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ORIGINAL ARTICLE

Microbiological Spectrum and Antibiotics Sensitivity Pattern of Chronic Suppurative Otitis Media (CSOM) Patients: A Prospective Study from a Tertiary Care Hospital

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ABSTRACT

Background: CSOM is a fatal condition because of its propensity for intracranial extension. Overuse of antibiotics has resulted in resistance among bacteria.

Objective: The aim of the current study was to find out the microbiological spectrum and antibiotics susceptibility patterns in tertiary care hospital.

Material and method: The current prospective study was conducted at the Department of ENT, Bolan Medical College / Complex Hospital, Quetta from February 2022 to February 2023 after taking approval from the research committee of the institute. A total of 118 individuals of both gender and different age groups with Chronic Suppurative Otitis Media were included. A pus sample was taken from both ears of individuals using an aseptic swab for microscopic analysis and bacterial culture. Following their inoculation into various media all of the samples were maintained in an aerobic environment at 37°C for 18 to 20 hours. For the identification of bacteria microscopy, gram staining and biochemical tests such as urease, citrate, and triple sugar iron were performed. Modified Kirby Bauer disc diffusion technique was used to find out the antibiotic susceptibility pattern of bacteria. We classified the bacteria as either susceptible or resistant based on the CLSI standards. Both clinical and demographic information about the patient was gathered using a well-structured questionnaire. The numbers (n) and percentages (%) were used to represent quantitative variables. For evaluating the data collected, SPSS version 12 was used.

Results: A total of 118 individuals were examined in this study out of which 60% were female and 40% were male. Out of the total samples 85% showed growth and 15% were culture negative**.** The most prevalent bacteria isolated was Pseudomonas aeruginosa 39% followed by S.aureus 25.4%, Proteus species 14.7% S. saprophyticus 7.8% Providencia 4(3.9%), Citrobacter3.9%, Serratia marcescens 1.9%, Enterobacter species 1.9% E. coli 1.9%. Antibiogram of isolated bacteria showed that S. aureus was mostly sensitive to Linezolid 82% and Vancomycin 78%. Gram-negative bacteria exhibited a wide range of sensitivity, with 52% -100% susceptibility to imipenem and Meropenem.

Conclusion: The current study concluded that the most prevalent bacteria isolated from chronic suppurative otitis media individuals were Pseudomonas aeruginosa followed by s.aureus. Vancomycin and Linezolid were more effective against gram positive bacteria and carbapenem, cefoperazone with sulbactam, and piperacillin/tazobactam were effective against gram negative bacteria.

Keywords: Microbiological Spectrum; Antibiotics Sensitivity Pattern; Chronic Suppurative Otitis Media

INTRODUCTION

suppurative otitis media (CSOM) is a long-term inflammatory condition in the middle ear that causes irreversible alterations in the tympanic membrane .[1] Persistent ear discharge & loss of hearing are clinical manifestations of CSOM that may have major long-term effects on language, auditory, cognitive, and educational development.[2] It is one of the most prevalent illnesses in all age groups particularly in children. Malnutrition, overcrowding, poor cleanliness, insufficient medical treatment, and recurring upper respiratory tract infections are the main causes of its prevalence in underdeveloped nations, particularly in low socioeconomic societies[3-4] According to the majority of microbiological studies on this diorder, Staphylococcus aureus Escherichia coli,Pseudomonas aeruginosa, Proteus species, and Klebsiella species are the most often detected bacteria . However, the variety of bacteria associated to this disease differs according on the region and additional variables.[5] topical antibiotics may acquire larger concentrations locally, they are more effective than systemic antibiotics for getting rid of auditory discharge.[6] The antibiotic susceptibility pattern of the most prevalent pathogens, such as Pseudomonas aeruginosa and Staphylococcus aureus, associated with CSOM, should guide the selection of empirical therapy. The development of antibiotics has reduced the occurrence of problems related to CSOM. However, resistance in bacterial isolates has grown increasingly prevalent due to the inappropriate use of broad-spectrum antibiotics.[7] Antibiotics are still available at drugstore counters, and doctors at polyclinics frequently prescribe them without doing antibiotic sensitivity testing. Numerous resistant bacterial strains have emerged as a result of the extensive use of antibiotics, and these strains can cause primary and after surgery infections in addition to causing significant financial burdens for patients.[8] All CSOM individuals benefit from early bacteriological diagnosis for conclusive treatment. The time and location of the investigation affect the pattern of microorganisms that are separated. However, it is not feasible to provide all patients with the best possible research and treatment since underdeveloped nations lack sufficient resources. The treating physician may be able to recommend an empirical schedule so that patients receive more effective and targeted therapies on time if they are aware of the local microbial flora & their susceptibility to antimicrobial drugs. The present study was carried out to explore the microbiological spectrum and antibiotics sensitivity Pattern of Chronic Suppurative Otitis Media.

