 DOI: 10.18231/2394-5478 .2016.0006

Antimicrobial susceptibility pattern of bacterial isolates from chronic suppurative otitis media patients in Central India

Garima[1,*], Deepti Chaurasia[2], VK Poorey[3]

[1]Assistant Professor, [2]Professor & HOD, Dept. of Microbiology, [3]Professor & HOD, Dept. of ENT, Gandhi Medical College, Bhopal

***Corresponding Author:**
Email: garima.kapoor.001@gmail.com

Abstract

Introduction: Chronic Suppurative Otitis Media (CSOM) takes a lot of time in the hospital outdoors and operation theatres. It is a chronic disease which is associated with irreversible sequelae and serious intracranial and extracranial complications. Henceforth early & effective treatment needs to be instituted to avoid such complications.

Materials & Methods: This study was planned at a tertiary care medical college to assess the bacterial etiology and antibiotic susceptibility profile of CSOM cases and to draw comparison with similar studies throughout India over the last four years. Isolation and identification of pathogen was done using aerobic culture followed by standard biochemical tests and antimicrobial susceptibility testing for commonly used antimicrobials.

Results: The commonest pathogens isolated were *Pseudomonas aeruginosa, Staphylococus aureus, Klebsiella spp.*, Escherichia coli, Coagulase Negative Staphylococci (CONS) and other gram negative rods mostly showing susceptibility to high end antibiotics like beta lactam-beta lactamase inhibitor, Carbapenems, Fourth generation cephalosporins & Glycopeptides.

Conclusion: There is wide variation in antibiotic sensitivity profile over varied geographical areas and populations throughout the country. For better management of this disease, clinical classification as well as antibiotic susceptibility testing of the organisms is essential for making the right choice of antibiotics. The high rate of multiple drug resistance as well as high level of resistance to individual antibiotics is a cause of concern.

Keywords: CSOM, Bacterial Profile, Antimicrobial resistance, Culture & Sensitivity, India

Introduction

Chronic Suppurative Otitis Media (CSOM) is defined as chronic inflammation of the middle ear and mastoid cavity, which presents with recurrent ear discharges or otorrhea through a tympanic perforation. The WHO definition requires only 2 weeks of otorrhea, but otolaryngologists adopt a longer duration, e.g. more than 3 months of active disease.[1]

CSOM involves 65–330 million individuals with ear discharge, of which 60% i.e. 39–200 million suffer from significant hearing impairment. Over 90% of cases are seen in the South-east Asia, Western Pacific regions, Africa, and regions around the Pacific. India is the country with one of the highest CSOM prevalence (>4%) and immediate attention is required to handle this massive public health problem.[1]

CSOM has gross impact on society directly & indirectly. It has direct impact in terms of hearing and indirectly in terms of utilization of resources i.e. use of antibiotics, numerous hospital visits and surgery.[2] The shorter and more horizontal Eustachian tube in children, easily impairs its opening leading to ear infection especially in those with low socioeconomic background.[3] The most probable risk factors apart from low socio-economic status are untreated sore throat, age, poor hygiene, upper respiratory tract infection, immunocompromised status, environmental factors, nutritional factors and facial anomalies etc.[4] In both children and adults, infections resulting from C.S.O.M. can lead to chronic hearing loss which affects the language & speech development which in turn affects social interaction as well as school or work place performance.[2]

The erosion of the middle ear and mastoid cavity walls may lead to chronic mastoiditis, labyrinthitis, lateral sinus thrombosis, facial nerve palsy, meningitis and brain abscess.[5,6,7] C.S.O.M. is a public health problem not only because of its high incidence and its associated complications but also because of widespread antimicrobial resistance and ototoxicity of both topical and intravenous antibiotics.[2] These patients are primarily treated with empirical antibiotics and are referred to otolaryngologists only upon treatment failure. The recurrent nature and the development of drug resistant pathogenic organisms, poses a great challenge in infection. The situation is further complicated by quacks who administer widespread antibiotics.[8]

Hence, the study of bacteria and its sensitivity pattern is important as it enables the treating physician to plan appropriate management and is utmost essential for ENT specialist to make the discharging ear dry for achieving best results of myringoplasty. However, the anti-biogram of bacteria in CSOM vary with time and geographical area due to indiscriminate antibiotic use.[9]

This study was carried out to know the emergence of drug resistant organisms. It is hoped that it will provide knowledge about the bacterial etiology of CSOM and their antibiotic susceptibility pattern in our especially in developing nation like ours.

Material and Methods

The main objectives of the study were:

a. To assess bacteria etiology of CSOM
b. Their susceptibility to commonly used antibiotics at Gandhi Medical College, Bhopal
c. The seasonal variation in the bacteriological pattern
d. To develop a standard operating protocol for empirical antibiotic therapy.

This will contribute to rational usage of antibiotics, success of treatment and prevention of the complications and antibiotic resistance.

