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Der Pharmacia Lettre, 2013, 5 (1):33-40  
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## Bacteriological agents of chronic suppurative otitis media and its complications at a tertiary care hospital

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### ABSTRACT

To study the pattern of Chronic Suppurative Otitis Media caused by aerobic flora and its complications in a tertiary care hospital. The ear discharge from one hundred patients with the clinical diagnosis of chronic suppurative otitis media was collected and investigated by direct smears and culture methods for isolation of aerobic bacteria and tested for their antibiotic sensitivity. The complications associated with CSOM were noted. Majority of the cases were of the age 0-20 yrs(71%). Direct smear examination and culture was positive in 93% of cases. *Pseudomonas aeruginosa* was the most common isolate (40%). The sensitivity pattern for the isolated aerobes was maximum for Amoxiclav and the least for Clindamycin. Microbial Culture and sensitivity helps in appropriate management of CSOM.

**Keywords:** Chronic suppurative otitis media, Sensitivity, Complications

### INTRODUCTION

Otitis media is an inflammation of the middle ear that affects the tympanic membrane[1], resulting in middle ear effusion, fever, and irritability. It is the most common bacterial infection among infants and young children.

Clinically, otitis media may be classified as acute, subacute, and chronic based on the duration of symptoms[2]. According to B.H.Senturia the acute phase is considered to be the initial three weeks of inflammation, chronic phase three months following the onset of inflammation, and subacute phase is said to lie between three weeks and three months of inflammation.

Commonest ear related problem among the children and the elderly people with ear discharge is suppurative otitis media. These cases may come to general practitioners, to specialists and sometimes to superspecialists also. These cases very often may be neglected because of ignorance, negligence and or poverty and established in the form of chronic suppurative otitis media, and / or as a non suppurative complications like mastoiditis and permanent ear drum damage resulting in permanent deafness. Suppurative complications may lead to dangerous deep seated infections like meningitis and subdural abscesses.

A complication of otitis media is defined as a spread of infection beyond the pneumatised area of the temporal bone and the associated mucosa.

The major complications of CSOM are:

1. Conductive deafness
2. Intracranial:
  - a. Extra dural abscess
  - b. Subdural abscess
  - c. Brain abscess
  - d. Sigmoid sinus thrombophlebitis

- e. Otitic hydrocephalus
- f. Meningitis
- 3. Extra cranial:
  - a. Mastoiditis
  - b. Labrynthitis
  - c. Facial nerve palsy
  - d. Stricture of Eustachian tube
  - e. Necrosis of ossicular chain
  - f. Middle ear fibrosis
  - g. Septicaemia

These complications can be prevented by

- a. Early diagnosis, culture of ear discharge specimen, and institution of treatment with appropriate antibiotic indicated by the antibiotic susceptibility testing.
- b. Control and prevention of upper respiratory infection and other infectious diseases.
- c. Prevention of entry of water in a perforated ear drum.

### MATERIALS AND METHODS

100 patients suffering from CSOM were randomly selected from the department of Otorhinolaryngology, Narayana Hospital, Narayana Medical College, Nellore. The ear discharge was collected under aseptic precautions with the aid of an aural speculum, prior to the instillation of any topical medication. The first swab was used to make a smear on a clean glass slide for direct smear examination by Gram's stain. The second swab was processed for the isolation of aerobic bacteria.

**Direct smear examination:** Gram's stain was performed by Jensen's modification and then screened under oil immersion to note the various morphological types of bacteria, their number, the presence or absence of inflammatory cells and the number of squamous epithelial cells in the sample.

**Aerobic culture:** - The swab on reaching the laboratory was inoculated on the following culture media.

- ✚ Mac conkey agar plate
- ✚ Blood agar plate
- ✚ Chocolate agar plate and
- ✚ Nutrient agar plate to isolate the organisms

The inoculated Blood agar and Mac conkey agar plates were incubated aerobically at 37<sup>0</sup>C for 24 hours.

After overnight incubation at 37degrees C the blood agar and Mac conkey agar plates were examined for evidence of growth. The colony characters were studied; smears were stained by Gram's stain and examined under the 100x objective.

After 48 hours incubation the chocolate agar plate was similarly examined and the colonies further processed.

