

## Research Article

# Aerobic bacteriology of chronic suppurative otitis media: a hospital based study

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### ABSTRACT

**Background:** Chronic suppurative otitis media (CSOM) remains one of the most common childhood chronic infectious diseases worldwide, affecting diverse racial and cultural groups both in developing and industrialized countries. It involves considerable morbidity and can cause extra- and intra-cranial complications. The aim of this study was to determine the microbial diversity and the antibiogram of aerobic bacterial isolates among patients suffering from CSOM who attended the ENT Department of SMHS hospital, a tertiary care centre located in the heart of the Kashmir valley.

**Methods:** A total of 154 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 total 154 ear swabs processed, microbial growth was seen in 138 (89.61%) while 16 (10.38%) samples showed no growth. In 102 (66.23%) samples mono-microbial growth was seen whereas 26 (16.88%) samples showed poly-microbial growth. The most frequent organism isolated was *Pseudomonas aeroginsa* followed by *Staphylococcus aureus* and *Proteus sp.* The most effective antibiotic against *Pseudomonas aeroginsa* was amikacin followed by imipenem and piperacillin plus tazobactam, while as *Staphylococcus aureus* showed maximum sensitivity to vancomycin.

**Conclusion:** Otitis media linked with high levels of multiple antibiotic resistant bacteria is a major health concern in all age groups of the study population. An appropriate knowledge of the etiology and antibacterial susceptibility of microorganisms would contribute to a rational antibiotic use and the success of treatment for chronic supportive otitis media.

**Keywords:** Chronic suppurative otitis media, CSOM, Aerobic isolates, Antibiotic susceptibility testing

### INTRODUCTION

Chronic suppurative otitis media (CSOM) is one of the most common chronic childhood infections worldwide. CSOM most often occurs in the first 5 years of life, and is common in developing countries, in special populations such as children with craniofacial anomalies and in certain racial groups<sup>1,2</sup>

The WHO defines CSOM as “otorrhea through a perforated tympanic membrane present for at least two

weeks”.<sup>3</sup> CSOM can occur when acute otitis media (AOM) causes acute perforation of the tympanic membrane or when AOM occurs in conjunction with chronic perforation or tympanostomy tubes.<sup>4</sup> The most common sequelae of CSOM is conductive or sensorineural hearing loss.<sup>5</sup>

Since CSOM can cause significant morbidity, knowledge of the pathogens responsible for CSOM can assist in the selection of the most appropriate treatment regimen. The aim of this study was to determine the aerobic organisms

and to study their *in vitro* antibiotic susceptibility in patients of CSOM.

**METHODS**

In this present prospective study, patients with clinical evidence of CSOM attending the Outpatient Department of ENT section of SMHS hospital from 1st January 2013 to 30th December 2013 were studied. The study protocol, informed consent document and procedures were approved by the institutional ethical committee.

Patients of all ages and either gender suffering from chronic suppurative otitis media, as determined by otoscopic examination, who had not received antibiotic therapy (topical or systemic) for previous ten days, were enrolled through convenience sampling. Exclusion criteria were current febrile illness, current antibiotic use or use in the preceding 2 weeks, recent ear surgery or an in-situ grommet or tympanostomy tube, mastoid surgery in the preceding 12 months, congenital ear or hearing problems, obstructed middle ear (eg, polyp). Patients with ear discharge due to cholesteatoma were also excluded from the study.

Sterile swabs were used to collect pus samples. All care was taken to avoid surface contamination and the swabs were transported to microbiology section of Government Medical college Srinagar. The swab was plated on 5% sheep blood agar (BA), MacConkey's agar and chocolate agar (CA). The plates were incubated at 37°C for 48 h. Organisms were identified using standard procedures.<sup>6,7</sup>

The antimicrobial susceptibility was carried out using modified Kirby-Bauer disc diffusion technique using Mueller Hinton (MH) agar as per CLSI (Clinical Laboratory Standards Institute) guideline.<sup>8</sup>

Results were interpreted in accordance with central laboratory standards institute guidelines.<sup>9</sup> Methicillin resistance among Staphylococcus aureus strains was detected by cefoxitin disc test.<sup>8</sup> Extended spectrum beta lactamase (ESBL) detection among the enterobacteriaceae strains were performed by double disc synergy test.<sup>9</sup>

All dehydrated media, reagents and antibiotic discs were procured from Hi-media Laboratories Pvt. Ltd., Mumbai, India.

