

Aerobic Bacterial Aetiology and the Antibiotic Susceptibility among Cases Diagnosed with Chronic Suppurative Otitis Media in a Tertiary Health Care Centre, Andhra Pradesh

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ABSTRACT

BACKGROUND

Chronic suppurative otitis media (CSOM) is the chronic inflammation of the middle ear. It can cause permanent perforation and is known for its' recurrence and persistent infection. Chronic Suppurative Otitis Media (CSOM) is one of the common hearing problems which can cause many complications if not treated at early stage. Injudicious use of antibiotics and increasing use of higher antibiotics has led to persistent change in microbial flora. Hence, the aim of the study is to identify the bacterial isolates causing CSOM and to study their antimicrobial susceptibility pattern.

METHODS

A hospital based cross sectional study was carried out in Katuri Medical College and Hospital, Guntur, for a period of 12 months from January 2017 to January 2018. A total of 230 patients of CSOM with unilateral or bilateral discharge attending the ENT department were included in the study. Bacterial isolates from ear discharge were identified using standard methods and antibiotic susceptibility testing was done and the results were interpreted.

RESULTS

Out of 230 samples collected from diagnosed cases of CSOM, significant pathogens were isolated in 167 samples. It was observed that females 52% (120) were found to be more affected with CSOM than males. Majority with CSOM i.e. 34% (78) belonged to 11-20 years age group followed by 27% (61) in 21-30 years age group. Right ear involvement was observed in 37% (86) of the study samples. Pure growth from the sample was observed in majority of the collected samples in this study. Majority of the isolates in this study were found to be Gram negative. In our study the predominant Gram positive species isolated was *Staphylococcus aureus* and predominant Gram negative species was found to be *Pseudomonas aeruginosa* followed by *Proteus spp.*, *Escherichia coli*, *Klebsiella spp.*, *Acinetobacter* and *Citrobacter spp.* Antibiotic sensitivity shows *Pseudomonas aeruginosa* 86.7% (65) with sensitivity towards Piperacillin-Tazobactam, Gentamicin, Amikacin, Imipenem, and *Staph aureus* showed sensitivity towards Linezolid, a first line drug followed by erythromycin, clindamycin.

CONCLUSIONS

Proper care needs to be taken while treating and it is strongly recommended to use selected local or systemic antibiotics guided by culture and sensitivity. It is mandatory to study each case of CSOM bacteriologically to formulate local antibiotic policy for appropriate use of antibiotics. This will certainly help in achieving a safe ear and to control the organisms developing resistance to prevalent antibiotics

KEY WORDS

Chronic Suppurative, Otitis Media, Aerobic Bacteria, Antibiotic Susceptibility

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BACKGROUND

CSOM is one the most commonly encountered diseases in the day to day practice of otorhinolaryngology.² CSOM usually develops in the first decade of life but can persist during adulthood. Prevalence of CSOM is more in the developing and underdeveloped countries. According to WHO, the prevalence of CSOM in India is more than 4% and it falls among those countries where urgent attention is needed.³ The incidence of CSOM is increasing in the developing countries because of low socio-economic status, poor nutrition, poor hygienic practices and lack of health education.^{4,5} Other risk factors involved in pathogenesis of CSOM are recurrent upper respiratory infections, breast-feeding while lying down, craniofacial malformation and Eustachian tube defect.⁶

The aerobic microorganisms most frequently isolated in CSOM are *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus* species, *Klebsiella* species, *Escherichia* species, *Acinetobacter*, *Citrobacter* spp etc.⁷ The complications of CSOM have been reduced to a greater extent because of the use of antibiotics. But irrational use of antibiotics has led to the emergence of resistant organisms to the commonly used drugs. Inadequate antibiotic treatment, misuse/improper choice of antibiotic and poor compliance of patients have resulted in changes in susceptibility to antibiotics of the causative organisms and also development of resistance to commonly used antibiotics. Thus, this study aimed to identify the aerobic bacterial aetiology and determine antibiotic susceptibility pattern in CSOM patients in a tertiary Health care centre, KMC&H, Guntur, Andhra Pradesh.

We wanted to study the bacteriological profile and antibiotic susceptibility pattern in CSOM patients.

METHODS

The present study was conducted in the Department of Microbiology of Katuri medical college, Guntur, Andhra Pradesh along with ENT department for a period of 12 months from January 2017 to January 2018. A total of 230 samples from clinically diagnosed cases of CSOM of all age groups and both sexes attending outpatient department of ENT as well as those admitted in ENT ward of Katuri Medical College, Guntur were included in this study.

