Main Article

Bacteriological Profile of Chronic Suppurative Otitis Media and its Antibiotic Sensitivity Pattern at a Tertiary Care Hospital

https://doi.org/10.47210/bjohns.2023.v31i2.976

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ABSTRACT

Introduction

Aggressive management of chronic suppurative otitis media is necessary as untreated and poorly treated unsafe cases can result in a variety of complications. Aim of this study was to identify the bacteriological profile and determine antibiotic susceptibility pattern of aerobic bacterial isolates in patients of chronic suppurative otitis media.

Materials and Methods

Observational cross-sectional study was conducted at the outpatient department of ENT in collaboration with the department of Microbiology from December 2022 to March 2023. A calculated sample size of 90 ear swabs were taken from 85 cases of chronic suppurative otitis media. Demographic and clinical details were noted. Ear discharges were subjected for aerobic bacterial culture under aseptic conditions along with direct Gram staining. Antibiotic sensitivity testing was done using Kirby–Bauer disc diffusion method on Mueller– Hinton Agar.

Results

Mean age of participants was 33.5 years. 94.1% had the unilateral infection. 94.4% had a tubo-tympanic type while 5.6% had attico-antral type. 70 (77.8%) samples showed mono-microbial growth, 13 (14.4%) showed poly-microbial growth and 7 (7.8%) samples showed no growth in aerobic culture. Pseudomonas aeruginosa 38 (39.58%) was the most common organism followed by Methicillin-sensitive Staphylococcus aureus 27 (28.13%), Coagulase-negative Staphylococcus species 8 (8.33%) and Klebsiella pneumoniae 6 (6.25%). Pseudomonas aeruginosa was more sensitive to Ciprofloxacin (47.3%), followed by Ceftazidime (44.7%), Imipenem (44.7%), Meropenem (42.1%), Gentamycin (42.1%) and Cefepime (42.1%) and was resistant to Ampicillin, Chloramphenicol and Cotrimoxazole. Methicillin sensitive Staphylococcus aureus was most sensitive to Vancomycin (100%), Linezolid (100%) followed by Chloramphenicol (96.2), Amikacin (88.9%) and Doxycycline (88.9).

Conclusion

Antibiotic sensitivity varies at different geographical areas. Continuous and periodic assessment of microbiological patterns and antibiotic sensitivity of isolates is required to formulate local antibiotic policy so that potential risk of complications can be reduced by early initiation of appropriate therapy.

Keywords

Chronic suppurative otitis media; Ear discharge; Bacteriological profile; Antibiotic sensitivity; Pseudomonas aeruginosa; Staphylococcus aureus

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Active chronic suppurative otitis media is chronic inflammation of the middle ear and mastoid mucosa, with recurrent discharge (at-least 2 weeks) through a chronic perforation of tympanic membrane.[1]

Aggressive management is necessary as untreated and poorly treated unsafe chronic suppurative otitis media can result in a variety of complications.[2] Indiscriminate and inappropriate use of antibiotics to treat chronic suppurative otitis media has led to the disease chronicity.[3] The incidence of chronic suppurative otitis media-related complications has decreased due to the introduction of antibiotics. However, the irrational use of broad-spectrum antibiotics has increased the resistance in the bacteria.[4] The periodic surveillance for bacteriological profile and its drug sensitivity is thus necessary to plan the general management of chronic suppurative otitis media and it is essential for the ENT surgeon to make the discharging ear dry for better results of myringoplasty and ossiculoplasty.[5] Culture and sensitivity for antibiotic will help in making a correct choice of antibiotic. The prevalence and antibiogram of these organisms have been reported to vary with time and geographical area along with the advent of newer antibiotics therefore, knowledge of local micro-organism patterns is essential for effective and low-cost treatment.[6,7] This study is aimed to identify the bacteriological profile and determine antibiotic sensitivity pattern against the aerobic bacterial isolates in patients of chronic suppurative otitis media which can act as a guideline for empirical antibiotic therapy before starting definitive antibiotic therapy.

