

Allam et al. Afr. J. Clin. Exper. Microbiol. 2020; 21 (1): 60 - 65

<https://www.afrcem.org>African Journal of Clinical and Experimental Microbiology ISSN 1595-689X
AJCEM/1967: <https://www.ajol.info/index.php/ajcem>

Jan 2020 Vol.21 No.1

Copyright AJCEM 2020: <https://dx.doi.org/10.4314/ajcem.v21i1.8>**Short Communication****Open Access****Otitis externa in a tertiary care hospital in Zagazig, Egypt: isolated pathogens and their antibiotic sensitivity patterns**¹*Allam, A. A. E., ²Tantawy, A. E. E., ²Mohamed, K. A. E., ³El ghamrey, N. A. M.,
¹Morad, E. A., and ¹El Shafei, M. A. E.¹Medical Microbiology and Immunology Department, Faculty of Medicine, Zagazig University, Egypt²ENT Department, Faculty of Medicine, Zagazig University, Egypt³ENT specialist, Egypt Ministry of Health and Population*Correspondence to: Egyayman66@yahoo.com; +20155777174, +201227989609**Abstract:****Introduction:** Recurrent otitis externa is a worldwide problem. This study aims to identify the different aetiological organisms isolated from otitis externa and their sensitivity to different antibiotics.**Methods:** A total of 27 patients with clinical presentation of otitis externa for a period of three weeks or more were enrolled for the study. Two swab samples collected from each infected ear were cultured for bacterial and fungi, and growth identified using standard microbiological methods including analytical profile index (API) system. Antibiotic susceptibility of isolated bacteria was performed by the disk diffusion technique.**Results:** Thirty one organisms were isolated from the 27 patients; 12 (38.7%) fungi and 19 (61.3%) bacteria species. *Aspergillus* spp was the most frequently isolated organism (35.4%) while *Pseudomonas aeruginosa* was the most frequently isolated bacteria (19.3%), and was most sensitive to amikacin. Four of 11 patients with *Aspergillus* infection showed clinical resistance to econazole local treatment but had complete clinical response to itraconazole oral treatment.**Conclusion:** Otitis externa in Egypt is caused by antibiotic resistant bacteria or fungi, and the most causative organisms are *Aspergillus* spp and *Ps. aeruginosa*.**Keywords:** Otitis externa, antibiotic resistance, *Pseudomonas aeruginosa*, Egypt

Received June 25, 2019; Revised September 3, 2019; Accepted September 19, 2019

Copyright 2020 AJCEM Open Access. This article is licensed and distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution and reproduction in any medium, provided credit is given to the original author(s) and the source.**Otite externe à l'hôpital de soins tertiaires de Zagazig, en Égypte: agents pathogènes isolés et leur profil de sensibilité aux antibiotiques**¹*Allam, A. A. E., ²Tantawy, A. E. E., ²Mohamed, K. A. E., ³El ghamrey, N. A. M.,
¹Morad, E. A., et ¹El Shafei, M. A. E.¹Département de microbiologie médicale et d'immunologie, Faculté de médecine, Université de Zagazig, Égypte²Département d'ORL, Université de Zagazig, Faculté de médecine, Égypte³spécialiste ENT, Ministère égyptien de la santé et de la population*Correspondance à: Egyayman66@yahoo.com; +20155777174, +201227989609**Abstrait:****Introduction:** L'otite externe récurrente est un problème mondial. Cette étude vise à identifier les différents organismes étiologiques isolés d'une otite externe et leur sensibilité à différents antibiotiques.**Méthodes:** Un total de 27 patients présentant une présentation clinique de l'otite externe sur une période de trois semaines ou plus ont été inclus dans l'étude. Deux échantillons de prélèvement prélevés sur chaque oreille infectée ont été mis en culture pour détecter la présence de bactéries et de champignons, et leur croissance a été identifiée à l'aide de méthodes microbiologiques standard, notamment d'un système d'indice de profil analytique (API). La