Study design: Prospective, observational study

Study group: The study included 923 patients who were admitted or visited the outpatient department of ENT department of Gandhi Medical College & associated hospital with CSOM during the period of two years i.e. January 2014 to December 2015. Patients of all ages and both sexes were enrolled in the study after approval of the institutional ethical committee.

Inclusion Criteria

a. Cases who complained of ear discharge, continuous or intermittent, with a non-intact tympanic membrane for at least 12 weeks
b. Patients not on any local/systemic antibiotics for the last 7 days.

Exclusion Criteria

a. Ear discharge for less than 3 months.
b. Patients on systemic/ local antibiotics in previous one week.
c. Discharge with intact ear drum (otitis externa).

A detailed history on admission was taken which comprised of age, duration of ear discharge and any local/systemic antibiotic received. Along with it a thorough clinical examination was done in order to rule out acute otitis media and otitis externa. A month wise visit of the patients was recorded to note any seasonal variations in the isolates.

The results were analyzed statistically after entering in excel worksheet using Statistical Package for Social Sciences (SPSS Inc, Chicago, IL, USA) version 18.0 was used for analysis.

Specimen collection: Aural swabs were taken from the draining ears (after cleaning external auditory canal with spirit) by using a sterile swab stick on the 1st day of ENT OPD attendance before any local medication. Two sterile swabs properly labeled for each patient, were used to collect the specimen and then promptly transported to the microbiology laboratory.

Isolation and identification of pathogen: With one swab, Gram's stain of direct smear was performed. The other swab was inoculated on Blood and Macconkey agar, incubated aerobically at 37°C overnight and bacteria were identified using morphological, cultural and biochemical characteristics. Culture for anaerobes was not performed in this study.

Antibiotic sensitivity tests: It was done on Muller Hilton Agar by Kirby Bauer method[10] using the antibiotics commonly used at our hospital. The zone of inhibition around the antibiotics (Hi Media Laboratories Private Ltd., India) was measured after overnight incubation, as per Clinical Laboratory Research Institute (CLSI) standard[11]. The intermediate zone of susceptibility was not taken into consideration.

Results

Out of 923 patients enrolled in our study, 57.6 % (507) were males and 42.4% (416) females. The ratio of male to female was 1.2:1. The mean age of cases enrolled in our study was 24 years (range 1.5-80). The commonest (26.6%) age group affected was 21-30 years Table 1.

Table 1: Demographic profile of the CSOM cases

Age groups	Sex		Total
	Male	Female	
1-10	72	52	124
11-20	95	82	167
21-30	111	94	199
31-40	64	61	125
41-50	60	41	101
51-60	46	32	78
61-70	34	33	67
71-80	25	21	46
Total	507	416	923

Fig. 1 shows the month wise distribution for 2 years of CSOM cases, with maximum number of cases in the months of July and August.

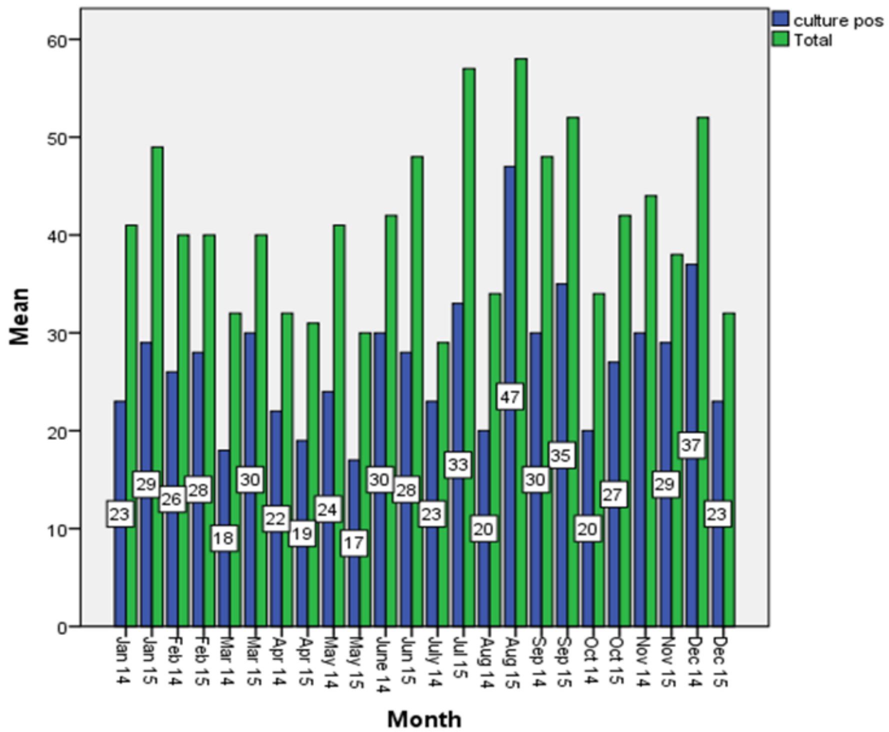

Fig. 1: Month wise distribution of clinically suspected and culture confirmed CSOM cases over two years

