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Original Article

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Microbiological Profile of Chronic Suppurative Otitis Media in a Tertiary Care Hospital in Kashmir Valley, India

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Abstract

***Background & Aims*:** Chronic Suppurative Otitis Media (CSOM) is defined as chronic inflammation of middle ear and mastoid cavity that may present with recurrent ear discharges. Its importance lies in its refractoriness to treatment and chronicity, leading to complications. CSOM is almost always associated with mixed bacterial flora. Knowledge of the local microbial flora as well as continuous, periodic evaluation of microbiological pattern, and antibiogram of isolates are necessary to decrease the potential risk of complications by early institutions of appropriate treatment.

***Materials & Methods*:** In this prospective cross-sectional study, a total of 134 consecutive swab samples of the patients diagnosed with CSOM, referred to a tertiary care hospital in Kashmir Valley, India were included. The bacterial colonies were identified in line with standard procedures. Antimicrobial sensitivity testing (AST) was carried out according to the Clinical Laboratory Standards Institute (CLSI) guidelines by modified Kirby-Bauer disc diffusion method on Mueller Hinton agar (MHA) medium. The data was analysed using SPSS version 24 and the prevalence of the organisms was determined and expressed in percentages.

***Results*:** Out of total 134 ear swabs processed, microbial growth was seen in 111 (83%). The most common organism isolated was Methicillin Resistant *Staphylococcus aureus* (MRSA) in 43 (39%) of the patients, followed by *Pseudomonas* in 37 (27.6%). 9 (8%) of the cases had fungal etiology. Linezolid (LZ) showed 100% sensitivity in Gram-positive Cocci whereas, Tigecycline (TIG) showed 100% sensitivity in Gram-negative Bacilli. All MRSA were 100 % sensitive to tetracycline, linezolid, amikacin**.** All the isolates of *Pseudomonas* were 100 % sensitive to Tigecycline, Ofloxacin, Colistin, Imipenem, Aztreonam, Cefepime**.**

***Conclusion*:** Isolation of various aerobic, anaerobic, and fungal isolates shows that different conditions of CSOM could be differentiated on microbiological grounds. Thus, for better management of CSOM, microbial classification of infection as well as drug sensitivity test of organisms recovered are essential for making appropriate decision of antimicrobials that will effectively eradicate the pathogen.

***Keywords*:** Chronic Suppurative Otitis Media, Antibiotic Sensitivity Testing, Methicillin Resistant Staphylococcus Aureus, Pseudomonas, Linezolid, Tigecycline

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Introduction

Chronic Suppurative otitis media (CSOM) is defined as chronic inflammation of the middle ear and mastoid cavity that may present with recurrent ear discharges or otorrhoea through a tympanic perforation (1). Occurrence of this disease is high in developing countries, mostly among low socio-economic society because of malnutrition, overcrowding, poor hygiene, inadequate health care, and recurrent upper respiratory tract infection (2). The overall incidence is estimated to be around 9 per 100,000 people (3). CSOM causes conductive and sensorineural hearing loss and adverse effects on child development (4). CSOM and its complications are the bugbear of otologists, pediatricians, and general practitioners. It is a disease of multiple etiology. Its importance lies in its refractoriness to treatment and chronicity, leading to complications (5).

CSOM is almost always associated with mixed bacterial flora. The most common microorganisms found in CSOM are *Pseudomonas* aeruginosa, *Staphylococcus aureus*, coliforms, Proteus mirabilis, and anaerobic bacteria (6). Changes in bacterial flora of CSOM in the last decade have been confirmed and described by various authors (7-9). With the development and widespread use of antibiotics, the prevalence and antibiogram of these organisms has been reported to vary with the time and geographical area (10). Knowledge of the local microbial flora as well as continuous and periodic evaluation of microbiological pattern and antibiogram of isolates are necessary to decrease the potential risk of complications by early institutions of appropriate treatment. Also, due to misuse and/or overuse of antibiotics, antibiotic drug resistance (ADR) is increasing among the pathogens causing CSOM, which makes this mandatory for periodic surveillance of microbiological and sensitivity profile of CSOM (3).

