryngology clinic of UCH were included in this study. Bacterial pathogens of acute otitis media and CSOM were isolated and identified from these aural swabs using standard bacteriological methods. They were subsequently subjected to antimicrobial susceptibility testing according to the recommendation of the Clinical and Laboratory Standards Institute (CLSI) for disc diffusion tests (15). The susceptibility pattern of the bacterial pathogens were determined towards the following antimicrobial agents, ciprofloxacin, gentamycin, pefloxacin, ofloxacin, ceftriaxone, cefuroxime, ceftazidime, amikacin, amoxicillin/clavulanate, and cefixime. The diameters of zones of inhibition around the bacterial colonies were measured with a calibrated ruler and interpreted as susceptible or resistant using an interpretive chart (15).

RESULTS

Aural swabs obtained from 132 patients with clinical diagnosis of CSOM and OM were included in this study. Seventy(53%) of these patients were males while 62(47%) were females. Among these, 80(60.6%) were diagnosed as CSOM while 52(39.4%) were diagnosed as OM. The age distribution of the patients are demonstrated in Table 1.

Table 1. Distribution of otitis media by age and sex

Age (Years)	No (%)
< 10	62 (47.0)
10 - 20	30 (22.7)
21 - 40	18 (13.6)
41 - 60	8 (6.1)
> 60	6 (4.6)
*Unspecified	8 (6.1)
Total	132 (100.0)
Sex	
Male	70 (53.0)
Female	62 (47.0)
Total	132 (100.0)

*Study patients gave estimated ages which may

not be accurate, hence classified as "unspecified".

A single pathogen was demonstrated in 120(90.9%) patients, two in 10 (7.6%) and no growth in 2(1.5%). The double pathogens were demonstrated in 4 (80%) patients with CSOM and 1(20%) with OM.

Pseudomonas aeruginosa was the most frequently isolated in both CSOM and OM while *S.aureus* 2 (1.4%), was the least commonly isolated. The frequency of isolation of the bacterial pathogens in CSOM and OM are demonstrated in Table 2.

Table 2. Distribution of bacteria pathogens in otitis media.

Bacterial Pathogens	CSOM	OM	Total No (%)
<i>Klebsiella species</i>	24	20	44 (31.0%)
<i>Pseudomonas aeruginosa</i>	40	22	62 (43.7)
<i>Proteus species</i>	12	8	20 (14.1)
<i>Escherichia coil</i>	8	2	10 (7.0)
<i>Staphylococcus aureus</i>	2	-	2 (1.4)
<i>Hemophilus influenzae</i>	4	-	4 (2.8)
Total	90	52	142 (100.0)

CSOM - Chronic suppurative otitis media

OM - Acute otitis media.

From 132 patients with CSOM and OM, a total of 142 bacterial pathogens were isolated. Of these, 140(98.6%) were Gram-negative bacilli and 2 (1.4%), Gram-positive cocci. *Pseudomonas aeruginosa* 62(44.3%) and *Klebsiella* species 44(31.4%) were the most prevalent among the Gram-negative pathogens. *S.aureus* was the only Gram-positive pathogen isolated.

Of the ten antibiotics tested against these bacterial pathogens, ciprofloxacin had the highest susceptibility rates for *P. aeruginosa* (77.4%) and *Klebsiella* species (59.1%). Cefixime demonstrated nil (0%) susceptibility to all the pathogens except *E.coli* where the susceptibility rate was 40%. The antibiotic susceptibility profiles of the various pathogens isolated are shown in Table 3.

Table 3. Antibiotic susceptibility pattern of bacterial pathogens of otitis media

Antibiotics	Susceptibility pattern of isolates					
	Pseud N = 62	Kleb N = 44	Proteus N = 20	<i>E.coli</i> N = 10	<i>S.aureus</i> N = 2	<i>H.inf</i> N = 4
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
Ciprofloxacin	48(77.4)	26(59.1)	6(30.0)	4(40.0)	2(100.0)	2(50.0)
Gentamycin	40(64.5)	20(45.5)	10(50.0)	2(20.0)	2(100.0)	2(50.0)
Pefloxacin	24(38.7)	8 (18.2)	2(10.0)	4(40.0)	0(0.0)	0(0.0)
Ofloxacin	36(58.1)	26 (59.1)	10(50.0)	0(0.0)	2(100.0)	2(50.0)
Ceftriaxone	16(25.8)	20 (45.5)	14(70.0)	4(40.0)	0(0.0)	2(50.0)
Cefuroxime	4(6.5)	16 (36.4)	4(20.0)	4(40.0)	0(0.0)	4(100.0)
Ceftazidime	42(67.7)	10 (22.7)	6(30.0)	4(40.0)	0(0.0)	0(0.0)
Amikacin	26(41.9)	4(9.1)	0(0.0)	2(20.0)	0(0.0)	0(0.0)
Augmentin	0(0.0)	12(27.3)	0(0.0)	0(0.0)	2(100.0)	4(100.0)
Cefixime	0(0.0)	0(0.0)	0(0.0)	4(40.0)	0(0.0)	0(0.0)

Augmentin-Amoxicillin/clavulanate

DISCUSSION

In this study, *P.aeruginosa* (43.7%) was found to be the most prevalent bacterial pathogen of OM and CSOM in this environment, followed by *Klebsiella* species (31%), *Proteus mirabilis* (14.1%), *Escherichia coli* (7%), *H. influenzae* (2.8%) and *S.aureus* (1.4%). The preponderance of *P.aeruginosa* in this study is in agreement with a study conducted by Kawo et al in the Northern part of Nigeria (16). In contrast, however, in a study conducted in Iran, the most frequently isolated pathogen of OM was *S. aureus* followed by *P.aeruginosa* and *Proteus* species (17). In the United States of America, Israel and Eastern Europe, the commonest bacterial pathogens of OM were *Streptococcus pneumoniae*, *H.influenzae* and *Moraxella catarrhalis* (14).

In the present study, the peak incidence was found in the age group 0 - 10 years (47%),

followed by 10-20 years (22.7%), and a decline with advancement in age (Table 1). This has been attributed to the shorter, wider, and horizontal Eustachian tube in children than in adults, offering greater opportunities for pathogens to ascend from nasopharynx to the sterile middle ear cavity (18).

The frequency of double causative agents (7.6%) was much lower than single causative agent (90.9%). This contradicts the report of Alsaimary where the frequency of double causative agents was higher than single causative agent (19). The incidence rate of otitis media is higher in males (53%) than females (47%) which agrees with the finding of another study elsewhere (10).

Many antimicrobial agents have been used for the treatment of OM infection and these include penicillin, cephalosporins, vancomycin and azithromycin. However, bacterial resistance to these antimicrobials has become an increasing problem in the treatment of otitis media (19). In this study, the most effective antimicrobial agent against *P.aeruginosa*, the most prevalent etiological agent of OM in this environment, was ciprofloxacin (77.4%), followed by ceftazidime (67.7%), gentamycin (64.5%), ofloxacin(58.1%) and amikacin(41.9%). The high susceptibility demonstrated towards ciprofloxacin is similar to what was reported in another study where *P.aeruginosa* demonstrated 100% susceptibility to ciprofloxacin(17).

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