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# PATHOGENIC AGENTS OF CHRONIC SUPPURATIVE OTITIS MEDIA IN ILORIN, NIGERIA

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## ABSTRACT

***Objective:*** **To determine the type and pattern of antibiotic susceptibility of the pathogenic micro-organisms causing chronic suppurative otitis media (CSOM) in our environment.**

***Design:*** **A retrospective study of ear discharges from patients presenting consecutively with chronic suppurative otitis media.**

***Settings:*** **University of Ilorin Teaching Hospital, a major referral centre in the Middle Belt region of Nigeria.**

***Main outcome measures:*** **Bacterial isolates and their sensitivity patterns.**

***Subjects:*** **Three hundred and seventy five patients aged between eight months and 70 years referred to the ear, nose, and throat clinic of The University of Ilorin Teaching Hospital were enrolled in the study.**

***Results:*** **About 95.5% and 4.5% of the specimens were culture positive and negative respectively. The commonest bacterial aetiologic agents were *Pseudomonas aeruginosa* (26.0%) and *Proteus spp* (21.8%). Peak prevalence of 30.5% occurred among the 0-5 years age group. Seventy five per cent of isolates were gram-negative bacteria. Ofloxacin produced 100% sensitivity in both gram positive and gram-negative organisms tested. Colistin, ceftazidime and cefuroxime were highly active ( 80%) against the gram-negative bacteria while erythromycin and cloxacillin were very effective ( 80%) against the gram-positive isolates.**

***Conclusion:*** **Chronic suppurative otitis media is still highly prevalent in our environment, affecting mainly children. The antibiotic susceptibility pattern of pathogenic isolates is different from those of other regions of Nigeria with increasing resistance recorded for some organisms. Hence, where possible and available, susceptibility tests should guide the management of CSOM in this environment, otherwise, ofloxacin if indicated and cloxacillin/ erythromycin may provide relief and delay emergence of resistant strains.**

## INTRODUCTION

Chronic suppurative otitis media (CSOM) is a condition of non-healing perforation of the tympanic membrane associated with chronic inflammatory changes of the muco-periosteum of the middle ear cleft resulting in mucoid or mucopurulent otorrhoea of more than three months duration(1,2). It commonly results from previous acute otitis or secretory otitis media. The infection is usually bacterial in origin, however, viral and fungal agents have also been isolated(3). CSOM is a childhood disease and the commonest ailment seen by otorhinolaryngologists in Nigeria(4,5). Despite advances in public health and medical care, CSOM is still prevalent around the world. It is most common in developing countries and in certain high risk populations in developed nations(6-8). CSOM is associated with a high rate of complications such as meningitis, brain abscess, facial nerve palsy subperiosteal mastoid abscess, and even death, if not adequately managed.

Decher and Daum(9), showed that both single and mixed infections of *Pseudomonas, Staphylococcus, Proteus* and *E. coli* are important in the early stage of CSOM but after a long time *Pseudomonas aeruginosa* tends to predominate. Reports from Europe(10,11) also indicate that these organisms offer various degrees of resistance to available anti-microbial agents employed in their treatment.

Several studies from various parts of Nigeria and the world over excluding Kwara State have found different proportions of *Pseudomonas aeruginosa, Staphylococcus aureus, Proteus spp.* and *Klebsiella* as the main causative organisms of CSOM(3,12-21). Therefore, it is important to know the type of antibiotic susceptibility of the pathogens causing CSOM in our environment, so that appropriate measures for containing and preventing their complications may be put in place.

## MATERIALS AND METHODS

This is a retrospective study of 375 ear specimens of patients presenting consecutively with chronic suppurative otitis media (CSOM), at the ear, nose, and throat (ENT) clinic of University of Ilorin Teaching Hospital (UITH), from January

1998 to December 1999. Ear swab specimens were carefully obtained from patients by ENT surgeons on first clinic attendance after thorough physical examination with the documentation of their biodata and drug history. Very slender ear swabs were used to collect the exudate from the middle ear. In cases where the external meatus were filled with pus, this was initially mopped dry to allow access to the middle ear specimen. Patients on antimicrobial therapy within 72 hours of presentation were excluded from the study.

Appropriate specimens were immediately sent to the laboratory where streaking on Chocolate, MacConkey and Sabourad's dextrose agar plates, were carried out and incubated aerobically at 37°C for 18-24 hours. Isolates were identified by standard methods(22), which included gram and Ziehl-Neelsen stains.

The anti-microbial susceptibility patterns of isolates were determined by the standard disc diffusion method(23), on Mueller-Hinton agar employing Habdisc multidiscs with the following antibiotics: gentamicin 10ug colistin 25ug, cloxacillin 5ug, cotrimoxazole 25ug, ampicillin 2ug, tetracycline 10ug, erythromycin 5ug, and chloramphenicol 10ug. When necessary single discs of ofloxacin 10ug, ceftazidime 30ug, and cefuroxime 30ug were added. Growth inhibition zone diameter was measured in millimetres with a calibrated ruler after 18-24 hours incubation at 37°C and results interpreted as susceptible or resistant while *S. aureus* (NCTC 6571), *E. coli* (NCTC 10413), and *P. aeruginosa* (NCTC 10662), served as control organisms.

