Original Research Article

Aerobic bacterial profile and their antimicrobial sensitivity pattern in patients of otitis media with ear discharge

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ABSTRACT

Background: The average prevalence of Chronic suppurative otitis media (CSOM) in India is 5.2%. It is more prevalent due to various predisposing factors such as malnutrition, overcrowding, poor hygiene, inadequate health care, and recurrent upper respiratory tract infection. In recent years, there is increased preponderance of multi drug resistant organisms due to the irrational use of antibiotics, making treatment of CSOM more difficult.
Methods: Samples from 100 subjects of uncomplicated CSOM who presented to the Oto-Rhino-Laryngology outpatient department of our hospital were collected. Aerobic bacterial profile and its Antimicrobial susceptibility were studied by conventional methods. Results were compiled and evaluated by descriptive statistics and inferential statistics.
Results: *Pseudomonas aeruginosa* (50.7%) and *Staphylococcus aureus* (19.04%) were the predominant isolates in our study. Aminoglycosides and Fluoroquinolones were found to be effective first line drugs, followed by Carbapenems.
Conclusions: These antibiotics can be used to prevent the life-long complications of CSOM. Timely culture and sensitivity helps in the management of these cases.

Keywords: CSOM, India, Pseudomonas

INTRODUCTION

Acute Suppurative Otitis Media (ASOM) is the acute infection of middle ear. It is common among children less than 6 years of age but with peak around 2 years. Despite treatment this can lead to spontaneous perforation of tympanic membrane and chronic inflammation of middle ear called as Chronic Suppurative Otitis Media (CSOM). The patient will have continuous discharge of mucoid material from the affected ear for a period of 6 weeks to 3 months. It is known for its recurrence and persistent infection. CSOM is one of the common causes of deafness, likely to inhibit language and cognitive development may result in learning disability and poor scholastic performances recognized as an important cause of preventable hearing loss in the developing world.[1] CSOM continues to be the major predisposing factor for intracranial abscess due to contigual spread.[2] CSOM can have a profound impact on the society, in terms of resources utilized in treatment of the disease and rehabilitation.[3-5]

The aerobic bacteria like *Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus, Streptococcus pyogenes, Proteus mirabilis, Klebsiella spp* or anaerobes like *Bacteroides, Peptostreptococcus, Propionibacterium* may be responsible for CSOM.[6] These are infrequently found on the skin of the external auditory canal, may then gain entry to the middle ear through a chronic perforation. Among these bacteria, *P. aeruginosa* has been particularly blamed for the deep-seated and progressive destruction of middle ear and mastoid structures through its toxins and enzymes.

The indiscriminate, increased and irrational use of wide-spectrum antibiotics, the resistance in the bacterial isolates

has become very common and poor follow-up of patients have resulted in persistence of low-grade infections. Changes in the microbiological flora of the modern-day CSOM, and their in vitro antibiotic sensitivity pattern is very important for the clinician to plan a general outline of treatment for a patient with a chronically discharging ear.[7] Therefore, the microbial culture and sensitivity will help in appropriate management of otitis media and its complications, thus preventing the emergence of resistant bacterial strains.[8,9]

Knowledge of the common causative organisms and their antibiotic sensitivity is helpful in deciding the drug of choice in perioperative management of unsafe CSOM. The treatment of CSOM is controversial and subject to change particularly in the developing countries, the prevalence and antibiogram of these organisms have been reported to vary with time and geographical area as well as continent to continent, probably due to indiscriminate use of the antibiotics.[10] Hence, the periodic update of prevalence and antibiogram of the etiological agents for CSOM would be helpful for the management of patients.[11]

METHODS

This was a prospective study conducted in the Department of Microbiology, Mysore Medical College and Research Institute during November 2019 to November 2020. 100 subjects of uncomplicated CSOM who presented to the Oto-Rhino-Laryngology outpatient department of our hospital were included in the study. Patients who were not on any topical or systemic antibiotics were included in the study. Patients who were on antibiotics or those who had undergone invasive procedures for previous ear infections and patients with complicated CSOM were excluded from the study.

Ethical clearance for the study was obtained from institutional review board.

The purpose of the study was explained to the study subjects or their attendant and after taking oral consent. Detailed history was collected and recorded in the performa. Then the specimen was collected from the affected site right, left or both ears. The site for collection of the sample was observed using sterile specula and the specimen was collected with the help of sterile cotton swabs. All care was taken to avoid surface contamination and the swabs were taken to the microbiology laboratory for further bacteriological processing.

