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Prevalence of *Pseudomonas aeruginosa* in CSOM cases at a tertiary care centre

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) is an infectious chronic ear disease in India characterised by discharge from ear. This is the commonest infection in children more so in low socio economic group. CSOM is caused by various gram positive and gram negative organisms.
Methods: Study group includes CSOM patients coming to ENT Department of Kamineni Institute of Medical Sciences, Narketpally, Telangana, India. Swabs were taken from discharging ears and sent for Gram's staining, culture and antibiotic sensitivity. The results were analysed and a protocol was devised for effective treatment of *Pseudomonas aeruginosa*.
Results: Total numbers of study group were 180 of. 180 patients, 84 were males and 96 were females. CSOM infection was found to be more common in 11-30 yrs age group. When the ear discharge was sent for culture and sensitivity only 106 patients out of 180, showed culture positivity. *Pseudomonas aeruginosa* was the most common organism identified. Its prevalence in the present study was 23%. *Methicillin Resistant Staphylococcus aureus* (MRSA) and *Klebsiella sps* were the next common isolates, whose prevalence was detected to be 10% and 8% respectively. *Pseudomonas* is resistant to all routine broad spectrum antibiotics like amoxicillin, ampicillin and amoxycillin - clavulanate and cephalosporins, but sensitive to ciprofloxacin, gentamycin, imipenem, meropenem, piperacillin.
Conclusions: CSOM is common among children and young adults. *Pseudomonas aeruginosa* was the most common isolate (23%) in our study. As *Pseudomonas* was found to be resistant to routine antibiotics, inadvertent use of routine antibiotics will lead to the development of multidrug resistant strains in the community which are difficult to treat. Specific antibiotic treatment should be started based on the culture and antibiotic sensitivity report of the swab.

Keywords: *Pseudomonas* infection, CSOM, Otitis media, Treatment of *Pseudomonas*, Prevalence of *Pseudomonas*

INTRODUCTION

Chronic suppurative otitis media (CSOM) is the most common prevailing infection in developing countries especially in children of low socioeconomic group. It presents as painless discharge and is the most common cause of deafness in India.[1] Various studies have shown that both gram positive as well as gram negative organisms are responsible for CSOM.[2] *Pseudomonas aeruginosa* is the most commonly identified organism in CSOM reported by various studies in India and abroad with incidence ranging from 21% -52.94%.[3] Among the organisms, pseudomonas infection is known to produce deep seated and progressive infection in middle ear and mastoid leading to various intracranial and extracranial complications.[4]

Complications of CSOM are rare due to the advent of broad spectrum antibiotics, but inadvertent use of antibiotics both topical and systemic, will lead to emergence of multidrug resistant strains of bacteria.[2,4,5] Prevalence of organisms and its susceptibility to antimicrobials will guide the clinician to effectively treat CSOM infection and simultaneously prevents the spread of antibiotic resistance.

The present study is aimed to

1) Identify the Prevalence of various organisms which cause CSOM.
2) Isolate the most common organism.
3) Identify the Antibiotic sensitivity pattern of the most common organism.

METHODS

The study group included patients who were clinically diagnosed as CSOM presenting with discharge from the ear coming to ENT outpatient department, Kamineni Institute of Medical Sciences, Narketpally, Telangana, India, during March 2015- March 2016.

Inclusion criteria

1. CSOM patients of all age groups
2. Pus collected from both unilateral and bilateral discharging ears
3. Patients who have not taken any antibiotics either topical or systemic for the last 7 days.

Exclusion criteria

1. Post-operative discharging cavities were excluded from study.
2. Complicated cases of CSOM like intracranial complications, Petrositis, Labyrinthitis and Facial nerve palsy were excluded from study.
3. Immunocompromised patients.
4. Hospitalized patients in wards of other departments with discharging ears.
5. Otomycosis.

Pus was collected from the discharging ears of CSOM patients using two sterile cotton swabs under aseptic conditions and sent to the Microbiology laboratory. First swab was smeared on a clean glass slide allowed to air dry and heat fixation was done to perform Gram's staining. The stained glass slides were examined microscopically for characteristic staining of microorganisms and the presence of pus cells.

The second swab was then inoculated for culture onto Blood agar, MacConkey agar and Nutrient agar. These media were incubated at 37° C for 18-24 hrs under aerobic conditions. A variety of organisms were isolated of which *Pseudomonas aeruginosa* was the most common isolate which showed grey moist flat colonies on blood agar, non-lactose fermenting colorless colonies on MacConkey agar and water soluble bluish green pigment was observed on Nutrient agar.

