**Original Research Article**

# Chronic Suppurative Otitis Media (CSOM): Evaluation of fungal and aerobic bacterial agents and antibiotic sensitivity pattern of the bacterial isolates

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**A R T I C L E   I N F O**

**A B S T R A C T**

**Introduction:** Chronic suppurative otitis media (CSOM) is an important cause of preventable hearing loss, particularly in the developing world.

**Aim:** To determine the microbiological profile of CSOM and determine the antibiotic susceptibility testing of aerobic bacteria which will be beneficial for appropriate treatment there by reducing complications.

**Methods and Materials:** A total of 109 patients with CSOM attending outpatient and admitted inpatient in ENT department were included in the study. Two pus swabs each for infected ear were collected. Specimens were subjected to Gram stain and plated on to appropriate culture media to isolate bacterial and fungal pathogens. Bacterial and Fungal species identification and Antibiotic susceptibility testing of aerobic bacteria of isolated pathogens was done.

**Results:** Out of 109 samples cultured there were 70 bacterial and 14 fungal isolates. Most common aerobic bacterial isolate was Pseudomonas aeruginosa (34.2%) followed by Proteus mirabilis (22.8%) and Staphylococcus aureus (17%). Among fungal isolate, Aspergillus niger (64.3%) was predominant followed by Aspergillus flavus (21.4%) and Candida species (14.3%). Amikacin (91.6%) and Ciprofloxacin(87.5%) showed maximum activity to Pseudomonas aeruginosa. The antibacterial susceptibility pattern of Staphylococcus aureus revealed 58.3% Methcillin resistant Staphylococcus aureus (MRSA) strains.

**Conclusions:** Emergence of Pseudomonas aeruginosa as most common aerobic isolate and high incidence of Methicillin Resistant Staphylococcus aureus in present study indicates the necessity of continuous evaluation of bacteriological profile and antimicrobial susceptibility testing in all CSOM cases.

## 1. Introduction

Chronic suppurative otitis media (CSOM) is a chronic inflammatory condition of the middle ear and mastoid cavity, which results in recurrent otorrhoea due to tympanic perforation.[1] The disease usually begins in childhood as a acute infection of the middle ear, known as acute otitis media (AOM). As per otolaryngologists, after more than 3 months of acute otitis media it develops into CSOM.[2] CSOM is an important cause of preventable hearing loss in the developing world. This results from disruption of the eardrum and ossicles assembly (conductive hearing loss) or from hair cell damage by bacterial infection that has penetrated the inner ear (sensory hearing loss), or both (mixed hearing loss).[3] The most common aerobic bacterial agents causing CSOM are Pseudomonas aeruginosa, Escherichia coli, Proteus mirabilis, Klebsiella pneumonia and Staphylococcus aureus.[4] Fungal infections are associated with immunocompromised state of patient like diabetes, use of corticosteroids, unhealthy practices of ear cleaning. Common fungal agents causing secondary infection in CSOM are Candida spp., Aspergillus spp., Rhizopus spp., and Penicillium spp.[5,6] Complications of CSOM include as facial nerve paralysis, lateral sinus thrombosis, labyrinthitis, meningitis and brain abscess.[7] Occurence of CSOM is higher in developing countries like India due to low socioeconomic status, poor personal hygiene, overcrowding and poor medical facilities. CSOM

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being a chronic recurrent disease there is more chance of indiscriminate, haphazard use of antibiotics and poor follow up of patients resulting in changes in bacterial flora, multidrug resistant strains and disease complications. In addition present scenario of excessive use of broad spectrum antibiotics, corticosteroids and cytotoxic chemotherapy and increase in the number of immune deficiency condition are precipitating factors for poor treatment outcome. Present research work was aimed to determine the microbiological profile of CSOM in tertiary care centre and antibiotic susceptibility testing of aerobic bacteria which will be beneficial for appropriate treatment of CSOM patients there by reducing morbidity and complications.

## 2. Materials and Methods

The study was carried out in the Department of Microbiology, in RVMIMS Siddipet, India over a period of one year from April 2018 to May 2019. A total of 109 patients presenting with CSOM of all age groups and both sexes attending inpatient and outpatient of ENT department were included in the study.

### 2.1. Inclusion criteria

Patients with complaints of ear discharge in one or both ears for at least four weeks

### 2.2. Exclusion criteria

Patients who have taken antibiotics within one week.
Patients with acute otitis media / otitis externa.

