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MICROBIOLOGICAL SPECTRUM CAUSING CHRONIC SUPPURATIVE OTITIS MEDIA AND DETERMINATION OF THE ANTIBIOTIC SENSITIVITY PATTERN OF ISOLATED BACTERIA

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ABSTRACT

Background

The middle ear cleft is chronically inflamed in chronic suppurative otitis media (CSOM). It is one of the most prevalent hearing issues and, if unchecked, can lead to a number of difficulties. The most common bacteria causing CSOM are *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Escherichia coli*. This study was conducted to identify the typical bacteria and fungi that cause CSOM and to assess the susceptibility of bacterial isolates to various antibiotics.

Methods

From 119 patients, 125 ear pus samples from the ENT outpatient department of Devdaha Medical College were determined to be culture positive. The patients gave their written consent. There were two swabs taken from the discharged ear. Gram staining was done on the first swab, and culture and sensitivity were done on the second. Simple statistical techniques were used for the analysis of the results.

Results

Patients between the ages of 11 and 30 were frequently affected, with the left ear predominating**.** *Staphylococcus aureus* and *Pseudomonas aeruginosa* were the most frequently isolated microorganisms, followed by *Escherichia coli*, *Klebsiella pneumoniae*, and *Proteus mirabilis*. Most of the bacteria were highly sensitive to, Amikacin, Vancomycin, Piperacillin/Tazobactam and developing resistance to Amoxicillin/Clavulanic acid, Ciprofloxacin and Tetracycline.

Conclusion

The most frequent bacteria found were *Staphylococcus aureus*, which was also the most responsive to Amikacin (96.22%) and Ciprofloxacin (26.41%). In the view of developing antibiotic resistance, and extra- and intracranial complications in improperly treated cases, judicial use of antibiotics is necessary.

Keywords: Antibiotic sensitivity, Chronic suppurative otitis media (CSOM), Ear discharge, *Staphylococcus aureus*

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INTRODUCTION

It is well acknowledged that children who experience acute otitis media (AOM) or otitis media with effusion (OME) frequently serve as the precursor to chronic otitis media. Otitis media with effusion may cause the tympanic membrane to thin, hearing loss, delayed speech development, and it may also have an effect on the child's educational progress[1]. CSOM is a persistent inflammation of the middle ear and mastoid cavity mucosa. It continues for longer than two months, leading to the formation of an eardrum hole and the continual release of fluid from the ear canal.[2] *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumoniae*, *Escherichia coli, Aspergillus spp*, and *Candida spp* are the most prevalent bacteria detected in CSOM, but these organisms differ depending on the region.[3] The bacterial agents that cause otitis media are eliminated with antimicrobial therapy, although the majority of microorganisms are developing antibiotic resistance. This issue is escalating quickly in emerging nations as a result of antibiotic abuse. Poor hospital hygiene, overcrowding, a lack of resources for infection control, and a lack of staff educated in infection control in hospitals were determined to be the key contributing reasons to its occurrence.[4] Antibiotic resistance can be natural or acquired.[5] There are certain mechanism for the causes of bacterial resistance such as:

- The presence of enzymes that inactivates the antimicrobial agent(s).
- Mutation in the antimicrobial agent's target(s), which reduces the binding of the antimicrobial agent.
- Reduced uptake of the antimicrobial agent(s).
- Overproduction of target of antimicrobial agent(s).

Determining the indigenous microorganisms is important since CSOM is still a serious health issue in underdeveloped nations like Nepal. Doing so will help lead appropriate treatment at the right time, prevent problems, and give records for future use. Determine the antibiotic sensitivity of bacterial isolates and identify the typical microorganisms causing chronic suppurative otitis media are our goals.

METHODS

A hospital based cross-sectional descriptive analytical study was carried out in the department of ENT and Microbiology in Devdaha Medical College, Rupandehi, Butwal from June 2023 to August 2023.Following a thorough clinical history pertaining to the patient's age, the length of the ear discharge, and notably any antibiotic treatment taken, patients with unilateral or bilateral chronic suppurative otitis media will be recruited. Ear discharge of more than three month and Patient of any age and sex are included in the study. Patient with cholesteatoma, otitis externa and otomycosis are excluded. The study utilized simple random sampling to select chronic suppurative otitis media patients. As participants arrived at the outpatient department, they were enrolled in the study with the strict application of the inclusion and exclusion criteria until the required number was reached.