The objective of this prospective cross-sectional study was to determine the diversity of aerobic bacterial isolates and their resistogram among the patients suffering from CSOM who attended to a tertiary care hospital in Kashmir Valley, India.

Materials & Methods

This prospective study was carried out in the department of Microbiology GMC Srinagar, Kashmir Valley, India. A total of 134 consecutive swab samples of the patients diagnosed with CSOM received in the hospital department were included in the study.

Inclusion criteria was any patient presenting with CSOM.

Exclusion criteria were the patients on antibiotics or antifungal drugs for more than seven days before presenting to the ENT outpatients department (OPD).

Sample Processing:

The swabs were inoculated on sterile Blood Agar (BA), Chocolate Agar (CA), and MacConkey's Agar (MA) plates and were then incubated at 37°C for 24-48 hrs. The bacterial colonies were identified in line with standard procedures (10, 11). Antimicrobial Sensitivity Testing (AST) was carried out according to the Clinical Laboratory Standards Institute (CLSI) guidelines by modified Kirby-Bauer disc diffusion method on Mueller Hinton agar (MHA) medium (12).

A suspension of the isolated colonies of each test strain equivalent to a 0.5 McFarland's standard was prepared in sterile normal saline. Briefly, a suspension of each strain was made so that the turbidity was equal to 0.5 McFarland standards and then plated as a lawn culture onto MHA. Antibiotic discs were placed and plates were incubated at 37°C for 18-24 hrs. Results were interpreted in accordance with CLSI guidelines (12).

The bacteria were tested for susceptibility against Penicillin, Cotrimoxazole, Teicoplanin, Cefoxitin, Clindamycin, Erythromycin, Linezolid, Tetracycline, Amikacin, Piperacillin, Piperacillin-tazobactum, Imipenem, Ceftazidime, Amoxiclavulonic acid, Ampicillin-Sulbactam, Tigecycline, Ticarcillin, Ceftriaxone, Aztreonam, Vancomycin, Cefepime, Gentamicin, Ciprofloxacin, Tobramycin, Levofloxacin, Colistin, Meropenem, Carbenicillin, Ceftazidime, Cefixime, Cefoperazone-Sulbactam, Ceftazidime-Tazobactam, Imipenem, Cefazolin, and Azithromycin.

Statistical analysis:

The data was analysed by Statistical Package for Social Sciences (SPSS) version 24 and the prevalence of the organisms was determined and expressed in percentages.

Results

Out of total 134 ear swabs processed, microbial growth was seen in 111 (83%), while 23 (17%) samples showed no growth (Figure 1). In 104 (94%) of the samples, mono-microbial growth was seen whereas 7 (6%) samples showed poly-microbial growth (Figure 2). The mean age of the patients was 30 years and the peak incidence of CSOM was observed in the age group between 21 years and 30 years (33%). Figure 3 shows the age-wise distribution of CSOM patients. Females (55%) were more commonly affected than males (45%) (Figure 4).