The identified organism was confirmed as *Pseudomonas aeruginosa* by oxidase, catalase, motility and biochemical reactions which included fermentation of sugars, oxidation and fermentation, indole production and nitrate reduction.

Among the gram positive isolates, *Methicillin Resistant Staphylococcus aureus* (MRSA) was the most common isolate, followed by *Methicillin Sensitive Staphylococcus aureus* (MSSA) and *Coagulase Negative Staphylococcus* (CoNS). Among the Gram negative and culture positive organisms, *Pseudomonas aeruginosa* was the most common isolate followed by *Escherichia coli*, *Klebsiella sps*, *Proteus mirabilis* and *Acinetobacter sps.*

Antimicrobial disk susceptibility testing (AST) was performed by Kirby-Bauer disc diffusion method. The inoculum of the isolate was adjusted to 0.5 McFarland standard broth and then it was inoculated on Muller Hinton agar (MHA) by lawn culture. The following antimicrobial discs were placed which include Piperacillin (100 µg), Piperacillin Tazobactum (10 µg), Amikacin (30 µg), Gentamicin (10 µg), Ciprofloxacin (5µg), Ceftazidime (30 µg), Imipenem (10 µg) and Meropenem (10 µg) (HiMedia).

The plates were incubated at 37° C for 18-24 hrs. The results were interpreted according to the standard CLSI guidelines.

The present study is an observational prospective study. The statistical analysis was done using Excels sheet and charts and the prevalence of *Pseudomonas aeruginosa* was calculated. The prevalence of various aerobic organisms and their growth characteristics were studied. Antibiotic sensitivity patterns of various organisms were studied.

Empirical treatment protocol for aerobic organisms causing CSOM was devised.

RESULTS

Total no of CSOM patients that presented with discharge in ear to ENT OPD were 180. CSOM infections were more common in younger age group from 11-30 yrs.

Sex distribution

Of 180 patients, 84 were males and 96 were females.

When the ear discharge swabs were sent for Culture and Sensitivity only 106 patients out of 180, showed culture positives. No growth was isolated from the rest of the isolates.

Out of 106 patients of culture positives, gram positive growth was isolated in 32 patients (Figure 2) and gram negative growths were isolated in 74 patients (Figure 3).

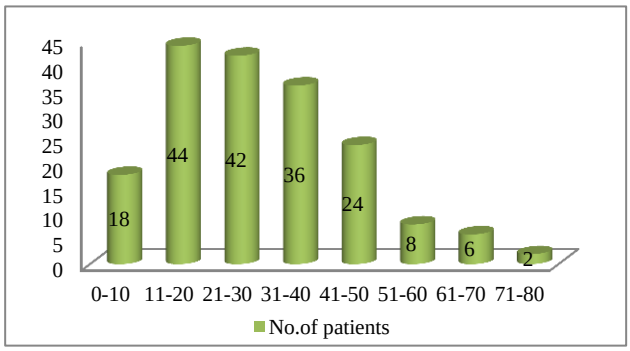

Figure 1: Age distribution among the study sample is as follows.

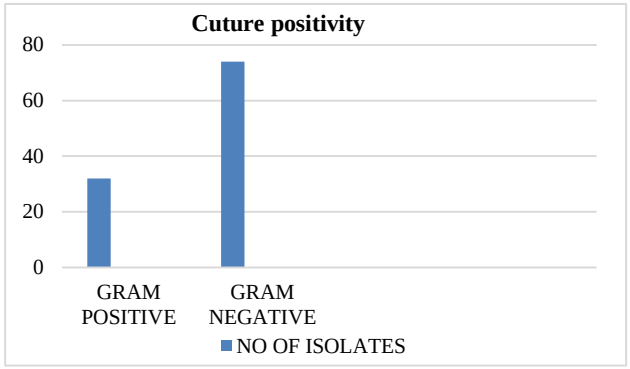

Figure 2: Culture positivity.

Among the gram positive organisms isolated, MRSA was most common and was found in 18 out of 32 patients (56%). Next most common was MSSA (7.5%).

Among the gram negative organisms, *P. aeruginosa* was most commonly isolated organism found in 42 patients out of 74 patients (57%). Next most common organism isolated was *Klebsiella* species, seen in 16 patients (22%).

