Research Article

Bacterial and fungal study in chronic suppurative otitis media from a developing country

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Abstract

Introduction: Chronic suppurative otitis media (CSOM) associated with fungal infection has been associated with much morbidity including economic burden. Considering the differences in the etiological agents and their susceptibility pattern, it becomes necessary to have up-to-date information on microbial resistance to guide the rational use of the existing antimicrobials. Hence, the present study has been envisaged to evaluate the spectrum of micro-organisms causing chronic suppurative otitis media and their antimicrobial susceptibility pattern in a tertiary care hospital. **Materials and Methods:** The present study was a cross-sectional study. Patients who have been diagnosed to have chronic suppurative otitis media by clinical symptoms and signs were enrolled in the study with ethical view. Demographic details (age, sex), history associated with risk factors (unhygienic mopping, past history of antibiotic use/ear infections/surgery in the ear or head) were collected from each study participant. Three cotton swabs were used to collect the discharge and were subjected to Gram stain; aerobic culture and direct examination (KOH Preparation) for fungal elements and fungal culture were done. **Results:** There were total 176 patients included in study. A total of 70 (37.04%) consecutive CSOM patients were identified of which, majorly were males than females. Majority had unilateral involvement and most of them were between age of 21-40 years old. Most of patients had history of discharge for the duration of 3 months to 6 months. Majority of the study participants had mucopurulent discharge, history of instillation of topical antibiotics and reported of having unhygienic mopping of ear discharge. *Pseudomonas aeruginosa* was the most predominant organisms isolated followed by *Staphylococcus aureus, Klebsiella pneumonie and Escherichia coli.* Most of the isolated organisms (68.4%)] were sensitive to Gentamicin, Amikacin, Augmentin and Ceftriaxone. **Conclusion:** We found that majority of the patients of CSOM had clinical presentation similar to other parts of the world. Even the growth and sensitivity of the isolated micro-organisms were similar to previous studies.

Keywords: chronic suppurative otitis media, Gram stain, culture, antibiotic sensitivity.

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INTRODUCTION

Chronic suppurative otitis media is a chronic inflammation of middle ear due to various causes and is also famous for its chronicity and recurrence. This is common in the developing countries, where prevalence is as high as 6-11% across various group as in developed countries.[1] It affects all age group with preponderance in adult but no sex discrimination. Cause of chronic suppurative otitis media is multifactorial origin. Therapeutic failure is seen in chronic suppurative otitis media, causing high incidence and prevalence in community. It may lead to complications such as labyrinthitis, mastoiditis, facial palsy, meningitis, intracranial abscess. CSOM also causes an enormous economic burden to the society in terms of physician visits, medications, surgical procedures, and absences from work, school, or day care. *Pseudomonas aeruginosa* is the most commonly recovered organism from

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chronically draining ears then it is followed by *Staphylococcus aureus*. Chronic suppurative otitis media is most likely the result of an incompletely or unsuccessfully treated acute episode of otitis media. Moreover, the resistance profile of micro-organisms may vary due to the difference in geography, local antimicrobial prescribing practices and prevalence of resistant bacterial strains. Thus, it becomes necessary to have up-to-date information on microbial resistance to guide the rational use of the existing antimicrobials. Without knowing the sensitivity pattern of the micro-organisms causing CSOM, empirical antibiotic therapy of CSOM is not justifiable. Hence the present study has been envisaged to evaluate the spectrum of micro-organisms causing CSOM and their antimicrobial susceptibility pattern in a tertiary care hospital.

