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Clinico-Bacteriological Profile of Chronic Suppurative Otitis Media in a Teaching Hospital of Uttar Pradesh.

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) is a commonly encountered infection of the middle ear. It can cause extra cranial and intracranial complications and involves considerable morbidity. Although it is a global disease, its incidence has remained relatively higher in resource-constrained countries. Due to its recurrent nature and the development of resistant pathogenic organisms, control of infection poses a greatest therapeutic challenge. Knowledge of the local microbial flora in CSOM is essential for initiating empirical therapy. The objective of our study was to examine the current bacteriological profile and antibiotic sensitivity pattern to locally available antibiotics in CSOM. **Methods:** A total of 157 patients clinically diagnosed of CSOM were enrolled in the study and the samples were obtained from each patient using sterile cotton swabs and were processed as per standard microbiological techniques. Antibiotic sensitivity to ten locally available antibiotics was analyzed. Antibiotic susceptibility testing for bacterial isolates was conducted using Kirby-Bauer disc diffusion method. **Results:** Out of total 157 swabs bacterial growth was seen in 144 (91.72%) with *Pseudomonas aeruginosa* (28.5%) and *Staphylococcus aureus* (22.9%) being the most common bacterial isolates. Among the antibiotics tested amikacin (88.3%), ciprofloxacin (78.9%) and cotrimoxazole (78.2%) were found to be most active against all the isolates, whereas maximum resistance was seen for ampicillin (45.8%). Poor hygiene 79 (50.3%) and pond/river bath 51 (32.5%) were the two most common predisposing factors associated with CSOM. **Conclusion:** In the era of continuously increasing drug resistance among bacteria, periodic monitoring of the bacterial isolates causing CSOM and their antibiogram with clinical correlation is very important. Local antimicrobial susceptibility data should be utilized for formulating antibiotic policy for every institution. Our results will surely help in the modification of hospital's current antibiotic policy and also will optimize the therapy to patients.

Keywords: Amikacin, CSOM, Drug resistance, Otorrhea, Pseudomonas, Staphylococcus.

INTRODUCTION

Chronic suppurative otitis media (CSOM) is a commonly encountered infection of the middle ear. It is defined as chronic or intermittent otorrhea of more than six weeks through a persistent non intact tympanic membrane (TM).[1] CSOM is usually classified into two types, tubo-tympanic and attico-antral depending on whether the disease process affects the pars tensa or pars flaccida of the TM.[2] It is a disease with high risk of irreversible complications which may range from persistent otorrhoea, mastoiditis, labyrinthitis, facial palsy to more serious intracranial abscesses or thromboses.[3] The most important symptoms which make patients seek medical advice are hearing loss and suppurative discharge, reported in around 50% of the cases.[4] The incidence of CSOM is higher in developing countries, especially among the low socioeconomic strata of the society with malnutrition, overcrowding, improper hygiene, recurrent upper respiratory tract infections (URTI) and lack of health education being the major predisposing factors.[2] The urban to rural ratio of the disease is 1:2 and the poorer rural communities have highest prevalence.[5] The associated complications to CSOM were more common in pre-antibiotic era however the advent of antibiotics gave clinicians a tool to use indiscriminately, even in the absence of precise etiological diagnosis. Such haphazard use of antibiotics led to the appearance of multi drug

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resistant (MDR) bacterial strains and disease complication in return.[6]

Chronic suppurative otitis media, whether tubo-tympanic or attico-antral, is almost always associated with mixed bacterial flora. The most common microorganisms found in CSOM are *Pseudomonas aeruginosa*, *Staphylococcus aureus*, coliforms, *Proteus mirabilis* and anaerobic bacteria.[7] Changes in bacterial flora of CSOM in last decade have been confirmed and described by various authors.[1,2,8] With the development and widespread use of antibiotics, the prevalence and antibiogram of these organisms has been reported to vary with time and geographical area.[8] Knowledge of the local microbial flora as well as continuous and periodic evaluation of microbiological pattern and antibiogram of isolates is necessary to decrease the potential risk of complications by early institution of appropriate treatment.