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MATERIAL AND METHOD

The current prospective study was conducted at the Department of ENT, Bolan Medical College / Complex Hospital, Quetta from February 2022 to February 2023 after taking approval from the research committee of the institute. A total of 118 individuals of both gender and different age groups with Chronic Suppurative Otitis Media were included. Individuals who had intermittent or continuous discharge for more than 12 weeks, as well as those who had not taken antibiotics locally or systemically before to sample collection, were enrolled in the study while individuals who had taken antibiotics prior to sample collection, those who had acute otitis media, cholesteatoma, concurrent external ear infections were excluded. A pus sample was taken from both ears of individuals using an aseptic swab for microscopic analysis and bacterial culture. The external ear canal was first cleaned with an

alcohol swab under a bright light source. Next, using a speculum, a cotton tip swab was carefully inserted into the external auditory canal so as not to come into contact with the skin that surrounded it. Finally, the stick was placed in the tube and the cap was placed. The swab was transferred to the microbiology lab. Each sample was prepared by making a thin, homogeneous smear and letting it air dry. The morphology of bacteria were then examined under a microscope using Gramm staining. Following their inoculation into various media, such as nutritional agar, blood agar, and MacConkey's agar medium, all of the samples were maintained in an aerobic environment at 37°C for 18 to 20 hours. For the identification of bacteria microscopy, gram staining and biochemical tests such as urease, citrate, and triple sugar iron were performed. Modified Kirby Bauer disc diffusion technique was used to find out the antibiotic susceptibility pattern of bacteria by following the guide lines of Clinical and Laboratory Standard Institute (CLSI 2024). To inoculate Mueller-Hinton agar, we made a colony suspension for each isolate (either directly with a swab stick or with distilled water). After choosing commercially available antibiotic discs (Oxoid Ltd., Hampshire, UK), we put them on the medium and incubated it for twenty-four hours at 37°C. The media's pH, expiration date, and growth in the media during a 24-hour period without any inoculation were all used to assess the media's quality. We classified the data as either susceptible or resistant based on the CLSI standards. Both clinical and demographic information about the patient was gathered using a well-structured questionnaire. Patients' compliance with their antibiotics and degree of improvement were monitored at one-month intervals. The numbers (n) and percentages (%) were used to represent quantitative variables. For evaluating the data collected, SPSS version 12 was used.

RESULTS

A total of 118 individuals were examined in this study out of which 71(60%) were female and 47(40%) were male.“The mean age of the study population was 21± 2 years and the most prevalent age group was 68(57.6%) years. Majority of the participants were from rural areas 80(67.7%) and illiterate 68(57.6%) as presented in the table 1. The most prevalent sign was purulent ear discharge (100%), which was followed by tinnitus (42%), hearing loss (70%), & earache (80%).Out of the total samples 100 (85%) showed growth and 18(15%) were culture negative as presented in figure 1.Out of these 100 positive samples 97 exhibited single microbial growth and 3 showed growth of multiple microorganisms (1 pseudomonas plus S.aureus, 1 pseudomonas+ Coagulase-negative staphylococcus. Over all 102 bacterial isolates were identified among these 68(66.6%) were gram negative and 34 (33.3%) were gram positive. the most prevalent bacteria isolated was Pseudomonas aeruginosa 40(39%) followed by S.aureus 26 (25.4%), Proteus species 15(14.7%) S. saprophyticus 8(7.8%) Providencia 4(3.9%), Citrobacter 4(3.9%), Serratia marcescens 2(1.9%), Enterobacter species2(1.9%), E. coli 2(1.9%) as presented in table 2. Antibiogram of isolated bacteria showed that S. aureus was mostly sensitive to Linezolid 82% and Vancomycin 78% among gram-positive bacteria. On the other hand, CoNS were mostly susceptible to Imipenem 77%, Cefoperazone/sulbactam 89%, and Linezolid 89%. The following information was found in the resistance spectrum of gram-positive bacteria: Clindamycin 67%, Ampicillin (72%) Ceftriaxone (77-82%), Amoxicillin/Clavulanate (77%), and Ciprofloxacin (86% to 77%). Gram-negative bacteria exhibited a wide range of sensitivity, with 52% to 100% susceptibility to imipenem, 52% – 95% for piperacillin/tazobactam, 52% – 81% for cefoperazone with sulbactam, and 52% – 100% for Meropenem. According to this study, the resistance profile of gram-negative bacteria showed the following information: Amoxicillin/Clavulanate (72-92%), Ceftriaxone (89%), Ceftazidime (52-77%), Ciprofloxacin (52-89%), and Ampicillin (77%) as presented in table 2.after follow up after one month 96(81.3%) individuals were improved of which 80(83.3%) compliant with the antibiotics were prescribed according to C/S reports while 22 (18.6%) were symptomatic, of which among them 14(63.6%%) were not compliant with antibiotics demonstrating a strong correlation ($p<0.01$) between medication noncompliance and symptom persistence.(table 3)”

