

## Microbiological profile and changing trends of antibiogram profile in patients of chronic suppurative otitis media in a tertiary hospital in NCR region

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### Abstract

**Introduction:** Otitis media (OM) is a major health issue involving mainly middle ear and is quite prevalent in developing countries in the low socioeconomic group. The aim of this study was to isolate the organisms associated with chronic suppurative otitis media (CSOM) and to detect the antibiogram of the aerobic isolates.

**Methods:** A total of 150 patients clinically diagnosed with CSOM were enrolled in the study and the samples were obtained from each patient using sterile cotton swabs and cultured for microbial flora. Drug susceptibility testing for aerobic isolates was conducted using Kirby-Bauer disc diffusion method.

**Results:** Out of the 119 (79.33%) were culture positive, of which 93 (78.15%) were pure bacterial isolates and 26 (27.95%) were mixed cultures. Bacterial isolates in pure cultures were *Staphylococcus aureus* in 46 isolates (49.46%), *Pseudomonas aeruginosa* 22(23.6%). Antimicrobial profile of aerobic isolates revealed maximum sensitivity to amikacin (95.5%), ceftriaxone (83.4%) and gentamicin (82.7%).

**Conclusions:** Knowing the etiological agents of CSOM and their antimicrobial susceptibility is of essential importance for an effective treatment, prevention of both complications and development of antibiotic resistance and finally, the reduction of the treatment costs.

**Keywords:** Attico-antral, Chronic suppurative otitis media, *Pseudomonas aeruginosa*, *Staphylococcus aureus*.

### Introduction

Chronic suppurative otitis media is defined as a perforation of the tympanic membrane with persistent drainage of pus from the middle ear lasting from 6 to 12 weeks. It is a major cause of acquired hearing impairment of varying severity mostly in developing countries.<sup>1,2</sup> Hearing loss in children is likely to affect the language and cognitive development. WHO has classified the countries into different groups according to the prevalence of chronic suppurative otitis media (CSOM) like Highest (> 4%), High (2-4%), Low (1-2%), and Lowest (<1%), in which India comes under Highest category (WHO, 1998). Prevalence of CSOM in India according to the WHO reports is 7.8% which puts India amongst the group with the highest prevalence and hence demands urgent attention to deal with a massive public health problem.<sup>3</sup>

The incidence of this disease is higher in developing world because of malnutrition, overcrowding, poor hygiene, inadequate health care, and recurrent upper respiratory tract infection.<sup>4</sup> The urban to rural ratio of the disease is 1:2 and the poorer rural communities have the highest prevalence.<sup>5</sup>

The objective of this study was to investigate the clinico-microbiological profile of CSOM and to analyze the susceptibility pattern of the aerobic bacterial isolates at our tertiary care centre, so that an antibiotic policy is formulated for CSOM, for better patient management.

### Methods

This cross sectional study was conducted for a period of 14 months from March 2016 to April 2017 at a tertiary care teaching hospital. Ethical clearance was obtained from the Institutional Ethical Committee. The study group included 150 randomly selected patients between 1 and 78 years, who were clinically diagnosed with CSOM. Inclusion criteria included patients presenting with tympanic perforation and ear discharge of more than 3 months. Only those patients who were not on any antibiotics (oral and systemic) in the previous five days were included in the study. Informed consent was obtained at enrollment.

Before collecting the aural discharge, the external auditory canal was cleared of cerumen, swabbed with boric acid spirit and allowed to dry. The middle ear discharge was then aseptically collected by the otorhino-laryngologist from the tympanic cavity with a thin, sterile cotton swab (Hi Media, Mumbai, India). Also, care was taken not to touch the tympanic membrane or the external auditory canal during sample collection. The specimens so collected were transported immediately to the microbiology laboratory for further processing.

