

# Bacterial Otitis Externa in Patients Attending an ENT Clinic in Babol, North of Iran

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## Abstract

**Background:** Acute otitis externa, an inflammatory condition of the external auditory canal, is a common clinical problem in general medicine.

**Objectives:** This study aimed to determine the etiology of otitis externa in patients from the Mazandaran province, north of Iran, which has a humid climate, as humidity can affect the prevalence of pathogenic microorganisms.

**Patients and Methods:** This cross-sectional study involved 116 patients with otitis externa. Two sets of samples were collected from their ears; one set was used for slide preparations, and the other for microbial culturing. After culturing, the microorganisms were identified by conventional methods.

**Results:** Patients between 35 and 44 years of age were most frequently affected (25.00%) by otitis externa (average age, 43.87 ± 18.08 years). Moreover, women (54.31%) were more frequently affected than men (45.69%). Upon direct investigation, Gram-positive *bacilli* were the most commonly identified microorganisms (22.41%). Furthermore, *Bacillus* spp. and coagulase-negative staphylococci (22.41% and 19.83%, respectively), were the organisms most frequently identified from cultures of otitis externa samples.

**Conclusions:** Direct examination and culture showed that a mixed infection of fungi and bacteria is the most common cause of otitis externa. The present study revealed that *Bacilli* spp. were the most abundant bacteria isolated from patients with otitis externa. Thus, it is recommended that both organisms should be considered as etiologic agents in protocols for treatment of otitis externa.

**Keywords:** Bacterial Infections, Etiology, Otitis Externa

## 1. Background

The ear canal can be affected by known and unknown agents that influence the normal function of the ear (1, 2). Otitis externa is an inflammation or infection of the outer ear canal and it is a common ear condition across individuals of all ages (3). The signs and symptoms allow easy diagnosis of the condition (2, 4, 5). Inflammation of the external ear canal is usually localized, and topical treatment is sufficient. Management of immunocompromised patients with otitis externa is, however, very important, as there is the possibility of the infection spreading to other organs (6). Around 90% of cases of otitis externa are unilateral, the frequency rate of patients age was belonged to 12 years old. The disease usually results from high humidity, warm swimming pools, local trauma, and the use of hearing aids (4, 7, 8). The most important environmental factor is excessive moisture, which increases the pH and decreases cerumen (6, 9). This disease is therefore a common problem in swimmers and people who

are regularly exposed to water (10).

Bacterial ear infections are seen mostly in tropical regions and in the summer (11). Discharge, hearing loss, swelling of the skin, ear discomfort, and itchiness are the most common symptoms of otitis externa (12); the most common cause is bacterial infection (6, 8, 13). Bacterial otitis is often caused by *Pseudomonas aeruginosa* and other Gram-negative bacteria, such as *Escherichia coli*, *Proteus mirabilis*, and *Staphylococcus aureus*. Moreover *S. aureus* and *Streptococcus viridans* are also present in the external auditory canal as normal flora (3, 7). In the presence of decreased cerumen, waste materials absorb water and provide a suitable medium for bacterial growth (6), and various bacteria can be seen in the ear canal under these circumstances (14, 15).

## 2. Objectives

This study was performed to determine the cause of bac-

terial otitis externa in clinics in Babol, (Northern Iran), to obtain more information about this condition.

### 3. Patients and Methods

#### 3.1. Background

This cross-sectional study was conducted from August 2012 until February 2013 on 116 patients with external otitis who were referred to health centers in Babol, Northern Iran. Individuals with ruptured tympanic membrane, middle ear lesions without otitis externa, previous surgery, or any risk factor (according to consultation), or patients with negative results upon direct examination, were excluded.

#### 3.2. Sampling

After conducting a physical examination on the patient's, the ear, nose, and throat (ENT) specialist obtained from ear specimens, (two sets of samples) using a special ear speculum suction curette or a sterile loop. Then, ENT specialist obtained pairs of ear specimens using a special ear speculum, suction curette, or a sterile loop. A set of specimens was prepared on slides for direct visual examination, and another set was inoculated into chocolate agar medium (HiMedia, Mumbai, India), which is an enriched medium for culturing of almost all bacteria that may be a cause of externa otitis, as well as into blood agar medium (Merck, Darmstadt, Germany) for transportation of samples to the Microbiology Laboratory of Babol university of medical sciences. The inoculated media were incubated at 37°C for 18 - 24 hours (chocolate agar media were incubated in a 5% CO<sub>2</sub> atmosphere).

