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Original Research Article

Antimicrobial susceptibility pattern of bacterial isolates in patients of chronic suppurative otitis media in a tertiary care hospital in India

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) is a massive public health problem in developing countries like India, especially among low socio-economic class because of malnutrition, overcrowding, poor hygiene, inadequate health care and recurrent upper respiratory tract infections. CSOM cases unless managed effectively may land into various complications such as persistent otorrhoea, hearing impairment, mastoiditis, labyrinthitis, facial nerve paralysis to more serious intracranial abscesses.
Methods: The study was carried out in a tertiary care hospital from January 2017 to December 2017 with an aim to determine the microbiological profile of ear discharge in patients suffering from CSOM and their antimicrobial susceptibility pattern using Kirby Bauer disc diffusion method.
Results: Out of 630 samples processed, 407 (64.6%) samples were culture positive. Most common organism isolated was *Pseudomonas* spp. (43.2%) followed by *S. aureus* (39.1%). Most of isolates recovered were multidrug resistant.
Conclusions: Management of CSOM consists mainly of eradicating infection and closure of tympanic membrane. Periodic monitoring of bacterial isolates and their antibiotic susceptibility pattern is necessary for administering appropriate antibiotics as empirical treatment and also helps in reducing the potentially disabling and fatal complications of CSOM.

Keywords: CSOM, Ear discharge, *Pseudomonas*, *Staphyloccus*

INTRODUCTION

Otitis media has been classified into acute and chronic pathologies. It can be due to multiple aetiologies like nasopharyngeal infections, sinusitis or oropharyngeal infections or can be predisposed by craniofacial anomalies like cleft palate, cleft lip or microcephaly. Acute otitis media is usually marked by fever and pain in the ear.[1] Despite therapeutic interventions, acute otitis media may progress to chronic suppurative otitis media (CSOM) that is characterised by persistent or recurrent discharge through a perforation of the tympanic membrane.[2,3]

CSOM is one of the common problems related to ear in developing and developed countries and affects all ages but children constitute the most vulnerable group due to horizontal, wider and shorter eustachian tube, bacteria can gain entry into the middle ear via the external ear canal also.[4] Studies on the microbiology of CSOM have revealed that the most common bacteria associated with CSOM are *Pseudomonas aeruginosa*, *Staphylococcus*

aureus, Escherichia coli and *Klebsiella pneumoniae*.[5] Untreated cases of CSOM can result in a broad range of complications which may be related to the spread of bacteria to structures adjacent to the ear or to local damage in the middle ear itself. Such complications range from persistent otorrhoea, conductive deafness, mastoiditis, labyrinthitis and facial nerve paralysis to more serious intracranial abscesses or thromboses.[6-8] Out of all these complications, hearing loss is the most common and preventable one. Moreover, in children hearing loss can also lead to failure of development of communication, language development and cognitive development. So, it is very important for the clinician to know about the bacteriology and sensitivity pattern for management of chronic otitis media, as antimicrobial susceptibility profile of bacteria varies in different geographical area due to local antimicrobial prescribing practices and prevalence of resistant bacterial strains.

The objective of this study was to determine the bacteriological profile and the susceptibility pattern of CSOM patients as the knowledge of the local pattern of infections is essential to enable efficacious treatment and to achieve a dry ear, improve hearing and to prevent complications.

METHODS

This study was carried out in a tertiary care hospital in Delhi from January 2017 to December 2017. Patients of any age and either gender presenting with complaints of ear discharge for more than 14 days were included in the study. A total of 630 patients with ear discharge attending the ENT out patients department were taken in the study. After taking an informed consent from the patient, relevant history, regarding patient's name, age, sex, nature of discharge, duration of ear discharge and any antibiotic treatment taken were noted. Patient on any antibiotic therapy (topical or systemic) before presenting to the ENT outpatients department were excluded from the study.

Ear discharge was collected from patients under strict aseptic precautions using two sterile cotton swabs with the assist of aural speculum, taking care not to touch the external acoustic canal and transported to the Department of Microbiology and processed without any delay. The first swab was used for direct Gram stain and the second swab was cultured in blood agar, Macconkey and chocolate agar plates and incubated at 37˚C for 18-24 hrs. The isolates grown were identified by standard microbiological procedure (cultural characteristics, morphology and biochemical reactions). All the bacterial isolates obtained were subjected to antimicrobial susceptibility testing for a wide range of antimicrobial agents, by Kirby Bauer disc diffusion method on Muller Hinton agar. The antimicrobial agents tested for Gram positive bacteria were penicillin G (30µg/disc), ampicillin (10µg/disc), cefuroxime (30µg/disc), erythromycin (15µg/disc), clindamycin (2µg/disc), ciprofloxacin (5µg/disc), vancomycin (30µg/disc) and trimethoprim-sulfamethoxazole (1.25/23.75µg/disc), tetracycline (30µg/disc). While for Gram negative bacteria, the antimicrobial agents tested were ciprofloxacin (5µg/disc), gentamicin (10µg/disc), amikacin (30µg/disc), ceftazidime (30µg/disc), piperacillin (100µg/disc), piperacillin/tazobactum (100/10µg/disc), imipenem (10µg/disc) and meropenem (10µg/disc).

