Original Research Article

Microbiological profile of chronic suppurative otitis media presenting to a tertiary care teaching hospital - A cross-sectional study

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Abstract

Background: Chronic suppurative otitis media (CSOM) is one of the most frequently observed diseases in Otolaryngology practice. The primary objective of the study was to assess the bacteriological and mycological profile in chronic suppurative otitis media among patients visiting a tertiary care hospital in Tamil Nadu.

Materials and methods: A total of 268 samples from 200 patients fulfilling the criteria were included. All patients underwent otoscopic examination; Tuning fork test and pure tone audiometry (PTA) were performed. Microbial identification was performed by collecting Aural discharge from the middle ear of each patient by using two sterile swabs.

Results: More than half of the patients belonged to 21 to 40 year age group. Only 5.5% of them were aged 20 years and below. Unilateral involvement of CSOM was observed in 66% of the patients with 34% of them affecting both the ears. Microbial assay showed 78% of cases with gram-negative microbial infection while 22% were with gram-positive microbes. Staphylococcus aureus was the commonest gram positive bacteria (90.9%) while Pseudomonas aeruginosa was the most frequent gram-negative microbe. Among fungi, Candida albicans was found in 71.42 patients.

Conclusion: The findings of the study revealed that Staphylococcus aureus and Streptococcus pyogenes were the most prevalent gram-positive bacteria while Pseudomonas aeruginosa and Klebsiella pneumoniae were the commonest CSOM-causing gram-negative microorganisms.

Key words

CSOM, Chronic suppurative otitis media, Microbiological profile.

Introduction

Chronic suppurative otitis media (CSOM) chronic inflammation of middle ear and mastoid cavity that may present with recurrent ear discharges or otorrhoea through a tympanic perforation lasting at least two weeks [1]. Its incidence is particularly common among low socio-economic groups due to malnutrition, overcrowding, poor hygiene, inadequate health care, and recurrent upper respiratory tract infection [2]. The urban to rural ratio of the disease is 1:2 and the poorer rural communities have highest prevalence [3]. The global burden of illness from CSOM is estimated to involve about 65 to 330 million individuals with draining ears, 60% (39 to 200 million) of whom suffer from significant hearing impairment. Over 90% of the burden is borne by developing countries in Southeast Asia, the Western Pacific Region, and Africa [4]. The typical microbes reach middle ear following insufflations of respiratory pathogens through the eustachian tubes from the nasopharynx and spread from the external ear canal inwards through a non-intact tympanic membrane [5, 6].

The microbiology of CSOM is unique as polymicrobial aerobic and anaerobic flora were isolated from over half of the cases. Aerobic and facultative organisms, mainly Staphylococcus aureus and Gram-negative bacilli (including Pseudomonas aeruginosa), were long considered to be the major pathogens causing CSOM [7]. However, studies that were done in several European, Asian, and American countries and utilized proper methods of collection, transportation, and cultivation of anaerobic bacteria reported their recovery from many cases of CSOM [8-10]. Anaerobes were isolated from 8 to 59% of the patients studied. The predominant aerobic isolates were S. aureus and P. aeruginosa and the predominant anaerobic organ- isms were anaerobic Gram-positive cocci and pigmented Prevotella and Porphyromonas species. The differences in the rate of recovery of anaerobes in these studies may be due to differences in geographic locations and the laboratory techniques.

Studies on microbiologic diagnoses of CSOM differ in regard to patient age, geography, and the presence of complications such as cholesteatomas, and these inconsistencies likely impact some of the variation in reported pathogens, which could be partly related to sampling variation and methods of processing [11]. Understanding of the microbiology of chronic otitis media is important for efficient and effective treatment, and prevention of complications and antibiotic resistance. Hence, the present study aimed to assess the bacteriological and mycological agents and their antibiogram in chronic suppurative otitis media among patients visiting a tertiary care hospital in Tamil Nadu.

Materials and methods

The cross sectional study was conducted in the Department of Otorhinolaryngology in association with Department of Microbiology for 18 months from January, 2017 to June, 2018. A total of 200 cases were selected from the patients who attended ENT OPD of a tertiary care hospital and Govt. Hospital at Perambalur on the basis of the following criteria.

Inclusion criteria

- Patients diagnosed as CSOM-discharge for more than 4 weeks (safe/ Tubotympanic type)

- Age: All ages and both sex
- Residual or Recurrence of Disease
- Patient not underwent any surgical treatment for CSOM.

Exclusion criteria

- CSOM with co-morbid conditions like diabetes, chronic drug intake previous ear surgeries
- Patients with complications of CSOM (facial palsy, brain abscess, lateral sinus thrombosis, cavernous sinus thrombosis and profound hearing loss)
- Antibiotic intake (oral/ intravenous/ topical) more than 5 days prior to clinical presentation.

A total of 200 patients fulfilling the criteria were included. The demographic information of the patients like name, age, sex, religion, education, occupation and income were recorded. Detailed history regarding the illness was noted in a specially designed proforma for the study. A systematic clinical examination of each patient that included otoscopic examination, Tuning fork test and pure tone audiometry (PTA) were performed. All patients were explained about the details of the study and their written consent was obtained.

