



# Otitis Externa in Children and Auditory Impairment

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## 14.1 Introduction

Otitis externa refers to any condition in which the epidermis, dermis, or hypodermis of the external auditory meatus becomes infected. Infection may also affect the ear drum or auricle. Otitis externa may occur in various forms, such as acute diffuse, circumscribed, chronic otitis, or malignant (where necrosis is a feature). A number of conditions may be responsible, such as perichondrial inflammation, erysipelas, a fungal infection, herpes zoster of the ear, bullous and hemorrhagic forms, otitis media with a perforated tympanic membrane, eczema, cholesteatoma, or a malignant neoplasm involving the external auditory meatus [1, 2].

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## 14.2 Etiological and Epidemiological Features

Otitis externa occurs frequently worldwide but is more common in the tropics than in more temperate regions since the tropical climate is warmer and more humid. It is estimated to affect one in ten people during their lifetime [3]. People who swim are five times more likely to develop otitis externa [4], which explains why it is often referred to as “swimmer’s ear.” Bacterial infections account for at least 90% of cases [4]. The most frequently isolated pathogen is *Pseudomonas aeruginosa* (22–62% of cases), followed by *Staphylococcus aureus* (between 11 and 34%). The simultaneous isolation of multiple pathogens occurs frequently [5]. Fungal infections are infrequent reasons for acute otitis externa (10% of cases) but are more frequently seen where the infection becomes chronic. The usual fungal pathogens are from the genus *Aspergillus* (between 60 and 90%) [1, 6] or *Candida* (between 10 and 40%) [1]. The prolonged use of antibiotics predisposes to otomycosis. Also at risk are patients who are immunosuppressed or have diabetes mellitus [1].

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## 14.3 Classification

Cases of otitis externa (OE) may be categorized in the following manner [7]

- Acute diffuse OE. This is the most frequently encountered form, with patients usually being swimmers.
- Acute localized OE (furuncle). This occurs when a hair follicle becomes infected.
- Chronic OE has the same features as acute diffuse OE, although it persists for at least 6 weeks.
- Eczematous/eczematoid OE is an umbrella term for a variety of skin disorders that may cause an infection of the external auditory meatus and thus provoke OE. This includes allergic dermatitis, psoriasis, systemic lupus erythematosus, and eczema.
- Malignant (i.e., necrotic) OE occurs when the site of infection extends deep into the tissues surrounding the external auditory meatus. This condition mainly affects patients with immunocompromise (such as those with diabetes mellitus or AIDS).
- Otomycosis refers to an infection of the external auditory meatus caused by fungi, such as *Candida* spp. or *Aspergillus* spp.

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## 14.4 Signs and Symptoms: Otitis Externa and Auditory Impairment

On physical examination, the main signs to look for are pain when the tragal region is touched, or the auricle is pulled (a cardinal sign). There are a number of other potential signs or symptoms to look out for, such as [7]:

- Earache, which may be slight or severe and generally worsens over the course of one to a couple of days.

- Auditory impairment.
- Perception of fullness or pressure in the ear.
- The external auditory meatus may be reddened, swollen, and narrower than usual.
- Tinnitus.
- Pyrexia (in a few cases).
- Pruritus, particularly in chronic OE or otomycosis.
- Pain that is severe and deep in a patient with immunocompromise may signal malignant OE.
- Otorrhea, which begins as a clear fluid, after which pus is seen, accompanied by a foul odor.
- In a few cases, there may be facial or cervical cellulitis, and the lymph nodes of the same side may be swollen and tender.
- Rarely, there may be symptoms from both ears.
- The history often reveals that the patient has been involved in water-based activities, such as swimming, surfing, or canoeing.
- There may also be a history of injury to the ear, frequently as a result of cleaning the ears too energetically, inserting a cotton bud in the canal or taking water into the ears.

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## 14.5 Signs and Symptoms: Otitis Externa and Hearing Loss

OE is typically a clinical diagnosis made on the basis of a matching history and supportive physical findings, not omitting otoscopy. Any patient with diabetes or some other source of immunocompromise and who complains of severe otalgia should be referred to an ENT specialist in case malignant OE is the diagnosis.

### 14.5.1 Physical Examination

On physical examination, the main signs to look for are pain when the tragal region is touched, or the auricle is pulled (a cardinal sign). The external auditory meatus may be reddened, swollen, and narrower than usual. There may be otorrhea, either clear or containing pus. Auditory impairment of conductive type may be noted. In a few cases, there may be facial or cervical cellulitis, and the lymph nodes of the same side may be swollen and tender [8].

