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Antibiotic susceptibilities of bacteria isolated from chronic suppurative otitis media

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Abstract

Background: To identify the bacteria that cause chronic suppurative otitis media and determine their antibiotic susceptibilities.

Material and Methods: We examined bacterial cultures that were isolated from the ear discharge of 180 patients who were admitted to the otolaryngology clinic between September 2014 and October 2015 due to suppurative bluish-green discharge from the middle ear. We also assessed the antibiotic susceptibilities of these microorganisms by retrospectively using the results of particular tests. The identification and antibiograms of bacteria were carried out using the VITEK 2 automated system.

Results: Microbial growth was detected in 162 of 180 samples (90%). The most frequently isolated strains were P. *aeruginosa* in 58 samples (35.8%) and *S. aureus* in 34 samples (20.9%). *P. aeruginosa* strains showed the highest sensitivity to amikacin (3.4%) and gentamicin (3.4%), but showed the greatest resistance to cefuroxime (82.7%) and trimethoprim/sulfamethoxazole (89.6%). *S. aureus* showed the lowest resistance to vancomycin (%0) and highest resistance to penicillin (88.2%) respectively.

Conclusion: We detected low resistance to aminoglycosides and quinolones, which are frequently used in the treatment of chronic suppurative otitis media. The detection of microorganisms, and a prior knowledge of their antibiotic susceptibilities, will contribute to successfully treating this disease.

Key words: Otitis media, *Pseudomonas aeruginosa, Staphylococcus aureus*

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Introduction

Chronic suppurative otitis media (CSOM) is a disease that is characterized by eardrum perforation and suppurative discharge, and thus chronic inflammation in the middle ear, mastoid cavities, and infection. Acute infections improve within six weeks, but irreversible alterations begin when the infection and suppuration continue for longer than six weeks. If the active suppuration continues for longer than three months, and if there is an absence of response to medical treatment, the disease is accepted as being chronic (1,2). CSOM

can be treated in a number of ways, and it sometimes requires the long-term use of antibiotics (3).

The aim of acute otitis media (AOM) and CSOM treatment is to obtain a dry ear that does not contain necrotic tissue and inflammation. Therefore, it is important to possess knowledge of the pathogens involved, as well as their antibiotic susceptibilities, in order to successfully treat this disease.

In this study, we aimed to identify the bacteria involved and determine their antibiotic susceptibilities in order to improve the treatment of CSOM.

Materials and methods

We examined bacterial cultures that were isolated from the suppurative bluish-green discharge of 180 CSOM patients who visited the otolaryngology clinic in Amasya University, Şerefeddin Sabuncuoğlu Training and Research Hospital, Turkey between September 2015 and October 2015. The patients complained of middle ear discharge, and samples of this discharge were collected from patients who had not received any specific medication in the previous 30 days. Cultures were collected according to standard procedures using sterile swabs, and all samples were transferred to the laboratory without informing the laboratory staff of their nature. In order to culture the anaerobic bacteria, we seeded samples in 5% sheep blood agar, eozin metilen blue agar, and chocolate agar, and microbial growth was evaluated 24 and 48 hours after incubation. Colony morphologies and Gram staining features of microorganisms were identified using conventional techniques. In addition, the antibiotic susceptibilities of these bacteria were determined using VITEK 2 (bioMerieux, France) automated systems, and were retrospectively evaluated. We did not include patients who had used antibiotics in the previous one month, those who had been hospitalized for any reason, and those who had immune deficiency or cleft palate abnormalities.

Results

Microbial growth was detected in 162 of the 180 samples (90%). A mixed growth of bacteria and fungus was observed in nine patients. We observed no growth in 18 samples. The isolated strains were found in the following order of frequency: *Pseudomonas aeruginosa* in 58 patients (35.8%), *Staphylococcus aureus* in 34 patients (20.9%) and Coagulase-negative staphylococci (CNS) in 20 patients (12.3%). The list of isolated bacteria is summarized in Table in Table 1.

P. aeruginosa strains were most frequently isolated, and amikacin (3.4%) and gentamycin (3.4%) were the most effective antibiotics for these strains (bacteria showed the least resistance to these antibiotics). Other antibiotics that were also effective against *P. aeruginosa* strains were imipenem (5.1%), ceftazidime (6.8%), ciprofloxacin (13.7%), and piperacillin/tazobactam (24.1%. The highest resistance rates were observed for cefuroxime (82.7%) and trimethoprim/sulfamethoxazole (89.6%) antibiotics (Table 2).

Table 1. The distribution of pathogens isolated from patients with otitis media.

Isolated bacteria	n	%
P. aeruginosa	58	35.8
S. aureus	34	20.9
CNS	20	12.3
Proteus spp.	12	7.4
E. coli	10	6.1
K. pneumoniae	7	4.3
Enterobacter spp.	6	3.7
S. pneumonia	6	3.7
Other bacteria*	9	5.8
Total	162	100

CNS: Coagulase-negative staphylococci, *Acinetobacter spp., Citrobacter spp., Enterococcus spp., Morganella spp.

Table 2. Antibiotic resistance profile of isolated *P. aeruginosa* strains.

