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# Bacteriological Profile of Chronic Suppurative Otitis Media and Antibiotic Susceptibility in a Tertiary Care Centre of Central Nepal

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## ABSTRACT

### Background

Chronic suppurative otitis media is one of the most common cause of hearing impairment especially in developing countries due to illiteracy, poor hygiene, respiratory infections and poverty. If left unchecked, it can cause serious local and systemic complications. The aim of the study was to determine the causative organisms and their antibiotic susceptibility pattern.

### Methods

This study included total 90 patients who were clinically diagnosed as chronic suppurative otitis media having active ear discharge presenting to outpatient Department of ENT, Bharatpur hospital from May 2024 to Feb 2025. Pus swab was obtained under aseptic precautions and samples were processed in microbiological lab using standard operating protocol. For isolated bacterial strains, antibiotic susceptibility test was performed by using Kirby Bauer disc diffusion method and the results were analyzed using simple statistical techniques.

### Results

The most commonly affected age group was >40 years and majority of them had unilateral disease. Females were more affected than males. The most common isolated organisms were *Pseudomonas aeruginosa* (47.8%) and *Staphylococcus aureus* (8.9%) followed by *Klebsiella Pneumoniae* (7.8%), *E. coli* (5.6%), *Proteus mirabilis* (5.6%), *Acinetobacter* (3.3%), Coagulase negative *Staph aureus* (2.2%) and *proteus vulgaris* (1.1%). Majority of the common isolated strains were sensitive to Amikacin and Levofloxacin. Ciprofloxacin was found to be one of the least sensitive drugs and majority of strains were found to be resistant to Amoxycyclav and third generation cephalosporins.

### Conclusions

*Pseudomonas aeruginosa* was the most common predominant isolated organism followed by *Staphylococcus aureus*. It is essential to know the etiological agents of CSOM and their antimicrobial susceptibility for effective treatment and preventing both the complications and development of antibiotic resistance.

**Keywords:** chronic suppurative otitis media; antibiotics; *pseudomonas aeruginosa*.

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## INTRODUCTION

Chronic suppurative otitis media (CSOM) is defined as chronic inflammation of middle ear and mastoid cavity that may present with recurrent ear discharges or otorrhoea through a tympanic perforation.<sup>1</sup> Incidence is more in developing countries especially among low socio-economic society because of malnutrition, overcrowding, poor hygiene, and recurrent upper respiratory tract infection.<sup>1</sup> CSOM often leads to conductive hearing loss and constitutes a risk factor for permanent sensorineural hearing loss as well as intracranial complications.<sup>2</sup> The primary culprits behind CSOM include aerobic organisms such as *Pseudomonas aeruginosa*, *Haemophilus influenzae*, *Proteus*, *Staphylococcus aureus* and anaerobic organisms.<sup>3</sup> Identifying the bacterial spectrum and susceptibility to antimicrobials is essential for efficient empirical treatment of CSOM. The objective of this cross-sectional prospective study is to determine the microbial diversity and the resistogram of aerobic bacterial isolates among the patients suffering from CSOM who attended ENT Department of our hospital.

## METHODS

A hospital based cross sectional study was carried out for duration of nine months (August 2024 to April 2025) in the department of ENT in Bharatpur hospital, Chitwan, Nepal. The study was conducted following Ethical clearance from Institutional review committee (IRC) of Bharatpur Hospital, Bharatpur, Chitwan, Nepal (Ref. No. 081/82-021). Clinically diagnosed chronic suppurative otitis media patients of any age group having unilateral or bilateral ear discharge attending outpatient department of ENT were included in the study. The sample size for this study was calculated through the use of sample size calculation formula as: Sample size (n) =  $Z^2 pq/d^2$ . Prevalence was taken from study "Sharma S, Dhakal A. Microbiological Spectrum Causing Chronic Suppurative Otitis Media and Determination of the Antibiotic Sensitivity Pattern of Isolated Bacteria. Medical Journal of Eastern Nepal. 2023 Dec 21;2(02):16-20.<sup>4</sup>  $p=94.4\%$  =0.94 (Ref 8),  $q=1-0.94=0.056$ ,  $Z=95\%$  confidence interval= 1.96,

$d=5\%=0.05$ (allowable error). Then, estimated sample size ( $n= Z^2 pq/d^2 = (1.96 \times 1.96 \times 0.94 \times 0.056) / (0.05 \times 0.005) = 80.88 = 81$ . Adding 10% non-response rate, the final sample size was 90. Simple random sampling technique was used in patient's selection. All clinically diagnosed CSOM patients of any age group presenting to outpatient department of ENT were enrolled in the study. Immunocompromised patients like HIV, Diabetes were excluded.