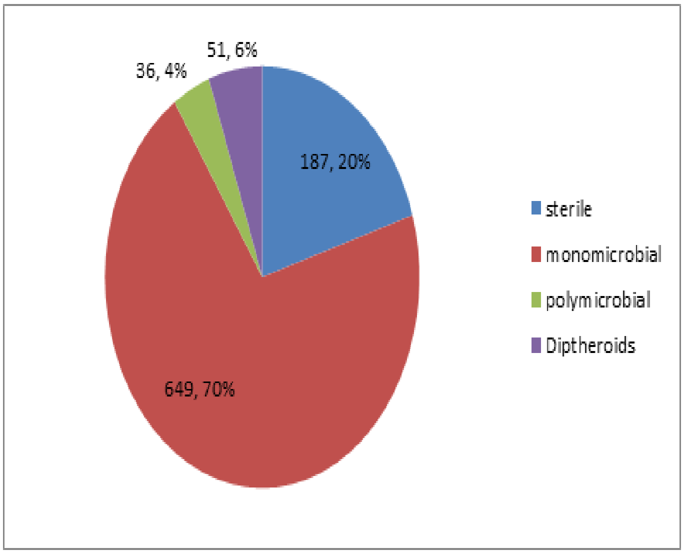

Fig. 2: Culture pattern amongst CSOM patients

The distribution of bacterial isolates in our study is depicted in Table 2; we received 419 & 504 samples during the year 2014 and 2015 respectively. Of these 20.26% samples were sterile. 5.5% of the samples grew Diptheroids, which are normal skin flora. 45.17% of the samples had growth of Gram Negative Bacilli, of which the commonest was *Pseudomonas spp.* (32.07%), followed by *Klebsiella spp.* (6.4%) & *Escherichia coli* (2.92%). Gram positive organisms constituted 25.14%, of which the commonest was *Staphylococcus aureus* (21%). Polymicrobial growth was seen in 3.9% of the CSOM isolates. (Fig. 2)

Table 2: Aerobic Bacterial distribution in CSOM isolates

	2014 (n= 419)	**2015 (n = 504)**	**Total (n=923)**
Sterile	96 (23%)	91 (18.05%)	187 (20.26%)
Diptheroids	20 (4.8%)	31 (6.2%)	51(5.5%)
Gram negative bacilli	192 (45.82%)	225 (44.64%)	417 (45.17%)
Pseudomonas spp.	132 (31.50%)	164 (32.53%)	296(32.07%)
Klebsiella spp.	31(7.4%)	28(5.5%)	59(6.4%)
Proteus spp.	9(2.1%)	6(1.2%)	15(1.62%)
Escherichia coli	7(1.7%)	20(4%)	27(2.92%)
Acinetobacter spp.	8(2%)	3(0.6%)	11(1.2%)
Enterobacter spp.	1(0.2%)	1(0.2%)	2(0.2%)
Citrobacter spp.	4(0.9%)	2(0.4%)	6(0.65%)
Moraxella spp.		1 (0.2%)	1(0.1%)
Gram positive cocci	101 (24.11%)	131 (26%)	232 (25.14%)
Staphylococcus aureus	76 (18.14%)	117(23.21%)	193 (21%)
Coagulase negative Staphylococci	19(4.6%)	5(1%)	24(2.6%)
Streptococci	6(1.4%)	9(1.8%)	15(1.62%)
Mixed infections	10 (2.4%)	26 (5.16%)	36(3.9%)
Klebsiella spp.+ Pseudomonas spp.	6(1.4%)	21(4.16%)	27(2.9%)
E.coli + Pseudomonas spp.		3(0.6%)	3(0.3%)
Klebsiella spp. + Proteus spp.	4(1%)	1(0.2%)	5(0.54%)
Klebsiella spp.+ E.coli		1(0.2%)	1(0.1%)

For *Pseudomonas spp*., Beta-lactam-beta lactamase inhibitors had the highest susceptibility rate i.e. Cefoperazone-Sulbactum (83.8%), Piperacillin-Tazobactum (83.8%), Ticaracillin clavulanate (78.3%) followed by Amikacin (74.7%), Meropenem (73.9%), Cefepime (71.7%), Aztreonam (71.4%), Imipenem (71%), Levofloxacin (63.6%), Netilmicin (54.8%), Ceftazidime (41.2%) and Cefoprozil (11.4%).

Kleibsella spp. which was the second commonest gram negative bacilli had the highest susceptibility to Imipenem (84.4%) followed by Cefoperazone-Sulbactum (80.2%), Meropenem (75.8%), Piperacillin-Tazobactum (72.2%), Amikacin (69.2%), Ticaracillin (68.1%), Cefepime (65.1%), Levofloxacin 62.6%, Aztreonam (55.6%), Netilmicin (50%), Ceftazidime (42.7%) and Cefoprozil (31.3%). The antibiotic sensitivity pattern for rest of the Gram negative bacteria can be seen in Table 3.

