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Bacteriology and susceptibility pattern in CSOM in central India

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Abstract

Objective: Active chronic suppurative otitis media (CSOM) is the bacterial chronic infection of middle ear cleft mucosa and treated with antibiotics empirically, which may cause resistance to bacterial strains. In this study, we studied the bacteriology and susceptibility pattern in CSOM for efficient empirical treatment especially in central India.
Methods: Clinically proven 160 patients with CSOM with otorrhea, were included in our study. Ear discharge samples were collected with the asepsis method and bacterial culture and antibiotics sensitivity patterns were obtained.
Results: Bacterial growth was present in 76.1% of ear samples with Staphylococcus and Pseudomonas being most prominent. Vancomycin and Rifampicin were most effective for staphylococcus and amoxicillin and quinolones were most resistant. Meropenem and Piperacillin/tazobactam were the most effective antipseudomonal antibiotics. Ciprofloxacin and Levofloxacin were least sensitive antipseudomonal quinolones.
Conclusion: Amoxicillin with quinolones were highly resistant for bacterial growth in-ear samples so used cautiously as empirical therapy in CSOM. For effective treatment of CSOM and prevention of resistant strain emergence, all ear samples must be sent for culture sensitivity.

Keywords: Otitis media, antibiotics, culture media

Introduction

Active chronic otitis media equates with classic term chronic supportive otitis media (CSOM), which is the chronic infection of the mucosa of the middle ear and mastoid characterized by recurrent ear discharge (at least 2 weeks) with tympanic membrane perforation if untreated may lead to further complications including hearing loss, mastoiditis, labyrinthitis, facial paralysis, meningitis and brain abscess [1, 2]. CSOM is commonly a developing world disease with a high prevalence rate. In 2012, WHO estimated that 5.3% of the world population had disabling hearing loss with the greatest prevalence rate in the Asia Pacific (6.3% prevalence rate in India with most deaths 12/1000 according to WHO) [3]. Low socioeconomic status, poor

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nutrition, overcrowded places with poor hygiene and inadequate health facilities are some risk factors associated with a high prevalence rate in India and other developing countries [4].
Pseudomonas aeruginosa (P aeruginosa) is the most predominant pathological isolate in CSOM, while others isolate *Staphylococcus aureus (S aureus)* as the most common isolates [5]. Primary treatment of CSOM is aural cleaning, topical ear drops with systemic antibiotics. The antibiotics generally prescribed empirically in CSOM, may lead to resistance and incomplete resolution of disease. Multiple studies have assessed the bacteriology and antibiotic susceptibility pattern in CSOM [6-8]. However, few studies have focused on central India's bacteriology and antibiotic susceptibility pattern. Therefore, our study aimed to document bacteriology and antibiotic susceptibility pattern in CSOM that are essential for efficient empirical treatment, especially in central India.

Methods

This study was conducted in a tertiary health care Centre of central India from August 2021 to December 2021 in 160 patients with clinically proven CSOM, visiting the OPD (outer patient department) & IPD (Interpatient department) of Otorhinolaryngology, who presented with the unilateral or bilateral active aural discharge with tympanic membrane perforation with or without cholesteatoma. The patients of aural discharge other than CSOM e.g. (Otitis externa-fungal/furunculosis, foreign body ear, traumatic ear injury) was excluded from the study. The patients, who had received antibiotics (systemic or topical) within 1 week, were also excluded from the study. Well-informed consent was taken from all the patients, who were participated in the study.
After obtaining a comprehensive medical history for each patient, cleaning of the external auditory canal (EAC) was done with a spirit Schwab and pus samples were collected from the affected ear (one or both sides) with the use of sterile swab sticks by standard technique and sent for bacteriology and antibiotics susceptibility in the microbiology lab.

Results

A total of 160 patients of active COM were included in the study with mean age were 27.7 years & peak age group between 21-30 years. 53.1% were males and 46.9% were females with the male: female ratio being 1.13: 1(table 1). One forty patients (87.5%) had unilateral CSOM, while 20 patients (12.5) had bilateral CSOM.