### 2.3. Sample collection

Two swabs each for infected ear was used to collect pus oozing through the tympanic membrane perforation with the help of otoscope. The swabs were placed in sterile test tubes and transported to microbiology laboratory for processing.

### 2.4. Direct microscopic examination

Sample from one swab was subjected to Gram stain and other swab was inoculated on Blood agar, MacConkey agar and Sabourauds dextrose agar with chloramphenicol for isolation of aerobic bacteria and fungi respectively. Bacterial species identification was done by using standard microbiological technique.[8]

Antibiotic susceptibility testing of aerobic bacteria was performed by Kirby-Bauer's disk diffusion method as per CLSI guidelines.[9] Methicillin resistant staphylococcus aureus was detected by cefoxitin disc test.[9]

Fungal identification was done by routine cultural characteristics, Gram stain, Lactophenol cotton blue mount, Germ tube test and slide culture.

## 3. Results

In present study out of total 109 samples collected 35% were males and 65%were females. Maximum patients (45%) belonged to age group of 21-30 yrs. Unilateral infection was observed in 92(84 %) cases. Most cases belonged to lower socio-economic status and had history of local treatment with ear drops. Out of 109 samples, 70 bacterial and 14 fungal isolates were obtained. Single bacterial growth was seen in 68 cultures, single fungal growth was observed in 12 cultures, mixed bacterial and fungal growth was observed in 2 cultures and no growth was observed in 27 cultures. Percentage of bacterial and fungal isolates is presented in Tables 1 and 2. In present study out of 70 bacterial isolates most common was Pseudomonas aeruginosa (34.2%) followed by Proteus mirabilis (22.8%) and Staphylococcus aureus (17%). In present study out of 14 fungal isolates Aspergillus niger (64.3%) was predominant followed by Aspergillus flavus (21.4%) and Candida species (14.3%).

Antibiotic sensitivity testing of aerobic bacteria was carried out on 69 isolates as 1 isolates were identified as staphylococcus epidermidis. Results of sensitivity testing of various aerobic bacterial isolates are depicted in Tables 3, 4 and 5.

Amikacin (91.6%) and Ciprofloxacin(87.5%) showed maximum activity to Pseudomonas aeruginosa. In case of E.coli, Proteus and Klebsiella sp, Imipenem was found to be the most effective drug followed by Amikacin and Ciprofloxacin. The antibiotic susceptibility pattern of Staphylococcus aureus revealed 58.3% MRSA (methcillin resistant Staphylococcus aureus) strains by cefoxitin disc diffusion method recommended by CLSI guidelines.[9] Aminoglycosides and Cotrimoxazole were seen to be most effective against Staphylococcus aureus strains.

## 4. Discussion

In present study highest prevalence was found in second decade and accounted for 45% of the cases which was in accordance with other researchers.[10–12] In this study female predominance was higher (65%) than male, which is in accordance to other reasearches[6,12] but in contrast to studies by Harvinder et al.[11] The study involved random selection of cases therefore predominance of female patients over male may be only an incidental finding. Moreover, no knowledge of anatomical differences in the ear structures of male and female has been reported. Unilateral infections were found to be higher than bilateral ear infections which is similar to previous study by Sengodan Rajesh et al.[13] Mono bacterial etiology was most common in present study which was in accordance with other studies.[10,12,14] Most common bacterial isolates were Gram negative (Pseudomonas aeruginosa followed by Proteus mirabilis) followed by Gram positive (Staphylococcus aureus). This

**Table 1:** Bacterial isolates (n=70)

| Bacteria | | Number | Percentage (%) |
|---|---|---|---|
| Gram Negative Bacteria 56 (80%) | Pseudomonas aeuruginosa | 24 | 34 |
| | Proteus mirabilis | 16 | 23 |
| | Klebsiella species | 8 | 11.5 |
| | Escherichia coli | 5 | 7.2 |
| | Acinetobacter spp. | 3 | 4.3 |
| Gram Positive Bacteria 14 (20%) | Staphylococcus aureus | 12 | 17.2 |
| | Coagulase negative staphylococcus | 1 | 1.4 |
| | Enterococcus fecalis | 1 | 1.4 |
| | **Total** | **70** | **100** |

**Table 2:** Fungal isolates (n=14)

| Fungi | | Number | Percentage (%) |
|---|---|---|---|
| Moulds 12(85.7%) | Aspergillus niger | 9 | 64.3 |
| | Aspergillus flavus | 3 | 21.4 |
| Yeast 2(14.3%) | Candida albicans | 2 | 14.3 |
| | **Total** | **14** | **100** |

