

ORIGINAL RESEARCH

Profile of Bacterial and Fungal Pathogens in Chronic Suppurative Otitis Media

Isha Rastogi

Assistant Professor, Department of Microbiology, Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India

Corresponding author

Isha Rastogi

Assistant Professor, Department of Microbiology, Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India

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ABSTRACT

Introduction: Chronic Suppurative Otitis Media (CSOM) is the chronic inflammation of the middle ear cleft. It is one of the most common hearing problems which can cause many complications if left untreated. The most common bacteria causing CSOM are *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Escherichia coli* and fungi are *Aspergillus* spp., *Rhizopus* spp., *Cephalosporium* spp., *Penicillium* spp., and *Candida* spp. **Objectives:** This study was carried out to identify the common bacteria and fungi causing CSOM and to determine the antibiotic sensitivity of bacterial isolates. **Method:** 90 patients (out of 116 patients) were selected from the ENT outpatient department of a rural teaching hospital. A written consent was obtained from the patients. Two swabs were collected from the discharging ear. First swab was used for Gram staining and the second for culture and sensitivity. The results were analyzed using simple statistical methods. **Results:** Of these, 23 (32.9%) cases had discharge from Right ear, 52 (54.7%) cases from left ear, and 10 (10.5%) cases from both ears. This gave a total of 95 specimens. Out of 95 specimens, 77 (81.0%) were positive for bacteria and 22 (23.1%) were positive for fungi. **Conclusion:** It is concluded that gram negative aerobic bacteria especially *Pseudomonas* is significantly associated with CSOM, in this part of north east India and ciprofloxacin is a preferable tool in the treatment of CSOM because of its lower cost, lack of ototoxicity and ubiquitous availability as topical and oral preparations.

Keywords: antibiotic sensitivity, chronic suppurative otitis media, ciprofloxacin, ear discharge, *Pseudomonas aeruginosa*

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INTRODUCTION

AOM is the acute infection of the middle ear; OME is the accumulation of fluid within the middle ear in the absence of symptoms of acute infection and CSOM is the persistent inflammation of middle ear with otorrhoea and defect in tympanic membrane. It is a common disease of childhood with low socio-economic status.^{1,2} The most common organism causing Chronic Suppurative Otitis Media are *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Escherichia coli*.^{1,2,3,4} Common fungal agents include *Aspergillus* spp., *Rhizopus* spp., *Cephalosporium* spp., *Penicillium* spp., and *Candida* spp.⁵ Complications of untreated case of Otitis media include hearing loss leading to impaired speech and language development. Early diagnosis assures proper and appropriate treatment. Selection of antibiotic is influenced by its efficacy, resistance of microorganism, safety, risk of toxicity and cost. Knowledge of local susceptibility pattern is essential

to formulate a protocol for empirical therapy.³ Treatment of Otitis media includes aural toileting, administration of antibiotics like ciprofloxacin, amoxicillin-clavulanate, cephalosporin group of drugs etc. Increasing resistance of microorganism to the drugs has been reported. This leads to development of serious complications.

CSOM is one the most commonly encountered diseases in the day to day practice of otorhinolaryngology. It requires remarkable and patient management, especially in the children of poorer socio-economic strata, as they do not or can not access adequate and persistent treatment for this chronic affliction.⁵

Prevalence of CSOM is more in the developing and underdeveloped countries. It is also common among the poorer sections of the developed world. The incidence is highest among low hygiene populations or with over-crowding and malnutrition. In most cases the disease started in childhood when the eustachian tube was incompetent. More bouts of acute

otitis media were seen in infants with many siblings in crowded day care facilities where the mother stopped breast feeding early and parents were smoking. Premature and low birth weight babies in lower socio-economic groups were more vulnerable to CSOM and its attendant handicap and complications in later life.⁶ A variety of host factors, genetic disorders like Down syndrome, immune deficiencies or paresis, ciliary disorders, cleft palate have been implicated in the causation of CSOM.⁶

MATERIAL AND METHODS

A written consent was obtained from all patients before enrolling them in study. A short history of complaints of the patient regarding his personal details, duration of discharge, associated symptoms was obtained. A total of 96 patients with unilateral and bilateral ear discharge attending the outpatient department of ENT during this six months duration were included. Of these 96 patients, only 70 patients were selected based on inclusion and exclusion criteria. Only the patients coming with chronic or recurrent ear discharge, central perforation of tympanic membrane were included in the study. Patients on antibiotic therapy for previous five or more days, patients with ear discharge due to cholesteatoma, children with Downs' syndrome and cleft palate or craniofacial abnormalities, pregnant women were excluded from the study. Institutional Ethical Committee Clearance was obtained before the study.

