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Microbial flora of mastoid cavity after canal wall down (CWD) mastoidectomy

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Abstract

Introduction: Many scientists have worked on microbial flora of the ear canal or middle ear in nonoperated patients, but it is not clear that what changes would be occurred in the flora of the mastoid cavity postoperatively. It can help the surgeons to choose the appropriate drugs in the perioperative period. The study was designed to investigate the microbial flora of the middle ear and mastoid cavities after canal wall down (CWD) mastoidectomy. **Materials and Methods:** The survey was designed as a prospective cross-sectional study. All patients with chronic otitis media who had undergone CWD mastoidectomy in a public university hospital from 2014 to 2017 were enrolled in the study. They were periodically followed up postoperatively at least for 6 months. Swab sampling from ear cavity was performed, and the samples were sent for culture and antibiogram. Each specimen was sent for bacterial and fungal analysis. If bacterial culture result was positive, the sensitivity of the cultured organisms to common antibiotics was also assessed. **Results:** Seventy-four patients entered into the survey. Twenty-six (35%) of samples were positive for bacteria, and 11 (14.5%) were positive for fungi. Furthermore, 3 (4%) of the studied ears were positive simultaneously for both bacterial and fungal culture. Among cultured bacteria, *Staphylococcus epidermidis* was the most common species (29%). *Candida* species was the most common fungal species (8%). **Conclusions:** Microbial infection is a common finding after CWD mastoidectomy. *S. epidermidis* and *Candida* species should be considered as the primary targets of treatment.

Keywords: Bacteriology, mastoid, mastoidectomy, microbiology, mycology, otologic surgical procedure, tympanoplasty

INTRODUCTION

Chronic otitis media (COM) is an infection which may cause irreversible damages to the ear and mastoid cavity mucosa. COM can cause some destructive events in the middle ear due to chronic inflammation. These changes may include granulation tissue formation, perforation of tympanic membrane, and ossicular chain destruction which may cause hearing loss.^[1-3] This inflammation may involve some critical parts such as facial nerve, sinus lateralis, or grow intracranially which may further cause major complications such as deafness and meningitis.^[4] The main management option for COM and its complications is surgery. Many scientists have worked on microbial flora of the ear canal or middle ear in nonoperated patients, but it is not clear that what changes would be occurred in the flora of the mastoid cavity postoperatively. This study was designed to investigate the microbial flora of the middle ear and mastoid cavities in patients with COM

who have undergone canal wall down (CWD) mastoidectomy and assessing the antibiotic susceptibility of the cultured organisms.

MATERIALS AND METHODS

The current research was designed as a prospective cross-sectional study among patients with COM who underwent CWD mastoidectomy in a public university hospital and were followed up at least for 6 months. The Ethical Committee of Shahid Beheshti University of Medical Sciences approved the current study. Informed consent forms were signed by all patients who participated in the study. All patients with COM who underwent CWD mastoidectomy in Taleghani Hospitals

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(Tehran - Iran), from 2014 to 2017 were enrolled in the study. Patients who were immunocompromised and patients with a history of endocarditis who received prophylactic antibiotic regimen did not enter the study.

Patients were periodically followed up 2, 4, 8, and 24 weeks postoperatively. Microscopic ear examination was done, and the presence or absence of ear discharge was determined. Middle ear and mastoid cavity swab sampling was performed in a sterile standard setting for all cases. Samples were sent for culture and antibiogram. Bacterial culture was performed in blood agar, chocolate agar, and EMB culture media. Antibiogram testing was done in standard condition with different potential antibiotic disks (Rosco Diagnostica, Denmark). Fungal culture was done in Sabouraud's dextrose agar (Merck, Germany). Each specimen was sent for bacterial and fungal analysis. If culture result was positive, antibiogram was prepared. The sensitivity of the cultured organisms to common antibiotics was also assessed.

RESULTS

In this study, 74 samples of 74 patients were collected. Minimum time of follow-up was 6 months and maximum time was 12 months postoperatively. Of these, 44 (60%) patients were male and 30 (40%) patients were female. The mean age was 30.8 years. In the examination, which was done before taking ear samples, 50 (67.5%) ears were dry (no discharge or otorrhea) and 24 (32.5%) were wet (with otorrhea). Twenty-six (35%) samples were positive for bacteria and 11 (14.5%) were positive for fungi. Furthermore, 3 (4%) of the studied ears were positive simultaneously for both bacterial and fungal cultures. Among cultured bacteria, *Staphylococcus epidermidis* was cultured in 22 (29%) patients and was the most common species, followed by *Staphylococcus aureus* in 4 (5%) patients.

Among cultured fungi, *Candida* species were cultured in 6 (8%) patients and was the most common fungal species, followed by *Aspergillus* species in 5 (6%) patients.

Bacterial antibiogram was prepared in samples positive for bacteria. Overall, 19 (25.5%) of positive samples of bacteria were sensitive to vancomycin. Vancomycin was the most sensitive antibiotic. Other sensitive antibiotics were clindamycin, ceftazidime, and imipenem.