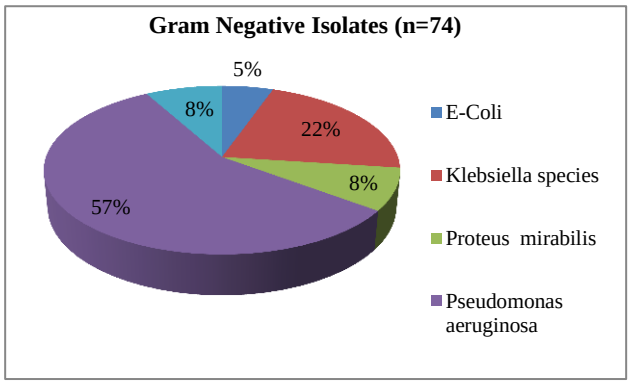

Figure 3: Gram negative isolates (n=74).

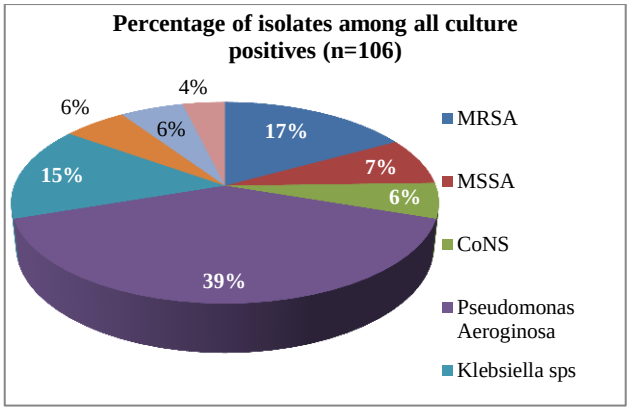

Figure 4: Prevalence of all isolated organisms both gram positive and negative together.

Among all the culture positives (n=106), *P. aeruginosa* was the most common isolate, which was detected in 42 swabs (39%). The prevalence of *P. aeruginosa* among the study group was 23% *i.e.*; isolated in 42 swabs out of 180. The second common isolate was MRSA followed by *Klebsiella* species, the prevalence of which was 10% and 8% respectively. Least common isolate was *E. coli*, prevalence of which was 2%.

Antimicrobial sensitivity pattern of various isolates was done to detect the percentage of sensitivity with various antibiotics (Table 2).

As the *P. aeruginosa* was the most common isolate, its sensitivity pattern was studied in detail to devise the first line drug to treat *P. aeruginosa*.

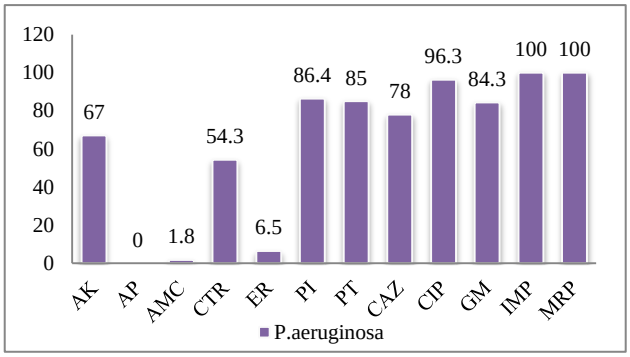

Figure 5: Sensitivity pattern of *P. aeruginosa*.
AK-Amikacin, AP–Ampicillin, AMC–Amoxycillin clavulunate, CTR-Ceftriaxone, ER–Erythromycin, PI-piperacillin, PT-Piperacillin- Tazobactum, CAZ-ceftazidime, CIP-ciprofloxacin, GM-Gentamicin, IMP-Imipenem, MRP-Meropenem.

P. aeruginosa was found to be 100% sensitive with Imipenem and Meropenem which are the reserve drugs. It is found to be reasonably sensitive with Ciprofloxacin, Piperacillin, Piperacillin-Tazobactam, and Gentamycin. As Ciprofloxacin and Gentamycin are commonly used drugs with tolerable side effects and cost effective, these drugs are recommended for use as first line drugs as oral as well as topical ear drops.

Table 1: Antimicrobial sensitivity pattern of middle ear bacterial isolates in patients with CSOM.

Isolate	*Pseudomonas aeruginosa*	*Escherichia coli*	*Proteus mirabilis*	*Klebsiella sps.*	*Acineto-bacter sps.*
AK	67	76	86	83	0
AP	0	0	0	3.4	0
AMC	1.8	0	16.2	33.2	28.6
CTR	54.3	40.2	64.6	85	67.2
ER	6.5	0	26.5	34.2	24.5
PI	86.4	0	45	33	78
PT	85	0	44	32	77.4
CAZ	78	5.3	68	13	67
CIP	96.3	45.8	67.5	96	45
GM	84.3	56.4	100	65	87.3
IMP	100	100	100	100	100
MRP	100	100	100	100	100

AK-Amikacin, AP–Ampicillin, AMC–Amoxycillin clavulunate, CTR-Ceftriaxone, ER–Erythromycin, PI -Piperacillin, PT-Piperacillin-Tazobactum, CAZ-Ceftazidime, CIP-Ciprofloxacin, GM-Gentamicin, IMP-Imipenem, MRP-Meropenem.

