



Prevalence and antibiogram of *Pseudomonas aeruginosa* in Chronic Suppurative Otitis Media (CSOM)

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Abstract

Background: CSOM is the most common notorious infection seen in developing countries which has led to a number of serious life threatening complications. The most common organism isolated in CSOM is *Pseudomonas aeruginosa*. Early and effective treatment based on the causing organism and its antibiotic sensitivity has helped in prevention of complications. The main objective of this study is to identify the prevalence of *Pseudomonas aeruginosa* in CSOM and to know their sensitivity pattern against the commonly prescribed antibiotics.

Material and Methods: A total of 130 patients with unilateral and bilateral CSOM were enrolled in the study. Samples were processed and organisms were identified by standard bacteriological methods. Antibiotic sensitivity testing was done according to CLSI guidelines. Sensitivity was tested for 11 different antibiotics by dividing into 6 classes.

Results: Of the total 130 samples collected, 40 (30.7%) showed growth of *Pseudomonas aeruginosa*. Sensitivity pattern of *Pseudomonas aeruginosa* showed that piperacillin was active against 90% of isolates followed by piperacillin+tazobactam 82.5% and meropenem 70%.

Conclusion: *Pseudomonas aeruginosa* was the most common bacteria isolated from CSOM followed by *Staphylococcus aureus*. Penicillin group of drugs were found to be most effective followed by carbapenem group. *Pseudomonas aeruginosa* showed high resistance to tobramycin. Continuous surveillance is hence necessary to monitor antimicrobial resistance and to guide in empirical treatment.

Keywords: Chronic Suppurative Otitis Media, *Pseudomonas aeruginosa* Antibiogram.

Introduction

Chronic Suppurative Otitis Media (CSOM) is the inflammation of the middle ear mucosal lining characterized by perforated tympanic membrane with persistent discharge from the ear caused by bacteria, viruses &/ fungi.¹ CSOM is a major health problem in developing countries like India.

It is more common in children of low socioeconomic group cause being poor hygiene, overcrowding, malnutrition, inadequate health care facilities and high rates of URTI.^{2,3,4,5,6} CSOM is a condition requiring early detection & appropriate treatment as the complications caused by it range widely from simple otorrhoea/

mastoiditis/ labyrinthitis/ facial palsy to life threatening complications like intracranial abscess/ thrombosis/ meningitis.^{4,7,8}

The bacterial cause for CSOM can include both aerobic & anaerobic bacteria. Common aerobic bacterial cause being *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus* sp., *Klebsiella pneumoniae*, *Citrobacter* sp., etc; anaerobic bacteria being – *Bacteroids*, *Peptostreptococcus* etc and fungi like *Candida* sp., *Aspergillus* sp., etc.^{5,9,10,11,12,13} Variations in the bacterial flora of CSOM is observed by many authors in the last decade.^{4,9,14,15} CSOM is majority of the times treated empirically with topical steroids & antibiotics, but due to the bacterial resistance & ototoxicity seen to both topical & systemic antibiotics, it has become the matter of concern.¹⁶ This has happened due to the inappropriate & indiscriminate antibiotic usage and has led to emergence of MDR organisms making it difficult to treat, thus resulting in complications. *Pseudomonas aeruginosa* is one of the major causative organism for CSOM with its incidence ranging from 20-53%, as reported by several researchers from India as-well-as from abroad.^{17,18,19,20,21,22,23,24,25} It is a very versatile organism known to cause nosocomial infections and also for its MDR attribute.

Thus the knowledge of local microbiological profile of CSOM & its antibiogram pattern is a must for empirical therapy to be started effectively. Hence the present study was done to determine the prevalence & antibiotic susceptibility pattern of *Pseudomonas aeruginosa* isolated from CSOM cases.

Material and Methods

This study was carried out at the Department of Microbiology, Jawaharlal Nehru Medical College, KAHER University, KLE's Dr. Prabhakar Kore's Charitable Hospital and MRC, Belagavi.