MATERIAL AND METHOD

The present study was a cross-sectional study conducted between June 2007 and December 2008 in the ENT clinic, Krishna Institute of Medical Sciences and Dr. Kantak ENT Hospital, Karad. The study was initiated following approval from the institutional ethics committee and written informed consent. Patients who have been diagnosed to have chronic suppurative otitis media by clinical symptoms and signs were enrolled in the study. Demographic details (age, sex), history associated with risk factors (unhygienic mopping, past history of antibiotic use/ear infection/surgery in the ear or head) were also collected. The external ear was cleaned with sterile wet cotton swab and at same time, type of discharge observed. Thin sterile cotton swab (manually made and autoclaved) was passed through the ear with auditory speculum and pus was collected from adjacent of the tympanic membrane and placed into sterile culture tubes. Three cotton swabs were used to collect the discharge. One swab was used for Gram staining and aerobic culture. The culture was carried out on plain blood agar, MacConkey's agar and chocolate agar and incubated aerobically at 37^0C overnight. The aerobic organisms were identified according to standard methods (Mackie and McCartney). Isolated organisms were tested for their sensitivity against antibiotics according to the Kirby-Bauer method as per CLSI standards. The control organism strains that were used include *Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 25923, *Pseudomonas aeruginosa* ATCC 27853 and *Klebsiella pneumoniae* ATCC 13883. The second swab was processed for direct examination of fungal elements by KOH Preparation and third swab for fungal culture. Two sets of Sabouraud's dextrose agar with and without actidione were inoculated with the specimen, and incubated at 25^0C and 37^0C respectively. These were examined everyday in the first week and then twice a week for the next three weeks for the growth of any yeast or mycelial fungus. Lacto phenol cotton blue preparation, slide culture and germ tube test (in case of *Candida albicans*) were also performed to identify the species. Descriptive statistics were used for representing the demographic details of the study participants. Age was categorized into three categories (0-20, 21-40, above 40 years).

RESULTS

Demographic details

A total of 70 consecutive CSOM cases among 176 patients were identified. Out of which, 52 (100%) were males and 18 (100%) were females, 33 (47.14%) were of 21-40 age group of years, 21 (30%) were of >40 years and 16 (22.86%) were of 0-20 years. In relation to bacterial and age sex, there was no significant ($p>0.05$) difference. Majority [45/70(32.37%)] had unilateral while the remaining [25/70 (67.57%)] had bilateral involvement of the ears.

Table 1: Age and sex distribution of CSOM study

Age	No.	Male	Female
0 – 20 years	16 (22.86%)	12 (23.08%)	4 (22.22%)
21 – 40 years	33 (47.14%)	24 (46.15%)	9 (50%)
> 40 years	21 (30%)	16 (30.77%)	5 (27.78%)
Total	**70 (100%)**	**52 (100%)**	**18 (100%)**

Spectrum of micro-organisms

Culture was positive in 60/70 (96.2%) patients. 10 cases showed no growth. A total of 50 individuals had shown growth of one micro-organism, remaining had polybacterial origin so, a total of 81 organisms have been grown in the culture, of which 72 were bacterial isolates and the remaining 9 belong to fungus. Of the 72 bacterial isolates, *Pseudomonas aeruginosa* (43.06%) is the common isolate followed by *Staphylococcus aureus* (23.61%), *Klebsiella pneumoniae* (22.22%) and *E.coli* (8.33%). Other isolates were *Micrococcus and Diphtheriods*. In mycology profile 6 isolates of *Aspergillus*, 5 (55.56%) isolate were of *Aspergillus fumigatus* and one belongs to *Aspergillus flavus*. In case of *Candida (*33.33%), two of belong to *Candida albicans* and one is of *Candida spp*.

Antimicrobial sensitivity pattern

Many of the isolated organisms (68.4%)] were sensitive to gentamicin, (58.33%) were sensitive to Amikacin, (54.17%) to Augmentin and (52.78%) to Ceftriaxone. Details of the microbial isolates, fungal isolates, antimicrobial sensitive and resistance pattern of the isolated micro-organisms are depicted in Table 2, 3, 4, and 5.