Inclusion Criteria

Patients who were diagnosed as suffering from CSOM after thorough clinical evaluation by an ENT Surgeon, patients of all age groups and both sexes, patients who were not on antibiotic both systemically and topically for minimum of 24 hours prior to sample collection were included in this study.

Exclusion Criteria

1. Patients who were suffering from CSOM and were on systemic antibiotics or who were on topical medication to the ear.
2. CSOM Cases with fungal aetiology.
3. ASOM and otitis externa were excluded from this study.

The aim and objectives of the study were explained to the study participants and an informed consent was taken from

the patient or from the guardian (in case of minor) in the prescribed format.

A pre-designed semistructured questionnaire which include demographic details and relevant clinical data was used for the present study. Ethical committee clearance was obtained from the institutional ethics committee before initiation of the study.

Methodology

The external ear was wiped with sterile cotton and then with 70% alcohol and allowed to dry. With the aid of head mirror and lamp as a source of light, sterile ear speculum was introduced into the ear and taking aseptic precautions, the ear discharge was collected using sterile cotton swabs in duplicate prior to instillation of any topical medication. One swab was used for microscopy for Gram staining following standard protocol.⁸ The second swab was then inoculated on Blood agar (BA), MacConkey agar (MA) and finally in Brain heart infusion (BHI) broth. Blood agar and MacConkey agar plates were then incubated at 37°C for 16 -18 hours. In case of no growth, plates were re-incubated for 48 hours and subculture was done from BHI broth on BA and MA at 37°C. If growth was observed preliminary tests like colony characteristics, Gram stain, catalase, oxidase, coagulase and motility test were carried out as per standard procedures.⁹ Final identification of the pathogen was done according to standard microbiological procedures. The antimicrobial susceptibility testing was done by Kirby Bauer Disc Diffusion Method. Results were interpreted using Clinical Laboratory Standards Institute [CLSI] Guidelines.

The data tabulation was done using Excel 2013 and tables are represented in the form of frequencies and percentages.

RESULTS

The present study shows, out of 230 ear swabs processed, 160(69.5%) samples showed pure culture, 7(3.2%) samples showed mixed cultures, 63 (27.3%) samples showed no growth. (Table 1).

In the present study, out of 230 Study participants, female 52% (120) were found to be more affected with CSOM compared to male 48%(110) (Table 1). Among the study participants, the highest percentage. i.e., 34% (78) were in 11-20 years age group followed by 27% (61) in 21-30 years age group. Thus, in the present study, it can be observed that 11-30 years age group people are most affected age groups with CSOM (Table 1). Based on the site wise distribution with CSOM among the study participants, right ear involvement was observed in 37% (86) and 34%(78) show left ear involvement. Bilateral involvement was observed in 29% (66). (Figure 1)

From the bacterial isolates, 123 (53.5%) samples showed Gram negative reaction and 51 (22.2%) samples showed Gram positive reaction and no reaction was observed in 56 (24.3%) samples. (Table 2)

Out of the total sample of 230, 174 samples have shown Gram reactivity, among those Gram-positive bacteria was found in 51 samples and 123 samples yielded Gram negative bacteria. Among Gram positive bacteria, *Staphylococcus aureus* 86.2% (44) was identified to be prominent species

causing CSOM and among the Gram negative bacteria predominantly *Pseudomonas* 60.97% (75), *Proteus spp.* 13% (16), *E.coli* 10.57% (13) and *Klebsiella spp.* 8.95% (11) were identified causing CSOM as per the results of this study. (Table 2)

Among the Gram positive bacteria, out of the 44 isolates of *Staph aureus* shows highest sensitivity towards Erythromycin 59% (26), Clindamycin by 54.5%(24), Gentamicin and Amikacin by 36.3% (16) each and 29.5% (13) showed sensitivity to ceftriaxone, Sensitivity to penicillin was 15.9% (7) and cefoxitin 6.8%(3).To the higher antibiotic Linezolid 81.8% (36) sensitivity was observed in the present study. (Table 3)

Among the Coagulase negative *Staph aureus* (n=5), 80% (4) showed sensitivity to gentamycin and linezolid. 20% (1) isolate showed sensitivity to penicillin and cefoperazone – sulbactam.

Among the 75 isolates of *Pseudomonas*, 86.7% (65) samples show sensitivity towards Piperacillin-Tazobactam, 85.3% (64) showed sensitivity towards Amikacin, 70.7% (53) showed sensitivity towards Gentamycin, sensitivity towards Imipenem was identified to be 68%(51). 4% (3) show sensitivity towards Ampicillin. (Table 4)

Out of 16 isolates of *Proteus spp.*, 100% showed sensitivity towards Piperacillin –Tazobactam, Amikacin followed by decreasing sensitivity towards gentamycin, imipenem, ciprofloxacin, cefoperazone –sulbactam, cotrimoxazole.

