Analysis of Microbes and their Sensitivity Patterns in Chronic Otitis Media in West Bengal

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ABSTRACT

Introduction

Chronic otitis media (COM) is a commonly encountered condition in India because of socio-economic factors. Empirical antimicrobial therapy is crucial till definitive surgical management can be done. Periodic updating of prevalence and antibiogram of the etiological microorganisms of COM is thus important.This hospital based study aimed to detect the ongoing trend of microbes associated with chronic otitis media in eastern India and determination of antibiotic sensitivity patterns of bacteria.

Materials and Methods

A prospective study was conducted wherein ear swabs were taken from discharging ears of selected patients and sent for culture and antibiotic sensitivity tests.

Results

One hundred and forty two (142) samples were collected from 104 patients. 124 samples revealed monomicrobial involvement while 5 samples did not reveal any pathological organism. Pseudomonas aeruginosa and Staphylococcus aureus were the most common isolates comprising 31.33 % and 30.67 % respectively. Most organisms were susceptible to fluoroquinolones and aminoglycosides along with imipenem, meropenem followed by penicillin group of antibiotics.

Conclusion

The huge burden of chronic otitis media patients in India makes it essential to have an evidence-based protocol for initiation of empirical treatment. Hence, an idea about the microbes commonly responsible for disease and their antibiotic sensitivity patterns is helpful in clinical practice.

Keywords

Otitis Media; Microbial Sensitivity Tests

Chronic otitis media (COM) is a commonly encountered condition in India because of socio-economic factors like malnutrition, overcrowding and poor hygiene, inadequate healthcare, and recurrent upper respiratory tract infection.[1]

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Though the main aim of treatment of COM lies in surgical repair, it is necessary to eliminate the infection before surgery or to combat complications of COM with the help of antibiotics. If we fail to manage cases with empirical antibiotics, culture and sensitivity of the ear discharge are usually done to know about the causative organisms, their antibiotic susceptibility patterns. Most cases of complicated COM do not give us ample time for culture and antibiotic sensitivity tests. In those cases, we must administer some broad-spectrum antibiotic to combat the situation promptly to avoid further aggravation of the condition. So, the choice of antibiotics always plays a crucial role in managing COM.

The prevalence and antibiogram of causative organisms of COM have been reported to vary with

time and geographical areas. This is probably due to recurrent mutations of the causative microorganisms as a result of indiscriminate use of antibiotics. Hence, periodic updation of prevalence and antibiogram of the etiological microorganisms of COM would help to manage those cases more effectively.

In different studies three to four decades back, Pseudomonas and Proteus were the most common microbial isolates in patients with COM.[2,3] The incidence of community-acquired methicillin-resistant Staphylococcus aureus (MRSA) has increased over the years. It is now the most common isolate reported, followed by methicillin-sensitive S. aureus (MSSA).[4,5] Besides, different studies show there is a gradual increase in the involvement of gram negative bacteria like Enterobacteriaceae family along with the involvement of different anaerobic bacteria and fungi. The causative organisms also differ between mucosal and squamous varieties of COM. Squamous variety of diseases are almost thirty times more likely to have mixed infections compared to the mucosal variety of disease, which is usually monomicrobial.[6]

This study aimed to detect the ongoing trend of microbes associated with chronic otitis media in Eastern India and the determination of antibiotic sensitivity patterns of bacteria. Due to the absence of a recent data, this study was designed to see the recent trend and make empirical treatment of COM more effective.

Materials and Methods

This prospective hospital based study was conducted in the Department of Otorhinolaryngology – Head and Neck Surgery, in collaboration with the Department of Microbiology, in a tertiary care hospital in Kolkata between September 2012 to August 2014. Patients attending the outpatient clinic and diagnosed to have active chronic otitis media were considered for inclusion and a sample selected at random using random number tables. Patients who had already received topical or systemic antimicrobials in the past three months were excluded from consideration.

