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A Study of Bacterial Causes and Factors Affecting Middle Ear Infection among Hearing Aid User in the City of Fallujah

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Annotation: In this research, a group of samples were taken at Fallujah Hospital. By taking samples from patients with middle ear infections of different ages and for both sexes, it was found that the infection rate in the city is greater than the infection rate in the village. It was also noted that the infection rate in males is higher than in females.

1-1 Introduction

The ear has a complex structure concerned with maintenance of equilibrium as well as hearing. An abnormality or disruption in the anatomical structures and function of the ear can result in ear diseases and may affect all the age groups including the elderly, as a result of aging[1] . Aging is a natural process that affects all human beings , and different body systems are affected by the aging process at different rates . It affects all the organs of the body including the ear . As age increases, there is degeneration of the tissues which results in increased susceptibility to diseases of the ear such as diminished hearing, impacted wax, chronic suppurative otitis media(as in figure 1)[2]

Figure-1-suppurative otitis

Age related changes that affect the ears are commonly not life threatening when compared to age related changes and medical diseases that affect the respiratory and cardiovascular systems of the body . Among the common ear diseases in the elderly is hearing impairment. Age related hearing loss may be defined as mid to late adult onset, bilateral, progressive sensorineural hearing loss, after exclusion of any underlying causes. It excludes hearing loss caused by primary factors including loud noise exposure, underlying medical conditions intrinsic ear disease, head injury and drug toxicity . Ear infections e.g. otitis media(as in figure 2), are considered among the common ear diseases which are higher in developing countries, especially among low socioeconomic society due to malnutrition, overcrowding, poor hygiene, inadequate health care and recurrent upper respiratory tract in[3,4]

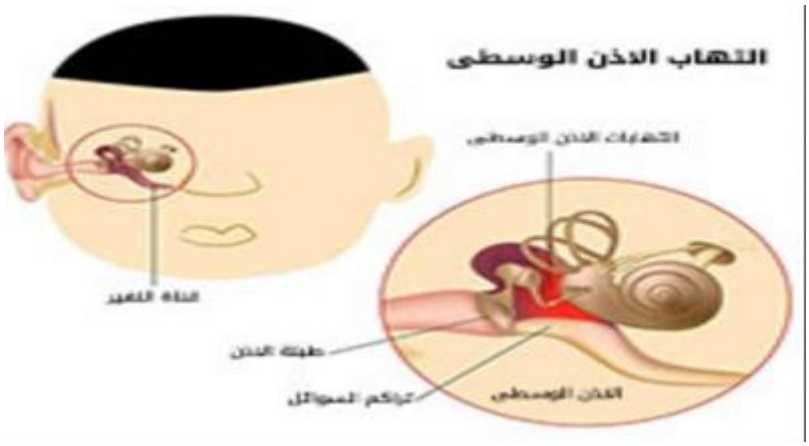

Figure -2-middle ear otitis

A variety of factors may be associated with and predisposed to suppurative ear infections including gender, low socioeconomic status, overcrowding, unawareness about the disease, living in a slum area, poor hygiene, bathing in pond/ river water, smoking, and foreign bodies in the ear . However, the effects of various host and environmental factors have not been well defined . Diseases of other systems were reported to be associated with the onset of ear disorders.[5,6,7]

They may act as important risk factors for the onset of ear problems such as hearing impairment . The resulting disability caused by ear diseases may not be life threatening, but it has deleterious effects on the patient's quality of life and increases the economic burden on the family . So, this study was conducted to identify the frequency and types of ear diseases among .[8]

1.2 Development of ear disease

The development of ear disease can be influenced by various factors, including genetic predisposition and environmental exposure. Abnormalities in ear development can lead to conditions that affect different parts of the ear, such as the inner, middle, and outer ear. These anomalies may result from genetic factors, maternal infections such as rubella and cytomegalovirus, or noise exposure. Common congenital anomalies include enlarged vestibular aqueduct (EVA) syndrome, Mondini's dysplasia, and microtia. Ear developmental disorders can[9]