The bacterial species then isolated were identified by morphology, cultural characteristics and bio-chemical reactions according to the standard techniques.[3]

Staphylococci were identified as Staphylococcus aureus and Staphylococcus albus This was done by taking into account colony characteristics (large, circular, smooth, convex, shiny, opaque and easily emulsifiable) pigmentation (white to golden yellow, ) mannitol fermentation and coagulase test. The slide coagulase test was done as per Williams and Harper (1946) method and the tube coagulase test was done as per Gillespie's method.[4]

The Gram negative bacilli were tested for motility by hanging drop and then subjected to other biochemical and sugar fermentation test. The tests were read after incubation at 37<sup>0</sup>c at the end of 24 hours and 48 hours.

The sugars were used to study the fermentation reaction with Glucose, lactose, sucrose, maltose and Mannitol.[3] The Bio-chemical test s done were Indole, Methyl red, Voges – Proskaver, citrate (IMVIC) and Urease.[3]

All sugar fermentation and biochemical tests were done from the subcultures made from isolated colonies picked from the primary isolation media. All subcultures were incubated before putting up the sugar and biochemical test.

After the subcultures reached MC Farland's Grade 3 turbidity the sugars and biochemical tests were put up and incubated at 37°C for 24 hours and 48 hours.

#### **Antibiotic sensitivity tests:**

Antibiotic sensitivity testing was done by Kirby Bauer disk diffusion method.

The antibiotics used were

- Amoxicillin
- Cephexime
- Cephazidone
- Ciprofloxacin
- Chloramphenicol
- Amoxiclav
- Cefaperazone with Sulbactam
- Cefataxime
- Sporofloxacin
- Ampicillin
- Erythromycin
- Vancomycin
- Penicillin
- Oxacillin
- Cephaxoline
- Azithromycin

Inoculation and Incubation:

Standard protocols for inoculation and incubation were followed as per the set norms.

### **RESULTS AND DISCUSSION**

One hundred patients attending the ENT Department of Narayana Medical College Hospital, Nellore, with the clinical diagnosis of chronic suppurative otitis media with or without complications were included in the study. The ear discharge was collected and investigated by direct smears and culture methods for isolation of aerobic bacteria and tested for their antibiotic sensitivity.

#### **Demographic data:**

Of the hundred patients studied, 73 belonged to urban area and 27 belonged to the rural area. (Table 1)

**Table 1: Distribution of patients among urban and rural population**

Situation	No. of cases	Percentage
Urban	73	73%
Rural	27	27%
Total	100	100%

Out of one hundred patients studied, 57 patients were male and 43 patients female. (Table 2)

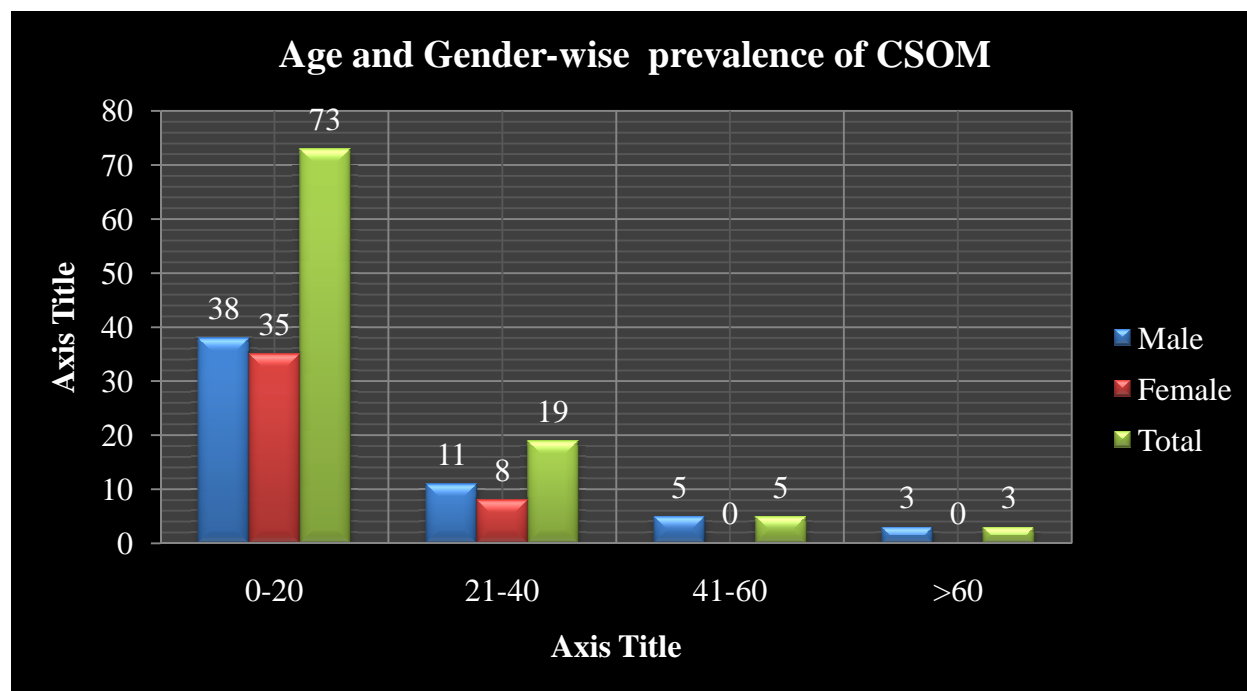
**Table 2: Gender-wise distribution of patients**