Table 2: Analysis of 81 microbial isolates among 60 culture positive CSOM cases in pure and mixed form

Organisms	Monobacterial	Polybacterial	Total
Pseudomonas aeruginosa	25 (50.00%)	6(17.14%)	31
Staphylococcus aureus	9 (18.00%)	8 (22.86%)	17
Klebsiella pneumonie	15(30.91%)	1 (2.86%)	16
E. coli	1 (2.00%)	5 (14.29%)	6
Diphtheroids		1 (2.86%)	1
Micrococcus		1 (2.86%)	1
Candida albicans and its spp.		3 (8.57%)	3
Aspergillus spp.		6 (17.14%)	6
Total	**50 (61.73%)**	**31 (38.27%)**	**81**

Table 4: Incidence of bacterial isolates in CSOM

Organisms	Total
Bacterial isolates (72)	
Pseudomonas aeruginosa	31
Staphylococcus aureus	17
Klebsiella Pneumoniae	16
E. coli	6
Diphtheroids	1
Micrococcus	1
Fungal isolates(9)	
Candida albicans and its spp.	3
Aspergillus spp.	6
Total	**81**

Table 3: Incidence of fungal isolates CSOM culture positive case

Organisms	CSOM	%
Candida albicans	3	33.33%
Aspergillus Fumigatus	5	55.56%
Aspergillus flavus	1	11.11%
Total	**9**	**100%**

Table 5: Antimicrobial sensitivity and resistance pattern of the isolated micro-organisms

	Total	Resistnat to all	AK	AZK	AG	CN	CX	PG	GM	PC	PR	RP	RC	CF	AM
Pseudomonas aeruginosa	31	12	18	8	15	10	9	11	21	15	14	16	16	9	12
Klebsiella Pneumoniae	16	8	9	6	10	12	6	8	10	3	-	9	8	7	8
Staphylococci aureus	17	1	10	8	12	6	12	4	13	16	21	7	5	8	5
E. coli	6	-	3	2	1	1	1	-	4	1	1	3	2	1	1
Diphtheroids	1	-	1	1	1	-	-	-	1	-	1	1	-	1	1
Micrococcus	1	-	1	1	-	-	-	-	1	-	1	-	1	1	-
Total	**72**	**-**	**42**	**26**	**39**	**29**	**28**	**23**	**50**	**35**	**38**	**36**	**32**	**27**	**27**
Percentage		**-**	**55.26**	**34.21**	**51.32**	**38.16**	**36.84**	**30.26**	**65.79**	**46.05**	**50.00**	**47.37**	**42.11**	**35.53**	**35.53**

AK- Amikacin; AZK- Azithromycin; AG- Augmentin; AM-Ampicillin ; CN- Carbencillin ; CX - Cloxacillin ; PG - Penicillin ; GM - Gentamicin ; PC - Piperacillin ; PR - Ceftriaxone ; RP - Cefotaxin ; RC - Ciprofloxacin ; CF - Cephalexin ;

DISCUSSION

The present study has been done over a period of 1.5 years to evaluate the clinical features, type of micro-organisms and their antimicrobial susceptibility pattern in chronic suppurative otitis media patients. Many bacterial organisms were identified to be the causative agents and several risk factors also have been identified to increase the incidence of chronic suppurative otitis media. In India it accounts to almost 3.5% of total patients attending outdoors.[2] In Africa and other developing nations where disease prevalence could be as high as 11% with severe economic loss.[1, 2] Worldwide, the prevalence of CSOM ranges between 2.3-20%.[3] Otomycosis is frequently encountered along with CSOM in tropics, its incidence has increased due to the wide spread use of topical antibiotic, aural preparations. Several researches have shown that, people of low socioeconomic status, poor living conditions, host and environmental factors are the main predisposing risk factors.[4] but according to Taneja [2], incidence of chronic suppurative otitis media as compared to acute otitis has increased in recent years in spite of vast improvement in socioeconomic status, living condition, personal hygiene and better healthcare. Other factors also influence the cause of chronic suppurative otitis media (CSOM), like seasonal and race; Seasonal variations with the disease progression also have been reported in both tropical and temperate region. According to Ibekwe inactive chronic otitis media becomes active during the rainy season in West Africa; similar observation was also mode in America and Europe during winter season.[5] In India the disease is more commonly seen during rainy season.[6] CSOM is one of the most common infections middle of age. We found that majority of the study

