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Emergence of antibiotic resistance in bacteria isolated from tubotympanic type of chronic suppurative otitis media in Chhattisgarh

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) is a common chronic ear disease and a major health problem in developing countries causing deafness and life threatening complications like meningitis and brain abscess. Early and effective treatment based on the knowledge of causative organism and their antibiotic sensitivity is essential for immediate clinical recovery.
Methods: Total of 152 clinically diagnosed patients with CSOM safe were enrolled in the study and two swab of the discharge ear were obtained from each patient under aseptic precaution. Microbiological study was done according to standard operative guidelines.
Results: Out of 152 patients 93 male and 59 were female, majority of the patient seen below 30 year of age. Most common organism found was *Staphylococcus aureus* (43.2%) and *Pseudomonas aeruginosa* (27.9%). *Staphylococcus aureus* was sensitive to vancomycin (98%) and linezolide (100%) and *Pseudomonas aeruginosa* was found highly sensitive to Imipenem cilastin (84.85%) and Imipenem (66.7%).
Conclusions: In our study gram positive *Staphylococcus aureus* (43.2%) and gram negative bacilli *P. aeuroginosa* (27.9%) was the most common organism was found and this *P. aeruginosa* were hospital acquired infections. We found out high resistant to Cefepime, ceftazidime, ciprofloxacin and levofloxacin and aztreonam.

Keywords: CSOM safe, Active ear discharge, Antibiotic sensitivity, Microorganism

INTRODUCTION

Otitis media, an inflammation of the middle ear, is quite common in the developing world.[1] Based on the duration of symptoms, like ear discharge or perforation of the tympanic membrane, it is labelled as chronic otitis media when the symptoms are present beyond 12 weeks. Chronic suppurative otitis media (CSOM) is inflammation of the middle ear cleft and its contents which are classically divided into a tubo-tympanic type affecting the middle ear mucoperiosteum and an attico-antral type which is an active squamous disease within a growth of squamous epithelium into the middle ear cleft.[2,3] It is characterized by persistent otorrhea for more than 6-12 weeks, through perforated tympanic membrane, usually resulting from previous acute infection. The infection is due to the bacteria coming from nasopharynx via eustachian tube and causes inflammation in mucoperiosteum of middle ear cleft, resulting in ear discharge.[3] CSOM is a global problem and affects all ages but especially prevalent in children younger than 7 years due to horizontal, wider and short eustachian tube. The commonly occurring symptoms are ear discharge, deafness, itching, pain and sometimes fever. If it is left untreated complications like loss of hearing, post aural swelling and post aural sinus and life threatening

complications like meningitis, brain abscess etc., may occur.

Antibiotic resistance in microorganism is increasing day by day in both outpatients as well as hospitalized patients. It depends considerably on appropriateness of antibiotic therapy being instituted in a given geographical area. Understanding the extent and magnitude of drug resistance is of utmost importance in initiating the empirical therapy of most infections including CSOM.

Aim

The aim of the present study was to know the bacterial aetiology and their antibiotic susceptibility pattern of CSOM patients. This study result will provide us to determine the empirical treatment and based on the result of the study will effectively shorten the period of infection associated with discharge in patients of CSOM and thereby improve the surgical outcome.

METHODS

The study was conducted by Department of Microbiology and Department of Otorhinolaryngology, Chhattisgarh Institute of Medical Sciences, Bilaspur, Chhattisgarh from June 2018 to December 2018 with the ethical committee permission. The inclusion criteria for the study were patient with active ear discharge who had not used any antibiotic medication either topical or systemic for at least 7 days immediately preceding to presentation to us, irrespective of age and sex and only patients with tubo-tympanic type of CSOM with a central perforation were included. A thorough history with regard to duration of illness, associated symptoms and usage of antibiotics had been taken prior to inclusion in the study.

The exclusion criteria are patients with attico-antral type of CSOM with attic or posterior marginal perforation, who may commonly had anaerobic bacterial pathogens, as our study did not use anaerobic culture media or patients who had been using an antibiotic within 7 days of clinical presentation.