**Table 3:** Number(N) & Percentage(%) Of Sensitive Strains of Non-fermentors

| S.No. | Antibiotic | Pseudomonas aeruginosa (N=24) | Acinetobacter spp. (N=3) |
|---|---|---|---|
| 1 | Amikacin | 22(91.6%) | 2(66.6%) |
| 2 | Gentamicin | 18(75%) | 1(33.3%) |
| 3 | Ciprofloxacin | 21(87.5%) | 1(33.3%) |
| 4 | Pipercillin-Tazobactum | 14(58.3%) | 0 |
| 5 | Ceftazidime / Cefotaxime | 5(20.8%) | 1(33.3%) |
| 6 | Cefepime | 8(33.3%) | 1(33.3%) |
| 7 | Imipenem | 20(83.3%) | 3(100%) |

**Table 4:** Number and percentage of sensitive strains of Enterobacteriaceae

| | E.coli (N=5) | Klebsiella spp. (N=8) | Proteus mirabilis (N=16) |
|---|---|---|---|
| Ampicillin | 1(20%) | 0 | 0 |
| Amoxyclav | 2(40%) | 1(12.5%) | 0 |
| Pipercillin Tazobactum | 4(80%) | 5(62.5%) | 8(50%) |
| Amikacin | 5(100%) | 6(75%) | 12(75%) |
| Gentamicin | 4(80%) | 5(62.5%) | 10(62.55%) |
| Ciprofloxacin | 5(100%) | 7(87.5%) | 12(75%) |
| Cefotaxime | 4(80%) | 6(75%) | 9(56.25%) |
| Cefuroxime | 3(60%) | 4(50%) | 6(37.5%) |
| Cefepime | 5(100%) | 6(75%) | 10(62.55%) |
| Imipenem | 5 (100%) | 7(87.5%) | 14(87.5%) |

**Table 5:** Number(N) & Percentage(%) Of Sensitive Strains of Gram positive bacterial isolates:

| S.No. | Antibiotic | Staphylococcus aureus (N=12) | Enterococcus fecalis (N=1) |
|---|---|---|---|
| 1 | Cefoxitin | 5(41.6%) | ● |
| 2 | Amikacin | 9(75%) | - |
| 3 | Gentamicin / High level gentamicin | 8(66.6%) | 1(100%) |
| 4 | Ciprofloxacin | 6(50%) | 1(100%) |
| 5 | Azithromycin | 7(58.3%) | 0 |
| 6 | Tetracycline | 4(33.3%) | 0 |
| 7 | Cotrimoxazole | 9(75%) | - |
| 8 | Amoxyclav | - | 1(100%) |
| 9 | Pipercillin / Tazobactum | - | 1(100%) |

finding is in accordance with some researchers [11,14,15] but in contrast with other researchers. [6,10,16] The most sensitive antibiotic for all Gram negative bacteria is Amikacin followed by ciprofloxacin. This finding is consistent with studies by previous investigators. [11,14,16] Since Amikacin is cheaper and has less ototoxic effect compared to other antibiotics it is preferred choice for treatment. Among Gram positive isolates, Staphylococcus aureus was most common and showed high percentage of methicillin resistance. High rate of MRSA in present study is in accordance with studies by other researchers. [14,17] More frequent isolation of environmental bacteria like Pseudomonas, Proteus and Staphylococcus and there declining sensitivity to antibiotics can be attributed to poor hygiene, unorthodox practices, recurrent upper respiratory tract and nasal diseases, indiscriminate use of antibiotics and steroids, poor patient compliance, occupation and changing life style like increased use of mobile phones & sharing of ear phones. When the results of various workers were compared, one fact became obvious that the bacteriology and antibiotic sensitivity pattern of CSOM has been changing from time to time. Hence, antibiotic susceptibility tests should guide the management of CSOM. In our study, out of 14 fungal isolates, 85.7% were Aspergillus species, followed by Candida (14.3%). Our results were in accordance with other researchers. [6,10,11,15]

## 5. Conclusion

Emergence of Pseudomonas aeruginosa as most common aerobic isolate and high incidence of Methicillin Resistant Staphylococcus aureus in present study indicates the necessity of continuous evaluation of bacteriological profile and antimicrobial susceptibility testing in all CSOM cases. This study helps in prudent use of antibiotics thus decreasing the risk of drug resistance and in turn prevent complications like secondary fungal infection and hearing loss.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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