

# Aerobic Bacteriology in Chronic Otitis Media & Its Clinical Significance

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## ABSTRACT

**Background and Objectives:** Chronic otitis media (COM) poses a major health problem in developing countries causing serious socioeconomic consequences and occasional life threatening complications. Early and effective treatment based on the antibiotic sensitivity of the microbes is the key for effective management. This study was done to find out aerobic microorganisms responsible for chronic otitis media (COM), in both mucosal and squamous disease and to study the antibiotic sensitivity pattern of the organisms isolated.

**Materials & Methods:** 100 patients with COM were included in the study. The patients had chronic ear discharge and had not received antibiotics for the last two weeks. Swabs were taken and cultured for microbial flora. Drug susceptibility testing for aerobic isolates was conducted by Kirby-Bauer's disc diffusion method.

**Results:** Out of 100 patients 88 were diagnosed with mucosal disease and 12 squamous disease. Analysis of this study showed predominance of gram negative organisms (60%). The highest incidence was that of *Pseudomonas aeruginosa* (42%), followed by *Staphylococcus aureus* (21%). Antimicrobial profile revealed maximum sensitivity to gentamicin (75%), ciprofloxacin (70% and Amikacin (66%).

**Conclusion:** Knowing the aetiological agents of COM and their antimicrobial susceptibility is important in effective treatment and prevention of complications and development of antibiotic resistance and finally cost-effective management.

**Keywords:** Chronic otitis media, microorganisms, antibiotics, antibiotic susceptibility

## INTRODUCTION

Chronic otitis media (COM) is the chronic inflammation of middle ear cleft presenting with recurrent ear discharge and deafness.<sup>1</sup> It can be of two types; mucosal and squamous. Mucosal type is often associated with recurrent ear discharge and antibiotic therapy is the treatment of choice to make the ear dry. Inadequate treatment may lead to persistence of the disease and may promote bacterial resistance which in turn can lead to complications, increasing the morbidity.<sup>2</sup> In vitro antibiotic sensitivity becomes important for the clinician to make a protocol for a patient of discharging ear.<sup>3</sup> The incidence of COM appears to depend on race and socio-economic factors. Socio-economic factors such as overcrowding, poor hygiene and nutrition have been suggested as a basis for the wide spread prevalence of the disease.

The present study is aimed at finding out the aerobic organisms causing chronic otitis media by taking the ear swab for culture and sensitivity.

## MATERIALS AND METHODS

One hundred patients diagnosed with chronic otitis media (COM) of all age groups and both genders, attending the outpatient department and those admitted in ENT department were selected randomly for the study after ethical committee clearance from the institution. The study was done in a tertiary care hospital over a period of 18 months. All clinically discharging ears of

more than three months duration with tympanic membrane perforation – both mucosal and squamosal types of COM were selected. Patients with otitis externa and acute otitis media, who had local/systemic antibiotics for the last 2 weeks were excluded from the study. The swab was taken using sterile precautions and with ear speculum in place to prevent contact with the outer part of the ear canal. Ear discharge was inoculated on Blood agar, MacConkey's agar plates, incubated at 37°C and evaluated at 24/48/72 hours. Specific identification of the bacterial pathogens was done based on microscopic morphology, staining characteristics, pigment production, beta haemolysis in blood agar, motility, cultural and biochemical properties using laboratory procedures. Susceptibility of bacterial isolates to the commonly used antibiotics is done by Kirby-Bauer disc effusion method.

## RESULTS

60% of the patients isolated gram negative organisms, gram positive in 30% and gram staining were not done in the remaining 10% as culture showed commensals or no growth.

Out of the 100 patients evaluated, commonest organism isolated was *Pseudomonas aeruginosa* – 42%, followed by *Staphylococcus aureus* – 21%, *Klebsiella* – 9%, *Proteus* – 5%, Coagulase negative *Staphylococcus aureus* – 5%, *Acinetobacter* – 4% and *Escherichia coli* – 4%. There was no growth in 8% of patients and commensals were found in 2%. (Table I)

Table I: Showing the organisms isolated

Organism isolated	Percentage (%)
<i>Pseudomonas aeruginosa</i>	42
<i>Staphylococcus aureus</i>	21
<i>Klebsiella</i>	9
<i>Proteus</i>	5
Coagulase negative <i>Staphylococcus aureus</i>	5
<i>Acinetobacter</i>	4
<i>Escherichia coli</i>	4
No growth	8
Commensals	2

Out of the 100 patients analysed, organisms isolated showed maximum sensitivity to Gentamicin (75%), followed by

Ciprofloxacin (70%), Amikacin (66%), Cefotaxime (55%). They were least sensitive to Doxycycline, Norfloxacin, Tobramycin, Roxithromycin, Cefazolin and Chloramphenicol. *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* showed some degree of resistance across all the antibiotics tested. *Moraxella* species was tested for amikacin and gentamicin and did not show any resistance.

