Evaluation of cholesteatoma microbiologic findings in patients with chronic suppurative otitis media

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Abstract

Aim: this study was designed with the aim to investigate the most common microorganisms involved in cholesteatoma in patients with chronic otitis media and to determine their antimicrobial susceptibilities to in use antibiotics.

Methods: Thirty individuals with the diagnosis of cholesteatoma were enrolled into this study. The microbial samples of middle ear were gotten during the surgery and studied by the microbiologist for the culture and antimicrobial susceptibility tests.

Results: In total 26 out of 30 tested samples were culture positive (80%), of which 34 bacterial species were recovered. Two cultures (6.6%) were positive for fungi and 4 (13.4%) cultures were negative. The most prevalent gram-negative aerobic pathogens were P. aeruginosa (23.5%), Proteus mirabilis (14.7%) and E. coli (11.7) and the most common gram-positive organisms were S. epidermidis (8.8%), S. aureus (5.8%) and diphteroides (5.8%). Based on the antibiotic susceptibility testing, ciprofloxacin and ceftazidime were the most effective antibiotics against gram positive and gram negative isolated bacteria respectively, except for P. aeruginosa. Among gram positive aerobic bacteria, the most resistant bacterium was S. epidermidis.

Conclusion: The results of this study showed that a wide variety of pathogens including aerobic and anaerobic bacteria are involving in cholesteatoma. For eradication of these bacteria we need to use broadspectrum antibiotics in addition to the surgery to control the infection in cholesteatoma.

Key words: cholesteatoma; microbiologic findings; suppurative; otitis media

Introduction

Cholesteatoma is a type of chronic otitis media which occurs due to abnormal accumulation of squamos epithelium in the middle ear. The mean annually onset of cholesteatoma is 9.2 % in 100000 individuals [1]. Although it can be without any sign or symptom, most patients complain of otorrhea and hearing loss [2]. The infected epithelium and bacterial growth can involve the bones of middle and inner ear and cause hearing loss and vertigo meningitis [3], 7th nerve palsy and epidural abscess can occur due to nerves and meningeal involvement [4-5].

The most prevalent aerobic bacteria in chronic otitis media are Staphylococcus aureus, Escherichia coli (E. coli), Klebsiella pneumonia, and Pseudomonas aeruginosa [6, 7]. The main treatment for cholesteatoma is surgery, but use of appropriate antibiotic therapy before and after the procedure is essential to control the infection [8].

Since cholesteatoma is a disease which can cause significant morbidity and mortality, a reliable knowledge about pathogens and medication can assist in the selection of most appropriate antibiotic regimens and minimize the complications [1]. The aim of this study was to determine the aerobic and anaerobic organisms and their susceptibility to our antimicrobial drugs in the patients with cholesteatoma.

Materials and methods

In this cross sectional study, all the patients with chronic otitis media referred to Emam Khomeini Teaching Hospital of Ahvaz, during the
years 2009-2010 were screened. Among them, 30 patients with the diagnosis of cholesteatoma (which was defined during the surgery) were enrolled in the study. All the patients received antibiotics before the surgery. During the surgery, samples were collected from the secretion of middle ear using a sterile swab and were put into thioglycollate broth and transferred to the microbiology laboratory of School of Medicine for aerobic and anaerobic cultivation.

The Thioglycollate containing samples were incubated at 37°C for 24 hours and subcultured on duplicate blood agars, chocolate agar, McConkey agar and mannitol salt agar (Hi-media, India) for aerobic and anaerobic bacteria. One of blood agar plates were placed in anaerobic jar and the cultures were kept up to 24-48h at 37°C. The grown colonies on the plates were then examined by Gram staining and the organisms were then identified by culture characters, morphology and standard biochemical tests [9]. The antibiotic susceptibility testing were performed on the isolates in the next step, using disk diffusion method as per CLSI guideline [10]. The tested antibiotics were: cefazidime, cefixime, cephalothin, nalidixic acid, imipenem, ciprofloxacin and trimethoprim-sulfamethaxazole (Mast Co., UK). The proposal of this work was approved by the Research Ethics Committee of the Ahvaz Jundishapur University of Medical Sciences.

Results

Based on the results, 26 out of 30 tested samples were microbiologically positive. Of these, 24 were positive for bacteria (80%) and 2 for fungi (6.6%). The rest 4 (13.4%) samples were negative for microorganisms. In culture, we isolated 34 bacterial species, which 27 (79.4%) were aerobic bacteria. Pseudomonas aeruginosa followed by Proteus mirabilis were the most common aerobic gram negative and S. epidermidis was the most prevalent gram positive bacteria isolated in this study. The isolated aerobic organisms are presented in Table 1. According to the results of anaerobic cultivation, 7 (20.5%) cultures were positive for anerobes, comprising gram positive cocci 4 (11.7%) and bacteroides 3 (8.8%). Figure 1 represents the total aerobic and anaerobic bacteria isolated in this study.