Impair hearing and cause cosmetic deformities, with protruding ears being a common anomaly. An evaluation by an otolaryngologist and pediatric audiologist is usually required to evaluate abnormalities and hearing loss. New surgical treatments have been created for auditory rehabilitation. Ear infections, such as acute otitis media, can be caused by viral or bacterial infections, leading to symptoms such as ear pain, hearing loss, and fluid buildup in the middle ear. Factors such as age, group child care, infant feeding, seasonal allergies, and poor air quality can increase the risk of ear infections[10]. Complications of ear infections may include hearing loss, delayed speech, spread of infection, and ruptured eardrum. Preventive measures include hand hygiene, avoiding passive smoking, breastfeeding, and maintaining good air quality. Treatment for ear infections may include antibiotics, pain medications, or surgery in severe cases. Symptom monitoring and appropriate management are crucial in treating ear diseases and disorders[11]

3. Historical reriew

1. **In 1999,** Dr. Susan Raffaccio, several studies showed that middle ear infection during childhood has a negative impact on language development later[12].

2. **In 2001,**Dr. Robert Sander stated that otitis externa is most often caused by a bacterial infection, although it is sometimes fungal, and the most distinctive symptom is discomfort that is limited to the external auditory canal.[13]

3. **In 2004**, Dr. Edmund J. Rosser stated that otitis externa is the most common disease in humans and is defined as inflammation of the canal with an underlying cause of infection and inflammation in basically all cases.[14]

4. **In 2009**, Dr. Kelvin Kong Harvey L.C. Coates, otitis media still represents a major health problem, as poor living conditions and exposure to cigarette smoke are the main risk factors for otitis media.

5. **In 2011, Dr**. J. David Osgothorpe Otitis externa can take an acute or chronic form, with the acute disease usually caused by bacterial or fungal overgrowth in the ear canal exposed to excess moisture.

6. **In 2014**, Dr. Brandon E. Cohen, Ann Dorstenfeld, Pamela C. Rome, many viral infections can cause hearing loss. Hearing loss caused by these viruses can be congenital or acquired, unilateral or bilateral, and it can be sensorineural, conductive, or mixed, as well as It can directly damage the structures of the outer ear[15]

7. **In 2017** Alexander**,** KC Leung, Alex HC Wong, Acute otitis media is a common infection in childhood. Prompt diagnosis and appropriate treatment are very important. Acute otitis media affects more than 80% of children before their third birthday.

8. **In 2019,** Heidi L. Gaddy, Matthew Thomas Wright, Tracy N. Nelson**,** Acute otitis media (AOM) is the most common diagnosis in acute pediatric visits. By age three years, 50% to 85% of children will have at least one episode of AOM. Symptoms may include ear pain (rubbing, tugging, or grabbing the ear may be a sign of pain), fever, irritation, runny ears, loss of appetite, and sometimes vomiting or lethargy. AOM is diagnosed in symptomatic children who have moderate to severe swelling of the tympanic membrane or new otorrhea not caused by acute

otitis externa, and in children with mild swelling and ear pain of recent onset (less than 48 hours) or Severe erythema from otitis externa.

9. **In 2020,** Carolyn R. Paul, Megan A. Moreno[], The terminology that health care professionals use to describe ear conditions in children can be confusing. There are 3 common terms. (1) Acute otitis media (AOM) is the term used for middle ear infections. (2) Otitis media with effusion occurs when there is uninfected fluid in the middle ear space. This does not require antibiotics. (3) Otitis externa is an infection that affects the space outside the eardrum and affects the ear canal. Sometimes, this condition is known as swimmer's ear. Acute otitis media is one of the most common diseases

10. **In 2022,** Ran D Goldman, Acute otitis media (AOM) is one of the most common findings among children in our family medicine office, and we often see this disease during seasons with high rates of upper respiratory tract infections. With the widespread use of pneumococcal vaccination,[16,17]

4. Aim of work

It aims to study the microbial characteristics that lead to ear canal debris and identify special factors among hearing aid users in the city of Fallujah.

