

# Study of Bacterial Pathogens and Antibiotic Sensitivity Pattern of Ear Infections in Patients with Chronic Suppurative Otitis Media Attending a Tertiary Care Hospital in Panipat, India

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## ABSTRACT

**Background:** Chronic suppurative otitis media (CSOM) is an inflammation of the middle ear irrespective of the etiology or pathogenesis. CSOM is a disease of multiple etiologies and is well known for its persistence and recurrence in spite of treatment. It is renowned for its arrival suffering disease.

**Aim:** This study aims to study the bacterial pathogens and their antibiotic sensitivity pattern of ear infections in patients with chronic otitis media.

**Materials and Methods:** This prospective study was conducted at the Department of ENT and Department of Microbiology, Medical College and Hospital, India, over a period of 1 year from January 2018 to December 2018. A total of 100 patients were included in this study. The ear discharge which is collected with sterile swabs is subjected to Gram's staining and culture of the causative organism. Antibiotic sensitivity test of cultured bacterial growth is undertaken to know the susceptibility of the causative organism.

**Results:** Of 100 samples, 72 were positive for microbial growth and 28 showed no growth. The most common bacteria causing CSOM was *Pseudomonas aeruginosa* in 43 (54.43%) of samples followed by *Staphylococcus aureus* 12 (15.19%), coagulase-negative staphylococci 9 (11.39%), *Klebsiella pneumoniae* 7 (8.86%), *Escherichia coli* 4 (5.06%), *Proteus vulgaris* 2 (2.53%), and *Proteus mirabilis* and *Streptococcus pneumoniae* 1 (1.27%) each. Susceptibility test was done for known the best antibiotic agents which can be used as a proper treatment to CSOM infection.

**Conclusion:** In the present study, the most effective antibiotics agents for most of bacterial isolates were gentamicin, ciprofloxacin, amikacin, and chloramphenicol.

**KEY WORDS:** Antibiotic sensitivity testing, chronic suppurative otitis media, ear infection, pathogenic bacteria.

## Introduction

Chronic suppurative otitis media (CSOM) is an inflammation of the middle ear irrespective of the etiology or pathogenesis. CSOM is disease of multiple etiologies and is well known for its persistence and recurrence in spite of treatment. The causes and pathogenesis of CSOM are multifactorial. CSOM is

usually a sequel of acute otitis media.<sup>[1]</sup> CSOM is a common cause of hearing impairment in developing countries.<sup>[2]</sup> The infection of the middle ear pursues viral diseases of the upper respiratory tract yet before long attacks the middle ear with pyogenic organisms. The majority of these infections is caused by bacteria. The indiscriminate, imprecise, improper, and haphazard use of antibiotics have caused the emergence of multiple resistant strains of bacteria, which can produce both primary and post-operative infections.<sup>[1,3]</sup>

The etiology, recurrence, and antimicrobial resistance examples of ear contamination are distinctive in various land territory and atmosphere conditions. As per reports of numerous investigations, *Pseudomonas*

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*aeruginosa*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumoniae*, and *Escherichia coli* are the basic life forms disconnected from instances of ear disease. The increased bacterial resistance to many commonly used antibiotics is posing a serious threat to public health. The changes are occurring in the microbiological flora following the advent of sophisticated synthetic antibiotics.<sup>[4]</sup>

The expanded bacterial protection from numerous ordinarily utilized antibiotics is representing a genuine danger to public health. What's more, ear disease may prompt tumor in the center ear, post-aural swelling, and aural sinus intricacies. Due to the restricted microbiology research facility setup, doctors in the investigation territory recommend both of the accompanying medications: Amoxicillin, amoxicillin/clavulanic corrosive, chloramphenicol, gentamicin, or ciprofloxacin without the direction of culture and anti-toxin weakness tests to treat patients with possible of otitis media which could prompt rise of medication obstruction. Therefore, data on antibiotic resistance should be accessible at national and neighborhood level to direct the normal utilization of the current antimicrobials.<sup>[4]</sup>

The aim of this study mainly is to detect the bacterial isolates in patients with otitis media infections and their antibiotics susceptibility pattern against bacterial pathogens among patients attending a tertiary care hospital in Panipat district.

