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Chronic Otitis Media- Bacteriological Spectrum and Antibiogram

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Abstract:
Introduction: *Chronic Suppurative Otitis Media (CSOM) is the chronic inflammation of the middle ear cleft and one of the most common cause of conductive deafness which can lead to neumerous complications if left untreated. The most common bacteria causing CSOM are Pseudomonas aeruginosa, Staphylococcus aureus, Proteus mirabilis, Klebsiella pneumonia and Escherichia coli.*
Objectives: *This study was carried out to identify the common bacterial pathogens causing CSOM and to access their antibiotic susceptibility pattern.*
Method: *This is a retrospective analysis of the ear swabs of the 132 patients who presented to the ENT department of JNUIMSRC with the chief complain of chronic/ recurrent ear discharge. Two swabs were collected from the discharging ear of each patient. First swab was used for Gram staining and the second for culture and sensitivity. The results were analyzed using simple statistical methods.*
Results and Discussion: *Total 111 patients were found to be culture positive from the 132 known case of CSOM. 77.27% of the samples showed pure growth and 6.81% showed mixed growth. The most commonly isolated bacteria was Pseudomonas aeruginosa (56.30%) followed by Staphylococcus aureus(23.52%), Coagulase negative staphylococci, Klebsiella pneumoniae, Proteus mirabilis, Escherichia coli. Pseudomonas was found to be most sensitive to colistin, Amikacin and Imipenem. While staphylococcus was found to be most sensitive to linezolid, vancomycin and teicoplanin.*
Conclusion: *Pseudomonas aeruginosa was the most predominant bacteria isolated with a high sensitivity to colistin and Amikacin. In the view of developing antibiotic resistance, and extra- and intracranial complications in improperly treated cases, timely identification of the causative pathogen and judicious use of appropriate antibiotics is key to prevention of major complications.*
Keywords: *antibiotic sensitivity, chronic suppurative otitis media, ear discharge, Pseudomonas aeruginosa.*

I. Introduction

Chronic suppurative otitis media (CSOM) is a chronic inflammation of the middle ear and mastoid cavity, which presents with recurrent or chronic ear discharge through a perforation in the tympanic cavity. The disease generally begins in early childhood [1,2] as an acute infection of the middle ear, such as acute otitis media (AOM) leading to spontaneous perforation of the tympanic membrane, or as a consequence of less severe secretory otitis media[3,4]. Though CSOM is known to be prevalent worldwide but is clearly affecting the developing or underdeveloped countries with the major burden of disease[5]. Higher incidence of CSOM is known to occur in communities with poor socio-economic standards, owing to the malnutrition, overcrowding and poor hygiene associated with it[6]. CSOM is caused by variable bacterial etiology which includes both aerobic and anaerobic bacteria. Amongst the aerobic bacteria, the most common pathogens are known to be *Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus, Streptococcus pyogenes, Proteus mirabilis, Klebsiella* species and Bacteroides, Peptostreptococcus, Proprionibacterium are the common anaerobes causing CSOM [7,8]. These bacteria may be found as commensals in the skin of the external auditory canal, but these bacteria may then gain entry to the middle ear through a chronic perforation, proliferate and become pathogenic whenever given an opportunity as in the form of trauma, inflammation, lacerations or high humidity [9, 10]. Amongst the bacterial pathogens *Pseudomonas* has been found to be most notorious in causation of widespread and deep-seated infection with progressive destruction of middle ear cleft through the various toxins and enzymes secreted by it. Even in this era of powerful antibiotics, CSOM still consumes considerable medical expenditure, especially in the poorer sections of the society. Important consideration is also to be given to the pattern of bacterial resistance to various antibiotics and there side effects profile such as ototoxicity during treatment[11]. Untreated cases of CSOM may result in numerous complications such as persistent otorrhea, mastoiditis, labyrinthitis, and facial nerve palsy to grave consequences like meningitis, intracranial abscesses, and thrombosis[12]. So, timely management of CSOM cases is of utmost importance to prevent the development of these life threatening complications. Recurrence and persistence of low grade infections have increased recently due to indiscriminate use of broad spectrum antibiotics and poor follow up of patients and have resulted

in the emergence of multiple drug resistant strains of bacteria. Changes in the microbiological flora following the advent of newer synthetic antibiotics increase the requirement of the reassessment of the modern day flora in CSOM, along with their in-vitro antibiotic sensitivity pattern which plays a major role as a guide for clinician to plan a eradicative treatment for chronically discharging ear. Hence, this study was undertaken to acquire the knowledge of the local pattern of aerobic organisms causing CSOM & to determine the antibiotic sensitivity pattern of the aerobic bacterial isolates prevalent in our hospital to help us develop the hospital protocol for empirical therapy to our patient suffering from chronic suppurative otitis media.

