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Bacteriological And Mycological Profile Of Chronic Suppurative Otitis Media In A Tertiary Care Hospital

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Abstract:
Background*: Chronic suppurative otitis media is the most common infection prevalent in developing countries causing long-standing infection of middle ear cleft. It leads to dangerous complication if not treated timely.*
Materials and Methods*: In this prospective cross sectional study aural swabs collected aseptically from 230 suspected patients of CSOM. Standard protocol was followed in the microbiology department to process samples for both bacteria and fungi. Antimicrobial susceptibility testing was performed for all bacterial isolates by modified Kirby Bauer disc diffusion method as per CLSI guidelines.*
Results*: Out of 230 samples, 178(77.39%) samples were culture positive. Among 178 culture positive, 157(88.2%) were bacterial & 21(11.8%) were fungal isolates. The most common bacterium isolated was Pseudomonas aeruginosa followed by staphylococcus aureus. Pseudomonas aeruginosa was most sensitive to Colistin, Imipenem, Meropenem and least sensitive to Netilmicin. Staphylococcus aureus most sensitive to Vancomycin, Linezolid, and least sensitive to Ciprofloxacin & Penicillin. Among fungus Aspergillus niger was the predominant isolate.*
Conclusion: *Continuous and periodic evaluation of Microbiological pattern, their antibiotic sensitivity and early institution of appropriate treatment are essential to decrease the impending risk of complication.*
Key Word*: Chronic suppurative otitis media, antimicrobial susceptibility testing, Pseudomonas aeruginosa*

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I. Introduction

Chronic suppurative otitis media is a long-standing infection of middle ear cleft. It is characterized by ear discharge and a permanent perforation of tympanic membrane.[1] Incidence of this disease is higher in developing countries especially among low socio-economic society because of malnutrition, overcrowding, poor hygiene, inadequate health care.[2] Triggers for CSOM infections are craniofacial deformity, recurrent upper respiratory infections, nursing while in bed and Eustachian tube dysfunction.[3] CSOM infections may be of bacterial, fungal or viral origin.[4]

Ear infections have been linked to a number of bacterial species.[5] The microbial flora is continually changing as a result of the introduction of newer, broad-spectrum antibiotics.[2] The fungi are usually secondary invaders of tissue already rendered prone by bacterial infections, physical injury or excessive accumulation of cerumen in the external auditory canal.[6]

In many cases of CSOM the antibiotics are prescribed indiscriminately. The consequences are treatment failure, the emergence of resistant strains of organisms, super-infection, intracranial and extracranial complications and lengthening the treatment costs.[7] CSOM may causes fatal condition like facial nerve paralysis, lateral sinus thrombosis, labyrinthitis, meningitis and brain abscess[8]

Against this background, this study was conducted in tertiary care hospital to know the etiological agents causing CSOM, with emphasis on the antimicrobial susceptibility patterns of the bacterial isolates.

II. Material And Methods

This prospective study was carried out at Microbiology department, B. J. Medical College Ahmedabad from January 2021 to December 2022. Institutional Ethical Committee (IEC) permission was taken and Informed consent was obtained from all the patients. 230 clinically suspected patients were enrolled for the study.

Inclusion criteria: Patients of all age group with ear discharge more than 2 weeks duration, hearing loss, ear pain or discomfort, low grade fever, aural fullness, vertigo.

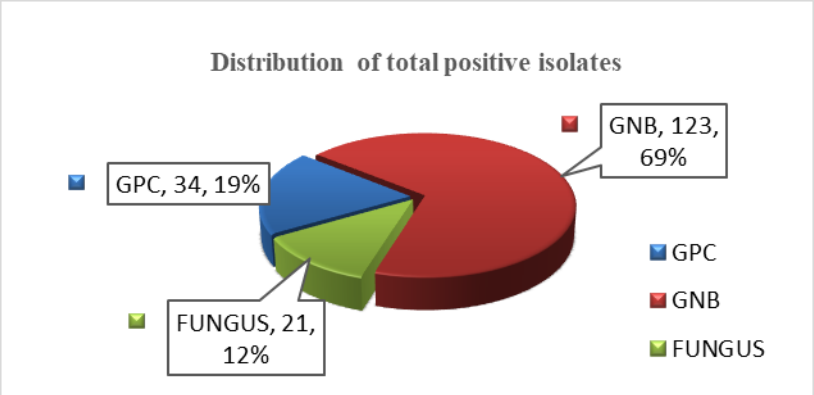
Exclusion criteria: Patient without signs and symptoms of CSOM, family history of congenital or acquired sensory neural hearing loss, history of noise exposure, History of head injury, prior ear surgery or the possibility of a peri-lymphatic fistula, Patients not willing to participate in the study.

