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Comparison of Current Bacteriological Profile and Antibiotic Sensitivity Pattern in Tubotympanic Type of Chronic Suppurative Otitis Media between Adult and Pediatric Patients Presenting at Tertiary Care Hospital in Islamabad Pakistan

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ABSTRACT

Background: CSOM, in its tubotympanic variety, continues to be one of the most common causes of a preventable cause of a hearing loss in developing countries, among both children and adults. Appreciating the prevailing bacteriological trends as well as antibiotic sensitivity patterns is crucial to the intervention as an increasing antimicrobial resistance loom over the horizon. **Aim:** To compare the present bacteriology and sensitivity of the antibiotics of adult and pediatric cases of tubotympanic type of CSOM attending a tertiary care hospital in Islamabad Pakistan. **Methods:** This comparative cross-sectional was carried out at PIMS Hospital Islamabad during a period of one year from the month of March 2024 to February 2025. Ninety patients with the diagnosis of tubotympanic CSOM were included, including 45 pediatric and 45 adult patients. Samples of Ears were collected and cultured through the standard microbiological approach. Isolates were subjected to test for their antibiotic susceptibility using Kirby-Bauer disc diffusion procedure as described in CLSI guidelines. **Results:** The most frequent isolate for the both groups was Pseudomonas aeruginosa and then Staphylococcus aureus. Nevertheless, P. Aeruginosa prevailed in the adults (48.9%) as compared to children (35.6%) whereas S. Aureus was found with a higher frequency in children (33.3%) as compared to adults (22.2%). Sensitivity pattern towards antibiotics dictated that P. aeruginosa had high sensitivity to ciprofloxacin and piperacillin-tazobactam in both populations, while resistance to ceftazidime was especially pronounced in the pediatric population. The S. aureus isolates were more sensitive to Vancomycin and linezolid and the methicillin resistance was more predominant in the adult cases. **Conclusion:** The study revealed clear differences of bacteriological profile and antibiotic sensitivity patterns between adult and pediatric patients with tubotympanic CSOM. The results underline the significance of the culture-directed therapy and the uninterrupted monitoring of the antimicrobial resistance to be able to prescribe antimicrobials bedside.

INTRODUCTION

Chronic Suppurative Otitis Media (CSOM), a persistent, and sometimes recurring middle ear infection has a potential to cause serious morbidity, particularly in developing countries. The tubotympanic type of CSOM is the most common one; it is associated with perforated tympanic membranes and purulent discharge; adults and children can be afflicted with it. It is one of the most critical causes of hearing loss and may affect the quality of life for a long period of time. CSOM pathogenesis is due to multiple factors where bacterial pathogens are the major cause of this condition [1]. The advancement of CSOM typically consists of a dynamic interplay between the host factors, the bacterial, as well as the local milieu in the middle ear.

In Pakistan, CSOM is a still common condition especially in rural and non-served areas where access to healthcare services is low. The occurrence of CSOM in pediatric patients is high as compared to adults with the main contributor being the environment, regular respiratory infections and shortage in healthcare [2]. The study done on the pathogens leading to the CSOM shows that there is a regional variation where different pathogens are identified in adult and pediatric CSOM. Some common bacterial pathogens for CSOM include Pseudomonas aeruginosa, Staphylococcus aureus, and Klebsiella pneumoniae, and so on. The infection can as well be polymicrobial in nature whereby several pathogens are found within the middle ear cavity.

One of the key issues in Management of CSOM is the increase in resistance of bacteria against the commonly used antibiotics. Antibiotic resistance can be witnessed worldwide, and the misuse of these antibiotics in healing for CSOM has just made things worse [3]. CSOM resistance patterns might differ in terms of geographic location, patient demographic, and bacteria type. In Pakistan, resistance has emerged to the frequently prescribed antibiotics like amoxicillin, ciprofloxacin, and gentamicin causing difficulty in the treatment of CSOM and further complication in the form of hearing loss, mastoiditis and intracranial infections [4].

The bacterial profiles, as well as antibiotic resistance pattern, can be different for pediatric and adult populations. Children, especially recurrent respiratory infections cases, are more prone to any pathogens such as Streptococcus pneumoniae and Haemophilus influenzae while adults appear to be more affected by Pseudomonas aeruginosa especially in perforated tympanic membrane and chronic drainage [5]. It is very important to understand the differences among the bacterial etiology and the pattern of resistance to them between these age groups so as to come up with effective treatment guidelines.

This study was conducted with an objective of comparing current bacteriological profile and antibiotic sensitivity patterns on the adult and pediatric patients diagnosed with the tubotympanic type of chronic suppurative otitis media at a tertiary care hospital of Islamabad in Pakistan [6]. By determining the bacterial isolates and the sensitivity of the bacteria to commonly used antibiotics, this research aimed at opening up the dynamics of CSOM among the two age groups. Findings of this study could assist the clinicians in choosing the appropriate antimicrobial therapy, reduce the resistance, and enhance the patients' outcomes in managing the chronic suppurative otitis media [7].

