

# Otitis externa infection in Jordan

## Clinical and microbiological features

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### ABSTRACT

**Objective:** Aims of this study were to investigate the clinical findings and to identify causative microorganisms and their susceptibility to antibiotics in otitis externa infection.

**Methods:** The symptoms and signs, as well as the bacterial and fungal flora from the auditory canal of one hundred and eighty patients (100 males and 80 females), age range from 6 month to 19-years old suffering from acute otitis externa were studied from January 2001 to December 2002. One way ANOVA and Least Significant Difference (LSD) were carried out for statistical analysis.

**Results:** Pain was the most common symptom (97.2%) while, itching and difficulty in hearing were the least common (11.7 %). *Pseudomonas aeruginosa* (*P.aeruginosa*) was isolated from (41.7%) which showed the best susceptibility to ciprofloxacin (93.4%),

*aspergillus species* from (19.4%), *candida albicans* from (10.6%), *staphylococcus aureus* from (16.1%) which showed the best susceptibility to amikacin and ciprofloxacin (96.5%), *proteus mirabilis* from (2.8%) which showed the best susceptibility (100%) to amikacin, ciprofloxacin, imipenem and ofloxacin, anaerobic bacteria from (2.2%); and no bacteria growth was observed in (7.2%). There was a significant variation relating signs, symptoms and sex in favor of males ( $P=0.03$ ). Significant seasonal variation in otitis externa infection was observed ( $P < 0.05$ ).

**Conclusion:** *Pseudomonas aeruginosa* was the most frequently isolated pathogenic microorganism, which showed the best susceptibility to ciprofloxacin. Pain was the most common symptom.

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Acute otitis externa, inflammation of the external ear canal is a common otological disease encountered by general practitioners and otolaryngologists and relatively easy to diagnose based on the history and physical examination finding.<sup>1-3</sup> Otitis externa is a common clinical problem in general practice and yet there are remarkably few data available on the demographic characteristics of patients with this condition.<sup>2</sup> Otitis externa, frequently known as "swimmer's ear" in humans, is usually caused by *Pseudomonas aeruginosa*, (*P.aeruginosa*) although other

gram-negative rods (such as *escherichia coli*, *proteus mirabilis* (*P.mirabilis*), *staphylococcus aureus* (*S.aureus*), or fungus may sometimes be involved.<sup>1,4,5-9</sup> In many cases, however, no obvious predisposing factors can be found despite careful history and examination.<sup>1</sup> The normal commensal flora of the external auditory canal includes *Staphylococcus epidermidis* (*S.epidermidis*) and *Corynebacterium species spp* (Diphtheroides); *S.aureus* and *Streptococcus viridense* may be present without causing ill effect.<sup>10,11</sup> It is a controversial concept because other experts like

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Roland and Stroman<sup>9</sup> claimed a clear pathogenic role of these organisms in acute otitis externa. Otitis externa is also associated with other aquatic activities. The aquatic environment adds viable moisture to the ear canal. Bacteria may be introduced with the moisture, and in the warm environment of the canal, multiply, generate debris, invade the canal lining and cause the symptoms of acute otitis externa.<sup>12</sup> Development of antibiotic resistance in bacteria is a problem of great concern.<sup>9,13</sup> Methicillin-resistant *staphylococcus aureus* (MRSA) is causing growing concern in hospital. There has been a steady increase in the number of cases of nosocomial MRSA infections recently, and this will no doubt apply to otitis externa, one of the most common ENT infections.<sup>14,15</sup> The difficulty of treating patients with otitis externa infections is well documented.<sup>16,17</sup> Therefore, there is agreement on the recommendation to obtain cultures and perform susceptibility studies in cases of failure to therapy, recurrences and or immunocompromised host.<sup>18,19</sup>

Aims of this study were to identify the pathogens involved in the pathogenesis of otitis externa infection in Jordanian patients in different age group and gender, to test their susceptibility to antibiotics in order to justify the use of antibiotics, to find out the correlation between otitis externa infection and age, sex, signs and symptoms.