Table 2: Antimicrobial susceptibility testing of gram positive isolates.

Antimicrobial agent	MRSA	MSSA	CONS
PN	0	66	45
GM	67	86	92
CIP	57	89	76
ER	96	78	94
CD	15	68	87
CT	25	35	37
LZ	100	100	100
VA	100	100	100
C	22	34	47%

PN-Penicillin, GM-Gentamicin, CIP-Ciprofloxacin, ER-Erythromycin, CD-Clindamycin, CT-cotrimoxazole, LZ-Linezolid, VA-vancomycin, C-chloramphenicol.

DISCUSSION

Chronic suppurative otitis media (CSOM) is a common disease with global incidence of about 5%.[3] CSOM is one of the leading causes of preventable hearing impairment (DHI) in developing countries like India.

Various studies reported the incidence of *P. aeruginosa* as the most commonly isolated organism in CSOM ranging from 21%-52.94%.[6] Our study also reported 23% *Pseudomonas* in non-complicated cases of CSOM. The Antibiotic sensitivity plate with bluish green pigment of *P. aeruginosa* is shown in Figure 1. The next common organisms isolated were MRSA followed by *Klebsiella sps.*

In our study, 74 isolates (41.1%) were culture negatives. This observation is compatible with the findings in other reports where negative cultures were documented.[7,12,13] There were no fungal isolates in our study.

Most of the investigators reported high sensitivity rate for *P. aeruginosa* to ciprofloxacin.[7-12] Sensitivity rate of *P. aeruginosa* to ciprofloxacin in our study was 96%. This rate is comparable to various studies mentioned above.

CSOM has been described as disease more common among people of the poorer socio economic status, where there is overcrowding, more siblings under the age of five, poor sanitation and inadequate access to health care facilities; especially in children.[14] The present study too shows that 104 out of 180 patients were less than 30 years of age, suggesting that children and adolescents constitute the maximum patient population of CSOM.

Our study reported 100% sensitivity with Imipenem and Meropenem and resistant to Amoxycillin, Amoxycillin – clavulanic acid Ampicillin and Cephalosporins which are commonly used drugs. Since *Pseudomonas* was the predominant organism isolated in most CSOM cases and is mostly highly sensitive to ciprofloxacin which has none of the ototoxic risks of aminoglycosides, and resistant to routinely used penicillin group of drugs and cephalosporins, it may be concluded that ciprofloxacin ear drops be adopted as a first line antimicrobial

treatment for CSOM culture positive cases. Oral antibiotic therapy is recommended only after culture and sensitivity of the discharge. Piperacillin –tazobactam, imipenem and meropenem though highly sensitive, are considered as reserve drugs in CSOM cases which are not responding to ciprofloxacin and gentamycin.

CONCLUSION

This is a prospective study of 180 cases, of CSOM coming to ENT OPD of Kamineni Institute of Medical Sciences, Narketpally Nalgonda district, Telangana during March 2015 to March 2016. Swabs were taken from discharging ears and sent for Gram's staining and culture of organism and antibiotic sensitivity testing. Out of 180 swabs only 106 swabs showed monomicrobial isolates of microorganisms and in rest no growth was reported. CSOM was more common in younger age group (11-30yrs). *Pseudomonas aeruginosa* was the most common isolate which was 23% followed by MRSA and *Klebsiella sps* which were 10% and 8% respectively. *P. aeruginosa* was found to be sensitive to Ciprofloxacin (96%), Gentamicin (84%) and Imipenem (100%), Meropenem (100%), and resistant to Ampicillin (0%), Amoxycillin - clavulanic acid (1.8%), Erythromycin (6.5%) and Ceftriaxone (54%).

Ciprofloxacin was found to be highly sensitive and most effective, with least common side effects. So, Ciprofloxacin and Gentamycin are best first line drugs as topical antibiotics (ear drops) but the drug of choice for oral administration whenever necessary should be chosen based on the culture and sensitivity report of the ear discharge. Inadvertent use of routine antibiotics like penicillin group of drugs of cephalosporins will lead to spread of multidrug resistant strains in the community.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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