The swabs were inoculated onto sheep blood agar, chocolate agar and MacConkey agar for aerobic culture and the inoculated plates were incubated at 37°C for 24–48 h with 5% carbon dioxide enrichment for blood agar and chocolate agar plates. The aerobic bacterial isolates were identified according to standard

bacteriological techniques. Antimicrobial susceptibility testing for aerobic bacterial isolates was done by Kirby-Bauer disc diffusion method following the Clinical Laboratory Standards Institute (CLSI) guidelines.<sup>6</sup> Methicillin resistance among *Staphylococcus aureus* strains was detected by cefoxitin disc test. ESBL production was considered positive if zone diameter of inhibition around the disc of ceftazidime clavulanic acid and cefotaxime clavulanic acid  $\geq 5$  mm than the ceftazidime or cefotaxime disc alone.<sup>7</sup> AmpC production was suggested when the isolate was resistant to cefoxitin (Zone diameter  $\leq 14$  mm) but susceptible to cefepime (Zone diameter  $\geq 25$  mm). Isolates showing reduced susceptibility to imipenem were selected for detection of MBL enzymes by imipenem-EDTA combined disk method.<sup>8</sup>

A standard bacteriological procedure was followed to keep the quality of all laboratory tests. American Type Culture Collection (ATCC) strains (*E. coli* ATCC 25922, *P. aeruginosa* ATCC 27853, *S. aureus* ATCC25923, *K. pneumoniae* ATCC 700603 and *P. mirabilis* ATCC 35659) were used as controls for culture and sensitivity testing. The data was analyzed by using Statistical Package for Social Sciences (SPSS) version 11 and the prevalence of organisms was determined and expressed in percentage.

## Results

Out of the 119 (79.33%) were culture positive, of which 93 (78.15%) were pure bacterial isolates and 26 (27.95%) were mixed cultures. In clinically diagnosed cases of CSOM, the age varied from 0 to 70 years. Maximum patients were in the age group of 21- 30 years (46%) followed by age group 31-40 (24%) years and those between 11- 20 (12.66%) years. [Table 1] Among the COSM patients, 122 (81%) were from the

rural area while 28 (19%) belong to the urban area. Among the 150 cases, right ear was involved in 55 (37%) cases while left ear was involved in 82 (54%) cases with 13 (9%) cases of bilateral involvement. Males (55%) were more commonly affected than females (45%) and the sex ratio male: female was 1.2:1. Bacterial isolates in pure cultures were *Staphylococcus aureus* in 46 isolates (49.46%), *P. aeruginosa* 22 (23.6%), *Klebsiella pneumoniae* (13.97%), *Proteus vulgaris* 8 (8.6%), *Citrobacter freundii* 2 (2.15%), *Acinetobacter baumannii* 1 (1.07%) and Enterococcus spp.1 (1.07%). [Table 2] Among the mixed growth cultures predominate bacteria were *Staphylococcus aureus* (42.3%) and *P. aeruginosa* (34.61%).

*S. aureus* isolates were found to be 100% sensitive to Vancomycin followed by Clindamycin (92.6%), ceftazidime (89.7%), cefoxitin and amikacin whereas 11.5% of *S. aureus* isolates were MRSA strains which were found to be 100% sensitive to Vancomycin and 75% sensitive to Clindamycin. *Pseudomonas aeruginosa* shows maximum sensitivity to imipenem (92.5%) followed by piperacillin-tazobactam (75%), amikacin (70%) and ceftazidime (70%). *Klebsiella pneumoniae* showed 100% sensitivity to amikacin, imipenem and piperacillin tazobactam. *E.coli* was 100% sensitive to piperacillin tazobactam, ceftazidime, imipenem and cefoxitin whereas 66% sensitive to amikacin, Amoxiclav and Gentamycin imipenem and cefoxitin. *Proteus vulgaris* was 100% sensitive ceftazidime, imipenem and cefoxitin whereas 66% sensitive to amikacin, Amoxiclav and Gentamycin. *Citrobacter freundii* was 100% resistant to Ciprofloxacin whereas *Acinetobacter baumannii* was 100% resistant to Gentamycin. [Graph 1] Result of  $\beta$ -lactamase production is shown in Table 3.

