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Microbiological Profile of Chronic Suppurative Otitis Media

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A B S T R A C T

Chronic suppurative otitis media (CSOM) is a persistent, insidious and potentially dangerous disease because of its various fatal complications. It is still a significant health problem in developing countries. It is the common cause of conductive deafness. Change in the bacteriological scenario with indiscriminate use of antimicrobial agents has been associated with the emergence of multiple drug resistant strains. Information regarding the common pathogens and their antibiotic sensitivities is essential for the proper choice of antibiotics. Hence the present study is undertaken to know the aerobic bacteriological flora of CSOM and their antibiogram. One hundred and nine clinically diagnosed cases of CSOM of all age groups and both the sexes attending ENT OPD and admitted in ENT wards were studied. Ear swab was taken from each patient, further subjected to Gram staining and culture onto blood agar, MacConkey's agar and Chocolate agar. The bacterial isolates were identified by standard biochemical reactions. Antibiotic susceptibility testing was done by Kirby-Bauer disc diffusion method. A random selection of 109 CSOM cases was studied, of which 71 were males and 38 were females. Majority of the patients were in the age group of 11 to 20 years. Predominance of *Pseudomonas aeruginosa* (53.91%) followed by *Staphylococcus aureus* (28.69%), *Proteus mirabilis* (6.09%), *Klebsiella pneumoniae* (5.23%), *Citrobacter freundii* (4.35%) and *Escherichia coli* (1.73%). Antibiotics like Imipenem, Piperacillin-tazobactum, Amikacin, ciprofloxacin and Levofloxacin were found to be more effective against all Gram positive and Gram negative isolates. *Pseudomonas aeruginosa* was the predominant organism followed by *Staphylococcus aureus, Proteus mirabilis, Klebsiella pneumoniae, Citrobacter freundii* and *E. coli*. The most effective drugs were Imipenem, Piperacillin-tazobactum, Amikacin, ciprofloxacin and Levofloxacin.

Introduction

Otitis media is an inflammation of the middle ear & mastoid process, which could be acute purulent otitis media, otitis media with effusion and chronic suppurative otitis media (CSOM) (Berman, 1997). CSOM is a condition of non-healing perforation of the tympanic membrane associated with chronic inflammatory changes of the Muco-periosteum of the middle ear cleft resulting in mucoid or mucopurulent otorrhea of more than three months duration (Nwabuisi and Ologe, 2002; Sharma *et al.*, 2004). CSOM is a major problem in developing countries like India. It is more common in children

belonging to lower socioeconomic group (Lasisi *et al.,* 2007). It is single most important cause of hearing impairment in our country (Srivastava *et al.,* 2010).

The study of microorganisms associated CSOM and their antibiotic sensitivity pattern is most important for clinician to plan general outline of treatment of chronically discharging ear (Greval and Ram, 1996). The most common microorganisms found in CSOM are *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella* species, *Escherichia coli*, *Aspergillus* spp, and *Candida* Spp, but these organisms vary in various geographical areas (Anwar-us-Salam and Abdulla, 1997).

Early and effective treatment based on the knowledge of causing microorganisms and their sensitivity results in good clinical recovery and prevents damage and complications caused by CSOM (Taneja, 1999). Antimicrobial therapy used to eradicate the bacterial agents causing otitis media but most of the microorganisms are acquiring antibiotic resistance. In developing countries, this problem is rapidly increasing due to misuse of antibiotics. The important factors associated with occurrence CSOM found to be a poor hospital hygiene, overcrowding, lack of resources for infection control and lack of personnel trained in controlling infections in hospital (Hart and Kariuki, 1998).

Pseudomonas aeruginosa is the most predominant organism among the cases of CSOM reported by several workers in India and abroad with an incidence ranging from 21% to 52.14% (Gulati *et al.,* 1969; Ayyagari *et al.,* 1981; Rao and Bhaskaran, 1984). *Pseudomonas aeruginosa* possesses an intrinsic resistance to many antibiotics and has an ability to develop resistance through mutations in different loci or through the horizontal acquisition of resistant genes, which carried on plasmids, transposons or integrons (Bannerman *et al.,* 2007).