All the strains of *Staphylococcus aureus* isolated were also screened for methicillin resistance by cefoxitin disc method as recommended by the CLSI (Clinical Laboratory Standards Institute).

The plates were read after overnight incubation at 37˚C by measuring the zone of inhibition around the antibiotic discs as per CLSI guidelines.[9]

RESULTS

The study was carried out on a total of 630 patients comprising 388 males and 242 females (Figure 1), (Table 1).

Table 1: Age distribution of patients.

Age	Number	Percentage
0-10	78	12.3
11-20	131	20.8
21-30	206	32.7
31-40	89	14.1
41-50	48	7.6
51-60	30	4.8
61-70	38	6.1
>70	10	1.6

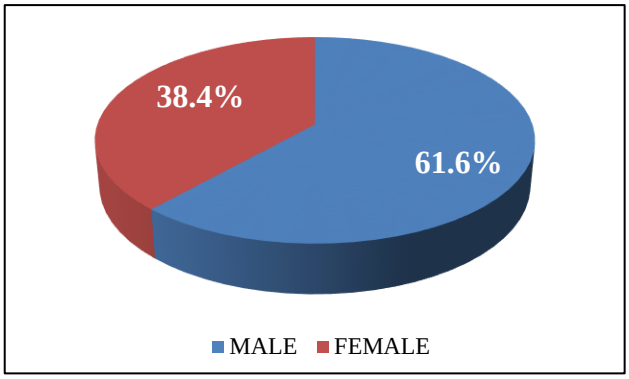

Figure 1: Gender distribution of cases.

Out of 630 samples, bacterial pathogens could be isolated from 407 samples. Among total samples, 87samples were culture negative while 85 of the samples showed mixed growth and 41 grew contaminants (Table 2).

The most common organism isolated in this study was *Pseudomonas* species followed by *Staphylococcus aureus*. *Coagulase negative Staphylococcus, Klebsiella*

pneumoniae, *Escherichia coli*, *Proteus spp.*, Acinetobacter spp. and *Streptococcus pneumoniae* were the other organisms isolated.

Table 2: Organisms isolated from culture.

Microorganisms	No.	Percentage %
Staphylococcus aureus	159	39.1
Coagulase negative Staphylococcus	40	9.8
Pseudomonas sp.	176	43.2
Klebsiella pneumonia	12	2.9
Escherichia coli	12	2.9
Proteus spp.	3	0.73
Acinetobacter spp.	3	0.73
Streptococcus pneumonia	2	0.5

Pseudomonas spp. showed 100% susceptibility to meropenem, 99% to piperacillin-tazobactam, 88.6% to piperacillin, 85% to cephalosporins, 49-59% to aminoglycosides while only 36% isolates were sensitive to ciprofloxacin (Figure 2).

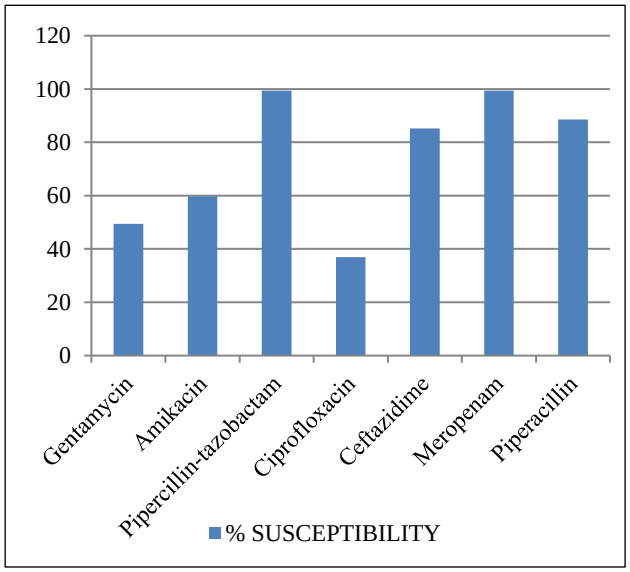

Figure 2: Antibiogram of *Pseudomonas spp*.

All isolates of *Staphylococcus aureus* (159) were susceptible to vancomycin, while 93% isolates showed susceptibility against tetracycline. 100% isolates showed resistance to ampicillin. Among 159 isolates of the *Staphylococcus aureus*, six isolates were found to have methicillin resistance (MRSA) (Figure 3).

All isolates (40) of *Coagulase negative Staphylococcal* (CoNS) species showed resistance to ampicillin (100%) followed by 75% resistance to ciprofloxacin, 50% to tetracycline and 37.5% resistance to cotrimoxazole. 12.5% isolates showed resistance to both erythromycin and clindamycin. All cons isolates were found to be susceptible to methicilin and vancomycin.

Escherichia coli and *Klebsiella pneumoniae* were 100% susceptible to imipenem, 96% susceptible to piperacillin-tazobactam, 87-96% susceptible to amikacin, gentamicin and 50-75% susceptible to cephalosporins.