Out of 13 Isolates of *E coli*, 92.3% (12) showed sensitivity towards Piperacillin-Tazobactam, Ciprofloxacin, Gentamycin. The least sensitivity i.e. 7.7% was observed with Ampicillin.

Among the 11 isolates of *Klebsiella*, 100% Antibiotic sensitivity was observed towards Cefoperazone-Sulbactam, Gentamycin, Amikacin, Piperacillin-Tazobactam, and the least sensitivity 72.7% (8) towards Co-Trimoxazole.

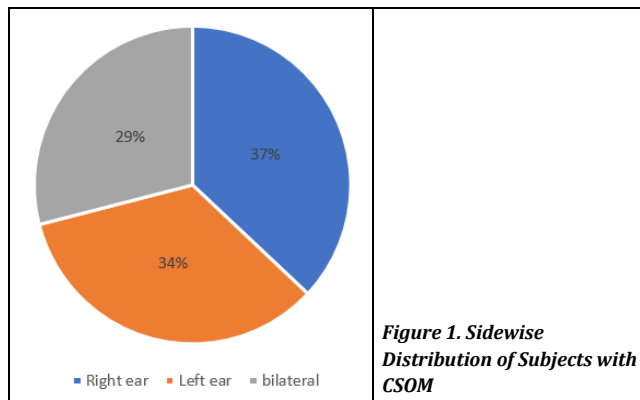


Figure 1. Sidewise Distribution of Subjects with CSOM

Culture	No. of Isolates	Percentage
Pure growth	160	69.5%
Mixed growth	7	3.2%
No growth	63	27.3%
Age Group	Total Subjects (n=230)	Percentage
1-10	14	6%
11-20	78	34%
21-30	61	27%
31-40	35	15%
41-50	14	6%
51-60	18	8%
61-70	10	4%
Gender	Total Study Subjects (N=230)	Percentage
Male	110	48%
Female	120	52%

Table 1. Distribution based on Growth in Culture, Age Wise and Gender Wise Distribution of Subjects Affected by CSOM

Reactivity	Bacterial Isolate	Percentage
Gram +ve	51	22.2%
Gram -ve	123	53.5%
No Reaction	56	24.3%
Type of Organism	n=174	Percentage
Gram +ve	n=51	100%
<i>Staph. aureus</i>	44	86.2%
Coagulase Negative Staph	5	9.9%
<i>Diphtheroids</i>	2	3.9%
Gram -ve	n=123	100%
<i>Pseudomonas</i>	75	60.97%
<i>Klebsiella</i>	11	8.95%
<i>E. coli</i>	13	10.57%
<i>Proteus Vulgaris</i>	9	7.3%
<i>Proteus Mirabilis</i>	7	5.70%
<i>Acinetobacter. Spp.</i>	6	4.88%
<i>Citrobacter</i>	2	1.63%

Table 2. Gram Reactivity of Bacterial Isolate and Type of Bacterial Species Isolated from Samples of Swabs

Antibiotics	<i>Staphylococcus aureus</i> (n=44)		Coagulase Negative <i>Staphylococcus</i> (n=5)	
	n	%	n	%
Penicillin	7	15.9	1	20
Cefoxitin	3	6.8	2	40
Erythromycin	26	59	1	20
Clindamycin	24	54.5	2	40
Co-trimoxazole	10	22.7	2	40
Gentamycin	16	36.3	4	80
Amikacin	16	36.3	3	60
Ciprofloxacin	17	38.6	2	40
Linezolid	36	81.8	4	80
Ceftriaxone	13	29.5	2	40
Cefoperazone-Sulbactam	3	6.8	1	20

Table 3. Antibiotic Sensitivity Pattern of Bacterial Isolates (Gram Positive Organisms) (n=49)