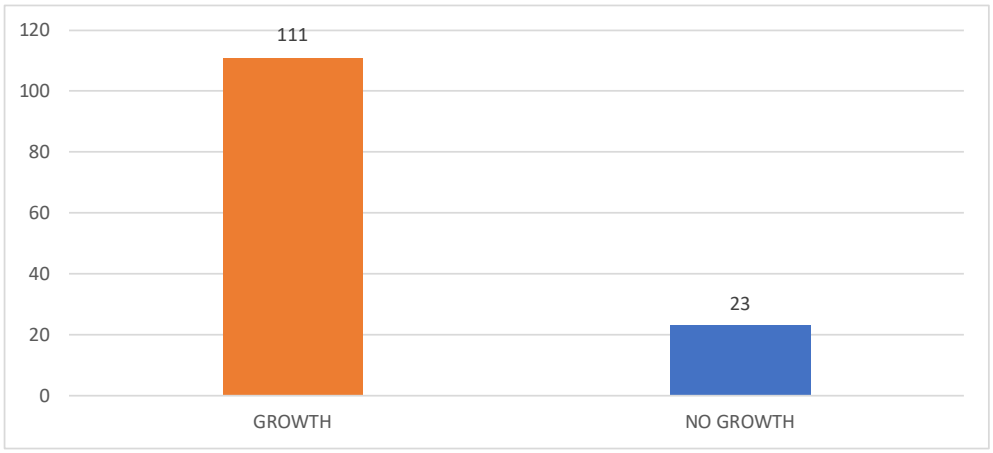

Fig. 1. Swab Sample Growth Distribution of CSOM Patients

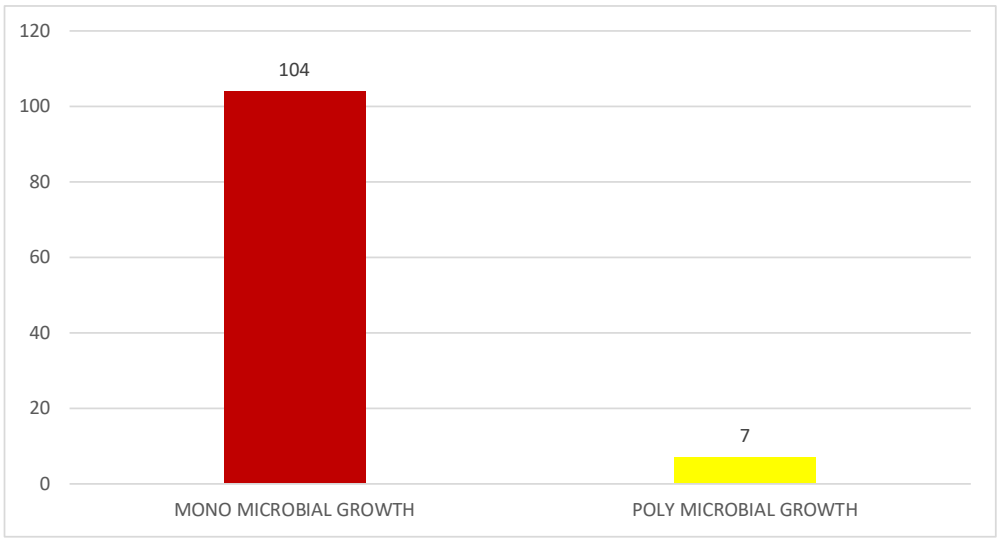

Fig. 2. Mono-Microbial and Poly-Microbial growth distribution of CSOM Patients

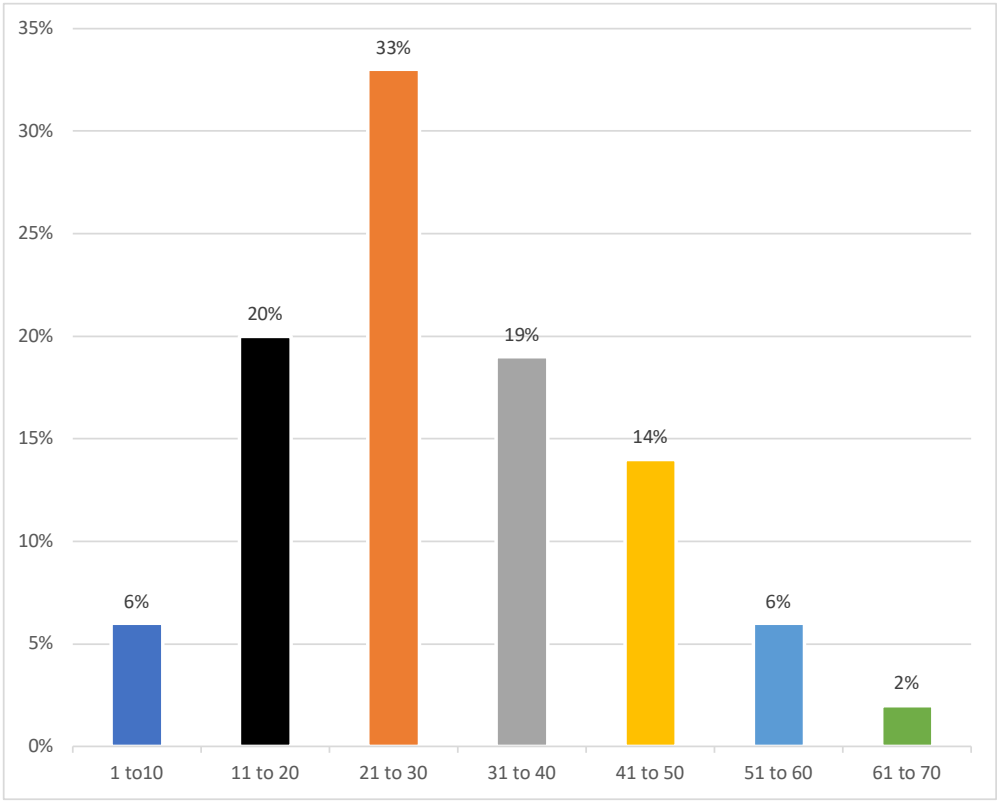

