

**An Observational Assessment of the Prevalent Aerobic Bacteria That Are Accountable for the Development of Chronic Otitis Media****Kumari Jyoti Mani<sup>1</sup>, Tabassum Perween<sup>2</sup>, Sonam Kumari<sup>3</sup>, Satyendra Sharma<sup>4</sup>**<sup>1</sup>Senior Resident, Department of ENT, Nalanda Medical College and Hospital, Patna, Bihar, India<sup>2</sup>Junior Resident, Department of ENT, Nalanda medical college and Hospital, Patna, Bihar, India<sup>3</sup>Senior Resident, Department of ENT, Nalanda medical college and Hospital, Patna, Bihar, India<sup>4</sup>Professor, Department of ENT, Nalanda medical college and Hospital, Patna, Bihar, India

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**Abstract****Aim:** The aim of this study is to identify the most common aerobic bacteria responsible for causing chronic otitis media.**Methods:** In this present prospective study, patients with clinical evidence of chronic otitis media attending the Outpatient Department of ENT section were studied for the period of one year. A total of 200 patients clinically diagnosed with chronic otitis media were enrolled in the study and the samples were obtained from each patient using sterile cotton swabs and cultured for microbial flora.**Results:** The age group of the patients ranged from 6 months to 80 years, with highest prevalence seen in 0-20 years. Declining trend was observed as the age advances. Out of 200 cases, 110 males and 90 females were affected. Out of 200, 192 were pure bacterial isolates and 8 samples showed mixed growth. In the present study, a total of 192 aerobic bacteria were isolated, of which Staphylococcus aureus was predominant, followed by Pseudomonas species, Escherichia coli, Klebsiella pneumoniae, Citrobacter species, Proteus species, non fermenting gram negative bacilli and skin contaminants. Staphylococcus aureus with Pseudomonas species was the most common polymicrobial growth pattern observed in the present study. Pseudomonas species is the second most common organism, which was highly sensitive to amikacin and imipenem followed by piperacillin and are least sensitive to Tobramycin. S. aureus isolates were found to be 100% sensitive to vancomycin, followed by gentamicin, amikacin, Cefoxitin and Cefotaxime.**Conclusion:** Several studies have showed the predominance of different etiological agents in different geographical regions with different antibiotic sensitivity pattern. So, the knowledge of local etiological agent and its susceptibility pattern helps clinicians in treating the patients and to prevent its complications and drug resistance.**Keywords:** Chronic otitis media, Aerobic isolates, Antibiotic susceptibility testingThis is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Chronic Otitis Media is one of the most commonly encountered diseases in the Otolaryngology practice. Chronic otitis media is a disease of multiple aetiologies and is well known for its persistence and recurrence. The World Health Organization (WHO) defines chronic otitis media as “Otorrhoea, i.e. ear discharge through perforated tympanic membrane present for at least 2 weeks”, though few guidelines takes “chronic” as symptoms persisting for more than 6 weeks. [1] chronic otitis media is classified into two types, mucosal and squamosal depending on whether the disease process affects the pars tensa or pars flaccida of the tympanic membrane (TM). [2] The disease is worldwide in distribution. [3] Incidence of the disease is higher in developing

countries, especially among the low socioeconomic societies because of malnutrition, overcrowding, poor hygiene, inadequate health care and recurrent upper respiratory tract infections. [4]

Chronic otitis media is an inflammatory process in the middle ear space that results in long-term or more often, permanent changes in the tympanic membrane including atelectasis, dimer (formerly monomer) formation, perforation, tympanosclerosis, retraction pocket and cholesteatoma. [5] India is one of the countries with highest chronic otitis media prevalence (>6%) where urgent attention is needed. [6] The disease is mainly classified into two types: tubotympanic and

atticoantral depending on whether the disease process affects the pars tensa or the pars flaccida of the tympanic membrane. [4] Shreshta BL et al [7] found that the most common organisms isolated were *Staphylococcus aureus* 74 (32.2%) and *Pseudomonas aeruginosa* 62 (26.9%). *Staphylococcus epidermidis*, *Corynebacterium* spp., *Streptococcus viridans*, and *Staphylococcus aureus* are usually present as commensal flora on the skin of the external auditory canal. [8] *Pseudomonas* and *Proteus* spp. invade secondarily in cases of otitis externa due to breakage in the skin's natural defense mechanism. The widespread use of antibiotics has precipitated the emergence of multiple resistant strains of bacteria which can produce both primary and post-operative complications. [9]

Being an important cause of pediatric hearing loss in developing countries that is potentially preventable, studies facilitating efficient care of chronic otitis media are highly desirable. As the pathogenesis and varying microbiology of chronic otitis media are not fully understood, it is of importance to investigate the prevalence of various pathogens in different areas. [10] Knowledge on the local incidence as well as spectrum of bacteria present and their antimicrobial susceptibility patterns is imperative for effective empirical treatment as well as contributing to the general understanding of the disease. [11]

The aim of this study was to identify the most common aerobic bacteria responsible for causing chronic suppurative otitis media.