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>No. (%)</th>
</tr>
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<tbody>
<tr>
<td>P. aeruginosa</td>
<td>8 (23.5%)</td>
</tr>
<tr>
<td>Proteus mirabilis</td>
<td>5 (14.7%)</td>
</tr>
<tr>
<td>E. coli</td>
<td>4 (11.7%)</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>2 (5.8%)</td>
</tr>
<tr>
<td>S. epidermidis</td>
<td>3 (8.8%)</td>
</tr>
<tr>
<td>S. aureus</td>
<td>2 (5.8%)</td>
</tr>
<tr>
<td>Diphtheroid</td>
<td>2 (5.8%)</td>
</tr>
<tr>
<td>S. spoilier</td>
<td>1 (2.9%)</td>
</tr>
</tbody>
</table>

Table 1. Isolated gram positive and gram negative bacteria in present study

The antibiotic susceptibility testing revealed that ciprofloxacin and ceftazidime were the most effective antibiotics against gram positive and gram negative isolated bacteria respectively. It is necessary to mention that all isolated organisms were susceptible to 3rd generation tested antibiotics except for P. aeruginosa which was resistant to these antibiotics. Among gram positive aerobic bacteria, the most resistant bacterium was S. epidermidis. Figures 2 and 3 represent the profile of antibiotic resistance pattern among isolated bacteria.

Figure 1. Isolated aerobic and anaerobic bacteria isolated from middle ear pus (%)

Figure 2. Antibiotic resistance of gram-negative aerobic species (%) in cholesteatoma
Our study showed that the most effective antibiotic against aerobic gram negative bacteria causing cholesteatoma could be Ceftazidime which can eradicate most of them. However this antibiotic was less effective against *P. aeruginosa* and aerobic gram positive pathogens such as *S. epidermidis*. In such cases a combination of the drug with ciprofloxacin, could be a solution. Other investigators showed that the most effective antibiotics were amikacin followed by gentamycin and cefotaxime [13], and a combination of ofloxacin and erythromycin based on another survey [15]. Although our study and the study of Saini et al. [14], showed that *P. aeruginosa* was fully resistant to 3rd generation cephalosporins. In spite of the similar findings of causative organisms in most of similar studies, the result of antibacterial susceptibility tests, shows that the organisms isolate in different centers may show various response to antibiotics and this is related to the factors that facilitates the spread of resistance among bacteria such as widespread use of antibiotics and genetic mutations make especially gram negative bacteria resistant to a wide variety of antibiotics. So, due to these and other unknown reasons, the rate of antibiotic resistance was more predominant in the area of study. This study wasn’t without limitation. Due to the laboratory difficulties, we could not define antibacterial resistance for anaerobic organisms and fungi, since it could be more helpful for choosing an appropriate antibiotic regimens for destroying the causative organisms.

In conclusion, according to the result of this study, many different pathogens comprising aerobic and anaerobic bacteria, both gram negative and positive, were responsible for infection in cholesteatoma. The most common aerobic pathogens were *P. aeruginosa* followed by *P. mirabilis* and *E. coli* which were the most susceptible to Ceftazidime except for *P. aeruginosa*. So, due to this, and resistance of *S. epidermidis* as the most prevalent gram positive cocci to ceftazidime, use of combination therapy according to susceptibility testing could be a guide to manage the infection and reduce the intracranial and extracranial complication of cholesteatoma.

Discussion

Since now, various studies were conducted by some authors to assess the aerobic and anaerobic bacteriology of cholesteatoma. Although their studies could simply show the species and prevalence of pathogens which are responsible for cholesteatoma, new studies which can show bacterial resistance to antibiotics are still lacking. Due to widespread use of antibiotics, the response of pathogenic organisms to antibiotic therapy have changed dramatically [11]. So, knowledge of the species and resistance rate of current pathogens can help us find appropriate antibiotics for the patients with cholesteatoma.

We found in our study, that the most prevalent aerobic pathogens involve in cholesteatoma were *P. aeruginosa*, *Proteus mirabilis* and *E. coli* and the most common anaerobic organisms were gram-positive cocci and bacteroides. Our findings were in agreement with similar studies of Smith and Danner [5], Yeo et al. [11], Attallah et al. [12], and Maji et al.[13], which they reported *P. aeruginosa*, and *Proteus mirabilis* as the most prevalent isolated gram negative bacteria. Besides, in the latter mentioned study, the most common anaerobic bacteria recovered from samples were reported as peptostreptococcus and bacteroides, which was similar to our findings.

On the other hand another study, *S. aureus* was reported as the second most common isolated aerobic bacteria which was discordant to our findings. We recovered only 5.8% *S. aureus* from our samples [2]. In the study of Saini et al. there was a concordance for isolated anaerobic bacteria with our results [14].

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References


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