**Table 1: Socio demographic and clinical manifestation of patients with ear discharge**

S. No.	Variable		Frequency (%) (N = 150)
1	Sex		
		Male	82(55%)
		Female	68 (45%)
2	Age		
		0-10	1(.01)
		11-20	19(12.66)
		21-30	69(46)
		31-40	36(24)
		41-50	21(14)
		51-60	3(.02)
	61-70	1(.01)	
3	Residence		
		Urban	68 (45.33 %)
		Rural	82 (54.67 %)
4	Previous hospital visit and treatment		
		Yes	86 (57.33 %)
		No	64 (42.67 %)
5	Ear involved		

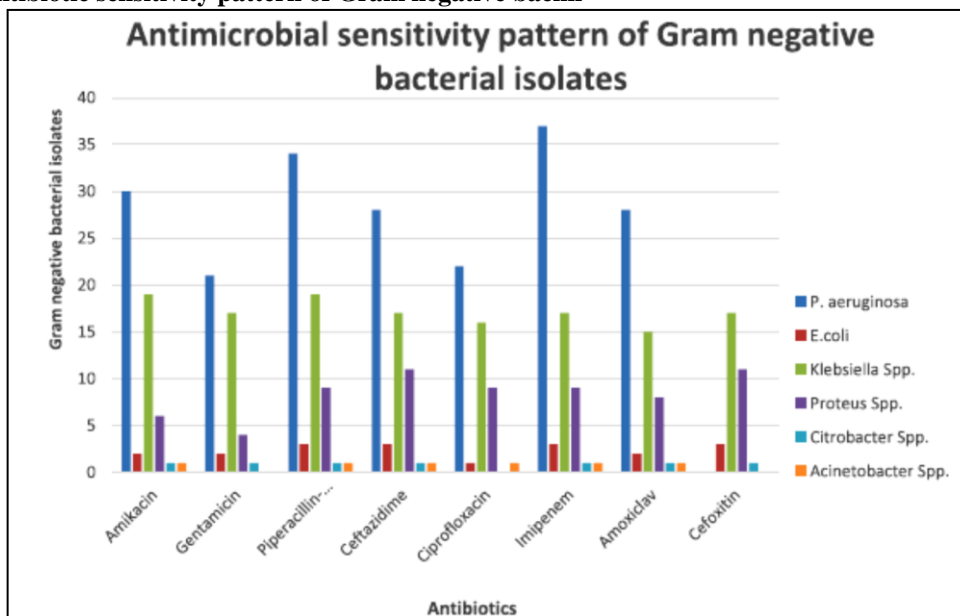
		Right	55(37%)
		Left	82(54%)
		Both	13(9%)
6	Reason to visit ENT clinic		
		Self	51 (34%)
		Referred	99 (66%)

**Table 2: Shows different types of isolates from CSOM patients**

S. No.	Types of organisms	Number of isolates
1	Aerobic bacteria	119(79.33%)
2	<i>Staphylococcus aureus</i>	61 (49.46%)
3	<i>P. aeruginosa</i>	34(23.6%)
4	<i>Klebsiella pneumonia</i>	17(13.97%)
5	<i>Proteus vulgaris</i>	10(8.6%)
6	<i>Citrobacter freundii</i>	2(2.51%)
7	<i>Acinetobacter baumannii</i>	1 (1.07%)
8	Enterococcus Spp.	1(1.07%)

**Table 3: Result of  $\beta$ -lactamase Production in Gram negative bacilli**

S. No.	$\beta$ -lactamase	Number of isolates (%)
1	ESBL combined disk test	14 (16.09)
2	MBL (Imipenem-EDTA combined disk method)	07(9.07)
3	Amp C disk test	02(2.09)

**Graph 1: Antibiotic sensitivity pattern of Gram negative bacilli**

## Discussion

CSOM is a major public-health problem, and India is one of the countries with high-prevalence where urgent attention is needed.<sup>9</sup> CSOM is an important cause of preventable hearing loss and of serious concern in pediatric age group because it may have long-term effects on early communication, language development, educational process, auditory processing and physiological and cognitive development.<sup>10</sup> Early, microbiological diagnosis ensures prompt and effective treatment to avoid such complications. A total of 150

cases of CSOM were undertaken in the study and it was found that as compared to females, males were found to be more associated with CSOM in our study which is analogous to studies done on CSOM cases.<sup>9,11</sup> whereas in contrast to our study, females were more affected than males in another study.<sup>12</sup> On the other hand, another study reported no difference in the prevalence of otitis media among sexes.<sup>13</sup> Our results may be due to outdoor working habits of males which is usually higher in poor developing areas as well as due to geographical variations.