The changing flora of CSOM and emergence of strains resistant to the commonly employed antibiotics stimulated this study. The present work deals with the bacteriological study of CSOM to identify and categorize various organisms isolated and to evaluate their sensitivity pattern (Agrawal *et al.,* 2013).

Materials and Methods

The present study carried out after the clearance from the ethical committee in the department of Microbiology at Tertiary care hospital.

Total 109 patients presenting with ear discharge for more than 3 months of age group varying from 1-70 years and both sexes were included in the study. Medical history were noted including ear discharge, its duration, hearing status, previous history of upper respiratory tract infection (URTI), ear surgery and ear trauma, presence of nasal allergy, chronic tonsilitis, tuberculosis etc.

Ear discharge collected under aseptic precaution in clinically diagnosed cases of CSOM with sterile cotton wool swabs. Excess discharge was mopped out from external auditory canal and it was cleaned with 70% alcohol first and was allowed to act for 30-40 seconds to achieve sterile area (Vartiainen and Vartiainen, 1996; Gopichand *et al.,* 2015).

The specimens were cultured on blood agar, MacConkey's agar and chocolate agar for aerobic bacteria and incubated at 37^0C overnight (18-24 hours). The reading of the plate, colony identification, Gram Stain, biochemical test was done as per standard microbiological method (Forbes *et al.,* 2002). A plate showing no growth after 48 hours was considered as negative. The antimicrobial

susceptibility was performed on Mueller Hinton Agar (MHA) by Kirby Bauer disc diffusion method as per CLSI guidelines (Biemer, 1973; Jorgensen *et al.,* 2007).

Inclusion criteria

The patients with active aural discharge for more than 3 months belonging to different age, sex, religion and different classes were included in the study. The samples were further subjected to aerobic culture and Gram stain.

Exclusion criteria

Patients with history of using antibiotic either systemic or local in the form of ear drops for last 7 days were excluded in the study.

Results and Discussion

A total of 109 patients having CSOM were studied, different organisms are isolated and their antibiogram was done. The results were correlated with demographic data of the individuals.

Chronic suppurative otitis media (CSOM) is a condition of the middle ear characterized by persistent or recurrent discharge through a chronic perforation of the tympanic membrane. Due to the perforated tympanic membrane, bacteria can gain entry into the middle ear via the external ear canal. Infection of the middle ear mucosa subsequently results in ear discharge. Untreated cases of CSOM can result in broad range of complications that leads to spread of bacteria to structures adjacent to the ear or to local damage in the middle ear and such complications are ranges from persistent otorrhea, mastoiditis, labyrinthitis, facial nerve palsy and intracranial abscesses or thromboses. While the incidence of such complications is low, they need to be borne in mind when faced by a patient with active CSOM. Hence, early and effectively treatment required to avoid such complications (Loy *et al.,* 2002).

In the present study maximum number of patients 47 (42%) were in the age group of 11-20 years. Studies conducted by (Poorey, 2002), (Vijaya and Nagarathnamma, 1998) and (Urmil Mohan and Jindal, 1998) have reported maximum number of patients belonging to the second decade. The higher incidence of otitis media in first two decades may be due to abundance of lymphoid tissue in children that may obstruct the eustachian tube and increased risk of respiratory infection in children may result in CSOM. The infection of CSOM was more common in males 71 (65%) than the females 38 (35%). The male predominance may be because of their more exposed way of life (Varshney and Gupta, 1999). The CSOM cases were more common in rural area 60(55%) as compared to urban area 49(45%) which is in accordance with (Gulati, 1997) and (Urmil Mohan and Jindal, 1998). Incidence of CSOM is high in rural areas because of lack of education, awareness and availability of trained specialists. The CSOM cases were more prevalent during winter season 59(54%) and during early spring 30(28%) which is correlated with Kathleen A. Daly (1991) and Charles D Bluestone (2004). Nwokoye *et al.,* (2012) have reported increased incidence of CSOM in rainy season (May-Oct). Increased incidences in winter season are mainly attributed to repeated upper respiratory tract infection (viral, bacterial) (Paparella *et al.,* 1991).