Table 3: Percentage sensitivity pattern of Gram negative bacteria

	Cefoperazone-Sulbactum*	Cefepime	Ceftazidime	Cefoprozil	Piperacillin-Tazobactum	Ticaracillin-Clavulanate	Imipenem	Meropenem	Levofloxacin	Amikacin	Aztreonam	Netilmicin
Pseudomonas spp.	83.4%	71.7%	41.2%	11.4%	83.8%	78.3%	71%	73.9%	63.6%	74.7%	71.4%	54.8%
Klebsiella spp.	80.2%	65.1%	42.7%	31.3%	72.2%	68.1%	84.4%	75.8%	62.6%	69.2%	55.6%	50%
Proteus spp.	56.3%	66.7%	58.3%	50%	62.5%	68.8%	66.7%	62.5%	50%	62.5%	25%	25%
Moraxella spp.	66.7%			100%	100%	66.7%	100%	33.3%	100%	100%	100%	100%
E.coli	80%	70.6%	50%	7.7%	77.4%	71%	23.1%	74.2%	67.7%	74.2%	100%	100%
Acinetobacter spp.	100%	100%	28.6%	40%	100%	90.9%	100%	100%	63.6%	72.7%	100%	75%
Citrobacter spp.	83.3%	100%	40%	25%	66.7%	83.3%	50%	66.7%	66.7%	83.3%	100%	100%
Enterobacter spp.	100%		50%	100%			100%					

Staphylococcus aureus which is second most common organism in our study had the highest susceptibility to Vancomycin (90%) followed by Linezolid (85.5%), Teicoplanin (78.2%), Moxifloxacin (76.8%), Cefazolin (73.2%), Cefaclor (71.8%), Ampicillin-sulbactum (71.1%), Clindamycin (68.3%), Gentamicin (66.9%), Clarithromycin (51.4%), Lomefloxacin (51.4%) and Azithromycin (50%). For the rest of Gram positive bacteria sensitivity profile refer to Table 4.

Table 4: Percentage sensitivity pattern of Gram positive bacteria

	Cefaclor	Cefazolin	Linezolid	Gentamicin	Clindamycin	Vancomycin	Amp-sulbactum	Azithromycin	Lomefloxacin	Clarithromycin	Teicoplanin	Moxifloxacin
Staphylococcus aureus	71.8%	73.2%	85.2%	66.9%	68.3%	90%	71.1%	50%	50.4%	51.4%	78.2%	76.8%
Coagulase negative Staphylococcus	58.3%	62.5%	62.5%	45.8%	45.8%	62.5%	66.7%	39.1%	16.7%	33.3%	54.2%	54.2%
Alpha hemolytic Streptococcii	0	0	100%	0	0	0	100%	100%	0	0	0	100%
Grp D Streptococcii	75%	81.3%	87.5%	56.3%	75%	81.3%	75%	43.8%	50%	56.3%	75%	75%

Discussion

In this study conducted at a tertiary care medical college of central India, we looked for the two year bacterial and sensitivity profile of CSOM cases. Further, we compared the bacterial distribution and antibiotic sensitivity of the two most common isolates from CSOM cases all over the country from various studies published over a four year period (2012-2015).

The commonest age group affected was 21-30 years just like in the study by Pankti et al[12]. Children and young adults below 30 years constituted > 53% of total cases as seen by Raakhee T et al[3] and Poorey VK et al[13]. This may be so because of the short and wider Eustachian tube in children[3] and the young adults are the main workers who most of the time remain in field and humid atmosphere where excessive sweating keeps moisture maintained for infection to set in[12]. In India with majority still living below poverty level; activities like pouring oil in the ear, swimming & washing clothes in contaminated water, also attribute to ear infections[3].

Out of 923 patients, 57.6% (507) were males and 42.4% (416) females; the male: female ratio being 1.2: 1. This may be indicator of just the more OPD attendance by males. Some researchers however argued that males may be predisposed to traumatic conditions due to their active and adventurous nature. Similar gender incidence was observed by few authors[14,15] while in contrast with other studies[3,16].

During the two year study period; there was an increase in cases during July and August. This is in concordance with Maji et al[2]. Increased infection by an omnipresent & saprophytic organism like *Pseudomonasspp*. in the Monsoon season is due to filling up of water bodies with rain water and the habit of pond bathing being still prevalent in this part of country.