Sterile cotton swab was used to collect pus sample from affected ear using aseptic measures. Sample was immediately transported to microbiology lab and sample was inoculated in Macconkey and blood Agar and incubated for 48 hrs. at 37°C Gram staining, conventional biochemical testing and colony morphology were used to identify bacterium. Kirby Bauer disk diffusion method was used to evaluate the susceptibility to various antibiotics. Antibiotics used were Amikacin, Amoxiclav, cefixime, cefotaxime, ceftriaxone, ciprofloxacin, cefepime, colistin, imipenem, levofloxacin, piperacillin, tazobactam, aztreonam, cotrimoxazole. Data was collected through semi structured questionnaire prepared through expert advice and research. All collected data were entered in Microsoft excel and analyzed in SPSS version 16. Descriptive analysis was presented through frequency, percentage and pie-charts.

## RESULTS

Out of 90 enrolled patients, 47(52%) were females and 43(48%) were male (Figure 1).

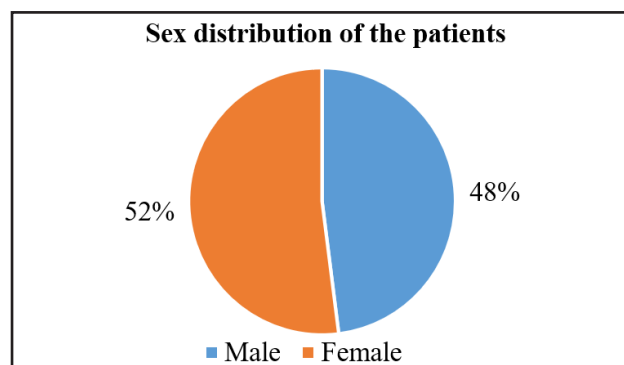


Figure 1. Sex distribution of patients.

There were 75(83.3%) no. of patients having unilateral disease and 15(16.7%) having bilateral disease (Figure 2).

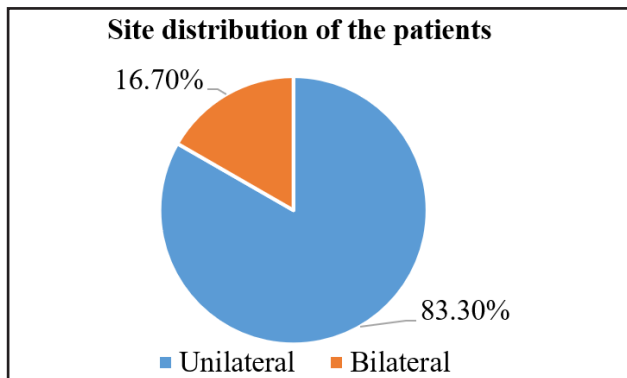


Figure 2. Site distribution of patient.

Maximum no. of patients affected age group was found to be more than 40 years. Out of 90 patients, 44 (48.9%) patients were greater than 40 years of age (Table 1).

**Table 1. Age Distribution of the patient.**

Age group (years)	Frequency (%)
<10	1(1.1)
11-20	15(16.7)
21-30	16(17.8)
31-40	14(15.6)
>40	44(48.9)

The most common organisms isolated were *Pseudomonas aeruginosa* 43(47.8%), *staphylococcus aureus* 8(8.9%) and *Klebsiella pneumoniae* 7(7.8%). Other organisms isolated were *E. coli* 5(5.6%), *proteus mirabilis* 5(5.6%), *Acinetobacter* 3(3.3%), coagulase negative *Staphylococcus* 2(2.2%) and *Proteus vulgaris* 1(1.1%). No growth were seen in 16(17.8%) cases (Table 2).