The factor associated with socio-economic status were also evaluated and it was observed that CSOM was more among lower socio-economic class (59%) followed by middle class (30%) and 11% in upper class individuals. This finding correlates with studies of Gulati (1997), Urmil Mohan and Jindal (1998) (Table 1–5).

Table.1 Demographic data of CSOM patients (n=109)

Categories		Frequency	Percentage
Age group in years	1-10	16	15%
	11-20	47	42%
	21-30	20	18%
	31-40	15	14%
	41-50	03	03%
	51-60	04	04%
	61-70	04	04%
	Total	**109**	**100%**
Gender	Male	71	65%
	Female	38	35%
	Total	**109**	**100%**
Area	Urban	49	45%
	Rural	60	55%
	Total	**109**	**100%**
Season	March-June	20	18%
	July – October	30	28%
	November- February	59	54%
	Total	**109**	**100%**
Socio-Economic status	Lower	64	59%
	Middle	33	30%
	Upper	12	11%
	Total	**109**	**100%**

Table.2 Incidence of pure and mixed culture

Organisms	Frequency	Percentage
Monomicrobial	88	81%
Polymicrobial	21	19%
Total	109	100%

Table.3 Incidence of polymicrobial bacterial isolates

Sr. No	Organisms	Frequency	Percentage
1	*Staph. aureus & P. aeruginosa*	11	52%
2	*Proteus mirabilis & P. aeruginosa*	4	18%
3	*Staph.aureus & Citrobacter*	1	05%
4	*E. coli & Staph.aureus*	1	05%
5	*P. aeruginosa & E. coli*	1	05%
6	*Proteus Mirabilis & Staph. aureus*	1	05%
7	*P. aeruginosa & K. pneumoniae*	1	05%
9	*Citrobacter & K. pneumoniae*	1	05%
	Total	21	100%

Table.4 Antibiotic susceptibility pattern of gram-negative organisms

Antibiotics	*Pseudomonas aeruginosa* (62)	*Proteus mirabilis* (07)	*Klebsiella pneumoniae* (06)	*Citrobacte freundii* (05)	*Escherichia coli* (02)
Ciprofloxacin	33(53%)	-	-	-	-
Co-trimoxazole	-	1 (14%)	05 (83%)	0 (00%)	1 (50%)
Amikacin	39(63%)	6 (86%)	05 (83%)	3 (50%)	2(100%)
Levofloxacin	28 (45%)	5 (71%)	02 (33%)	2(40%)	2(100%)
Amoxy-clav	-	1 (14%)	02 (33%)	0 (00%)	0 (00%)
Ofloxacin	-	5 (71%)	4 (67%)	2 (40%)	2 (100%)
Piperacillin	27 (44%)	-	-	-	-
Piperacillin-Tazobactum	49(79%)	6 (86%)	1 (17%)	1 (20%)	0 (00%)
Ceftazidim	13(21%)	-	-	-	-
Cefixim	-	01(14%)	1 (17%)	2 (40%)	2(100%)
Imipenem	62(100%)	5 (71%)	3 (50%)	2 (40%0	1 (50%)
Cefuroxime	-	0 (00%)	3 (50%)	0 (00%)	0 (00%)
Cefeperozone	-	2 (29%)	4 (67%)	1 (20%)	0 (00%)
Ceftriaxone	-	1 (14%)	3 (50%0	0 (00%)	0 (00%)
Cefepime	12(19%)	-	-	-	-