sensibilité aux antibiotiques de bactéries isolées a été réalisée par la technique de diffusion sur disque. **Résultats:** Trente et un organismes ont été isolés parmi les 27 patients; 12 espèces de champignons (38,7%) et 19 espèces de bactéries (61,3%). *Aspergillus* spp était l'organisme le plus fréquemment isolé (35,4%), tandis que *Pseudomonas aeruginosa* était la bactérie la plus fréquemment isolée (19,3%) et était la plus sensible à l'amikacine. Quatre des 11 patients infectés par *Aspergillus* ont présenté une résistance clinique au traitement local à l'éconazole, mais ont présenté une réponse clinique complète au traitement oral à l'itraconazole.

Conclusion: L'otite externe en Egypte est causée par une bactérie ou un champignon résistant aux antibiotiques. Les organismes les plus responsables sont *Aspergillus* spp et *Ps. aeruginosa*.

Mots-clés: otite externe, résistance aux antibiotiques, *Pseudomonas aeruginosa*, Égypte

Introduction:

Otitis externa, also known as external otitis or swimmer's ear, is an inflammation of the pinna and external ear canal (1). Swimming in polluted water is a common means by which swimmer's ear is contracted but it is also possible to contract the disease from water trapped in the ear canal after a shower, especially in a humid climate. In addition to the presence of microorganisms, impairment of the integrity of the skin of the ear canal is required for external otitis to develop (2). Acute otitis externa is usually caused by bacteria while fungal involvement is commoner with chronic otitis externa.

Otitis externa is one of the most commonly encountered diseases by otorhinolaryngologists, and is common in certain parts of world with hot humid climate. Due to humid climate of Egypt, there is a high occurrence of otitis externa, especially in the summer. A number of patients are seen without evidence of eczematoid-type chronic otitis externa or other clear-cut causes of their recurrent bouts of otitis externa (3).

Although, the course of the disease is usually self-limited and responds quickly to basic treatment, some cases of otitis externa become resistant or are associated with multiple recurrences. This study aims to identify the microbial pathogens of otitis externa and determine their susceptibility to different antibiotics.

Materials and method:

Study setting and design

This cross sectional study was conducted at the Otorhinolaryngology Department of Zagazig University Hospital and Medical Microbiology and Immunology Department, Faculty of Medicine, Zagazig University, Egypt. The subjects included 27 patients with clinical diagnosis of otitis externa, who were enrolled among those attending the outpatient clinic on complaints of otitis externa for a period of three weeks or more, irrespective of previous therapy. The

Institutional Review Board of Faculty of Medicine, Zagazig University approved the study. Informed consent of each patient was obtained prior to enrollment.

Clinical features of subjects

Each patient had full medical history including duration of illness, symptoms and history of previous treatment, and a general examination. The patient ears were then examined after thoroughly dry-mopping with cotton pads, and signs such as tenderness, erythema, scales, exfoliation and ear discharge were recorded.

Specimen collection and culture isolation

Two swab samples were collected from each infected ear, one swab for bacterial culture and antibiotic susceptibility, and the other for fungal culture. The swabs were rapidly transferred to laboratory within one hour. For bacterial isolation, swab specimens were cultured on Blood, Chocolate and MacConkey agar plates. The Chocolate agar plate was incubated in candle extinction jar while the Blood and MacConkey agar plates were incubated in air. All media were incubated at 37°C for 48 hours. For fungi isolation, swab specimens were inoculated on two plates of Sabouraud Dextrose agar (SDA), one plate was incubated at 25°C (room) temperature and the other at 37°C for 14 days.

Microbial identification from culture

Isolated bacteria were identified according to standard bacteriology techniques of Gram stain, colony morphology and biochemical reactions including the API system (4). Antibiotic susceptibility test was performed by the disc diffusion method and interpreted according to Clinical and Laboratory Standards Institute (CLSI) guidelines (5). Filamentous fungi isolated were identified using modified slide culture technique (6) while *Candida albicans* was identified by the germ tube test.