The objective of this cross sectional study was to determine the diversity of aerobic bacterial isolates and their resistogram among the patients suffering from CSOM who attended Department of Otorhinolaryngology and Head and Neck Surgery of our hospital a tertiary care center.

MATERIALS AND METHODS

Patient population: This hospital based cross sectional study was carried out for a period of six months (July 2014 to December 2014) in a tertiary care hospital of Western Uttar Pradesh, India. With the Institutional Ethics Committee approval and individual informed consent (signed by patient or parent/guardian) samples were obtained from 157 patients clinically diagnosed of CSOM.

Inclusion and Exclusion criteria: All the patients having discharge from one or both the ears for more than six weeks duration with TM perforation were included. Excluded from the study were, patients with discharge of less than six weeks duration, discharge with intact TM (otitis externa), and who were on antibiotics (topical/oral/systemic) for last 7 days.

Sample collection and processing: The external auditory canal (EAC) of each patient was cleaned well with alcohol (70% isopropanol) and the aural discharge was collected using sterile cotton swabs (Hi-media Laboratories Pvt. Ltd, Mumbai, India). Utmost care was taken to avoid any contact with the EAC. The specimens collected were transported immediately to microbiology laboratory for processing. The swabs were inoculated on sterile blood agar (BA), chocolate agar (CA), MacConkey's agar (MA) plates and were then incubated at 37°C for 24-48 hrs. Emergent bacterial colonies were identified according to standard procedures.[9,10]

Antimicrobial sensitivity testing (AST) was carried out according to the Clinical Laboratory Standards Institute (CLSI) guidelines by modified Kirby-Bauer disc diffusion method on Muller Hinton agar (MHA) medium.[11] A suspension of the isolated colonies of each test strain equivalent to a 0.5 McFarland's standard was prepared in sterile normal saline. Briefly a suspension of each strain was made so that the turbidity was equal to 0.5 McFarland standards and then plated as a lawn culture onto MHA. Antibiotic discs were placed and plates were incubated at 37°C for 18-24 hrs. Results were interpreted in accordance with CLSI guidelines.[11] *Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 25923 and *Pseudomonas aeruginosa* ATCC 27853 were used as control strains for AST.

All dehydrated media, reagents, sterile swabs and antibiotic discs were procured from Hi-media Laboratories Pvt. Ltd, Mumbai, India

RESULTS

Table 1: Age wise distribution of patients with chronic suppurative otitis media. (n=157).

Age (in years)	Growth	Sterile	Total
0-15	45	2	47
16-30	38	3	41
31-45	33	1	34
46-60	21	2	23
>60	7	5	12
Total	144	13	157

Table 2: Various bacterial isolates from patients with chronic suppurative otitis media (n=144).

Bacterial Isolate	Frequency (%)
Pseudomonas aeruginosa	41 (28.5)
Staphylococcus aureus	33 (22.9)
Klebsiella species	21 (14.6)
Escherichia coli	16 (11.1)
Proteus vulgaris	11 (7.6)
CONS	7 (4.9)
Acinetobacter baumannii	5 (3.5)
Streptococcus pneumoniae	5 (3.5)
Citrobacter freundii	3 (2.1)
Diphtheroids	2 (1.4)
Total	144 (100)

CONS: Coagulase Negative Staphylococcus species

Out of total 157 ear swabs processed, bacterial growth was seen in 144 (91.7%) while 13 (8.3%) samples showed no growth. Monomicrobial growth was seen in 98 (68.1%) whereas 46 (31.9%) samples showed polymicrobial growth. Males (58%) were more commonly affected than females (42%) with male: female ratio of 1.4: 1. The mean age of the patients was 26.2 years and the peak incidence was observed in age group 0-30 years (56.1%). Table 1 shows the age wise distribution of patients with CSOM.