participant's belonged to adolescent age group. Majority of the study participants [9/70 (8.57%)] had purulent discharge while mucopurulent [46/70 (76.67%)], mucoid [7/70 (10%)], blackish debris [4/70 (10%)], it indicate fungal growth and no blood mixed discharge were seen in the rest. Most of patients had 3months to 6 months history of discharge. A total of 58/70(96.69%) reported deafness, 18/70 (30%) had blocking sensation in the ear, 42/70 (70%) had ear ache and remaining no one had having symptoms like pulsatile ear discharge and fever. Many individuals 22/70 (31.42%) had claimed application of topical antibiotics and also did unhygienic mopping of the ear with sticks, 12/70(17.14%) reported of having applied oil or hot water in the ears, 60/70 (100%) had used a topical antibiotic, that predisposed for the development of CSOM. This is more commonly seen amongst the patients from rural areas. Regarding clinical manifestations, 26/70 (43.33 %) had history of allergic rhinitis, 14/70 (23.33%) had history of tonsillitis, 4/70 (6.67%) had chronic illness and no one had history of bottle feeding and common cold. In this study, majority cases of polybacterial origin. These findings are in concurrence with studies by Rao and Reddy *et al* [7] (68.52%, 74 cases), Varshney *et al* [8] (82.7%, 124 cases), Ballal *et al* [9] (63.8%, 227 cases), Pajor *et al* [10], poorey *et al* [11], sinha *et al* [12] and Kulkarni *et al* [13]. In the present study, micro-organisms were isolated in around 96% of the cases. *Pseudomonas aeruginosa*(43.06%) was most common followed by *Staphylococcus aureus* 17 (23.61%) were found. *Diphtheroids* and *Micrococcus* were also implicated. It is believed that isolation of these nonpathogenic commensal was not because of contamination from external canal but due to invasion of middle ear by acting as opportunistic pathogens. The precise role played by *Pseudomonas aeruginosa* in chronic suppurative otitis media is difficult to define, as it seems that this pathogen evolves insidiously from saprophytes to full fledged pathogen.[1 ,14] There may be difference in the etiologies of CSOM between different geographical regions. In study of Saini *et al* [15] (2005) *Pseudomonas aeruginosa* (28.36%) was most common followed by *Staphylococcus aureus coagulase positive* (25.53%), *Klebsiella pneumoniae* (14.18%), *E.coli* (7.8%) and *Streptococcus pyogenes* (7.09%). Oguntibeju *et al* [16] (2003), study showed majorly *Pseudomonas aeruginosa* (31%) followed by *Staphylococcus aureus coagulase positive* (17.2%), *Klebsiella pneumoniae* (13.8%), *E.coli* (8.6%) and *Streptococcus pneumoniae* (5.2%). Study of Varshney *et al* [8], noted Pseudomonas *aeruginosa* (35.71%) followed by *Staphylococcus aureus coagulase positive* (19.50%), *Klebsiella pneumoniae* (6.19%), *E.coli* (5.74%), *Streptococcus pyogenes* (1.9%) and *Streptococcus pneumoniae* (1.4%). Urmil *et al* [17] (1998), reported that *Pseudomonas aeruginosa* (44.8%) was the commonest isolate followed by *Staphylococcus aureus coagulase positive* (20.4%), *Klebsiella pneumoniae* (14.1%), *E.coli* (7.8%) and *Streptococcus pyogenes* (3.1%). Brook during his study found that *Pseudomonas aeruginosa* and *Bacteroides* species were more frequently isolated in patients who had a perforation for a longer period of time, or in those who had received treatment with more than one course of antimicrobial agent.