S. epidermidis was sensitive to vancomycin as the most sensitive antibiotic (35%) and after that is clindamycin (24%). Furthermore, *S. aureus* was sensitive to vancomycin as the most sensitive antibiotic [Table 1]. Of antibiotics which were reported resistant, ciprofloxacin (5%) and oxacillin (3%) were the most common [Table 2].

Among sensitive antibiotics, vancomycin, clindamycin, and ceftazidime were those with the highest number of sensitive organisms.

S. epidermidis was cultured in 22 (29%) patients. In 50% of them, the patient ear was reported dry (no discharge), and in 50%, the patient ear was reported wet (with discharge).

Table 1: Bacterial sensitivity to antibiotics based on antibiogram

Antibiotic	Bacteria (%)	
	<i>Staphylococcus aureus</i>	<i>Staphylococcus epidermidis</i>
Vancomycin	Sensitive (32)	Sensitive (35)
Clindamycin	Sensitive (22)	Sensitive (24)
Ceftazidime	Sensitive (8)	Sensitive (11)
Imipenem	Sensitive (6)	Sensitive (8)

Table 2: Bacterial resistance to antibiotics based on antibiogram

Antibiotic	Bacteria (%)	
	<i>Staphylococcus aureus</i>	<i>Staphylococcus epidermidis</i>
Ciprofloxacin	No resistance	Resistant (5)
Oxacillin	No resistance	Resistant (5)

In three patients, two different organisms were cultured. In two of them, *S. epidermidis* and *Candida* were cocultured, and in another one, *S. epidermidis* and *Aspergillus* were cocultured.

DISCUSSION

Several factors contribute in the pathogenesis of COM. Acute otitis media or otitis media with effusion are usually the beginning events.^[5]

There are two main procedures for surgical management of COM: CWD and canal wall up (CWU) mastoidectomy. Each of them has its own advantage or disadvantage. Khalil *et al.* believed that CWD was better than CWU mastoidectomy, because of extensive middle ear visualization. Preoperative concerns that would favor a canal wall down procedure include a patient with an only-hearing ear, a patient whose anesthesia is high risk, or a patient in whom follow-up is problematic.^[5]

Antibiotic selection is mainly guided by bacteriologic studies on patients with COM. One should insert a sterile applicator into the external ear canal and get enough sample from the ear discharge. It should be transported in a sterile tube to the microbiology laboratory.

Occlusion of aditus ad antrum, the communicating part between the mastoid and middle ear, causes the pathologic tissues to be accumulated in the mastoid cavity, and in severe cases, cholesteatoma may develop. In these patients, the same infective agents have been found in both mastoid and middle ear.^[1,6]

The current study demonstrated that more than a half of middle ear and mastoid cavities were culture positive after CWD mastoidectomy. The most common cause of bacterial and fungal growth was *S. epidermidis* and *Candida* species, respectively. These bacteria were mostly sensitive to vancomycin and clindamycin.

In our study, the most common pathogen discovered was *S. epidermidis*, followed by *S. aureus*. The rate of positive culture for bacteria was 35%. It means that 65% of ear cavities were culture negative after COM surgery. The absence of bacterial growth in these patients may be due to previous treatment with antibiotics. Bacteriostatic agents can lead to a reduced proliferation of pathogenic bacteria.^[7,8] According to a research in Korea, the most prevalent pathologic agent was *Pseudomonas aeruginosa*.^[1] Madana *et al.* found that the most common isolated pathogens from the middle ear secretion were *Pseudomonas* (32%), *Proteus mirabilis* (20%), *S. aureus* (19%), *Candida albicans* (4%), and methicillin-resistant *S. aureus* (2%).^[4]

The results of the study by Minami *et al.* in 2017 showed that of a total of 155 participants, 88 had COM. The most common bacterial growth which was found in the normal middle ears was *Proteobacteria*, followed by *Actinobacteria*, *Firmicutes*, and *Bacteroidetes*.^[9] In Mofatteh *et al.*'s study in 2018, *Staphylococci* spp. (64.9%), *Klebsiella* spp. (12.9%), and *P. aeruginosa* (10.3%) were the most common isolated pathogens.^[10] According to Neff *et al.*, *S. aureus* and some other Gram-positive and Gram-negative pathogens were found in both cases with or without any type of COM. Even in many healthy people, the same organisms were cultured.^[11] In the study of Prakash *et al.* in 2013, it was reported that the most prevalent pathologic agents were *S. aureus* (48.69%) and *P. aeruginosa* (19.89%). The prevalence rate of anaerobes and fungi was 29.41% and 12.25%, respectively.^[12] Lack of bacteria (NO growth) was evident in 65% of patients. Bacterial culture often is not much sensitive in patients with a history of antibiotic treatment. Therefore, the results of culture depend on its method and false negative reports may occur.^[1,13]

CONCLUSIONS

Knowing the normal flora of the ear cavity and the most common bacterial and fungal cause of ear discharge after CWD mastoidectomy, is helpful in choosing appropriate antibiotics both for prophylaxis and management of postoperative infections. According to the present study, *S. epidermidis* and *Candida* species should be considered as the most probable etiology of middle ear and mastoid infections after CWD

tympanomastoidectomy. The most effective antibiotics are vancomycin and clindamycin.

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Conflicts of interest

There are no conflicts of interest.

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