Facilities for retrieving and culturing anaerobic bacteria were lacking in the centre during the period of the study.

## RESULTS

Of the 375 specimens studied, 358 (95.5%) were culture positive while 17 (4.5%) yielded no growth. There were 342 unilateral and 32 bilateral cases, with an age range of eight months to 70 years. Male/female ratio was 1.3:1. The peak prevalence of 30.5% occurred among the 0-5 year age group and 45% of subjects were within ten years of age (Table 1). As shown in Table 2, *Pseudomonas aeruginosa* (26%) was the commonest isolate. The frequency of other isolates were: *Proteus spp.* (21.8%), *S. aureus* (13.5%), *K. pneumoniae* (10.5%), atypical coliform (8.6%) *E. coli* (8.6%), *Candida spp* (3.8%), *S. pneumoniae* (3.2%), *S. faecalis* (2.7%), and *serratia spp.* (1.3%). There were 13 mixed growths of *Staphylococcus aureus/Candida spp* (five cases), *Pseudomonas aeruginoosa/Candida* spp (seven cases), and *Proteus/Serratia* spp (one case). No mycobacterial agent was encountered.

**Table 1**

*Distribution of specimens positive for bacterial isolates by age and sex in UITH (n=358)*

| Age range (yrs) | Sex | | Total | |
|---|---|---|---|---|
| | M | F | | % |
| 0- 5 | 69 | 40 | 109 | 30.5 |
| 6-10 | 33 | 20 | 53 | 14.8 |
| 11-15 | 20 | 16 | 36 | 10.1 |
| 16-20 | 10 | 11 | 21 | 5.8 |
| 21-25 | 14 | 11 | 25 | 7.0 |
| 26-30 | 10 | 9 | 19 | 5.3 |
| 31-35 | 12 | 10 | 22 | 6.1 |
| 36-40 | 12 | 13 | 35 | 7.0 |
| 41-45 | 10 | 8 | 18 | 5.0 |
| +45 | 15 | 15 | 30 | 8.9 |
| Total | 205 | 153 | 358 | 100.0 |

**Table 2**

*Prevalence of pathogenic isolates among patients with chronic suppurative otitis media*

| Isolate | No. | % |
|---|---|---|
| *P. aeruginosa* | 96 | 26.0 |
| *Proteus* spp. | 81 | 21.8 |
| *S. aureus* | 50 | 13.5 |
| *K. pneumoniae* | 39 | 10.5 |
| Atypical coliforms | 32 | 8.6 |
| *E. coli* | 32 | 8.6 |
| *Candida spp.* | 14 | 3.8 |
| *S. pnuemoniae* | 12 | 3.2 |
| *S. faecalis* | 10 | 2.7 |
| *Serratia spp* | 5 | 1.3 |
| Total | 371 | 100 |

**Table 3**

*Antimicrobial susceptibility patterns of common isolates from patients with chronic suppurative otitis media in Ilorin, Nigeria*

| (Disc concentration) Antimicrobial agent | Organisms (% susceptibility) *P. aeruginosa* | *Proteus spp* | Atypical coliforms | *K. pneumoniae* | *E. coli* | *S. aureus* | *S. pneumoniae* |
|---|---|---|---|---|---|---|---|
| Gentamicin (10 ug) | 58 (60.4) | 43 (53.1) | 29 (93.4) | 35 (89.7) | 31 (96.8) | 45 (90) | 8 (66.6) |
| Colistin (25 ug) | 91 (94.8) | 35 (45.2) | 30 (93.8) | 39 (100) | 30 (93.8) | – | – |
| Ofloxacin (10 ug) | 96 (100) | 81 (100) | 32 (100) | 39 (100) | 32 (100) | 50 (100) | 12 (100) |
| Cloxacillin (5 ug) | – | – | – | – | – | 48 (96.0) | 12 (100) |
| Cotrimoxazole (25 ug) | – | 21 (26.0) | 11 (33.4) | 15 (38.1) | 18 (56.3) | 13 (26.0) | 6 (50.0) |
| Ceftazidime (30 ug) | 85 (88.5) | 78 (96.3) | 32 (100) | 36 (92.3) | 28 (87.5) | 26 (50.0) | 6 (50.0) |
| Ampicillin (25 ug) | | 5 (4.1) | 2 (6.3) | 6 (15.3) | 14 (43.8) | 10 (20.0) | 10 (83.0) |
| Tetracycline (10 ug) | – | – | 5 (15.6) | 7 (18.0) | 11 (34.3) | 22 (44.0) | 10 (83.0) |
| Erythromycin (10 ug) | – | – | – | – | – | 42 (84.0) | 10 (83.0) |
| Chloramphenicol (10 ug) | 21 (21.9) | 38 (47.0) | 13 (40.6) | 9 (23.0) | 20 (62.5) | 30 (60.0) | 6 (50.0) |
| Cefuroxime (30 ug) | 85 (88.5) | 78 (90.3) | 30 (93.8) | 30 (77.0) | 30 (93.8) | 25 (50.0) | 6 (50.0) |