A total of 130 patients with unilateral and bilateral CSOM samples were received and processed in one year from Jan 2017 to Dec 2017.

All the samples from patient of any age and any sex with ear discharge of more than 3 months duration were included in the study. Discharge of less than 3 months duration and patient who had received antibiotics were excluded from the study. Ear discharge was collated with two sterile cotton swab under aseptic precautions. The first swab was used for Gram staining and second swab was used to culture onto Blood agar (Hi-media), Mac Conkey (Hi-media) and nutrient agar (Hi-media) media followed by incubation at 37°C for 18-24 hrs. The bacterial isolates of *Pseudomonas aeruginosa* were identified by colony morphology, pigment production, characteristic musty/earthy odor. The identification was confirmed by standard biochemical tests.^{26,27} Antimicrobial susceptibility testing was done by Modified Kirby Bauer Disc Diffusion method and results of all the tests were interpreted in accordance with CLSI (Clinical and laboratory standards Institute.) guidelines using *Pseudomonas aeruginosa* ATCC 27853 as control strain.^{28,29}

Due to the lack of official definition of MDR,³⁰ *Pseudomonas aeruginosa* isolated showing resistance to more than three core antibiotics (Amikacin &/ Gentamycin, Ceftazidime, ciprofloxacin, Imipenem, Pipacillin) was considered as MDR as by Livermore DM et al;^{31,32}

So antibiotics tested were categorized into 6 classes.

- 1) Aminoglycosides – Amikacin, Gentamycin, Tobramycin
- 2) Cephalosporins – Cefazidime, Cefipime
- 3) Penicillin – Pipracillin, Pipracillin+Tazobactam
- 4) Carbapenems – Imipenem, Meropenem
- 5) Fluoroquinolones – Ciprofloxacin, Levofloxacin
- 6) Monobactam – Aztreonam.

Pseudomonas aeruginosa was labelled as MDR if the strain showed resistance to atleast one antibiotic in each class.³²

Results

A total of 130 cases of CSOM were included in the study. *Pseudomonas aeruginosa* was the most

common isolate accounting for 30.7% (40 isolates). Antibiotic sensitivity pattern of the isolates are depicted in Table 1.

Maximum sensitivity was seen to Penicillin group of drugs followed by Carbapenem group and least sensitivity to Fluroquinolones.

Table 1: Shows antibiotic sensitivity pattern of *Pseudomonas aeruginosa* isolates(n=40)

Antibiotic class	Antibiotic	Sensitive(%)
Aminoglycosides	Amikacin	24 (60%)
	Gentamycin	19 (47.5%)
	Tobramycin	15 (37.5%)
Cehalosporins	Ceftazidime	20 (50%)
	Cefipime	18 (45%)
Penicillins	Piperacillin	36 (90%)
	Piperacillin+Tazobactam	33 (82.5%)
Carbapenems	Imipenem	17 (42.5%)
	Meropenem	28 (70%)
Fluoroquinolones	Ciprofloxacin	18 (45%)
	Levofloxacin	16 (40%)
Monobactam	Azetreonam	22 (55%)

Discussion

CSOM is one of the major health issue mainly in developing countries like India. CSOM if not treated properly at correct time may lead to various complications ranging from simple chronic ear discharge to fatal intra-cranial infections.^{33,34} In CSOM microorganisms reach the middle ear either through Eustachian tube from nasopharynx or through perforated tympanic membrane from the external auditory canal.

Indiscriminate antibiotic usage along with poor patient compliance has led to chronicity of CSOM & emergence of antibiotic resistance.^{15,35,36} In our study *Pseudomonas aeruginosa* is the most common pathogen responsible for CSOM (30.7%). This finding is in tandem with the observations by other authors.^{5,7,8,15,16,18,34,36,37,38,39,40} Few other researchers have reported staphylococcus aureus as the predominant causative pathogen for CSOM followed by *Pseudomonas aeruginosa*.^{14,41,42} This discrimination in the finding could be due to difference in study population & geographical conditions.