Materials and Methods

This observational cross-sectional study was conducted at the outpatient department of ENT in collaboration with the department of Microbiology in a tertiary care hospital from December 2022 to March 2023. Ethical clearance for the study was obtained from Institutional Ethical Committee. Written informed consent/assent was obtained from all the patients at the time of enrolment. The sample size was estimated based on the reported bacteriological profile of chronic suppurative otitis media in patients found in previous studies[8] using the formula $n=4pq/d^2$ Where, p= 32.6 % (prevalence of pseudomonas aeruginosa), with absolute precision of 10%. Accordingly, the sample size was calculated to be 90 and thus, 90 consecutive ear swab samples were considered for the study.

Patients of all age groups and both genders clinically diagnosed with chronic suppurative otitis media were included in the study. Patients who were on antibiotics or antifungal drugs (topical or systemic) for 7 days or less before presenting themselves to the OPD, patients diagnosed with any immunodeficiency, patients with malignant lesions of the external and middle ear and patients who had undergone surgery previously in the affected ear were excluded from the study.

Demographic and clinical characteristics of the patients were recordedand noted as per the structured pro-forma. The external auditory canal was cleansed with a sterile cotton pledget soaked in 70% ethyl alcohol. This was allowed to dry. Then using a sterile auditory speculum, a sterile cotton swab stick was introduced into the middle ear for collecting the ear discharge without touching the external auditory canal. Two such samples were collected from each ear and were immediately transported to the Microbiology laboratory. One swab was subjected to Gram staining followed by Microscopy. Another swab was inoculated onto blood agar, chocolate agar and Mac-Conkey agar for aerobic culture and the inoculated plates were incubated at 37°C for 24–48 hours. Blood agar and Mac-Conkey's agar were incubated in aerobic bacteriological incubator for Oxygen requirement, and chocolate agar was incubated in aerobic bacteriological incubator providing 10% CO_2 helping capnophilic organisms to grow at 37 degree celcius for 24 to 48 hours. Cefoxitin discs were used as a surrogate marker for detecting Methicillin Resistant Staphylococcal species. Microbes were identified by gram stain findings under microscope, colony morphology, cultural characteristics and biochemical reactions according to standard bacteriological techniques. Organisms that failed to grow within 48 hours were critically analyzed before excluding as no growth or anaerobic isolate or slow-growing bacteria not routinely reported or slow-growing fungi or due to residual effects of previously treated antibiotics. Antimicrobial sensitivity testing for aerobic bacterial isolates was determined by Kirby–Bauer disc diffusion method on Muller Hinton agar to the panel of antibiotics under Gram-positive cocci/ Gram-negative bacilli/ Pseudomonas aeruginosa or non-fermenting group of Gram-negative bacilli according to latest Clinical and Laboratory Standards Institute, M 100, 2022 guidelines.[9] The data was compiled and statistically analyzed to present the results in the form of numbers and percentages using MS-Excel.

Results

In our study, 85 patients were enrolled making a total sample of 90 ear swabs. The majority of cases were between the age of 16-30 years (32.9%). The mean age of participants was 33.5 years and males were predominantly affected (57.7%). Unilateral infection (94.1%) was more common compared to bilateral infection (5.9%). 94.4% had the tubo-tympanic type of chronic suppurative otitis media while 5.6 had the attico-antral type. (Table I)

Table I: Profile of the study participants

VARIABLE		n (%)
Gender (n = 85)	Male	49 (57.7)
	Female	36 (42.3)
Age in years (n = 85)	< 15	10 (11.8)
	16 – 30	28 (32.9)
	31 – 45	22 (25.9)
	46 – 60	15 (17.6)
	61 – 75	9 (10.6)
	>75	1 (1.2)
Laterality/ side (n = 85)	Unilateral	80 (94.1)
	Bilateral	5 (5.9)
Type of CSOM (n = 90)	Tubo-tympanic	85 (94.4)
	Attico-antral	5 (5.6)

Table II: Microbiological profile of culture growth

TYPE OF GROWTH	n = 90 n (%)
Mono-microbial	70 (77.8%)
Poly-microbial	13 (14.4%)
No growth	7 (7.8)
Total	90 (100)