II. Material And Methods

This is a retrospective study carried out in the department of microbiology, Jaipur National University, Institute for medical sciences and research. It included the patients who presented to the ENT department of the hospital with the chief complaint of chronic/recurrent ear discharge between the duration of Nov 2015 to Oct 2016. During this period total 255 ear swabs from ENT department were received by the microbiology department for culture & sensivity. For retrospective analysis, the patient's clinical history and disease profile were looked into by reviewing the patient's medical record and the sample requisition forms. Out of total 255, only 132 patients, fulfilling the following inclusion criteria were included in the study.

Inclusion Criteria

-Patients of any age, gender, presenting with recurrent or chronic discharge of more than 3 months duration from unilateral or bilateral ears were included in study.

Remaining 123 samples were not taken into consideration on account of the following exclusion criteria.

-Patients with ear discharge of less than 3 months duration.

-Patients with ear discharge with intact tympanic membrane.

-Patients receiving antibiotics at the time of presentation or within a week of presentation.

-Patients with disease in external ear or operated cases were excluded from the study.

As per the routine sample collection protocol followed at this hospital, the ear discharge were collected from the affected ear using two sterile cotton swabs with all aseptic precautions. At this hospital, the specimens for pus culture are collected, under good illumination by swabbing the discharging ear with two sterile cotton swabs from deeper part of the external auditory canal and sent for bacterial culture and sensitivity. Swabs are immediately transported to the Microbiology laboratory. In the laboratory, the first swab is used for gram staining and direct microscopical examination to note the morphology of bacteria, their number, and presence or absence of inflammatory cells and epithelial cells in the sample. Second swab is inoculated on MacConkey agar, Blood agar and Chocolate agar for bacterial isolation. The bacterial culture plates are incubated at 37^{o}C for 48 hours before any sterile report is issued. For the positive cultures, standard biochemical tests were put for the identification of bacteria. Along with that antibiotic susceptibility testing is carried out using Kirby Baeur Disk Diffusion method on muller hinton agar.

Statistical analysis was carried out using the R software. Frequency was calculated for gender and bacteria culture. Mean and standard deviation was calculated for the age of the patient.

III. Results

In the total duration of study period ie; one year from Nov 2015 to Oct 2016, total 132 patients presented with the clinical picture of CSOM, but out of them only 111 cases were found to be associated with bacterial etiology of aerobic origin. In this study there was a clear predominance of males over females. Out of total 132 patients, 81 (61.36%) were male and 51 (38.68%) patients were female and male to female ratio was 1.58. The disease was found to be more common in the lower and the middle socio-economic strata of the society with an urban: rural ratio of 1:2.2. Mean age of the patients was found to be 37.4 years. Out of 132 patients, 102 patients (77.27 %) revealed growth of single organism while 9 patients (6.81 %) showed mixed growth. So total 111 patients were found to be positive for bacterial etiology (84.09%) and 21 patients (15.9%) did not grow any organism ie; they were culture negative. Amongest 102 patients who showed a growth of single organism , Pseudomonas aeruginosa was isolated in 59 patients followed by staphylococcus aureus 24, Coagulase negative Staphylococci 08, Klebseilla pneumoniae 04, Proteus mirabilis 03 and E.coli 03. Among the 09 patients with mixed growth, pseudomonas aeruginosa was seen in 08, Staphylococcus aureus in 04, Coagulase negative Staphylococci in 02, E. coli in 02, Proteus mirabilis in 01 and Klebsiella pneumoniae was seen in 01 patients. So in 132 patients, total 119 bacterial isolates were grown. Pseudomonas aeruginosa was the commonest found organism 67 (56.30%) followed by staphylococcus aureus 28 (23.52%), Coagulase negative Staphylococci 10 (8.4%), Klebsiella pneumoniae 05 (4.2%), E. Coli 05 (4.2 %) and Proteus mirabilis 04 (3.36 %) (Figure 1).

The anitibiotic sensitivity pattern of *Pseudomonas aeruginosa* revealed that the isolates were highly sensitive to colistin, amikacin and imipenem followed by piperacillin-tazobactam, levofloxacin, netilmicin & gentamicin. They were found to be less sensitive to ceftazidime, cefipime, aztreonam and cotrimoxazole. (Figure 2).
Staphylococcus isolates were most sensitive to linezolid, vancomycin and tiecoplanin. They were highly sensitive to gentamicin, followed by doxycycline & cotrimoxazole. They showed less sensitivity against commonly used antibiotics like ampicillin, cefoxitin, clindamycin & erythromycin. They were resistant to penicillin & ciprofloxacin. (Figure 3). The prevalence of MRSA was 44% as found with the cefoxitin disc.