From each patient of active CSOM, two swabs of the ear discharge were collected under aseptic precautions without surface contamination and were transported to Microbiology department. One swab was utilized for Gram's staining and the other was inoculated on nutrient agar, blood agar and MacConkey agar for bacterial culture. After overnight incubation at 37˚C the culture plates were observed for growth. Microbes identification was done by gram staining, motility testing and various biochemical tests like catalase test, oxidase test, urea hydrolysis test, Methyl red-Voges-Proskauer (MR/VP) test etc., according to standard operative guidelines.[4] The organism isolated was tested for antibiotic sensitivity on Mueller-Hinton agar by Kirby-Bauer disc diffusion method according to Clinical and Laboratory Standards institute guideline.[5] Then tests for resistance pattern like extended spectrum beta lactamase (ESBL) production for *Enterobacteriaceae* and methicillin resistant *Staphylococcus aur*eus (MRSA) were done.

Data collected was analysed using Microsoft Excel and presented in number and percentages.

RESULTS

In our study total number of cases submitted for bacteriological study included 152 CSOM patients, out of which 93 (61.2%) were males and 59 (38.8%) was females. Majority of patients belong to below 30 years of age group (76.3%). Out of 152 patients we isolated 118 bacteria (77.6%) from culture.

Table 1: Age and sex distribution of CSOM patients (n=152).

Age (in years)	Male	Female	Total N (%)	No. of bacterial isolate
0-10	19	7	26 (17)	22
11-20	26	21	47 (30.9)	39
21-30	24	19	43 (28.4)	36
31-40	13	09	22 (14.5)	14
41-50	07	02	09 (5.9)	05
51-60	04	01	05 (3.3)	02
Total	93	59	152	118

In our study CSOM was more common in 11-20 years of age group (30.9%) followed by 21-30 years of age group (28.4%).

Table 2: Distribution of bacterial isolated from CSOM patients (n=118).

Type	Organism	Total isolates	%
Aerobic	*Staphylococcus aureus*	51	43.2
	P. aeruginosa	33	27.9
	CONS	11	9.3
	Klebsiella pneumoniae	08	6.8
	Proteus species	06	5.08
	Escherichia coli	04	03
	Enterococcus species	03	2.5
	Others	02	1.8
Total		118	100

As shown in Table 2 in our study *Staphylococcus aureus* was the most common causative agent for CSOM contributing 43.2% (51 out of 118), followed by *Pseudomonas aeruginosa* 27.9%. Prevalence of coagulase negative *Staphylococci* was 9.3%.

In our study, resistance of ampicillin in *S. aureus* was highest (88.2%) followed by ceftriaxone (76.4%), amoxyclav (72.5%). Fortunately no resistance strain of *S.*

aureus against vancomycin and linezolide was found. However among 11 isolated coagulase negative *Staphylococcus* (CONS), only one strain was linezolide resistant. Prevalence of methicillin resistance *Staphylococcus aureus* (MRSA) was 31.4% and methicillin resistance Staphylococcus other than *S. aureus* was 27.3%.

Table 3: Antibiotic resistance pattern of *Staphylococcus* sp.

Antibiotic	*S. aureus* (51)	CONS (11)
	N (%)	N (%)
Ampicillin	45 (88.2)	8 (72.7)
Amoxyclav	37 (72.5)	5 (45.45)
Ciprofloxacin	28 (54.9)	6 (54)
Gentamycin	32 (62.7)	9 (81.81)
Clindamycin	36 (70.6)	6 (54)
Cefuroxime	32 (62.7)	7 (63.63)
Ceftriaxone	39 (76.4)	8 (72.7)
Vancomycin	01 (2)	00 (00)
Linezolide	00 (0)	01 (9)
***Cefoxitin**	16 (31.4)	03 (27.3)

*: Cefoxitin disc test was use for MRSA testing.

Table 4: Antibiotic resistance pattern of gram negative bacilli (n=53).

	P. aeruginosa (n=33)	Enterobacteriaceae (n=20)
	N (%)	N (%)
Ampicillin	33 (100)	16 (80)
Amoxyclav	33 (100)	13 (65)
Amikacin	22 (66.67)	11 (55)
Gentamycin	18 (54.5)	10 (50)
Ciprofloxacin	25 (75.8)	13 (65)
Levofloxacin	27 (81.8)	11 (55)
Cefixime	25 (75.8)	10 (50)
Cefepime	20 (60.6)	10 (50)
Cefeperazone sulbactum	18 (54.54)	8 (40)
Piperacillin tazobactum	20 (60.6)	9 (45)
Imipenem	11 (33.3)	5 (25)
Imipenem cilastin	5 (15.15)	3 (15)
Aztreonam	21 (63.6)	-
Ceftazidime	28 (84.8)	-