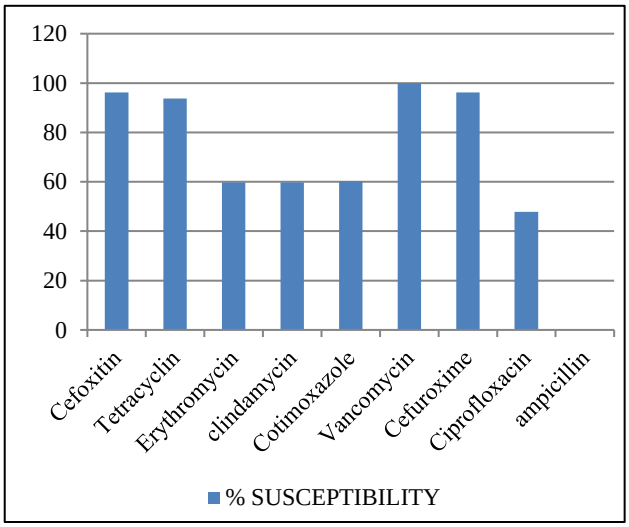

Figure 3: Antibiogram of *Staphylococcus aureus*.

Three isolates each of *Acinetobacter spp*. and *Proteus spp*. were isolated. Out of these, isolates of *Acinetobacter spp*. showed 100% susceptibility to meropenam and 100% resistance to aminoglycosides, piperacillin-tazobactam, fluoroquinolones and cephalosporines. Isolates of *Proteus spp*. were susceptible to piperacillin-tazobactam, meropenam, cephalosporins, fluoroquinolones. Both isolates of *Streptococcus pneumoniae* were susceptible to penicillin G.

DISCUSSION

CSOM is a major cause of preventable hearing loss in developing countries like India. It could be an emanation of inadequately treated acute otitis media or as a result of infection of acute suppurative otitis media (ASOM) with organisms from external auditory canal. Repeated attacks of acute otitis media, frequent upper respiratory tract infections, respiratory allergies, overcrowding, eustachian tube dysfunction, inadequate antibiotic treatment, poor living conditions with poor nutrition and hygiene may predispose development of CSOM.[10] Craniofacial anomalies like cleft palate, cleft lip, and microcephaly augment the risk of CSOM probably through altered eustachian tube anatomy and function.[11] Repeated cycles of inflammation lead to mucosal ulceration and granulation tissue formation which may destroy the surrounding bony margins and ultimately lead to various complications of SOM. Hence, treatment needs to be instituted early to prevent complications. The mainstay of treatment for uncomplicated CSOM is meticulous aural toilet and instillation of topical antibiotics. Systemic antibiotics are a second line of treatment for CSOM and are started if primary treatment of aural toilet and tropical antibiotics fail to clear otorrhoea after three weeks of

therapy. Since antibiotics are usually started empirically prior to the microbiological culture result, hence the knowledge of the local microorganism pattern and their antibiotic susceptibility is essential to allow for efficacious and timely management.

In the present study, 32.7% isolates were from patients in the age group of 21-30 years followed by 11-20 years (20.8%), this indirectly signals acute exposure during the childhood. Similar age pattern has been reported by Raakhee T et al and Panchal et al.[12,13] Predominant involvement of males (61.6%) in our study was in concordance with data reported by other authors.[14-16] These finding can be rationalized with the assumption that young male adults are the main workers who remain all time in field and humid atmosphere where excessive sweating keeps moisture maintained, which is favourable condition and provide nidus for microorganisms to set an infection.

Pseudomonas spp. (43.2%) was the most common isolate followed by *Staphylococcus aureus* (39.1%) which is similar to findings as observed by other investigators.[17,18] CoNS isolation rate was 9.8%. Cons are usually considered as commensal organism of the skin but can become an opportunistic pathogen.

In our study, *Pseudomonas spp.* isolates were found to be highly susceptible to meropenem, piperacillin/tazobactum and piperacillin while 40-60% of the isolates were found resistant to aminoglycosides and ciprofloxacin. Isolates of *S. aureus* showed better susceptibility to vancomycin and tetracycline as compared to ciprofloxacin and cotrimoxazole. These findings are similar as observed in other studies. Other Gram negative isolates i.e. *Escherichia coli*, *Klebsiella* spp., Proteus spp. and *Acinetobacter* spp. were found fairly sensitive to imipenem and piperacillin/tazobactum along with varying susceptibility patterns to other routine antibiotics. The declining sensitivity trend of organisms with commonly used antimicrobial agents may be explained by number of factors including injudicious use, inappropriate doses of antimicrobials and development of enzymatic resistance in microorganisms.

CONCLUSION

CSOM is one of the commonest chronic infectious diseases in developing countries. Factors playing role in the pathogenesis of CSOM are not fully comprehensible and underscore the urgent need for research in the area of development of novel and effective therapeutic strategies. Aural toilet remains an integral component of the therapeutic management. Selection of antimicrobial agents must factor in the problem of drug resistance among infecting organisms. Hence, it becomes imperative on part of the health care facilities to undertake periodic evaluation of antimicrobial susceptibility profiles of the microbial pathogens for designing effective empiric treatment protocols and prevent potential risk of unforeseen complications.

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