



## MICROBIOLOGY OF CHRONIC OTITIS MEDIA: A PROSPECTIVE STUDY IN A TERTIARY CARE CENTRE.

### ENT

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### ABSTRACT

**Background:** Chronic suppurative otitis media (CSOM) is a condition of the middle ear that is characterized by persistent or recurrent discharge through a chronic perforation of the tympanic membrane. Due to the perforated tympanic membrane, bacteria can gain entry into the middle ear via the external ear canal. Since CSOM pathogenesis and etiology remain poorly understood, assessing the microbiological profile in different regions is critical. Antibiotics are generally used empirically, which may lead to the emergence of resistant bacterial strains. **Objective:** Identifying the bacterial spectrum and susceptibility to antimicrobials is essential for efficient empirical treatment, and would help better understand CSOM. Therefore, this work aimed to document CSOM's bacteriological profile and evaluate antibiotic susceptibility in CSOM patients. **Materials and methods:** 150 patients who presented to the Ear, Nose and Throat (ENT) department from February 2023 to January 2024 were prospectively studied. All patients had perforated tympanic membranes with active purulent discharge. Only patients who had not received antibiotic therapy (topical or systemic) for the previous five days were included in the study. **Results:** A total of 150 adult patients of CSOM were included in the study. Out of 150 samples, 124 samples showed growth while remaining 26 samples did not show any growth in culture. Of 124 isolates 95 were gram negative bacilli while 21 were gram positive cocci. *Pseudomonas aeruginosa* was predominant isolate followed by *Klebsiella Pneumoniae* and *Staphylococcus aureus*. *Pseudomonas aeruginosa* showed maximum sensitivity to imipenem (100%) followed by piperacillin-tazobactam combination (97.8%), ciprofloxacin (87.2%) and ceftazidime (94.6%). **Conclusion:** The study of bacteriological profile and their antibiotic sensitivity determines the prevalent organisms causing chronic otitis media in the area taken for study. It helps in starting the appropriate treatment of otitis media and prevents the development of complications and for successful outcome.

### KEYWORDS

Chronic Suppurative Otitis Media, Culture, Microbiology, Antibiotic Sensitivity

### INTRODUCTION

Chronic suppurative otitis media (CSOM) is characterized by repeated otorrhea via tympanic membrane perforation. Globally, 21000 individuals succumb yearly to CSOM complications.<sup>1</sup> The average global incidence rate of CSOM is estimated at 4.76/1000 individuals, totaling 31 million cases (all ages) per year; among the patients, 22.6% are below 5 years of age.<sup>1</sup> Chronic suppurative otitis media prevalence is high in nonindustrialized nations. Chronic suppurative otitis media often leads to conductive hearing loss and constitutes a risk factor for permanent sensorineural hearing loss because of inner ear injury as well as intracranial complications.<sup>2</sup>

Chronic suppurative otitis media is mostly caused by bacterial infection of the middle ear. Many studies from different countries have reported common pathogens causing CSOM. Some studies considered *Pseudomonas aeruginosa* (*P. aeruginosa*) the commonest pathogen, while other studies showed that *Staphylococcus aureus* (*S. aureus*) is the most predominant pathogen.<sup>3</sup> The discrepancies among the various studies might result from the patient populations and geographical areas assessed. Chronic suppurative otitis media is primarily treated with combined ear cleaning and topical antimicrobial drops. Antibiotics are generally used empirically, which may lead to the emergence of resistant bacterial strains. Multiple studies have assessed antibiotic susceptibility and resistance patterns of bacterial pathogens.<sup>4,6</sup>

Since CSOM pathogenesis and etiology remain poorly understood,<sup>3</sup> assessing the rates of various pathogens in different regions is critical. Moreover, identifying the bacterial spectrum and susceptibility to antimicrobials is essential for efficient empirical treatment, and would help better understand CSOM. Therefore, this work aimed to document CSOM's bacteriological profile and evaluate antibiotic susceptibility in CSOM patients.