Gender	Number of cases	Percentage
Male	57	57%
Female	43	43%

Analysis of these patients of otitis media in both genders and age groups revealed that 73% were in the age group of 0 - 20yrs in both genders.

Age-wise distribution of patients with CSOM revealed 19%, 5%, 3% patients in age groups 21 to 40, 41-60 and beyond 60 respectively. (Figure 1)

Figure 1: Age-wise and Gender- wise prevalence of CSOM patients



62(62%) patients had discharge from the right ear. 33(33%) patients had discharge from the left ear, and 5(5%) of patients had discharge from both the ears. (Table 3)

Table 3: Predominant side of otitis media

Ear discharge	Number	Percentage
Right Ear	62	62%
Left Ear	33	33%
Both Ears	5	5%
Total	100	100%

A total of 74 cases (74%) were uncomplicated and (26%) cases were associated with complications. Out of these 26 cases, conductive deafness was present in 8 cases(8%), Granulations with polyp was seen in 8 cases (8%), 4 had Facial palsy (4%), 4 cases had mastoiditis (4%) and 2 cases (2%) had vertigo with vomiting. (Table 4)

Table 4: Complications of CSOM

	Complication	No.	Percentage
1	Conductive Deafness	8	8%
2	Granulations with Polyp	8	8%
3	Facial palsy	4	4%
4	Mastoiditis	4	4%
5	Vertigo with vomiting	2	2%
	Total	26	26%

Out of the 100 specimens, 93 (93%) were direct smear positive and culture positive. 7 specimens (7%) were sterile by culture and also did not show any organism on direct smear examination. (Table 5)

Table 5: The Results of Direct smear and culture

	Specimen	Number	Percentage
1	Smear positive and culture positive	93	93%
2	Smear Negative and culture negative	7	7%

The overall results of bacteriological investigation revealed that out of the 100 cases of otitis media studied, 93 (93%) cases yielded positive cultures and 7(7%) cases yielded no growth on culture. (Figure 2)