Table 1: Demographic features of the study population

Features	N(%)
Gender	
Male	47(40%)
Female	71(60%)
Age groups in years	
Below 20 years	18(15.2%)
20 to 30	68(57.6%)
30 to 40	16(13.5%)
Above 40	14(11.5%)
Residency	
Rural	80(67.7%)
Urban	38(32.2%)
Education	
Illiterate	68(57.6%)
Primery	20(16.9%)
Intermediate	14(11.5%)
Graduate	10(8.4%)
Post graduate	6(5%)

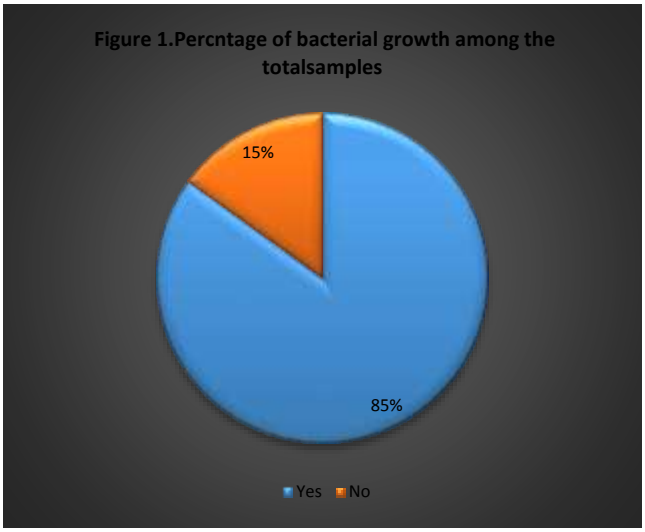

Table 2: Percentage distribution of the isolates of bacteria from clinical specimens that exhibit an antibiotic sensitivity pattern.

Bacteria	AK	GEN	CIP	AMC	AT	PIT	CPM	CFS	CAZ	CTR	IPM	V	LZ	MPM
Gram positive														
S.aureus		25%	18%	26%		38%	18%	66%	0.08%	22	30	78%	82%	30%
CoNS		64%	27%	27%		64%	52%	89%	52%	27	77%		89%	89%
Gram negative														
P. aeruginosa	57%	14%		12%	52	81%	57%	81%	55%	13	76%			81%
Proteus species	67%	15%	15%	30%	88	95%	52%	80%	52%		95%			95%
Providencia Species	26%	26%	16%		26%	52%	52%	52%	26%		52%			77%
Citrobacter species	26%	52%	27%		26%	52%	52%	52%	26%		77%			100%

Serratia marcescens	52%		52%			52%		52%			100%			52%
Enterobacter species	52%										100%			100%
E. coli	100%	100%					52%	52%						50%

CONS: "Coagulase-negative staph **AK:** Amikacin, **GEN:** Gentamycin, **CIP:** Ciprofloxacin, **AMC:** Amoxicillin/Clavulanate, **AT:** Aztreonam, **PIT:** Piperacillin tazobactam, **CPM:** Cefepime, **CFS:** Cepoferzone/sulbactam, **CAZ:** Ceftazidime, **CTR:** Ceftriaxone, **IPM:** Imipenem, **V:** Vancomycin, **LZ:** Linezolid, **MPM:** Meropenem"

Table 3**:** Participants follow up analysis

	Improved	Symptomatic	Total	Value of P
Complaint	80	8	88	<0.001
Non complaint	16	14	30	
Total	96	22	118	