**Methods.** One hundred and eighty ear swabs of human patients (100 males and 80 females, age range from 6 months to 19 years) were collected from external canals of subjects with clinically diagnosed acute otitis externa (136 unilateral and 44 bilateral) during 2-years interval (2001-2002) from ear, nose and throat (ENT) clinics at hospitals and private clinics in Amman-Jordan. Patients were distributed according to age groups as follows: <1 year, n=29, 1-4 year, n=38, 5-9 year, n= 50, 10-14 year, n=37, 15-19 years, n=26. The diagnosis of acute otitis externa was made in the presence of complaints of discharge, itching or pain on manipulation of the auricle; and objective findings at otoscopy of erythema, edema, desquamation of the external auditory meatus with purulent discharge. Particular attention was given to eardrum, as an indispensable request for diagnosis of primary external infection. Perforated acute otitis media cases were recorded for diagnosis of primary and secondary external infection. This was achieved by using a designed questionnaire filled by the physician ensuring that patients who were tested underwent additional clinical examination to confirm infection. Correlation between the number of otitis externa infection and month during the study period was studied. Swabs obtained from the auditory canal were immediately placed in Stuart

transport medium before sending to laboratory. One ear swab was examined from each patient. The diagnostic methods used were the same for all ear swab samples.<sup>1,20</sup> All aerobic cultures were identified according to standard method by Cowan.<sup>21</sup> Anaerobic bacteria were identified on the basis of colony morphology, Gram staining, sensitivity to metronidazole, resistance to gentamycin, and a characteristic sensitivity pattern using oxoid anaerobic identification discs.<sup>22</sup> Fungal isolates were identified according to methods described by Lennette et al.<sup>23</sup> All media products were obtained from bioMerieux, France. Bacteria isolates were identified by using gram stain and other recommended biochemical tests.<sup>20,24</sup> Antimicrobial susceptibility test was performed using agar diffusion disc methods advocated by the National Committee for Clinical Laboratory Standards.<sup>25</sup> Bacterial isolates were evaluated for susceptibility to the following antibiotics: amikacin (30mcg), ampicillin (10ug), carbenicillin (100mcg), cefixime (10mcg), ceftazoxime (10mcg), cefoxitin (30ug), ceftazidime (30mcg), ceftriaxone (30mcg), cephaloridine (5ug), ciprofloxacin (5ug), amoxicillin and clavulanic acid (augmentin, 10ug), erythromycin (15mcg), gentamycin (10ug), imipenem (10ug), methicillin (10ug), norfloxacin (10mcg), ofloxacin (10mcg), piperacillin (100mcg), tetracycline (30mcg). *Corynebacterium* isolates and other commensal microorganisms with their culture/identification methods were outside the scope of this study.

**Statistical analysis.** One way ANOVA and Least Significant Difference (LSD) were carried out to examine the differences between the mean numbers of cases of otitis externa infection by different pathogens and patient's age groups. The percentages of signs and symptoms in the age groups were also analyzed. Tests for independent samples of sex were carried out to find out if there is a correlation between signs, symptoms, bacterial pathogens and sex. *P* value of less than 0.05 was considered to indicate statistical significant.<sup>26</sup>

**Results.** Positive ear cultures were observed in 167 patients. The most common otitis externa infectious organisms were *P.aeruginosa* 75 cases (41.7%), *aspergillus spp.* 35 cases (19.4%), *s.aureus* 29 cases (16.1%), *candida albicans* (*C.albicans*) 19 cases (10.6%), *P.mirabilis* 5 cases (2.8%), anaerobic bacteria 4 cases (2.2%). No bacterial growth was seen in 13 cases (7.2 %), which may be due to viral infection. Single culture, usually *p.aeruginosa* was recovered from 75 patients (45%), 2 isolates were recovered from 60 patients (36%) and 3 isolates were recovered from 32 (19%) patients. The age groups more affected were 5-9 year, 1-4-year, and 10-14-year. There was