Antibiotics	<i>Pseudomonas</i> (n=75)		<i>Proteus Species</i> (n=16) (<i>Vulgaris</i> (n=09) and <i>mirabilis</i> (n=07))		<i>E-Coli</i> (n=13)		<i>Klebsiella</i> sps (n=11)		<i>Acinetobacter</i> (n=06)		<i>Citrobacter</i> (n=02)	
	n	%	n	%	n	%	n	%	n	%	n	%
Ampicillin	3	4.0	02	12.5	01	7.7	-	-	01	16.7	01	50
Ceftriaxone	30	40.0	05	31.25	08	61.5	10	90.9	03	50.0	01	50
Ceftazidime	38	50.7	04	25	08	61.5	10	90.9	03	50.0	01	50
Cefoperazone – Sulbactam	42	56.0	11	68.75	10	76.9	11	100.0	03	50.0	01	50
Co-trimoxazole	14	18.7	14	87.5	03	23.1	08	72.7	04	66.7	01	50
Gentamycin	53	70.7	14	87.5	12	92.3	11	100.0	06	100.0	01	50
Amikacin	64	85.3	16	100	11	84.6	11	100.0	05	83.3	01	50
Ciprofloxacin	39	52.0	14	87.5	12	92.3	10	90.9	04	66.7	01	50
Piperacillin – Tazobactam	65	86.7	16	100	12	92.3	11	100.0	04	66.7	01	50
Imipenem	51	68.0	14	87.5	10	76.9	10	90.9	03	50.0	01	50
Meropenem	12	16.0	12	75	09	69.2	09	81.8	03	50.0	01	50
Aztreonam	17	22.7	-	-	09	69.2	-	-	-	-	-	-
Tobramycin	13	17.3	-	-	-	-	-	-	-	-	-	-

Table 4. Antibiotic Sensitivity Pattern of Bacterial Isolates (Gram Negative Organisms) (n=123)

DISCUSSION

Chronic Suppurative Otitis Media is a major health problem and occurs with a high incidence and prevalence in both developed and developing countries. In India, due to temperate climate with heavy monsoons, CSOM is a major complaint encountered in ENT clinics. In the present study an attempt was made to know the bacteriological profile of CSOM along with their antimicrobial susceptibility patterns from the cases of CSOM in the population attending Katuri Medical College and Hospital, Guntur.

In this study gender wise dominance of CSOM was observed to be more in female patients. Similar findings were observed in study done by Prakash m etal⁷ in 2013, Ashutosh Rawat et al¹⁰ in 2015, Raghukumar et al.¹¹

It was observed in this study that much of the affected subjects by CSOM are in between 11-30 years. Similar observations were observed in various studies done by Ashutosh Rawat et al. Raghukumar et al. But in study done by Mary Nirmala et al¹² the predominant age group of occurrences of CSOM was 41-50 and another study done by Hirapure et al¹³ showed the age of occurrence of CSOM is more during 0-20 years. In study done by Mary Nirmala et al, unilateral CSOM were more common than bilateral CSOM our study showed similar findings. As per study done by Hirapure et al right ear is more effected than left ear and it is similar to this study finding and also study done by Mary Nirmala et al.

Pure growth from the sample was observed in majority of the collected samples in this study and such similarities were observed in studied done by Raghu Kumar et al and Ashutosh Rawat et al. Majority of the isolated samples in this study were found to be gram negative and similar findings were observed in studies done by Raghu Kumar et al, Hirapure et al, Ashutosh Rawat et al. In this study on culture the most predominant Gram positive species isolated is found to be *Staphylococcus aureus* and dominant Gram negative species was found to be *Pseudomonas* followed by *Proteus spp.*, *Escherichia coli*, *Klebsiella spp.* Similar findings were seen in studies done by Ashutosh Rawat et al, Mary Nirmala et al. Raghu Kumar et al, Prakash et al.

In the present study, *Pseudomonas*, 86.7% (65) samples show sensitivity towards Piperacillin-Tazobactam, Gentamycin, Amikacin, Imipenem. *Staph aureus* showed sensitivity towards erythromycin, clindamycin and also higher antibiotic Linezolid which was similar to the findings in a study conducted by Nagraj M et al¹⁴ where *Pseudomonas aeruginosa* isolates were most sensitive to Piperacillin Tazobactam and *Staphylococcus aureus* isolates were most sensitive to erythromycin, clindamycin and Linezolid. Similar findings identified in a study by Hiremamath B et al¹⁵ where *Pseudomonas aeruginosa* showed maximum sensitivity to piperacillin (91.11%) followed by gentamicin (71.11%), amikacin (71.11%).

CONCLUSIONS

In developing countries like India, chronic suppurative otitis media is of great public health importance. Proper care needs to be taken while giving treatment and it is strongly recommended to use selected local or systemic antibiotics guided by culture and sensitivity. This will prevent development of drug resistance and administration of unwanted antibiotics and in return would prevent complications related to CSOM. It is mandatory to study each case of CSOM bacteriologically to formulate local antibiotic policy for appropriate and judicious use of antibiotics. This will certainly help in achieving a safe ear and to control the organisms developing resistance to prevalent antibiotics. One important fact to be kept in mind is that the antibiotic susceptibility pattern of CSOM causing organisms keeps

changing. Hence, routine antibiotic susceptibility testing before treatment is recommended.

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