Original Article

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The Evaluation of the Causes of Otitis Externa in Children referring to the ENT Clinic of Ayatollah Rohani Hospital of Babol, 2013-14

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ABSTRACT

BACKGROUND AND OBJECTIVE: Otitis externa in children is defined as the inflammation of the external ear canal and it is a common clinical issue in general medicine. This study aimed to determine the main causes of otitis externa in children in Babol, Iran.

METHODS: This cross-sectional study was conducted on 56 children diagnosed with otitis externa referring to the Ear, Nose and Throat (ENT) Clinic of Rohani Hospital of Babol, Iran. Demographic data of the subjects including age, gender and duration of symptoms were recorded, and earwax was removed using a speculum. Afterwards, the obtained samples were evaluated microscopically, and were partly inoculated on media such as chocolate agar, blood agar and Sabouraud dextrose agar with Chloramphenicol. Eventually, the effective organisms were detected using different laboratory methods.

FINDINGS: In this study, the most frequent symptoms of ear infection among children were inflation (76.8%) and secretion (75%), while the most common clinical manifestations were inflation of channel (82.1%) and secretion (69.6%), respectively. Moreover, direct observation of the studied patients indicated bacteria as the most frequent organisms (42.9%). The most commonly isolated bacteria included Bacillus, coagulase-negative Staphylococci and Streptococci, while the most frequent fungi were Aspergillus niger, Aspergillus flavus and Candida albicans.

CONCLUSION: According to the results of this study, otitis externa in children could be caused by fungi, bacteria or the combination of both these organisms.

KEY WORDS: External Ear Infection, Children, Bacteria, Fungi.

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Introduction

The external ear canal is responsible for the transfer of sound to the middle ear as well as the protection of the middle and internal ear against damage. This canal is skin-covered, dark and prone to dampness, which lays the ground for the growth of bacteria and fungi. Nevertheless, the ear canal has a special defensive barrier called Cerumen, also known as earwax, which is rich in lipids and is able to impede bacteria and fungi growth through hydrophobic properties. Insufficient cerumen might cause infection, while high amounts of it could lead to the obstruction and retention of water and wastes (1-3).

External ear infection is a prevalent disease, which could be caused by a variety of factors such as bacteria, fungi (otomycosis) and different viruses, or the aggregation of all these organisms in the ear canal. The highest incidence of this infection is within the age range of 7-12 years and it is frequently observed at younger ages (less than 9 years). High humidity, warm environments such as swimming pools, local trauma and use of hearing aid tools are also known to cause external ear infection (4).

The most effective environmental factor in the incidence of external ear infection is excessive humidity, which leads to the increase of the pH and loss of cerumen. With the loss of cerumen, the waste keratin material begins to absorb the water intermediating bacterial growth (2). The two major manifestations of external ear infection include ear discomfort (Otalgia) and ear discharge (Otorrhea) (4).

Initially, ear discomfort involves a feeling of itchiness, which might turn into severe pain and become worse during the movements of the ear in activities such as chewing. If the inflammation causes the ear canal to swell in a way that the patient complains of hearing loss or a sense of fullness in the ears, fungi is probably the cause of the infection. Otorrhea has a variety of features to help identify the origin of the disease (2,3,5,6); for instance, Pseudomonas aeruginosa is a frequent organism known to cause otorrhea. Moreover, Staphylococcus aureus or gram-negative bacteria such as Escherichia coli, Proteus mirabilis and fungi could occasionally lead to otorrhea (7-9).

Acute otitis externa is unilateral in approximately 90% of the cases (4). Although bacteria are considered as the most common cause of ear infections, overgrowth of fungi accounts for10% of these infections. Furthermore, other non-dermal processes are likely to trigger external ear infection (10-12). Due to the frequent admissions of children with ear infection to Ayatollah Rohani Hospital of Babol, this study aimed to investigate the main causes of this infection among these patients.

Methods

In this study, 56 patients with otitis externa younger than 19 years of age who were referrred to the Ear, Nose and Throat (ENT) Clinic of Ayatollah Rohani Hospital of Babol were evaluated by easy sampling. Children presented with external ear infection were enrolled in this study, and the exclusion criteria were ruptured eardrum, middle ear lesion with no signs of external ear infection, and a history of surgery (with the exception of successful tympanoplasty surgery or myringoplasty surgery).

Following the microscopic physical examination of the subjects, their medical history was evaluated and questionnaires were completed by an ENT specialist. Earwax removal was performed in sterile conditions using devices such as ear speculum, suction devices, and a loop instrument called curette.

No cerumen softening materials were used due to the possibility of test impairment. After the removal of samples, they were immediately spread on sterile slides and were cultured on chocolate agar (Hi Media, India), blood agar (Merck, Germany) and dextrose agar (Biolife, Italy) with Chloramphenicol (Merck KGaA, Germany). Afterwards, the culture media were transferred to the specialized laboratory of microbiology and mycology of Babol University of Medical Sciences. Chocolate agar medium plates were stored at 37° C with 5% CO2, and blood agar plates were preserved at 37° C between 24-18 hours. Both plates containing dextrose agar medium with Chloramphenicol were stored at room temperature for up to 2 weeks.