Ear swabs were taken with a sterile swab from discharging ears of the selected patients. Care was taken to ensure that the swab was taken from the deeper part of the external auditory canal using sterile ear speculum to avoid contact between the swab stick and outer part of the external auditory canal. The swab stick was then placed inside a sterile test tube and sent immediately to the microbiology department for culture and antibiotic sensitivity test.

After ear swabs were taken, wet mopping was done to clean the external auditory canal and clinically classify the ear as a mucosal or squamous variety of COM. Data was collected and subsequently analysed using commercially available software.

Results

A total of 104 patients were selected as per the previously described methods. Among them, 66 patients had unilateral ear discharge, while the remaining 38 patients had bilateral ear discharge. The total number of samples studied was 142.

There was almost equal gender distribution among the patients with 49 (47.11%) male patients and 55 (52.89%) female patients. The age of the patients ranged from 1 year to 60 years. The maximum number of cases were within the 2nd decade, that is in the age group of 11-20 years (n=35, 33.65%).

Among 142 discharging ears, 98 ears had active mucosal variety comprising 69.01% while 44 ears had active squamous type comprising 30.99%.

Out of the 142 samples, 124 samples revealed monomicrobial involvement. Polymicrobial involvement was seen in 13 samples, with each sample having two types of bacterial or fungal species. (Table I) 5 samples did not reveal any pathological organism. Therefore, the total number of isolates for sensitivity testing from 142 samples was 150.

Pseudomonas aeruginosa and Staphylococcus aureus were the most common isolates comprising 31.33 % and 30.67 % respectively. Klebsiella and Proteus sp. were found in 8.67 % and 7.33% cases, respectively. Some fungal species like Aspergillus and Candida sp. were also detected. (Table II)

Among 150 isolates, only five samples (3.33%) revealed anaerobic bacilli as a causative organism. It

Table I: Distribution of different organisms isolated from ear discharge samples

ISOLATED ORGANISMS	MONOMICROBIAL	POLYMICROBIAL	CULTURE NEGATIVE
Pseudomonas aeruginosa	45	2	
Staphylococcus aureus	35	11	
Streptococcus pneumoniae	3	0	
Klebsiella sp.	9	4	
Proteus sp.	6	5	
Acinetobacter sp.	13	0	
E. coli	2	0	
Aspergillus sp.	5	1	
Candida sp.	3	1	
Anaerobes	3	2	
No growth or only commensals			5
Total number of samples (n=142)	124	13	5

was noted that all the 5 samples showing anaerobic organisms were drawn from an active squamous variety of ear disease. In three cases, anaerobic bacteria were isolated as a monomicrobial involvement while in the other two cases, it was isolated along with Staphylococcus aureus. Streptococcus pneumoniae and E. coli were detected only in 3 and 2 samples, respectively. Among 13 samples where there was mixed flora, the most common gram-positive organism found was Staphylococcus aureus, the second microbe usually being Klebsiella, Proteus or anaerobes.

All the causative bacteria except anaerobes had undergone antimicrobial susceptibility testing using Mueller Hinton agar. Fungal isolates were also excluded

Table II: The distribution of different organisms

ISOLATED ORGANISMS	NUMBERS	PERCENTAGE (%)
Pseudomonas aeruginosa	47	31.33
Staphylococcus aureus	46	30.67
Streptococcus pneumoniae	3	2
Klebsiella sp.	13	8.67
Proteus sp.	11	7.33
Acinetobacter sp.	13	8.67
E. coli	2	1.33
Aspergillus sp.	6	4
Candida sp.	4	2.67
Anaerobes	5	3.33
Total	150	100

from antimicrobial sensitivity patterns. We found most of the organisms were susceptible to fluoroquinolones and aminoglycosides along with imipenem, meropenem followed by penicillin group of antibiotics. (Table III)

Discussion

COM is a significant public health problem, and India is one of the countries with high prevalence where urgent attention is needed.[7] It is a significant cause of preventable hearing loss, particularly in the developing world,[8] and a serious concern in children because it may have long-term effects on early communication, language development, auditory processing, educational process, and physiological and cognitive development.[7] Early microbiological diagnosis ensures prompt and specific treatment to avoid such complications.