Figure 2: Culture Results

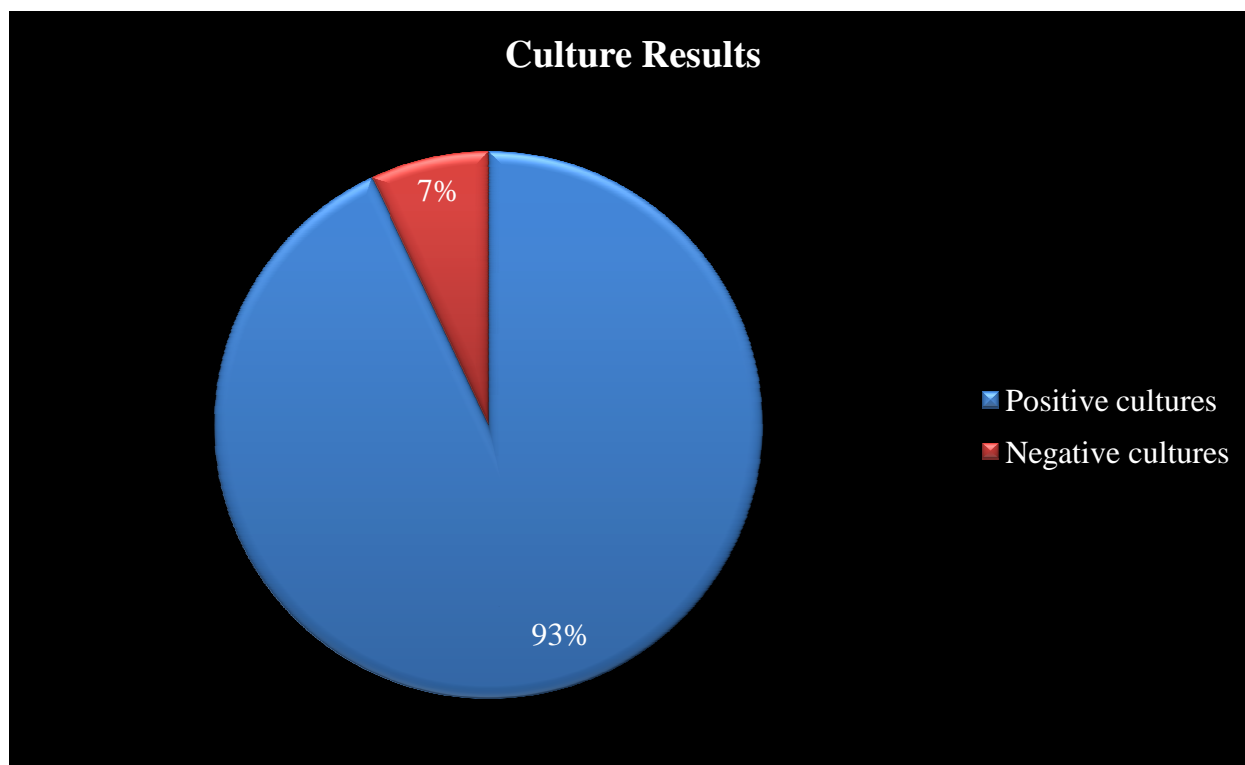
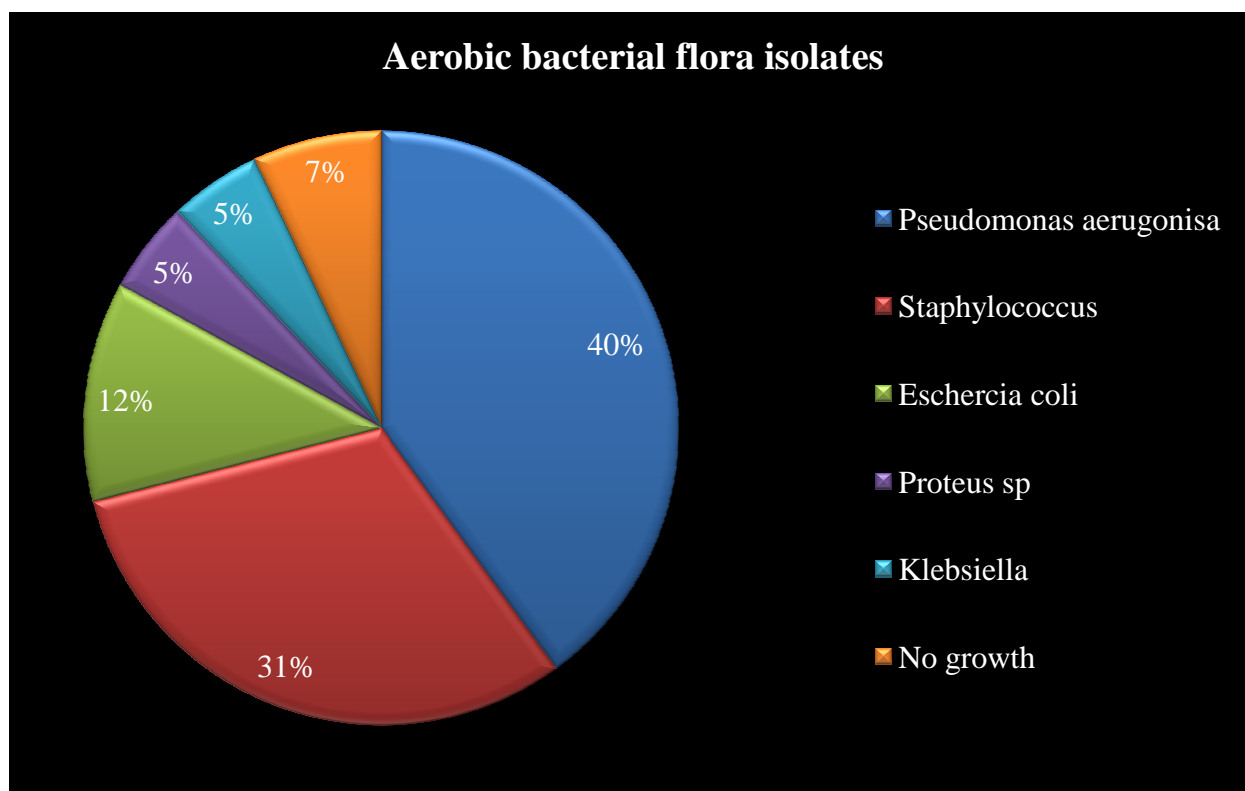