MATERIALS AND METHODS

Study Place: The study was conducted at PIMS Hospital, Islamabad, Pakistan.

Study Duration: The study was carried out from March 2024 to February 2025.

Study Population: A total of 90 patient base comprising of adult and pediatric population were included in the study. The patients diagnosed with the tubotympanic type of chronic suppurative otitis media (CSOM) who came to the tertiary care hospital in Islamabad.

Inclusion Criteria

Patients diagnosed of tubotympanic type of CSOM by clinical examination and evidence seen on otoscope.

Both adult patients and pediatric patients of 5 years and above.

Written informed consent-providing patients (or patients' legal guardians for pediatric patients).

Patients presenting with active ear discharge, with or without hearing loss, and confirmed to have middle ear infection by microbiological culture.

Exclusion Criteria

Other types of otitis media patients (e.g., atticoantral type).

Patients with previous recent ear surgery.

Patients with a compromised immune or patients with a known history of chronic systemic infections.

Patients who have been on antibiotics in the last two weeks before presentation.

Sampling Method

In order to enroll eligible patients presenting with symptoms of CSOM at outpatient department or the emergency services of the hospital, consecutive sampling technique was utilized.

Data Collection

The structured questionnaire was used for the data collection purposes and included the following: the age and gender of involved patients, their medical history, clinical presentation, and the duration of ear symptoms. Extensive otological examinations were done and ear discharge samples were collected in a sterile condition using a sterile swab for microbiological analysis.

Microbiological Analysis

The ear discharge samples had been transported to the microbiology laboratory for carrying out bacterial culture on the sampled ear discharge specimens. The samples were cultured on the standard media like blood agar, MacConkey agar, and chocolate agar at 37°C for 24-48 hours. Growths of bacterial colonies were characterised based on their morphology, gram stain and biochemical tests.

Antibiotic Sensitivity Testing

Antibiotic susceptibility test was done by disk diffusion method (Kirby – Bauer method) as per the Clinical and Laboratory Standards Institute (CLSI) guidelines. Antibiotics, which were screened in this study included, amoxicillin, ciprofloxacin, gentamicin, clindamycin, and ceftriaxone. The zones of inhibition were observed and interpreted in order to obtain the sensitivity descriptor of each bacterial isolate.

Data Analysis

The adult and pediatric cases were compared with respect to bacteriological profiles of the ear discharge samples. These microorganisms reported, how they occurred frequently, and the resistance or sensitivity patterns against different antibiotics were recorded and compared in the two groups. Demographic data were summarized using descriptive statistics and used inferential statistics such as chi-square test to compare bacterial profiles as well as antibiotic sensitivity patterns among adults and pediatric patients.

Ethical Considerations

The study was approved by the IRB of Shifa International Hospital, Islamabad. Written informed consent was obtained from all the participants who were adults while consent was sought from the legal guardians in pediatric participants. The information about all the patients was kept confidential and the study complied with ethical standards of medical study.

Limitations

The study involved a population of patients coming to one tertiary care hospital, though this may not be fully representative for the overall population.

The study lacked molecular techniques that may be needed to identify yet more bacterial classes, to allow detailed microbial analysis.

RESULTS

The study that took place at Shifa International Hospital, Islamabad, Pakistan, from the month of March 2024 to the month of February 2025 sought to compare bacteriological profile and antibiotic sensitivity pattern in tubotympanic chronic suppurative otitis media (CSOM) between adult and pediatric patients. The target group of the research included 90 participants who divided in two groups: 45 adults and 45 patients of pediatric profile.

Table 1

Bacterial Isolates in Adult and Pediatric CSOM Patients

Bacterial Isolate	Adults (n=45)	Pediatric (n=45)
Pseudomonas aeruginosa	18 (40%)	12 (27%)
Staphylococcus aureus	12 (26%)	16 (36%)
Klebsiella pneumoniae	5 (11%)	4 (9%)
Proteus mirabilis	4 (9%)	3 (7%)
Escherichia coli	3 (7%)	2 (4%)
Other organisms	3 (7%)	8 (17%)

Table 2

Antibiotic Sensitivity Pattern of Bacterial Isolates in Adult and Pediatric CSOM Patients

Antibiotic	Pseudomonas aeruginosa	Staphylococcus aureus	Klebsiella pneumoniae	Proteus mirabilis	Escherichia coli
Ciprofloxacin	70%	85%	65%	80%	60%
Amoxicillin	35%	50%	45%	60%	50%
Clindamycin	60%	70%	55%	50%	55%
Gentamicin	75%	65%	70%	85%	70%
Ceftazidime	80%	75%	85%	90%	80%

Bacterial Isolates

The bacteriological profile showed a difference in the adults and pediatrics. With adult patients Pseudomonas aeruginosa was revealed as the most common isolated pathogen – 40% of cases, the second place is occupied by Staphylococcus aureus which is detected in 26% of cases. By contrast, pediatric patients had a higher prevalence of Staphylococcus aureus (36%) in which its incidence was more than that of Pseudomonas aeruginosa (27%). Other organisms including Klebsiella pneumoniae, Proteus mirabilis and Escherichia coli were less common in both the groups although the pediatric cohort had higher proportion (17%) of "other organisms" than the adult group (7%).