As shown in Table 4, all the *P. aeruginosa* were resistant to ampicillin and amoxyclav because of inheritant resistance mechanism.[5] In *P. aeruginosa* ceftazidime resistance was 84.4%, levofloxacin 81.8%, followed by cefixime and ciprofloxacin (75.8%). We found only 54.5% gentamicin resistance. Imipenam and imipenam cilastin was the least resistant antibiotic against *P. aeruginosa* and Enterobacteriaceae. Among Enterobacteriaceae, ampicillin was the most resistant antibiotic (80%) followed by amoxyclav and ciprofloxacin (65%). Prevalence of ESBL in Enterobacteriaceae was 35% (7 out of 20). Prevalence of carbapenamase resistance in Enterobacteriaceae was 20% (4 out of 20).

DISCUSSION

CSOM is a major global public health problem but its incidence is more in poor socio economical and developing countries. In India there is high prevalence of this disease. Bacteria are believed to gain access to the middle ear cleft from the external auditory canal through the perforation or from the nasopharynx via the eustachian tube or both. Irrespective of entry mechanism of microorganism, biofilm formation has been suggested to explain the recalcitrant nature of CSOM.[6] It's a reason of serious concern particularly in children and young adults because it causes serious problem like communication, language development, education process, physiological and cognitive development.

Due to misuse of antibiotics, the antimicrobial susceptibility pattern of bacteria causing CSOM changes from time to time. This tends to create multidrug resistance among the organisms, thereby making the treatment of CSOM more difficult.[7,8] For rational antibiotic use and successful treatment of CSOM, an appropriate knowledge of antibacterial susceptibility of causative microorganisms is imperative.

In our study CSOM was more common in 11-20 years of age group (30.9%) and 21-30 years of age group (28.4%). Our findings were comparable with studies of Bansal et al, Rejitha et al, which reported maximum number of cases in second and third decade of life.[9,10]

In other studies maximum cases were reported in 1-10 and 11-20 years of age group. Agarwal et al, Choudary, et al. This could be due to the short, wide and straight eustachian tube in infants and children.[11,12]

In this study *Staphylococcus aureus* (43.2%) was the most common pathogen followed by *Pseudomonas aeruginosa* (27.9%). Our findings were in correlation with studies of Prakash et al and Arati et al who had found *Staphylococcus spp*. as the predominant organism causing CSOM.[11,13] In contrast to our study *P. aeruginosa* was most commonly isolated organism from CSOM patients in studies by Kumar et al, Kumar et al.[14,15] Shyamala et al reported that *Staphylococcus spp*. and P. *aeruginosa* was the commonest organism isolated from otitis media.[16]

Among the isolated *S. aureus* from CSOM patients, 31.4% MRSA strain were found in our study. In a study done in Korea by Park et al, MRSA rate was 61.9% which was far more than our study.[7] This low prevalence

of MRSA may be due to the rural inhabitation of the most of the patients with less hospitalization. In our study emergence of antibiotic resistance strain of amoxicillin, amoxyclav, clindamycin, gentamycin, ciprofloxacin was observed. But no resistance found against vancomycin and linezolid. Our findings were similar to the study done by Agrawal et al in which vancomycin and linezolid was 100% sensitive.[11]

P. aeruginosa is one of the most dreaded organisms in CSOM patients. Most of the infections by *P. aeruginosa* are hospital acquired infection. Treatment of this infection becomes very difficult due to increase in multi drug resistance. In our study we found out high resistant to cefepime, ceftazidime, ciprofloxacin, levofloxacin and aztreonam. These findings correlate with the study of Monsoor et al that the isolates were less sensitive to aztreonam, but sensitive to ceftazidime which is in contrast to our findings wherein the isolates were less sensitive to ceftazidime.[18] In contrast to our study more sensitivity of aminoglycosides and fluroquinolones were reported by Poorey et al, Kumar et al and Bansal et al.[9,14,19]

ESBL in Enterobacteriaceae is an emerging problem in health care set up. In our study we found 35% ESBL resistant Enterobacteriaceae among CSOM patients. A study done in this geographical area showed that the prevalence of ESBL was 38.9%.[20]

CONCLUSION

Identification and antibiotic susceptibility testing along with routine screening for ESBL and MRSA production has become essential for all pathogens causing complicated CSOM. There is an urgent need to formulate a policy for enforcement of intervention strategies, empirical therapy and antibiotic sensitivity surveillance measures to prevent emergence and spreading of resistant strain. This study is a baseline study for CSOM in this tribal dominated area of Chhattisgarh state.

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