Modified slide culture technique:

A 1 by 1 cm block of SDA was cut with sterile scalpel and transferred to a plate of SDA. The isolated fungus was inoculated using

sterile wire needle into the four sides of the agar block. Sterile cover slip was put over the block with slight pressure to ensure adherence and the plate cover replaced afterwards. The plates were incubated at 25°C (room temperature). The growth of the fungus was examined periodically. The closed Petri dish was placed on the microscope stage and the slide culture examined with the low power. When reproduced structures had developed, a forcep was used to remove the cover slip and put on a second slide for examination. The agar block was removed using flamed wire needle and put into a container of antifungal disinfectant. A drop of Lactophenol cotton blue stain was put on the remaining slide and was then covered with a new cover slip (6).

Therapy and follow up of patients:

Patients were treated with appropriate antibacterial and antifungi agents, and follow-up visit was at the seventh day after the baseline visit. Treatment was continued for patients whose symptoms persist with follow-up visits at 2 and 3 weeks. At each follow up, clinical information such as pain, itching, otorrhoea, stuffy feeling, burning, irritation and compliance with treatment were obtained from patients and recorded.

Results:

The study was conducted on 27 patients with clinical otitis externa, 18 males and 9 females (M: F ratio of 2:1). The age range of the subjects was 15-64 years with

mean of 42.37±14.01. Table 1 summarizes the demographic characteristics and clinical manifestations of the patients.

Table 2 shows that 31 organisms were isolated from the patients; 12 (38.7%) fungi and 19 (61.3) bacteria species. *Aspergillus* spp was the most frequently isolated organism (35.4%). Bacteria isolated were 9 (29%) Gram positive and 10 (32.3%) Gram negatives. *Pseudomonas aeruginosa* was the most frequently isolated bacteria (19.3%), followed by *Staphylococcus epidermidis* (16.1%), *Klebsiella* spp (9.7%) and *Staphylococcus aureus* (9.6%). As shown in Table 3, there was no significant association between the types of microorganism isolated (bacteria or fungi) and symptoms of otalgia ($p=0.8137$), itching ($p=0.7347$) or ear discharge ($p=0.2522$).

The antibiotic susceptibility of the Gram positive bacteria as depicted in Table 4 shows that they were mostly sensitive to ciprofloxacin, levofloxacin and linezolid, and resistant to clindamycin, tetracycline and ceftriaxone. The Gram negative bacteria were mostly sensitive to imipenem, levofloxacin, ciprofloxacin and colistin, and largely resistant to chloramphenicol, gentamicin, tobramycin and ceftriaxone.

Patients with *Aspergillus* infection (n=11) were treated with econazole but only 7 had complete clinical response to econazole local treatment while the remaining 4 had complete clinical response to itraconazole oral treatment. The patients with *Candida* infection had clinical response to terbinafine cream.

Table 1: Socio-demographic characteristics and clinical history of patients with clinical otitis externa in Zagazig University Hospital, Egypt

Characteristics	Frequency	Percentage
Gender		
Male	9	33.3
Female	18	66.7
Marital status		
Married	25	92.5
Single	1	3.75
Widow	1	3.75
Occupation		
Employed	13	48.2
Unemployed	14	51.8
Smoking history		
None	21	77.8
Smokes	6	22.2
Past medical history		
No previous surgery	14	51.8
Adenotonsillectomy	1	3.75
Tonsillectomy	2	7.5
Allergy from drugs	1	3.75
Not relevant	9	33.3
Clinical manifestations		
Otalgia	26	96.3
Discomfort	22	88.5
Itching	26	96.3
Edema of ear canal	27	100

Table 2: Microorganisms isolated from patients with otitis externa in Zagazig University Hospital, Egypt

Microorganism	Frequency	Percentage
Fungi	12	38.7
<i>Aspergillus</i> spp	11	35.4
<i>Candida</i> spp	1	3.2
Gram positive bacteria	9	29
Diphtheroids	1	3.2
<i>Staphylococcus aureus</i>	3	9.6
<i>Staphylococcus epidermidis</i>	5	16.1
Gram negative bacteria	10	32.3
<i>Pseudomonas aeruginosa</i>	6	19.3
<i>Klebsiella</i> spp	3	9.7
<i>Proteus</i> spp	1	3.2
Total	31	100