Predominant bacterial aetiology (aerobic) of COM in this region is Pseudomonas aeruginosa (31.33%), and this observation was very close to the views by other researchers like studies in Nagpur (41.5%),[9] in DHQ (45.9%), in Hyderabad (54%).[10] In contrast, other studies from different areas showed different trends as Staphylococcus aureus was the most prevalent organism in studies in Uttarakhand (48.69%),[11] in Kathmandu (32.2%),[12] in County Hospital, Bosnia (30.6%)[13] and this could be due to the variation in the prevalence of microorganisms or effects of local conditions. In our study, we could isolate Staphylococcus aureus in 30.67% of cases which is remarkably close to the isolates of Pseudomonas. Therefore, as per our research, both Pseudomonas aeruginosa and Staphylococcus aureus predominate the clinical prevalence.

Pseudomonas aeruginosa was more susceptible to antibiotic like ciprofloxacin, levofloxacin, ceftazidime, cefoperazone + sulbactam, amikacin, gentamicin, imipenem, meropenem while most resistant against amoxicillin, amoxicillin + clavulanic acid, ceftriaxone, ceftriaxone + sulbactam, erythromycin, azithromycin. It was noticeably clear from our study that the drugs which were being used for gram negative organisms in our in-patient department, like ceftriaxone or ceftriaxone + sulbactam, were losing the fight against resistant bacteria like Pseudomonas aeruginosa. In our study, Pseudomonas was sensitive to piperacillin +

tazobactam in only 8 cases (17.02%) which was quite contrary to a survey held in DHQ Teaching Hospital and Microbiology Department where it was sensitive in all the cases (100%).[14]

Staphylococcus aureus was susceptible to linezolid, vancomycin, tazobactam + piperacillin, amikacin, gentamicin, imipenem, ceftriaxone + sulbactam, levofloxacin, ciprofloxacin but mostly resistant to cotrimoxazole, amoxicillin, erythromycin, which are commonly used to eradicate upper respiratory tract infections and associated infective conditions. Like most studies, in our research, we found amikacin to be effective against both Staphylococcus aureus and Pseudomonas aeruginosa, which was in contrast to a study conducted in Hyderabad,[10] where amikacin was effective against Pseudomonas aeruginosa in 55% and against Staphylococcus aureus in 72% cases.

When the results of our study were compared with results of other studies, it was clear that the microbial profile and AST pattern of COM has been changing over time. Indiscriminate and irrational antibiotic use, as well as patient noncompliance, are the factors usually responsible for the changes. The advent of sophisticated synthetic antibiotics has increased the relevance of reevaluation of the modern-day flora in COM and their in vitro AST patterns to assist efficacious empirical treatment.

Conclusion

The massive burden of chronic otitis media patients in India makes it essential to have an evidence-based protocol for initiation of empirical treatment. Geographical variation of antibiotic sensitivity patterns and even microbes presents a challenge to the clinician initiating empirical treatment till formal microbiological confirmation is obtained. Often, due to lack of resources or sheer numbers, the clinician is forced to omit culture sensitivity tests totally. Hence, an idea about the microbes commonly responsible for disease and their antibiotic sensitivity patterns is helpful in clinical practice.