Ear discharge was obtained from the diseased ear of the patient, using three separate pre-sterilized swabs, 1st swab was used for microscopical examination by Gram's stain, Ziehl-Nelsen stain and KOH mount. From 2nd Swab Blood agar and MacConkey's agar were inoculated. After overnight incubation, bacterial species were identified by morphology, growth characteristics and biochemical reactions according to standard techniques. From isolated organism, Antibiotics sensitivity was done by modified Kirby Bauer method of disk diffusion on Mueller Hinton Agar plates. Interpretations of the results were made according to Clinical and laboratory standard institute (CLSI) guidelines.[9] In staphylococcus aureus MRSA is detected by using cefoxitin disk. Vancomycin MIC testing is carried out with vancomycin screen agar method for gram positive bacteria and Colistin MIC testing is carried out with colistin screen agar method for gram negative bacteria. 3rd swab was inoculated on Sabouraud's Dextrose Agar (SDA) and incubated in duplicate sets, first set 37ºC and the second set at 25ºC for the isolation of fungus. Lactophenol cotton blue (LPCB) is used to study microscopic appearance of fungal isolates grown on culture. For further identification of candida species, germ tube test, CHROMagar candida medium and biochemical reactions like sugar fermentation test was used.

III. Result

Out of 230 patients, 125(54.35%) were male and 105(45.65%) were female with male: female ratio 1.19: 1. Maximum number of patients 24.78% belonged to the age group of 21-30 years. The majority of patients' ear discharge presentations lasted between 1 to 5years. Out of 230 suspected patient 49% patient had right ear involvement, 42 % patient had left ear involvement and 9% had bilateral ear involvement.

Figure 1: Distribution of total positive isolates



Out of the 230 samples, 178 (77.39%) was positive, while 52 (22.61%) were negative. Among total 178 positive isolates, 34(19.1%) were Gram positive cocci (GPC), 123(69.1%) were Gram negative bacilli (GNB), and 21(11.8%) were fungus isolates as shown in figure 1.

Table 1: Distribution of bacterial isolates(N=157)

Bacterial isolates	Number	Percentage%
Acinetobacter baumannii	3	1.9
Escherichia coli	11	7.01
Klebsiella pneumoniae	11	7.01
Proteus mirabilis	13	8.28
Providencia spp.	5	3.18
Pseudomonas aeruginosa	80	50.96
Staphylococcus aureus	34	21.66
TOTAL	157	100

AS shown in table 1, out of 157 bacterial isolates, *Pseudomonas aeruginosa* was the most common isolated bacteria 50.96% followed by *Staphylococcus aureus* 21.66%, *Proteus mirabilis* 8.28%, *Escherichia coli* 7.01%, *Klebsiella pneumoniae* 7.01%, *Providencia spp*. 3.18% and *Acinetobacter baumannii* 1.9%.

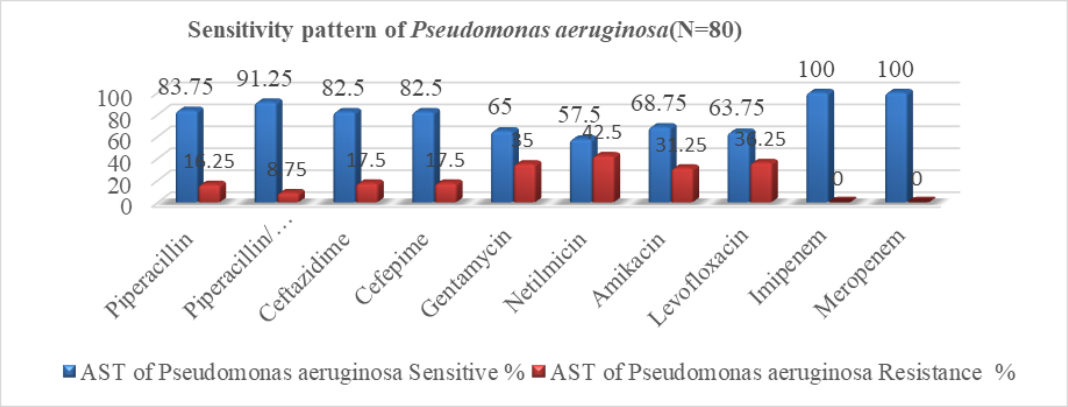
Table 2: Distribution of fungal isolates(N=21)