Fig. 3. Age wise distribution of CSOM patients

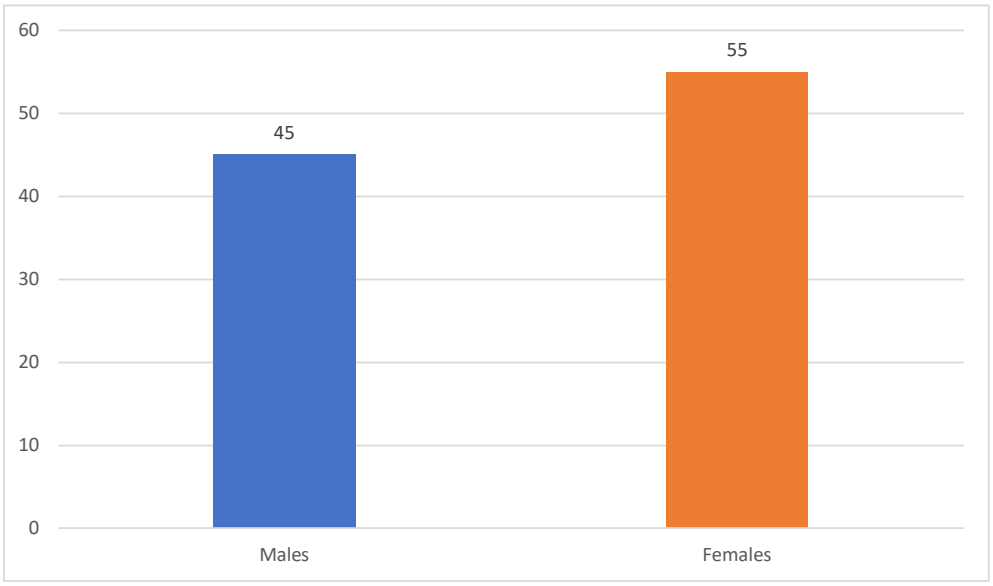

Fig. 4. Gender wise distribution of CSOM patients

The most common organism isolated was MRSA 43 (39%). 9 (8%) cases had fungal etiology. Figure 5 depicts the Distribution of various isolates in CSOM.