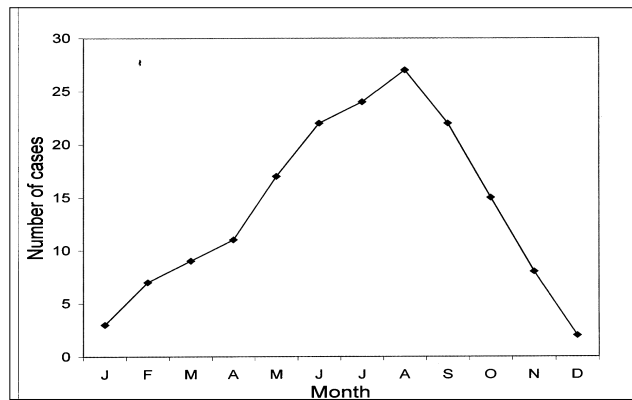
no significant variation in terms of number of cases of infection caused by different microorganisms and age groups ( $P=0.8$ ) and sex ( $P=0.45$ ), or between signs and symptoms caused by different pathogens and age groups ( $P=0.2$ ). Pain was the most common symptoms (175 patients, 97.2%) while, itching and difficulty in hearing were observed in 21 patients (11.7%), purulent discharge from the ear was seen in 78 patients (43.3%) and swelling and redness in 131 patients (72.8%). A significant variation ( $P=0.03$ ) between signs, symptoms and sex was observed. Seasonal variation of acute otitis externa infection during June-August period was observed ( $P<0.05$ ). Perforated acute otitis media was observed in 70 (38.9%) patients. Significant seasonal variation in otitis externa infection was observed ( $P<0.05$ ). **Figure 1.**

**Bacterial pathogens. Pseudomonas.** Seventy-five cases (41.7%) of the studied samples showed isolates of *p.aeruginosa*. The highest incidence rate 23 (30.7%) was seen in the age group 5-9 year followed by 18 (24%) in the age group <1 year old. There was a high resistance to the antibiotics tested. However, the most effective antibiotic was, ciprofloxacin (93.4%) (**Table 1**).

**Staphylococcus.** Twenty-nine cases (16%) of *S.aureus* were recovered. The highest number of isolates 8 (27.6%) were found in the age groups 5-9 years and 10-14-years. The most effective antibiotics were amikacin and ciprofloxacin (94%) while the least effective antibiotic was tetracycline (6.9%) (**Table 1**). Seven (24%) isolates of *S.aureus* were methicillin resistant. *Proteus mirabilis* was recovered from 5 patients (2.8%), one patient in each group. The most and the least effective antibiotics were amikacin, ciprofloxacin, imipenem and ofloxacin (100%) and ceftazidime (20%), **Table 1**. Anaerobic bacteria were recovered from 4 patients (2.2%). Sensitivity to metronidazole (100%) was observed. **Table 1.**

**Fungi. Aspergillus species.** Was recovered from 35 patients (19.4%), while *C.albicans* was isolated from 19 patients (10.6%).

**Discussion.** Otitis externa is a common disease in the all regions. The diagnosis of otitis externa poses no particular problem, except on occasions when it is necessary to exclude the presence of middle ear diseases.<sup>1,27</sup> *Pseudomonas aeruginosa* was the most commonly isolated bacterium, which is in agreement with the findings of other studies<sup>8,28,29</sup> including the one conducted in a localized area in Jordan.<sup>1</sup> However, the contribution of the pathogens *S.aureus* and *P.mirabilis* differ from that reported by them.<sup>1</sup> *Pseudomonas aeruginosa* and *P.mirabilis* showed the greatest susceptibility for ciprofloxacin, ofloxacin and amikacin, which agree with other studies.<sup>4,17,30</sup>



**Figure 1** - Monthly number of otitis externa cases during the period (January 2001 through to December 2002).

**Table 1** - Percent of antibiotic susceptibility of bacterial pathogens isolated from Jordanian patients suffering from otitis externa infection during a 2-year study period (2001 through to 2002).