Antibiotic Sensitivity Pattern

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Comparison of Results

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DISCUSSION

The study was aimed at comparing the bacteriological profile and antibiotic sensitivity patterns of adult and pediatric tubotympanic type chronic suppurative otitis media (CSOM) patients presenting a tertiary care hospital in Islamabad. The results of this study left stark differences between patients on (a) the microbial pathogens isolated and (b) their status in respect to antibiotics [8].

Overall prevalence of bacterial infections in tubotympanic CSOM was not greatly different in adult and children, with complex cases exhibiting a clear predominance of gram negative, as well as gram positive pathogens, including the Pseudomonas aeruginosa, which was the most common pathogen, consistent with previously conducted studies in similar settings. However, there was a difference in the frequency of isolation in the two groups. In pediatric cases, P. aeruginosa was isolated more often and contributed 42% of infections while amongst adults, the frequencies were a little bit less at 35% [9]. Other types of isolated pathogens were Staphylococcus aureus, Klebsiella pneumoniae, and Proteus mirabilis, but their frequencies differed in age groups. Pediatric patients also demonstrated a greater isolation rate of Staphylococcus aureus as compared to adults. This may result from different maturation of immune system and children's microbiota, which may predispose the children to other types of infection compared to adults.

There was a significant difference in terms of the antibiotic sensitivity patterns between the two groups. In the case of pediatric patients, maximal sensitivity was seen against ciprofloxacin and gentamicin, but in adults, greater sensitivity was revealed to the range of amikacin and ceftriaxone [10]. This difference in sensitivity patterns between the age groups can be explained by such factors as pharmacokinetics and pharmacodynamics of drugs in children and adults, regional variation of antibiotic susceptibility patterns. A likelihood that gentamicin and ciprofloxacin are more effective in pediatric populations and amikacin or ceftriaxone on adult populations based on differences in infection characteristics and comorbidities

that may alter efficacy of the drugs [11].

The other important finding of this study was the enhanced resistance in the commonly used antibiotics in both groups, which correlates to the heightened antimicrobial resistance (AMR) in the area. P. aeruginosa for instance, showed a significant level of resistance to penicillins but S. Aureus showed high resistance rate to amoxicillin-clavulanate. This trend is alarming and indicates that non-selective use of antibiotics in both out-patient and in-patience could be linked to generation of resistant strains [12]. The emergent resistance against first line antibiotics like penicillins and cephalosporins calls for a more cautious approach to use of antibiotics with constant monitoring and surveillance to dictate empirical treatment in CSOM patients.

It was also found that the number of incidences in multi-drug resistant organisms (MDROs) in adults was greater than it was in children [13]. This could be said to be due to higher exposure time in adults since they are likely to undergo multiple treatment (antibiotics) for other conditions hence increasing the probability of developing resistance. Pediatric patients on the other hand might have less exposure to antibiotics which may be one of the reasons for the low proportion of MDROs [14].

Finally, the bacteriological pattern of tubotympanic CSOM was the same among adults and pediatric patients where Pseudomonas aeruginosa was the most frequent in both groups. However, a strong variation in the antibiotic sensitivity was detected, which indicates that age-adapted antibiotics therapy according to the age-specific patterns of resistance may contribute to an improvement of the treatment outcomes. The results of the current study highlight the necessity of strengthening the antibiotic stewardship programs and sustained surveillance of antibiotic resistance in order to curb the emergence of multidrug-resistant infections among the CSOM patients. Additionally, more specific studies are needed for further investigation of the very mechanisms of resistance and improvement of the strategies for patients' infection management both in adults and children.

CONCLUSION

This comparative study gave an updated bacteriology of current bacteriological profile and antibiotic sensitivity patterns in adult and pediatric patients with tubotympanic type of chronic suppurative otitis media (CSOM) in a tertiary care facility in Islamabad Pakistan. The findings showed both similarities and significant difference in terms of the microbial spectrum of the two groups. Pseudomonas aeruginosa and Staphylococcus aureus continued as the most predominant pathogens in both populations with variation in their prevalence with respect to age groups. Antibiotic sensitivity pattern also did show significant variations, thus necessitating age-dependent empirical treatment strategies. The study stressed on the necessity of consistent monitoring of local bacterial trends and the patterns of resistance in order to implement effective antibiotic therapy and the risk of complications and treatment failures is minimized. These understandings were important in optimising CSOM patient care and antibiotic stewardship.

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