Original Research Article

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Bacteriological profile of chronic suppurative otitis media in a tertiary care hospital

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ABSTRACT

Background: Chronic suppurative otitis media is a disease affecting the middle ear and mastoid cavity, leading to considerable morbidity by causing hearing loss; and even life threatening complications in squamosal type of CSOM, if left untreated over long periods of time. Hence it is imperative to treat the persistent ear discharge in CSOM according to the antibiotic susceptibility of the organisms isolated.

Methods: This is a prospective cross sectional study done in 135 patients of chronic suppurative otitis media presenting with active ear discharge. Sterile swabs were used to collect pus from discharging ear and sent for culture sensitivity.

Results: *Staphylococcus* and *Pseudomonas aeruginosa* were the most common organisms isolated in this study. *Pseudomonas aeruginosa* was most sensitive to Piperacillin-Tazobactam, followed by Meropenem and Ciprofloxacin. *Staphylococcus aureus* was most sensitive to Linezolid followed by Cefoxitin and Erythromycin.

Conclusions: Treating active discharge of CSOM according to pus culture sensitivity pattern reduces the bacterial load in the middle ear and makes the ear more favourable for graft uptake.

Keywords: Chronic suppurative otitis media, Aerobic bacterial culture, Antibiotic susceptibility, *Pseudomonas aeruginosa*, *Staphylococcus aureus*

INTRODUCTION

Chronic suppurative otitis media is a disease affecting the middle ear and mastoid, routinely seen in the outpatient setting in Otorhinolaryngology. Among the South-East Asian countries, India has the highest prevalence rate of 7.8%. Chronic suppurative otitis media (CSOM) is defined as 'chronic or intermittent otorrhea through a persistent non intact tympanic membrane. It presents with recurrent ear discharge or otorrhea through tympanic membrane perforation. CSOM is a disease with varied etiology and is classified into two types namely mucosal type and squamosal type of CSOM depending upon whether the disease process affects the pars tensa or pars

flaccida of the tympanic membrane. The episodes of otorrhea are often provoked by upper respiratory tract infections, particularly common in children. A smaller group of patients of squamosal type of CSOM, particularly those who have not been treated, tend to develop life threatening complications over a long period of time.

Indiscriminate and inappropriate use of antibiotics to treat CSOM has led to the disease chronicity. Inadequate treatment regimen has led to the development of bacterial resistance which in turn can lead to the development of complications of CSOM, increasing the morbidity of the patient. Hence there is a need to treat the persistent ear

discharge appropriately according to the antibiotic sensitivity pattern of the causative organisms. Bacteriology from pus is also required for the maintenance therapy of antibiotics till the patient undergoes definitive surgical treatment.

METHODS

This study was carried out in patients attending the outpatient department of Otorhinolaryngology, Mandya Institute of Medical Sciences, Mandya, Karnataka, India, between January 2016 to June 2016, who presented with ear discharge and tympanic membrane perforation/retraction with or without cholesteatoma. This prospective cross sectional study was approved by the Institutional Ethical committee and informed consent was obtained from patients enrolled into the study.

A total of 135 patients clinically diagnosed with CSOM presenting with more than three weeks of ear discharge and who did not receive any topical or systemic antibiotics in the past one week were included in the study. Patients with both mucosal type of CSOM in active stage and squamosal type of CSOM were included in the study. Patients with ear discharge with less than three weeks duration and otomycosis were excluded from the study. Pus was collected from the discharging ear in a sterile cotton swab before suctioning and aural toilet. Care was taken to avoid surface contamination and swabs were sent to the department of Microbiology for Gram stain, and culture and sensitivity.

Both aerobic and anerobic cultures were done by inoculating the swabs on Blood agar, Mac Conkey's agar, Chocolate agar, Nutrient agar and Robertson's cooked meat media. Antibiotic susceptibility testing was done by modified Kirby-Bauer disk diffusion method and the results were interpreted using international CLSI guidelines (Clinical and Laboratory Standard Institute 2015) i.e., M100 which is disk diffusion and MIC (minimal inhibiting concentration) for aerobes and anaerobes.³

RESULTS

A total of 135 patients with CSOM were enrolled in the study. 123 patients had mucosal type of CSOM, whereas 12 patients were diagnosed with squamosal type of CSOM (Figure 1). 17 patients out of total 135 had

bilateral CSOM. Age group of patients ranged from 1 to 70 years with mean age being 29.4 years. The highest incidence of CSOM was found in the 1 to 15 years age group (Table 1). Male to female ratio was 8:7 (Figure 2).

Single microbial isolate was found in 108 cases, (80%). Multiple bacteria were isolated in 7 cases, (5.2%). 20 samples (14.8%) were reported with sterile culture or no growth of microbes (Table 1). The most frequently isolated organism in this study was Staphylococcus; 43 out of 135 (31.8%) of which Staphylococcus aureus was 28/43 (65.11%), MRSA (Methicillin Staphylococcus aureus) were 6/43 (13.9%) and CONS (Coagulase Negative Staphylococcus) were 9/43 (20.9%). The second most common organism isolated was Pseudomonas aeruginosa; 42 out of135 (31.1%) (Figure 3). There were no anaerobes that were isolated in this study (Table 2).