Although it is potentially challenging to get a clear view of the ear drum on otoscopy in such cases, it may be possible to see evidence of tympanic inflammation. The drum should move normally when subjected to pneumatic otoscopy. The auricle may show signs of eczema. If there are signs of the cranial nerves being affected (such as the facial nerve or the ninth to twelfth nerves), the diagnosis cannot be uncomplicated OE [8].

Otomycosis generally causes severe pruritus but is not normally as painful as infection with bacteria. There is frequently an accompanying viscous otorrhea of gray or white color. Infections caused by *Pseudomonas* generally provoke a

green- or yellow-colored discharge of pus, whereas a fungal infection caused by *Aspergillus* resembles a fine mat of white with black spheres resting on top. When the fungal discharge is examined microscopically, spores or hyphae may be seen, or there may be indistinct areas [8].

If the ear is viewed under magnification, the presence of granulation tissue may be apparent within the meatus. Infection may extend into the adjoining soft tissues, including the parotid gland. If the infection tracks into the bone, the mastoid, temporomandibular joint, or basal skull may be invaded, resulting in involvement of CN VII and IX–XII [8].

### 14.5.2 Laboratory Tests

Generally speaking, the diagnosis does not call for laboratory investigations, although these may be of value where there is immunocompromise, treatment failure, or features suggestive of otomycosis. Potentially useful investigations include the following [7]:

- Gram staining and microscopy of discharge from the ear
- Serum glucose estimation
- Urinalysis

### 14.5.3 Imaging Investigations

In the majority of patients with suspected OE, imaging is not appropriate. Nonetheless, imaging studies may be required in specific cases, where, for example, malignant OE or mastoiditis is the putative diagnosis.

**The following imaging methods may be of value**

- High definition computed tomography (CT) is the investigation of choice as it reveals osseous erosion.
- Bone scan utilizing radionucleotides.
- Gallium scan.
- Magnetic resonance imaging (MRI) is less commonly employed than other methods but may be helpful as a second line investigation if there is a suspicion the infection has spread to the soft tissues [9, 10].

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## 14.6 Treatment

The first line in treating OE is to provide analgesia, debride the external auditory meatus, provide topical treatments to counter infection and reduce swelling, and prevent factors that are complicating the situation [8].

The majority of cases resolve with over-the-counter painkillers and ear drops applied to the canal. The ear drops usually employed for this purpose are ones containing ethanoic acid (to manipulate the acidity of the meatus), antibiotics (for bacterial causes), and antifungals. Although OE of eczematous or psoriatic type is frequently responsive to topically applied steroids, such cases may recur or become persistent. There may be a need for regular debridement using suction and under microscopic guidance. If the meatus is very swollen, a wick may be placed in the canal to carry topical treatments deeper into the meatus [8].

Clinical improvement is observed within 7–10 days in 65–90% of treated cases of OE, irrespective of the agent employed [5]. A meta-analysis of randomized controlled trials, conducted by the Cochrane Collaboration, found that equal benefit occurred when either antiseptic or antibiotic medications were used. Monotherapy was as effective as combination treatments and the addition of steroids did not affect the outcome [11]. When corticosteroids were applied topically, however, it was noted that there was a reduction in erythema and ear discharge. Some of the trials included did purport to indicate varying outcomes, depending on whether a single or multiple agents were employed in treatment. The wide variety of different agents employed means that meaningful conclusions about best practice were difficult to draw [11].

In a systematic review that compared topical antibiotic agents with placebo, the active agent was associated with a 46% increase in resolution as assessed clinically, or 61% when assessed bacteriologically [12]. In cases of tympanic perforation, agents with known ototoxicity should not be used. The use of a gauze wick impregnated with medication as monotherapy appears to increase the efficacy of topically applied agents and to reduce swelling from inflammation, but no randomized trial of this method has yet been reported [11].

## 14.6.1 Antibiotics

Since the majority of patients with OE have a superficially located bacterial infection of the ear canal, a topically applied antibiotic solution is generally appropriate. Sometimes the antibiotic is combined with a corticosteroid. The dose of corticosteroid involved is low, but sufficient to reduce otalgia and swelling in the canal [8].

### 14.6.1.1 Hydrocortisone/Neomycin/Polymyxin B (Cortisporin, Cortomycin)

This agent is a combination of antibiotic and anti-inflammatory intended to be applied to the ear. It comes in solution or suspension forms. The indication is where OE is caused by a condition susceptible to treatment by corticosteroid and either a bacterial infection already exists or there is a danger of one occurring [8].

#### 14.6.1.2 Ofloxacin Ear Drops

This antibiotic is a broad-spectrum quinolone that prevents bacterial multiplication through inhibition of DNA gyrase. It is supplied as a solution containing ofloxacin 3 mg/mL (i.e. 0.3%) [8].