Table.5 Antibiotic sensitivity pattern of Gram positive organisms

	Staphylococcus aureus (33)	
Antibiotics	**Frequency**	**Percentage**
Penicillin	11	33
Cefoxitin	09	27
Erythromycin	12	36
Clindamycin	17	52
Ciprofloxacin	17	52
Co-trimoxazole	15	45
Linezolid	17	52
Amikacin	19	58
Levofloxacine	18	55
Doxycycline	04	12

The criteria for socio-economic status was as follows- lower (<3000/month), middle (3000-14000/month) and upper class (>14000/month) (Paparella *et al.*, 1991). It is presumed that multiple factors such as poor sanitation, unhygienic living conditions, overcrowding, malnutrition, illiteracy and lack of health consciousness in low socio-economic status may contribute to the increased development of otitis media (Hivemath *et al.*, 2001).

The polymicrobial infection was 21(19%), which is in accordance with (Poorey, 2002).

However, (Rao and Reddy, 1994) found equal incidence of mixed and pure culture. Use of topical and systemic broad-spectrum antibiotics in the period before consultation was probably responsible for the lower incidence of mixed infection (Koppad). Although in the present study patients not taken antibiotics were amongst the exclusion criteria, but as CSOM being chronic disease patients must have been taken topical or systemic antibiotics by local general practitioners and this is probably responsible for lower incidence of mixed infection (Koppad).

In the present study *P. aeruginosa* was the predominant organism 62 (53.91%) followed by *Staphylococcus aureus* 33 (28.69%), *Proteus mirabilis* 7 (6.09%), *Klebsiella pneumoniae* 06 (5.23%), *Citrobacter freundii* 5(4.35%) and *Escherichia coli* 2(1.73%). The findings are in accordance with (Shazia parveen and Rao, 2012).

The next predominant organism in the present study was *Staphylococcus aureus* 33 (28.69%). This is in accordance with the finding reported by (Hiremath *et al.,* 2001), (Loy *et al.,* 2002). The frequency of *Staphylococcus aureus* in the middle ear infections can be attributed to their ubiquitous nature and high carriage of resistant strains in the external auditory canal and upper respiratory tract (Chole and Sudhoff, 1998).

The next most common organism isolated was *Proteus mirabilis* 7(6.09%) that correlates with the findings of (Gul *et al.,* 2006) followed by *Klebsiella pneumoniae* 6 (5.23%), *Citrobacter freundii* 5 (4.35%), and *Escherichia coli* 2 (1.73%).

The occurrence of *P. aeruginosa* as the prime offender can be attributed to various factors like minimal nutritional requirement and its armamentarium of antibacterial products, pyocyanin and bacteriocin (Mansoor *et al.,* 2009). The Vartiainen and Vartianen postulated that Pseudomonas has the ability to carve out a niche for itself in local infection through the necrotizing activities of its extracellular enzymes. The physical characteristics of the niche, a damaged epithelium, interrupted circulation and devitalized tissue protects the organism from normal host defense mechanisms and antibiotic agents (Vartiainen and Vartiainen, 1996).

All the isolates were further subjected Antibiotic sensitivity testing, gram negative organisms were 89% sensitive to Imipenem, followed by Piperacillin-Tazobactum (70%), Amikacin (67%), Ciprofloxacin (54%). (Mansoor *et al.,* 2009) reported similar sensitivity pattern. The *P. aeruginosa* isolates were 100% sensitive to Imipenem which is in accordance with the studies of (Gul *et al.,* 2006). Among gram-positive organism, *Staphylococcus aureus* 27% were resistant to cefoxitin indicating MRSA strains.

When the results of various workers compared, one fact became obvious that the bacteriology and antibiotic sensitivity pattern of CSOM has been changing from time to time. Sensitivity patterns and drug resistance vary according to the region and may give different picture as the time passes on. A carefully selected local and/or systemic antibiotic guided by culture and sensitivity is an effective treatment modality. This will prevent development of drug resistance and administration of unwanted antibiotics.

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