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**Original Research Article**

# Microbial Trends and their Antibiotic Sensitivity Pattern In Paediatric and Adult Chronic Suppurative Otitis Media (CSOM), in Tertiary Care Hospital, at Bettiah, West Champaran, Bihar

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**Abstract**
**Objective:** *Chronic Suppurative Otitis Media (CSOM) is one of the commonest illnesses in ENT practice which requires medical attention all the more in children of poor socio-economic status having in past inadequate treatment and negligent medical care. The aim of present study was conducted to evaluate the different aerobic and anaerobic microorganisms causing CSOM in paediatric and adult patients and their antimicrobial susceptibility pattern as a guide to therapy.*
**Materials and Methods:** *A total of 126 clinically diagnosed cases of CSOM patients were included in the study. From all the patients 126 samples were collected and processed according to standard CLSI Guidelines.*
**Results:** *Out of 90 paediatric CSOM patients, 88 patients (97.77%) were bacterial culture positive while out of 36 adults CSOM patients, 29 patients (80.55%) were culture positive. Bilateral CSOM was slightly more common in adults (28%) than paediatric (23%) age group. It was found that causative organism of CSOM was Polymicrobial in both paediatric (69.18%) and in adult 71.83% of cases while number of organisms isolated per lesion was slightly higher in adults (2.36) as compared to paediatric cases. Staphyloccocus aureus was the commonest aerobic isolates found in paediatric CSOM, while in adult CSOM, Pseudomonas aeruginosa was the commonest one. Among anaerobes Peptostreptococcus spp was commonest in paediatrics CSOM where as Prevotella melaninogenica in adult CSOM. Sensitivity of S. aureus to Doxycycline, Clindamycin, Linezolid were 100%, piperacillin + Tazobacatum 97.8%, cefuroxime was 97.8% while that of gram negative bacilli was higher to ceftriaxone, Azithromycin, Clindamycin, Doxycycline 90 to 100%. Among anarobes higher sensitivity was seen to metronidazole (100%), clindamycin (100%) and ceftriaxone (92%).*
**Conclusion:** *In CSOM there was a mixed infection, so that urgent appropriate antibiotic therapy can be given as early as possible to effectively reverse the disease process and thereby preventing long term complications.*
**Keywords:** *CSOM, aerobe, anaerobe, Antibiogram.*

## Introduction

Chronic Suppurative Otitis Media (CSOM) is defined as long standing chronic suppuration of middle ear cleft and its mucoperiosteal lining resulting in discharging ear and deafness. Manifestations of CSOM are extremely variable and they may be any lesion from a small healed deformity of tympanic membrane, to a cholesteatoma infiltrating widely throughout the temporal bone. The close relation of middle ear cleft to the facial nerve, the auditory labyrinth, the lateral sinus and the middle and posterior cranial fossa, make it all too easy for complications to develop. About two third cases of chronic otitis media involve beta Lactamase producers and more than half involve anaerobic bacterial species, usually in combination with aerobes.

CSOM particularly in children may cause serious morbidity such as permanent ear damage, decrease in hearing and sometimes serious sequele such as extension of infection to the intracranial spaces. CSOM often responds poorly to topical or systemic empirical antimicrobial therapy.

Therefore present study was conducted to evaluate the different aerobic and anaerobic microorganisms causing CSOM in paediatric and adult patients and their recent antimicrobial susceptibility pattern as a guide to therapy.

## Materials and Methods

Present study was conducted in the Department of Microbiology, Government Medical College, Bettiah, West Champaran, Bihar, with the help of ENT Department, during the period of February 2018 to January 2019. A total of 126 clinically diagnosed patients of CSOM attending ENT OPD of our hospital were included in the study.