Samples were cultured on blood agar and MacConkey's agar. The blood agar plates were incubated in a candle jar with 5% CO_2. All organisms isolated were identified according to the standard microbiological protocols. Antimicrobial susceptibility test was performed using Kirby Bauer disc diffusion method. *Staphylococci* were screened for Methicillin resistance with Cefoxitin 30µg disc. Gram negative bacilli were tested for drug resistance

mechanisms like Extended Spectrum Beta Lactamases (ESBL), Metallo Beta Lactamases (MBL), AmpC by disc potentiation method. ESBL was detected with Ceftazidime/ Ceftazidime Clavulanic acid discs, MBL was detected with Imipenem/ Imipenem EDTA discs, and AmpC was detected by Cefoxitin / Cefoxitin with Phenyl Boronic Acid.

Results were compiled and evaluated by descriptive statistics and inferential statistics (chi square test). Following descriptive statistics were employed in the present study – mean, standard deviation, frequency and percentage. All the statistical analysis was done through Statistical package for social sciences (SPSS) for windows. (version 16.0)

RESULTS

Out of 100 subjects the culture yielded growth of 63 isolates. Distribution as per age is shown in table 1. Commonest being 11-20 years of age, followed by 21-30 years.

Table 1: Distribution of isolates in different age group.

Age	No. of patients
1 – 10	9
11-20	18
21-30	15
31-40	12
41-50	7
51-60	1
61-70	1

The isolation of organisms 25 (39.7%) from right and left ear were equal in number and both ear sample isolation was 11 (17.5%). Pseudomonas aeruginosa was the most common isolate 32 (50.7%) followed by *Staphylococcus spp., Proteus spp.* etc. as shown in table 2.

Antibiotic sensitivity pattern of gram-positive cocci and gram-negative bacilli isolates shown in table 3, 4. All the organisms were resistant to Ampicillin. Most sensitive antibiotics were Ciprofloxacin and Gentamicin. Among the second line drugs for gram negative organisms, all of them were susceptible to Aztreonam followed by Netilmycin and Tetracycline. Sample of antimicrobial susceptibility is as shown in the Figure 1, 2.

Drug resistance among the isolates

Most of the gram-negative organisms showed Amp C beta lactamase production (48%) and 20% of them showed MBL production. Only 5% of the isolates showed the production of ESBL.

Table 2: Organisms isolated from the specimen.

Organism	RT (ear) n (%)	LT (ear) n (%)	BL n (%)	RT mastoid discharge n (%)	Non resolving CSOM n (%)	Total N (%)
Staphylococcus spp.	7 (58.33%)	2 (16.66)	2 (16.66)	0	1 (8.33)	12 (19.04)
Pseudomonas aeruginisa	12 (37.5%)	14 (43.8%)	5 (15.6%)	1 (3.1%)	0	32 (50.7)
Proteus spp.	1 (10%)	6 (60%)	3 (30%)	0	0	10 (15.87)
E. coli	2 (66.7%)	1 (33.3%)	0	0	0	3 (4.7)
Klebsiella spp.	3 (60%)	1 (20%)	1 (20%)	0	0	5 (7.9)
Enterococcus spp.	0	1 (100%)	0	0	0	1 (1.5)
	25 (39.7%)	25 (39.7%)	11 (17.5%)	1 (1.6%)	1 (1.6%)	63

Table 3: Antimicrobial susceptibility pattern of gram-positive cocci.

Gram positive organisms	Az	A.	Lz	Co	Cd	E	G	Te
S. aureus	33.3	0	100	16	33.3	16.7	66.7	50
MRSA	0	0	100	20	10	40	40	20
MRCoNS	0	0	100	0	0	0	100	100
Enterococcus spp.	0	0	100	0	0	0	100	0

Az-Azithromycin, A-Ampicillin, LZ-Linezolid, Co-Cotrimoxazole, Cd-Clindamycin E-Erythromycin, Te-Tetracycline

Table 4: Antibiotic sensitivity pattern of gram-negative bacilli.

Gram Negative organisms	Ac	Ak	G	Cf	Ca	Ce	Co	Cu	Ci	I	Net	PT	Ao
Pseudomonas aeruginosa	0	43.8	71.3	43.8	34.4	15.7	6.3	3.1	25	18.8	37.5	50	100
Klebsiella spp	-	100	40	100	20	0	0	0	0	0	40	60	0
Proteus spp	20	10	30	50	30	60	20	10	0	40	10	-	10
E. coli	0	33.3	100	0	0	0	0	0	0	0	33.3%	33.3%	0

AC-Amoxyclav, AK-Amikacin, G-Gentamycin, Cf-Ciprofloxacin, Ca-ceftazidime, Ce-Cefatoxime, Ci-Cefpodoxime, Cu-Cefuroxime, I-Imipenem, Net-Netlimycin, PT-Piperacillin Tazobactum, Ao-Aztreonam

Table 5: Detection of methicillin among *Staphylococci*.

