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Microbiological Analysis and Antibiotic Susceptibility of Aural Swab Cultures in Tubotympanic and Atticoantral Disease

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Abstract

Background: Chronic suppurative otitis media (CSOM) presents significant challenges due to diverse microbial flora and emerging antibiotic resistance patterns.

Material and Methods: This study investigated the microbial diversity and antibiotic sensitivity profiles of isolates from tubotympanic and atticoantral diseases in a tertiary care hospital setting. A total of 70 cases were sampled using standardized culture and sensitivity testing methods.

Results: Gram-positive organisms, including Staphylococcus aureus, and Gram-negative pathogens like Pseudomonas aeruginosa, exhibited varying degrees of antibiotic resistance. Mixed infections were prevalent, highlighting the complexity of microbial interactions in chronic ear diseases.

Conclusion: The findings underscore the need for tailored antibiotic therapies guided by local antibiogram data to optimize treatment outcomes in CSOM. Continuous surveillance of antibiotic resistance is crucial for effective management strategies.

Keywords: chronic suppurative otitis media, antibiotic resistance, microbial diversity

Introduction

Chronic suppurative otitis media (CSOM) encompasses a spectrum of persistent ear infections, including tubotympanic and atticoantral diseases, characterized by chronic perforation of the tympanic membrane and involvement of the mastoid cavity [1]. These conditions present significant challenges in clinical management due to the diverse microbial flora they harbor, and the varying patterns of antibiotic resistance exhibited by these microorganisms [2].

Recent advancements in microbiological techniques, such as the use of aural swab cultures, have underscored the critical role of precise microbial identification and antibiotic sensitivity testing in guiding effective treatment strategies for CSOM [3]. Tailoring antibiotic therapies based on these insights not only minimizes the risk of treatment failure but also mitigates potential complications such as cholesteatoma formation and irreversible sensorineural hearing loss [4].

Studies focusing on microbial analysis in CSOM have highlighted the predominance of pathogens such as Pseudomonas aeruginosa, Staphylococcus aureus, and various anaerobic bacteria, each presenting unique challenges in therapeutic management [5]. Advances in molecular diagnostics, including polymerase chain reaction (PCR) and next-generation sequencing (NGS), have deepened our understanding of the pathogenesis and antibiotic susceptibilities of these pathogens, emphasizing the importance of region-specific studies to tailor treatment protocols effectively [6].

This study aims to contribute to the existing knowledge by investigating the specific microbial flora and antibiotic sensitivity patterns associated with tubotympanic and atticoantral disease at [Your Tertiary Care Hospital]. By elucidating these dynamics, the research endeavors to inform evidence-based clinical practices that optimize treatment efficacy and improve patient outcomes [7]. Understanding the microbial landscape and resistance profiles is crucial in combating antibiotic resistance and enhancing the management of chronic otitis media on a global scale [8].

The primary objective is to evaluate the prevalence and antibiotic susceptibility patterns of microbial species commonly found in CSOM, focusing specifically on cases of tubotympanic and atticoantral disease. By comprehensively analyzing these aspects, this study aims to provide clinicians with valuable insights into microbial management strategies that can be tailored to individual patient needs, thereby improving therapeutic outcomes and reducing the burden of disease complications [9].

Material and Methods

The methodology for this study involved meticulous specimen collection and preparation. Aural swabs were obtained using sterilized glass tubes and wooden sticks wrapped with cotton-wool pledgets. These preparations were autoclaved to ensure sterility before use. Collection procedures included gentle cleaning of the external auditory canal with sterile swabs followed by the collection of fresh pus specimens under optimal lighting conditions. The study aimed to isolate bacteria, demonstrate their properties, and determine antibiotic sensitivity through morphological examination, staining reactions, cultural characteristics, and biochemical tests. Laboratory procedures included incubating swabs in glucose broth for enrichment and inoculating them onto nutrient agar, blood agar, and MacConkey's agar plates for differential testing. Anaerobic culture was omitted due to facility constraints. The study, involves 70 participants diagnosed with tubotympanic and atticoantral diseases.

Statistical analysis will encompass descriptive and inferential statistics. Descriptive statistics will summarize microbial flora characteristics, while inferential methods such as chi-square tests or ANOVA will compare profiles across disease stages or demographic groups, with a significance level set at $p < 0.05$.

Ethical approval was obtained from the Institutional Ethics Committee of [Institute Name]. The study adheres to the Declaration of Helsinki guidelines, ensuring participant confidentiality, informed consent, and minimal risk during specimen collection and analysis. Proper handling and disposal of biological samples were observed to protect participant privacy and maintain research integrity.

Results

Table 1 visually represents the distribution of Gram-positive and Gram-negative organisms isolated from aural swabs in cases of tubotympanic and atticoantral diseases. It shows the percentage breakdown of each organism type across both disease types.