1. Introduction

Otitis externa refers to any inflammation of the ear and ear canal, which appears without rupture and arises from microorganisms and represents about 5% to 20% of all cases involving otitis externa. This type of infection(Which occurs in the inner, middle, or outer parts of the ear) is usually classified into acute and chronic diseases. External ear infections are some of the most common types of ear infections that doctors encounter every day.Ear infections that occur in the area between the eardrum and the inner ear are represented by the Eustachian tube.

They are called middle ear infections. These are acute or chronic infections that begin with epithelial tissue.[18]

The lining of the external ear canal, which is characterized by redness, exudation, and shedding of the epithelial tissue, and the inflammation develops to affect the middle ear, which is characterized by the retention of secretions inside it as a result of the perforation of the tympanic membrane, and thus the entry of germs into the interior through the external ear canal. Ear infections are common in humans at young ages, which are always accompanied by infections. Viral upper respiratory tract and influenza diseases.[19]

2. Middle ear diseases

1. **Otitis Media**: An inflammation of the middle ear caused by bacteria or viruses, leading to fluid accumulation behind the eardrum. It is common in both children and adults and can cause ear pain, fullness, and fever
2. **Otosclerosis:** Abnormal bone growth in the middle ear, often causing gradual hearing loss in adults. Surgery can help restore hearing in some cases[20,21]
3. **Tinnitus:** Characterized by a constant ringing or buzzing sensation in the head, with no known cure currently available
4. **Ménière's Disease**: A chronic condition affecting balance and hearing in the inner ear, leading to symptoms like vertigo, hearing loss, and tinnitus. Medications can help manage symptoms[22]
5. **Presbycusis**: Age-related hearing loss that occurs gradually in adults as they age, often affecting both ears symmetrically
6. **Barotrauma:** Physical damage to the ear due to changes in air or water pressure, which can impact the ear structures[23]

7. **Acoustic Trauma**: Damage caused by exposure to sudden, loud noises like explosions or loud music, requiring assessment and monitoring for long-term effects
8. **Hearing Loss**: Can result from various causes such as heredity, illness, trauma, or exposure to loud noise. Treatments like hearing aids or cochlear implants can help correct hearing impairment[24]

3. Causes of ear infections

Some of the many causes of ear infections and contributing risk factors include:

- ✓ Upper respiratory infections
- ✓ Sudden changes in air pressure, such as during plane travel
- ✓ The Eustachian tube is smaller than average, or the Eustachian tube is blocked
- ✓ Cleft palate
- ✓ Young age – Infants and children are more susceptible to ear infections
- ✓ Swimming in polluted water
- ✓ Not drying the outer ear properly after swimming or showering

-- Excessive cleaning of the ears, which may scratch sensitivety[25,26,27]

Figure-4-swimming polluted water

4. Types of Ear Bacteria:

1. **Staphylococcus aureus**: This bacteria is a common culprit in ear infections, particularly in cases of eczematous otitis externa. It is often found in ear discharge samples and can lead to infection[28]

2. **Proteus mirabilis**: Known for causing ear infections, especially in individuals with weakened immune systems, Proteus mirabilis is another bacteria that can be isolated from ear discharge samples

3. **Escherichia coli:** This bacteria can also contribute to ear infections, particularly in cases of otitis externa. It is one of the bacterial isolates found in ear discharge samples[29,30]

4. **Pseudomonas aeruginosa:** Common in swimmer's ear infections, Pseudomonas aeruginosa is known to cause severe infections in the ear. It is another bacterial isolate that can be found in ear discharge samples[31]

5. **Klebsiella pneumoniae**: This bacteria is also present in ear discharge samples and can contribute to ear infections. It is part of the Gram-negative bacteria group that can be isolated from ear infections[32]

6. **Haemophilus influenzae:** Another bacteria found in ear infections, Haemophilus influenzae is part of the Gram-negative bacteria group and can be isolated from ear discharge samples

5. Types of Middle ear infection (Otitis media)

- *First type: Severe Middle ear infection:*

Caused by a bacterial or viral infection in most cases and may be due to complications of an infection of the upper respiratory tract or sinuses. These symptoms usually disappear by treating the pathogen.[33]