Antibiotics	n	%
Amikacin	2/58	3.4
Gentamicin	2/58	3.4
Imipenem	3/58	5.1
Ceftazidime	4/58	6.8
Ciprofloxacin	8/58	13.7
Piperacillin/Tazobactam	14/58	24.1
Cefuroxime	48/58	82.7
Trimethoprim/Sulfamethoxazole	52/58	89.6

S. aureus strains were the second most frequently isolated pathogens from our samples, and we determined that these strains showed the least resistance to vancomycin and trimethoprim/sulfamethoxazole, but showed the most resistance to penicillin (88.2%) (Table 3).

Table 3. Antibiotic resistance profile (%) of isolated *S. aureus* strains.

Antibiotics	n	%
Penicillin	30/34	88,2
Erythromycin	6/34	17,6
Clindamycin	6/34	17,6
Gentamicin	4/34	11,7
Ciprofloxacin	4/34	11.7
Cefuroxime	3/34	8,8
Oxacillin	3/34	8.8
Trimethoprim/Sulfamethoxazole	2/34	5.8
Vancomycin	0/34	0

Discussion

CSOM is commonly observed throughout the world and is one of the most frequently occurring infections. Ear discharge and hearing loss is found in the majority of patients, whereas some may be asymptomatic (1,4). CSOM can lead to a variety of extracranial (bone destruction mastoiditis and petrozit, subperiosteal abscess, facial paralysis, and labyrinthitis) and intracranial (meningioma, extradural abscess, subdural abscess, brain abscess, lateral sinus thrombophlebitis, and otitis media hydrocephalus) complications. Medical treatment is the first and most important option in the treatment of CSOM, and its basis is the detection of the microorganisms involved and the administration of appropriate antibiotic(s) in adequate doses and duration (5,6). Pathogens that lead to CSOM and AOM are highly variable; it is primarily *P. aeruginosa* and *S. aureus* that cause CSOM, while AOM most frequently occurs as a result of *Sreptococcus pneumonia*, *Haemophilus influenza*, and *Moraxella catarrhalis* infection (7).

In our study, we detected *P. aeruginosa* (35.8%), *S. aureus* (20.9%), and CNS (12.3%) as disease factors, and the order of frequency in which they were found is in accordance with the results of other studies: Ozbakkaloglu et al (8) identified *P .aeruginosa* (32%) and *S. aureus* (26%) as the most common causative factors in 309 CSOM patients, Gorur et al.(9) showed that *P. aeruginosa* (51.2%) and Proteus spp. (13%) were the most common, and Gul et al.(10) found that *P. aeruginosa* (23%) and *S. aureus* (18%) were the most frequently observed causative factors. International studies performed by Sharma et al. (11) and Kumar et al. (12) showed that CSOM primarily occurred as a result of *P. aeruginosa* (47.2% and 42.2%, respectively) and *S. aureus* (27% and 34.4%, respectively) infections.

P. aeruginosa bacteria are associated with high mortality, morbidity, and a capacity to spread very rapidly. They are primarily observed in older people, in those with diabetes, and in individuals whose immune system is repressed (13, 14). *P. aeruginosa* rarely affects the epithelium of healthy individuals other than via the external auditory meatus (15).

Regarding the antibiotic susceptibilities of *P. aeruginosa* strains in CSOM patients, Gul et al. (10) found that *P. aeruginosa* strains were susceptible to ceftazidime and imipenem (100%), ciprofloxacin (92%), and gentamicin and amikacin (85%). On the other hand, Sanlı et al. (16) showed that *P. aeruginosa* strains were susceptible to piperacillin/tazobactam and ceftazidime (100%). Additional to national studies, Malkappa et al. (17) found that the maximum susceptibility was observed for amikacin and Sharma et al. (11) found that the maximum susceptibility was observed for imipenem and tobramycin. In our study, we found that amikacin and gentamycin antibiotics were more effective in *P. aeruginosa* strains compared to other antibiotics. Imipenem was the second most effective antibiotic, and strains showed the highest resistance to cefuroxime and trimethoprim/sulfamethoxazole.

S. aureus strains are those that are most commonly isolated from CSOM patients, and the highest susceptibilities were observed for vancomycin and ciprofloxacin by Gul et al. (11), and for ampicillin-sulbactam antibiotics by Gorur et al. (10). According to our findings, the most effective antibiotic was vancomycin for *S. aureus* strains, while the susceptibility was 88.3% for gentamicin and ciprofloxacin, which have important roles in COM treatment.

S. pneumoniae strains are rarely observed in CSOM cases. Similarly, we excluded *S. pneumoniae* strains at 3.7%. In addition, we did not detect *H. influenzae* strains in any of our cases. This was because the Haemophilus species rarely causes CSOM, and also we did not use the appropriate medium in our study.

Conclusion

We detected low levels of resistance to aminoglycosides and quinolones, although these antibiotics have long been used to treat ear infections. High levels of *P. aeruginosa* and *S. aureus* isolation from CSOM patients can be associated with the easy settlement of these strains in atrophied and weak tissues. Therefore, the

identification of disease factors in CSOM patients and selection of the most suitable antibiotics will lead to rapid and effective treatments. In addition, it will also be possible to prevent potential complications.

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