Table III: Antibiotic sensitivity pattern of most common microorganisms

ANTIBIOTICS	P. AERUGINOSA (47 CASES)		S. AUREUS (46 CASES)		S. PNEUMONIAE (3 CASES)		KLEBSIELLA (13 CASES)		PROTEUS SP. (11 CASES)		ACINETOBACTER SP. (13 CASES)		E. COLI (2 CASES)	
	SENSITIVE	RESISTANT	SENSITIVE	RESISTANT	SENSITIVE	RESISTANT	SENSITIVE	RESISTANT	SENSITIVE	RESISTANT	SENSITIVE	RESISTANT	SENSITIVE	RESISTANT
AMO	3 (6.38%)	44 (93.62%)	14 (30.43%)	32 (69.57%)	2 (66.67%)	1 (33.33%)	5 (38.46%)	8 (61.54%)	3 (27.27%)	8 (72.73%)	1 (7.69%)	12 (92.31%)	0 (0.00%)	2 (100%)
AMC	7 (14.89%)	40 (85.11%)	23 (50.00%)	23 (50.00%)	3 (100%)	0 (0.00%)	6 (46.15%)	7 (53.85%)	4 (36.36 %)	7 (63.64%)	2 (15.38%)	11 (84.62%)	0 (0.00%)	2 (100%)
ERY	2 (4.26%)	45 (95.74%)	28 (60.87%)	18 (39.13%)	2 (66.67%)	1 (33.33%)	1 (7.69%)	12 (92.31%)	1 (9.09%)	10 (90.91%)	NA	NA	0 (0.00%)	2 (100%)
AZY	5 (10.64%)	42 (89.36%)	30 (65.22%)	16 (34.78%)	2 (66.67%)	1 (33.33%)	2 (15.38%)	11 (84.62%)	1 (9.09%)	10 (90.91%)	NA	NA	0 (0.00%)	2 (100%)
COT	11 (23.40%)	36 (76.60%)	4 (8.70%)	42 (91.30%)	0 (0.00%)	3 (100%)	6 (46.15%)	7 (53.85%)	2 (18.18%)	9 (81.82%)	0 (0.00%)	13 (100%)	1 (50.00%)	1 (50.00%)
CLA	4 (8.51%)	43 (91.49%)	25 (54.35%)	21 (45.65%)	1 (33.33%)	2 (66.67%)	1 (7.69%)	12 (92.31%)	0 (0.00%)	11 (100%)	NA	NA	0 (0.00%)	2 (100%)
CIP	33 (70.21%)	14 (29.79%)	37 (80.43%)	9 (19.57%)	2 (66.67%)	1 (33.33%)	8 (61.54%)	5 (38.46%)	6 (54.55%)	5 (45.45%)	7 (53.85%)	6 (46.15%)	2 (100%)	0 (0.00%)
LEVO	41 (87.23%)	6 (12.77%)	43 (93.48%)	3 (6.52%)	3 (100%)	0 (0.00%)	10 (76.92%)	3 (23.08%)	10 (90.91%)	1 (9.09%)	8 (61.54%)	5 (38.46%)	2 (100%)	0 (0.00%)
CEFPO	19 (40.43%)	28 (59.57%)	27 (58.70%)	19 (41.30%)	2 (66.67%)	1 (33.33%)	6 (46.15%)	7 (53.85%)	7 (63.64%)	4 (36.36%)	4 (30.77%)	9 (69.23%)	2 (100%)	0 (0.00%)
CEFU	21 (44.68%)	26 (55.32%)	31 (67.39%)	15 (32.61%)	3 (100%)	0 (0.00%)	7 (53.85%)	6 (46.15%)	6 (54.55%)	45 (45.45%)	5 (38.46%)	8 (61.54%)	2 (100%)	0 (0.00%)
CFT	35 (74.47%)	12 (25.53%)	32 (69.57%)	14 (30.43%)	3 (100%)	0 (0.00%)	7 (53.85%)	6 (46.15%)	7 (63.64%)	4 (36.36%)	3 (23.08%)	10 (76.92%)	1 (50.00%)	1 (50.00%)
LIN	NA	NA	46 (100%)	0 (0.00%)	3 (100%)	0 (0.00%)	NA	NA	NA	NA	NA	NA	NA	NA