Bacterial growth was seen in 144 (91.72%) with *P. aeruginosa* (28.5%), *S. aureus* (22.9%) and Klebsiella species (14.6%) being the most predominant etiological agents for CSOM. Table 2 depicts the characterization of the bacterial isolates among CSOM patients. Except for the two isolates,

identified as Diphtheroids, AST was carried out for 142 isolates. Amikacin (88.3%), ciprofloxacin (78.9%), cotrimoxazole (78.2%), and ceftazidime (75.4%) were found to be most active against all the isolates, whereas maximum resistance was seen for ampicillin (45.8%). Additional sensitivity against piperacillin was tested for *P.aeruginosa* and 37/41 (90.2%) strains were found sensitive. Table 3 depicts the antibiogram of all the bacterial isolates.

The commonest predisposing factors associated with CSOM were poor hygiene 79 (50.3%), pond/river bath 51 (32.5%), URTI 48 (30.6), smoking active/passive 48 (35.55%). Table 4 depicts the predisposing factors and the socio economic status of all the patients with CSOM.

Table 3: Antibiogram of the bacterial isolates in chronic suppurative otitis media (n=42).

Isolate Tested	No. of Isolates	AMP	AMC	GEN	AMK	CAZ	CFX	CFZ	CTX	CIP
Pseudomonas aeruginosa	41	29	31	33	37	NT	NT	29	31	37
Staphylococcus aureus	33	13	25	25	28	28	28	29	28	28
Escherichia coli	16	4	9	8	13	11	11	12	12	11
Klebsiella pneumoniae	13	1	8	8	11	4	4	9	10	11
Proteus vulgaris	11	7	9	7	10	4	4	5	7	4
Klebsiella oxytoca	8	Nil	4	5	8	3	3	5	3	5
CONS	7	5	5	4	7	6	6	6	7	5
Acinetobacter baumanii	5	1	3	3	5	3	3	4	5	3
Streptococcus pneumoniae	5	5	5	NT	NT	5	5	5	5	5
Citrobacter freundii	3	Nil	1	1	2	1	1	3	3	3
Total	142	65	100	92	121	65	65	107	111	112

NT: Not tested, CONS: Coagulase Negative Staphylococcus species, AMP: Ampicillin, AMC: Amoxycillin Clavulanic acid, AMK: Amikacin, CAZ: Cefazolin, CFX: Cefuroxime, CFZ: Ceftazidime, CTX: Cotrimoxazole, CIP: Ciprofloxacin, GEN: Gentamicin

Table 4: Associated predisposing factors and the socioeconomic status of patients with chronic suppurative otitis media (n=157).

Predisposing factors	No. of cases (%)	Socio-economic status		
		Low	Upper middle	High
Poor hygeine	79 (50.3)	72	07	Nil
Pond/river Water bath	51 (32.5)	47	04	Nil
URTI	48 (30.6)	32	13	03
Smoking (active/passive)	48 (30.6)	34	02	12
Supine bottle feed	34 (21.6)	28	02	04
Deviated nasal septum	30 (19.1)	14	05	11
Chronic tonsillitis	27 (17.2)	13	08	06
Foreign body in ear	14 (8.9)	09	01	04
Adenoids	6 (3.8)	05	Nil	01
Tuberculosis	4 (2.5)	03	01	Nil

URTI: Upper respiratory tract infection

DISCUSSION

The cardinal symptoms of CSOM include prevalent otorrhea and progressive conductive deafness. Bacteria are believed to gain access to the middle ear cleft either from the EAC through the perforation or from the nasopharynx via the eustachian tube or both. But regardless of the entry mechanism, biofilms formation has been suggested to explain the recalcitrant nature of CSOM.[7,12] The untreated cases of CSOM can result in broad range of complications such as irreversible local destruction of middle ear structures, facial palsy, serious intracranial abscesses and thromboses.[3,13] However early diagnosis and treatment if instituted effectively can avoid such complications.