Detailed history, general physical examination, local ENT examination and X-ray mastoid was done for each case. For sampling purposes excess drainage was removed from external auditory canal with a sterile cotton swab and specimen was obtained with a specially prepared thin swab or 20 gauge blunt cannula attached to a 2 ml syringe by introducing it deep into the middle ear cavity and pus sample was collected and immediately put in Robertson's cooked meat (RCM) broth and incubated at $37^0$C for 48 hours. Direct examination was done with Gram's stain. Various media used for identification of aerobes and anaerobes were nutrient agar, Blood agar, Chocolate agar, Mac Conkeys agar, Brain heart infusion (BHI) agar, Neomycin BHI agar and Bacteroides bile esculin agar. All the isolates were processed and identified according to standard CLSI Guidelines. Antibiotic susceptibility of various isolates was performed with Kirby Bauer method for the commonly used antimicrobial agents e.g. Amoxycillin + Clavulenic acid, Cefuroxime, Doxycycline, Linezolid, Clindamycin, Piperacillin + Tazobactum, Metronidazole, Gentamicin, Azithromycin, Ceftrioxone and results were interpreted by CLSI Guidelines.

## Results

Out of 126 patients, 126 samples were collected. Out of 90 paediatric CSOM patients, 88 patients (97.77%) were bacterial culture positive. Out of 88 patients 61 (69.31%) were males and 27 (30.69) were females. While out of 36 adult CSOM patients culture showed growth of one or more organism in 29 (80.55%) cases, out of which 18 (62.06%) were males and 11 (37.94) were females. Bilateral CSOM was slightly more common in adults (35%) than paediatric (14%) age group. Nature of discharge was mucopurulent (66%), mucoid (21%), purulent (12%) and blood stained (1%) in cases of CSOM.

It was found that causative organism of CSOM was Polymicrobial in both paediatric (69.18%) and in adult 71.83% of cases while number of organisms isolated per lesion was slightly higher in adults (2.36) as compared to paediatric cases.

Among 110 Aerobes in paediatric CSOM Staphylococcus aureus (44 isolates) was the commonest isolated followed by Pseudomonas aeruginosa (34 isolates), Klebsiella spp. (14 isolates), Escherichia coli (08 isolates) and Streptococcus pyogenes (03 isolates) while

amongst 52 adult CSOM Aerobic isolates P. aeruginosa (25 isolates) was commonest followed by S. aureus (14 isolates), Klebsiella spp. (05 isolates), S. pyogenes (1 isolates) and E. coli (02 isolates).

Among 51 Anaerobes in paediatric CSOM, Peptostreptococcus spp. (26 isolates) was the commonest isolate followed by Prevotella melaninogenica (9 isolates), Bacteroides fragilis (07 isolates), Propionibacterium spp. (04 isolates) while among 16 Anaerobes in adult CSOM, Peptostreptococcus (06 isolates) was commonest followed by, P. melaninogenica (05 isolates) B. fragilis (01 isolates) and Propionibacterium (01 isolates).

Sensitivity of S. aureus to Doxycycline, Clindamycin, Linezolid, was 100%, than cefuroxime, Piperacillin + Tazobactum, Azithromycin and ceftriaxone (97.8%). Sensitivity of Gram Negative bacilli was higher to cefuroxime (96.15%) Doxycycline (80-95%), Clindamycin (70-95%), Ceftriaxone (80-95%), in comparison to Amoxyclav, Piperacillin + TZB, and Metronidazole. Among Anaerobes higher sensitivity was seen to Metronidazole (100%), Clindamycin (100%), piperacillin + TZB (100%) in peptostreptococcus, and ceftrixone (92%). Susceptibility was still higher as compared to Gentamicin.