Table 1: Age and sex-wise distribution (n=160)

Age-group	Male	Female	Unilateral	Bilateral	Total	%
0-10 year	6	5	8	3	11	6.3
11-20 year	10	8	15	3	18	11.3
21-30 year	43	42	77	8	85	53.1
31-40 year	16	13	26	3	29	18.7
>40 year	7	10	14	3	17	10.6
Total	85	75	140	20	160	

Table 2 shows the results of the culture of 180 samples of the total ear. 137 total samples (76.1%) had positive culture, while 43 ears (23.9%) did not show any growth after 72 hours of incubation. 120 samples (87.6%) were positive for a single bacterial isolate, while 17 samples (12.4%) showed polymicrobial growth.

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Table 2: Culture results of active chronic otitis media of total samples (n=180)

Culture results	Number of samples	Per cent of total samples%
Total number of growths	137	76.1
Monomicrobial	120	87.6
Polymicrobial	17	12.4
No growth	43	23.9

Table 3 shows the all-bacterial isolates in all 137 samples. *Staphylococcus* was the most common bacterial isolate (72&), followed by *Pseudomonas* (24%) & *Klebsiella* (10%) respectively. *Pseudomonas* (35.3%) growth predominates over *Staphylococcus* (29.3%).

Table 3: Distribution of all bacterial isolates in culture reports

Bacterial isolates	Monomicrobial(n=120)	Polymicrobial(n=17)
Staphylococcus	72(60%)	5(29.4%)
Pseudomonas	24(20%)	6(35.3%)
Klebsiella	10(8.3%)	2(11.2%)
Proteus	3(2.5%)	1(5.9%)
E. coli	4(3.3%)	2(11.7%)
Others	7(5.8%)	1(5.9%)

Table 4 shows *Staphylococcus* antibiotics susceptibility pattern. In this study, most active antibiotics against Staphylococcus were Vancomycin (98.7%), Rifampicin (96.1%), Gentamycin (92.2%) & Moxifloxacin (90.9%). Levofloxacin (71.4%), Amikacin (72.2%), Ciprofloxacin (74%), Ceftriaxone (77.9%) & Amoxycillin/clavulanic acid (79.2%) were least sensitive.

Table 4: *Staphylococcus* susceptibility and resistance to various antibiotics (n=77)

Antibiotics	Number of sensitive cases	Number of resistant cases	Percentage of sensitivity
Amoxicillin/clavulanic acid	61	16	79.2
Ceftriaxone	60	17	77.9
Cefoperazone/Sulbactam	65	12	84.4
Ciprofloxacin	57	20	74.0
Gentamycin	71	6	92.2
Amikacin	56	21	72.7
Levofloxacin	55	22	71.4
Moxifloxacin	70	7	90.9
Rifampicin	74	3	96.1
Vancomycin	76	1	98.7

Table 5 shows antibiotic sensitivity to *Pseudomonas* organism. Meropenem and Piperacillin/tazobactam were showed a hundred per cent killing in all culture media, followed by Cefepime (96.7%). Levofloxacin (56.7%), Ciprofloxacin (63.3%) & Ceftriaxone (70%) were least effective.

Table 5: *Pseudomonas* susceptibility and resistance to various antibiotics (n=30)

Antibiotics	Number of sensitive cases	Number of resistance cases	Percentage of sensitivity
Ceftriaxone	21	9	70.0
Ceftazidime	28	2	93.3
Cefepime	29	1	96.7

Meropenem	30	0	100
Piperacillin/tazobactam	30	0	100
Amikacin	26	4	86.7
Gentamycin	22	8	73.3
Ciprofloxacin	19	11	63.3
Levofloxacin	17	13	56.7

Discussion

Active Chronic otitis media is the major health problem and the leading cause of hearing impairment in India. It is mostly the consequences of unresolved or untreated or incomplete treatment of acute otitis media. In our study, 160 patients with the highest CSOM incidence were found in the age group 21-30 years. This finding was similar to studies done by Kumar *et al.* [9] & Pokharnikar *et al*. [10]. Mobility of young adults and more risk of upper respiratory infection may be the attributing factor. In this study, active chronic otitis media incidence was higher in males (53.1%) than in females (46.95), similar to other studies [9, 10]. As we selected patients randomly, this may be an incidental finding.