**Table 2. Microbiology profile of patient.**

Type of Organism	Frequency (%)
<i>Pseudomonas Aeruginosa</i>	43(47.8)
<i>Staphylococcus Aureus</i>	8(8.9)
<i>Klebsiella Pneumoniae</i>	7(7.8)
<i>Proteus Mirabilis</i>	5(5.6)
<i>E. coli</i>	5(5.6)
<i>Acinetobacter</i>	3(3.3)
Coagulase - staph	2(2.2)
<i>Proteus vulgaris</i>	1(1.1)
No growth	16(17.8)

*Pseudomonas aeruginosa* was found to be most sensitive to Imipenem (74.4%) followed by Levofloxacin (65.1%), Amikacin (62.8%) and Cefepime (60.5%). Only 4.7% cases were sensitive to Amoxycylav. Majority of cases were resistant

to Amoxycylav (46.5%) followed by ceftriaxone (34.9%) and Levofloxacin (23.3%). Ciprofloxacin was sensitive in 25.6% cases and resistant in 18.6% cases (Table 3).

**Table 3. Antimicrobial sensitivity pattern of *Pseudomonas Aueruginosa*.**

Antibiotics	Sensitive	Resistant
Amikacin	27(62.8%)	8(18.6%)
Amoxycylav	2(4.7%)	20(46.5%)
Cefixime	1(2.3%)	5(11.6%)
Cefotaxime	-	6(14%)
Ceftriaxone	7(16.3%)	15(34.9%)
Ciprofloxacin	11(25.6%)	8(18.6%)
Cefepime	26(60.5%)	6(14%)
Ceftazidime	14(32.6%)	8(18.6%)
Colistin	9(20.9%)	-
Imipenem	32(74.4%)	5(11.6%)
Chloramphenicol	-	2(4.7%)
Levofloxacin	28(65.1%)	10(23.3%)
Ampicillin/Sulbactam	-	1(2.3%)
Teicoplanin	-	1(2.3%)
Piperacillin	23(53.5%)	5(11.6%)
Tazobactam	16(37.2%)	1(2.3%)
Aztreonam	12(27.9%)	4(9.3%)
Cotrimoxazole	9(20.9%)	10(23.3%)

*Staphylococcus aureus* was found to be most sensitive to Linezolid (87.5%) followed by Cotrimoxazole (75%), Ceftriaxone (71.4%), Amikacin (62.5%) and Levofloxacin (62.5%). Only 12.5% cases were sensitive to Ciprofloxacin. No cases were found to be sensitive to Amoxycylav, Cefixime and Cefpodoxime. Majority of cases (50%) were resistant to Cefixime followed by Levofloxacin (37.5%) (Table 4).

The most sensitive Antibiotic against *Klebsiella pneumoniae* was found to be Linezolid (87.5%) followed by Ceftriaxone (71.4%), Levofloxacin (71.4%), Cefepime (57.1%) and Cotrimoxazole (57.1%). No cases were found to be sensitive to Amoxycylav, Cefixime and Ciprofloxacin. Majority of the cases were resistant to Amoxycylav (42.9%) followed by Cefotaxime (28.6%), Amikacin (28.6%) and Cotrimoxazole (28.6%). *Klebsiella pneumoniae* was found to be highly sensitive to Ceftriaxone (71.4%), only 14.3% were found to be resistant to it (Table 5).

<b>Table 4. Antimicrobial sensitivity pattern of Staphylococcus Aureus.</b>		
<b>Antibiotics</b>	<b>Sensitive</b>	<b>Resistant</b>
Amikacin	5(62.5%)	-
Amoxyclav	-	1(12.5%)
Cefixime	-	4(50%)
Cefepodoxime	-	1(12.5%)
Ceftriaxone	5(71.4%)	1(12.5%)
Ciprofloxacin	1(12.5%)	-
Cefepime	1(12.5%)	-
Levofloxacin	5(62.5%)	3(37.5%)
Linezolid	7(87.5%)	-
Tazobactam	1(12.5%)	-
Polymyxin-B	3(7%)	-
Tobramycin	-	3(7%)
Cotrimoxazole	6(75%)	-
Cloxacillin	4(50%)	-

<b>Table 5. Antimicrobial sensitivity pattern of Klebsiella Pneumoniae.</b>		
<b>Antibiotics</b>	<b>Sensitive</b>	<b>Resistant</b>
Amikacin	3(42.9%)	2(28.6%)
Amoxyclav	-	3(42.9%)
Cefixime	-	1(14.3%)
Cefotaxime	-	2(28.6%)
Ceftriaxone	5(71.4%)	1(14.3%)
Ciprofloxacin	-	1(14.3%)
Cefepime	4(57.1%)	-
Colistin	1(14.3%)	-
Imipenem	3(42.9%)	1(14.3%)
Levofloxacin	5(71.4%)	1(14.3%)
Linezolid	7(87.5%)	-
Piperacillin	2(25%)	-
Imipenem	3(42.9%)	1(14.3%)
Tazobactam	3(42.9%)	-
Aztreonam	2(28.6%)	1(14.3%)
Azithromycin	1(14.3%)	-
Polymyxin-B	1(14.3%)	-
Cotrimoxazole	4(57.1%)	2(28.6%)
Erythromycin	-	1(14.3%)
Norfloxacin	-	1(14.3%)