For direct examination, the samples were stained following the Gram-staining procedure, and were microscopically studied. Samples that were negative for bacteria in this direct examination were excluded from further analysis. Bacterial colonies were identified via Gram-staining results, from the shape of the bacteria, and the appropriate diagnostic test results. After isolation of bacteria from culture, bacteria were cultured in other media, such as TSI (Merck, Darmstadt, Germany), Urea agar (Merck, Darmstadt, Germany), Simmon's citrate agar (Merck, Darmstadt, Germany), SIM (Merck, Darmstadt, Germany), and lysine decarboxylase (HiMedia, Mumbai, India), according to the primary culture results.

#### 3.3. Data Analysis Methods

All the data were entered into the Statistical Package for Social Sciences (SPSS) software version 18 and this information was used to determine the mean and SD.

#### 3.4. Ethical Considerations

Babol university of medical sciences provided ethical approval for this study (8929512, 19 Dec 2009). All data obtained were kept confidential.

### 4. Results

One hundred and sixteen individuals were positive for the presence of bacteria upon direct examination of the specimens. The average age of the patient group as a whole was 43.87 ± 18.08 years, and that for women and men were 30.02 ± 15.00 years and 49.64 ± 17.71 years, respectively. Individuals aged between 35 and 44 years were the most affected (25.00%), while those aged between 55 and 64 years were least affected (Table 1).

Women were more commonly affected with bacterial otitis externa (54.31%) than men (45.69%). Of the affected individuals, 90 people (77.59%) lived in urban areas and the rest in rural areas. The most common occupation was housekeeping (37.07%), followed by self-employment (19.83%), and out patients (18.1%); driving was the lowest-paid occupation in this study (2.59%). Hearing loss (90.51%), swelling (89.66%), and itching (88.79%) were the symptoms most commonly present in patients. Almost all of the patients had two or more symptoms related to the ear canal, and swelling and logorrhea were commonly present upon ear examination (Table 2).

**Table 1.** Age distribution of patients with bacterial otitis externa attending the Ayatollah Rouhani Hospital in Babol, Iran

| Age Group, y | Values <sup>a</sup> |
|--------------|---------------------|
| 15 - 24      | 15 (12.93)          |
| 25 - 34      | 20 (17.24)          |
| 35 - 44      | 29 (25.00)          |
| 45 - 54      | 24 (20.69)          |
| 55 - 64      | 13 (11.21)          |
| > 64         | 15 (12.93)          |
| <b>Total</b> | <b>116 (100)</b>    |

<sup>a</sup> Data are presented as No. (%).

**Table 2.** Demographical Data of Patients With Bacterial Otitis Externa, Babol, Iran

| Variables         | Values <sup>a</sup> |
|-------------------|---------------------|
| <b>Employment</b> |                     |
| Housekeeper       | 43 (37.07)          |
| Self-employed     | 23 (19.83)          |
| Employee          | 21 (18.1)           |
| Student           | 9 (7.76)            |
| Farmer            | 6 (5.17)            |
| Retired           | 4 (3.45)            |
| Driver            | 3 (2.59)            |
| Unknown           | 7 (6.03)            |
| <b>Symptoms</b>   |                     |
| Hearing loss      | 105 (90.51)         |
| Swelling          | 104 (89.66)         |
| Itching           | 103 (88.79)         |
| Otorrhea          | 102 (87.93)         |
| Pain              | 93 (80.17)          |
| <b>Signs</b>      |                     |
| Swelling          | 109 (93.96)         |
| Otorrhea          | 100 (86.21)         |

<sup>a</sup> Data are presented as No. (%).

Gram-positive cocci, at a frequency of 33.93%, were the bacteria most frequently detected in the direct examination, followed by Gram-positive bacilli, at 33.62%; among the specimens, 6.89% showed mixed infection, with coinfection with Gram-positive cocci and Gram-positive bacilli seen in 3.45% of the otitis externa samples (Table 3).

After culturing the samples, *Bacilli* spp. and coagulase-negative staphylococci, at 22.41% and 19.83%, respectively, were identified as the most prevalent organisms in otitis externa. *Proteus* spp., at 0.86%, were the bacteria least frequently present. No colonies grew in 12.94% of samples (Table 4).

