

## Bacteriological and Mycological Profile of Chronic Suppurative Otitis Media In A Tertiary Teaching Hospital, Trichy, Tamilnadu

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**ABSTRACT:** Chronic Suppurative Otitis Media (CSOM) is the chronic inflammation of the middle ear cleft. It is one of the most common hearing problems which can cause many complications if left untreated. The most common bacteria causing CSOM are *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Escherichia coli* and fungi are *Aspergillus spp.*, *Rhizopus spp.*, *Cephalosporium spp.*, *Penicillium spp.*, and *Candida spp.* **Objectives:** This study was carried out to identify the common bacteria and fungi causing CSOM and to determine the antibiotic sensitivity of bacterial isolates. **Method:** 70 patients (out of 96 patients) were selected from the ENT outpatient department of a rural teaching hospital. A written consent was obtained from the patients. Two swabs were collected from the discharging ear. First swab was used for Gram staining and the second for culture and sensitivity. The results were analyzed using simple statistical methods. **Results and Discussion:** Children belonging to the age group of 1 – 10 years were commonly affected with a predominance of left ear. The most commonly isolated bacteria was *Pseudomonas aeruginosa* followed by *Staphylococcus aureus*, *Klebsiella aerogenes*, *Proteus mirabilis*, *Escherichia coli*, Non fermenting Gram negative bacilli and *Klebsiella oxytoca*. *Aspergillus spp.* was the only fungus isolated. Bacteria were sensitive to Ciprofloxacin, Amikacin, Amoxicillin-Clavulante and Cefazidime. **Conclusion:** *Pseudomonas aeruginosa* was the most predominant bacteria isolated with a high sensitivity to Ciprofloxacin (92.3%) and Amikacin (92.3%). In the view of developing antibiotic resistance, and extra- and intracranial complications in improperly treated cases, judicious use of antibiotics is necessary.

**KEYWORDS:** antibiotic sensitivity, chronic suppurative otitis media, ciprofloxacin, ear discharge, *Pseudomonas aeruginosa*

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### INTRODUCTION:

Otitis media is an inflammation of the middle ear and mastoid process which could be acute otitis media (AOM), otitis media with effusion (OME) and chronic suppurative otitis media (CSOM). AOM is the acute infection of the middle ear; OME is the accumulation of fluid within the middle ear in the absence of symptoms of acute infection and CSOM is the persistent inflammation of middle ear with otorrhoea and defect in tympanic membrane. It is a common disease of childhood with low socio-economic status<sup>1,2</sup>. The most common organism causing Chronic Suppurative Otitis Media are *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Escherichia coli*<sup>1,2,3,4</sup>. Common fungal agents include *Aspergillus spp.*, *Rhizopus spp.*, *Cephalosporium spp.*, *Penicillium spp.*, and *Candida spp.*<sup>5</sup>. Complications of untreated case of Otitis media include hearing loss leading to impaired speech and language development. Early diagnosis assures proper and appropriate treatment. Selection of antibiotic is influenced by its efficacy, resistance of microorganism, safety, risk of toxicity and cost. Knowledge of local susceptibility pattern is essential to formulate a protocol for empirical therapy<sup>3</sup>. Treatment of Otitis media includes aural toileting, administration of antibiotics like ciprofloxacin, amoxicillin-clavulanate, cephalosporin group of drugs etc. Increasing resistance of microorganism to the drugs has been reported. This leads to development of serious complications. This study was undertaken to find out the predominant organisms in the locality and the antibiotic susceptibility of the bacteria.

#### Objectives:

- To isolate and identify the bacteria and fungi causing Chronic Suppurative Otitis Media in patients attending the ENT outpatient department.
- To determine the antibiotic sensitivity of the bacterial isolates.
- To correlate the results in relation to age and sex of the patients.

## II. MATERIAL AND METHODS:

This study was a prospective study carried out in the Department of Microbiology in collaboration with Outpatient department of ENT our rural teaching hospital. The study was conducted for a period of 6 months (May – October 2013). A written consent was obtained from all patients before enrolling them in study. A short history of complaints of the patient regarding his personal details, duration of discharge, associated symptoms was obtained. A total of 96 patients with unilateral and bilateral ear discharge attending the outpatient department of ENT during this six months duration were included. Of these 96 patients, only 70 patients were selected based on inclusion and exclusion criteria. Only the patients coming with chronic or recurrent ear discharge, central perforation of tympanic membrane were included in the study. Patients on antibiotic therapy for previous five or more days, patients with ear discharge due to cholesteatoma, children with Downs' syndrome and cleft palate or craniofacial abnormalities, pregnant women were excluded from the study. Institutional Ethical Committee Clearance was obtained before the study.