### Materials and Methods

In this prospective study, patients with clinical evidence of COM attending the Outpatient Department of ENT of Nalanda Medical College and Hospital, Patna, Bihar, India were studied for the period of one year. A total of 200 patients clinically diagnosed with COM were enrolled in the study and the samples were obtained from each

patient using sterile cotton swabs and cultured for microbial flora.

Patients of all ages and either gender suffering from chronic otitis media, as determined by otoscopic examination, who had not received antibiotic therapy (topical or systemic) for previous ten days, were enrolled through convenience sampling. Exclusion criteria were current febrile illness, current antibiotic use or use in the preceding 2 weeks, recent ear surgery or an in-situ grommet or tympanostomy tube, mastoid surgery in the preceding 12 months, congenital ear or hearing problems, obstructed middle ear (eg, polyp). Patients with ear discharge due to cholesteatoma were also excluded from the study. Sterile swabs were used to collect pus samples. Every microbiological test was done in Nalanda Medical College and Hospital, Patna, Bihar, India. The swab was plated on 5% sheep blood agar (BA), MacConkey's agar and chocolate agar (CA). The plates were incubated at 37°C for 48 h. Organisms were identified using standard procedures. [12,13] The antimicrobial susceptibility was carried out using modified Kirby-Bauer disc diffusion technique using Mueller Hinton (MH) agar as per CLSI (Clinical Laboratory Standards Institute) guideline. [14] Results were interpreted in accordance with central laboratory standards institute guidelines. [15] Methicillin resistance among *Staphylococcus aureus* strains was detected by cefoxitin disc test. [14] Extended spectrum beta lactamase (ESBL) detection among the Enterobacteriaceae strains were performed by double disc synergy test. [15]

### Statistical Analysis

The data was analyzed by using Statistical Package for Social Sciences (SPSS) version 11 and the prevalence of organisms was determined and expressed in percentage.

### Results

**Table 1: Age and gender wise distribution of chronic otitis media cases and growth pattern**

Gender	N%
Male	110 (55)
Female	90 (45)
<b>Age in years</b>	
0-10	50 (25)
11-20	64 (32)
21-30	40 (20)
31-40	20 (10)
41-50	10 (5)
51-60	8 (4)
61-70	6 (3)
71-80	2 (1)
<b>Growth pattern</b>	
Mixed growth	8 (4)
Pure growth	192 (96)

The age group of the patients ranged from 6 months to 80 years, with highest prevalence seen in 0-20 years. Declining trend was observed as the age advances. Out of 200 cases, 110 males and 90 females were affected. Out of 200, 192 were pure bacterial isolates and 8 samples showed mixed growth.

**Table 2: Distribution of aerobic bacterial organisms causing chronic otitis media**

Isolate	Number	Percentage
Staphylococcus aureus	65	33.85%
Pseudomonas species	55	28.64%
Escherichia coli	34	17.70%
Klebsiella species	20	10.41%
Citrobacter species	8	4.26%
Proteus species	5	2.60%
Non Fermenting Gram Negative Bacilli	4	2.08%
Skin contaminants	1	0.52%
Total	192	100

In the present study, a total of 192 aerobic bacteria were isolated, of which Staphylococcus aureus was predominant, followed by Pseudomonas species, Escherichia coli, Klebsiella pneumoniae, Citrobacter species, Proteus species, non-fermenting gram negative bacilli and skin contaminants.

**Table 3: Distribution of polymicrobial growth pattern in CSOM**

Mixed isolates	Number
Staphylococcus aureus + Pseudomonas species	3
Staphylococcus aureus + Escherichia coli	1
Staphylococcus aureus + Klebsiella species	1
Pseudomonas species + Escherichia coli	2
Escherichia coli + Proteus species	1

Staphylococcus aureus with Pseudomonas species was the most common polymicrobial growth pattern observed in the present study.

**Table 4: Antibiotic sensitivity pattern of Pseudomonas aeruginosa**

Antimicrobial agent	%age of sensitive strains
Amikacin	91.39%
Imipenem	78.42%
Piperacillin	75.95%
Ceftazidime	52.28%
Levofloxacin	62.58%
Piperacillin + Tazobactam	65.12%
Tobramycin	28.22%
Ciprofloxacin	48.72%

Pseudomonas species is the second most common organism, which was highly sensitive to amikacin and imipenem followed by piperacillin and are least sensitive to Tobramycin.