In our current study, 20.26% samples from clinically suspected CSOM cases showed no growth on culture. This is comparable to the studies by Fatma et al[17], Geeta et al[18], and Chakraborty et al[19] but much higher than Loy et al[20], Malkapppa et al[21] and Kumar et al[22]. This could be due to poor techniques of obtaining the ear swabs and sending swabs for cultures when the diagnosis is uncertain and effectiveness of prior empirical antibiotic therapy.[23] Out of the total samples cultured 63% revealed monobacterial growth whereas 4% samples yielded mixed culture, just like Kumar et al[22], Prakash & Laxmi et al[16], Agrawal et al.[24] However, mixed bacterial culture was prominently reported by some investigators.[9]

It was seen that more than Gram negative bacteria (39.76%) Gram positive bacteria(19.71%) were responsible or infection like many previous investigators.[13,25] The widespread prevalence of Gram negative aerobes indicates that the nasopharynx is not the source of infection, as it lacks these organisms.[9] The bacteria are infrequently found on the skin of the external auditory meatus but may proliferate in the presence of inflammation, trauma, lacerations or high humidity. These bacteria then enter the middle ear through a chronic perforation. [1] Regardless of the entry the recalcitrant mechanism of CSOM is explained by biofilm formation.[26]

Pseudomonas spp. is the most predominant bacteria(32.07%) isolated like many of the previous studies[21,22,25] with a country wide incidence ranging from 19.89% to 45.9% [Table 5]. In our study, *Staphylococcus aureus and Pseudomonas sp*. together account for approximately 42.15% of cases, this is in accordance with the study by Deb et al[27], Harshika et al[28] and Umar et al.[29] *P.aeruginosa* through its toxins & enzymes is involved in progressive destruction of middle ear and mastoid structures.[1] Pseudomonas infections are mostly seen in the places where there is either breach in the continuity of skin as in burn or where the normal flora is replaced by constant use of topical antibiotics. This study points out to a very basic question of over the counter use of topical antibiotic formulations leading to ushering of a more serious type of organism like Pseudomonas which can create both intra and extra cranial complications.[2]

Table 5: Percentage of bacterial isolate among various CSOM Studies

Study	Deb et al (27)	Shyamala et al 2012 (37)	Malkappa et al 2012 (21)	Kumar et al 2012 (22)	Agrawal et al 2013 (24)	Prakash etal 2013 (30)	Prakash & Laxmi et al2013 (16)	Bansal et al 2013 (38)	Chavan et al 2014 (39)	Lakshmi et al 2014 (40)	Natarajan et al 2014 (34))	Sharma et al 2014 (35)	Sahu et al 2014 (36)	Rakhee et al 2014 (3)	Harshika et al 2015 (28)	Umar et al 2015 (29)	Jeyakumari et al 2015 (32)	Panchal et al 2015 (12)	Our study
Place of study	Agartala (Tripura)	Nellore (AP)	Nalgonda (AP)	Meerut (UP)	Agra (UP)	Srinagar,UK	Chennai	Jaipur	Adilabad(AP)	Secundarabad	Puducherry	Solan (HP)	Behrampur	Eluru	Bangalore	Gulbarga	Puducherry	Dharpur (Guj)	Bhopal
Sample size	97	100	130	62	125	204	80	190	100	97	200	170	100	71	130	176	105	100	923
Pseudomonas spp.	37.73 %	40%	45.24 %	45%	32.8 %	19.89 %	37.5%	45.9 %	43%	41%	41.5%	47.2 %	43.2%	34.2 %	33.09 %	26.2 %	37.6%	25.88%	32.07%
S. aureus	20.75 %	31%	22.22 %	13.33 %	37.6 %	48.69 %	41.25 %	26.3 %	25%	28.2%	30%	27	31%	27.63 %	21.58 %	29.4 %	19.4%	21.17%	21%
Klebsiella spp.	3.77 %	5%	6.35 %	18.33 %	4%	9.42%	7.5&	2.2%	14%	3.8%	10%	5%	8.1%	13.165	9.35 %	7%	7.7%	16.47%	6.4%
CONS	-	-	7.93 %		-	2.1%	11.25 %		-	2.5%	-	14%	-	15.78 %	1.43 %	8.9%	-	15.29%	2.6%
Proteus spp.	16.98 %	5%	11.1 %	20%	0.8%	2.10%	5%	6.8%	8%	7.6%	5.5%	3.4%	5.4%	6.58 %	5.75 %	2.5%	7.7%	5.88%	1.62 %
Escherichia coli	20.75 %	12%	4.76 %	3.33 %	3.2%	7.33%	5%	8%	8%	5.1%	9.5%	-	4%	2.63 %	3.59 %	3.2%	6.4%	8.23%	2.92 %
Streptococci	-	-	-	-	1.6%	1.05%	-	-	-	3.8%	-	-	2.7%	-	2.15 %	4.4%	2.6%	-	1.62 %
Other GNBs	-	-	-	-		3.14%	-	4.5%	2%	2.5%	-	-	5.3%	-	7.18 %	-	-	7.04%	2.15 %
Polymicrobial	-	-	0	9.09 %	8%	33.33 %	15%	-	-	4%	-	0	0	16.92 %	13.79 %	-	10%	3.40%	3.9%

Staphylococcus aureus (21%) has been the second common isolate in our study and matches the result of earlier investigators.[9,21,37] Several authors have reported *Staphylococcus aureus* as the most common bacterial agent in CSOM.[16,30] The ubiquitous nature and high carriage of resistant strains in the external auditory canal and upper respiratory tract accounts for increased frequency of middle ear infections with Staph aureus.[9] Coagulase Negative Staphylococci (CONS) were isolated from 2.6% ears. This organism was also isolated by several investigators.[9,16,20] These nonpathogenic organisms invade middle ear when extreme lowering of resistance occurs by other pathogens.[9]