IV. Discussion

Chronic suppurative otitis media (CSOM) is one of the most indication for the microbiological cultures from the ENT department. In CSOM, bacteria gain access to the middle ear either from the nasopharynx through the eustachian tube or from the external auditory canal through a non-intact tympanic membrane. Infection of the middle ear mucosa subsequently results in ear discharge [13]. In this study we found male preponderance i.e; 61.36%. The male is to female ratio was found to be 1.58. This finding is consistence with the other researchers [14,15]. The male predominance may have been because of the more exposed way of life of the males. This can also be just a reflection of the higher proportion of the male population which generally presents to this hospital. Contrastingly, some regional and local studies showed higher incidence of females than males in cases of CSOM [16]. Moreover, no knowledge of anatomical differences in the ear structures of male and female has been reported so the reason for such variability cannot be commented upon. In our study, patients presented predominantly between 6 to 68 years of age with mean age of 37.4 years. This finding is consistent with some other regional as well as international studies [17]. But few other studies reported that CSOM was seen in first and second decade of life[18]. According to this study the commonest bacteria isolated were Pseudomonas aeruginosa followed by S. aureus,CONS, proteus, Klebseilla and E. coli. This is in line with most other studies conducted worldwide, in which the commonest organisms implicated in CSOM were Pseudomonas followed by S. aureus, proteus and other enteric bacteria [19,20]. On the other hand few studies from India reported Staphylococcus aureus followed by the pseudomonas aeruginosa as the predominant bacterial etiology of CSOM [21,22] . The findings of this study do not correlate with few studies which have found Staphylococcus species as the predominant organism causing CSOM [23,24]. This observation may be attributed to diversity of microbial flora of CSOM infection in that region. In this research Klebsiella pneumoniae and Escherichia coli were isolated from 4.2% cases, which was consistent with the study of Mansoor, et al whereas the study done by Poorey and lyer reported a higher-incidence for klebsiella.

Antibiotic susceptibility pattern is very important and serve as a useful guide for making the choice of appropriate antibiotic. In the present study, majority of Pseudomonas isolates were highly sensitive to colistin, amikacin and imipenem followed by piperacillin-tazobactam, levofloxacin, netilmicin & gentamicin. Our findings correlate with few other studies[25, 26, 27] wherein amikacin was found to be the most effective drug. In the present study Pseudomonas aeruginosa were less sensitive to aztreonam, ceftazidime, and cefipime. Other studies [28] also showed pseudomonas to be less sensitive to aztreonam, but there was good sensitivity to ceftazidime which is in contrast to our findings. In our study Staphylococcal isolates were found to be most sensitive to linezolid, vancomycin and tiecoplanin followed by gentamicin, doxycycline & cotrimoxazole These findings correlate well with findings of other studies[29, 30, 31].

Though this study provided a good reflection of the aerobic bacterial pathogens associated with CSOM but the information on the fungal pathogens and anaerobes was completely missed out which was a drawback of the study. Anaerobes in CSOM are often detected with extensive cholesteatoma or granulation. Therefore it is advised that requisition for anaerobic culture should also be included and the treatment should be directed at the eradication of the aerobic and anaerobic organisms [32]. Keeping in line with the higher rate of fungal pathogens associated with CSOM, a more extensive study with a larger sample size is required to be done on etiological agents of CSOM including both fungal isolates and anaerobes to bring out the true picture. In the era of antibiotics the emergence of antibiotic resistance is becoming more common. Human negligence is a factor responsible for the development of antibiotic resistance. As soon as symptoms subside, many patients stop taking antibiotics before completion of therapy and allow partially resistant microbes to flourish. Such practice should be condemned strongly and people should be educated to avoid the same.

V. Conclusion

In conclusion, the present study on the etiological pathogens of CSOM showed that *Pseudomonas aeruginosa* was the most common followed by *Staphylococcus aureus* as the aerobic bacterial isolate causing CSOM. The periodic evaluation of microbiological pattern and their antibiotic sensitivity pattern in local area becomes important & helpful in prescribing empirical antibiotics for successful treatment of CSOM and thus minimizing its complications and emergence of resistance strains. As there is an increasing resistance to antibiotics, poor socio-economic status and increased cost of treatment, prevention of acquisition of infection is

always a better strategy with the help of Proper childcare and Public enlightment for maintanence of personal hygiene and environmental cleanliness. In case of infection appropriate use of antibiotics by proper selection, dosage and duration should be mandated to prevent development of life threatening complications of CSOM and human negligence regarding antibiotic misuse should be strongly condemned.

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