Discharge was collected from the affected ear using two sterile cotton swabs with all aseptic precautions. Swabs were transported immediately to the Microbiology laboratory. In the laboratory, the first swab was used for gram staining and direct microscopical examination to note the morphology of bacteria, their number, and presence or absence of inflammatory cells and epithelial cells in the sample. Second swab was inoculated on Nutrient agar, MacConkey agar, Blood agar and Chocolate agar for bacterial isolation; and Sabouraud's Dextrose Agar with Chloramphenicol for fungal isolation. The bacterial culture plates were incubated at 37°C for 48 hours and for fungal culture upto 1 week. The bacteria were identified with standard biochemical tests. Antibiotic susceptibility was carried out using Kirby Baur Disk Diffusion method. The antibiotics used were Amikacin, Amoxicillin-Clavulanate, Ceftazidime, Cefotaxime, Ciprofloxacin, Cotrimoxazole, Erythromycin, Imipenem, Linezolid, Penicillin, Piperacillin, Piperacillin-tazobactam and Vancomycin.

The results were tabulated and analyzed by simple statistical methods using Microsoft Excel.

## III. RESULTS:

A total of 70 patients (out of 96 patients) had been selected from the Out-patient department of ENT in a rural teaching hospital. Out of 70 patients, 41 were male and 29 were female. Age-wise analysis showed that Otitis media is more common in the age of 1 – 10 years (Figure 1). Both unilateral and bilateral ear discharge cases were present. Of these, 23 (32.9%) cases had discharge from Right ear, 42 (60%) cases from left ear, and 5 (7.1%) cases from both ears (Figure 2). This gave a total of 75 specimens. Out of 75 specimens, 67 (89.3%) were positive for bacteria and 12 (16%) were positive for fungi. (Table 1). In Figure 3, various bacterial isolates had been depicted. *Pseudomonas aeruginosa* was the most predominant species in 26 (34.7%) specimens, followed by *Staphylococcus aureus* in 14 (18.7%) specimens. Other isolates were *Klebsiella aerogenes* in 9 (12%) specimens, *Proteus mirabilis* in 7 (9.3%) specimens, *Escherichia coli* in 6 (8%) specimens, Non fermenting Gram negative bacilli in 4 (5.3%) specimens and *Klebsiella oxytoca* in 1 (1.3%) specimen. The fungi isolated were *Aspergillus fumigatus* [8 (10.7%) specimens] and *Aspergillus niger* [4 (5.3%) specimens] (Figure 4). 75% of fungi were present in combination with bacteria (Table 2).

The sensitivity pattern of various isolates against a panel of antibiotics was shown in Table 3.