**Statistical analysis**

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 total 154 ear swabs processed, microbial growth was seen in 138 (89.61%) while 16 (10.38%) samples

showed no growth. In 102 (66.23%) samples mono-microbial growth was seen whereas 26 (16.88%) samples showed poly-microbial growth. The mean age of the patients was 25.6 and the peak incidence of CSOM was observed in the age group 0-15 years (44.15%), followed by 29.80% in age group 16-30 years and a decline with advancement in age of the patients

**Table 1: Age wise distribution of patients with CSOM.**

Age	Microbial Growth			Total
	Monomicrobial	Polymicrobial	Sterile	
0-15	48	14	06	68
16-30	34	08	04	46
31-45	15	03	02	20
46-60	03	01	02	06
>60	02	00	02	04
Total	102	26	16	154

Females (52.90%) were more commonly affected than males (47.10%) and the sex ratio female: male was 1.2:1.

The microbiological profile of aerobic isolates from patients of CSOM is shown in Table 2. Pseudomonas aeruginosa was the most common isolate followed by Staphylococcus aureus, Proteus sp, E coli and Klebsiella sp.

**Table 2: Aerobic bacteria isolated from CSOM cases.**

Type of Organism	Number of Patients	Percentage
Pseudomonas aeruginosa	39	38.23%
Staphylococcus aureus	36	35.29%
Proteus sp	10	9.80%
E. coli	10	9.80%
Klebsiella sp	04	3.92%
Enterococcus sp	03	2.94%

Table 3, 4 and 5 show the sensitivity patterns of the various isolates

**Table 3: Antibiotic sensitivity pattern of Pseudomonas aeruginosa.**

S. No	Antimicrobial agent	No. of sensitive strains	%age of sensitive strains
1.	Amikacin	36	92.30%
2.	Imipenem	30	76.92%
3.	Piperacillin	31	79.48%
4.	Ceftazidime	20	51.28%

5.	Levofloxacin	24	61.53%
6.	Piperacillin + Tazobactam	25	64.10%
7.	Tobramycin	11	28.20%
8.	Ciprofloxacin	19	48.71%

**Table 4: Antibiotic sensitivity pattern of *Staphylococcus aureus*.**

S. No.	Antimicrobial agent	No. of sensitive strains	%age of sensitive strains
1.	Ampicillin	10	27.77%
2.	Gentamicin	30	83.33%
3.	Amikacin	29	80.55%
4.	Ciprofloxacin	20	55.55%
5.	Cephalexin	24	66.66%
6.	Cefotaxime	25	69.44%
7.	Cefoxitin	26	72.22%
8.	Vancomycin	36	100%

**Table 5: Antibiotic sensitivity pattern of *Proteus sp* and *Coliforms*.**

S. No	Name of isolate	Amikacin	Ciprofloxacin	Imipenem	Piperacillin	Ceftriaxone	Levofloxacin	Piperacillin + Tazobactam
1.	<i>Proteus sp</i>	98.02%	76.05%	98%	56.87%	23.09%	45.875	73.09%
2.	<i>E.coli</i>	94.90%	65.98%	95.08%	60.90%	34.76%	54.90%	67.98%
3.	<i>Klebsiella sp</i>	76.98%	56.98%	94.09%	51.05%	12.90%	43.09%	67.90%

In our study microbial growth was seen in 138 out of the 154 samples processed (89.61%). Most of the cases were between 0-30 years of age (>70%). This finding corroborates well with the observations made by other researchers.<sup>15,16,17,18,19,20</sup> High-prevalence of CSOM in children may be attributed to the fact that they are more prone to upper respiratory tract infections (URTIs). Furthermore, cold weather pre-disposes children to URTI.<sup>21,22,23</sup>