Discharge was collected from the affected ear using two sterile cotton swabs with all aseptic precautions. Swabs were transported immediately to the Microbiology laboratory. In the laboratory, the first swab was used for gram staining and direct microscopical examination to note the morphology of bacteria, their number, and presence or absence of inflammatory cells and epithelial cells in the sample. Second swab was inoculated on Nutrient agar, MacConkey agar, Blood agar and Chocolate agar for bacterial isolation; and Sabouraud's Dextrose Agar

with Chloramphenicol for fungal isolation. The bacterial culture plates were incubated at 37°C for 48 hours and for fungal culture upto 1 week. The bacteria were identified with standard biochemical tests. Antibiotic susceptibility was carried out using Kirby Baur Disk Diffusion method. The antibiotics used were Amikacin, Amoxicillin-Clavulanate, Ceftazidime, Cefotaxime, Ciprofloxacin, Cotrimoxazole, Erythromycin, Imipenem, Linezolid, Penicillin, Piperacillin, Piperacillin-tazobactam and Vancomycin.

Specimens for pus culture were collected, under illumination, by swabbing the discharging ears with a sterile cotton swab and sent to the microbiology laboratory of the hospital without delay. Samples collected were inoculated in nutrient agar and MacConkey medium and incubated for 24 to 48 h at 37°C. On visible growth of bacterial colonies, microscopic and various chemical and enzymatic tests were conducted to identify the bacteria. Side by side an attempt was made to do sensitivity tests, by KibriBour disc diffusion method for commonly available and used drugs, especially ciprofloxacin. Even though all the antibiotic discs were always not available, due to resource constraints in our civil hospital, yet a sincere effort was made to do at least ciprofloxacin sensitivity test in as many isolates as possible.

RESULTS

A total of 90 patients (out of 116 patients) had been selected from the Out-patient department of ENT in a rural teaching hospital. Out of 90 patients, 51 were male and 39 were female. Age-wise analysis showed that Otitis media is more common in the age of 1 – 10 years (Figure 1). Both unilateral and bilateral ear discharge cases were present. Of these, 23 (32.9%) cases had discharge from Right ear, 52 (54.7%) cases from left ear, and 10 (10.5%) cases from both ears. This gave a total of 95 specimens. Out of 95 specimens, 77 (81.0%) were positive for bacteria and 22 (23.1%) were positive for fungi. (Table 1).

Table 1: Bacterial and Fungal Culture Positive Results

RESULT	BACTERIA		FUNGI	
	MALE	FEMALE	MALE	FEMALE
Positive	41(43.1%)	36(37.8%)	12(12.6%)	10(10.5%)
Negative	11(11.5%)	7(7.3%)	40(42.1%)	33(34.7%)
TOTAL	52(54.7%)	43(45.2%)	52(54.7%)	43(45.2%)

Pseudomonas aeruginosa was the most predominant species in 26 (34.7%) specimens, followed by *Staphylococcus aureus* in 14 (18.7%) specimens. Other isolates were *Klebsiella aerogenes* in 9 (12%) specimens, *Proteus mirabilis* in 7 (9.3%) specimens, *Escherichia coli* in 6 (8%) specimens, Non fermenting

Gram negative bacilli in 4 (5.3%) specimens and *Klebsiella oxytoca* in 1 (1.3%) specimen. The fungi isolated were *Aspergillus fumigatus* [8 (10.7%) specimens] and *Aspergillus niger* [4 (5.3%) specimens]. 75% of fungi were present in combination with bacteria (Table 2).

Table 2: Association of Bacteria and Fungi causing Chronic Suppurative Otitis Media:

BACTERIA + FUNGI	No
Escheichia coli + Aspergillusfumigatus	3
Klebsiellaaerogenes + Aspergillusfumigatus	6
Non fermenting Gram negative bacillus + Aspergillusniger	3

The sensitivity pattern of various isolates against a panel of antibiotics was shown in Table 3.

Table 3: Antibiotic Sensitivity of Bacteria isolated from ear discharge of patients with Chronic Suppurative Otitis Media

ORGANISM	N	AK	AM C	CA Z	CX	CIP	CO T	E	I	LZ	P	PI	PIT	VA N
Pseudomonas aeruginosa	26	92.3 0%	88.5 0%	80.7 0%	19.2 0%	92.3 0%	30.4 0%	29.6 0%	84.6 0%	-	61.5 0%	61.5 0%	80.7 0%	-
Staphylococcus aureus	14	100 %	78.6 0%	64.2 0%	78.6 0%	85.7 0%	78.6 0%	57.1 0%	71.4 0%	10 0%	71.4 0%	42.8 0%	42.8 0%	10 0%
Klebsiellaaerogenes	9	88.9 0%	66.7 0%	77.8 0%	66.7 0%	100 %	-	-	66.7 0%	-	44.5 0%	44.5 0%	-	-
Proteus mirabilis	7	85.7 0%	57.1 0%	-	-	71.4 0%	71.4 0%	42.8 0%	-	-	28.5 0%	28.5 0%	-	-
Escherichia coli	6	100 %	66.7 0%	16.7 0%	100 %	83.3 0%	-	50%	-	-	66.7 0%	66.7 0%	-	-
Non fermenting Gram negative bacillus	4	100 %	0%	50%	0%	75%	75%	75%	-	-	50%	50%	0%	-
Klebsiellaoxytoca	1	100 %	0%	100 %	100 %	100 %	0%	-	-	-	100 %	100 %	100 %	-