The *in vitro* susceptibility patterns of the most common isolates are shown in Table 3. Ofloxacin produced 100% sensitivity in both gram positive and gram negative organisms tested. Among the older antimicrobial agents, colistin showed high activity ( 80%), while gentamicin had moderate activity ( 50%) respectively against the gram negative rods. Cloxacillin and erythromycin maintained high but narrowed sensitivity ( 80%) against the gram-positive organisms. The newer cephalosporins ceftazidime and cefuroxime, were highly active against the gram negative organisms but showed low sensitivity against the gram positive organisms.

## DISCUSSION

Two hundred and five (57.3%) of cases of CSOM in this study were males while 153 (42.4%) were females. The difference was statistically significant ($p<0.01$). The results conforms to literature reports, which claim from marginal to significant male preponderance(1-4,12,17). No rationale for this apparent disparity in sex prevalence has been identified. However, it may be due to higher exposure of male children who are more active than their female counterparts, to infectious conditions during the paediatric stage of growth, and a higher level of personal hygiene exhibited by female adults(24).

That the peak incidence of 30.5% occurred in the 0-5 year age group, with 45% of subjects being less than ten years old, agrees with the fact that CSOM is mainly a childhood disease(1). The incidence of such infections peak in early childhood before maturation of the immune system. Also, the Eustachian tube is relatively shorter, wider, and straightened in the infant and young child than in the adult. Hence infected materials from the nose, adenoids and sinuses more readily pass along the Eustachian tube to the tympanic cavity; particularly during coughing, sneezing, vomiting, and forced feeding commonly practiced in our environment with the child's nose blocked, while being held head down and half prone.

The pathogenic organisms isolated from the ears in this study were similar to those previously reported for the sub-region(3,12), with *P. aeruginosa* (26.0%) predominating. *Candida spp* was probably opportunistic being encountered in mixed culture with *pseudomonas aeruginosa* (seven cases), and *Staphylococcus aureus* (five cases).

The role of these organisms in causing CSOM is not clear(2). Bacteriological cultures taken from the middle ear with intact tympanic membrane, sometimes grow organisms which are unlikely to be contaminants from the external auditory meatus(2). Also isolates from active and inactive chronic otitis media are identical in nearly 50% of cases(2). In addition, elimination of anaerobic organisms with metronidazole treatment does note convert an active to inactive chronic otitis media. However, the combination of aerobic and anaerobic organisms can produce enhanced inflammatory response than the same organisms alone in an experimental animal(2), although the incidence of chronic otitis media associated with anaerobic bacteria is on the increase in recent times, probably due to improved isolation techniques of anaerobiosis(19).

Thus, it could be argued that the bacteria isolated from ears with CSOM are secondary invaders of a mucosa which is inflamed because of other factors rather than that they are the primary cause of the disease(2). This view is strengthened by the fact that *Pseudomonas* and *Proteus* are common inhabitants of even healthy external auditory canal. Studies show a high correlation of culture isolates from conventional canal swabs and middle ears swabs obtained under the guide of a microscope(15,25).

In this study, commonly available antibiotics (cotrimoxazole, ampicillin, tetracycline, and chloramphenicol) were generally ineffective against pathogenic isolates. This is in accordance with other reports from literature(12-14,17) and may be due to indiscriminate use and abuse of these antibiotics, resulting in the selection of resistant strains. Ofloxacin was 100%, effective against all isolated pathogens probably due to its mode of action, relative newness in the market and cost, which prohibits indiscriminate use. Cephalosporins have also been found most useful in other studies(20,21). Amadasun found gentamycin with hydrocortisone cost effective(18) and Moshi *et al*(19) found the use of boric acid in spirit ear drops safe, easy to administer, affordable and highly effective.

Gentamicin which was previously reported in Lagos(12), and Benin(13), to be the most active single antibiotic against bacterial agents of CSOM had only moderate sensitivity in this study, indicating increasing resistance against it. The cephalosporins together with cloxacillin and erythromycin on the other hand were highly active against gram negative and gram positive organisms respectively probably due to limited availability to the public because of high cost and hence less resistant strains(14,20,21).

Since the therapeutic option for eradicating the pathogenic agents of CSOM in our environment is not feasible due to many factors among which are increasing resistance, poor socio-economic status, prohibitive costs, and drug abuse, we recommended that preventive and control measures be adopted. This should include aggressive public enlightenment campaigns on the dangers of forced feeding, the need for environmental cleanliness, good personal hygiene, adequate and proper childcare procedures. Advocacy and the provision of social and health necessities by constituted authorities in concert and well meaning individuals would help reduce the burden of this infection.

Meanwhile, where possible and available, susceptibility tests should guide the management of CSOM in this environment otherwise, ofloxacin if indicated and cloxacillin/erythromycin may provide relief and delay emergence of resistance strains.

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