Coliforms including *Klebsiella spp*. and *E.coli* were isolated from 6.4% and 2.92% cases, respectively, and these findings were tandem to the reports by Mansoor et al. and Loy et al., who reported the same to be 8% and 4%[20,31] whereas Poorey & Lyer and Dayasena et al. reported a higher incidence of *Klebsiella spp.*[13,23] The frequent isolation of fecal bacteria reinforces the fact poor hygiene is the paramount reason for developing CSOM.[20,31] Table 6 compares the country wide distribution of bacterial etiology of CSOM in the last four years. Almost all the studies consistently revealed the preponderant of bacteria in CSOM is either *Pseudomonas aeruginosa* followed by *Staphylococcus aureus* or vice versa. This conclusion has also been drawn by studies from other resource poor countries.[32]

The antibiotic resistance of the common infecting microorganisms, make this potential dangerous condition difficult to treat. The treatment for uncomplicated CSOM involves instillation of a topical and systemic antimicrobial agent and meticulous aural toilet.[33] Aural toilet along with parenteral and oral antibiotics is better than aural toilet alone.[1] Empirical antibiotics are started prior to microbiological culture and sensitivity results. The factors which influence antibiotic selection are efficacy, safety, bacterial resistance, and cost. The knowledge of the local epidemiology of the organism and its susceptibility to an antibiotic is essential for effective treatment. The yield of microbiology cultures depends upon the patient population, climate and recent use of antibiotics.[28] This, henceforth implies that reliance only on empirical antibiotic therapy is not effective for treatment of CSOM. As a thumb rule, bacteriological study along with antibiotic sensitivity should be obtained for each and every CSOM patient so that specific antimicrobial therapy can be tailored.[7]

Hence in this study, all the pathogenic isolates (Except for 5.5% isolates of diptheroids) were tested against various antibiotics commonly provided to the patients at our hospital pharmacy. Upon analyzing the antibiotic sensitivity results it was evident that *Pseudomonas spp.*, the commonest gram negative isolate and all other Gram negative bacilli had highest sensitivity to Beta lactam + Beta lactamase inhibitor combinations (~80%). This was similar to studies by Malkappa et al (83%)[21] (21), Agarwal et al (85.4%)[24], Natarajan et al (93.97%)[34], Sharma et al (78.5%)[35], Sahu et al[36] (81%), Raakhee et al (85%)[3], Harshika et al[28] (91.4%) which showed high sensitivity to beta-lactam and beta-lactamase inhibitors. In our study sensitivity to carbapenems was 70% which was quite low as compared to other studies as almost all studies revealed sensitivity as high as 85%-90%.

The present study also points to the fact that there is wide spread resistance among *Pseudomonas* isolates against commonly used Aminoglycosides, Netilmicin, which is same as in literature[2]. Fortunately the resistance against Amikacin has not developed in this part of country as also seen by Maji et al[2]. We found it highly effective also as reported by previous researches from India[29], and also from Pakistan.[2]

Levofloxacin showed reduced effectivity upto 60% as in other community[2]. Sensitivity to 2nd and 3rd generation Cephalosporins was poor but quite good for 4th generation Cephalosporins (Cefepime). The monobactams, Aztreonam also shows a good susceptibility profile to *Pseudomonas aeruginosa*.[2]

The second predominant organism of our study, Staphylococcus aureus was highly susceptible to glycopeptides & oxazolidinones viz. vancomycin, teicoplanin, linezolid. The sensitivity in our study to vancomycin was 90% as compared to almost 100% seen in other studies. Similarly the sensitivity to linezolid was 85% which was as high as 95-100% in other studies. The sensitivity to Teicoplanin was 78.2% which in contrast to other studies was quite lower. 1st generation (Cefazolin) and 2nd generation (Cefaclor) cephalosporin also showed good susceptibility to gram positive bacteria. There was high resistance to some commonly used macrolides (50%) and aminoglycosides (66%). The reason could be that sensitivity testing is requested when common antibiotics fail.[8] Hence unjustified use of these antimicrobials should be avoided to prevent emergence of resistant isolates. Limitation of the present study is that role of anaerobic bacteria in CSOM was not evaluated.

Here in Table 5, we compare the sensitivity profile across the country of the commonly isolated bacteria from CSOM cases over varied geographical areas. This table compiled all the studies on aerobic bacteriology of CSOM throughout the nation over a four year period. Inspite of the wide variation in the antibiotics tested from each class by various investigators, this exhaustive table indicates that for judicious use of antimicrobial agents, empirical antibiotic should be deescalated as per antibiotic culture sensitivity results: as an empirical antibiotic policy developed for a geographic region cannot be used to predict for others for a country as varied as ours.

