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Bacteriological Profile and Pattern of Antibiotic Sensitivity in Subjects with Chronic Suppurative Otitis Media in a Medical College from Uttar Pradesh, India

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ABSTRACT

Background: Chronic Suppurative Otitis Media (CSOM) is widely known for its persistent course and frequent recurrence. Microbiology cultures usually show the growth of numerous organisms, frequently multiple and these differ based on patient characteristics and whether or not antibiotics have been recently used. Objectives: To identify common causative organisms of CSOM among subjects attending the ENT outpatient department in a medical college from northern India and document the sensitivity to antibiotics. **Methods:** The study was done on 100 patients with complaints of ear discharge. Aural discharge samples were collected using sterile swabs, subjected to culture and sensitivity and the organisms isolated were identified through morphological and cultural characteristics. **Results:** Most common organism causing CSOM was Staphylococcus aureus, followed by Pseudomonas aeruginosa. Most patients with Staphylococcus infection were sensitive to vancomycin (96.3%), gentamycin (85.2%), Linezolid (81.5%), Azithromycin (77.7%) and amikacin (74.1%). Patients with Pseudomonas aeruginosa were sensitive to amikacin (93.3%) and ciprofloxacin (80.0%). **Conclusion:** Early intervention using appropriate antibiotics can decrease the chronicity of CSOM and can help in preventing long term complications.

Keywords: Bacteriology, chronic suppurative otitis media, CSOM, antibiotic sensitivity, culture.

INTRODUCTION

Chronic Suppurative Otitis Media is a chronic inflammation of middle ear.[1] It is well known clinically for its recurrence and persistent infection.[1] It is one of the common causes of deafness and may also cause permanent perforation.[1,2] The disease usually occurs after upper respiratory viral infections followed by invasion of pyogenic organisms.[2] Previous studies have shown that the common organisms causing CSOM are Pseudomonas species, Staphylococcus aureus, Klebsiella pneumoniae and Proteus species.[1,2]

CSOM is usually classified into two types- tubotympanic and attico-antral depending on whether the disease process affects the pars tensa or pars flaccida of the tympanic membrane.[3] Tubotympanic is known as a safe type or benign type as there is no serious complication whereas, attico-antral is called as the unsafe or dangerous type because of associated complication. Infection can often spread from middle-ear to important structures namely mastoid, facial nerve, labyrinth, lateral sinus, meninges and brain, thereby leading to mastoid abscess, facial nerve, paralysis, deafness, lateral sinus thrombosis, meningitis and intracranial abscess.[3] Out of all the complications, hearing loss associated with chronic ear discharge is nearly always significant and reported in 50% of cases.[3,4]

Recent years have seen an increase in the incidence of CSOM in the developing countries and this is mainly because of the poor hygienic practices and lack of health education.[5] Antibiotics have played an important role in reducing the complications of CSOM. However, irrational use of antibiotics has lead to the emergence of resistant organisms.[5] The indiscriminate and unregulated use of broad spectrum antibiotics and inadequate follow up of patients has resulted in the emergence of multiple resistant strains of bacteria which lead to recurrence and persistence of low grade infections.[5] Consequently, assessing in-vitro antibiotic sensitivity pattern has become important for the clinician to plan a general outline of treatment for a patient with a chronically discharging ear.

This study was carried out to know the bacterial etiology of CSOM and their antibiotic susceptibility pattern. This knowledge is very important for the

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clinicians for appropriate management of the cases and to prevent or minimise the occurrence of complications. Treatment of the cases after studying the antimicrobial susceptibility pattern will probably help in preventing the emergence of resistant strains in the community.

MATERIALS AND METHODS

This hospital based, prospective study was conducted for a period of 6 months (November 2018 to April 2019) in the ENT department of Rama Medical College in Uttar Pradesh, India. A written informed consent (signed by patient or parent/guardian) was obtained at enrollment. The study was done in accordance with the ethical standards on human experimentation. A total of 100 patients who presented to the outpatient department with complaints of ear discharge and were clinically diagnosed of CSOM but who did not receive antimicrobial therapy were included in the study. Patients of all ages and either gender were included.