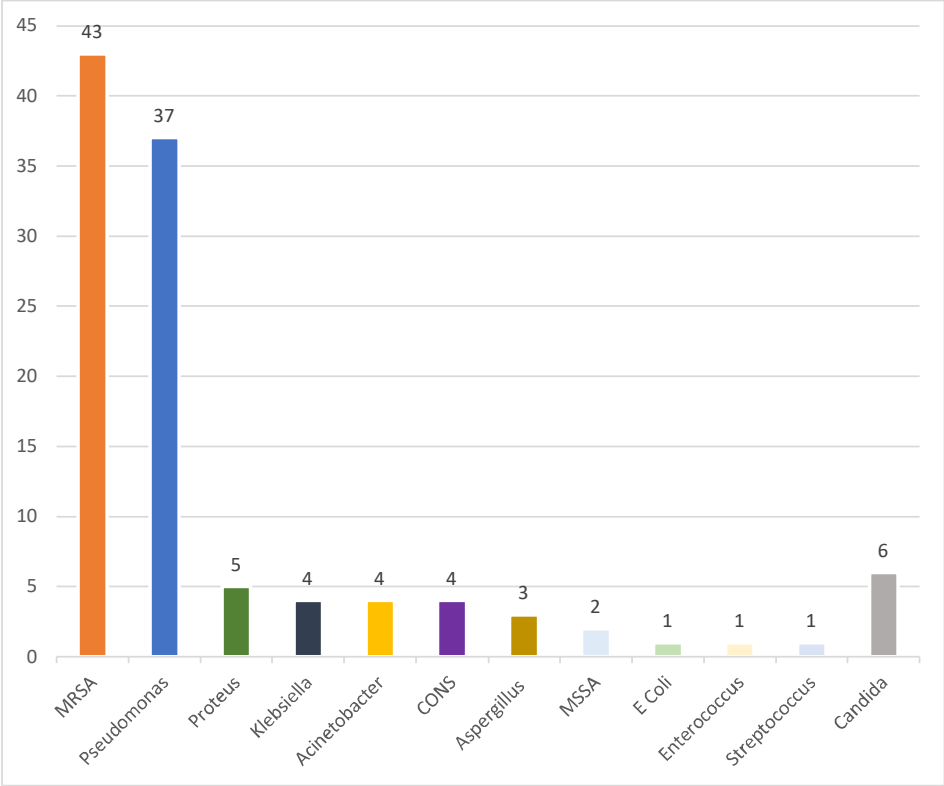

Fig. 5. Distribution of various isolates in CSOM

Antimicrobial sensitivity testing was carried out for 102 isolates. Linezolid (LZ) showed 100% sensitivity in Gram-positive Cocci, whereas Tigecycline (TIG) showed 100% sensitivity in Gram-negative Bacilli. The following disks were put for *Staphylococcus aureus*: cefoxitin, penicillin, erythromycin, clindamycin, tetracycline, linezolid, amikacin, levofloxacin, and cotrimoxazole.

All the isolates of *Staphylococcus aureus* and Coagulase-Negative Staphylococci (CoNS) were resistant to cefoxitin suggestive of MRSA, however, all MRSA were 100 % sensitive to tetracycline, linezolid, amikacin followed by cotrimaxazole 84%, Levofloxacin 75%, clindamycin 63%, and erythromycin 28%.

The following disks were put for *Pseudomonas*: Tigecycline, Azetronam, Gentamicin, Ofloxacin or Levofloxacin, Colistin, Meropenem or Imipenem, Ceftazidime, Cefepime, Cefoperazone-Sulbactam, Ceftazidime-Tazobactam,Cefazolin, Piperacillin-Tazobactum, Amikacin, and Ciprofloxacin.

All the isolates of *Pseudomonas* were 100 % sensitive to Tigecycline, Ofloxacin, Colistin, Imipenem, Aztreonam, and Cefepime followed by Piperacillin-tazobactum 92%, Ciprofloxacin 80%, and Amikacin 80%.

Discussion

CSOM is an important cause of preventable hearing loss, particularly in the developing world (13), and is 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. Early, microbiological diagnosis ensures prompt and effective treatment to avoid such complications. India is one of the countries with high-prevalence where urgent attention is needed (7).

