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Original Article

Antimicrobial Susceptibility Pattern of Bacterial and Fungal Isolates from Patients with Chronic Suppurative Otitis Media in Perspective of Emerging Resistance

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ABSTRACT: PURPOSE OF STUDY : To determine the antibiotic sensitivity pattern in patients with chronic suppurative otitis media (CSOM) to provide a guideline for making a protocol for empirical antibiotic therapy where culture facilities are not available. STUDY DESIGN: Descriptive hospital based study. PLACE AND DURATION: The study was conducted from January 2011 to December 2011 at the Central Lab, Civil Hospital Karachi. SUBJECTS & METHODS: A total of 251 patients with unilateral or bilateral active chronic suppurative otitis media attending the outpatient clinic and admitted in the ENT Wards were included in the study. Pus samples (Ear swabs) were collected from the discharging ear(s) and sent to Central Lab, Civil Hospital Karachi. Aerobic cultures were done. Antibiotic sensitivity testing was done with standard antibiotic discs using Kirby-Bauer disk diffusion method as per National Committee for Clinical Laboratory Standards recommendations. RESULTS: From the clinical specimens of 251 patients enrolled in the study, the pathogens were isolated in 206 (82.07%) patients, while in 45 (17.9%) patients' pathogenic micro-organisms were not isolated. There were 201, (98%) bacterial isolates and 5 (2%) fungi. Pseudomonas aeruginosa in 141 (68.44%) was the most common isolate, followed by Staphylococcus aureus in 53 (25.72%). Antibiotic sensitivities of Pseudomonas Aeruginosa showed that 100% isolates were sensitive to meropenem, where as 97% isolates were sensitive to sparfloxacin and 95% to sulbactam / cefoperazone, piperacillin / tazobactam and imipenem. Only 68% of Pseudomonas aeruginosa isolates were sensitive to aztreonam and 65% to chloramphenicol. For Staphylococcus aureus, 94.3% isolates were sensitive to Fusidic acid, 92% to Linezolid and 90% to Vancomycin. Over all 66% isolates were sensitive to Amoxicillin and 60% to Ciprofloxacin, Ofloxacin and Kanamycin. CONCLUSION: Pseudomonas aeruginosa was the most common isolate followed by Staphylococcus aureus. Clustering of cases was seen during the summer season. More than 80% of Pseudomonas aeruginosa isolates were sensitive to carbapenems and bêta-lactamase inhibitors while Fusidic acid, Vancomycin and Linezolid were found to be most sensitive for strains of Staphylococcus aureus. It is therefore concluded that the topical preparation of these antibiotics should be incorporated in the course of therapy to cover up the most frequent aerobic isolates implicated in CSOM.

Key Words: Chronic suppurative otitis media, Bacteria, Fungi, Risk factors, Culture and sensitivity.

INRODUCTION: Chronic suppurative otitis media (CSOM) is one of the most common problem related to ear in developing and developed countries, if left untreated causing more severe loss of hearing. It is characterized by persistent otorrhea for more than 6-12 weeks, through perforated tympanic membrane, usually resulting from previous acute infection[1]. The infection is due to the bacteria coming from nasopharynx via eustachian tube, and cause inflammation in mucoperiosteum of middle ear cleft, resulting in ear discharge[2]. CSOM is a global problem and affects all ages but especially prevalent in children younger than 7 years due to horizontal, wider and short eustachian tube[3]. The commonly occurring symptoms are ear discharge, deafness, itching, pain and sometimes fever. If it is left untreated complications like loss of hearing, post aural swelling and post aural sinus may occur[4]. The most probable risk factors included are untreated sore throat, low socio-economic status, age, poor hygiene, upper respiratory tract infection , immunocompromised, environmental factors, nutritional factors and facial anomalies etc[5, 6]. CSOM is mostly caused by bacteria, but fungi and virus can also be a cause CSOM[7]. Commonly found pathogens in CSOM are Pseudomonas aeruginosa, Staphylococcus aureus, Proteus mirabilis, Klebsiella pneumoniae, Escherichia coli, Aspergillus spp and Candida spp[8]. This middle ear infection can cause complications like facial nerve paralysis, meningitis and intracranial and extra cranial abscesses[9].

The basic aim of this study was to evaluate the bacteriological and mycological causes of CSOM and their antibiotic sensitivity pattern to commonly used antibiotics at CHK, finding the risk factors involved and to provide a guideline for making a protocol for

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empirical antibiotic therapy where culture facilities are not available. This will contribute to rational usage of antibiotics, success of treatment, prevention of the complications and antibiotic resistance of the pathogenic micro-organisms.