The samples on the slides were stained with Gram and investigated afterwards. Regarding the fact that the confirmation of bacterial otitis externa diagnosis is correlated with the culture of organisms, we used the shape and type of Gram reaction, as well as diagnostic tests, in order to determine their identity. However, since the detection of fungal otitis is directly associated with positive test results, the mycelium and yeast pus samples on the glass slides were also examined. On the other hand, the microscopic and macroscopic morphologies, as well as the Germ tube test and slide

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cultures, were used to determine the genus or species of fungi. After recording the collected data, tables were drawn, and SPSS V.18 was used to describe the obtained data in frequency tables and relevant charts.

Result

In the present study, the mean age of the children less than 19 years was 5.7± 2.4 years; among these subjects, 32 patients (57.1%) were under 6 years, 20 (35.7%) were between 6-12, and 4 patients (7.1%) were between 12-18 years old. The patients consisted of 34 male subjects (60.7%) and 22 (39.3%) female subjects. In addition, 10 patients (17.9%) lived in rural areas while 46 cases (82.14%) were residents of cities. Almost half the studied patients (N=28) were not students whereas the other half were. The length of the disease among the studied children with otitis externa was different; however, most of them (50%) had the disease for a period of less than 3 months (table 1).

Table 1. Disease period of Children with Otitis externa referring to ENT Clinics of Babol

Age(month)	N(%)
Less than 3	28(50)
3-8	11(19.6)
9-12	10(17.9)
More than 12	7(12.5)
Total	56(100)

The most common complaint for the referral of these children was inflation in 43 cases (76.79%), and secretion in 42 cases (75%) (fig 1). After the required clinical examinations, we detected 46 cases of canal inflation (82.14%), 39 cases of secretion (69.64%) and 3 cases of adenopathy (5.36%).

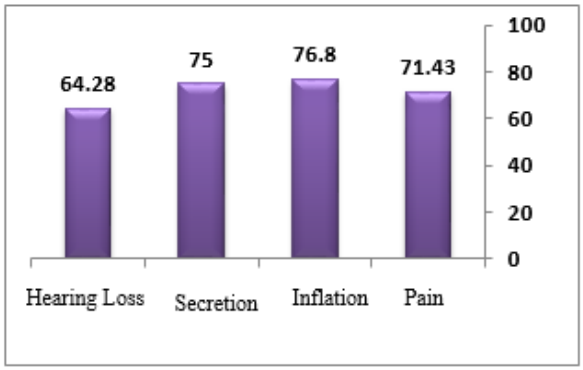

Figure 1. Symptoms of Studied Children with Otitis externa

The results of the current study indicated bacteria to have the highest prevalence (42.9%), while the combination of bacteria and fungi (35.7%) and fungi (16.1%) were the next two common causes of external ear infection.

Moreover, complete absence of bacterial or fungal agents was observed in 5.4% of the studied subjects. Among the contributing bacteria, gram-positive bacillus was observed in 20 cases (35.7%), and combined gram-positive cocci and bacilli were found to be the least effective organisms.

Among the fungal agents, 89.7% of the samples were true mycelium while others (11.4%) were pseudo mycelium and yeast. After culturing the samples for bacteria and fungi growth, the most frequent elements were observed to be simultaneous development of bacteria and fungi (44.6%) and bacterial growth alone (37.5%), while the lowest frequency in the medium belonged to fungal growth alone (14.3%).

After the culturing of ear samples in specialized bacteriology media, bacillus species were found to be the most frequent bacteria (N=13, 23.2%), while Bacillus and Staphylococcus aureus simultaneously accounted for the lowest frequency (table 2).

Table 2. Results of Bacteria culturing in Samples of Children with Otitis externa

Species	N(%)
Streptococcus	6(10.71)
Staphylococcus aureus	1(1.79)
Coagulase-negative Staphylococcus	7(12.5)
Bacillus samples	13(23.21)
Diphtheroids	4(7.14)
Pseudomonas species	6(10.71)
Proteus	2(3.58)
Bacillus	2(3.58)
Streptococcus	4(7.14)
Staphylococcus coagulase-negative bacillus	1(1.79)
Staphylococcus aureus	10(17.85)

On the other hand, the evaluation of the grown fungal colonies on the medium indicated Aspergillus niger to be the most common fungus, while Aspergillus fumigatus was observed to be the least frequent isolated organism (table 3).

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Table 3. Results of Fungi growth samples of Children with Otitis externa

Fungi	N(%)
Aspergillus niger	20(35.71)
Aspergillus fumigatus	30(5.35)
Aspergillus flavus	6(10.71)
Candida albicans	4(7.14)
Negative	23(41.7)

Discussion

According to the results of this study, ear infections were observed to be more prevalent among male subjects compared to female ones. The patients most commonly complained of ear swelling and otorrhea, and the most prevalent clinical manifestation of the infection was ear canal inflation. In addition, combined growth of bacteria and fungi was observed to be play a key role in the development of this infection, and bacillus species and Aspergillus niger were among the most frequent organisms.