Conclusion

CSOM like any other chronic illness can limit person's employability and quality of life. WHO declared that prevalence of >3% for CSOM must be targeted with high priority. This study was carried out for the identification of aerobic bacteriology of CSOM and to stress the importance of culture and sensitivity in the management of CSOM. *Pseudomonas spp* and *Staphylococcus aureus* are the major pathogens in CSOM. More than 70-80% of *Pseudomonas aeruginosa* were sensitive to carbapenems and beta lactam beta-lactamase inhibitors while Vancomycin, teicoplanin and Linezolid were found to be most sensitive for strains of *Staphylococcus aureus*. It is henceforth concluded that these antibiotics should be incorporated in the course of therapy to cover up the most frequent aerobic isolates implicated in CSOM. Culture and sensitivity remains time tested investigation of choice for better medical treatment, it has advantages like preventing resistance, minimizing complications and total cost of treatment. Knowledge of risk factors, seasonal variation and local antibiotic susceptibility profile also help to get best possible results of medical management of CSOM.

Acknowledgement

We would like to thank Dr. Saima Khan, Medical Officer, Dept. of Microbiology for her support in data collection and all the technical staff of Bacteriology section for their support in microbiology processing of specimens.

References

1. Chronic suppurative otitis media Burden of Illness and Management Options Child and Adolescent Health and Development Prevention of Blindness and Deafness World Health Organization Geneva, Switzerland 2004. www.who.int/pbd/publications/Chronicsuppurativeotitis_media.pdf.
2. Maji PK, Chatterjee TK, Chatterjee S, Chakrabarty J, Mukhopadhyay BB. The investigation of bacteriology of chronic suppurative otitis media in patients attending a tertiary care hospital with special emphasis on seasonal variation. Indian J. Otolaryngol. Head Neck Surg; 59:128-131.
3. Raakhee T, Sreenivasa RU. Bacteriological study of discharging ear in patients attending a tertiary care hospital. Int J Res Med Sci. 2014;2:602-606.
4. Fatima G, Shoaib M, Mohammad ZR, Bilal Syed. Antimicrobial Susceptibility Pattern of Bacterial and Fungal Isolates from Patients with Chronic Suppurative Otitis Media in Perspective of Emerging Resistance. Pakistan Journal of Otolaryngology 2013;29:49-53.
5. Elango S, Purohit GN, Hashim M, Hilmi R. Hearing loss and ear disorders in Malaysian school children. Int J Pediatr Otorhinolaryngol 1991;22:75-80.
6. Elango S, Than T. Mastoiditis in Kelantan. Med J Malaysia, 1995,50(3):233-236.
7. Mawson S, Ludman H. Disease of the Ear. A Textbook of Otology. 4th ed. London, Edward Arnold Publication,1979.
8. Orji FT, Dike BO. Observations on the Current Bacteriological Profile of Chronic Suppurative Otitis Media in South Eastern Nigeria. Annals of Medical and Health Sciences Research 2015;5;124-128.
9. KG Raghu Kumar, S Navya, KG Basavarajappa. A Study of Bacterial Profile and Antibiotic Susceptibility Pattern of Chronic Suppurative Otitis Media among Patients attending a Tertiary Care Centre, Davangere. Sch. J. App. Med. Sci., 2014;2:1606-1612.
10. Mackie, McCartney. Practical medical microbiology. In: Mackie, McCartney, eds. 14th ed. US: Kundli Press, Elsevier Publishers; 2012.
11. Clinical and Laboratory Standards Institute (CLSI). Performance standards for antimicrobial disc susceptibility tests. Clinical and Laboratory Standards Institute, Wayne. 24th information supplement 2014;34:M100-S24.
12. Panchal PD, Patel BV. Evaluation of bacteriological profile and antibiotic susceptibility pattern of patients with otorrhea in a tertiary care teaching hospital. Int J Res Med Sci. 2015 Nov;3:3167-3170.
13. Poorey VK, Lyer A. Study of bacterial flora in CSOM and its clinical significance. Indian J Otolaryngol Head Neck Surg. 2002;54:91-5.
14. Morris PS, Leach AJ. Prevention and management of chronic suppurative otitis media in aboriginal children: A practical approach. Community Ear Hear Health 2007;4:22-5.
15. Kuchhal V. Antibiotic sensitivity pattern in chronic suppurative otitis media in Kumoun region. Indian J Otol 2010;16:17-21.
16. Prakash M, Lakshmi K, Anuradha S, Swathi GN. Bacteriological profile and their antibiotic susceptibility pattern of cases of chronic suppurative otitis media. Asian J Pharm Clin Res 2013;6:210-212.
17. Fatma AA, Assiry S, Siraj MZ. Microbiological evaluation and aspects on management of chronic suppurative otitis media in Riyadh. Indian J Otol 1998;4:115-20.
18. Geeta SH; Study of aerobes, anaerobes, and fungi in CSOM in a Referral Hospital of Bangalore Rural. Journal of Evolution of Medical and Dental Sciences, 2014;3:6297-6303.
19. Chakraborty A, Bhattacharjee A, Purkaystha P. Microbiological profile of chronic suppurative otitis media. Its significance in North-East India. Indian J Otol 2005;11:39-44.
20. Loy AH, Tan AL, Lu PK. Microbiology of chronic suppurative otitis media in Singapore. Singapore Med J 2002;43:296-9.
21. Malkappa SK, Kondapaneni S, Surpam RB, Chakraverti TK. Study of aerobic bacterial isolates and their antibiotic susceptibility pattern in Chronic Suppurative Otitis Media. Indian Journal of Otology, 2012;18:136-139.
22. Kumar S, Sharma R, Saxena A, Pandey A et al. Bacterial flora of infected unsafe CSOM. Indian J Otol 2012;18:208-11.
23. Dayasena RP, Dayasiri MB, Jayasuriya C, Perera DS. Aetiological agents in chronic suppurative otitis media in Sri Lanka. Aust Med J 2011;4:101 4.
24. Agrawal A, Dharmendra K, Ankur G et al. Microbiological profile and their antimicrobial sensitivity pattern in patients of otitis media with ear discharge. Indian J Otol 2013;19:1.
25. Indudharan R, Haq JA, Aiyar S. Antibiotics in chronic suppurative otitis media: A bacteriologic study. Ann Otol Rhinol Laryngol., 1999;108(5):440-445.