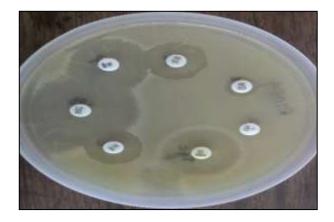|	n=12	%
MRSA	5	41.66
MRCONS	1	8.33
	6	50%

Figure 2: Detection of ESBL, MBL and Amp C in P. aeruginosa.

Detection of the Methicillin resistance in Coagulase positive strains 5 (41.66%) and other coagulase negative Staphylococci (MRCONS).

Figure 1: AST pattern of a S. aureus.

Table 6: ESBL producing gram negative bacilli.

Organism	Positive n (%)	Negative n (%)	Total n (%)
Pseudomonas aeruginosa	14 (43.8%)	18 (56.2%)	32 (100.0%)
Proteus spp.	3 (30.0%)	7 (70%)	10 (100.0%)
E. coli	0 (0.0%)	3 (100%)	3 (100.0%)
Klebsiella spp.	3 (60.0%)	2 (40%)	5 (100.0%)
Total	20 (40%)	30 (40%)	50 (100%)

Table 7: MBL in Gram negative isolates.

Organism	Positive n (%)	Negative n (%)	Total n (%)
Pseudomonas aeruginosa	3 (9.4%)	29 (90.6%)	32 (100)
Proteus spp.	2 (20)	8 (80)	10 (100)
E. coli	0 (0)	3 (100)	3 (100)
Klebsiella spp.	2 (40)	3 (60)	5 (100)
Total	7 (100)	43 (100)	50 (100)

DISCUSSION

CSOM is a common disease with approximately 5% global incidence. The chronic inflammation results from the invasion of bacteria into the middle ear and mastoid cavity.

Bacteria are believed to gain access to the middle ear and biofilm formation has been suggested to explain the recalcitrant nature of CSOM. The susceptibility of organisms causing CSOM to antibiotics changes considerably from time to time and this variation is even worsened by misuse of antibiotics, which tend to create multidrug resistance among the organisms, thereby making the management of CSOM more difficult.

In this study CSOM was found to commonly occur in the age group of 11-20 years. This finding is corresponding to other studies.[8] This higher incidence among the younger age could be related to their immune status, frequent exposure to upper respiratory tract infections and malnutrition.

Of 100 patients sampled, 63 showed evidences of bacterial infection. All of them were mono-microbial growths. This lower incidence of culture positivity was likely due to usage of topical or systemic antibiotics.[10]

We found Pseudomonas aeruginosa to be predominant pathogen among the isolated organisms, followed by Staphylococcus spp. and Enterobacteriaceae. Similar pattern of organisms was reported by various other studies.[8,10]

Linezolid had excellent susceptibility results for all the Gram-positive cocci. However, it cannot be used for empirical therapy. Sensitivity to Gentamicin was found satisfactory and can be used guardedly. Other studies report similar findings.[4,7,12]

Pseudomonas aeruginosa was found to be most sensitive to Gentamicin followed by Amikacin and Ciprofloxacin among the first line drugs. Penicillins and Cephalosporins were relatively more resistant. Enterobacteriaceae were found to be susceptible to Ciprofloxacin and Gentamicin. All isolated Gram-negative bacilli were susceptible to Aztreonam, followed by Tetracycline and Netilmycin. Similar susceptibility patterns are reported by many studies.[8,7,10,12,13] However few studies report Amoxycillin-Clavulanic acid to have better susceptibility and Ciprofloxacin to be more resistant among GNBs Isolated GNBs were not so susceptible to Imipenem, which is commonly used as a empirical parenteral therapy for complicated CSOM cases.[12,13] Few studies report similar unsatisfactory results for carbapenems.[14,15] However some studies report excellent susceptibility to carbapenems.[8]

Methicillin resistance was found in 50% of the Staphylococcus spp. which is a significant finding. Similar higher incidence of MRSA was found in other studies.[7,13] As CSOM is a community acquired disease and this high prevalence of Methicillin resistance indicates the fact that Community Acquired MRSA is spreading its tentacles even among younger population.

Evidence of ESBL, MBL and AmpC production among the isolates were statistically significant. This finding is in concordance with other studies.[7,9,16] and relates to the difficulty in management of unsafe CSOM and its other complications.

Shortcomings of our study are that anaerobic bacteria and fungi were not included in the profile. Similar study with a larger population is needed to formulate antibiotic policy for the concerned disease.

CONCLUSION

CSOM remains the commonest disease causing chronic ear discharge, preventable hearing loss and intracranial abscesses. With the advent of antibiotics and their inadvertent use, there is a shift towards emergence of more resistant microbiological profile. This finding is alarming and change of practice from empirical therapy to culture guided therapy is warranted to curtail the situation. This study emphasises the need for close monitoring and appropriate prescription of drugs before and after the culture-sensitivity results.

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