## DISCUSSION

Out of 90 cases, 47(52.2%) were female patients and 43(47.8%) were male patients. In our study, chronic suppurative otitis media was more common in females as compared to males. This finding is similar to study conducted by Hassan et al.<sup>5</sup> and Basnet

R et.al.<sup>6</sup> In contrast to this study, there was male predominance in studies conducted by Jianghong XMD et al.,<sup>2</sup> Kumar and Seth<sup>7</sup> and Gul et.al.<sup>8</sup> In our study, most commonly affected age group was more than 40yrs of age which is similar to study done by Jianghong XMD et.al.,<sup>2</sup> The reason may be, most of the patients presenting to us are adults and most paediatric patients visit pediatric department and/or consults otolaryngologists in children's hospital. This finding is in contrast to study done by Raakhee et al<sup>9</sup> where more prevalence was seen in age group 16-25yrs and in study done by Shrestha et.al<sup>10</sup> and Ahmad and Kudi<sup>11</sup>, where 1-10 years age group were commonly affected. In this study, the most common organism isolated was Pseudomonas aeruginosa(47.8%) followed by Staphylococcus aureus(8.9%) and Klebsiella pneumoniae (7.8%). This finding is similar to study done by Maji Pk et.al<sup>12</sup> and Loy AHC et.al.,<sup>13</sup> In contrast to this study, Staphylococcus aureus was found to be most common organism in studies done by MP, KL et.al.,<sup>14</sup> and Garba BI et.al.,<sup>15</sup> The warm and wet environment of ear canal and middle ear cavity may be conducive to the growth of Pseudomonas or its spread from one patient to another via medical instruments in outpatient clinics.<sup>16</sup> In our study, the most effective antibiotic against Pseudomonas aeruginosa were Imipenem (74.4%) followed by Levofloxacin (65.1%), Amikacin (62.8%) and Piperacillin (53.3%). It was found to be least sensitive. Cefixime (2.3%), Amoxyclav (4.7%), ceftriaxone (16.3%), cotrimoxazole (20.9%) and ciprofloxacin(25.6%). This finding is similar to study done by Rabina et.al.,<sup>6</sup> where the most effective drug was Imipenem (100%) and Amikacin (89.2%) and least effective drugs were Amoxyclav (21.9%) and Cotrimoxazole (30.2%).<sup>4</sup> Jianghong<sup>2</sup> found that most of the cases were resistant to Amoxyclav (46.5%), only 4.7% cases were sensitive. This result suggests that Amoxyclav as a first line antibiotic in Pseudomonas infection should be reconsidered which is one of the most commonly prescribed empirical therapy in CSOM. Empirical antibiotic drugs, for example ciprofloxacin, are very effective against multiple Gram positive and Gram negative bacterial organisms



responsible for CSOM<sup>17,18</sup>, but in our study, Only 25% cases were sensitive to ciprofloxacin, 18.6% cases were found to be resistant. In contrast to this study, Raakhee et.al<sup>9</sup> found that *Pseudomonas* was highly sensitive to Ciprofloxacin (92.3%). Gu et.al<sup>8</sup> also found ciprofloxacin to be most sensitive followed by Amikacin. In this study, *Pseudomonas* was found to be most resistant to Amoxycylav (46.5%) followed by Ceftriaxone (34.9%) and Levofloxacin (23.3%). This finding was similar to Jianhong<sup>2</sup> where *Pseudomonas* was most resistant to Levofloxacin (42.5%), Ciprofloxacin (40%) and Ceftriaxone (30%). In this study, most effective cephalosporin were found to be Cefepime (60.5%), followed by Ceftazidime (32.6%). Ceftriaxone, a commonly prescribed empirical drug was found to be the most resistant Cephalosporin (34.9%). It was sensitive only in 16.3% cases. Cefixime (2.3%) was the least sensitive and no isolates were sensitive to cefotaxime. The findings suggest that Cephalosporins and Ciprofloxacin should be cautiously used in treating CSOM. Kristo and Buljan<sup>19</sup> reported that *Pseudomonas* showed marked sensitivity to third generation cephalosporin. These discrepancies are likely due to differences in methodology, sample size, antibiotic treatment before bacteriologic testing, and infection by slowly replicating pathogens, and/or local hygienic conditions. *Staphylococcus aureus* was found to be second most common isolated organism (8.9%) similar to studies of Maji PK<sup>12</sup> and Loy AHC<sup>13</sup>. In contrast to this finding, *Staphylococcus aureus* was found to be the most common isolated organism in studies done by Bilkisu<sup>15</sup> and Rangaiah.<sup>20</sup> The most sensitive antibiotic against *Staphylococcus* was Linezolid (87.5%) followed by cotrimoxazole (75%), Ceftriaxone (71.4%) Amikacin (62.5%) and Levofloxacin (62.5%). Amikacin was found to be the most effective drug in studies (4) and (6) where it was found to be 96.22% and 100% sensitive respectively. In this study, no case were sensitive to Amoxycylav, Cefixime, Cefpodoxime and Tobramycin. Only 12.5% cases were sensitive to Ciprofloxacin, which account for one of the least sensitive drugs. This finding is similar to study<sup>4</sup> where the least sensitive drug