Out of 90 samples, 70 (77.8%) showed mono-microbial growth, 13 (14.4%) showed poly-microbial growth and 7 (7.8%) samples did-not show any growth in aerobic culture. (Table II)

Table III: Organisms isolated from aerobic culture

TYPE OF BACTERIA	BACTERIAL ISOLATES	n* = 96 n (%)
Gram Negative Bacteria	Pseudomonas aeruginosa	38 (39.58)
	Klebsiella pneumoniae	6 (6.25)
	Escherchia coli	4 (4.17)
	Acinetobacter boumannii	3 (3.13)
	Proteus mirabilis	3 (3.13)
Gram Positive Bacteria	Methicillin sensitive Staphylococcus aureus	27 (28.13)
	Coagulase-negative Staphylococcus species	8 (8.33)
	Methicillin resistant Staphylococcus aureus	4 (4.17)
	Streptococcus pneumoniae	3 (3.13)

*n = 96 (includes micro-organisms from mono-microbial & poly-microbial culture growth)

Gram-negative bacteria 54 (56.25%) were more frequently observed than Gram-positive bacteria 42 (43.75%). Pseudomonas aeruginosa 38 (39.58%) was the most common organism isolated followed by Methicillin-sensitive Staphylococcus aureus 27 (28.13%), Coagulase-negative Staphylococcus species 8 (8.33%) and Klebsiella pneumoniae 6 (6.25%). Methicillin-resistant Staphylococcus aureus was isolated in 4 samples (4.17%). (Table III)

Table IV : Antibiotic sensitivity pattern of gram negative bacteria (n = 54)

ANTIBIOTIC	PSEUDOMONAS AERUGINOSA (n = 38) n (%)	KLEBSIELLA PNEUMONIAE (n = 6) n (%)	ESCHERCHIA COLI (n = 4) n (%)	ACINETOBACTER SP (n = 3) n (%)	PROTEUS MIRABILIS (n = 3) n (%)
Ciprofloxacin	18 (47.3)	2 (33.3)	2 (50)	0 (0)	2 (66.6)
Ceftazidime	17 (44.7)	3 (50)	3 (75)	1 (33.3)	0 (0)
Imipenem	17 (44.7)	4 (66.7)	4 (100)	3 (100)	1 (33.3)
Meropenem	16 (42.1)	4 (66.7)	4 (100)	2 (66.6)	1 (33.3)
Gentamycin	16 (42.1)	2 (33.3)	3 (75)	2 (66.6)	2 (66.6)
Cefepime	16 (42.1)	3 (50)	3 (75)	1 (33.3)	0 (0)
Aztreonam	13 (34.2)	3 (50)	3 (75)	0 (0)	0 (0)
Ofloxacin	6 (15.9)	4 (66.7)	3 (75)	0 (0)	2 (66.6)
Tobramycin	6 (15.9)	3 (50)	3 (75)	2 (66.6)	2 (66.6)
Netilmicin	6 (15.9)	3 (50)	3 (75)	2 (66.6)	2 (66.6)
Piperacillin	5 (13.1)	2 (33.3)	2 (50)	1 (33.3)	3 (100)
Amikacin	3 (7.9)	5 (83.3)	4 (100)	2 (66.6)	3 (100)
Cefoxitin	3 (7.9)	2 (33.3)	2 (50)	0 (0)	0 (0)
Cephalexin	3 (7.9)	1 (16.7)	1 (25)	0 (0)	0 (0)
Cefuroxime	3 (7.9)	0 (0)	1 (50)	0 (0)	0 (0)
Ampicillin	0 (0)	0 (0)	1 (25)	0 (0)	0 (0)
Chloramphenicol	0 (0)	1 (16.7)	1 (25)	0 (0)	0 (0)
Cotrimoxazole	0 (0)	2 (33.3)	2 (50)	0 (0)	1 (33.3)

Antibiotic sensitivity patterns of gram-negative and gram-positive bacteria are shown in table IV and V. Pseudomonas aeruginosa was more sensitive to Ciprofloxacin (47.3%), followed by Ceftazidime (44.7%), Imipenem (44.7%), Meropenem (42.1%), Gentamycin (42.1%) and Cefepime (42.1%). Pseudomonas aeruginosa was resistant to other commonly used antibiotics like Ampicillin, Chloramphenicol and Cotrimoxazole.