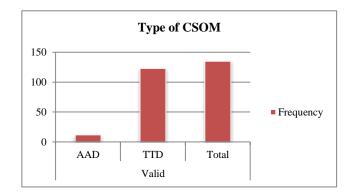


Figure 1: Frequency of mucosal and squamosal type of CSOM.

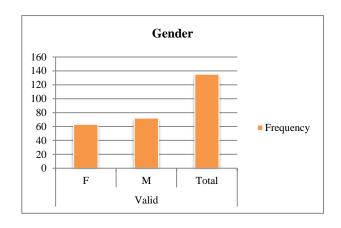


Figure 2: Gender distribution of CSOM.

Table 1: Culture pattern in various age groups.

Age group	Single bacteria isolated	Multiple bacteria isolated	Sterile culture	Total
1-15	32	0	8	40
16-30	28	2	5	35
31-45	28	4	4	36
46-60	14	1	2	17
61-75	6	0	1	7
Total	108	7	20	135

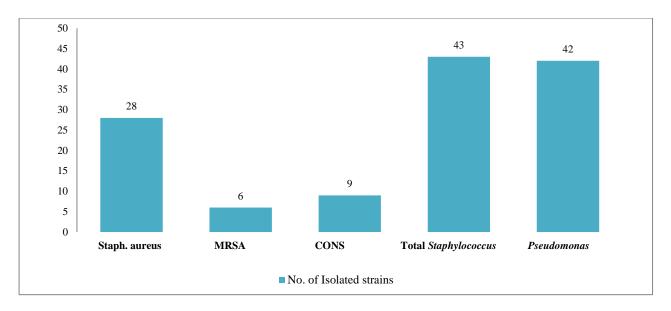


Figure 3: Most common organisms isolated in this study.

Table 2: Organisms isolated in the study (M = multiple organisms).

Organism	Frequency	Percent
Acinetobacter	8	5.9
Acinetobacter, CONS (M)	1	0.7
Citrobacter	3	2.2
CONS	6	4.4
E.coli	7	5.2
E.coli, CONS (M)	1	0.7
E.coli, Pseudomonas (M)	2	1.5
Enterococci	2	1.5
Klebsiella	3	2.2
MRSA	6	4.4
No growth	20	14.8
Pneumococci	1	0.7
Proteus mirabilis	1	0.7
Proteus vulgaris	3	2.2
Pseudomonas	38	28.1
Pseudomonas, Staph. aureus (M)	1	0.7
Schwanella species, CONS (M)	1	0.7
Schwanella	4	3.0
Staph. aureus	26	19.3
Staph. aureus, Pseudomonas (M)	1	0.7
Total Staphylococcus	43	31.8
Total Pseudomonas	42	31.1

Antimicrobial agents with maximum activity against isolates, in order were Meropenem (46.7%), Piperacillin Tazobactam (46.7%), Gentamycin (43.7%) (Figure 4). Antibiotic sensitivity pattern for *Staphylococcus* including *Staphylococcus* aureus, MRSA and CONS in order was Linezolid, Cefoxitin and Erythromycin (Table 3). Antibiotic sensitivity pattern for *Pseudomonas*

aeruginosa in order was Piperacillin Tazobactam, Meropenem and Ciprofloxacin (Table 4).

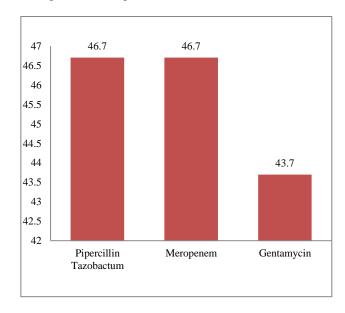


Figure 4: Maximum antibiotic sensitivity against all organisms.

Table 3: Antibiotic sensitivity pattern for Staphylococcus.

S. No.	Antibiotic	No. of sensitive strains	Percentage of sensitive strains (%)
1	Linezolid	37	86.04
2	Cefoxitin	24	55.81
3	Erythromycin	22	51.16
4	Vancomycin	16	37.20
5	Gentamycin	16	37.20
6	Ciprofloxacin	14	32.55

Table 4: Antibiotic sensitivity pattern for Pseudomonas aeruginosa.