**Table** shows Aerobes and anaerobes isolates in CSOM patients

| **Organism** | **Paediatric CSOM** | **Adult CSOM** | **Total** |
|---|---|---|---|
| **AEROBES** | | | |
| **Gram Positive Cocci** | **50 (45.45%)** | **18 (34.61%)** | **68** |
| Staphylococcus aureus | 41 | 14 | 55 |
| Coagulase Negative Staphylococcus (CONS) | 5 | 3 | 8 |
| Streptococcus pyogenes | 3 | 1 | 4 |
| Streptococcus viridans | 1 | 0 | 1 |
| **Gram Negative Bacilli** | **60 (54.54%)** | **34 (65.39%)** | **94** |
| Escherichia coli | 8 | 2 | 10 |
| Klebsiella spp. | 14 | 5 | 19 |
| Proteus spp. | 3 | 1 | 4 |
| Pseudomonas aeruginosa | 34 | 25 | 59 |
| Other Non-fermenters | 1 | 1 | 2 |
| **Total Aerobes** | **110 (100%)** | **59 (100%)** | **162** |
| **ANAEROBES** | | | |
| **Gram Positive Cocci** | **26 (50.98%)** | **06 (37.5%)** | **32** |
| Peptostreptococcus spp. | 26 | 6 | 32 |
| **Gram Positive Bacilli** | **07 (17.32%)** | **04 (25%)** | **11** |
| Bifidobacterium spp. | 3 | 2 | 5 |
| Propionibacterium spp. | 4 | 2 | 6 |
| **Gram Negative Bacilli** | **18 (35.29%)** | **6 (37.5%)** | **24** |
| Bacteroides fragilis | 7 | 1 | 8 |
| Prevotella melaninogenica | 9 | 5 | 14 |
| Fusobacterium spp. | 1 | - | 1 |
| Other Bacteroides spp. | 1 | - | 1 |
| **Total Anaerobes** | **51 (100%)** | **16 (100%)** | **67** |
| **Total Isolates** | **161** | **68** | |

**Antibiotic Susceptibility pattern of Isolates in CSOM**

| Isolates | Amoxy clav | Cefuroxime | Doxycycline | Clindamycin | Linezolid | Piperacillin + TZB | Metro Nidazole | Gentamicin | Azithromycin | Ceftriaxone |
|---|---|---|---|---|---|---|---|---|---|---|
| S. aureus (n=46) | 42 (91.3%) | 45 (97.8%) | 46 (100%) | 46 (100%) | 46 (100%) | 45 (97.8%) | 0 (0%) | 30 (65.2%) | 45 (97.8%) | 45 (97.8%) |
| P. aeruginosa (n=52) | 32 (61.5%) | 50 (96.15%) | 50 (96.15%) | 48 (92.3%) | 46 (88.4%) | 48 (92.3%) | 0 (0%) | 26 (50%) | 50 (96.5%) | 51 (98.07%) |
| Kl. Pneumoniae (n=16) | 10 (62.5%) | 11 (68.76%) | 13 (81.26%) | 13 (81.26%) | 14 (87.5%) | 14 (87.5%) | 0 (0%) | 6 (37.5%) | 12 (75%) | 12 (75%) |
| E. Coli (n=9) | 5 (55.56%) | 7 (77.78%) | 6 (66.67%) | 7 (77.78%) | 0 (0%) | 5 (55.56%) | 0 (0%) | 3 (33.34%) | 7 (77.78%) | 8 (88.89%) |
| Proteus spp. (n=3) | 0 (0%) | 3 (100%) | 2 (66.67%) | 2 (66.67%) | 1 (33.34%) | 2 (66.67%) | 0 (0%) | 1 (33.34%) | 1 (33.34%) | 2 (66.67%) |
| Peptostreptococcus spp. (n=25) | 10 (40%) | 10 (40%) | 22 (88%) | 25 (100%) | 25 (100%) | 25 (100%) | 25 (100%) | 0 (0%) | 20 (80%) | 23 (92%) |
| Bacteroides spp. (n=7) | 2 (28.57%) | 0 (0%) | 5 (71.43%) | 7 (100%) | 1 (14.28%) | 2 (28.57%) | 7 (100%) | 3 (42.85%) | 2 (28.57) | 3 (42.85%) |
| Propionibacterium spp. (n=4) | 1 (25%) | 3 (75%) | 3 (75%) | 4 (100%) | 2 (50%) | 1 (25%) | 4 (100%) | 0 (0%) | 3 (75%) | 3 (75%) |

## Discussion

CSOM whether atticoantral or tubotympanic disease, is associated with mixed bacterial flora. In the past cultures from CSOM grew only aerobic organisms. The foul smell of chronic ear discharge and the high frequency of anaerobic bacteria in otogenic intracranial infections suggested that anaerobes are a common occurrence in chronic otitis media. Anaerobes produce many virulence factors which are responsible for tissue destruction and inhibition of host defences.