Antibiotics	Pathogen (Number of isolated strains)		
	<i>S.aureus</i> (29)	<i>P.aeruginosa</i> (75)	<i>Pr.mirabilis</i> (5)
Amikacin	96.5	92	100
Ampicillin	10.3	0	0
Carbenicillin	65.6	0	80
Cefixime	10.3	0	40
Ceftazoxime	62.1	0	60
Cefoxitin	94	NT	20
Ceftazidime	58.6	46.7	80
Ceftriaxone	55.9	NT	NT
Cephaloridine	72.4	NT	NT
Ciprofloxacin	96.5	93.4	100
Amoxycillin and clavulanic acid (augmentin)	89.7	0	60
Erythromycin	34.5	NT	NT
Gentamycin	72.4	0	80
Imipenem	93.1	NT	100
Methicillin	75.9	NT	NT
Norfloxacin	51.7	0	80
Ofloxacin	93.1	90.7	100
Piperacillin	89.7	NT	60
Tetracycline	6.9	NT	NT

*S.aureus* - staphylococcus aureus,  
*p.aeruginosa* - pseudomonas aeruginosa  
*Pr.mirabilis* - proteus mirabilis

Susceptibility of *S.aureus* to betalactam antibiotics is of interest in this study, since around 24% of the isolates were methicillin-resistance. These finding were concordant to those observed by others.<sup>16</sup> where MRSA infections appeared to be more common in chronic otitis media than in acute otitis externa. Anaerobic infections and misuse of antibiotics have now been recognized as the cause of failed responses to treatment and for an increasing numbers of reported clinical conditions.<sup>1,8,31,32</sup> *Corynebact spp.* (Diphtheroids) was out of the scope of this study due to the fact that

these organisms were considered as part of the normal flora of the external auditory canal,<sup>27</sup> and no significant difference was observed between number of isolates from otitis externa cases and control.<sup>1</sup> Although it is a controversial concept to other experts, like Roland and Stroman, who claimed a clear pathogenic role of these organisms in acute otitis externa.

**Aspergillus species.** Was the most frequent fungus isolated followed by *C.albicans*, which agrees with other report<sup>21</sup> Although, lower percentage of fungal etiology in a primary acute otitis externa reported by other studies.<sup>9</sup> disagree with our findings. Fungal overgrowth was also found in the setting of tympanostomy tube otorrhea reported by Isaacson.<sup>33</sup> In our study a high percentage of fungal isolates was expected due to different factors such as geographic distribution, different in climates, bad hygiene, shortage of water resources especially during summer season and inefficient control of compliance after prescribing antibiotic therapy. Therefore, the pathogenicity of *Aspergillus spp.* and *C.albicans* was the subject of debate,<sup>28</sup> but nowadays it seems to be related to chronic or inadequately treated cases.<sup>34</sup> Data of this study indicate that only 7.2% of patients had negative swab culture and this may be related to poor hygiene and late presentation of patients to a physician and specimens to the laboratory for direct testing. On the other hand, it could be related to secondary bacterial overgrowth of normal flora of the external auditory canal. A direct relationship between the incidence of otitis externa and the amount of exposure to the water was reported.<sup>35,36</sup> In this study it was not possible to correlate such information due to poor patients history and unknown predisposing factors for otitis externa, which were outside the scope of this study. Number of perforated acute otitis media reported in this study was correlated with discharging ears. Other symptoms such as psoriasis, seborrheic, allergic or a topic dermatitis were not considered in this study. The relationships and statistical significance between microbiology, symptoms/signs, age, sex and seasonal variation obtained in this study are in agreement with similar studies conducted in the United Kingdom.<sup>2</sup> The observed seasonal variation of acute otitis externa infection during June through to August period might be due to the facts that during summer there are shortage of water resources, low water hygiene, swimming in contaminated water and or after shower/bath exposure and all these factors may be involved in the increased number of bacterial and fungal otitis externa infections.<sup>1,9,36</sup> Moreover, it appears that there is a marked decline in the pattern of susceptibility of otitis externa pathogens to various antimicrobial agents.<sup>15,27,30</sup> This might be due to indiscriminate use, frequent use, and long treatment.

In order to prevent the selection of resistant strains, a need for national policy of antibiotics prescribing is required. *Pseudomonas aeruginosa* was the most frequently isolated pathogenic microorganism, which showed the best susceptibility to ciprofloxacin, and pain was the most common symptom.

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