was found to be Ciprofloxacin. In study<sup>21</sup>, majority were resistant to Ciprofloxacin. In contrast to this, Ciprofloxacin was found to be highly sensitive to *Staphylococcus aureus* in a study conducted by Garba<sup>15</sup>. Majority of cases in our study were resistant to Cefixime (50%) followed by Levofloxacin (37.5%). *Staphylococcus* has been associated with middle ear infection due to its ubiquitous nature and high MRSA coverage in upper respiratory tract and external auditory canal. In our study, very less no. of *Klebsiella pneumoniae* (7.8%) *Proteus mirabilis* (5.6%), *E. coli* (5.6%) and *Proteus vulgaris* (1.1%) were isolated. This is similar to study Romena et al.,<sup>22</sup> In contrast to our findings, Chirwa et al.,<sup>23</sup> found out *Proteus mirabilis* to be the most common isolated bacteria. *Klebsiella pneumoniae* was highly sensitive to Linezolid (87.5%) and Ceftriaxone (71.4%). Amoxycylav was found to be most resistant (42.9%) to *Klebsiella*. Irrational and injudicious use of antibiotics along with inadequate treatment of infection is an important factor in the emergence of various resistant bacteria. Like other bacterial infections, there is a growing concern on multidrug resistance bacteria in CSOM. High levels of antibiotics resistance against commonly used drugs like Amoxycylav, cephalosporins, fluoroquinolones is a major concern and thus a challenging problem in the proper management of CSOM. Continuous and periodic antibiogram in CSOM is always a need to guide for proper treatment and to provide records for future reference due to changing antibiotics susceptibility. Literature review indicates only few studies have been carried out in our country and still there is lack of adequate updates on recent trends of microorganisms and their susceptibility in CSOM. The present study was conducted to explore the current trend in bacteriological profile and their antimicrobial susceptibility among CSOM patients in a tertiary level hospital in Central Nepal.

### Limitations

Anaerobes and fungi couldn't be isolated. The findings couldn't be generalized as the study has been conducted in only one centre of Nepal and because of limited sample size.

## CONCLUSIONS

In this study, the most common organisms isolated were *Pseudomonas aeruginosa* (47.8%) and *Staphylococcus aureus* (8.9%). *Pseudomonas aeruginosa* was found to be most sensitive to Imipenem (74.4%) and *Staphylococcus aureus* was most sensitive to Linezolid (87.5%). In both organisms, majority were found to be sensitive to Amoxycylav and Levofloxacin. Majority of *Pseudomonas* were resistant to Amoxycylav (46.5%) and Ceftriaxone (34.9%). Majority of *Staphylococcus aureus* were resistant to Cefixime (50%) and Levofloxacin (37.5%). Ciprofloxacin was found to be one of the least sensitive drugs against both organisms, *Pseudomonas* (25.6%) and *Staphylococcus aureus*

(12.5%). In view of these findings, most commonly used empirical drugs in treatment of CSOM like Amoxycylav, fluroquinolones and cephalosporins should be cautiously used and continuous and periodic antibiogram should be considered to guide treatment and provide future references in view of changing antimicrobial susceptibility. Proper judicial use of antibiotics is essential to prevent the emergence of antibiotic resistance.

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