[18] In study of Mishra *et al* [19] (1997) *Pseudomonas aeruginosa* (35.75%) was majorly isolate followed by *Staphylococcus aureus coagulase positive* (19.52%), *Klebsiella* pneumoniae (6.92%), *E.coli* (5.74%), *Streptococcus pyogenes* (1.9%) and *Streptococcus pneumoniae* (1.43%). Nilekar *et al* [20] (1996) found that *Pseudomonas aeruginosa* (21.09%) was majorly isolates followed by *Staphylococcus aureus coagulase positive* (17.96%), *Klebsiella pneumoniae* (12.1%), *E.coli* (7.4%) and *Streptococcus pneumoniae* (5.4%). Kulkarni *et al* [13] (1993) reported that *Pseudomonas aeruginosa* (46.37%) was the commonest isolate followed by *Staphylococcus aureus coagulase positive* (21.73%), In study of Ballal *et al* [9] (1992) *Pseudomonas aeruginosa* (31.9%) was the commonest isolate followed by *Staphylococcus aureus coagulase positive* (30.6%), *Klebsiella pneumoniae* (13.4%). In study of Margaret *et al*[21] (1986) *Pseudomonas aeruginosa* (36.55%) was the commonest isolate followed by *Staphylococcus aureus coagulase positive* (10.75%), *Streptococcus pneumoniae* (3.2%), *E.coli* (2.2%) and *Streptococcus pyogenes* (1.05%). In other study, Lakshmi *et al*[22] showed *Staphylococcus aureus coagulase positive (41.25%)* was the commonest isolate followed by *Pseudomonas aeruginosa* (37.55%) and *Shrestha et al*[23] showed same finding. The antibiotics have to be empirical enough to cover the suspected micro-organisms causing infection. Indiscriminate use of antibiotics has lead to a widespread antimicrobial resistance in the current scenario. In our study, majorly isolated organisms (68.4%)] were sensitive to Gentamicin (69.44%) followed by Amikacin (58.33%), Augmentin (54.17%) and Ceftriaxone (52.78%), and least effective antibiotic was Azithromycin (36.11%) and Penicillin (31.94%),the spectrum similar to other reports. of Amadasun *et al* [24] (2003), where maximum sensitivity was seen to Gentamicin 28%, followed by Streptomycin 16%, Chloramphenicol 16%. In Poorey *et al* [11] study (2002), Amikacin was the most effective antibiotic. It was effective against maximum number of strains 87 (85.29%) followed by Ciprofloxacin 83 (81.30%). Cefoperazone 78 (76.4%), Gentamicin 77 (75.4%), Cefotaxime 76 (74.5%) and Amoxicillin 68 (66.6%). In mycology profile 6 isolates *Aspergillus* , 5 isolate were of *Aspergillus fumigatus* and one belongs to *Aspergillus*

flavus. In case of 3 Candida, (33.33%) its two was of *Candida albicans* and one was of *Candida* spp. This finding is in concurrence with studies of Baveja *et al* [25] (1993), where *Aspergillus fumigatus* (52%) was the commonest isolate followed by *Aspergillus niger* (28%) and *Candida albicans* (12%) and Mohanty *et al*[26] (1999), *Aspergillus niger* (41.1%) was the commonest isolate followed by *Aspergillus flavus* (24%) and *Candida albicans* (5.5%). The strengths of the study are that we have collected microbiological reports from slightly more than 100 consecutive patients of CSOM and assessed the presence of various risk factors from each of the study participants. However, the study is limited by the fact that no long-term follow up of the study participants was done, data on recurrence of CSOM was not collected and Mycobacterium cause has not been looked into. In conclusion, we found that majority of the patients of CSOM had clinical presentation similar to other parts of the world. Even the growth and sensitivity of the isolated micro-organisms were similar to previous studies.

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