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PATTERN OF BACTERIAL PATHOGENS OF ACUTE OTITIS MEDIA IN A TERTIARY HOSPITAL, SOUTH WESTERN NIGERIA

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ABSTRACT

INTRODUCTION: Otitis media was reasonably prevalent prior to the use of antibiotics for treatment. In Nigeria, hospital incidence reports indicate that chronic suppurative Otitis media is the commonest. Complications that usually arise as a result of untreated Otitis media are meningitis, brain abscess, keratoma, otosclerosis, and hearing loss. The study aimed at providing information on the pattern of bacterial pathogens of acute Otitis media in LAUTECH Teaching hospital, Osogbo, Nigeria. **METHODS:** It was a cross-sectional study involving patients with acute Otitis media attending ENT clinic at LAUTECH Teaching Hospital, Osogbo, Nigeria. Ear swabs were collected from the patients after informed consent. The samples were inoculated on general and selective laboratory media. Bacterial pathogens were isolated and identified. Antibiotic susceptibility testing was performed on each of the bacterial isolates using modified Kirby Bauer disk diffusion. **RESULTS:** There were 115 isolates from 98 patients with acute Otitis media. Gram negative bacteria constituted 66.7% of the isolates. The most common organism was *Pseudomonas aeruginosa* (34.8%). Others were *Staphylococcus aureus* (30.4%), *Proteus* spp (15.7%), *Klebsiella* spp (11.3%), *Escherichia coli* (2.6%) and few Fungi (4.1%). Antibiotics sensitivity results of the isolates showed high resistance against most readily available antibiotics. The cumulative resistance of all the bacteria isolates to Augmentin was 89%, gentamicin 80%, ciprofloxacin 34% and ceftazidime 10%. About 88% of the Gram positive bacteria were resistant to penicillin G, amoxicillin, cotrimoxazole, and erythromycin. While 100% of the Gram negative bacteria were resistant to cotrimoxazole, tetracycline, and chloramphenicol. However, commonly isolated organisms were highly susceptible to few 3rd-generation cephalosporins especially ceftriaxone and ceftazidime. **CONCLUSION:** Based on the result of this study, it is suggested that knowledge of antibiotic profile of etiological agents in Otitis media would be of great advantage in reducing the morbidity and mortality associated with Otitis media.

KEYWORDS: Otitis media, Bacterial agents, Antibiotic resistance.

PATHOLOGIE BACTERIENNE D'OTITE MOYENNE AIGUË DANS UN HOPITAL TERTIAIRE AU SUD - OUEST DU NIGERIA.

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RESUME

INTRODUCTION: L'Otite moyenne était prévalence avant l'utilisation des antibiotiques pour le traitement. Au Nigeria, le rapport d'incidence des hôpitaux indique que l'Otite moyenne suppurée est la plus courante. Les complications qui surviennent habituellement à la suite d'Otite moyenne non traitée sont la méningite, les abcès cérébraux, le kératome, l'otosclérose et la perte auditive. L'étude visait à fournir des informations sur le profil des pathogènes bactériens de l'Otite aiguë moyenne à l'hôpital d'enseignement LAUTECH, Osogbo, Nigeria. **METHODE:** Il s'agissait d'une étude transversale impliquant des patients atteints d'Otite moyenne aiguë fréquentant la clinique ENT de l'hôpital d'enseignement LAUTECH, Osogbo, Nigeria. Des écouvillons auriculaires ont été prélevés auprès de patients après un consentement éclairé. Les échantillons ont été inoculés sur des milieux de laboratoire généraux et sélectifs. Pathogènes bactériens ont été isolés et identifiés. Des tests de sensibilité aux antibiotiques ont été effectués sur chacun des isolats bactériens en utilisant la diffusion de disque de Kirby Bauer modifiée. **RESULTATS:** Il y avait 115 isolats de 98 patients atteints d'Otite moyenne aiguë. Gram négatif constituait 66,7% des isolats. Les organismes les plus communs étaient *Pseudomonas aeruginosa* (34,8%), *Staphylococcus aureus* (30,4%), *Proteus* spp (15,7%), *Klebsiella* spp (11,3%), *Escherichia coli* (2,6%) et quelques champignons (4,1%). Les résultats de sensibilité aux antibiotiques des isolats ont montré une résistance élevée contre les antibiotiques les plus facilement disponibles. La résistance cumulée de tous

les isolats de bactéries à Augmentin était 89%, la gentamicine 80%, la ciprofloxacine 34% et la ceftazidime 10%. Environ 88% des bactéries Gram positives étaient résistantes à la pénicilline G, à l'amoxicilline, au cotrimoxazole et à l'érythromycine. Tandis que 100% des bactéries Gram négatif étaient résistantes au cotrimoxazole, à la tétracycline et au chloramphénicol. Cependant, les organismes communément isolés étaient très sensibles à quelques céphalosporines de 3ème génération. CONCLUSION: Basé sur le résultat de cette étude, il est suggéré que la connaissance du profil antibiotique des agents étiologiques dans l'Otite moyenne serait un grand avantage pour réduire la morbidité et mortalité associées à l'Otite moyenne.

