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RESEARCH ARTICLE

Bacterial Etiology of Otitis Media and their Antibiotic Susceptibility Pattern among Patients coming to a Tertiary Care Hospital, Jaipur, India

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ABSTRACT

Aim: The aim of the study was to identify the microorganisms associated with the chronic discharging ears and their antimicrobial susceptibility pattern.

Materials and methods: A total of 251 samples of ear swabs were received at Mahatma Gandhi Medical College & Hospital, Jaipur, Rajasthan, India. Pus samples were taken from external auditory canal using sterile cotton swabs and then cultured on different microbiological media. Antibiotic sensitivity was tested and interpreted by method according to Clinical and Laboratory Standards Institute standards.

Results: Out of 251 samples received, 135 (53.78%) samples had growth. The microbiology of these 135 samples was studied. *Pseudomonas aeruginosa* was the major organism isolated from 88 samples followed by *Staphylococcus aureus* (37), and other coliforms (10). Drug susceptibility of *P. aeruginosa* showed that colistin was active against all isolates followed by piperacillin-tazobactam and imipenem. Approximately 60% *S. aureus* isolates were methicillin-resistant *S. aureus*. Vancomycin, linezolid, and teicoplanin were 100% sensitive.

Conclusion: From the current study, it was concluded that *P. aeruginosa* is the potential cause of ear-associated infections. All isolates of *P. aeruginosa* were susceptible to colistin, and *S. aureus* was susceptible to vancomycin, linezolid, and teicoplanin.

Keywords: Chronic suppurative otitis media, methicillin-resistant *S. aureus,* Pseudomonas aeruginosa, Staphylococcus aureus,

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INTRODUCTION

Otitis is a general term for inflammation or an infection of the human ear. It is divided as otitis externa, which involves outer ear and ear canals. Otitis media and otitis interna are involvements of middle ear and inner ear respectively.

Children tend to have higher predisposition to ear infection than adults because anatomy of the Eustachian tube in children permits easier access of organism through the nasopharynx.[1]

Otitis media is a major health problem and occurs with a high incidence and prevalence in both developed and developing countries.[2,3] It can be either suppurative or nonsuppurative. The inflammation often begins when infections that cause sore throat, cold, or other respiratory or breathing problems spread to middle ear.[4] Otitis media could be of viral or bacterial origin. It could present an acute or chronic course.[5] Acute otitis media (AOM) is a common childhood illness. An AOM episode, i.e., not diagnosed promptly or is inadequately treated can lead to chronic suppurative otitis media (CSOM).[6] It is characterized by the presence of persistent perforation of tympanic membrane with recurrent or persistent mucoid/mucopurulent discharge for at least 4 to 6 weeks.[7-10] Persistence of purulent otorrhea may lead the mucous membrane to become ulcerated, polypoid, or granulomatous. Resorption of the ossicles and mastoid bone due to demineralization and osteoclastic activity may be seen in prolonged infection.

Around 30 million cases of CSOM occur worldwide every year, with a large number in pediatric population.

The organisms isolated in chronic otitis media can be aerobes, anaerobes, mixed, or fungi. Various studies done in United States, United Kingdom, Japan, Ghana, India revealed that the common causative organism may be aerobic (e.g., *Pseudomonas aeruginosa*, *Escherichia coli, Staphylococcus aureus, Streptococcus pyogenes, Proteus mirabilis, Klebsiella* species) or anaerobic (e.g., *Bacteroides, Peptostreptococcus,* etc.) or mixed infections/organisms.[7,9-11]

In discharging ear, both topical and systemic therapy are employed for treatment. The systemic therapy is chosen depending on the organism isolated in culture.

Our study is aimed to determine the prevalence and pattern of bacteria isolates and their antimicrobial susceptibility pattern in cases of CSOM.

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MATERIALS AND METHODS

The study was carried out from January 1, 2016, to June 30, 2016, in Microbiology Department at Mahatma Gandhi Medical College & Hospital, Jaipur, Rajasthan, India. The study was conducted on relevant specimens received in microbiology department lab. These specimens were obtained from adults and children of both sexes coming to the ENT department with history of fever, ear pain, and ear discharge.

Single-use commercially available sterile cotton swabs were used to collect the pus, by inserting and rotating the swab, as deep as possible in ear, without hurting the patient. All samples were collected by standard microbiological technique, and outmost care was taken to avoid contamination.