Figure 1: Age- and Gender-wise Distribution of Patients

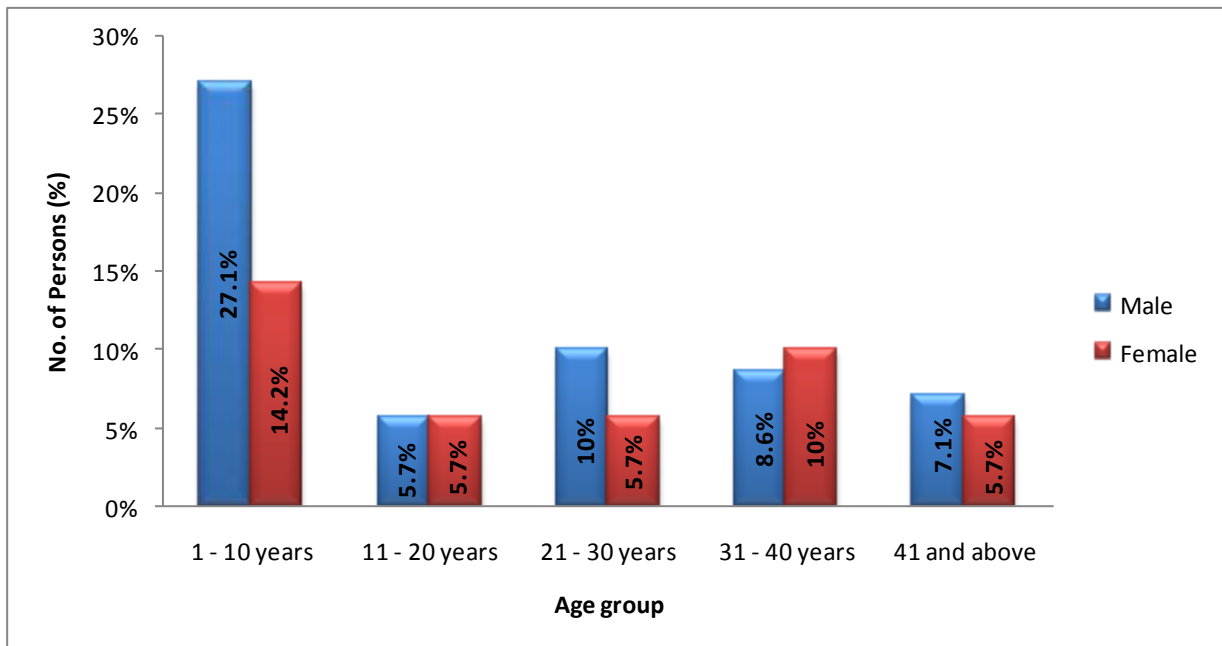


Figure 2: Predominant side of Ear discharge

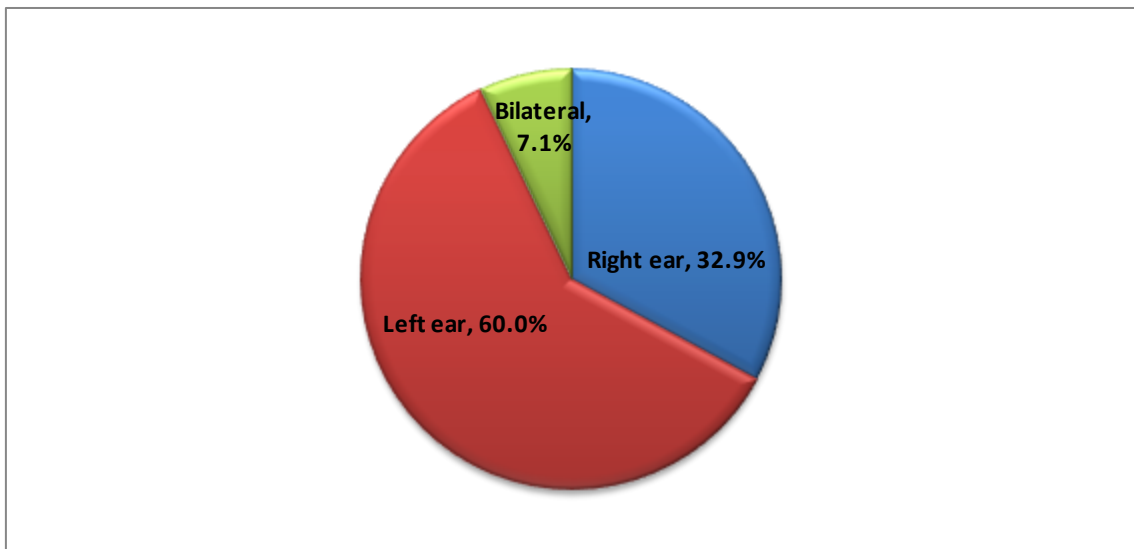


Table 1: Bacterial and Fungal Culture Positive Results

RESULT	BACTERIA		FUNGI	
	MALE	FEMALE	MALE	FEMALE
Positive	36(48%)	31(41.3%)	7(9.3%)	5(6.7%)
Negative	6(8%)	2(2.7%)	35(46.7%)	28(37.3%)
<b>TOTAL</b>	42(56%)	33(44%)	42(56%)	33(44%)