Sample Size: 1197

The sample size was calculated as follows

$$n = Z^2 \times p \times (1-p) / e^2$$
$$= (1.96)^2 \times 0.5 \times (1-0.5) / (0.09)^2$$
$$= 119$$

Where,

n = minimum required sample size

Z = 1.96 at 95% Confidence Interval

p = prevalence, 50% for maximum sample size

q = 1-p

e = margin of error, 9%

Procedure: Two sterile cotton swabs were used to capture the discharge from the afflicted ear while taking all necessary aseptic measures. Swabs were immediately delivered to the microbiology lab. The initial swab was used in the lab for gram staining and direct microscopy examination to count the quantity of bacteria and observe their shape as well as whether or not inflammatory cells and epithelial cells were present in the sample. Second swab was inoculated on Nutrient agar, MacConkey agar, Blood agar and Chocolate agar for bacterial isolation. The bacterial culture plates were incubated at 37c for 48 hours and for fungal culture up to 1 week. Gram staining, conventional biochemical testing, and colony morphology were used to identify the bacterium. The Kirby Bauer Disk Diffusion method was used to evaluate the susceptibility to various antibiotics. The antibiotics utilized were Amikacin, Amoxicillin-Clavulanate, Ceftazidime, Cefotaxime, Ciprofloxacin, Cotrimoxazole, Erythromycin, Imipenem, Linezolid, Penicillin, Piperacillin-tazobactam, and Vancomycin.[8]

RESULTS

Table 1: Total 125 ear swabs were studied from 119 patients of which 118(94.4%) ear swabs showed growth and 7(5.6%) patients showed no growth. Single organism was isolated from 125 samples which were studied from 119 patients. There were 113 patients (94.95%) with unilateral disease and 6 patients (5.04%) with bilateral disease.

Table 2: Out of 119 patients 41 (34.45%) patients were male and 78(65.54%) were female.

Table 3: The mean age of patients was 30-48 years range from 5- 70 years with the peak age group being young adults below 30 years.

Table 4: The most common casual organism isolated were *S.aureus*(42.4%) and *P.aeruginosa*(22.4%) followed by *E.coli*(16.8%).Other organisms isolated were *K.pneumoniae* (5.6%), *P.mirabilis*(4.8%)and Coagulase Negative Staphylococcus (CoNS)(2.4%).

Table 5: The most sensitive antibiotic against *S.aureus* isolated from the ear pus sample was Amikacin (96.22%)followed by Vancomycin (92.45%) and least sensitive antibiotics was Ciprofloxacin (26.41%) followed by Levofloxacin (28.30%).

Table 6: Isolated *P.aeruginosa* were highly sensitive to Amikacin (92.85%) followed by Tetracycline (92.85%) and Piperacillin/Tazobactam (89.28%). Only 17.85% of Pseudomonas isolates were sensitive to Amoxicillin/clavulanate and 35.71% were sensitive to Cotrimoxazole and Cefixime.

Table 1: Site distribution of patients

Site	Number(n)	Percentage (%)
Right ear	38	31.93
Left ear	75	63.02
Both	6	5.04

Table 2: Sex distribution of patients

Sex Distribution	Number(n)	Percentage (%)
Male	41	34.45
Female	78	65.54

Table 3: Age distribution of patients (n=119)

Age	Number(n)	Percentage (%)
<10 years	10	8.40
11-20 years	39	32.77
21-30 years	36	30.25
31- 40 years	17	14.28
above 40 years	17	14.28

Table 4: Microbiology profile of patients

Type of organism	Number	Percentage
S. aureus	53	42.4
P.aeruginosa	28	22.4
E.coli	21	16.8
P.mirabilis	6	4.8
K.pneumoniae	7	5.6
No growth	7	5.6
CoNS	3	2.4

Table 5: Shows antimicrobial susceptibility pattern of *S.aureus*

Antibiotis	Sensitive		Resistant	
	n	%	n	%
Ceftriaxone	39	73.58	14	26.41
Cefixime	35	66.03	18	33.96
Amoxicillin/clavulanate	37	69.81	16	30.18
Cefpodoxime	32	60.37	21	39.62
Cotrimoxazole	16	30.18	37	69.81
Levofloxacin	15	28.30	38	71.69
Gentamicin	42	79.24	11	20.75
Vancomycin	49	92.45	4	7.54
Piperacillin/tazobactam	46	86.79	7	13.20
Amikacin	51	96.22	2	3.77
Ciprofloxacin	14	26.41	39	73.58
Tetracycline	44	83.01	9	16.98
Imipenem	41	77.35	12	22.64

Table 6: Shows antimicrobial susceptibility pattern of *P.aeruginosa*

Antibiotics	Sensitive		Resistant	
	n	%	n	%
Ceftriaxone	24	85.71	4	14.28
Cefixime	10	35.71	18	64.28
Amoxicillin/clavulanate	5	17.85	23	82.14
Cefpodoxime	19	67.85	9	32.14
Cotrimoxazole	10	35.71	18	64.28
Levofloxacin	24	85.71	4	14.28
Gentamicin	23	82.14	5	17.85
Vancomycin	21	75	7	25
Piperacillin/tazobactam	25	89.28	3	10.71
Amikacin	26	92.85	2	7.14
Ciprofloxacin	23	82.14	5	17.85
Tetracycline	26	92.85	2	7.14
Imipenem	22	78.57	6	21.42