### METHODOLOGY

150 patients who presented to the Ear, Nose and Throat (ENT) department from February 2023 to January 2024 were prospectively studied. All patients had perforated tympanic membranes with active purulent discharge. Only patients who had not received antibiotic therapy (topical or systemic) for the previous five days were included in the study. Patients with ear disease due to cholesteatoma were excluded from the study. Single use Mini-tip Culturette swabs were used to harvest the middle ear microflora through the tympanic membrane perforation. One swab was processed for aerobic bacteria, and another swab for anaerobic bacteria, using standard microbiological procedures with enrichment. Any fungi that were isolated were subcultured onto Sabouraud Dextrose agar. All organisms isolated were identified according to standard microbiological methods, using tubed media, and where necessary, the API system (bioMérieux, France). Antimicrobial susceptibility test for aerobic bacteria was performed using modified Kirby Bauer disk diffusion method (1), and using National Committee for Clinical Laboratory Standards (NCCLS) breakpoints for interpretation of results (2). Apart from the standard antibiotics, testing was also done specifically for gentamicin, neomycin and chloramphenicol, which are available locally as topical antibiotic eardrops.

### OBSERVATIONS AND RESULTS

A total of 150 adult patients of CSOM were included in the study. The maximum numbers of patients belonged to 21-30 years age group (27.34%), as shown in Table 2. Out of these 150, 86 were males (57.33%) and 64 were females (42.67%) (Table 1). 112 patients had unilateral infection, out of which 58 had unilateral right and 54 had unilateral left infection and 38 patients had bilateral CSOM (Table 3). Out of 150 samples, 124 samples showed growth while remaining 26 samples did not show any growth in culture (Table 4). Of 124 isolates 95 were gram negative bacilli while 21 were gram positive cocci. *Pseudomonas aeruginosa* was predominant isolate followed by *Klebsiella Pneumoniae* and *Staphylococcus aureus* (Table 5). Anaerobes were not found to be significantly associated with

CSOM in the present study. In the present study, *Pseudomonas aeruginosa* showed maximum sensitivity to imipenem (100%) followed by piperacillin-tazobactam combination (97.8%), ciprofloxacin (87.2%) and ceftazidime (94.6%). (Table 6)

**Table 1: Sex distribution in study group**

Sex	Number	Percentage
Males	86	57.33%
Females	64	42.67%
Total	150	100%

**Table 2: Age distribution in study group**

Age	Males	Females	Total	Percentage
14-20	20	17	37	24.67%
21-30	25	16	41	27.34%
31-40	20	16	36	24%
41-50	15	13	28	18.67%
51-60	06	02	08	05.34%
Total	86	64	150	100%

**Table 3: Overall Frequency Distribution Of Laterality Of CSOM In The Study.**

S.No	Laterality	Frequency (n)	Proportion (%)
1	Bilateral	38	25.34%
2	Unilateral-right	58	38.67%
3	Unilateral -Left	54	36%

**Table 4: Overall Frequency Distribution Of Growth Observed In CSOM Samples In The Study.**

S.No	Nature of growth	Frequency (n)	Proportion (%)
1	Growth present	124	82.67%
2	Growth absent	26	17.34%

**Table 5: Frequency distribution of organisms isolated from the growth in the study population.**

S.No	Name of the organism Isolated from the culture	Total growth (n=91)		
		n	%	
1	Gram Negative Bacilli	<i>Pseudomonas aeruginosa</i>	47	
2		<i>Klebsiella pneumonia</i>	26	
3		<i>Escherichia coli</i>	4	02.67%
4		<i>Proteus</i>	13	
5		<i>Enterobacter</i>	3	02%
6		<i>Citrobacter</i>	2	01.34%
7	Gram Positive Cocci	<i>Staphylococcus aureus</i>	18	
8		CONS	1	0.67%
9		Enterococci	2	01.34%
10	Gram negative coccobacilli	<i>Acinetobacter</i>	1	0.67%
11	Fungal	<i>Candida species</i>	3	02%
12		<i>Aspergillus flavus</i>	2	01.34%
13		<i>Aspergillus niger</i>	2	01.34%