MOTS CLES: L'Otite moyenne, Agent bactériens, Résistance aux antibiotiques.

INTRODUCTION

Otitis media (OM) is an inflammatory disease of the mucosal lining of the middle ear that is frequently caused by the accumulation of fluid usually behind the blocked Eustachian tube (1, 2). It is one of the commonest reasons for the under-five children visitations to the general practitioners (3). Acute otitis media (AOM) is characterized by the rapid onset of symptoms like otalgia, fever, vomiting and accumulation of fluid in the middle ear cavity (4). Globally, over 700 million cases of AOM are diagnosed among the under-five group of children annually (5). A patient is said to have recurrent AOM (RAOM) after being diagnosed of three episodes of AOM within six months or over four episodes in 12 months (6), and this is usually noticed in about 65% of children in their first five years of life (6). Hearing loss is one of the commonest complications at a critical developmental stage of their lives (3). Otitis media related hearing impairment was found to be estimated at 30.82/10,000 annually (5). Otitis media with effusion (OME) usually resolves spontaneously within 3 months (7), however if this fails to happen few percentage of these children would experience persistent fluid in the middle ear for more than 3 months (7).

Some of the significant risk factors include poor living conditions, overcrowding, lack of access to medical care, environmental factors and exposure to cigarette smoke (8). Others include cultural, seasons of the year and family history of middle ear infections (4).

Initiation of infection in otitis media depends on the route of infection to the middle ear (9), and this could be caused by complications arising from diseases of nasopharyngeal areas, sinuses, oropharynx and tonsils (8, 9). OM is commonly prevalent in children because of their shortness and more horizontal Eustachian tube that contain flaccid cartilage than in adults (10). This usually impairs the opening of the tube in children (11) and facilitate the accumulation of fluids with the ultimate blockage (11).

The most common bacteria involved in the otitis media are *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Streptococcus pyogenes*, *Staphylococcus aureus*, *Moraxella catarrhalis* and *Pseudomonas aeruginosa* (12). Other important organisms that have

been implicated in otitis media include *Bacillus* spp, *Escherichia coli* and *Proteus* spp (13).

In view of the well-known growing fact about microbial drug resistance all around the globe (14), an effective monitoring of the predominant bacterial and other microbial pathogens is important to inform new treatment strategies of this infection (3). The study aimed at providing information on the pattern of bacterial pathogens of acute Otitis media in LAUTECH Teaching hospital, Osogbo, Nigeria.

METHODS

It was a cross-sectional prospective study involving patients with features suggestive of acute Otitis media attending ENT clinic at the LAUTECH teaching hospital (LTH), Osogbo, Nigeria. Osogbo is situated in Olorunda Local Government and is the capital of Osun state, Nigeria. The city is about 500 kilometers from Abuja. The study was carried out between the periods of January -December 2005. An informed consent was obtained for each patient to collect the swab of an ear discharge by the physician and filled a short open-ended questionnaire. Ethical approval for the study was obtained from the ethical /research committee of Ladoke Akintola University Teaching Hospital.

Specimen collection and processing

Swabs of the ear discharge from each of the patients was collected aseptically at the ENT clinic after an informed consent and was transported to the microbiology laboratory of LTH, Osogbo for immediate processing. Ear discharge swabs were then inoculated on the laboratory media like blood, chocolate and MacConkey agars. Inoculated plates were then incubated aerobically at 37°C for 18-24 hrs. Bacterial isolates from these specimens were identified by the standard bacteriological methods (15), and were then subjected to antibiotics susceptibility testing following the Clinical and Laboratory Standard Institute (CLSI) for the disc diffusion test (16). Disc susceptibility testings were carried out on tetracycline (10ug), cefuroxime (30ug), ampicillin (10ug), erythromycin (15ug), ceftriaxone (30ug), ciprofloxacin (5ug), ofloxacin (5ug), gentamycin (10ug), ceftazidime (30ug), amoxicillin-clavulanic acid (10ug) and cotrimoxazole (25ug). The susceptibility patterns of the drugs were interpreted according to standard methods (16). The reference

strains of *Staphylococcus aureus* (NCTC 6751) and *Escherichia coli* (NCTC 10418) were used as quality control.