Figure 3: Bacteria isolated from specimen

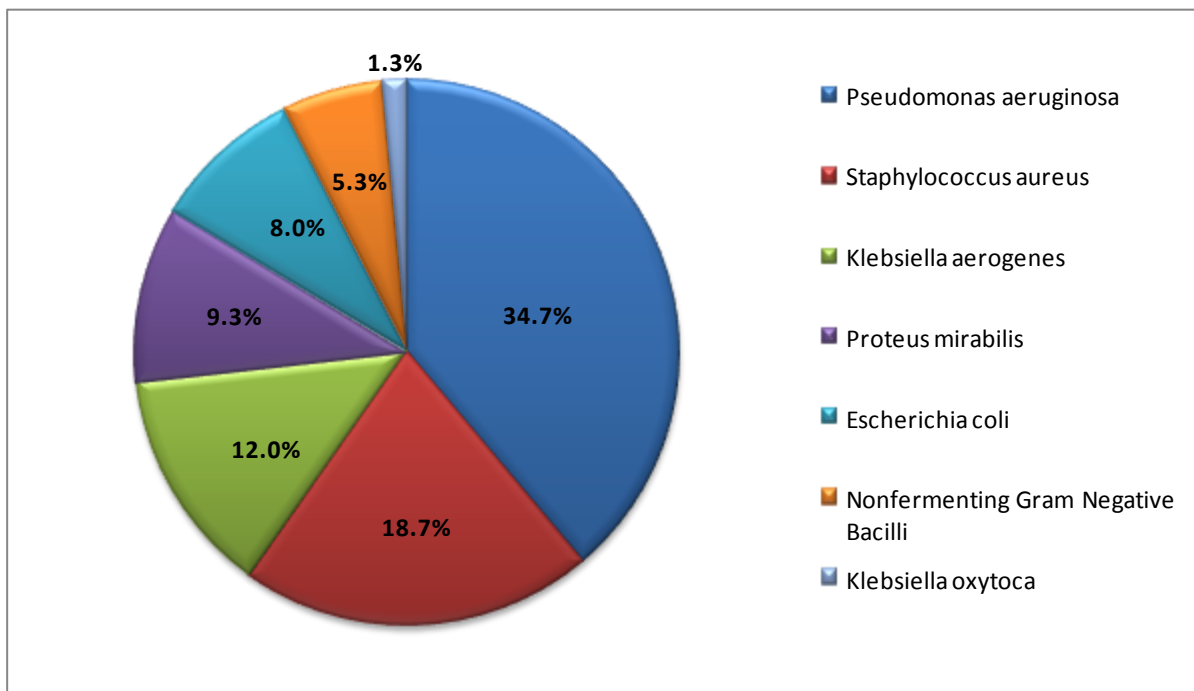


Figure 4: Fungi isolated from specimen

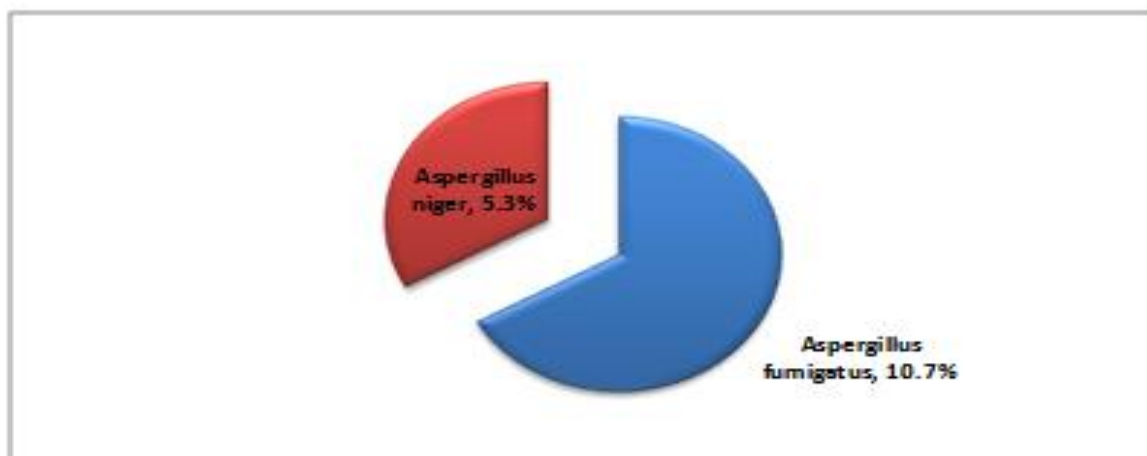


Table 2: Association of Bacteria and Fungi causing Chronic Suppurative Otitis Media:

BACTERIA + FUNGI	No
<i>Escheichia coli</i> + <i>Aspergillus fumigatus</i>	2
<i>Klebsiella aerogenes</i> + <i>Aspergillus fumigatus</i>	5
Non fermenting Gram negative bacillus + <i>Aspergillus niger</i>	2

**Table 3: Antibiotic Sensitivity of Bacteria isolated from ear discharge of patients with Chronic Suppurative Otitis Media**