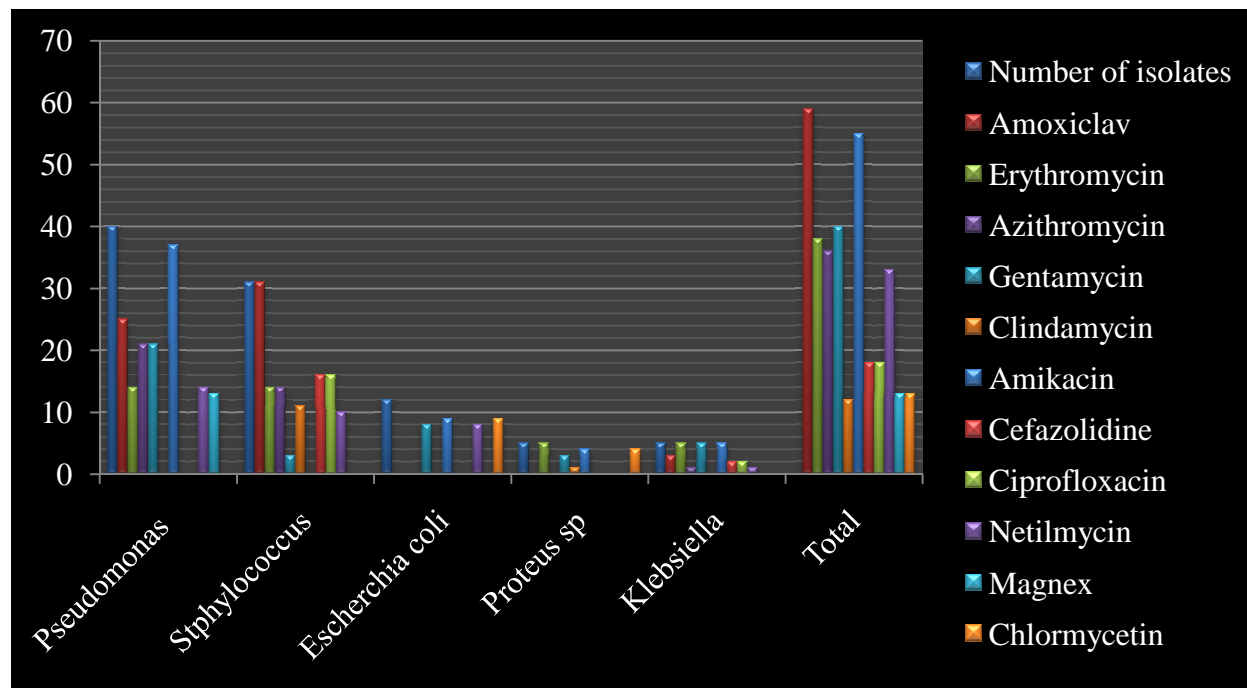
Figure 3 shows the incidence of various aerobes isolated from 100 specimens. *Pseudomonas aeruginosa* was the most predominant species in 40 cases (40%), followed by *Staphylococcus aureus* (31 cases (31%) next *Escherchia coli* was present in 12 cases(12%) and *Proteus sp* and *Klebsiella sp* were seen in 5 cases each (5%).

Figure 3: Aerobic bacterial flora isolates



**Figure 4** demonstrates the results of the antibiotic sensitivity pattern of aerobic organisms isolated from CSOM. Table 9 demonstrates the results of the antibiotic sensitivity pattern of aerobic organisms isolated from CSOM.