Probable reason for prevalence of *Pseudomonas aeruginosa* as predominant causative organism for CSOM could be due to its special character like

minimal requirement of nutrition for survival & its ability to produce self-defense products like pyocyanin, bacteriocin & pyoviridin.^{44,45}

Pseudomonas aeruginosa has the ability to grow in damaged tissue with poor blood supply to the area which helps it to evade from host defense mechanism & from various antibiotics.^{32,45} MDR being known in *Pseudomonas aeruginosa*, antibiotic susceptibility for them was tested by grouping the antibiotics into 6 groups.

Aminoglycosides are the antibiotics which are active mainly against gram negative bacteria with mode of action being interfering in protein synthesis. In our study 60% and 47.5% of *Pseudomonas aeruginosa* were sensitive to Amikacin & Gentamycin respectively, which is similar to the findings of the study done by Iqbal SMetal; and Gul AA et al;^{46,48} but in contract to the study done by Ahmed S et al; showing resistance to Gentamycin.⁴⁷

Third generation cephalosporins are the widely used antibiotics for the treatment of infections caused by *Pseudomonas aeruginosa*. In our study 50% of *Pseudomonas aeruginosa* isolates showed sensitive to ceftazidime which is in contrast to the finding observed by Ahmed A et al; which showed 89% sensitivity.⁴⁹

Penicillin group of drugs belong to beta-lactam family of antibiotics which act by inhibiting bacterial cell growth that eventually kills the bacteria. In our study 90% were sensitive to Piperacillin and 82.5% to Piperacillin+Tazobactam.

Imipenem and Meropenem belong to carbapenem group of antibiotics which acts by inhibiting cell wall synthesis of bacteria by binding to penicillin-binding proteins. In our study 70% of *Pseudomonas aeruginosa* isolates showed sensitive to Meropenem & 42.5% to Imipenem, which is similar to the findings seen in studies done by Ahmad S et al; and Gul AA et al;^{47, 48}

Fluroquilonones act by inhibiting DNA gyrase which is required for bacterial DNA replication. In our study 45% were sensitive to Ciprofloxacin and 40% to Levofloxacin, which is similar to the

findings seen by Maji PK et al;³⁹ but in contrast to the findings in a study done by Maji PR et al;³⁹ but in contrast to the study done by Ayson AN et al;⁵⁰ showing 85.7% sensitivity Indudharam R et al;⁴⁰ showing 98.9% sensitivity.

Aztreonam is a monobactam antibiotic which acts by inhibiting bacterial cell wall synthesis through binding to penicillin binding protein-3 (PBP-3). In our study 55% of *Pseudomonas aeruginosa* isolates showed sensitive to aztreonam which is similar to the finding seen by Somekh E et al;⁵¹ while in contrast to the study done by Anwar-us-Salam et al; and Gul AA et al;^{12,48}

Pseudomonas aeruginosa being the most versatile organism, it can survive in all conditions without any special growth requirements, thus making it the most common causative agent for CSOM. So, the knowledge about its antibiotic susceptibility pattern is important, as it changes from time to time. Antibiotics to which *Pseudomonas aeruginosa* were sensitive earlier are showing resistance now. So overall, Penicillin group of drugs remain the first drug of choice in the treatment of CSOM caused by *Pseudomonas aeruginosa*.

Antibiogram studies should be carried out regularly to know the existing susceptibility pattern in the hospitals, to prevent the emergence of resistance strains, their spread and also helps in start of empirical treatment.

Conclusion

Like any other chronic diseases, CSOM also limits individual's quality of life. Due to the indiscriminate usage of higher antibiotics, the pattern of causative organisms and their antibiotic resistance pattern has changed. Most of the commonly used antibiotics have become ineffective to *Pseudomonas aeruginosa*. Thus proper usage of antibiotics based on sensitivity pattern mentioned by Clinical Microbiologist is a must to prevent emergence & spread of MDR *Pseudomonas aeruginosa*.

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