SLNo	ORGANISM	N	ANTIBIOTIC PROFILE												
			AK	AMC	CAZ	CX	CIP	COT	E	I	LZ	P	PI	PIT	VAN
1	<i>Pseudomonas aeruginosa</i>	26	24 92.3%	23 88.5%	21 80.7%	5 19.2%	24 92.3%	8 30.4%	5 19.2%	22 84.6%	-	-	16 61.5%	21 80.7%	-
2	<i>Staphylococcus aureus</i>	14	14 100%	11 78.6%	9 64.2%	14 100%	12 85.7%	11 78.6%	8 57.1%	10 71.4%	14 100%	10 71.4%	6 42.8%	6 42.8%	14 100%
3	<i>Klebsiella aerogenes</i>	9	8 88.9%	6 66.7%	7 77.8%	6 66.7%	9 100%	-	-	6 66.7%	-	-	4 44.5%	4 44.5%	-
4	<i>Proteus mirabilis</i>	7	6 85.7%	4 57.1%	-	-	7 100%	5 71.4%	-	3 42.8%	-	-	2 28.5%	2 28.5%	-
5	<i>Escherichia coli</i>	6	6 100%	4 66.7%	-	1 16.7%	6 100%	5 83.3%	-	3 50%	-	-	4 66.7%	4 66.7%	-
6	Non fermenting Gram negative bacillus	4	4 100%	0	2 50%	2 50%	4 100%	3 75%	3 75%	3 75%	-	2 50%	2 50%	4 100%	-
7	<i>Klebsiella oxytoca</i>	1	1 100%	0	1 100%	-	1 100%	1 100%	0	1 100%	-	-	1 100%	1 100%	-

(AK – Amikacin; AMC – Amoxicillin-clavulanate; CAZ – Ceftazidime; CX – Cefotaxime; CIP – Ciprofloxacin; COT – Cotrimoxazole; E – Erythromycin; I – Imipenem; LZ – Linezolid; P – Penicillin; PI – Piperacillin; PIT – Piperacillin tazobactam; VAN – Vancomycin)

#### IV. DISCUSSION:

Otitis media is one of the most common ear diseases which is encountered in day-to-day practice. If left untreated, it may cause destruction of middle ear structures leading to hearing loss and may also cause complications like mastoiditis, periostitis, facial paralysis, labyrinthitis, brain abscess, meningitis, lateral sinus thrombophlebitis etc. Aural toileting with meticulous antimicrobial treatment is essential to prevent complications. In our study, Chronic Suppurative Otitis Media was more common in males compared to females. This study correlates with the study report of Iqbal et al.,<sup>1</sup> Nwasbuisi et al.<sup>4</sup> and Kumar et al.<sup>6</sup> In contrast to this result, Mansoor et al.<sup>2</sup> and Shrestha et al.<sup>7</sup> study revealed a higher female preponderance. In our study, the peak incidence was found in the age group between 1 and 10 years. This was in concordance with the study of Iqbal et al.<sup>1</sup> and Shymala et al.<sup>8</sup> which showed that peak incidence was occurring in infants and young children. In contrast to our study, Arya et al.<sup>9</sup> reported that the highest incidence among 11 – 20 years. Children are more prone to the development of Otitis media because their Eustachian tubes are shorter and more horizontal than adults and are made of more flaccid cartilage which causes impaired opening of the tube. It is also related to forced feeding, improper positioning of infants during breast feeding and bottle feeding. In the present study, unilateral infection was predominant. Left ear was more commonly affected than right ear. This was in contrast to the study of Shrestha et al.<sup>7</sup> and Shymala et al.<sup>8</sup> in which right ear was commonly affected.

About 89.3% of cases yielded positive result.