**Table 5: Antibiotic sensitivity pattern of Staphylococcus aureus**

Antimicrobial agent	%age of sensitive strains
Ampicillin	28.72%
Gentamicin	84.36%
Amikacin	80.52%
Ciprofloxacin	56.54%
Cephalexin	66.64%
Cefotaxime	68.42%
Cefoxitin	72.28%
Vancomycin	100%

S. aureus isolates were found to be 100% sensitive to vancomycin, followed by gentamicin, amikacin, Cefoxitin and Cefotaxime.

**Table 6: Antibiotic sensitivity pattern of Proteus sp and Coliforms**

Name of isolate	Amikacin	Ciprofloxacin	Imipenem	Piperacillin	Ceftriaxone	Levofloxacin	Piperacillin + Tazobactam
Proteus Sp	98.02%	75.05%	97%	55.84%	22.08%	45.85	73.07%
E. coli	94.96%	65.95%	95.05%	60.86%	34.72%	54.96%	67.93%
Klebsiella Sp	76.94%	56.94%	94.06%	51.09%	12.88%	43.07%	67.93%

## Discussion

Chronic otitis media is one of the most common chronic childhood infections worldwide. Chronic otitis media most often occurs in the first 5 years of life, and is common in developing countries, in special populations such as children with craniofacial anomalies and in certain racial groups. [16,17] The WHO defines Chronic otitis media as "otorrhea through a perforated tympanic membrane present for at least two weeks. [18] The most common sequelae of Chronic otitis media is conductive or sensorineural hearing loss. [19] Chronic otitis media is a major public-health problem, and India is one of the countries with high-prevalence where urgent attention is needed. [20]

The age group of the patients ranged from 6 months to 80 years, with highest prevalence seen in 0-20 years. Declining trend was observed as the age advances. Out of 200 cases, 110 males and 90 females were affected. This finding corroborates well with the observations made by other researchers. [2,21,22] Out of 200, 192 were pure bacterial isolates and 8 samples showed mixed growth. Aslam, et al. from Pakistan [23] in their study on 142 samples revealed that 76% of them were pure and 23.9% were mixed cultures and only 2.1% fungi, whereas, Poorey and Iyer from India [24] in their study on 100 samples found pure growth from 82, mixed growth from 10, and no growth in 8 samples. Difference in results of various authors could have been due to the difference in the patient population studied and geographical variations.

In the present study, a total of 192 aerobic bacteria were isolated, of which *Staphylococcus aureus* was predominant, followed by *Pseudomonas* species, *Escherichia coli*, *Klebsiella pneumoniae*, *Citrobacter* species, *Prtoeus* species, non-fermenting gram negative bacilli and skin contaminants. *Staphylococcus aureus* with *Pseudomonas* species was the most common polymicrobial growth pattern observed in the present study and this observation was in line with diversity of microbial flora of COM infection in colder regions as reported in studies by Ettehad, et al [25] from Iran (31.15%) and Singh, et al [26] from India (36%).

*Pseudomonas* species is the second most common organism, which was highly sensitive to amikacin

and imipenem followed by piperacillin and are least sensitive to Tobramycin. *S. aureus* isolates were found to be 100% sensitive to vancomycin, followed by gentamicin, amikacin, Cefoxitin and Cefotaxime. The most effective antibiotic against *Pseudomonas aeruginosa* was amikacin followed by imipenem and piperacillin plus tazobactam. These findings were parallel to the reports by other authors. [2,26-28] For the antibiotics commonly available as topical ear drops, gentamicin, and ciprofloxacin showed good activity for most of the commonly isolated organism and can be used as effective first line topical antibiotic in the treatment of chronic otitis media. Studies have revealed that quinolones like ciprofloxacin are safe and effective particularly against *S. aureus* and *Pseudomonas aeruginosa*. [29,30]

## Conclusion

Knowing the etiological agents of COM and their antibiogram is of paramount importance for an efficient treatment and prevention of both disease complications and antimicrobial resistance. In the present study *Staphylococcus aureus* is the most common etiologic agent of COM followed by *Pseudomonas* species. Proper selection of topical/systemic antibiotics guided by culture and sensitivity report with keeping ear dry is the effective treatment modality of COM to prevent drug resistance, unwanted antibiotic administration and complications. However, considering the risk for unsuccessful treatment due to antimicrobial resistance, topical antiseptic agents should be considered as the first-hand choice for treatment of COM. Further research is needed to enhance our knowledge of COM and develop targeted interventions.

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