CEF+S	36 (76.60%)	11 (23.40%)	38 (82.61%)	8 (17.39%)	2 (66.67%)	1 (33.33%)	8 (61.54%)	5 (38.46%)	5 (45.45%)	6 (54.55%)	10 (76.92%)	3 (23.08%)	2 (100%)	0 (0.00%)
CEFT	3 (6.38%)	44 (93.62%)	35 (76.09%)	11 (23.91%)	3 (100%)	0 (0.00%)	7 (53.85%)	6 (46.15%)	4 (36.36%)	7 (63.64%)	6 (46.15%)	7 (53.85%)	2 (100%)	0 (0.00%)
CEFT+S	5 (10.64%)	42 (89.36%)	40 (86.96%)	6 (13.04%)	3 (100%)	0 (0.00%)	8 (61.54%)	5 (38.46%)	8 (72.73%)	3 (27.27%)	8 (61.54%)	5 (38.46%)	2 (100%)	0 (0.00%)
CEFI	19 (40.43%)	28 (59.57%)	37 (80.43%)	9 (19.57%)	3 (100%)	0 (0.00%)	6 (46.15 %)	7 (53.85%)	5 (45.45%)	6 (54.55%)	4 (30.77%)	9 (69.23%)	1 (50.00%)	1 (50.00%)
CFZ	27 (57.45%)	20 (42.55%)	39 (84.78%)	7 (15.22%)	3 (100%)	0 (0.00%)	9 (69.23%)	4 (30.77%)	6 (54.55%)	5 (45.45%)	5 (38.46%)	8 (61.54%)	2 (100%)	0 (0.00%)
AMI	42 (89.36%)	5 (10.64%)	45 (97.83%)	1 (2.17%)	2 (66.67%)	1 (33.33%)	11 (84.62%)	2 (15.38%)	9 (81.82%)	2 (18.18%)	9 (69.23%)	4 (30.77%)	2 (100%)	0 (0.00%)
GEN	40 (85.11%)	7 (14.89%)	43 (93.48%)	3 (6.52%)	2 (66.67%)	1 (33.33%)	12 (92.31%)	1 (7.69%)	10 (90.91%)	1 (9.09%)	10 (76.92%)	3 (23.08%)	2 (100%)	0 (0.00%)
IMI	45 (95.74%)	2 (4.26%)	39 (84.78%)	7 (15.22%)	3 (100%)	0 (0.00%)	13 (100%)	0 (0.00%)	10 (90.91%)	1 (9.09%)	13 (100%)	0 (0.00%)	1 (50.00%)	1 (50.00%)
MER	47 (100%)	0 (0.00%)	11 (23.91%)	35 (76.09%)	3 (100%)	0 (0.00%)	12 (92.31%)	1 (7.69%)	9 (81.82%)	2 (18.18%)	12 (92.31%)	NA	2 (100%)	0 (0.00%)
TAZ+PIP	8 (17.02%)	39 (82.98%)	40 (86.96%)	6 (13.04%)	2 (66.67%)	1 (0.00%)	NA	NA	NA	NA	10 (76.92%)	3 (23.08%)	NA	NA
VAN	NA	NA	45 (97.83%)	1 (2.17%)	3 (100%)	0 (0.00%)	NA	NA	NA	NA	NA	NA	NA	NA

(AMO - Amoxicillin, AMC - Ampicillin, ERY - Erythromycin, AZY - Azithromycin, COT - Cotrimoxazole, CLA - Clarithromycin, CIP - Ciprofloxacin, LEVO - Levofloxacin, CEFPO - Cefpodoxime, CEFU - Cefuroxime, CFT - Cefotaxime, LIN - Lincomycin, CEF+S - Cefuroxime + Sulbactam, CEFT+S - Ceftriaxone + Sulbactam, CEFI - Cefixime, CFZ - Ceftazidime, AMI - Amikacin, GEN - Gentamicin, IMI - Imipenem, MER - Meropenem, TAZ+PIP - Tazobactam + Piperacillin, Van - Vancomycin)

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