Inclusion criteria

The patients with active aural discharge (either unilateral or bilateral) for atleast 3 months and with a visible tympanic membrane perforation, belonging to different age, sex, religion, and different classes, were included in the study.

Exclusion criteria

Patients with ear discharge of less than 3 months duration, patients with ear discharge with intact tympanic membrane (otitis externa) & patients receiving antibiotics at the time of presentation or within a week of presentation will be excluded. The patients with aural discharge due to any cause other than CSOM (foreign body ear, otomycosis, furuncle in the ear, etc.) were also excluded from the study. Also excluded were patients with a history of recent trauma to the ear.

Sample Collection and identification of pathogens

Ear discharge was obtained from the diseased ear of the patient, using two separate pre-sterilized swabs. One of the swabs was used for aerobic culture and was plated on 5% sheep blood agar (BA), MacConkey's agar and chocolate agar (CA) which were then incubated at 37°C for 48 hours. Second swab was used for anaerobic culture and was inoculated in Robertson's cooked meat (RCM) broth; thereafter incubated at 37°C for 72 hours. On third day, sub-cultures from RCM were made on 5% BA and Neomycin BA (Neomycin concentration of 70 µg/ml). Dynox anaerobic jar based on Marshal's chromous absorption principle was used for anaerobic culture.[6] All organisms were identified using standard procedures.[7] We conducted antimicrobial sensitivity testing for aerobic isolates using Kirby Bauer disc diffusion method on Muller Hinton agar.[8] All results and outputs were interpreted in accordance with central laboratory standards institute guidelines.[9]

RESULTS

Table 1: Age distribution of the study subjects (N=100)

Age of the study subjects (in years)	Number (%)
6-10	51 (51.0)
11-20	16 (16.0)
21-30	14 (14.0)
31-40	6 (6.0)
41-50	4 (4.0)
51-60	4 (4.0)
61-70	3 (3.0)
71-80	2 (2.0)
Total	100(100.0)

Table 2: Gender distribution of the study subjects (N=100)

Gender	Number (%)
Male	57 (57.0)
Female	43 (43.0)
Total	100(100.0)

Table 3: Type of growth obtained from ear discharge

Type of growth	Total isolates (%)
Pure growth	75 (75.0)
Mixed growth	20 (20.0)
No growth	5 (5.0)
Total	100 (100.0)

Table 4: Pure growth in culture of chronic suppurative otitis media

Organisms	Number of isolates (%)
Staphylococcus aureus	
MSSA	21 (28.0)
MRSA	8 (10.7)
CONS	6 (8.0)
Pseudomonas aeruginosa	24 (32.1)
Klebsiella species	6 (8.0)
Escherichia coli	4 (5.3)
Proteus species	4 (5.3)
Enterobacter species	1 (1.3)
Citrobacter species	1 (1.3)

MRSA- Methicillin resistant staphylococcus aureus; MSSA- Methicillin sensitive staphylococcus aureus; CONS- Coagulase negative staphylococcus aureus

Table 5: Mixed growth in culture of chronic suppurative otitis media

Organisms	Number of isolates (%)
Staphylococcus aureus	
MSSA	6 (30.0)
MRSA	4 (20.0)
Pseudomonas aeruginosa	6 (30.0)
Klebsiella species	1 (5.0)
Escherichia coli	1 (5.0)
Proteus species	2 (10.0)

MRSA- Methicillin resistant staphylococcus aureus; MSSA- Methicillin sensitive staphylococcus aureus

In the present study, majority of the patients were of 6–10 years of age (51%), followed by 16% in 11–20 years age category and 14% patients in the 21–30 years age category [Table 1]. Majority of the study participants were males (57.0%) [Table 2]. A total of 75 percent of the isolates showed pure growth,

whereas 20% were mixed growths and no growth was seen in 5% patients [Table 3].