## DISCUSSION

Chronic otitis media (COM) is a chronic infection of the middle ear cleft. Improperly treated COM can lead to a variety of complications. Hence the diagnosis of the causative organism is mandatory for proper and successful management of the disease. Due to the changing pattern of bacteriological profile of otitis media and sensitivity of microorganisms towards antibiotics, it is very important to find out the organism causing the disease.<sup>4</sup>

According to the present study, gram staining of the organisms isolated showed gram negative organisms in majority of the cases (60%) and gram positive organisms in 30%. *Pseudomonas aeruginosa* was the predominant organism which is comparable with previous study done by, Poorey V.K. et al in 2002 which suggested that, *Pseudomonas* is the predominant organism followed by *Klebsiella*<sup>5</sup>, Tanmoy Deb et al in 2012, in a study of the bacteriological profile of COM, also suggested that gram negative bacteria are associated with COM in north east India.<sup>6</sup>

In the present study, the commonest organism found in the culture was *Pseudomonas aeruginosa* (42%) followed by *Staphylococcus aureus* (21%), *Klebsiella* (9%), *Proteus* and coagulase negative staph aureus (5%) each and *Acinetobacter* and *E. coli* (4%) each. There was no growth in (8%) and 2% are commensals. These results are comparable with previous study done by Fliss DM et al in 1992, who found that *Pseudomonas aeruginosa* was the most

common isolate. In 48 cases (38%) it was the only isolate. Enteric bacilli, *Staphylococcus aureus*, Streptococci and *Hemophilus influenza* were also found.<sup>7</sup> Atanu Nandy et al in 1991, published a series wherein out of 146 cases of COM, comprising of 77 males and 69 females in different age groups. Out of the total 192 isolates, *Pseudomonas* species ranked highest with 43.8% incidence followed by *staphylococcus pyogenes* (18.2%), *Proteus* (12%), *Klebsiella* (7.3%) and *Diphtheroides* (6.7%).<sup>8</sup> Erkan M et al in 1994, in a study of bacteriology of COM in 183 patients *Pseudomonas aeruginosa* was recovered from 68 patients, other aerobes commonly recovered included *Staphylococcus aureus* and *Klebsiella pneumoniae*.<sup>9</sup> RS Greval et al in 1996, in a study on Bacteriological patterns of COM, in a series of 300 cases of COM encountered in Ludhiana, Punjab, *Pseudomonas*, *Staphylococcus* and *Proteus* head the list.<sup>10</sup> Gupta V et al in 1998, in a study of 334 adult patients with COM, the commonest organisms isolated were *P. aeruginosa* while *S.aureus* was found in COM with cholesteatoma.<sup>4</sup> Indudharan R et al in 1999, in his study on antibiotics in COM and bacteriological study, 382 swabs were examined, the major organism isolated were *P.aeruginosa* (27.2%) followed by *S.aureus* (23.6%).<sup>11</sup> Maji PK et al in 2007, in a study showed that *P.aeruginosa* is the most prevalent organism.<sup>12</sup> Seung Geun Yeo et al in 2007, did a retrospective study of 1102 patients with COM in Korea from January 2001 to December 2005 and reported that most commonly identified pathogenic bacterial species was *Pseudomonas*, with the next most prevalent being MRSA.<sup>13</sup> Kamran Iqbal et al in 2011, in a study on microbiology of COM showed from 190 specimens, 174 (91.6%) were positive, and 16(8.4 %) culture negative. There were 167 (87.9%) bacterial isolates and 7(3.7%) fungi. *Pseudomonas aeruginosa* (45.9%) was the dominant isolate, followed by *S.aureus* (26.4%) including 10 isolates of MRSA.<sup>14</sup> Tanmoy Deb et al in 2012, in a study of the bacteriological profile of COM

in Agartala, reported that gram negative bacteria, mostly, *Pseudomonas* is the commonest bacteria involved in CSOM in part of north east India.<sup>6</sup> Kabir MS, in a study with 110 patients, *Pseudomonas aeruginosa* is the most common organism (43.68%) isolated in pure culture followed by *S.aureus* (27.59%), *E.coli* (10.35%), *Klebsiella* sp.(9.19%) and *Proteus* sp.(8.04%).<sup>15</sup>