The highest percentage of patients in CSOM was observed in the age group of 21-30 years and 31-40 years as seen in other studies.<sup>13</sup> While Loy et al, (2002) and Gupta V et al, (1998) report the highest percentage of presentation in the fourth decade.<sup>14,15</sup>

High rate of unilateral involvement of ear discharge (91%) was observed along with low rate of bilateral involvement of ear discharge (9%) among CSOM patients. In accordance with our study, high rate of unilateral involvement (82%) was also recorded by Nwokoye et al and Akinpelu et al cases of Otitis media.<sup>16,17</sup>

In this study 79.33% CSOM cases were culture positive while no growth was observed in 20.15% of cases as a similar study by Kumar et al<sup>18</sup> while in contrast to present study, Singhal et al<sup>19</sup> showed 94.67% of culture positive and 5.33% of culture-negative cases.

The most common bacterial isolate in CSOM in our present study was *S. aureus* in (49.46%) of which 11.5% were MRSA, followed by *Pseudomonas aeruginosa* (23.6%) similar to few other studies.<sup>20, 21</sup> In contrast to our study, few studies have demonstrated *Pseudomonas aeruginosa* to be the most common isolate, followed by *S. aureus*.<sup>22</sup> These studies depict that the microbial profile vary between different regions based on patient population and geographical distribution and hence necessitates the need for frequent analysis and update of the microbial profile in every region.

In present study, *S. aureus* isolates were found to be 100% sensitive to Vancomycin followed by Clindamycin (92.6%), ceftazidime (89.7%). 8 (11.5%) isolates of *S. aureus* isolates were identified as MRSA strains and were found to be (100%) sensitive to Vancomycin and 75% sensitive to Clindamycin. Similarly, Rakesh Kumar et al<sup>23</sup> observed that *S. aureus* was 100% sensitive to Linezolid and Vancomycin followed by Cefoperazone / Sulbactam, amikacin, Clindamycin, piperacillin / tazobactam, Erythromycin and Ofloxacin. *Pseudomonas aeruginosa* shows maximum sensitivity to imipenem (92.5%) followed by piperacillin-tazobactam (75%), amikacin (70%) and ceftazidime (70%). In contrast to our study *Pseudomonas aeruginosa* showed 100% susceptibility to piperacillin-tazobactam and ceftazidime-Clavulanic acid, imipenem (96%), Ciprofloxacin (89%) and amikacin (82%) in the study done by Jeya Kumari, D et al.<sup>24</sup>

In our study, ESBL were detected in 14 (18.42%) of 87 the Gram-negative bacilli, of which 12 ESBL were *Pseudomonas aeruginosa* and 2 isolates were *Klebsiella* spp. However, higher incidence of ESBL among *Pseudomonas aeruginosa* from 42% to 64% has been reported in other studies.<sup>7,25</sup> In our study MBL were detected in 7 (9.21%) Gram negative bacilli by imipenem-EDTA combined disc test of which 3 (7.5%) were *Pseudomonas aeruginosa*, 2 (10.5%) were

*Klebsiella pneumoniae* and 2 (18.1%) were *Proteus vulgaris*. In contrast, MBL producers were not detected in a study done by Khatoun et al.<sup>26</sup>

In our study AmpC were detected in 1.33% *Klebsiella pneumoniae* whereas 20% AmpC were detected in study done by Khatoun et al.<sup>26</sup> The sensitivity pattern shows that it is increasingly becoming more resistant to the common and routine antibiotics used in the ENT OPD. One reason for this could be the fact that most of these patients usually present in the ENT OPD after the previous treatments have failed and another key factor is that the cultures are mostly requested when commonly used drugs have failed to eradicate past infection.

Continuous and periodic evaluation of microbiological profile and antimicrobial sensitivity pattern of bacterial is essential for optimum management of CSOM patients. In conclusion, it is necessary to highlight the antibiotic crisis as a result of the emergence of many genera of bacteria that are multi drug resistant. We believe that our data may contribute to an effective medical management of CSOM.

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