The external auditory canal of the patients was cleaned well and their aural discharge was collected for the middle ear by using two sterile swabs under a septic precautions. An aural speculum was used so that the swabs do not touch the external ear while collecting the samples. The discharge from aural swab was added to the Stuart transport medium and transported to microbiology lab, DSMCH. Post aural swab collection, the patients were treated with broad spectrum antibiotics, according to antibiotic policy of the institution and were recalled for follow up after 5 days. Once the culture and sensitivity reports were received, the antibiotics were changed during the follow up based on the type of microbes cultured.

Culture studies

All the 200 patients were considered for culture studies and from each patient two aural swabs were collected. Out of the two swabs, one swab was inoculated on blood agar and other on Mac Conkey's agar after Gram's stain smear was done. The inoculated medium was incubated at 37˚C for 48 hours. Though reporting was done after 48 hours each culture tube was kept for a week. The plate inoculated with Mac Conkey's agar, was also incubated at 37˚C for 24 hours. The second swab was inoculated in SDA for fungal identification. Gram's staining of the slide was done to have an idea on the types of organism present. Next day appearance of growth in nutrient broths and the colour of the broth were noted. A loop full of growth from nutrient broth was taken and smear was prepared and Gram's staining was done, The Motility of the organisms was also studied by hanging drop method to confirm the organism. A loop full of growth from nutrient broth was inoculated on each of blood agar plate and Mac Conkey's medium. Appearance of growth and colony characters on the solid media were recorded. Any change in color on Mac Conkey's plate and type of hemolysis on blood agar plate were also noted. Further, smears taken from both the plates and stained by Gram's staining and motility by hanging drop method were studied and the type of organism was confirmed.

If there was no growth in the first 24 hours the medium was reintubated and studied again after additional 24 hours. Cultures were reported sterile if no growth was obtained even after the incubation of 48 hours. In the cases where gram negative organisms were grown a colony from Mac Conkey's plate was picked up by Nichrome loop and inoculated in peptone water and incubated for 24 hours at 37˚C. Organisms from peptone water was transferred to various sugar media such as Glucose, Lactose, Maltose, Mannitol, Sucrose, Simmon's citrate media, Glucose phosphate media and Christensen's urea medium. Standard biochemical test was done. After Incubating in these media for 24 hours, the standard biochemical reactions were reported in

the next day. If the organisms grown were gram positive cocci, coagulase test was done. After isolation of pure culture on solid media, Colony of each organism was inoculated on Nutrient broth and incubated for 24 hours at 37˚C.

Results

Total of 200 subjects included in the study. **Table - 1** describes the demographic characteristics of the patients. Majority of 27% participants were aged in 31 to 40 years age group, followed by 21 to 30 years, 41 to 50 years, 51 to 60 years and 61 to 70 years age group was 23%, 18% and 11% respectively. In our study, 105 (52.5%) were males and 95 (47.5%) were females. In this present study, we did not find any significant predominance of one ear, both left and right ears were almost equally affected. In bilateral cases of CSOM, one of ear either left or right, as per patient comfort, aural swabs was collected and send to lab.

Table - 1: Summary of baseline characteristics (N=200).

	Number of cases	%
Age Distribution / in Years		
1-10	1	0.5
11 – 20	10	5
21 – 30	46	23
31 – 40	54	27
41 – 50	36	18
51 – 60	30	15
61 – 70	22	11
71 – 80	1	0.5
Gender		
Male	105	52.5
Female	95	47.5
Laterality Side		
Right	65	32.5
Left	67	33.5
Bilateral	68	34.0
Total	200	100

A total of 268 samples from 200 subjects were included in the final analysis. Out of 268 samples tested, among 200 (74.7%) at least one organism was isolated and 48 (17.9%) samples had no isolates and 20 (7.4%) samples were contaminated (**Table - 2**).

Table - 2: Summary of culture results of 268 samples tested.

	No. of cases	%
At least one organism isolated	200	74.7%
No organism	48	17.9%
Contaminated samples	20	7.46%

Table - 3: Details of organisms isolated among the culture positive samples (N=200).

	No. of cases	%
Organism isolated (N =200)		
Gram positive	44	22
Gram negative	156	78
Gram positive isolates (N=44)		
Staphylococcus aureus	40	90.9
Streptococcus pyogenes	4	9.1
Gram negative isolates (N=156)		
Pseudomonas aeruginosa	82	52.56
Klebsiella pneumoniae	34	21.79
Proteus mirabilis	24	15.38
E coli	16	10.25
Fungus isolated (N=7)		
Candida albicans	5	71.42
Aspergillus fumigatus	2	28.58
Bacterial and fungus (N=7)		
E coli (GN) and Candida albicans	3	42.85
Klebsiella pneumonia (GN) and Candida albicans	2	28.57
E coli (GN) and Aspergillus fumigates	2	28.57

Table - 3 describes the microbiological assay of the CSOM. Among the study population, 44 (22%) participants were organism isolated gram

positive. Out of 44 gram positive, 40 (90.9%) participants had staphylococcus aureus and 4 (9.1%) participants had streptococcus pyogenes. Among the staphylococcus aureus isolates, 90% were Coagulase positive and 10% were Coagulase negative. Among the people with fungus isolated, 5 (71.42%) participants had Candida albicans and 2 (28.58%) participants had Aspergillus fumigatus. Among the people with bacterial and fungus, 3 (42.85%) participants had E coli (GN) and Candida albicans and 2 (28.57%) participants had Klebsiella pneumonia (GN) and Candida albicans and E coli (GN) and Aspergillus fumigates for each.