However, not every study has reported *pseudomonas* as the commonest organism. In a study by Gupta V, Gupta A, Sivarajan K in June 1998, *S. aureus* was commonest organism (30.73%), followed by *P.aeruginosa* (27.60%) and *Klebsiella* (9.90%).<sup>4</sup> In a study by Vijaya D, Nagarathnamma T in 1998 with 250 cases of COM, *S.aureus* was the most commonest bacteria isolated (19.9%), followed by *Klebsiella* species (18.44%) and Fungal isolates were *Aspergillus* species and *Candida albicans*.<sup>16</sup> V.K. Srivastava et al in 1979, in a study of CSOM in children showed that the majority (47.4%) was in the age group of 10-14 years and males (57.9%). *S.aureus* was the commonest isolate (44.0%) followed by *E.coli* (11.1%), *S. albus* (10.2%), *Strep. Pyogenes* (8.5%), *Strep. Viridians* (5.9%), *Proteus vulgaris* (5.9%).<sup>17</sup> Rao et al in 1994, in a study of COM, randomly selected 120 cases were investigated for bacterial and fungal isolates. Total of 145 bacterial isolates were identified and their susceptibility to various antibiotics was tested. *S. aureus* was the predominant pathogen isolated (42.5%), followed by *P.aeruginosa* (21.6%) and *Proteus* species (18.33%). Fungi were isolated from 7.5% of cases, but no growth was observed in 10% of specimens collected.<sup>18</sup> BM Ahmad et al in 2003, in a retrospective study of 206 patients with COM. *S.aureus* (37.8%), *P.aeruginosa* (28.9%) and *Proteus* (18.3%) were the main isolates.<sup>19</sup> Patricia N et al in 2006, In a study of COM: Bacteriology and Drug Sensitivity Patterns at the Quirino Memorial Medical Center (2004-2005) showed that from 54 ear discharge samples, 42 (78%) were pure

cultures and 9(16.7%) were mixed, only 3(5.6%) of the submitted samples had no growth. There were 42 pure isolates, the most common of which was *S.aureus* 21 (50%), followed by *P.aeruginosa* 14(33.3%).<sup>20</sup> Nikakhlagh S et al in 2008, showed that the most common pathogens for CSOM, were *S.aureus*, *P.aeruginosa*, *Klebsiella* & *Proteus*.<sup>21</sup> A Yousuf et al in 2012, in a study on bacteriological profile of ear discharge and their antibiotic sensitivity in COM in Kashmir, with 125 patients, microbiological culture was positive in 110 specimens. The most common causal organisms isolated were *S.aureus* (48%) including 8% of MRSA and *P.aeruginosa* (16%) followed by coagulase negative *Staph aureus*.<sup>22</sup>

In the present study, the organisms isolated showed maximum sensitivity to Gentamicin followed by Ciprofloxacin, Amikacin, Cefotaxime and is comparable with studies done by Atanu Nandy et al in 1991, in a bacteriological study of COM, out of total 146 cases of COM & out of total 192 isolates, showed susceptibility towards Gentamicin followed by Chloramphenicol (31.3%) and Ampicillin (14.8%)<sup>8</sup>. Rao et al in 1994, investigated a random selection of 120 cases of COM for bacterial and fungal isolates. Total of 145 bacterial isolates were identified and their susceptibility to various antibiotics was tested. The majority of the bacterial isolates showed multiple drug resistance. Gentamicin was the drug of choice in treating the causative strains of either gram positive or gram negative bacteria and tetracycline was found to be the least effective.<sup>18</sup> Ciprofloxacin should be considered as the most effective drug in the management of COM, because it can be given topically, orally and intravenously. It is less toxic compared to Gentamicin.

It has been proposed that anaerobic organisms may play a role in squamous type of COM with extensive cholesteatoma and granulations and in occasional cases of mucosal disease. It is advocated that while investigating pathogenic organisms in COM requests for anaerobic culture should be

included and the medical therapy should be directed at the eradication of the pathogenic anaerobic organisms.<sup>23</sup> However, we didn't include the anaerobic organisms in the study because of lack of financial resources. This is one of the limitations of our study apart of small sample size.

## CONCLUSION

It is generally considered that antibiotic or antibiotic/ steroid ear drops are effective in reducing the discharge in COM. The success rate for Gentamicin and Corticosteroid combination was 65%, compared with 18% with placebo. A common adverse effect of topical aminoglycosides is the development of allergic sensitivity, which is found particularly with Neomycin and Framycetin. Polymyxin B has a broad spectrum bactericidal activity that includes *P. aeruginosa*. Chloramphenicol otic preparations have high incidence of local sensitivity reactions. Ciprofloxacin and Ofloxacin may have useful topical activity in chronic ear disease. Topical Ciprofloxacin has been used successfully in humans with COM and discharging mastoidectomy cavities without any adverse effects.

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