## Materials and Methods

This prospective study was conducted at the Department of ENT and Department of Microbiology, Medical College and Hospital, India, over a period of 1 year from January 2018 to December 2018. The population under study was among people attending the outpatient department of ENT in Medical College and Hospitals, India. A total of 100 patients with signs and symptoms of CSOM who were not on any antibiotics were included and investigated in this study, their ages ranged from 2 to 70 years.

The samples collected from patients with ear exudates using two sterile cotton swabs under strict aseptic precautions and send immediately to microbiology laboratory without delay. The swabs were inoculated onto blood agar, MacConkey agar, and Chocolate agar. The inoculated culture plates were incubated at 37°C for 24 h. Then, a Gram stain examination was made from the second swab of specimen and examined with light microscopy.

Identification of bacterial isolates was done by standard microbiological tests.<sup>[5]</sup> Furthermore, the antibiotic sensitivity testing of the bacterial isolates was performed by Kirby–Bauer disc diffusion method on Muller-Hinton agar. The result of plates was read after incubation overnight at 37°C by measure of the inhibition zones around the discs of antibiotics as per Clinical Laboratory Standards Institute.<sup>[6]</sup>

## Results

In the present study, of total 100 ear swabs, samples were collected and processed from 100 patients suffering from CSOM. Of 100 cases studied, pure growth was obtained in 65 (65%), mixed growth in 7 (7%) while no growth in 28 (28%).

The sex-wise distribution of patients was maximum males (70%) and females (30%). The male-to-female ratio was 3:1 (Table 1).

Their ages ranged from <10 to 61 and above years. The peak incidence of CSOM in age groups 2–10 (37%) followed by age groups 11–20 (25%), 31–40 (13%), 21–30 (12%), 41–50 (7%), 51–60 (5%), and 61 and above (1%) (Table 2).

The most common bacteria causing CSOM was *P. aeruginosa* in 43 (54.43%) of samples followed by *S. aureus* 12 (15.19%), coagulase-negative

**Table 1: Distribution of ear infection in relation to sex of patients**

Sex	n (%)
Male	70 (70)
Female	30 (30)
Total	100 (100)

**Table 2: Distribution of ear infection in relation to age of patients**

Age group in years	n (%)
2–10	37 (37)
11–20	25 (25)
21–30	12 (12)
31–40	13 (13)
41–50	7 (7)
51–60	5 (5)
61 and above	1 (1)
Total	100 (100)

staphylococci 9 (11.39%), *K. pneumoniae* 7 (8.86%), *E. coli* 4 (5.06%), *Proteus vulgaris* 2 (2.53%), and *P. mirabilis* and *Streptococcus pneumoniae* 1 (1.27%) each (Table 3).

The results of sensitivity testing are described in Table 4. Among the 43 isolates of *P. aeruginosa*, it was sensitive to gentamicin and chloramphenicol 41 (95.35%) each, amikacin 38 (88.37%), cefotaxime 37 (86.05%), ampicillin/sulbactam 35 (81.40%), levofloxacin 33 (76.74%), ciprofloxacin 29 (67.44%), ofloxacin 22 (51.16%), lincomycin and tetracycline 21 (48.84%) each, and cotrimoxazole 12 (27.91%). *S. aureus* was maximum sensitive to cefotaxime 10 (83.33%), followed by gentamicin, ampicillin/sulbactam and amikacin 9 (75%) each, ciprofloxacin and tetracycline 8 (66.67%) each, levofloxacin 7 (58.33%), ofloxacin and lincomycin 6 (50%) each, and cotrimoxazole 4 (33.33%). Coagulase-negative staphylococci were maximum sensitive to gentamicin, ampicillin/sulbactam, cefotaxime, ciprofloxacin, and amikacin 9 (100%) each, tetracycline, levofloxacin, and lincomycin 8 (88.89%) each, ofloxacin 7 (77.78%), and cotrimoxazole 5 (55.56%). *Klebsiella pneumoniae* was maximum sensitive to gentamicin and chloramphenicol 7 (100%), cefotaxime, ciprofloxacin, tetracycline, levofloxacin, and amikacin 6 (85.71%) each, ofloxacin 4 (57.14%), and cotrimoxazole and lincomycin 3 (42.86%). *E. coli* was sensitive to gentamicin, ciprofloxacin, chloramphenicol, and amikacin 4 (100%), cefotaxime, tetracycline, and levofloxacin 3 (75%) each, and ampicillin/sulbactam, cotrimoxazole, ofloxacin, and lincomycin 2 (50%). *P. vulgaris* was sensitive to gentamicin, cefotaxime, ciprofloxacin, chloramphenicol, and amikacin 2 (100%),