The pus swabs were cultured on sheep blood agar, chocolate agar, and MacConkey's agar and incubated at 37°C for 24 to 48 hours. The blood agar and chocolate agar plates were incubated at 5% CO_2 at 37°C. After overnight incubation, suspected colonies of isolated organism were identified according to the standard microbiological methods (colony morphology, hemolysis, metallic sheen, pigmentation, and Gram stain). Antibiotic susceptibility testing was performed on Mueller Hinton agar as per Clinical and Laboratory Standards Institute (CLSI) standards.[12]

Using Kirby–Bauer disk diffusion method, the following antibiotics were tested for susceptibility testing of Gram-negative organisms:

Amikacin (30 µg), Ampicillin (10 µg), Amoxy-Clavulanate (20/10 µg), Aztreonam (30 µg), Cefepime (30 µg), Ceftazidime (30 µg), Ceftriaxone (30 µg), Ciprofloxacin (5 µg), Colistin (10 µg), Gentamycin (30 µg), Imipenem (10 µg), Levofloxacin (5 µg), Meropenem (10 µg), Piperacillin-tazobactam (100/10 µg), and Ticarcillin-clavulanate (75/10 µg).

The following antibiotics were tested for susceptibility testing of Gram-positive organisms:

Amikacin (30 µg), Azithromycin (15 µg), Cefoxitin (30 µg), Clindamycin (2 µg), Cotrimoxazole (1.25/23.75 µg), Doxycycline (30 µg), Erythromycin (15 µg), Gentamycin (10 µg), Linezolid (30 µg), Penicillin G (10U), Teicoplanin (30 µg), and Vancomycin (30 µg).

Zone of inhibition around each antibiotic disk was interpreted with the help of CLSI standards M100 S25.

RESULTS

A total of 251 ear swab samples were received in study duration. Of these, 135 samples showed growth on culture, giving isolation rate of 53.78%. The most common organism isolated was *P. aeruginosa* 88 (65.18%) followed by *S. aureus* 37 (27.4%). Coliforms were isolated in 10 (7.4%) patients (Tables 1 and 2).

Table 1: Drugs susceptibility to *P. aeruginosa*

Antibiotic	*n (susceptibility %)*
Amikacin	47 (53.41%)
Cefepime	41 (46.59%)
Ceftazidime	46 (52.27%)
Ciprofloxacin	44 (50%)
Colistin	88 (100%)
Gentamycin	45 (51.13%)
Imipenem	49 (55.68%)
Piperacillin-tazobactam	56 (63.63%)

Table 2: Drugs susceptibility to *S. aureus*

Antibiotic	*n (susceptibility %)*
Amikacin	35 (94.59%)
Cefoxitin	15 (40.54%)
Clindamycin	19 (51.35%)
Erythromycin	08 (21.62%)
Gentamycin	32 (86.48%)
Linezolid	37 (100%)
Teicoplanin	37 (100%)
Vancomycin	37 (100%)

DISCUSSION

Otitis media is a serious health care concern worldwide. Previous publications have reported its incidence to depend on socioeconomic factors, like poor living conditions, over-crowding, poor hygiene, and nutrition as basis for the widespread of the CSOM in developing countries.[13]

In our study, the pattern of bacterial isolates showed that *P. aeruginosa* (65.18%) was the most prevalent bacterial organism found in the middle ear with CSOM, which is similar to the finding elsewhere.[13-15] This is followed by *S. aureus* (27.4%) as the second most common, which also corresponds to other studies in other centres.[11,14] Coliforms (i.e., *E. coli, P. mirabilis*) were relatively low (7.40%). Anaerobic culture was not carried out and no fungi was isolated in our samples.

Antimicrobial susceptibility of *P. aeruginosa* in our study revealed that all the isolates were susceptible for colistin. Piperacillin-tazobactam (63.63%) and Imipenem (55.68%) were next two most sensitive antibiotics. Antipseudomonal cephalosporins did not fare well and were less sensitive in comparison to amikacin (53.41%).

Among isolated *S. aureus,* approximately 60% were methicillin-resistant *S. aureus* (MRSA). Vancomycin, linezolid, and teicoplanin were 100% sensitive. Aminoglycosides, amikacin (94.59%), and gentamycin (86.48%) were sensitive in most of the isolates. Susceptibility testing of coliforms was also carried out.

CONCLUSION

Pseudomonas aeruginosa is a major cause of ear infections. Empirical antibiotic coverage is needed to cover this pathogen as it develops resistance very rapidly. Empirical therapy should be revised after result of culture and sensitivity so that targeted therapy is given to eradicate the pathogen. In our study, *P. aeruginosa* was the most common isolate followed by *S. aureus*. *Pseudomonas aeruginosa* showed good susceptibility to colistin, piperacillin-tazobactam, and imipenem. Majority of *S. aureus* were MRSA and sensitive to vancomycin, linezolid, and teicoplanin.

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