Discussion

The CSOM is defined as a longstanding infection of a part of whole of middle ear cleft characterized by ear discharge and a permanent perforation [12]. Aerobes, anaerobes, and fungi are all potential pathogens in CSOM. Knowledge of the true frequency of polymicrobial infection, particularly the extent of anaerobic involvement, is limited by differences in collection and culture techniques [13, 14]. Traditional swab specimen collection has been associated with contamination with normal skin flora like Staphylococcus epidermidis, diphtheroids and anaerobic organisms, such as Propionibacterium acnes [15].

Among the study participants, the prevalence of CSOM was particularly high among adults accounting for 50% among those aged between 21 and 40 years. However, the prevalence was conspicuously very low among the children (0.5% in 1-10 year olds). In line with these findings Chirwa, et al. [16] in their hospital based cross-sectional study of 104 patients with CSOM found 61.5% of them between the age of 18-40 years. Contrasting with the study findings Deb and Roy observed 36.18% of adults between age group 21-40 years.

Gender wise, relatively high proportion of males (52.5%) had CSOM compared to females (47.5%). These findings are in line with a hospital based study at Agartala [17] in which 51.54% of males and 48.46% of females were affected. However, Chirwa, et al. [16] noted a higher prevalence among males (61.5%) compared to females (38.5%).

Regarding the side of the ear involvement, Chirwa, et al. [16] observed 86.5% cases with unilateral involvement and 6.7% bilateral involvement. However, in the present study 66% of the patients had unilateral CSOM and 34% were affected on both ears. Also it is to be noted that there was no significant preponderance as left ear, right ear and involvement of the both the ears was almost similar.

The microbiological assessment of the swabs collected from patients with CSOM revealed gram-negative bacteria (78%) as the commonest microbe compared to gram-positive bacteria (22%). Similar to these findings Chirwa, et al. [16] also found gram-negative organisms in 72.7% of the cases and gram-positive microbes in 27.3% of cases. It is usually seen that aerobic gram-negative rods outnumber gram-positive cocci in CSOM. This could be attributed to exposure to contaminated water [2, 18].

Among the gram-positive organisms, Staphylococcus aureus (90.9%) was invariably the most commonly isolated compared to Streptococcus pyogenes (9.1%). Though, Staphylococcus aureus was the commonest gram-positive organism isolated by Chirwa, et al. [16], its proportion was far lesser (20.1%). Among the gram-negative microbes, it was Pseudomonas aeruginosa (52.56%) was the commonest followed by Klebsiella pneumoniae (21.79%). Contrastingly these findings differ from another study from Malawi [16] which found Proteus mirabilis (28.6%) as the most frequently isolated gram-negative microbe followed by Pseudomonas aeruginosa (20.8%). Bacterial infection is often the cause of exacerbation and treatment failure in CSOM [19]. If proper antibiotic therapy is provided, with culture and sensitivity operative

management can be avoided. Fungal infections of the middle ear are common as fungi thrive well in moist ears [20]. The most commonly isolated fungi in CSOM are Candida and Aspergillus fumigatus [10]. Similarly Of the seven cases of fungus infected CSOM, Candida albicans (71.42%) was the most frequently isolated from the swabs followed by Aspergillus fumigatus (28.58%). However, Contrary to this, Chirwa, et al. [16] in Malawi noted Aspergillus (17.8%) as the commonest fungus followed by Candida albicans. The key limitation of the study was non-inclusion of procedures to isolate anaerobic organisms, the inclusion of which would have made the study more comprehensive.

Conclusion

The findings of the study revealed that Staphylococcus aureus and Streptococcus pyogenes were the most prevalent gram-positive bacteria while Pseudomonas aeruginosa and Klebsiella pneumoniae were the commonest CSOM-causing gram-negative microorganisms. Candida albicans and Aspergillus fumigatus were the frequent fungi associated with CSOM. Even in this era of powerful antibiotics, CSOM still consumes considerable medical expenditure, especially in the poorer sections of the society. Future studies should focus on the bacterial profile of multidrug-resistant strains resulting from indiscriminate use of antibacterial agents. So formation of empirical antibiotic policy of a specified geographical region is of vital importance. This will have a huge positive impact by avoiding surgical procedure, minimizing the health care expenditure and more importantly preserving the quality hearing, to lead a normal social life.

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