Fungal isolates	Number	Percentage
Aspergillus flavus	3	14.28
Aspergillus fumigatus	2	9.53

Aspergillus Niger	7	33.33
Aspergillus terreus	2	9.53
Candida albicans	4	19.04
Candida krusei	1	4.76
Candida tropicalis	2	9.53
TOTAL	21	100

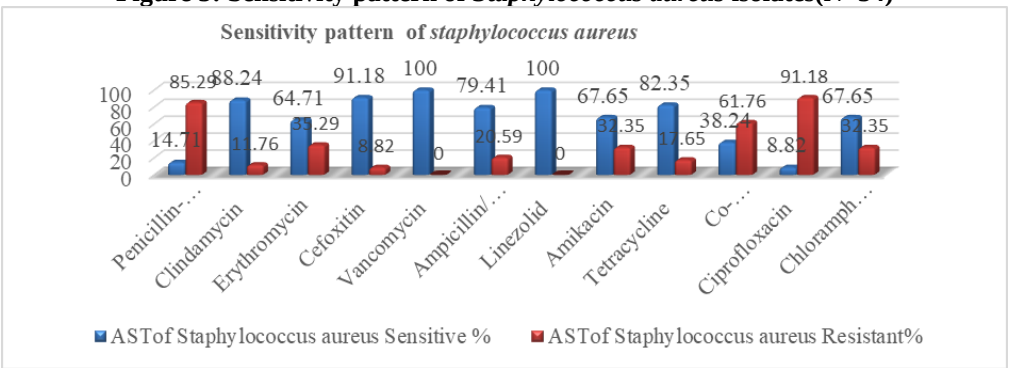
As shown in table 2, out of % 21 fungus isolated, the most common is *Aspergillus niger(*33.33%), followed by 19.04% *Candida albicans*, 14.28% *Aspergillus flavus*, 9.53% *Aspergillus fumigatus*, *Aspergillus terreus* and *Candida tropicalis* and 4.76% *Candida krusei* were isolated.

Figure 2: Sensitivity pattern of *Pseudomonas aeruginosa* isolates(N=80)



As shown in figure 2, out of 80 *Pseudomonas aeruginosa* isolates, the sensitivity of the organisms is maximum with Colistin (100%), Meropenem (100%), Imipenem (100%) followed by Piperacillin/Tazobactam (91.25%), Piperacillin (83.75%), Ceftazidime and cefepime (82.5%) respectively. Highest resistance was noted for Netilmicin (42.5%)

Figure 3: Sensitivity pattern of *Staphylococcus aureus* isolates(N=34)



As shown in figure 3, out of the 34 *Staphylococcus aureus* isolates, the sensitivity of the organisms is maximum with Vancomycin and Linezolid 100% followed by Cefoxitin 91.18%, Clindamycin 88.24%, Tetracycline 82.35%, ampicillin/sulbactam 79.41%, Amikacin 67.65%, Chloramphenicol 67.65%, Erythromycin 64.71%, Cotrimoxazole 38.24%, Penicillin-G 14.71%, Ciprofloxacin 8.82% respectively. Among the 34 isolates, 3 (10%) were MRSA isolates

Sensitivity pattern among the other 43 Gram negative bacilli, In *Proteus mirabilis* high sensitivity was seen in Meropenem (100%) and least sensitivity to Chloramphenicol (15.38%). In *Providencia spp.* highest sensitivity seen in Meropenem (100%), Piperacillin/tazobactam (100%), Cefoperazone/sulbactam (100%) and least sensitivity seen in Cotrimoxazole (20%), Chloramphenicol (20%) and Ampicillin/sulbactam (20%). In *Escherichia coli* highest sensitivity seen in Meropenem (92.31%) and least sensitivity seen in Cotrimoxazole (9.09%). In *Klebsiella pneumoniae* highest sensitivity seen in Meropenem (92.31%), and least sensitivity to the Cotrimoxazole (18.18%). In *Acinetobacter baumannii* highest sensitivity seen in Meropenem (100%), Piperacillin/tazobactam (100%) & Cefoperazone/sulbactam (100%) and least sensitivity to the Gentamicin (33.33%), Amikacin (33.33%) & Cotrimoxazole (33.33%).