**Figure 4: Antibiotic Sensitivity Pattern Of Aerobic Organisms Isolated**



Out of a total 93 strains,  
 59 strains were sensitive to Amoxiclov,  
 55 strains were sensitive to Amikacin.  
 40 strains were sensitive to Gentamycin  
 38 strains were sensitive to Erythromycin  
 36 strains were sensitive to Azithromycin  
 33 strains were sensitive to Netilmycin  
 13 strains were sensitive to Cefaperazone with Sulbactam(Magnex)  
 13 strains were sensitive to chloramphenical and 12 strains were sensitive to Clindamycin.

According to Senturia the acute phase of otitis media is considered to be the initial three weeks of inflammation, chronic phase three months following the onset of inflammation and subacute phase is said to be between three weeks and three months of inflammation.[2]

In this particular study of one hundred cases, all the patients had symptoms lasting more than three months, mainly the symptoms being, ear discharge, pain in the ear and other signs of inflammation like fever. Hence all the cases belong to the group of chronic suppurative otitis media. Out of the 100 cases of CSOM studied the highest incidence 71% was observed in the 0 – 20 age group. This finding corresponds with the work published by other authors Gulati et al, Baruah et al, Nandan Singh and Radha Bhasker, Changani and Goyal, A Nandy, PS Mallaya and K Sivaranjan. Nelson's Text book of Pediatrics and NM Moshi et al report a high incidence in the first decade of life, where as Laxmi Naidu and Arya and Mahepatra reported the highest among the 11-20 yr age group.[4-12]

Analysis of the gender incidence in the present study revealed that otitis media was found to be more common in males(57%) than in females(43%). As this study involved a random selection of cases, the prevalence of male patients over female patients may be only an incidental finding.

Arya and Mahapatr Gulati et al Nandan singh and Radha Bhaskar, PJagtap and O.Hardas, Bhavan desi et al, and NH Moshi et al have reported a significant male predominance. Our findings are in close association with the above studies.[4,5,10,12]

Published reports indicate that CSOM may be unilateral or bilateral. Unilateral infections may involve either the right ear or left ear.

In the present study unilateral infection was predominant- seen in 95% of the patients. Right ear was involved in 62% of the patients and the left ear in 33%. Bilateral involvement was present only in 5% of cases. These findings correspond with the study done by Laxmipathi and Bhaskaran and Baruah & Agarwal.[4,6]

The complications of chronic suppurative otitis media observed in the study were – conductive deafness in (8%) of cases. Granulations with polyp formation in 8% of cases, facial palsy was seen in 4% of cases, mastoiditis was seen in 4% of cases and vertigo was seen in 2% of cases.

A total of 74% of cases were uncomplicated and the above complication accounted for 26% of cases. Palva Halstrom, Chhagani and Goyal also observed granulations, mastoiditis as common complications of CSOM.[7] In the study done, bacteria were demonstrated in direct smears in 93% of specimens and culture could isolate bacteria in 93% of specimens.

Smear Positive	}	93
Culture Positive		
Smear Negative	}	7
Culture Negative		

7 specimens (7%) yielded no growth. The negative culture could be due to the instillation of broad spectrum antibiotics which were used already by the patient.

The bacteriologic study of otitis media revealed the isolation of a variety of organisms. *Pseudomonas aeruginosa* is the most prominent organism being isolated in 40 (40%) of the cases.

It is followed in order of predominance by *Staphylococcus aureus* in 31 (31%) cases. This is followed by *E.coli* is 21 (21%) cases. *Proteus mirabilis* in 5 cases (5%) *Klebsiella pneumonia* in 5 cases (5%) .

*Pseudomonas aeruginosa* is the most predominant organism among the cases of CSOM reported by several workers with an incidence ranging from 21% to 52.94%. [5,8,]

*Staphylococcus aureus* isolated in 31 cases (31%) is observed as the next predominant organism in this study our findings are similar to those of Fine Gold and Brook and Moshi et al Laxmipathi and Bhaskaran observed almost similar results with the monomicrobial infection in 46.2% cases.[4]

Whereas, Friedman, Mann et al, Baruah et al , Ramarao and Jayakar and Karov et al reported the most predominant organism in CSOM as being *staphylococcus aureus*. [6]

*Escherichia coli* was isolated in 12 cases (12%). Chatterjee et al reported a high incidence (37%) of 101 isolates of *Escherichia coli*.

*Proteus* species were found in 5 isolates (5%) some workers like Vaishnav and Chhagavi found *Proteus* to be the leading organism to be isolated from cases of CSOM with 44 isolates. Other workers have reported 5 – 20% incidence.