Several mechanisms have been identified by which anaerobes may contribute to the net pathogenicity of polymicrobial infection. These includes, Ability of anaerobes to impair host defence thereby allowing their co pathogens to exert their intrinsic virulence, Provision of nutrients by one bacterial species to enhance growth of its bacterial partners, Capacity of anaerobes to alter the local microenvironment thereby rendering it more conductive to bacterial survival and proliferation and transfer of virulence factors to other micro-organisms causing mixed infection.

The facultative organism helps to maintain a low oxidation redox potential by reducing oxygen and they produce enzymes that inactivate oxygen radicals. Thus the mixture of organisms acts synergistically to produce infection.

Our study highlights the polymicrobial (70%) nature of CSOM in both paediatric and adult age groups. Commonest pattern of isolation in paediatric age group was one aerobe and one anaerobe (55%) while two aerobes plus one anaerobe was commonest pattern (30%) of microorganisms isolated in adult CSOM. Aerobe and anaerobe ratio (2:1) was nearly same in both paediatric and adult CSOM.

In our study paediatric and adult CSOM was predominantly caused by aerobic gram negative bacilli, out of which P. aeruginosa was the most common organism involved 30.90% in children and 48.07% in adults. However P. aeruginosa is a common coloniser of the ear canal therefore isolation of this organism from the middle ear aspirate should be treated promptly. Several other studies have also reported P. aeruginosa to be the most predominant organism.

Our study also highlights S. aureus (82%) as commonest isolate in paediatric CSOM. Our study is in contrast with Sweeney et al who reported Proteus spp. to be the most common aerobic isolate in CSOM. Maximum isolation of S. aureus in paediatric CSOM is in accordance with the study done by Ibekwe et al. Other important organisms isolated were K. pneumoniae and E. coli in both paediatric and adult CSOM cases.

Our study shows that common anaerobic isolates in paediatric CSOM were Peptostreptococcus spp. (50.98%), P. melaninogenica (17.64%) and B. fragilis (13.72%) whereas in adult CSOM Peptostreptococcus spp. (37.5%) was the most

common isolate followed by P. Melaninogenica (31.25%). Our study is in comparison with Ayyagari et al and Erkan et al whereas Karma et al reported P. melaninogenica to the most common organism followed by B. fragilis and Peptostreptococcus spp.

On the basis of antimicrobial susceptibility pattern we suggest the usage of cefuroxime, Doxycycline, clindamycin, Piperacillin + TZB, ceftriazxone and Azithromycin for Gram negative bacilli including P.aeruginosa and Doxycyline, linezolid, Clindamycin, Ceftrioxone for S.aureus. However to provide anaerobic cover metronidazole, clindamycin may be included in therapy.

In present study only two isolates of both Peptostreptococcus and Propionibacterium spp. shows resistant to Gentamicin and only one isolates of B.fragilis showed resistance to metronidazole and Gentamicin.

A few resistant strains have also been reported by Inghanm et al and Narayan et al. Deficiency of enzymes pyruvate dehydrogenase decreases the capability to reduce metronidazole and generate active intermediate.

In our study 100% of anaerobic isolates were sensitive to Metronidazole and clindamycin which correlates well with study done by Narayan et al, Sutler and Finegold where all isolates showed 100% susceptibility against clindamycin.

**Conclusion**

CSOM particularly in children may cause serious morbidity such as permanent ear damage, decrease in hearing and sometimes serious sequele such as extension of infection to the intracranial spaces. CSOM often responds poorly to topical or systemic empirical antimicrobial therapy, so that after diagnosis prompt, appropriate antimicrobial therapy is given to the patients to save the life of patients.

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