In this study, only 76.1% of ear samples showed positive bacterial growth, similar to studies done by Kumar *et al*., Jianghong *et al*. & Kim *et al*. [9, 11, 12]. However, studies done by Moffateh *et al*., Madana *et al*. & Hydri *et al*. were reported higher positive cultures rates of 97.3%, 91% & 91.4%, respectively [7, 13, 14]. The differences in methodology, size of samples, slow-growing bacteria, local hygiene & geographical conditions may be the causes for these discrepancies.

This study found Monomicrobial isolates in 120 (87.6%) ear samples of positive growth. However, studies done by Kumar *et al*. & Jianghong *et al*. [9, 11] were reported a higher rate of single bacterial isolates (90.9% & 94.6% respectively) [9, 11]. Mix bacterial growth rate in our ear samples was 12.4% (17 Ears samples). This finding showed a higher growth rate of polymicrobial isolates in positive samples compared to studies done by Madana *et al*. & Rangaiah *et al*. (1.3% & 5.2% respectively) [13, 15].

The predominant bacterial isolates in Monomicrobial growth were Staphylococcus (60%), followed by Pseudomonas (20%) in our study. These observations were similar to studies done by Bilkisu *et al*., Jianghong *et al*., Rangaiah *et al*. & Taneja *et al*. [6, 11, 15, 16]. However, other studies reported Pseudomonas as predominant isolates [9, 14, 17]. In our study, Pseudomonas growth was more than Staphylococcus in polymicrobial growth. Klebsiella, Proteus and E coli growth was very less as compared to staphylococcus and pseudomonas in our study. However, Udden *et al*. & Chirwa *et al*., in 2018 observed Proteus as the most common bacterial isolate in-ear pus culture at Angola & Malawi [18, 19]. Geographical and climatic variations with different antibiotic usage & sample size variation may be attributing factors for these differences.

In India, the most routinely prescribed antibiotics are penicillins, cephalosporins & fluoroquinolones for active chronic otitis media. In our study, most sensitive antibiotics for Staphylococcus were vancomycin (glycopeptide), rifampicin & gentamycin (98.7%, 96.1% & 92.2% respectively). Amoxycillin, ciprofloxacin and levofloxacin showed sensitivity below 80 % that's why prescribed cautiously as first-line therapy for CSOM in ours.

The most effective antibiotic therapy for pseudomonal infections in our study was meropenem and piperacillin/tazobactam (100% effective). Among cephalosporins, ceftriaxone was not so sensitive (70% sensitivity) but Cefepime and Ceftazidime showed good sensitivity. Quinolones (levofloxacin & ciprofloxacin) were also not so sensitive for pseudomonas. Amikacin also showed a good sensitivity pattern to Pseudomonas. These results suggest a rethink to use levofloxacin, ciprofloxacin and gentamycin as first-line anti-pseudomonal antibiotics.

The most common topical antibiotics used inactive chronic otitis media are fluoroquinolones (ofloxacin, ciprofloxacin, moxifloxacin), aminoglycosides (gentamycin, neomycin,

tobramycin). Advantages of topical antibiotics as ear drops are, high concentration of antibiotics can directly deliver to the site of infection that causes the least chance of resistance to bacteria that's why topical administration is very effective. The disadvantages of topical ear antibiotics are local allergic reactions and ototoxicity, especially with aminoglycosides.
The most effective administration of antibiotics for active chronic otitis media is topical. However, refractory and recurrent cases after administering topical antibiotics for the treatment of otorrhea are also reported. In such cases systemic antibiotics are must give for treatment. Therefore, it is necessary to get an ear discharge culture and sensitivity reports for proper and complete treatment of active CSOM.

Conclusion

From the above study, it is observed that *Staphylococcus*, followed by *Pseudomonas* is the most common isolates of active chronic otitis media, especially in Monomicrobial growth. However, Pseudomonas is most common in polymicrobial growth, followed by *Staphylococcus*. The most effective antibiotics for *Staphylococcus*, are vancomycin, rifampicin & gentamycin and for *Pseudomonas* are meropenem and piperacillin/tazobactam. Amoxicillin, cephalosporins and fluoroquinolones sensitivity below 80% for *Staphylococcus & Pseudomonas* both, so should be cautiously used as first-line antibiotics.

Declaration of conflicts of interests

There is no conflict of interests

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Nil

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