Table 7: Shows the antimicrobial susceptibility pattern of *E coli*

Antibiotis	Sensitive		Resistant	
		%		%
Ceftriaxone	15	71.42	6	28.57
Cefixime	11	52.38	10	47.61
Amoxicillin/clavulanate	17	80.95	4	19.04
Cefpodoxime	18	85.71	3	14.28
Cotrimoxazole	18	85.71	3	14.28
Levofloxacin	18	85.71	3	14.28
Gentamicin	17	80.95	4	19.04
Vancomycin	20	95.23	1	4.76
Piperacillin/tazobactam	19	90.47	2	9.52
Amikacin	20	95.23	1	4.76
Ciprofloxacin	18	85.71	3	14.28
Tetracycline	5	23.80	16	76.19
imipenem	13	61.90	8	38.09

Majority of the patient showed sensitive to all antibiotics tested, but only 23.80% of isolated *E.coli* were sensitive to tetracycline.

DISCUSSION

In daily practice, one of the most frequent ear conditions seen is chronic suppurative otitis media. In our study, chronic suppurative otitis media was more common in female as compared to male. This study correlated with study report[9] but in contrast to our study[8] revealed a higher male preponderance. The differences in results are due to geographical reasons. In our study, left ear was commonly affected than right ear. This was in contrast to the study[3] where right ear was commonly involved. There are no genetic or structural distinctions between the right and left ear, which may explain why the left ear predominates in the study cases.

In our study, CSOM was most prevalent in the age group of 11 to 30 years which is similar to the study conducted[10] but in contrast to our study[8,3,11] reported that the highest incidence among 1-10 yrs 12 reported the highest incidence among 51-60 years. Due to the frequent lack of proper treatment, dietary inadequacies, overcrowding in simple housing, poor sanitation, lack of hygiene, frequent swimming in ponds, and ear pricking, this condition affects a significant percentage of people between the ages of 11 and 30 in the Terai region.

In our study *S.aureus* was found to be the most common organism (42.4%) followed by *P.aeruginosa* (22.4%)and *E.coli* (16.8%).This findings was concurrence with the study done[19,13]. In contrast to our study[14,15] found that the most frequent organism isolated in their study was *P. aeruginosa*. Due to its widespread distribution and high MRSA carriage in the upper respiratory tract and external auditory canal, *S.aureus* has been linked to middle ear infections. In a study conducted by[16] *P.mirabilis* was most common bacteria to be isolated whereas in our study very low number of *P.mirabilis* was isolated. In current study, the most effective drug against *S.aureus* isolated from the pus sample was Amikacin (96.22%) followed by Vancomycin (92.45%), whereas the least effective drug was Ciprofloxacin(26.41%) which is similar to the study conducted[8,17]. According[18] the injudicious usage, incorrect dosage, ease of accessibility, and the emergence of enzymatic resistance in the organism against quinolones are a few causes of diminishing sensitivity. In contrast to our study[19] observed that Ciprofloxacin was highly sensitive antibiotic to *S.aureus*.

In our study the most effective antibiotic against *P.aeruginosa* isolated from the pus sample were Amikacin(92.85%),followedbyTetracycline(92.85%) ,andPipaeracillin/Tazobactam(89.28%).While the study conducted[20,21] reported that Pseudomonas species were resistant to Tetracycline. The least effective drug against *P.aeruginosa* was Amoxicillin/ clavulinate and Cotrimoxazole which is similar to study conducted[9] Interestingly, general practitioners frequently recommend amoxicillin/ clavulinate, which is the most frequently administered empirical antibiotic in our experience in the CSOM.

In our study *E.coli* showed susceptible to majority of antibiotics except Tetracycline which is similar to the study conducted[22] where *E.coli* were resistant to Tetracycline whereas in the study conducted[23] *E.coli* showed resistant to Levofloxacin. In a study conducted by *P.mirabilis* was most common bacteria to be isolated whereas in our study very low number of *P.mirabilis* was isolated.

LIMITATIONS OF THE STUDY

Anaerobic bacteria and fungi could not be isolated because of the sample size's limited size.

CONCLUSION

P. aeruginosa and *S. aureus* were the two most frequent isolates from the culture specimens of chronic otitis media. Amikacin was found to be the most suitable antibiotic for all three organisms. These CSOM-causing microbes were most prevalent in females between the ages of 11 and 30. The varying climate, community environment, patient population, and the indiscriminate use of antibiotics are to blame for the discrepancy in findings from prior study. To prevent the emergence of antibiotic resistance, judicial use of antibiotics is essential.