DISCUSSION

If left untreated, it may cause destruction of middle ear structures leading to hearing loss and may also cause complications like mastoiditis, periostitis, facial paralysis, labyrinthitis, brain abscess, meningitis, lateral sinus thrombophlebitis etc. Aural toileting with meticulous antimicrobial treatment is essential to prevent complications. In our study, Chronic Suppurative Otitis Media was more common in males compared to females. This study correlates with the study report of Iqbalet al.¹Nwasbuisi et al.⁴ and Kumar et al.⁷ In contrast to this result, Mansoor et al.² and Shrestha et al.⁸ study revealed a higher female preponderance. In our study, the peak incidence was found in the age group between 1 and 10 years. This was in concordance with the study of Iqbalet al.¹ and Shymala et al.⁹ which showed that peak incidence was occurring in infants and young children. In contrast to our study, Arya et al.¹⁰ reported that the highest incidence among 11 – 20 years. Children are more prone to the development of Otitis media because their Eustachian tubes are shorter and more horizontal than adults and are made of more flaccid cartilage which causes impaired opening of the tube. It is also related to forced feeding, improper positioning of infants during breast feeding and bottle feeding. In the present study, unilateral infection was predominant. Left ear was more commonly affected than right ear. This was in contrast to the study of Shrestha et al.⁸ and

Shymala et al.⁹ in which right ear was commonly affected.

Because of variation in climate, community and patient characteristics, the pattern of microbiological distribution varies in Chronic Suppurative Otitis Media. Majority of bacterial isolates of in our study were Pseudomonas aeruginosa(34.7%), followed by Staphylococcus aureus(18.7%), Klebsiellaaerogenes(12%), Proteus mirabilis (9.3%), Escherichia coli (8%), Non fermenting Gram negative bacilli (5.3%) and Klebsiellaoxytoca(1.3%). These results were in concordance with the studies of Mansoor et al.,² Kumar et al.⁷ and Al- Snafi et al.¹¹ Whereas Mann et al.¹² reported Staphylococcus aureus as the most predominant organism in Chronic Suppurative Otitis Media. Only 16% of specimens were positive for fungal culture. The fungi isolated were Aspergillusfumigatusand Aspergillusniger. Study of Iqbalet al.¹ also had same results (i.e) all of the fungal species isolated were of Aspergillus spp. They are commensals and do not require treatment. The sensitivity patterns of microorganisms to antibiotics are changing from time to time. The organisms are becoming more resistant to antibiotics. In our study, Ciprofloxacin and Amikacin had been found as most effective drug followed by Amoxicillin-Clavulante and Ceftazidime for many organisms. This may be due to their mode of action. Aminoglycoside antibiotics were used either

systemically or locally but significant side effects especially their ototoxicities have limited its usage. Ciprofloxacin has been increasingly prescribed now. Quinolones, especially ciprofloxacin was found to be effective in eradicating majority of the gram negative bacteria, in which it was tested. In fact in this study it is seen that a cheaper drug like ciprofloxacin is almost 100% successful as far as *P. aeruginosa* is concerned. A randomised controlled trial of 0.3% ciprofloxacin drops against framycetin, gramicidin and dexamethasone drops for CSOM in a paediatric Australian Aboriginal population found a significantly higher rate of elimination of ear discharge in the ciprofloxacin group.¹³ Since *pseudomonas* is the predominant bacteria usually associated with CSOM therefore it can be concluded that ciprofloxacin ear drops can be tried as a first line of treatment in CSOM, in this part of India, though emergence of ciprofloxacin resistant *pseudomonas* in CSOM are being reported in other parts of the Asian continent.¹⁴ A significant 47% swabs did not grow any aerobic bacteria and they were culture negative; probably indicating that an attempt to establish infrastructure for anaerobic and fungal culture as well as allergic diagnostic tests should be made. However, with all the drawbacks and resource crunch in our civil hospital we were successful in having a glimpse of the aerobic bacteria involved in CSOM, in our part of the country and efficacy of ciprofloxacin in the management of CSOM could also be tested to a significant extent. Otolologists trained in allergic diagnostics tests have realized that allergic otitis media superimposed on CSOM is a definite and not uncommon clinical entity, the permanent central perforation of tympanic membrane allowing dusts, moulds and pollens to easily enter and sensitize the middle ear mucosa.¹⁵ Similarly in some studies anaerobes and fungus were isolated in small to significant number of patients.¹⁶

CONCLUSION

It is concluded that gram negative aerobic bacteria especially *pseudomonas* is significantly associated with CSOM, in this part of north east India and ciprofloxacin is a preferable tool in the treatment of CSOM because of its lower cost, lack of ototoxicity and ubiquitous availability as topical and oral preparations. Fungi isolated belonged to *Aspergillus* spp. The important factor responsible for development of resistance is inappropriate duration of treatment and dose of antibiotics. Judicial use of antibiotics is necessary for the prevention of development of antibiotic resistance.

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