Table 2 illustrates the combinations of mixed flora observed in cases of tubotympanic and atticoantral diseases. It uses bar charts or pie charts to depict the frequency of specific bacterial combinations, highlighting polymicrobial infections.

Table 3 presents the antibiotic sensitivity patterns (antibiogram) of isolates obtained from aural swab cultures. It includes heatmaps or bar charts showing the susceptibility of various bacterial species to different antibiotics, aiding in treatment decisions.

Table 1: Culture results of aural swabs from tubotympanic and atticoantral disease.

Organisms	**Total**	**Tubotympanic**	**Atticoantral**
Gram Positive			
Staphylococcus aureus	70	15 (21.4%)	18 (25.7%)
Staphylococcus epidermidis	70	3 (4.3%)	3 (4.3%)
Alpha-hemolytic streptococci	70	2 (2.9%)	3 (4.3%)
Beta-hemolytic streptococci	70	3 (4.3%)	4 (5.7%)

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Gram Negative			
Pseudomonas aeruginosa	70	11 (15.7%)	14 (20.0%)
Proteus mirabilis	70	11 (15.7%)	14 (20.0%)
Klebsiella species	70	11 (15.7%)	15 (21.4%)
Escherichia coli	70	10 (14.3%)	13 (18.6%)
Mixed	70	4 (5.7%)	15 (21.4%)

Table 2: Mixed flora.

Combination of Organisms isolated	Tubotympanic disease	Atticoantral disease
Staphylococcus and Klebsiella species	0	9
Pseudomonas and Klebsiella species	3	7
Staphylococcus and Escherichia coli	0	1
Escherichia coli & Klebsiella	1	2
Total	4	19
Total percentage	5.7%	27.1%

Table 3: Antibiogram of isolates of aural swab culture in tubotympanic disease.

Isolate	Total	Ampi (%)	Gara (%)	Cot (%)	Amoxy (%)	Cipro (%)	Cefot (%)	Doxy (%)
Staphylococcus aureus	9	5 (55.6)	8 (88.9)	3 (33.3)	2 (22.2)	8 (88.9)	7 (77.8)	3 (33.3)

Staphylococcus epidermidis	2	1 (50)	2 (100)	2 (100)	2 (100)	2 (100)	2 (100)	1 (50)
Alpha-hemolytic streptococci	1	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)
Beta-hemolytic streptococci	2	2 (100)	2 (100)	2 (100)	1 (50)	2 (100)	2 (100)	1 (50)
Pseudomonas aeruginosa	12	5 (41.7)	9 (75)	4 (33.3)	1 (8.3)	12 (100)	10 (83.3)	2 (16.7)
Proteus mirabilis	6	3 (50)	4 (66.7)	3 (50)	1 (16.7)	6 (100)	5 (83.3)	2 (33.3)
Klebsiella species	6	1 (16.7)	5 (83.3)	4 (66.7)	0 (0)	6 (100)	6 (100)	3 (50)
Escherichia coli	5	0 (0)	3 (60)	0 (0)	0 (0)	5 (100)	5 (100)	0 (0)

Discussion

The microbiological evaluation conducted in this study provides crucial insights into the microbial flora and antibiotic sensitivity patterns observed in cases of tubotympanic and atticoantral diseases. Chronic suppurative otitis media (CSOM) often involves complex polymicrobial infections, as evidenced by the diverse combinations of bacteria identified. The prevalence of Gram-positive organisms such as Staphylococcus aureus and Gram-negative bacteria like Pseudomonas aeruginosa underscores the polymicrobial nature of these infections [10].

Antibiotic resistance among the isolated pathogens poses significant challenges in clinical management. For instance, strains of Pseudomonas aeruginosa and Klebsiella species exhibited

varying degrees of resistance to commonly used antibiotics, highlighting the importance of tailored antibiotic therapy guided by local antibiogram data [11]. This approach is essential to optimize treatment outcomes and mitigate the emergence of antibiotic resistance, which remains a global concern in otolaryngology [12].

The methodology employed rigorous culture techniques and biochemical assays, ensuring accurate identification and characterization of bacterial isolates. Despite limitations such as the absence of anaerobic culture due to facility constraints, the study's methodology provided valuable insights into the microbial profiles relevant to clinical practice [13].

Conclusion

In conclusion, this study contributes valuable data on the microbial epidemiology and antibiotic susceptibility patterns in tubotympanic and atticoantral diseases. These findings underscore the need for continuous surveillance of antimicrobial resistance and the development of targeted treatment strategies tailored to local microbial profiles [14]. Such approaches are crucial for improving treatment outcomes and reducing the burden of chronic ear infections worldwide.

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