Table V: Antibiotic sensitivity pattern of gram positive bacteria (n = 42)

ANTIBIOTIC	METHICILLIN SENSITIVE STAPHYLOCOCCUS AUREUS (n = 27) n (%)	METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS (n = 4) n (%)	COAGULASE-NEGATIVE STAPHYLOCOCCUS SPECIES (n = 8) n (%)	STREPTOCOCCUS PNEUMONIA (N = 3) n (%)
Vancomycin	27 (100)	4 (100)	8 (100)	3 (100)
Linezolid	27 (100)	4 (100)	8 (100)	3 (100)
Chloramphenicol	26 (96.2)	1 (25)	8 (100)	3 (100)
Amikacin	24 (88.9)	0 (0)	8 (100)	0 (0)
Doxycycline	24 (88.9)	3 (75)	8 (100)	3 (100)
Amoxicillin-clavulanic acid	23 (85.2)	0 (0)	8 (100)	3 (100)
Cefoxitin	23 (85.2)	0 (0)	6 (75)	-
Erythromycin	23 (85.2)	0 (0)	6 (75)	2 (66.6)
Clindamycin	23 (85.2)	0 (0)	6 (75)	2 (66.6)
Gentamycin	23 (85.2)	0 (0)	8 (100)	0 (0)
Ciprofloxacin	18 (66.6)	2 (50)	7 (87.5)	0 (0)
Cotrimoxazole	18 (66.6)	1 (25)	4 (50)	2 (66.6)
Penicillin	16 (59.25)	0 (0)	0 (0)	3 (100)

Methicillin sensitive Staphylococcus aureus was most sensitive to Vancomycin (100%), Linezolid (100%) followed by Chloramphenicol (96.2), Amikacin (88.9%) and Doxycycline (88.9).

Discussion

Chronic suppurative otitis media is a major public health problem and India is one of the countries with a high prevalence rate. It is a disease with a high risk of irreversible complications.[10] It is an important cause of preventable hearing loss particularly in the developing world and may have long-term effects on early communication, language development, school performance and social interaction.[11]

In our study, 85 patients were enrolled making a total sample of 90 ear swabs. The majority of cases were between the age of 16-30 years (32.9%). The mean age of participants was 33.5 years and males were predominantly affected (57.7%). Unilateral infection (94.1%) was more common compared to bilateral infection (5.9%). 94.4% had the tubo-tympanic type of chronic suppurative otitis media while 5.6% had the attico-antral type. Similar results were observed by Kombade

SP et al where maximum cases were observed in the age group of 21 to 30 years (25.5%) and males (52.3%) were predominantly affected as compared to females (47.7%). Safe and unsafe type chronic suppurative otitis media was found in 60.1% and 39.9% of cases respectively.[12] In a study conducted by Hiremath B et al, it was observed that the majority of the cases were between the ages of 11-20 years (29.1 %) with male predilection (55.83%). Unilateral infection (77.5%) was more common than bilateral infection (22.5%).[13] In a study conducted by Shilpa C et al, out of 106 cases studied 63.20% were males and 36.79% were females, giving a male-to-female ratio of 1.6:1. Higher incidence of chronic suppurative otitis media was seen in the age group of19–45 years (52%).[10]

Early microbiological diagnosis assists in prompt and effective therapy to avoid complications. Microbiology cultures yield many organisms and these differ depending on the climate, patient population and usage of antibiotics. In our study of 90 samples, 70 (77.8%) showed mono-microbial growth, 13 (14.4%) showed poly-microbial growth and 7 (7.8%) samples showed no growth in aerobic culture. A total of 9 types of bacteria were isolated (4 gram-positive & 5 gram-negative bacteria). The total number of bacterial isolates obtained was 96 which included all isolates obtained from mono microbial and poly-microbial growth. Gram-negative bacteria 54 (56.25%) were more commonly observed than Gram-positive bacteria 42 (43.75%).Similar observations were made by Kombade SP et al, where bacterial growth was observed in 82.4% of samples while 17.6% showed no growth. Out of pathogenic isolates, mono microbial growth was seen in 90.8% of samples and 9.2% of samples showed poly-microbial growth. Gram-negative bacteria (69.2%) far exceeded Gram-positive bacteria (30.8%).[12] In a study conducted by Shilpa C et al, out of the 106 ear swabs processed, bacterial growth was found in 94.33%, while 5.66% showed no growth.[10] In a study conducted by Hiremath B et al, it was observed that 60.49% of cases were of gram-negative organisms and 39.51% of cases were of gram-positive organisms which shows that gram-negative organisms are more commonly involved in causation of chronic suppurative otitis media.[13]