In the present study, ear swab of 111 (83%) of the studied patients yielded bacterial growth and 23 (17%) cases were sterile. This is in comparison with the results found by the other researchers like Chakraborty et al., Prakash et al., and Rana et al. (14, 16, 17). Results showed S. aureus and P. aeruginosa as the most common isolates from active CSOM infection. Studies by Prakash et al., Agrawal et al., and many researchers have reported S. aureus as the predominant causative agent for CSOM followed by P. aeruginosa (18-24). This observation was in line with diversity of microbial flora of CSOM infection in colder regions, as reported in the studies done by Ettehad et al. (19) from Iran (31.15%) and Singh et al. (20) from India (36%). In contrast, other studies from India, (2, 25), Nigeria (26), and Pakistan (27) showed different trends as *Pseudomonas* was the most prevalent organism; this could be due to the variation in micro-organisms in different regions and effect of climate. In our study, we could isolate *Pseudomonas* in 37 (33.3%) of the cases. The increased isolation rate of P. aeruginosa has its own implications, as this organism is an important cause of nosocomial infections and has developed resistance to even more potent antibiotics. *Pseudomonas* being an opportunistic extracellular pathogen, thrives well in the warm damp external auditory meatus of CSOM patients, is difficult to eradicate, and has been particularly implicated in the causation of bony necrosis and mucosal disease (28). It's presence in the middle ear is almost always associated with secondary invasion to the middle ear via defect in tympanic membrane (9, 29).

Maximum number of patients were in the age group of 21-30 years followed by 11-20 years. Young children may develop CSOM due to unhygienic condition and over gathering in school premises. Similar findings were reported by Agarwal et al. (30) and Rathi et al. (31). In contrast, maximum number of patients in the age group of 0-8 years (72%) were observed by Chavan P et al. (32).

Fungal infections of the middle-ear are common as fungi thrive well in moist pus. The most commonly found fungi in CSOM are Candida species and Aspergillus species (33). In the present study, fungal etiology was found in 6 (5.40%) of the cases and were belong to candida species.

Antibiotic susceptibility test was carried out for all the bacterial isolates. It was found that most of the gram-positive isolates were 100% sensitive to Linezolid, Amikacin, and tetracycline followed by Cotrimaxazole (84%) and Levofloxacin (75%). For gram-negative isolates, Tigecycline and Ofloxacin showed 100% sensitivity, followed by Ciprofloxacin 80%, Amikacin 80%, and Piperacillin 75%.

Antibiotics commonly available as topical ear drops like Gentamicin and Ciprofloxacin showed good activity against most of the isolated organisms, and can be used as effective first line topical antibiotic in the treatment of CSOM. Studies reveal that quinolones like Ciprofloxacin are safe and particularly effective against S. aureus and P. aeruginosa (34-36). Similar results were found by Dhabekar et al. (37) and Prakash et al. (38).

On comparing the findings of our study with the findings of other researches, it is observed that microbial profile and AST pattern of CSOM have been changing with due course of time. Geographical variation and differences in the studied patient populations could be the possible factor for variability. Emergence of antimicrobial resistance is becoming more common. Indiscriminate and haphazard antibiotic use as well as negligence on the patient part are the factors responsible. As the symptoms subside, many patients stop taking antibiotics before the completion of therapy, and allow the partly resistant microbes to flourish. Patients should be instructed to avoid such practice. Changes in the microbial flora following the advent of sophisticated synthetic antibiotics increase the relevance of and reappraisal of the modern-day flora in CSOM, and there, in-vitro AST patterns are very important for the clinicians to plan the treatment of a chronically discharging ear (38).

From our study, we conclude that isolation of various aerobic, anaerobic, and fungal isolates shows that different conditions of CSOM could be differentiated on microbiological grounds. Thus, for better management of CSOM, microbial classification of infection as well as drug sensitivity test of the organisms recovered are essential for making appropriate decision of antimicrobials that will effectively eradicate the pathogen.

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No Declared

Conflict of interest

No conflict of interest declaration between the authors.

Funding/support

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Ethical statement

The study protocol was approved by the institutional ethics committee and the informed consent of the patients who participated in the study was obtained or waived according to the ethical standards. The confidentiality and anonymity of the patients and their swab samples were maintained throughout the study and the data analysis.

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