S. No.	Antibiotic	No. of sensitive strains	Percentage of sensitive strains (%)
1	Piperacillin Tazobactam	37	88.09
2	Meropenem	34	80.95
3	Ciprofloxacin	31	73.80
4	Amikacin	28	66.66
5	Ceftazidime	27	64.28
6	Gentamycin	25	59.52
7	Ceftazidime and Clavulanic acid	23	54.76

DISCUSSION

Chronic suppurative otitis media is one of the chronic infectious diseases worldwide, commonly having its onset in childhood and causing considerable morbidity into adulthood. Chronic suppurative otitis media, according to WHO, is defined as a chronic inflammation of the middle ear and mastoid cavity, which presents with recurrent ear discharges or otorrhea through a tympanic membrane perforation.¹ The WHO definition requires only two weeks of otorrhea, but otolaryngologists tend to adopt a longer duration, e.g. more than three months of active disease.4 Various risk factors have been quoted in the literature for the development of CSOM including frequent upper respiratory tract infections, nasal disease, inadequate antibiotic treatment, poor living conditions with poor nutrition and hygiene. These risk factors probably favor the development of CSOM by weakening the immunological defences, increasing the inoculum and encouraging early infection.⁵ The recurrent episodes of otorrhea and mucosal changes are characterised by osteoneogenesis, bony erosions and osteitis in the temporal bone and ossicles.⁶ The sequelae of otitis media, including chronic perforation of the tympanic membrane, ossicular erosion, labyrinthine erosion and tympanosclerosis contribute to hearing loss.⁷

In CSOM, the causative bacteria may be aerobic (e.g. Pseudomonas aeruginosa, Escherichia Staphylococcus aureus, Streptococcus pyogenes, Proteus mirabilis, Klebsiella species) or anaerobic (e.g. Bacteroides, Peptostreptococcus, Propionibacterium). The bacteria are infrequently found in the skin of the external auditory canal, but may proliferate in the presence of trauma, inflammation or high humidity. These bacteria may gain entry into the middle ear through perforation. Among these bacteria. chronic Pseudomonas aeruginosa in known to cause deep seated and progressive destruction of middle ear and mastoid structures through its toxins and enzymes.¹

In this study, the peak incidence of CSOM was found to occur in the 1^{st} and 2^{nd} decade, possible reason being the

frequent upper respiratory tract infections seen in this age group due to Eustachian tube dysfunction. Differences in sexual preponderance is incidental, and has no anatomical factors predisposing either sex to the development of CSOM. A single bacterium was isolated from 108 cases, 80%. Multiple bacteria were isolated from 7 samples, 5.2%. No growth was found in 20 cases (14.81%). A study by Prakash et al showed pure growth in 57.84%, mixed growth in 33.33% and no growth in 8.82% of samples.⁸ A study in 62 children with only atticoantral type of CSOM showed monomicrobial growth in 90.90%, polymicrobial growth in 9.09% and sterile in 5.11%. Another study on 71 CSOM patients presenting with complications showed 42.25% of cultures to be sterile, and 57.74% were positive with aerobic isolates. Out of these, 68.29% showed monomicrobial isolates and 31.7% showed polymicrobial isolates. ¹⁰ The reason for such grossly varied differences in studies could be the swabs being contaminated or usage of prolonged course of various antibiotics yielding the cultures sterile.

Staphylococcus was the most common organism isolated in this study 43/135 (31.8%). *Staphylococcus aureus* was 28/135 (20.74%); MRSA (methicillin resistant *Staphylococcus aureus*) was 6/135 (4.44%); and CONS (Coagulase negative *Staphylococcus aureus*) was 9/135 (6.66%). *Pseudomonas aeruginosa* was the second most common organism isolated in this study 42/135 (31.11%). *Staphylococcus aureus* was the most commonly isolated organism in CSOM in five studies whereas four other studies found that Pseudomonas aeruginosa was the most commonly isolated organism in CSOM. 8-16

A study by Prakash et al found significant proportion of anerobes (29.41%); predominantly *Clostridium* species, *Peptococcus* species and *Peptostreptococcus*.⁸ Studies by Ibekwe et al, Maji et al and Indudharan et al showed negligible *anerobic* isolates.¹⁷⁻¹⁹ In this study no anerobes were isolated.

Antibiotic susceptibility testing was carried out for all the microorganisms isolated. Most of the isolates were found to be sensitive to Meropenem, Piperacillin Tazobactam and Gentamycin. Pseudomonas isolates were most sensitive to Piperacillin Tazobactam and Staphylococcus aureus isolates were most sensitive to Linezolid. Most of the studies showed maximum susceptibility of culture isolates to amikacin.^{8,12,15} Ceftazidime was found to be the most sensitive antibiotic in one study. 16 Study by Prakash et al showed ciprofloxacin and gentamicin as an effective first line topical antibiotic in the treatment of otorrhea in CSOM.8 Chloramphenicol and metronidazole were found to be the most effective antibiotics against anaerobic organisms.¹⁹ In this study, most of the organisms were found to be resistant to regularly used cell wall inhibitors like penicillin group of drugs and cephalosporins.

CONCLUSION

CSOM is a chronic disease causing morbidity by deafness, delayed intellectual development, limited employability and a disturbed social life. Persistent otorrhea in active CSOM needs to be treated diligently according to the antibiotic susceptibility pattern of causative organisms. The purpose of continuing medical therapy for CSOM would be to prepare the ear by reducing the bacterial load before surgery and improving the graft uptake and stability of middle ear function post-surgery. Staphylococcus and Pseudomonas aeruginosa were the commonly isolated organisms in this study; and most of the isolates showed sensitivity to higher antibiotics like Meropenem, Piperacillin Tazobactam and Gentamycin.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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