**Table 3.** Microorganisms Present in Otitis Externa Specimens From Northern Iran

| Organism (s)                     | Values <sup>a</sup> |
|----------------------------------|---------------------|
| <b>Cocci g+<sup>b</sup></b>      | 44 (37.93)          |
| <b>Cocci g-</b>                  | 8 (6.9)             |
| <b>Bacilli g+</b>                | 39 (33.62)          |
| <b>Bacilli g-</b>                | 17 (14.66)          |
| <b>Cocci g+ and bacilli g+</b>   | 4 (3.45)            |
| <b>Cocci g+ and bacilli g-</b>   | 1 (0.86)            |
| <b>Cocci g- and bacilli g+</b>   | 2 (1.72)            |
| <b>Bacilli g+ and bacilli g-</b> | 1 (0.86)            |
| <b>Total</b>                     | 116 (100)           |

<sup>a</sup> Data are presented as No. (%).

<sup>b</sup> G, Gram-staining.

**Table 4.** Bacteria Isolated From Ear Canal Cultures of Otitis Externa Samples

| Type of Bacteria/Bacteria Name           | Values <sup>a</sup> |
|--|---------------------|
| <b>Cocci g+<sup>b</sup></b>              |                     |
| <i>Streptococcus</i> spp.                | 7 (6.03)            |
| <i>Staphylococcus aureus</i>             | 7 (6.03)            |
| <i>Staphylococcus coagulase negative</i> | 23 (19.83)          |
| <b>Bacilli g+</b>                        |                     |
| <i>Bacillus</i> spp.                     | 26 (22.41)          |
| <i>Diphtheroid</i> spp.                  | 20 (17.24)          |
| <b>Bacilli g-</b>                        |                     |
| <i>Pseudomonas</i> spp.                  | 14 (12.07)          |
| <i>Proteus</i> spp.                      | 1 (0.86)            |
| <b>Undefined</b>                         | 3 (2.59)            |
| --                                       |                     |
| <b>Not grown</b>                         | 15 (12.94)          |
| --                                       |                     |
| <b>Total</b>                             | 116 (100)           |
| --                                       |                     |

<sup>a</sup> Data are presented as No. (%).

<sup>b</sup> G, Gram-staining.

## 5. Discussion

One hundred and sixteen patients with otitis externa were enrolled after examination. Among these patients, 54.31% were females and the rest were males. The present study showed that the most abundant organisms isolated from patients with otitis externa were *Bacilli* spp., coagulase-negative staphylococci, *Diphtheroid* spp., and *Pseudomonas* spp. Battikhi et al., in Oman, studied 180 patients who were referred to the hospital due to acute otitis externa; of these, 100 patients were men (55.5%) (16). Cheong et al. studied 91 patients with logorrhea (July 2010 to February 2011) in Singapore, and found a frequency of 52.7% of male patients (17). Burgos et al. (11) reported that 56% of people suffering externa otitis were males, with an average age of 30.5 years. Hajjartabar reported that 32.21% of patients with otitis externa were women (18). Although women tend to be more health-conscious, most of the women in our study were housekeepers, which may have contributed to the condition as relative humidity can affect ear conditions, as reported previously in other studies on otitis in general (9, 11, 19).

In our study, middle-aged individuals (35- to 44-years-old) were more often infected than the other groups. Rowlands et al. in a study in UK reviewed the entire relevant medical records of patients who were referred to clinics because of otitis externa, and extracted information on age, sex, episodes of otitis externa, prescribed treatments, and eczema from this database. They concluded that otitis externa is common in all age groups (20). These results were not in agreement with our findings; this may be due to the differences in lifestyle, temperature, and access to health-care centers among the different populations (19). The reasons for these results may be more compact cerumen, patients job, environmental factors, and climate. It should also be noted, however, that our study was performed on patients aged older than 18 years.