26. Madana J, Yolmo D, Kalaiarasi Ret al Microbiological profile with antibiotic sensitivity pattern of cholesteatomatous chronic suppurative otitis media among children. Int J Pediatr Otorhinolaryngol 2011;75:1104 8.
27. Deb T, Ray D. A study of bacteriological profile of Chronic Suppurative Otitis Media in Agartala. Indian J Otolaryngol Head Neck Surg 2012;64:326-329.
28. Harshika YK, Sangeetha S, Prakash R. Microbiological Profile of CSOM and their Antibiotic Sensitivity Pattern in a Tertiary Care Hospital Int. J. Curr. Microbiol. App. Sci 2015;4:735-743.
29. Umar N, Mir BA. Prevalence and Anti-Biogram of Pseudomonas Aeruginosa Isolated from Otitis Media in KBN Hospital, Gulbarga. Sch. J. App. Med. Sci., 2015;3:2502-2505.
30. Prakash R, Juyal D, Negi V, Pal S et al. Microbiology of chronic suppurative otitis media in a tertiary care setup of Uttarakhand State, India. North American Journal of Medical Sciences, 2013;5(4):282-287.
31. Mansoor T, Musani MA, Khalid G, Kamal M. Pseudomonas aeruginosa in chronic suppurative otitis media: Sensitivity spectrum against various antibiotics in Karachi. J Ayub Med Coll Abbottabad 2009;21:120 3.
32. Jeyakumari D, Saranya R, Nagajothi J, Selvalingam E. Clinical and bacteriological profile of chronic suppurative otitis media in a rural area of Puducherry, India. International Journal of Development Research 2015;5:5518-5522.
33. Ahmad S. Antibiotics in chronic suppurative otitis media: A bacteriologic study. Egyptian Journal of Ear, Nose, Throat and Allied Sciences (2013) 14,191–194.
34. Arvind N, Chand P, KV Vishrutha. Microbiological profile of Chronic Suppurative Otitis Media. IJBR 2014;05:204-06.
35. Sharma V, Kaur G. Microbiology and antimicrobial susceptibility pattern of cases of chronic suppurative otitis media in a tertiary care teaching hospital. Int. J. Bioassays 2014;3:3033-3035.
36. Sahu SK, Narasimham MV, Mohanty I, Padhi S Panda et al. Otolarynology online journal 2014;4:1-14.
37. Shyamala R, Reddy PS. The study of bacteriological agents of chronic suppurative otitis media: Aerobic culture and evaluation. J Microbiol Biotech Res 2012;2:152-62.
38. Bansal Sulabh, Ojha Tarun, Kumar Suresh, Singhal Amit et al. Changing microbiological trends in cases of chronic suppurative otitis media patients Int J Cur Res Rev, Aug 2013/ Vol 05 (15) Page 76-81.
39. Chavan A, Nagarkar R, Chavan GN, Deshmukh PT. A study of microbiological spectrum with its antibiotic susceptibility in patients of chronic suppurrative otitis media at RIMS, Adilabad. International J. of Healthcare and Biomedical Research 2014;3:152-157.
40. Lakshmi JG, Geeta, Swarajya Lakshmi. Chronic suppurative otitis media profile of aerobic pathogens and antibiotic sensitivity g. J of Evolution of Med and Dent Sci 2014;3:14957-14962.

How to cite this article: Garima, Chaurasia D, Poorey VK. Antimicrobial susceptibility pattern of bacterial isolates from chronic suppurative otitis media patients in Central India. Indian J Microbiol Res 2016;3(4):373-382.