ampicillin/sulbactam, tetracycline, levofloxacin, and lincomycin 1 (50%), and, however, 100% resistant to ofloxacin and cotrimoxazole. *P. mirabilis* was sensitive to gentamicin, cefotaxime, ciprofloxacin, tetracycline, chloramphenicol, and amikacin 1 (100%) and, however, 100% resistant to ampicillin/sulbactam, cotrimoxazole, levofloxacin, ofloxacin, and lincomycin. *S. pneumoniae* was sensitive to gentamicin, cefotaxime, and tetracycline 1 (100%) each and, however, 100% resistant to ampicillin/sulbactam, ciprofloxacin, cotrimoxazole, levofloxacin, ofloxacin, lincomycin, and amikacin (Table 4).

## Discussion

The most ailment in oftentimes for patients to visit clinicians with take antimicrobials is ear contamination and the genuine human services concern around the world; it is the otitis media. The incidence of the otitis media in previously publications which reported its depend on the race the socioeconomic factors.<sup>[7-13]</sup>

CSOM is a condition of the middle ear that is characterized by diligent or intermittent release through an endless aperture of the tympanic layer. Due to puncturing of the tympanic membrane, microorganisms may pick up passage to the center ear by means of the outer ear.<sup>[2]</sup> Although such serious complications are low at present, still some patients have complications ranging from persistent otorrhea, mastoiditis, labyrinthitis, and facial nerve palsy.<sup>[1,9,14-16]</sup> Even, however, the complexities are uncommon, treatment ought to be begun early and viably to dodge and lessen the odds of complications.<sup>[17]</sup> The therapeutic use of antibiotics is usually started empirically before the results of microbiological culture. Selection of any antibiotic is influenced by its efficacy, resistance of bacteria, safety, risk of toxicity, and cost. Information of the neighborhood microorganism design and their antimicrobial affectability is basic to permit successful and cost-saving treatment.<sup>[17]</sup>

Among 100 samples collected from 100 patients, 72 samples were bacterial culture positive with a culture positivity of 72%. In studies done by Moorthy *et al.*,<sup>[18]</sup> Khanna *et al.*,<sup>[19]</sup> Poorey and Lyer,<sup>[1]</sup> Deb and Ray,<sup>[20]</sup> and Nikakhlagh *et al.*,<sup>[21]</sup> the culture positivity was 69%, 84%, 92%, 53%, and 82%, respectively. In our study, all were monobacterial cultures, whereas in studies done by Moorthy *et al.*,<sup>[18]</sup> Khanna *et al.*,<sup>[19]</sup> Poorey and Lyer,<sup>[1]</sup> polymicrobial or mixed cultures were obtained in 65% and 7%, respectively.

**Table 3: Distribution of bacterial isolates from ear infection of patients**

Bacteria	Number of isolates (n=79)	Percentages
<i>Pseudomonas aeruginosa</i>	43	54.43
<i>Staphylococcus aureus</i>	12	15.19
Coagulase-negative staphylococci	9	11.39
<i>Klebsiella pneumoniae</i>	7	8.86
<i>Escherichia coli</i>	4	5.06
<i>Proteus vulgaris</i>	2	2.53
<i>Proteus mirabilis</i>	1	1.27
<i>Streptococcus pneumoniae</i>	1	1.27