Several studies are indicative of the different incidence rate of external ear infection among male and female patients. In one study, Cheong et al. evaluated 91 patients consisting of 52.7% male subjects and 47.3% female subjects ageing between 6 months to 19 years old (13). In a study by Rijal, the ratio of male to female was 1 to 1.5 (14). In another study, Adhikari evaluated 2,000 children ageing between 5-13 years, 64.2% of whom were male and 35.8% were female (15). In the current study, the patients consisted of 60.71% male subjects and 39.29% female subjects with the mean age of 5.7 ± 4.2 years.

Although there were no significant differences between the results of our study and other studies in this regard, and otitis externa has been observed to be more prevalent among male patients compared to female ones, the difference in the abundance of the two genders could be due to the cultural diversities and public health conditions in different regions of the world. In the current study, more than 82% of the subjects were living in cities.

With regard to the causes and symptoms of referrals, Battikhi et al. reported pain (97.2%) to be the most common symptom among patients with otitis externa, while itching and hearing problems were the least frequent symptoms (16). Similarly, pain was observed to be the most prevalent symptom among children with otitis externa in a study by Price (4). In a retrospective study by Pontes et al. on 103 patients, the most common symptoms were reported to be itching, pain and otorrhea, respectively after the diagnosis of otomycosis (17).

In one survey, 69.9% and in another, 62.1% of hearing loss was reported to be due to the presence of pus in the ears of children (18, 19) while in the current study, inflation was found to be the most common symptom and hearing problems were the least prevalent. Furthermore, the most frequent clinical manifestations of infection in the present study were swelling and ear canal inflation. Despite the fact that the patients did not commonly complain of pain, and given that samples were obtained from children younger than 2 years of age, it is possible that the subjects were not able to express the pain. It is also noteworthy that examination of ear lesions could result in the diagnosis of the major causes of hearing loss. In one study, Enoz et al. evaluated 362 patients with the clinical diagnosis of otitis externa and according to their findings, 68.2% of aerobic bacteria or the combined form, 1.12% of anaerobic bacteria, 30.71% of fungi and 17.5% of poly microbial infections (2 cases) showed negative growth.

In the current study, bacterial and fungal growth were observed in 37.5% and 14.3% of the samples, respectively, and only 3.57% of the samples showed no organism growth of any kind. This difference between these two studies could be due to the type of organisms, as well as the different health conditions, in the regions of the studies. In their study, Battikhi et al. reported the isolation of Candida albicans and Aspergillus from the outer ear of the patients presented with infection (16), while in a retrospective study on 103 patients ageing between 2-66 years, Pontes et al. reported 55% of the fungi to account for Candida and 35% for Aspergillus.

In another study, Dorko et al. prepared swabs from the external ear canal of 40 patients with the clinical diagnosis of otomycosis. According to their results, the majority of the isolated candidates included Candida albicans, C. parapsilosis and C. tropicalis (20). In a study by Martin et al. on the same subject, most of the isolated fungi were Candida albicans, C. parapsilosis and Aspergillus niger (21). In the present study, Aspergillus niger was reported to be the most common fungus, and other frequent fungi were Aspergillus flavus, Candida albicans and Aspergillus fumigatus, respectively. Although our results are compatible with those of the aforementioned studies

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regarding the frequency of Aspergillus niger, such similarity is not observed in the case of Candida species. This difference could be due to the diversity of these organisms in the two areas of the ear, as high rates of Candida species were expected due to the excessive humidity of the upper area. According to the findings of Cheong et al., the most frequent isolated bacteria included Pseudomonas aeruginosa, Staphylococcus aureus, methicillin-susceptible S. aureus and methicillin-resistant S. aureus, respectively. Furthermore, concurrent growth of different types of fungi was observed in 75 cases (13). On the other hand, the findings of Dorko et al. were indicative of more than 77% of simultaneous fungal and bacterial growth (20). The findings of Battikhi reported Pseudomonas aeruginosa as the most frequently isolated organism, and Staphylococcus aureus and Proteus mirabilis were the next most frequent types; however, no bacterial growth was observed in 2.7% of the obtained samples (16). In the present study, the most frequent bacteria were Bacillus, coagulase-negative Staphylococci, Streptococcus species and Pseudomonas species, respectively.

The aforementioned differences between the results of the current study and other studies in this regard could be due to the diversities in the regional prevalence of these organisms, as well as the lack of access to anaerobic culture media.

In conclusion, swelling and inflation were observed to be the most common symptoms in children presented with otitis externa. Since direct examinations were indicative of bacterial infection, and cultures showed both bacteria and fungi to be the major infectious agents, the elimination of both these elements needs to be considered in the treatment protocol of external ear infection.

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