SUBJECTS AND METHODS: Collection of specimens: Two hundred and fifty one patients of chronic suppurative otitis media both unilateral and bilateral who presented to Ear, Nose and Throat (ENT) Department of Civil Hospital, Karachi from January 2011 to December 2011 were prospectively studied. All patients had perforated tympanic membranes with active purulent discharge for more than six weeks.Detailed clinical history regarding age, sex, duration of discharge and antibiotic treatment were taken. Disposable sterile cotton swabs and ear specula were used to collect pus swabs to harvest the middle ear micro flora through the tympanic membrane perforation. All care was taken to avoid surface contamination and the swabs were transported to Microbiology Department of Central Lab, CHK for further processing.

Inclusion criteria: Only those patients who had not received antibiotic therapy (topical or systemic) for previous 72 hours were included in the study. Exclusion criteria: Patients with ear discharge due to cholesteotoma and on treatment with systemic antibiotics were excluded from the study. Culture and antibiotic sensitivity: The pus swabs were cultured on Blood agar, MacConkey's agar and Chocolate agar and incubated at 37°C aerobically for 24-48 hours. Direct smear of pus was made and stained with Gram stain and looked for pus cells, epithelial cells and bacteria. All organisms isolated were identified according to standard microbiological methods. Antimicrobial susceptibility tests was performed using modified Kirby- Bauer disc diffusion method using national committee for clinical laboratory standards (NCCLS) for breakpoints of interpretation of results. The standard antimicrobial discs used for Staphylococcus aureus were Oxacillin (OX) 1 µg, Cotrimoxazole (COT) 1.25/23.75 µg , Gentamicin (CN) 10 µg, Chloramphenicol (C) 30µg, Ciprofloxacin (CIP) 5µg and Vancomycin (V) 30µg . The standard antimicrobial discs used for Pseudomonas aeruginosa were Gentamicin (CN) 10 µg, Amikacin (AK) 30µg, Ciprofloxacin (CIP) 5µg, Ceftazidime (CAZ) 30 µg and Piperacillin/Tazobactam 10/1 (TZP) 110 µg. The susceptible zone diameters were interpreted according to NCCLS criteria.

RESULTS: The overall age range of patients was 6-85 years with mean age of 36 years. There was almost equal distribution between sexes, males n=116 (46.21%) and females n=135 (53.78%).The microbiological profile of aerobic bacterial isolates is depicted in table 1 and figure 1. Pseudomonas aeruginosa n=141 (68.44%) was the most common isolate, followed by Staphylococcus aureus n=53 (25.72%). The month wise distribution of cases of CSOM is shown in figure 2. Clustering of cases was seen during the summer season with a peak obtained in the month of May. Fungal organisms were found to be more prevalent in the winter season. The antibiotic sensitivity pattern of the two commonest isolates Pseudomonas aeruginosa and Staphylococcus aureus from patients of CSOM is shown in (figures 3 & 4) respectively. The antibiotic sensitivity pattern for Pseudomonas aeruginosa was found to be as follows: Imipenem 95%, Amikacin 91%, Gentamycin 79.43%, Tobramycin 81%, Ceftazidime 82%, Aztreonam 69%, Chloramphenicol 66%, Polymyxin-B 76%, Neomycin 79%, Sparfloxacin 97%, Cefoperazone/Sulbactam 95%, Piperacillin/Tazobactam 95%, Levofloxacin 79%, Meropenem 100%, and Ciprofloxacin 80%. The antibiotic sensitivity pattern for Staphylococcus aureus was found to be as follows: Amoxicillin 66%, Amoxicillin+Clavulanic acid 88%, Doxycycline 77%, Ciprofloxacin 60%, Ofloxacin 60%, Fusidic acid 94%, Clindamycin 85%, Linezolid 92%, Vancomycin 90%, Kanamycin 60%. Among the minority of micro-organisms causing CSOM; Pneumococci and Enterococci were found to be sensitive to all conventional antibiotics while Klebsiella spp was found to be resistant to Cefuroxime and Proteus mirabilis was resistant to Chloramphenicol and Neomycin. E.coli was markedly resistant to all generations of cephalosporins and quinolones in the strains isolated.

Name Of Organism	No. of Isolates (N)	Percentage Yield (%)
Pseudomonas aeruginosa	141	68.44
Staphylococcus aureus	53	25.72
Eschericia Coli	2	0.97
Pneumococci	1	0.5
Enterococci	1	0.5
Proteus mirabilis	2	0.97
Klebsiella spp.	1	0.5
Aspergillus spp.	1	0.5
Candida spp	4	1.9

Table 1: Microbiological profile of patients with chronic suppurative otitis media (n=206).