*Klebsiella pneumoniae* was isolated from 5 cases (5%) in the present study.

Rekha Rao and Bhaskaran isolated *Klebsiella pneumonia* from 16(13% cases)

A look into the monomicrobial and polymicrobial infection in cases of otitis media shows that in this study monomicrobial etiology was found to be common. Usha Hardass and Chatterjee et al have reported monomicrobial etiology to be more common than the polymicrobial in the causation of otitis media. Other workers who have reported predominated polymicrobial etiology in otitis media are , Ayyagiri et al, Rekha Rao S Bhaskaran and Maninder Pal Singh et al. As regards the antibiotic sensitivity, in the present study Amoxiclav has proved to be the most effective drug for aerobes (59 strains) closely followed by Amikacin (55 strains), followed by Gentamycin (40 strains) and 38 strains sensitive to Erythromycin. Different workers showed different sensitivity patterns to Gentamicin.

### CONCLUSION

1. One hundred patients with the clinical diagnosis of chronic suppurative otitis media attending the outpatient department of Narayana Hospital, attached to Narayana Medical College, Nellore formed the study group. They were investigated by direct smears and culture methods for the isolation of aerobic bacteria.
2. Majority of the cases were of the age 0-20 yrs(71%). The over all incidence was found to be higher in males (57%) as compared to females(43%)
3. Direct examination revealed the presence of bacteria in 93% of cases The overall rate of culture positives was 93% and 7% of cases were culture negative.
4. Majority of cases were unilateral in nature.
5. Monomicrobial aetiology was found to be the common among the study group.
6. Among the aerobes, *Pseudomonas aeruginosa* was the most common isolate (40%), the other organisms in the order of decreasing frequency were,
  - a. *Staphylococcus aureus* -31%
  - b. *Escherichia coli* - 12%
  - c. *Proteus vulgaris* - 5%
  - d. *Klebsiella* - 5%
- e. Monomicrobial infection was found to be common in this study.
7. Complications in the neglected cases of suppurative otitis media noted are conductive deafness(8%), Granulomatous polyp formation(8%), Mastoiditis(4%), Facial palsy(4%) and Vertigo(2%).
8. The sensitivity pattern for the isolated aerobes in the decreasing order of frequency is Amoxiclav, Amikacin, Gentamicin, Erythromycin, Azithromycin, Netilmycin, Cephaperazone with Sulbactam, Chloramphenicol and Clindamycin.

### REFERENCES

- [1] K.B Bhargava, S.K.Bhargava, T.M.Shah, A Short Textbook of E.N.T. Diseases. Usha publications, India, **2005**, 7, 110.
- [2] B. H. Senturia, C. D. Bluestone, J. O. Klein, D. J. Lim, J. L. Paradise, *Ann. Otol. Rhinol. Laryngol. Suppl.***1980**, 89, 68, 3.
- [3] Cruickshank R, Medical microbiology: The practice of medical microbiology, Churchill Livingstone, U. K., 1989, 3, 374.
- [4] S. Nandan, Bhaskar, *Indian Journal of Otolaryngology and Head & Neck Surgery*, **1972**, 24, 4,161.
- [5] J. Gulati, P. L. Tandon, Waryan Singh, *Indian Journal of Otolaryngology and Head & Neck Surgery*, **1969**, 21, 4, 198.
- [6] P. C. Baruah, S. C. Aggarwal, M. M. L. Arora, Y. N. Mehra, *Indian Journal of Otolaryngology and Head & Neck Surgery*, **1972**, 24, 4, 157.
- [7] D. L. Chhagani, D. D. Goyal, *Indian J. Otolaryngology*1976, 28 , 41.
- [8] Atanu Nandy, P. S. Mallya, K. Sivarajan, *Indian Journal of Otolaryngology and Head & Neck Surgery*, **1991**, 43, 3, 136.
- [9] E. Behrman, Robert Kliegman, Waldo Emerson Nelson, Ann M. Arvin, Nelson text book of pediatrics., W.B. Saunders, Philadelphia, **1994**, 14, 203.
- [10] N. H. Moshi, B. M. Minja, *East Afr Med J*, **2000**, 77 1, 20.
- [11] M. Laxminaidu, *Ind.Med.Gaz.*, **1965**, 5, 1, 24.
- [12] S. C. Arya, L. N. Mohapatra, *Journal of the Indian Medical Association*, **1966**, 47, 8, 369.