In our study, Gram-negative bacteria 54 (56.25%) were more commonly observed than Gram-positive bacteria 42 (43.75%). Pseudomonas aeruginosa 38 (39.58%) was the more common organism isolated followed by Methicillin-sensitive Staphylococcus aureus 27 (28.13%), Coagulase-negative Staphylococcus species 8 (8.33%) and Klebsiella pneumoniae 6 (6.25%). Methicillin-resistant Staphylococcus aureus was isolated in 4 samples (4.17%). The occurrence of Pseudomonas aeruginosa as the most common organism could be attributed to the reason that it competitively survives with other pathogens due to its minimum nutritional requirements, its relative resistance to antibiotics, and its armamentarium of antibacterial products—pyocyanin and bacteriocin and its predilection for moist areas.[10,13] Similar observations are made by Hiremath B et al where Pseudomonas aeruginosa (38.79%) was the most commonly isolated aerobic bacteria followed by staphylococcus aureus (32.75%) and methicillin-resistant staphylococcus aureus (5.17%).[13] Similarly, Shilpa C et al reported that Pseudomonas aeruginosa was the mostcommonly isolated bacteria (49%), followed by Staphylococcus aureus (18%).10 Similarly observations were made by Wan Draman et al and Kombade SP et al.[8,12]

Our study revealed that Pseudomonas aeruginosa was more sensitive to Ciprofloxacin (47.3%), followed by Ceftazidime (44.7%), Imipenem (44.7%), Meropenem (42.1%), Gentamycin (42.1%) and Cefepime (42.1%). Pseudomonas aeruginosa was resistant to other commonly used antibiotics like Ampicillin, Chloramphenicol and Cotrimoxazole.According to study done by Hiremath B et al Pseudomonas aeruginosa showed maximum sensitivity to piperacillin (91.11%), followed by gentamicin (71.11%), amikacin (71.11%), moderate sensitivity to ceftazidime (51.11%), and resistant to carbpenicillin (60%).[13] In a study done by Rangaiah ST et al it was observed that Pseudomonas aeruginosa was more sensitive to Piperacillin (88.09%), Tazobactam (88.09%), Meropenem (80.95%) and Ciprofloxacin (73.8%).[3] The lower susceptibility to antibiotics like imipenem and meropenem could be attributed to inappropriate usage of higher antibiotics at health care setups.

In our study Methicillin sensitive Staphylococcus aureus was most sensitive to Vancomycin (100%), Linezolid (100%) followed by Chloramphenicol (96.2), Amikacin (88.9%) and Doxycycline (88.9). According to study done by Hiremath B et al Staphylococcus aureus showed maximum sensitivity to erythromycin (71.05%), followed by cotrimoxazole (63.15%), and ampicillin (55.26%). Maximum resistance was observed for ciprofloxacin (78.9%), followed by amoxiclave (55.26%).[13] In a study done by Rangaiah ST et al it was observed that staphylococcus was more sensitive to linezolid (86.04%), cefoxitine (55.81%) and erythromycin (51.16%).[3]

These antibiotic sensitivity pattern in different studies reflects that antibiotic sensitivity varies at different geographical areas which highlights the importance of formulating local antibiotic policy so that the potential risk of complications can be reduced by early institution of appropriate treatment

Conclusion

The emergence of antibiotic resistance is becoming more frequent due to the indiscriminate and inappropriate use of antibiotics in this present era of rapid advent of newer antibiotics. Also, the discontinuation of antibiotics by chronic suppurative otitis media patients before completion of the course may allow partially resistant microbes to flourish. Such practice should be discouraged through proper health education. The knowledge regarding the spectrum of microorganisms and their antibiotic susceptibility is important for effective treatment. Our findings reflect the importance of periodic evaluation of microbiological patterns and antibiotic sensitivity of isolates. This helps to formulate local antibiotic policy for the appropriate use of antibiotics in chronic suppurative otitis media so that the potential risk of complications can be decreased by early institution of appropriate treatment. This can act as a guideline for empirical antibiotic therapy where antibiotic policy is not formulated and for initiating empirical treatment until final antibiotic sensitivity report is available.