DISCUSSION: Chronic suppurative otitis media and various complications associated with the disease such as irreversible local destruction of middle ear structures, facial palsy, serious intracranial and extra cranial complications are amongst the most common conditions seen by ENT Specialists, Pediatricians and General Practitioners. It is a persistent disease and often causes irreversible damage to the middle ear cavity; recurrent otitis media may cause damage to ossicles, facial nerve and cochlea resulting in permanent hearing loss[10, 11]. This study was carried out for the identification of micro organisms of CSOM in our set up and to stress the importance of culture and sensitivity in the management of CSOM. The abuse of antibiotic in everyday practice is a routine, thus resulting in emergence of resistant organisms. In pathogenesis the commensals help the accompanying pathogenic bacteria by increasing beta lactamase and these enzymes also inhibit the activity of certain antibiotics[12]. The most common isolated organism according to our results is Pseudomonas aeruginosa followed by Staphylococcus aureus, however Escherichia coli, Proteus mirabilis, Klebsiella were

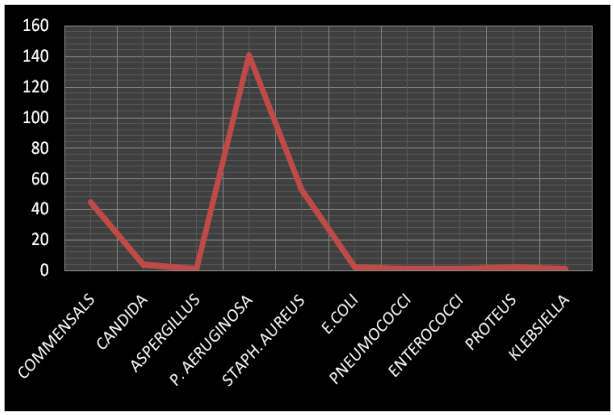


Figure 1: Frequency of etiologies of CSOM.

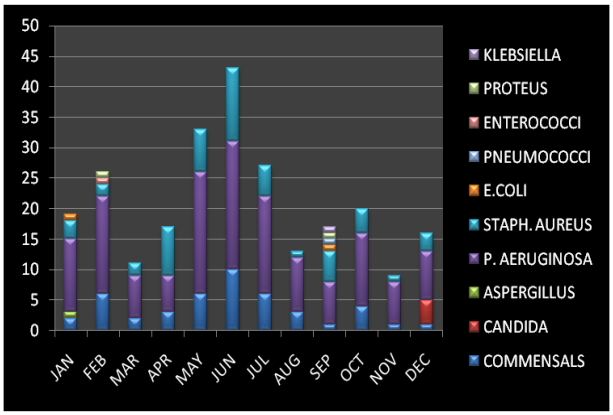
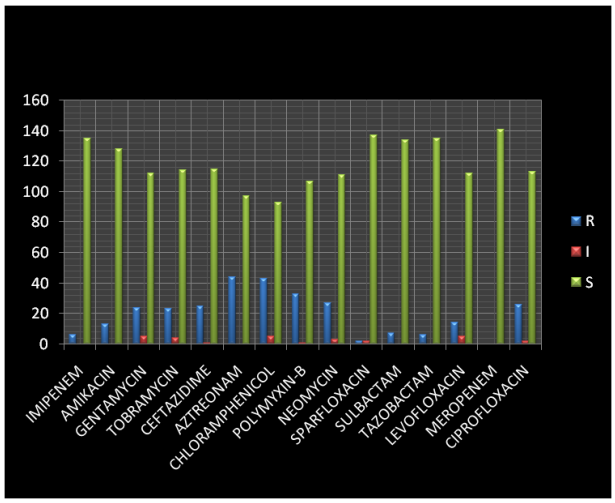


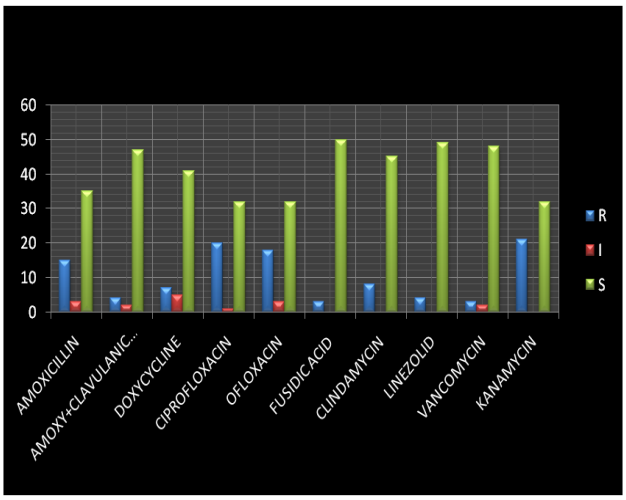
Figure 2: Monthly distribution of cases of CSOM by etiology of micro-organisms.