Data analysis Data were entered, cleaned manually and analysed using SPSS version 12.0. Frequency tables were generated and data were analysed using appropriate statistical methods. P value of < 0.05 was considered as statistically significant.

RESULTS

A total of ninety-eight patients with ear discharges were recruited into the study. Majority of the patients were males (53% vs 47%). The mean age of these patients was 15 yrs (+/- 16; Range 9 months - 78 years). Most of the study participants were under the age of 10 (55.2%) (Table 1).

TABLE 1: DISTRIBUTION OF THE PATIENTS BY AGE AND SEX

	Characteristics	Frequency (N=98)	Percentage (%)
Age (Yrs)	< 10	54	55.2
	11-20	8	8.1
	21-30	20	20.4
	31-40	4	4.1
	41-50	3	3.1
	>50	9	9.1
Sex	Male	52	53.0
	Female	46	47.0

Ear discharge was the commonest clinical finding observed in all the patients examined (100%). Chronic nasal discharge was the most prominent predisposing factor noticed among the patients as 40.0% of them had a long standing antecedent history of nasal discharge. Trauma mostly due to head injuries accounted for 7.1% of the cases. Other predisposing factors at presentations were as indicated in Table 2.

There were 115 microbial isolates from 98 patients. The overall prevalence of bacterial isolates was 96.5% and 74 (66.7%) were gram negative bacteria (GNB). *Pseudomonas aeruginosa* was the most prominent GNB isolated (34.8%) while *Staphylococcus aureus* (30.4%) was the commonest gram positive bacteria isolated (Table 3).

TABLE 2: DISTRIBUTION OF THE PATIENTS BY THE CLINICAL FEATURES AND RISK FACTORS

Predisposing factors	Frequency (N=98)	Percentage (%)
1. Trauma	7	7.1
2. Chronic Nasal discharge	39	40.0
3. Ear affected		
a. Unilateral	64	65
b. Bilateral	34	35
4. Earache	48	49
5. Ear discharge	98	100
6. Hearing loss	36	37

TABLE 3: DISTRIBUTIONS OF THE BACTERIAL ISOLATES IN ACUTE OTITIS MEDIA

Bacterial isolates	Frequency (N=115)	Percentage (%)
<i>Pseudomonas aeruginosa</i>	40	34.8
<i>Klebsiella spp</i>	13	11.3
<i>Proteus spp</i>	18	15.7
<i>Escherichia coli</i>	3	2.6
<i>Staphylococcus aureus</i>	35	30.4
<i>Streptococcus spp</i>	2	1.7
Fungi	4	3.5

The antibiotic susceptibility profiles of the bacterial isolates are shown in Table 4. Ceftazidime has the highest susceptibility rate for *P. aeruginosa* (97.5%), while it was 100% for the *Proteus spp* and *E. coli* respectively. The quinolones (Ciprofloxacin, Ofloxacin and Perfloxacin) demonstrated 50% resistance to *P. aeruginosa*. 97.5-100.0% of *P. aeruginosa* were resistant to Ampicillin, amoxicillin, Augmentin and Penicillin respectively. *Staphylococcus aureus* demonstrated high level of resistance against all the common antibiotics (Table 4).

TABLE 4: ANTIBIOTIC SUSCEPTIBILITY PATTERN OF BACTERIAL ISOLATES TO ANTIMICROBIAL AGENTS

Antibiotics	Susceptibility pattern of bacterial isolates to antimicrobial agents					
	<i>Pseudomonas aeruginosa</i> N=40	<i>Klebsiella spp</i> N=13	<i>Proteus spp</i> N=18	<i>Escherichia coli</i> N= 3	<i>Staphylococcus aureus</i> N= 35	<i>Streptococcus sp</i> N= 2
	S (%)	S (%)	S (%)	S (%)	S (%)	S (%)
Penicillin	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	2(5.7%)	0(0.0%)
Ampicillin	3 (7.5%)	1(7.7%)	0(0.0%)	0(0.0%)	4(11.4%)	0(0.0%)
Amoxicillin	1(2.5%)	1(7.7%)	5(27.8%)	3(100.0%)	3(8.6%)	0(0.0%)
Augmentin	1(2.5%)	1(7.7%)	5(27.8%)	0(0.0%)	3(8.6%)	1(50.0%)
Erythromycin	5(12.5%)	1(7.7%)	0(0.0%)	0(0.0%)	5(14.3%)	1(50.0%)
Gentamycin	8(20.0%)	11(84.6%)	6(33.3%)	2(66.7%)	16(45.7%)	1(50.0%)
Ciprofloxacin	19(47.5%)	8(61.5%)	13(72.2%)	2(66.7%)	21(60.0%)	2(100.0%)
Ofloxacin	20(50.0%)	9(69.2%)	8(44.4%)	2(66.7%)	22(62.9%)	2(100.0%)
Perfloxacin	20(50.0%)	6(46.1%)	8(44.4%)	3(100.0%)	20(57.1%)	1(50.0%)
Ceftriaxone	38(95.0%)	12(92.3%)	17(94.4%)	3(100.0%)	33(94.3%)	0(0.00%)
Ceftazidime	39(97.5%)	10(76.9%)	18(100.0%)	3(100.0%)	34(97.1%)	1(50.0%)
Cephalexin	30(75.0%)	12(92.3%)	16(88.9%)	2(66.7%)	30(85.7%)	2(100%)
Cotrimoxazole	0(0.0%)	2(15.4%)	3(%)	0(0.0%)	0(0.0%)	0(0.0%)