Hearing loss, swelling, itching, logorrhea, and pain were the most common clinical findings in our study. Al-Asaaf et al. have reported that pain and erythema are the most common clinical findings in patients with otitis externa; edema had a low incidence (21). In another study, hearing loss, otalgia, and logorrhea were the most frequent clinical findings in otitis externa (2). Similarly, Schaefer et al. have reported that inflammation, otalgia, and itching were the most frequent symptoms in patients (22). Hui et al. report in their review that otalgia and itching with or without hearing loss or pain are often present in otitis externa, while erythema with or without logorrhea are seen in ear canals with otitis externa (3). The results of our study and the above-mentioned studies are not entirely consistent. However, pain was the symptom common to all studies (3, 23), while symptoms such as itching, otalgia, logorrhea, and hearing loss may be present in other externa ear diseases (10). It is possible that various types of pathogens causing the disease, variation in the anatomy of the ear, and in the immune systems of patients

can lead to differences in the signs and symptoms noted between studies (23).

Culture results of specimens in media showed that the most common bacterium involved was *Bacillus* spp., followed by coagulase-negative *Staphylococcus* and *Diphtheroid* spp., which agreed with the direct examination results. Many bacteria can cause otitis externa (24). Enoz et al. studied 362 ear swabs from patients with a clinical diagnosis of otitis externa; of these, 219 cultures were positive and 267 types of organisms were grown. Among these isolates, 86.16% were aerobic bacteria or mixed bacteria, 12.1% were anaerobes, and 17.5% were poly-microbial (25). In another study, *P. aeruginosa* was the most commonly identified microorganism, followed by *Aspergillus niger* (11). Roland et al. studied 2838 bacterial colonies isolated from ear specimens of otitis externa; *P. aeruginosa*, *S. epidermidis* and *S. aureus* were the most commonly isolated (26). Al-Asaaf et al., in Oman, reported that *P. aeruginosa* and *S. aureus* were isolated in 39% and 18% of patients with otitis externa, respectively (21). Amigot et al. in Argentina, performed mycology and bacteriology examinations on 294 samples isolated from the external auditory canal. Bacteriology results in 52 patients (23.6%) were negative, while *P. aeruginosa*, *P. mirabilis*, and *Staphylococcus aureus* were commonly identified. *P. aeruginosa*, which was the most commonly found bacterial species, had no association with any fungus (27).

Nogueira et al. isolated 22 organisms from 27 externa otitis samples by culture. *S. aureus* was the most commonly isolated bacterium, and 22.73% of samples were poly-microbial. Fungal organisms were isolated in 18.18% of samples, and mostly involved *Candida* spp. (28). Ninkovic et al. in the UK (2007) reported that *P. aeruginosa* (45.1%), and *S. aureus* (9%), and anaerobic bacteria (6.3%) were the most common bacteria isolated from otitis externa specimens (15). Hajjartabar studied 176 patients with a history of ear problems, and who swam in pools. Cultures from 142 of these persons positive for aerobic bacteria revealed *P. aeruginosa* in 79.3% of patients (18). Cheong et al. studied 91 patients with logorrhea in Singapore during July 2010 to February 2011; the most frequently cultured bacteria were *P. aeruginosa* (31.6%), methicillin-sensitive *S. aureus* (16.8%), and methicillin-resistant *S. aureus* (4.2%) (17). In another study, the most common bacteria isolated from patients with otitis externa were *P. aeruginosa* (38%), *S. epidermidis* (9.1%), and *S. aureus* (7.8%) (26). Thus, in most studies, *P. aeruginosa* and *S. aureus* were reported as the bacteria most commonly isolated from the ear canal in otitis externa, which was not consistent with our results. These differences could be due to the different prevalence of microorganisms in different regions.

In our study 12.94% of cultures were negative for all bacterial growth, which was similar to findings by Kuczowski et al. who reported that 19.3% of otitis discharge cultures were negative for bacterial growth (4). Our research has shown that the most commonly isolated bacterium was *Bacillus* spp., but these are normal flora,

which cannot be considered as a pathogenic agent in otitis externa. Direct examinations and culture showed a mixed presence of bacteria and fungi; therefore it is recommended that both organisms should be considered in the protocol for treatment of otitis externa.

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## Footnotes

**Authors' Contribution:** Keyvan Kiakojuri arranged sample collections and was involved in the primary design of the study, Ramazan Rajabnia and Saeid Mahdavi Omran designed the study, wrote, and edited the manuscript, Bahareh Jalili, Meghdad Bagheri, and Elaheh Ferdousi Shahandashti carried out the examinations, and Mahmood Hajjahmadi analyzed the results.

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