also found, this result is similar to some studies conducted in various cities of Pakistan[13-16]. A study from USA also found the highest incidence of Pseudomonas aeruginosa followed by Staphylococcus aureus and Klebsiella. Other studies also described Pseudomonas aeruginosa followed by Staphylococcus aureus and Proteus mirabilis as the common organisms in their study[17,18]. Pseudomonas aeruginosa has been the most prevailing bacterial isolate so it was checked frequently for its antibiotic susceptibility pattern to aminoglycosides (Amikacin, Gentamycin) which are bactericidal antibiotics interfering with protein synthesis of the bacteria and is used largely for gram negatives species. We found it highly effective also as reported by previous researches from India[23], Nigeria, Nepal[21] and also from Pakistan[10, 15, 16]. Flouroquinolones (Ciprofloxacin, Sparfloxacin, Levofloxacin) which acts on DNA replication and transcription inhibition, were also very effective up to 80 % in our community[14, 16]. Cephalosporins have an extended antibiotic spectrum. In Pakistan it is shown that 3rd generation cephalosporins are very effective against the bacterial isolates in CSOM and some suggest Ceftriaxone as the drug of choice along with other antibiotic combinations[24]. Our results show 87% susceptibility to Ceftazidime which is comparable to other researches[13]. Imipenem and Meropenem of Carbopenem group is also very effective against the bacteria and show almost complete susceptibility[16]. The monobactam Aztreonam also shows a good susceptibility profile to Pseudomonas aeuriginosa[16] The second predominant organism in our study was Staphylococcus aureus which is similar to findings of various previously conducted studies in the world[25-27]. In our series the antibiotic sensitivity pattern for Staphylococcus aureus was found to be as follows: Amoxicillin 66%, Amoxicillin+Clavulanic acid 88%, Doxycycline 77%, Ciprofloxacin 60%, Ofloxacin 60%, Fusidic acid 94%, Clindamycin 85%, Linezolid 92%, Vancomycin 90%, Kanamycin 60%. It correspond to a previous studies where more suspectibitilty pattern of Staphylococcus aureus to Ampicillin, Amoxicillin+Clavulanic acid, macrolides, aminoglycosides, cephalosporins and flouroquinolones



Susceptibility Pattern:R=resistant, I=intermediate, S=sensitive)

Figure 3: Antibiogram of Pseudomonas aeruginosa (n=141).



Susceptibility Pattern:R=resistant, I=intermediate, S=sensitive)

Figure 4: Antibiogram of Staphylococcus aureus (n=53).

with 36%, 55%, 18%, 55%, 76% and 83% respectively[28]. We also noted that Ciprofloxacin, Augmentin (amoxicillin+clavulinic acid), Gentamycin were broad spectrum antibiotic sensitive to almost all gram negative and gram positive isolates in CSOM. To evaluate the associated factors with CSOM, age is considered as a major risk factor because of shorter and more horizontal Eustachian tube of children less than five years allow commensal organism from the nasopharynx to sterile middle ear cavity resulting in congestion of the tube. It has also been observed that children are more exposed to upper respiratory tract infection due to their immature immune system that minimally protect them against the opportunistic organisms[29], The overall age range observed in our study is 6-85 years, and a mean age of 36 years, this may be because our records are hospital admission based, though it corresponds to a few researches conducted before[2, 30]. We found almost equal sex distribution of the disease similar to other studies[31]. Some researchers however argued that males have higher incidence of disease which could be due to their active and adventurous nature which predispose them to traumatic conditions[32]. With respect to seasonal variation the clustering of cases was seen during the summer season with a peak obtained in the month of May. Fungal organisms were found to be more prevalent in the winter season. Since cold weather predispose to upper respiratory tract infections hence most of the chronic suppurative otitis media cases would be seen post dry season and more frequently in rainy season[29]. For better management of otitis media, clinical classification of infection as well as drug susceptibility testing of the organisms recovered from chronic cases are essential for making the right decision of antimicrobial drugs that will effectively eradicate the pathogens. The high rate of multiple drug resistance as well as high level of resistance to individual antibiotics is a cause of concern. In addition, educating parents and guardians regarding possible risk factors of the disease may be a preventive strategy that might reduce disease occurrences. CONCLUSION: Pseudomonas aeruginosa was the most common isolate followed by Staphylococcus aureus. Clustering of cases was seen during the summer season. More than 80% of Pseudomonas aeruginosa were sensitive to carbapenems and bête-lactamase inhibitors while Fusidic acid, Vancomycin and Linezolid were found to be most sensitive for strains of Staphylococcus aureus. It is therefore concluded that the topical preparation of these antibiotics should be incorporated in the course of therapy to cover up the most frequent aerobic isolates implicated in CSOM. Culture and sensitivity remains time tested investigation of choice for better medical treatment , it has advantages like preventing resistance, minimizing complications and total cost of treatment. Knowledge of risk factors, seasonal variation also help to get best possible results of medical management of CSOM.

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