References

1. Browning GG, Weir J, Kelly G, Swan RC. Chronic Otitis Media. In: Watkinson JC, Clarke RW, editors. Scott-Brown's Otorhinolaryngology Head & Neck Surgery. 8th ed. New York:CRC Press;2018.Vol 2:p.978
2. Mahajan T, Dass A, Gupta N, Chander J, Saini V, Pol SA. Bacteriological profile in attico-antral type of chronic suppurative otitis media. Indian J Otolaryngol Head Neck Surg [Internet]. 2019;71(Suppl 2):1412–21. Available from: http://dx.doi.org/10.1007/s12070-018-1486-1
3. Rangaiah ST, Dudda R, Prasad MH, Balaji NK, Sumangala B, Gudikote MM. Bacteriological profile of chronic suppurative otitis media in a tertiary care hospital. Int J Otorhinolaryngol Head Neck Surg 2017;3:601-5
4. Sah BP, Chettri ST, Bhattarai NR, Shah SP, Paudel D, Sarraf DP, Mishra S. Microbiological profile and their antibiotic sensitivity pattern in patients of chronic suppurative otitis media at eastern tertiary care center of Nepal. IP J Otorhinolaryngol Allied Sci 2020;3(3):86-90
5. Sharma K, Oberoi L, Narula V. Present scenario of microbiological pattern in chronic suppurative otitis media and its management guidelines. J Acad Clin Microbiol 2017;19:47-53
6. Smitha N R, Jnaneshwara K B, Patil A B, Harshika Y K, Medegar S. A study of aerobic bacteriological profile of chronic suppurative otitis media in a tertiary care hospital, South India. Indian J Microbiol Res 2018;5(4):470-475
7. Poorey VK, Thakur P, Clinicomicrobiological evaluation and antibiotic susceptibility in cases of Chronic Suppurative Otitis media . Indian j Otol(serial online) 2015 (Dec 4) ;21:10
8. Wan Draman WNA, Md Daud MK, Mohamad H,

Hassan SA, Abd Rahman N. Evaluation of the current bacteriological profile and antibiotic sensitivity pattern in chronic suppurative otitis media. Laryngoscope Investigative Otolaryngology. 2021;6(6):1300–6

9. CLSI.Performance standards for antimicrobial Susceptibility Testing. 32nd edition. CLSI Standard M100. Clinical and Laboratory Standards Institute. 2022

10. Shilpa C, Sandeep S, Thanzeemunisa U, Prakash BG, Radhika S, Virender S. Current microbiological trends of chronic suppurative otitis media in a tertiary care centre, Mysuru, India. Indian Journal of Otolaryngology and Head & Neck Surgery. 2018;71(S2):1449–52

11. Alam M, Sultan A, Chandra K. Microbiological assessment of chronic otitis media: Aerobic culture isolates and their antimicrobial susceptibility patterns. Indian Journal of Otolaryngology and Head & Neck Surgery. 2021;74(S3):3706–12

12. Kombade SP, Kaur N, Patro SK, Nag VL. Clinico-bacteriological and antibiotic drug resistance profile of chronic suppurative otitis media at a tertiary care hospital in Western Rajasthan. Journal of Family Medicine and Primary Care. 2021;10(7):2572

13. Hiremath B, Mudhol RS, Vagrali MA. Bacteriological profile and antimicrobial susceptibility pattern in chronic suppurative otitis media: A 1-year cross-sectional study. Indian Journal of Otolaryngology and Head & Neck Surgery. 2018;71(S2):1221–6.