IV. Discussion

CSOM is not fatal disease but chronicity leads to complications like labyrinthitis, facial nerve paralysis, mastoiditis, meningitis, deafness, extradural and intradural abscesses due to inadequate or inappropriate antibiotic treatment. This is considered as a serious problem in our country due to increased risk of morbidity in affected individuals. So, early diagnosis and effective treatment is necessary to avoid complications.

In our study, Maximum number of patients belonged to the age group of 21-30 years (24.78%) and least in >60 years of age group (7.83%). The study of Amit Prakash et al shows highest affected cases in 21-30 years of age group (34.5%) & least in >60 years of age group (2%)[10]. Young adults are most commonly affected because they are the main workers who most of the time remain in field and exposed to humid atmosphere which is favorable condition and provide nidus for bacteria as well as fungus to set an infection.

In our study, male predominance was higher (54.35%) than female (45.65%) with male: female ratio 1.19:1, which is similar to study done by V.C. Suresh Chander et al, Deepesh Aggarwal et al.[11,12]

In this study, out of 230 patient's sample, 178 patient's samples (77.39 %) were culture positive and 52(22.61 %) were culture negative which is correlated with the study by A. Srivastava et al in which, culture positivity is 80.3% and no growth in 19.7%.[13] The reason behind negative culture may be due to prior antibiotic usage by the patients or infection by strict anaerobes or viral agents.

Among culture positives bacterial isolates were 88.20% and fungal isolates were 11.80%. The study of Rajat Prakash et al shows bacterial isolates 84.41% and fungal isolates 15.58%.[14] Ravindra Singh Bisht et al shows bacterial isolates 77.27% and fungal isolates 22.72%.[15]

The most common bacterial isolated organism was *Pseudomonas aeruginosa* (50.96%) followed by *Staphylococcus aureus* (21.66%). Similar findings have been noticed in study by Pankti D Panchal et al, Ajaz U. Haq et al, and J. Chauhan et al., because of variation in climate and community and patient characteristics, the pattern of microbiological distribution varies in Chronic Suppurative Otitis Media.[16,17,3]

Antibiotic sensitivity testing of *Pseudomonas aeruginosa* showed (100 %) sensitivity with Meropenem, Imipenem and Colistin. Sensitivity with Piperacillin/Tazobactam was (91.25 %) and with Ceftazidime and Cefepime it was (82.5%) noted. Maximum resistance was seen in Netilmicin (42.5%), Levofloxacin (36.25%) and Gentamicin (35%). Similar results were observed in study of Kaur P. et al.[18]

In our study, *Staphylococcus aureus* showed sensitivity 100% to Vancomycin (100%), linezolid (100%), Clindamycin (88.24%), and Ampicillin-sulbactam (79.41%). Study by Garima et al showed sensitivity pattern of Staphylococcus aureus to Vancomycin (90%), Linezolid (85.5%), Ampicillin-sulbactam (71.1%), Clindamycin (68.3%).[8]

V. Conclusion

Both bacteria and fungi play an important role in etiology of CSOM infection. However, Gram negative infections were common than Gram positive organisms. *Pseudomonas aeruginosa* was the most common pathogen followed by *Staphylococcus aureus*. The most common fungi isolated belonged to *Aspergillus spp*. followed by *Candida spp*. Most of the Gram-negative isolates were sensitive to carbapenems and ß-lactamase inhibitors. Most of the Gram-positive isolates were sensitive to Linezolid and Vancomycin. Organisms are progressively becoming resistant to commonly used drugs like fluroquinolones. The rise of antibiotic resistance is becoming increasingly widespread in the modern era of antibiotics. One aspect that may contribute to the development of medication resistance is human negligence. When their symptoms go away, many patients quit taking antibiotics before their treatment is finished, and improper usage of broad-spectrum antibiotics may also contribute to drug resistance.

The microbiological pattern of CSOM and the developing multidrug resistance can both be addressed by practitioners with the help of this study. Proper health education to patient on possible risk factor, judicious use of antibiotic, treatment of patients after the culture and sensitivity report where the facilities are available and completion of full course of the antibiotic treatment have key role in better management of CSOM.

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