- *Second type: Middle ear infection with cold:*

The main cause of infection of this type is the accumulation of fluid and mucous secretions of the ear inside it due to several reasons, including: Blockage of the Eustachian tube after infection in the upper respiratory tract and the occurrence of leaching and the accumulation of mucous secretions inside the car.[34]

poor functioning of the Eustachian canal; usually due to cleft palate, frequent colds or air pressure shock.[35]

- *Third type: Chronic Middle ear infection:*

This type occurs as a result of delayed treatment of cases of acute inflammation in the ear, which leads to the accumulation of fluid and secretions for two weeks or more, thus forming wax that may reach the eardrum, with large amounts leading to discharge from the ear.[36]

Causes:

- Respiratory infection, such as a cold or flu.
- Allergy.
- Exposure to cigarette smoke.
- Inflammation of the adenoids or tonsils.[37]

1. Introduction

In this chapter, samples were collected from the Fallujah Teaching Hospital for patients of different genders and the environment in which they live in different areas.

Table (3-1) A table showing the type of infection for patients with middle ear infections Among hearing aid users.

Table -1- Men over the age 50

الاسم	العمر	يستعمل معين ؟	نوع الاصابة	سبب الاصابة	مدخن؟	البيئة
غالب حسون شاكر	60	كلا	بكتريا	فطريات	كلا	مدينه
توفيق محمد خضير	54	كلا	بكتريا	فطريات	كلا	قريه
رياض فؤاد احمد	55	نعم	بكتريا	سوائل	كلا	مدينه
يوسف وليد يوسف	50	كلا	بكتريا	جراحه	نعم	قريه
سجاد خالد	55	كلا	بكتريا	فطريات	نعم	قريه
عبدالرحمن حسن	50	كلا	بكتريا	سوائل	نعم	قريه
سلام رافد	61	كلا	بكتريا	ثقب في الطبلة	كلا	مدينه
احمد محمود	52	كلا	بكتريا	نزيف الاذن	كلا	مدينه
محسن راشد	58	كلا	بكتريا	ضعف العصب	كلا	مدينه
جنيد احمد	60	كلا	بكتريا	فطريات	كلا	قريه

Table -2- Men under the age 50

الاسم	العمر	يستعمل معين؟	نوع الاصابة	سبب الاصابة	مدخن؟	البيئة
حمزه غانم	7	كلا	بكتريا	ديدان	كلا	مدينه
عبدالله نجاح	5اشهر	كلا	بكتريا	فطريات	كلا	قريه
محمد وليد	10	كلا	بكتريا	سوائل	كلا	قريه
سعدي احمد	27	كلا	بكتريا	ثقب في الطبلة	نعم	قريه

Table -3-Women over the age 50

الاسم	العمر	يستعمل معين؟	نوع الاصابة	سبب الاصابة	مدخن؟	البيئة
هيفاء قاسم	50	كلا	بكتريا	فطريات	كلا	قريه
شفاء عبد الحافظ	59	كلا	بكتريا	سوائل	كلا	قريه
دعاء ياسين	55	كلا	بكتريا	افرازات جراحيه	كلا	مدينه
فوزيه خليفه	51	كلا	بكتريا	فطريات	كلا	مدينه
جنان ياسر	60	كلا	بكتريا	فطريات	كلا	مدينه

Table -4- Women under the age 50

الاسم	العمر	يستعمل معين؟	نوع الاصابة	سبب الاصابة	مدخن؟	البيئة
نبأ مصطفى	5	كلا	بكتريا	فطريات	كلا	مدينه
رؤى كامل	12	كلا	بكتريا	سوائل	كلا	مدينه
جنات سامي	24	كلا	بكتريا	سوائل	كلا	مدينه

Through the results shown in Table (3-1), it was found that the percentage of infected males is (65%) and the percentage of females is (40%). Fungal infections of the outer ear were also observed in both sexes.

The results showed that the infection rate among city residents is greater than that of village residents.

2. Conclusion

1. The study was conducted on some patients with middle ear infection in the city of Fallujah.
2. It was found that the percentage of infected people among males is greater than that of females.
3. It was noted that the infection rate in the city is greater than in the villages.

3. Suggestions for Future Work

1. Study of bacterial causes and factors affecting the ear.
2. Study the reason for the increase in the infection rate in the city.

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