**Table 6: Frequency Distribution Of Drug Sensitivity Or Resistance Of Pseudomonas To Various Antibiotics In The Study Population**

S. No	Drug Name	Pseudomonas isolated (n=47)			
		Sensitive		Resistant	
		n	%	n	%
1	Amikacin	37	78.7%	10	21.3%
2	Gentamicin	38	80.8%	09	19.2%
3	Ciprofloxacin	41	87.2%	06	12.8%
4	Ceftazidime	44	94.6%	03	06.4%
5	Meropenem	47	100	00	00
6	Piperacillin+Tazobactam	46	97.8%	02	04.2%

**DISCUSSION**

Chronic suppurative otitis media (CSOM) is a condition of the middle ear that is characterized by persistent or recurrent discharge through a chronic perforation of the tympanic membrane. Due to the perforated tympanic membrane, bacteria can gain entry into the middle ear via the external ear canal. Infection of the middle ear mucosa subsequently results in ear discharge. Untreated cases of CSOM can result in a broad range of complications. Such complications range from persistent otorrhoea, mastoiditis, labyrinthitis, and facial nerve paralysis to more serious intracranial abscesses or thromboses. While the incidence of such complications is low, they need to be borne in mind when faced by a patient with active CSOM. Treatment hence needs to be instituted

early and effectively to avoid such complications. The mainstay of treatment for uncomplicated CSOM is twofold: meticulous aural toilet (with suction/mopping up of ear debris and discharge) and instillation of a topical antimicrobial agent. The therapeutic use of antibiotics is usually started empirically prior to results of microbiological culture. Selection of any antibiotic is influenced by its efficacy, resistance of bacteria, safety, risk of toxicity and cost. Knowledge of the local microorganism pattern and their antibiotic sensitivity is then essential to allow for effective and cost-saving treatment. Our results show that active CSOM infection in our tertiary care Centre is mainly due to *Pseudomonas aeruginosa*, *Klebsiella pneumonia* and *Staphylococcus aureus*. This finding is in tandem with the pattern of CSOM infection within the tropical region.<sup>7-9</sup> *Pseudomonas aeruginosa* was shown to be sensitive to imipenem, ceftazidime, ciprofloxacin, piperacillin and amikacin, while *Staphylococcus aureus* was sensitive to cephalixin, cloxacillin, clindamycin and bactrim. Anaerobic bacteria were not a significant pathogen according to our results. Similarly, while fungi were not specifically cultured for in this study, they also did not appear to be a significant cause of active CSOM infection compared to bacteria. For the antibiotics commonly available locally as topical eardrops, gentamicin was shown to be the most effective, with high sensitivities for the most commonly isolated organisms. Gentamicin eardrops appear to be an effective first-line topical antibiotic in the treatment of active CSOM. There remains, however, a controversy over the question of ototoxicity with the topical usage of aminoglycosides, such as gentamicin.

While the systemic usage of aminoglycosides has been known to have a deleterious effect on the inner ear, the effect of topical aminoglycosides is less clear. The fact that the disease process in CSOM itself causes a sensorineural hearing loss have led many to conclude the benefits derived from the usage of topical aminoglycosides in the treatment of CSOM and the prevention of attendant complications far outweigh the ototoxic side-effects which may potentially occur.<sup>10</sup> Newer topical antibiotic eardrops such as ofloxacin and ciprofloxacin have also been recommended for the treatment of active CSOM, with the added advantage of not being ototoxic. While we did not assess their effectiveness against all the organisms isolated, several reports have indicated their efficacy particularly against *Pseudomonas aeruginosa* and *Staphylococcus aureus*.<sup>11, 12</sup> Furthermore, there is concern that widespread use of quinolones such as ofloxacin and ciprofloxacin could lead to the emergence of resistance especially in *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and some *Enterobacteriaceae*.<sup>13, 14</sup> There should therefore be judicious usage of this class of antibiotics in the treatment of active CSOM infection.

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