Table 3: Relationship between symptoms of otitis externa and microorganisms isolated among patients in Zagazig University Hospital, Egypt

Symptoms	Microorganism			χ^2	95% CI	p value
	Bacteria (n=19)	Fungi (n=12)	Total (n=31)			
Otalgia						
Positive	19	11	30	0.05552	0.4385-0.8005	0.8137*
Negative	0	1	1			
Ear discharge						
Positive	10	3	13	1.311	0.8878-2.666	0.2522*
Negative	9	9	18			
Ear itching						
Positive	18	11	29	0.1149	0.3015-5.111	0.7347*
Negative	1	1	2			

* = not significant

Table 4: Antibiotic susceptibility profile of bacteria isolates of otitis externa in Zagazig University Hospital, Egypt

Antibiotics	Gram positive bacteria (n=9)		Gram negative bacteria (n=10)	
	Sensitive (%)	Resistant (%)	Sensitive (%)	Resistant (%)
Oxacillin	1 (11.1)	8 (88.9)	NA	NA
Tetracycline	1 (11.1)	8 (88.9)	NA	NA
Clindamycin	1 (11.1)	8 (88.9)	NA	NA
Linezolid	9 (100)	0	NA	NA
Chloramphenicol	NA	NA	0	10 (100)
Tobramycin	NA	NA	4 (40)	6 (60)
Amikacin	NA	NA	7 (70)	3 (30)
Colistin	NA	NA	9 (90)	1 (10)
Aztreonam	NA	NA	6 (60)	4 (40)
Amoxicillin-Clavulanic acid	3 (33.3)	6 (66.7)	1 (10)	9 (90)
Ceftriaxone	1 (11.1)	8 (88.9)	4 (40)	6 (60)
Gentamicin	5 (55.6)	4 (44.4)	2 (20)	8 (80)
Ciprofloxacin	9 (100)	0	9 (90)	1 (10)
Levofloxacin	9 (100)	0	9 (90)	1 (10)
Imipenem	8 (88.9)	1 (11.1)	9 (90)	1 (10)

NA = Not Applicable

Discussion:

Otitis externa is a common disease and its severity varies from mild, self-limited condition to severe malignant otitis externa with involvement of cartilage and bone of the external auditory canal, and a tendency to break through to the brain (7). In the current study, *Ps. aeruginosa* was the most frequently isolated bacteria pathogen and constituted 19.5% of the isolates, which agrees with previous studies that established this pathogen

as the most frequent in acute otitis externa (8, 9). The rate for *Ps. aeruginosa* in this study is however lower than 41.7% reported from a study conducted on ear discharge of malignant otitis externa in Jordan (10) and 52.9% in India (11), but the rate is higher than 12% reported from a study in Iran (12).

Among the fungi, *Aspergillus* spp are the predominant organisms implicated in otomycosis (7). In the current study, *Aspergillus* spp was the most frequently isolated organism with 35.4%, which agrees with studies from

Turkey (13) and Iran (14), where *Aspergillus* spp constituted 78.6% of otomycosis agents, followed by *Candida* species (6.8%) and other saprophytic fungi (4.7%). The high prevalence of fungal otitis externa may be secondary to over use of broad spectrum antibiotics and increased topical use of fluoroquinolones (13), which encourages fungi overgrowth.

Fungal otitis externa is often asymptomatic, with discomfort being the most frequent complaint, but there may be pruritus and a feeling of fullness in the ear. *Aspergillus* species, particularly *Aspergillus niger* may grow in the cerumen and desquamated keratinaceous debris in the external auditory canal, sometimes forming a visible greenish or blackish fluffy colony (6). In this study, there was no significant difference between the symptoms of otalgia, ear itching or discharge between bacteria and fungi otitis externa ($p > 0.05$).