Staphylococcus aureus (35/75, 46.7%) and Pseudomonas aeruginosa (24, 32.1%) were identified to be the most common causative bacteria as pure growth [Table 4]. Methicillin sensitive S. aureus (MSSA) isolates (n=21; 28.0%) were more in number than methicillin resistant S. aureus (MRSA) (n=8; 10.7%) or coagulase negative S. aureus (CONS) (n=6; 8.0%). The remaining isolates were growing the other bacteria- Klebsiella spp (8.0%), Escherichia coli spp (5.3%). Proteus spp. (5.3%), Enterobacter spp.(1.3%), and Citrobacter sp. (1.3%) [Table 4]. S. aureus (50.0%) and P. aeruginosa (30.0%) were identified to be the most common causative bacteria as mixed growth. MSSA (30.0%) isolates were more in number than MRSA (20.0%). Other organisms grown were Klebsiella species (5.0%), E. coli (5.0%), and Proteus species (10.0%) [Table 5].

MSSA was mainly sensitive to vancomycin (96.3%), gentamycin (85.2%), Linezolid (81.5%), Azithromycin (77.7%) and amikacin (74.1%). A total of 66.7% participants had sensitivity to cefuroxime and clindamycin. MRSA showed maximum sensitivity to vancomycin (100%), gentamycin (100%), linezolid (91.2%) and clindamycin (83.3%). It was resistant to amoxyclav completely. Pseudomonas showed maximum sensitivity to amikacin (93.3%) and ciprofloxacin (80.0%). Maximum resistance was to amoxyclav (73.3%), clindamycin (66.6%), cefuroxime (63.3%) and linezolid (63.3%) [Table 6].

Table 6: Antibiotic sensitivity pattern of major isolates

	Amikacin	Clindamycin	Ciprofloxacin	Amoxyclav	Gentamycin	Linezolid	Vancomycin	Azithromycin	Cefuroxime
MSSA (N=27)									
Sensitive	20	18	8	13	23	22	26	21	18
Resistant	7	9	19	14	4	5	1	6	9
MRSA (N=12)									
Sensitive	8	10	3	0	12	11	12	4	4
Resistant	4	2	9	12	0	1	0	8	8
Pseudomonas (N=30)									
Sensitive	28	10	24	8	17	11	14	13	11
Resistant	2	20	6	22	13	19	16	17	19

MRSA- Methicillin resistant staphylococcus aureus; MSSA- Methicillin sensitive staphylococcus aureus

DISCUSSION

CSOM is a chronic infective condition of the middle ear that is characterized by persistent or recurrent discharge through a perforation of the tympanic membrane.[1] Infection usually spreads from middle ear to vital structures such as facial nerve, mastoid, labyrinth, lateral sinus, brain and meninges leading to a number of complications such as mastoid abscess, facial nerve paralysis, deafness, lateral sinus thrombosis, meningitis, and intracranial abscess.[3] Although the incidence of such complications is probably low, they should be searched for when faced by a patient with active CSOM. It is quite reassuring that early bacteriological diagnosis can assure appropriate and effective therapy.[4] It is important to note that the selection of the antibiotic is largely influenced by its efficacy and resistance of bacteria, safety as well as risk of toxicity.[5] It is worth to underscore that effective antibiotic therapy depends on the extent of knowledge of the nature of infecting organisms.[5]

In our study, we noticed a high prevalence of CSOM in the age group of 6–10 years followed by 11–20 years. Similar results were seen in studies done in other parts of the world.[5,10,11] The high prevalence of otitis media in early age group may be due to the fact that children are usually more prone to develop upper respiratory tract infections (URTIs) and that the cold weather predisposes children to URTI.[3,12,13] It has also been observed that poor hygiene and non-scientific approach to treatment such as use of unconventional ear drops and local home remedies such as oil and honey into the middle-ear may aggravate infections leading to blockage of eustachian tube.[14] Analysis of the gender distribution in this study revealed that CSOM was found to be more common in males (57%) than in females (43%). This is consistent with study done by Patigaroo et al,[5] and Moshi et al.[15] where the authors noted a higher incidence in male population. Five percent of the patients in our study had no growth in culture, while 75% had pure growth and 20% had mixed growth. Similar results were shown in other studies as well.[4,5,16] These studies showed that the incidence of sterile growth was least while incidence of pure growth had shown the highest trends. It is important to note that unlike studies done by Fliss et al.[17] Maji et al.[1] Malkappa et al.[16] and Indudharan et al,[18] where the most common causative agent was P. aeruginosa, our study showed the most common causative agent was S. aureus (46.7% in pure growth and 50.0% in mixed growth), while P. aeruginosa had the 2nd most common incidence (32.1% in pure growth and 30.0% in mixed growth).