In the present study, ear swab of 8.3% cases were sterile, and 91.7% yielded bacterial growth. This is in comparison with the results found by other researchers.[14-16] Results showed *P. aeruginosa* and *S. aureus* as the most common isolates from active CSOM infection, this is in tandem with the observations made by various other authors. [3,17-21] In contrast many researchers have reported *S. aureus* as the predominant causative agent for CSOM followed by *P. aeruginosa*,[15,22-27] and this could be due to the geographical variations and the different group of population studied. The increased isolation rate of *P. aeruginosa* has its own implications, as this organism is an important cause of nosocomial infections and has developed resistance to even more potent antibiotics. Pseudomonas being an opportunistic extracellular pathogen, thrives well in the warm damp external auditory meatus of CSOM patients, is difficult to eradicate and has been particularly implicated in the causation of bony necrosis and mucosal disease.[28] It's presence in middle ear is almost always associated with

secondary invasion to middle ear via defect in TM.[8,29]

Coliforms including *E. coli* and Klebsiella species were isolated from 25.7% cases and these findings were tandem to the reports by other researchers.[30,31] Frequent isolation of fecal bacteria like *E. coli*, Klebsiella and water bacteria like Pseudomonas indicates that individuals are at high risk of infection due to poor hygiene conditions.[15] In the current study, poor hygiene (50.3%) was also one of the commonest predisposing factors which further substantiate our findings. Pond/river bath (32.5%), and URTI (30.6%) were among the other major factors possibly associated with CSOM. We speculate that these factors may have been responsible for high prevalence of *P. aeruginosa* (known cause of Swimmer's ear), coliforms and *S. aureus* as the causative agents of CSOM. Moreover, majority of the patients were socioeconomically poor which may have further contributed to the high prevalence of the disease.

Among the various antibiotics tested amikacin, ciprofloxacin, ceftazidime, piperacillin were found to be most effective. Moreover gentamicin and ciprofloxacin, two commonly used ototopical agents showed good activity against most of the bacterial isolates. Aminoglycosides, the bactericidal antibiotics interfere with protein synthesis and are quite frequently used because of their activity against the gram negative bacteria. In the present study both *P. aeruginosa* and *S. aureus* showed good sensitivity to amikacin and gentamicin, and the finding is supported by previous studies.[29,32] Amikacin was found to be the most effective aminoglycoside, however its unavailability as topical preparation prevents its routine use. Although the few cases documented, but risk of ototoxicity due to aminoglycoside overuse should also be kept in mind.[33] Topical quinolones are considered as promising options in the management of CSOM. Quinolones inhibit the bacterial DNA gyrase or the topoisomerase-II, thereby inhibiting DNA replication and transcription. Our results showed 78.9% of all isolates sensitive to ciprofloxacin indicating that it is considerably effective in our community. However the treatment with topical quinolones needs to be closely monitored to prevent any secondary fungal growth causing otitis externa.

Knowing the etiological agents of CSOM and their antimicrobial susceptibility is of essential importance for an efficient treatment, prevention of both complications and development of antibiotic resistance and finally, the reduction of the treatment costs. Our results when compared with the findings of other researches, clearly indicated the change in microbial profile and AST pattern with due course of time. Geographical variation and difference in patient population studied could be the possible factor for variability. Changes in the microbial flora, introduction of more sophisticated synthetic antibiotics and the changing AST pattern increases the relevance of culture and sensitivity which serves as an important tool for the clinician to plan the treatment of a chronically discharging ear.

CONCLUSION

In the era of continuously increasing drug resistance among bacteria, periodic monitoring of the bacterial isolates causing CSOM and their antibiogram with clinical correlation is very important. Our results will surely help in the modification of hospital's current antibiotic policy and also will optimize the therapy to patients. It is important to culture the aural discharge from CSOM patients before administering any antibiotic (local/systemic). Moreover use of substandard antibiotics, prescription of illogical antimicrobial combinations by unskilled local medical practitioners, over the counter sale of antibiotics without prescription is common in Indian setting and is one of the reasons for antimicrobial resistance. Also as higher incidence of disease was seen among children so as a preventive strategy, parents should be educated about the possible risk factors of disease, this might reduce the disease prevalence.

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