Analysis of the gender incidence in the present study revealed that otitis media was found to be more common in females (52.90%) than in males(47.10%). As this study involved a random selection of cases, the prevalence of male patients over female patients may be only an incidental finding

Analysis of the total 154 cases revealed that mono-microbial growth was obtained in 138 (89.61%) samples and 26 (16.88%) samples yielded polymicrobial growth. This observation was supported by other researchers.<sup>24,25,26</sup>

**DISCUSSION**

CSOM is an important cause of preventable hearing loss particularly in the developing world<sup>10</sup> and a reason of serious concern, particularly in children, because it may have long-term effects on early communication, language development, auditory processing, educational process, and physiological and cognitive development.<sup>11</sup>

CSOM is usually classified into two types, tubotympanic and attico-antral depending on whether the disease process affects the pars tensa or pars flaccida of the tympanic membrane (TM).<sup>12</sup> Tubotympanic is called as a safe type or benign type as there is no serious complication whereas, attico-antral is called as the unsafe or dangerous type because of associated complication and may be life threatening at times.<sup>13</sup> Infection can spread from middle-ear to vital structures such as mastoid, facial nerve, labyrinth, lateral sinus, meninges and brain leading to mastoid abscess, facial nerve, paralysis, deafness, lateral sinus thrombosis, meningitis and intracranial abscess.<sup>10,14</sup> Of all the complications, hearing loss associated with chronic ear discharge is nearly always significant, reported in 50% of cases and tending to be more severe than those reported in other types of otitis media.

In our study, *Pseudomonas aeruginosa* (38.23%) was the commonest isolate followed by *Staphylococcus aureus* in 35.29% patients. This finding is in tandem with the pattern of CSOM infection of the other studies.<sup>25,26,27</sup>

But other studies from Korea and Iran have reported that *Staphylococcus aureus* was the commonest isolate in CSOM patients.<sup>28,29</sup>

In our study, majority of the *Pseudomonas aeruginosa* isolates were found in the teenager group as supported by other studies.<sup>30</sup> This may be due to multiple reasons as young children and infants may have low resistance and also because of relative short and straight eustachian tube.

In the present study the most effective antibiotic against *Pseudomonas aeruginosa* was amikacin (92.30%) followed by piperacillin (79.48%), imipenem, piperacillin plus tazobactam, levofloxacin and ceftazidime. This finding was corroborated by studies of numerous other authors.<sup>20,31,32</sup>

In another study conducted at the Gumuşsuyu Military Hospital, Turkey, *P. aeruginosa* strains were susceptible to ceftazidime and imipenem (100%), ciprofloxacin (92%) and amikacin and gentamicin (85%)

The antimicrobial susceptibility pattern of *Staphylococcus aureus* revealed 100% sensitivity to vancomycin followed by gentamicin, amikacin and cephalosporins and least sensitivity to quinolones. In case of *E.coli*, *Proteus* and *Klebsiella* sp, amikacin was found to be the most effective drug followed by imipenem, piperacillin plus tazobactam and ciprofloxacin. These findings are in accordance with those of Gulati et al (1997) and Mishra et al (1997). When the results of various workers were compared, it became obvious that the bacteriology and antibiotic sensitivity pattern of C.S.O.M. has been changing from time to time. The strains of yesterday which were sensitive to streptomycin, tetracycline and chloramphenicol no longer exhibit the old sensitivity pattern today. These drugs have been replaced by aminoglycosides, quinolones and cephalosporins.

## CONCLUSION

The wide spread use of antibiotics has precipitated the emergence of multiple resistant strains of bacteria which can produce both primary and post operative infections. The indiscriminate, haphazard use of antibiotics and the poor follow up of the patients have resulted in the persistence of low grade infections. The changes in the microbiological flora following the advent of sophisticated synthetic antibiotics have increased the relevance of the reappraisal of the modern day flora in chronic suppurative otitis media and their in vitro antibiotic sensitivity pattern is very important for the clinician to plan a general outline of treatment for a patient with a chronically discharging ear.

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