MSSA in our study was mainly sensitive to vancomycin (96.3%), gentamycin (85.2%), Linezolid (81.5%), Azithromycin (77.7%) and amikacin (74.1%), whereas in the study done by Patigaroo et al.[5] MSSA was sensitive to linezolid (92.5%), amoxiclav (90%), vancomycin (90%), cefuroxime (80%), and amikacin (45%). In the present study, MRSA showed maximum sensitivity to vancomycin (100%), gentamycin (100%), linezolid (91.2%) and clindamycin (83.3%). It was resistant to amoxyclav completely. In the study done by Patigaroo et al.[5] all the MRSA isolates were sensitive to vancomycin, linezolid, tetracycline, and doxycycline, 33% isolates to gentamicin, ciprofloxacin, clindamycin, and co-trimoxazole, and 17% isolates to erythromycin. Pseudomonas in our study showed maximum sensitivity to amikacin (93.3%) and ciprofloxacin (80.0%). Maximum resistance was to amoxyclav (73.3%), clindamycin (66.6%), cefuroxime (63.3%) and linezolid (63.3%). In a study done by Loy et al.[19] P. aeruginosa was shown to be sensitive to ceftazidime, ciprofloxacin, piperacillin, and amikacin. In the study by Nazir and Kadri,[11] the most effective antibiotic against P. aeruginosa was amikacin (92.30%), followed by piperacillin (79.48%), imipenem, piperacillin plus tazobactam, levofloxacin, and ceftazidime.

We found in our study, that S. aureus is the most common reason for CSOM in the patients among which MSSA and MRSA are almost equally responsible, and Gram negatives are not commonly involved. Hence we would like to believe that empirical antibiotics if prescribed to patients should certainly cover Gram positives (S. aureus) and especially if possible, they should cover MRSA. Recent studies have indicated that the microbial profile and antibiotic sensitivity pattern of CSOM has been highly dynamic with due course of time. Further, emergence of antimicrobial resistance is becoming common. Indiscriminate and dysregulated use of antibiotics could be the potential factors responsible. It is also worthwhile to note that poor and inadequate compliance by the patients could also be a factor responsible for growing antibiotic resistance as patients tend to stop taking antibiotics before the completion of therapy and allow the partly resistant microbes to flourish. It is therefore very crucial that patients should be instructed to avoid such practice. Changes in the microbial flora following the advent of antibiotics increase the relevance of and reappraisal of the modern day flora and therefore in vitro antibiotic sensitivity pattern is very important for the clinician to structure and plan the treatment a patient suffering from CSOM.

CONCLUSION

CSOM is a chronic condition that has immense capability to limit an individual's quality of life. From what is currently known, it mainly affects those that are in their childhood or early adulthood. Ear discharge is an early symptom and deafness could be a highly significant complication. S. aureus is the most common causative organism isolated from CSOM patients, followed by P. aeruginosa. Early, appropriate and effective intervention using antibiotics has the potential to decrease the chronicity of CSOM and prevent long term complications. With the current widespread use of antibiotics, there has been significant alteration in the types of pathogenic micro-organisms and their resistance to antibiotics. It is therefore imperative that continuous and periodic evaluation of microbiological pattern and antibiotic sensitivity of isolates is done in order to decrease the potential risk of antibiotic resistance and emergence of complications. Educating parents and caregivers on possible risk-factors may be a preventive strategy that could potentially reduce disease occurrences.

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