#### 14.6.1.3 Ciprofloxacin Otic (Cetraxal)

Ciprofloxacin is another agent that interferes with bacterial DNA replication through inhibition of DNA gyrase. It is classed as a fluoroquinolone. Bacterial species with sensitivity to this agent include *Pseudomonas* spp., *Streptococcus* spp., methicillin-resistant *Staphylococcus aureus* (MRSA), *S. epidermidis*, and the majority of Gram negatives. It is not effective against anaerobic bacteria. Preparations are available alone or in combination with hydrocortisone. Cetraxal is an ear drop that is supplied as 14 single-use applicators, each of which carries 0.25 mL of a 0.2% solution of the antibiotic.

Ciloxan is an eye drop that is also suitable for use in cases of OE [8].

#### 14.6.1.4 Dexamethasone/Tobramycin (TobraDex)

Tobramycin works by disrupting the bacterial outer membrane. It prevents the bacterium from manufacturing proteins by forming a bond to the 30S and 50S subunits of the bacterial ribosome. Dexamethasone exerts an anti-inflammatory effect through preventing recruitment of polymorphonuclear leucocytes and decreasing the permeability of the vascular endothelium.

TobraDex is an eye drop that is of value in treating OE.

#### 14.6.1.5 Gentamicin Ophthalmic (Garamycin, Gentak)

Gentamicin is classified as an aminoglycoside. It has activity against Gram negative organisms. This agent is an eye drop that is suitable for treating OE. The preparation is a mixture in which 1 mL contains both gentamicin sulphate 3 mg and betamethasone sodium phosphate 1 mg [8].

#### 14.6.1.6 Ciprofloxacin and Dexamethasone Otic (Ciprodex)

As stated earlier, ciprofloxacin is classified as a fluoroquinolone. Its mode of action is inhibition of DNA gyrase and DNA topoisomerase. Thus, it prevents bacteria from replicating and manufacturing gene products. Bacterial species with sensitivity to this agent include *Pseudomonas* spp., *Streptococcus* spp., methicillin-resistant *Staphylococcus aureus* (MRSA), *S. epidermidis*, and the majority of Gram negatives. It is ineffective against anaerobic bacteria. Dexamethasone exerts an anti-inflammatory effect through preventing recruitment of polymorphonuclear leucocytes and decreasing the permeability of the vascular endothelium. It also lessens otalgia [8].

Ciprodex has an indication for OE, and may be used for cases of otitis media in patients with grommets in situ.

### 14.6.1.7 Ciprofloxacin and Hydrocortisone Ear Drops (Cipro HC Otic)

Ciprofloxacin is classified as a fluoroquinolone. Its mode of action is inhibition of DNA gyrase and DNA topoisomerase. Thus it prevents bacteria from replicating and manufacturing gene products. Bacterial species with sensitivity to this agent include *Pseudomonas* spp., *Streptococcus* spp., methicillin-resistant *Staphylococcus aureus* (MRSA), *S. epidermidis* and the majority of Gram negatives. It is ineffective against anaerobic bacteria. Hydrocortisone exerts an anti-inflammatory effect through preventing recruitment of polymorphonuclear leucocytes and decreasing the permeability of the vascular endothelium [8].

### 14.6.2 Debriding and Draining the Ear Canal

The external auditory meatus is generally only debrided in cases of malignant OE or if complications occur, such as stenosis of the meatus. Debridement is frequently indicated if OE is highly severe or if there is a high level of otorrhea. This procedure is usually undertaken by an ENT specialist utilizing the operating microscope and suction equipment. For otomycosis, debridement is a key component in treatment.

Abscess formation within the external auditory meatus is unusual but may result from infection with *S. aureus*. The abscess can be treated straightforwardly by incising the lesion and draining it. Typically, an ENT surgeon uses a small bladed scalpel or needle to achieve this [8].

### 14.6.3 Complications

**Although complications seldom occur, potential complicating factors include the following [8]**

- Malignant OE, development of which heralds an emergency
- Mastoiditis
- Inflammation of the collagenous tissue in the pinna, by extension, especially in individuals whose ears have recently undergone piercing
- Osteomyelitis of the basal skull, causing osseous erosion [13]
- Invasion of the brain or spinal cord
- Cellulitis or lymphadenitis

Diabetic patients with these complications frequently also have diabetic ketoacidosis.

Herpes zoster may resemble OE at the start, with blisters erupting 1 or 2 days later. An infrequently occurring complication of herpes zoster is the Ramsay Hunt syndrome, in which patients develop a one-sided palsy of the seventh cranial nerve peripherally. Patients with herpes zoster should be informed about this potential complication and be instructed to consult a physician if symptoms develop [14].

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