DISCUSSION

The most frequently isolated bacteria, according to the study was Pseudomonas aeruginosa (39%), followed by S. aureus (25.4%)."Higher rates of resistance to ceftriaxone and ciprofloxacin were seen. Gram-negative bacteria were susceptible to carbapenem, piperacillin/tazobactam, and cefoperazone with sulbactam, whereas gram-positive bacteria had high susceptibility to Linezolid & Vancomycin. Results were greatly affected by the patient's compliance to antibiotic treatment, and persistent symptoms after a month of follow-up were highly correlated with noncompliance. Antibiotic resistance is a worrying trend that threatens world health.[9] Our study's findings are consistent with previous research, since most of the individuals studied were from rural regions, and were illiterate and majority were female. The majority of patients had purulent ear discharge when they first arrived, which is consistent with Wan Draman et al.'s findings.[10] In the course of our study, we recovered single bacterium from 97 individuals whose cultures demonstrated growth, which is consistent with the findings of Akter S et al.[11] Gram-negative bacteria predominated over gram-positive bacteria, and comparable results have been reported in the literature.[12] Pseudomonas aeruginosa was the most frequently isolated bacterium in our investigation, which is consistent with other investigations.[13] It may have a chronic nature since it uses enzymes to knock out bodily defences and pilli to cling to mucosal surfaces. Although S. aureus is the second most frequent isolate, a number of studies have identified it as one of the main bacterial sources of CSOM isolates. [14] Following S. aureus, in accordance with others, [15]were Proteus species, Coagulase-negative staphylococcus (CoNS), Providencia, Citrobacter, Serratia, Enterobacter, and E. coli. While CoNS were mostly susceptible to Cefoperazone/sulbactam 89%, Linezolid 89%, & Imipenem 77%, S. aureus was mostly susceptible to Linezolid 82% & Vancomycin 78%. Previous study has similarly shown comparable efficacy.[16] Both vancomycin and linezolid exhibit good efficacy against gram-positive pathogenic pathogens; nevertheless, these two antibiotics are not frequently used. The most effective antibiotics for gram-negative bacteria were imipenem & meropenem, subsequent to piperacillin/tazobactam and cefoperazone with sulbactam, with sensitivity ranging from 52 -100%.[17] Additionally, cephalosporins show reduced sensitivity, particularly third-generation cephalosporins like ceftazidime & ceftriaxone; just cefepime, a fourth-generation cephalosporin, demonstrated high sensitivity. Comparably, the widely used fluoroquinolone ciprofloxacin shown reduced efficacy against both gram-positive and gram-negative bacteria, with resistance ranging from 52% to 88%; this is consistent with various studies but contradicts others.[18]Amoxicillin/clavulanate, which was once prescribed for persistent suppurative otitis media, has had the greatest resistance, with resistance levels ranging from 74 to 92%. A considerable level of resistance to ampicillin, amoxicillin/clavulanate, cotrimoxazole, amoxicillin, & cefuroxime was found in one of the systemic reviews and meta-analyses. Our results are consistent with this investigation.[19] The increasing number of multidrug resistant microorganisms can be seen in the rising antibiotic resistance in chronically ear infections, which is a serious problem. The fact that this resistance occurs across several antibiotic classes emphasises how urgent it is to solve the problem. Patients who participate in rehabilitation programs have better health outcomes, according to follow-up studies, indicating the value of continued care. In contrast, certain participants may experience difficulties to adherence, including as demographic variables or lack of assistance, which can impair proper follow-up and therapy of CSOM.[20] This study highlighted the significance of judicious antibiotic usage based on culture findings and patient participation for better outcomes by revealing novel patterns of rising antibiotic resistance in CSOM. Antimicrobial resistance is made worse in countries like Pakistan by features including unethical antibiotic prescriptions for minor diseases, uncontrolled over-the-counter availability, and restricted use of facilities where bacterial culture may be performed. Raising awareness of the seriousness of resistance through focused educational programmes is essential to successfully addressing this issue. Furthermore, in order to maximise the use of antibiotics in inpatient and outpatient settings, tertiary care hospitals must undertake antibiotic stewardship programs. These measures are necessary to protect the efficacy of antibiotics in the treatment of CSOM and stop the spread of antibiotic resistance."

CONCLUSION

The current study concluded that the most prevalent bacteria isolated from chronic suppurative otitis media individuals were Pseudomonas aeruginosa followed by s.aureus. Vancomycin and Linezolid were more effective against gram positive bacteria and carbapenem, cefoperazone with sulbactam, and piperacillin/tazobactam were effective agaist gram negative bacteria.

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