DISCUSSION

The burden of bacteria as aetiological agents associated with otitis media was found to be very high in this study. The prevalence of bacterial isolates from the ear discharge samples was 95.6%. Otitis media is one of the commonest diseases of infants and young children and its sequelae persists in some individuals into adult years. In this study, most of the bacterial isolates were found among the under 10 years old children (55.2%), 34 (34.7%) of which belong to under-five years old children. This was in agreement with previous studies (11, 17-20). The increased incidence of AOM in children has been attributed to the shortness and horizontal Eustachian tube that contain more flaccid cartilage than in adults (10), and this facilitates the accumulation of fluids with the ultimate blockage in children (11).

Male gender has been reported as an important risk factor for the development and acquisition of otitis media (20, 21).

This study demonstrated increased prevalence of otitis media among male infants and young children than in female (53% vs 47%) and this is similar to the findings in other studies (18, 22). However, it contradicts the work of other researchers that believed there was no significance difference (20).

Gram negative bacteria (66.7%) were the commonest isolates compared with 33.3% of gram positive organisms. This is in agreement with other previous studies from Nigeria (17, 23, 24) and other countries (11, 21, 22). *P. aeruginosa* was the predominant bacterial isolated as it was recovered in 34.8% of the cases. The organism has been found to be the commonest aetiological agent of otitis media in Nigeria (9, 18, 25) and other African countries (11, 19). Other important gram negative bacterial isolates recovered in this study were *Proteus spp* (15.7%), *Klebsiella spp* (11.3%), and *E. coli* (2.6%). *Staphylococcus aureus* (30.4%) was the second most common organism, but the predominant gram positive bacteria isolated. This

is similar to the bacteriological profile discovered in another study as shown in the review by Verhoeff et al, 2006 (26). However, in another study, Saunders *et al* found that *S. epidermidis* was the predominant gram positive organisms (27).

The clinical symptoms and the predisposing factors observed in the study showed that ear ache and hearing loss to be most common symptoms observed at the presentation. This is also similar with findings in other study (11).

Susceptibility profile of the bacterial isolates showed high resistance level against the commonly prescribed antibiotics. Our results have shown that penicillin, ampicillin, amoxicillin, erythromycin, cotrimoxazole and amoxicillin-clavulanic acid in general are resistant to both gram negative and positive bacteria isolated from the ear discharge samples. The resistance rate of the antibiotics ranges from 50-100%. This finding contradicts the earlier study that showed excellent sensitivity to the above listed antibiotics (11). The only exception observed was the 100% susceptibility of *E. coli* to amoxicillin compared to the previous study that found high resistance level (19).

The most effective antimicrobial agent against *P. aeruginosa* was ceftazidime (97.5%), and this was closely followed by ceftriaxone (95.0%) and cephalexin (75.0%) respectively. This is contrary to

67.7% susceptibility to ceftazidime observed in another study in Nigeria(18). The high susceptibility rate demonstrated by the third generation cephalosporin to *P. aeruginosa* was similar to what was obtained against *Proteus* spp and *Klebsiella* spp. *P. aeruginosa* also showed moderate level of resistance to all the available quinolones in study, however, this contradicts the finding of another study that showed 100% susceptibility to ciprofloxacin (18).

Highly level of resistance noticed against the commonly prescribed antibiotics was due to indiscriminate use antibiotics in Nigeria by patronizing many unlicensed community pharmacy shops. Judicious use of antimicrobial therapy may prevent the development of antimicrobial resistance. Based on the results of this study, it is suggested that knowledge of antibiotic profile of etiological agents in Otitis media would be of great advantage in reducing the morbidity and mortality associated with Otitis media. We are encouraging many hospitals to adopt the principle of antibiotics stewardship to reduce this inappropriately usage of antibiotics.

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