In the current study, the Gram negative bacteria were mostly sensitive (90%) to imipenem, laevofloxacin, ciprofloxacin and colistin, but largely resistant to chloramphenicol, gentamicin, tobramycin and ceftriaxone. The Gram positive bacteria on the other hand were totally sensitive (100%) to laevofloxacin, ciprofloxacin and linezolid, and 89% sensitive to imipenem, but were largely resistant to clindamycin, tetracycline and ceftriaxone. The most frequently isolated Gram negative bacteria, *Pseudomonas* spp was mostly sensitive to amikacin, imipenem, laevofloxacin, ciprofloxacin and colistin, but largely resistant to amoxicillin-clavulanate, gentamicin, tobramycin and chloramphenicol. All *S. aureus* and *S. epidermidis* isolates were resistant to oxacillin, while the only diphtheroid was sensitive to the antibiotic. The issue of bacterial resistance to antibiotics is a global challenge (15). In developed countries such as the United States, contemporary ear culture isolates at quaternary care center show higher rates of methicillin resistant *S. aureus* (MRSA) compared to historical reports in the literature (16). However, the challenge of antibiotic resistance is more in developing countries such as Egypt (17), as a result of low socioeconomic state and behavioral pattern of the populace regarding antibiotic use (18). In Egypt, antibiotics can be purchased from pharmacies without medical authorization or prescription.

In this study, fungi were isolated in 38.7% of cases with half of them having bacteria pathogen concurrently involved, which explains the chronicity of the lesion. These cases were previously treated as pure bacterial infection while the fungal aetiology was hidden

by the discharge and erythema usually seen in bacterial infection. On the other hand, fungal infection is usually associated with itching as seen in 11 out of 12 (91.7%) cases in this study.

Treatment of acute otitis externa should include an active antimicrobial agent and not just an acidifying agent such as acetic acid (19). Moderate to severe cases will require ototopical agents in addition to antiseptic solution (20). Ciprofloxacin ear drop was the commonest agent used in the initial treatment of our patients followed by gentamicin with or without corticosteroid, and then econazole antifungal agent. Our study observed that many of the locally used drugs such as gentamicin, chloramphenicol and tetracycline have poor activity against most pathogens. This may be due to the injudicious use of these agents which has resulted in the emergence of more resistant strains, especially among the troublesome pseudomonads.

The resistant otitis externa cases could also be associated with contact dermatitis (7), therefore antiinflammatory corticosteroid combination in the ear drops may be required. In the case series by Smith et al., (21) in 1990, 23.5% of their patients with otitis externa had contact dermatitis, and this was even less than what Holmes and Johnson (22) had reported in 1982. Infestation by *Demodex* species can also cause persistent itching in resistant cases especially in immuno-compromised patients (23) or with prolonged use of local steroid which may increase the frequency of the parasite in the external ear canal of affected patients (24). In this study, local treatment of candida otitis externa was totally responsive to terbinafine cream but only 7 out of 11 patients with *Aspergillus* infection had complete clinical response to econazole local treatment. The four patients resistant to econazole had complete clinical response to itraconazole oral treatment. This observation agrees with a study in India (25), which reported that 5 days course of itraconazole treatment was very effective for recurrent otomycosis in diabetic patients.

Conclusion:

Our study reports that otitis externa in Egypt is caused by antibiotic resistant bacterial and fungi, the most common pathogens being *Aspergillus* spp and *Ps. aeruginosa*. Oral itraconazole was effective for recurrent fungal otitis externa. We recommend that in cases of otitis externa resistant to antibacterial agents,

fungi aetiology should be investigated by culture on Saboraud Dextrose agar.

Conflict of interest:

Authors declared no conflict of interest

Source of funding:

Authors received no funding from any agency in the public, commercial, or not-for-profit sectors.

Authors contributions:

AAA, AEET and KAEM were responsible for concept and design of the study. NAME undertook acquisition and interpretation of data and drafting of the manuscript. All authors contributed to data collection. AAA undertook critical review of the manuscript. NAME, EAM and MAEE undertook statistical analysis and review of the manuscript.

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