Table 4: Antimicrobial sensitivity patterns of bacterial isolates

Bacteria	No.	GM	AS	CF	CP	BA	TE	LE	OF	LM	CH	AK
<i>Pseudomonas aeruginosa</i>	43	41 (95.35)	35 (81.40)	37 (86.05)	29 (67.44)	12 (27.91)	21 (48.84)	33 (76.74)	22 (51.16)	21 (48.84)	41 (95.35)	38 (88.37)
<i>Staphylococcus aureus</i>	12	9 (75)	9 (75)	10 (83.33)	8 (66.67)	4 (33.33)	8 (66.67)	7 (58.33)	6 (50)	6 (50)	-	9 (75)
CONS	9	9 (100)	9 (100)	9 (100)	9 (100)	5 (55.56)	8 (88.89)	8 (88.89)	7 (77.78)	8 (88.89)	-	9 (100)
<i>Klebsiella pneumoniae</i>	7	7 (100)	5 (71.43)	6 (85.71)	6 (85.71)	3 (42.86)	6 (85.71)	6 (85.71)	4 (57.14)	3 (42.86)	7 (100)	6 (85.71)
<i>Escherichia coli</i>	4	4 (100)	2 (50)	3 (75)	4 (100)	2 (50)	3 (75)	3 (75)	2 (50)	2 (50)	4 (100)	4 (100)
<i>Proteus vulgaris</i>	2	2 (100)	1 (50)	2 (100)	2 (100)	0 (0)	1 (50)	1 (50)	0 (0)	1 (50)	2 (100)	2 (100)
<i>Proteus mirabilis</i>	1	1 (100)	0 (0)	1 (100)	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	1 (100)
<i>Streptococcus pneumoniae</i>	1	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	-	0 (0)

CONS: Coagulase-negative staphylococci, GM: Gentamicin, AS: Ampicillin/sulbactam, CF: Cefotaxime, CP: Ciprofloxacin, BA: Cotrimoxazole, TE: Tetracycline, LE: Levofloxacin, OF: Ofloxacin, LM: Lincomycin, CH: Chloramphenicol, AK: Amikacin

In the present study, of 79 bacterial isolates, *P. aeruginosa* was the predominant bacterium in 43 (54.43%) followed by *S. aureus* in 12 (15.19%), coagulase-negative staphylococci 9 (11.39%), *K. pneumoniae* 7 (8.86%), *E. coli* 4 (5.06%), *P. vulgaris* 2 (2.53%), *P. mirabilis* 1 (1.27%), and *S. pneumoniae* 1 (1.27%) isolates. Moorthy *et al.*<sup>[18]</sup> and Kenna *et al.*<sup>[22]</sup> found that *Pseudomonas* was the predominant organism, i.e. 54% and 67%, respectively, in their study. In a study done by Khanna *et al.*,<sup>[19]</sup> the most common bacterial isolate was *P. aeruginosa* 40.57% followed by *S. aureus* in 36.23% of cases. Nikakhlagh *et al.*<sup>[21]</sup> studied that *S. aureus* is common isolate in 32.4% followed by 21.69% of *P. aeruginosa*. Poorey and Lyer<sup>[1]</sup> observed that *Pseudomonas pyocyaneus* was the most common organism isolated in 35.2% followed by *Klebsiella aerogenes* in 25.4%. The observations made from different studies indicate that there can be variation in causative organism based on ethnic, geographic factors. In the present study, gentamicin, ciprofloxacin, amikacin, and chloramphenicol drug have emerged as the most effective antibiotic useful for the patients in our study which is sensitive against more than 85% of *P. aeruginosa*, *S. aureus*, and other pathogens. In studies done by Sharma *et al.*<sup>[23]</sup> and Poorey and Lyer,<sup>[1]</sup> amikacin was the most effective drug.

## Conclusion

All in all, bacterial ear disease is a noteworthy medical issue in the investigation region. *P. aeruginosa*, *S. aureus*, and other Gram-negative bacteria were the overwhelming detaches. Most of the isolates were linked with high levels of resistance against cotrimoxazole, ofloxacin, and ampicillin/sulbactam. In any case, gentamicin, ciprofloxacin, chloramphenicol, and amikacin were effective against the majority of the bacterial isolates. Therefore, it is recommended that treatment of ear infection be done when the causative agents as well as the drug sensitivity patterns are known and properly administered. This will enhance better treatment and reduce the burden of the infection on the patients and in the long term, it may reduce the cost of treatment.

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