Because of variation in climate, community and patient characteristics, the pattern of microbiological distribution varies in Chronic Suppurative Otitis Media. Majority of bacterial isolates of in our study were *Pseudomonas aeruginosa* (34.7%), followed by *Staphylococcus aureus* (18.7%), *Klebsiella aerogenes* (12%), *Proteus mirabilis* (9.3%), *Escherichia coli* (8%), Non fermenting Gram negative bacilli (5.3%) and *Klebsiella oxytoca* (1.3%). These results were in concordance with the studies of Mansoor et al.,<sup>2</sup> Kumar et al.<sup>6</sup> and Al-Snafi et al.<sup>10</sup> Whereas Mann et al.<sup>11</sup> reported *Staphylococcus aureus* as the most predominant organism in Chronic Suppurative Otitis Media. Only 16% of specimens were positive for fungal culture. The fungi isolated were *Aspergillus fumigatus* and *Aspergillus niger*. Study of Iqbal et al.<sup>1</sup> also had same results (i.e) all of the fungal species isolated were of *Aspergillus* spp. They are commensals and do not require treatment. The sensitivity patterns of microorganisms to antibiotics are changing from time to time. The organisms are becoming more resistant to antibiotics. In our study, Ciprofloxacin and Amikacin had been found as most effective drug followed by Amoxicillin-Clavulante and Ceftazidime for many organisms. This may be due to their mode of action. Aminoglycoside antibiotics were used either systemically or locally but significant side effects especially their ototoxicities have limited its usage. Ciprofloxacin has been increasingly prescribed now.

Main advantage of Ciprofloxacin is that it is not ototoxic. According to Loy et al.,<sup>12</sup> there is a concern that widespread use of quinolones could lead to emergence of resistance among the organisms. According to Sattar et al.,<sup>3</sup> the declining sensitivity may be due to number of factors including injudicious use, inappropriate dosage, easy accessibility and developing enzymatic resistance of organism against quinolones. Antibiotic sensitivity of *Pseudomonas aeruginosa* isolated from Chronic Suppurative Otitis Media specimens in our study revealed that they were sensitive to Amikacin, Amoxicillin-Clavulante, Ciprofloxacin, Ceftazidime, Imipenem and Piperacillin-tazobactam, and least sensitive to Erythromycin. Study of Mansoor et al.<sup>2</sup> showed *Pseudomonas* was sensitive to Amikacin, Ceftazidime and Ciprofloxacin whereas the study of Jang et al.<sup>13</sup> showed high resistance to Ciprofloxacin.

*Staphylococcus aureus* were sensitive to Amikacin, Cefotaxime, Ciprofloxacin, Linezolid and Vancomycin. They were least sensitive to Piperacillin, Piperacillin-tazobactam. Kumar et al.<sup>6</sup> study revealed that *Staphylococcus aureus* was sensitive to Amikacin and Linezolid; and resistant to Piperacillin-tazobactam and Cefotaxime. *Klebsiella aerogenes* were sensitive to Amikacin, Ciprofloxacin and resistant to Piperacillin, Piperacillin-tazobactam. *Proteus mirabilis* was found to be sensitive to Ciprofloxacin and resistant to Piperacillin, Piperacillin-tazobactam. *Klebsiella* spp. and *Proteus* spp. were sensitive to Ciprofloxacin in the study of Alsaimary et al.<sup>14</sup> *Escherichia coli* were sensitive to Amikacin, Ciprofloxacin and Cotrimoxazole; and resistant to Cefotaxime. Studies of Alsaimary et al. and Altuntas et al.<sup>15</sup> revealed that *Escherichia coli* were highly sensitive to Ciprofloxacin. Study of Iqbal et al.<sup>1</sup> showed that *Escherichia coli* were resistant to Ciprofloxacin. In our study, Non fermenting Gram negative bacilli were sensitive to Amikacin, Ciprofloxacin and Piperacillin-tazobactam; and resistant to Amoxicillin-Clavulanate. *Klebsiella oxytoca* was sensitive to Amikacin, Ceftazidime, Ciprofloxacin, Cotrimoxazole, Imipenem, Piperacillin and Piperacillin-tazobactam; and resistant to Amoxicillin-Clavulanate and Erythromycin.

#### V. CONCLUSION:

Out of the 70 patients with Chronic Suppurative Otitis Media, *Pseudomonas aeruginosa* was the most common pathogen followed by *Staphylococcus aureus*. Most of them were sensitive to Amikacin and Ciprofloxacin; and least sensitive to Erythromycin. Fungi isolated belonged to *Aspergillus* spp. The important factor responsible for development of resistance is inappropriate duration of treatment and dose of antibiotics. Judicial use of antibiotics is necessary for the prevention of development of antibiotic resistance.

**Suggestions:** As there is an increasing resistance to antibiotics, poor socio-economic status and increased cost of treatment, prevention is better. Some suggestions include,

- Appropriate use of antibiotics by selection, dosage and duration.
- Public enlightenment for personal hygiene and environmental cleanliness.
- Proper childcare.

#### Limitation of the study:

- It is a single centered study.
- Antibiotic usage in the community is not assessed.
- Anaerobic culture is not done.

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