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REFERENCES

1. Bluestone CD. Epidemiology and pathogenesis of chronic suppurative otitis media: implications for prevention and treatment. Int J Pediatr Otorhinolaryngol. 1998 Jan;42(3):207–23.
2. Khairkar M, Deshmukh P, Maity H, Deotale V. Chronic

Suppurative Otitis Media: A Comprehensive Review of Epidemiology, Pathogenesis, Microbiology, and Complications. Cureus. 2023 Aug;15(8):e43729.

3. Shrestha B, Amatya R, Shrestha I, Ghosh I. MICROBIOLOGICAL PROFILE OF CHRONIC SUPURATIVE OTITIS MEDIA. Nepalese Journal of ENT Head & Neck Surgery. 2011;2(2):6–7.
4. Hart CA, Kariuki S. Antimicrobial resistance in developing countries. BMJ. 1998 Sep 5;317(7159):647–50.
5. Normark BH, Normark S. Evolution and spread of antibiotic resistance. J Intern Med. 2002 Aug;252(2):91–106.
6. Fluit AC, Visser MR, Schmitz FJ. Molecular detection of antimicrobial resistance. Clin Microbiol Rev. 2001 Oct;14(4):836–71, table of contents.
7. Shrestha K, Madhup S, Shrestha B, Pokharel M, Dhakal A. Microorganisms and Culture and Sensitivity Pattern in Chronic Suppurative Otitis Media in a Tertiary Care Hospital. Journal of College of Medical Sciences-Nepal. 2021 Sep 30;17:252–6.
8. Sk S. Bacteriological and Mycological Profile of Chronic Suppurative Otitis Media In A Tertiary Teaching Hospital, Trichy, Tamilnadu.
9. Basnet R, Sharma S, Rana JC, Shah PK. Bacteriological Study of Otitis Media and Its Antibiotic Susceptibility Pattern. J Nepal Health Res Counc. 2017 Sep 8;15(2):124–9.
10. Kumar H, Seth S. Bacterial and Fungal Study of 100 Cases of Chronic Suppurative Otitis Media. Journal of Clinical and Diagnostic Research. 2011;5.
11. Poorey VK, lyer A. Study of bacterial flora in csom and its clinical significance. Indian J Otolaryngol Head Neck Surg. 2002 Apr;54(2):91–5.
12. Xu J, Du Q, Shu Y, Ji J, Dai C. Bacteriological Profile of Chronic Suppurative Otitis Media and Antibiotic Susceptibility in a Tertiary Care Hospital in Shanghai, China. Ear Nose Throat J. 2021 Nov;100(9):NP391–6.
13. M P, K L, S A, Gn S. BACTERIOLOGICAL PROFILE AND THEIR ANTIBIOTIC SUSCEPTIBILITY PATTERN OF CASES OF CHRONIC SUPPURATIVE OTITIS MEDIA. Asian Journal of Pharmaceutical and Clinical Research. 2013 Aug 1;210–2.
14. Maji PK, Chatterjee TK, Chatterjee S, Chakrabarty J, Mukhopadhyay BB. The investigation of bacteriology of chronic suppurative otitis media in patients attending a tertiary care hospital with special emphasis on seasonal variation. Indian J Otolaryngol Head Neck Surg. 2007 Jun;59(2):128–31.
15. Loy AHC, Tan AL, Lu PKS. Microbiology of chronic suppurative otitis media in Singapore. Singapore Med J. 2002 Jun;43(6):296–9.
16. Chirwa M, Mulwafu W, Aswani JM, Masinde P, Mkakosya R, Soko D. Microbiology of chronic suppurative otitis media at Queen Elizabeth Central Hospital, Blantyre, Malawi: A cross-sectional descriptive study. Malawi Med J. 2015 Dec;27(4):120–4.
17. Hiremath B, Mudhol RS, Vagrali MA. Bacteriological Profile and Antimicrobial Susceptibility Pattern in Chronic Suppurative Otitis Media: A 1-Year Cross-Sectional Study. Indian J Otolaryngol Head Neck Surg. 2019 Nov;71(Suppl 2):1221–6.
18. Sattar A, Alamgir A, Hussain Z, Sarfraz S, Nasir J, Badar-e-Alam null. Bacterial spectrum and their sensitivity pattern in patients of chronic suppurative otitis media. J Coll Physicians Surg Pak. 2012 Feb;22(2):128–9.
19. Garba BI, Mohammed BA, Mohammed F, Rabiu M, Sani UM, Isezuo KO, et al. Antibiotic susceptibility pattern of bacterial isolates in children with otitis media in Zamfara, North-Western Nigeria. AJMR. 2017 Nov 21;11(43):1558–63.