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REVIEW

Management of otitis externa

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Otitis externa is commonly encountered both in otolaryngological practice and in primary healthcare. It can range in severity from a very mild infection to a life-threatening infection in the form of malignant otitis externa in immunocompromised patients. Sound knowledge of the microbiology and pathophysiology is important for the correct management of otitis externa. This article discusses the anatomy, epidemiology, aetiology and treatment of otitis externa.

Keywords: acute/chronic otitis externa, necrotising otitis externa, eczematous otitis externa, furunculosis

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Definition

Otitis externa is defined as inflammation of the external auditory canal and may extend beyond the ear canal to involve the pinna and surrounding soft tissue. A number of subtypes can be distinguished (Table I)[1] based on patients' signs, symptoms, clinical history and time course of the disease.

Table I: Subtypes and synonyms for otitis externa

Subtype of otitis externa	Synonyms for the subtype
Acute generalised otitis externa	Acute diffuse otitis externa; swimmer's ear; fungal otitis externa (otomycosis) should also be considered
Acute focal otitis externa	Furunculosis
Chronic otitis externa	Eczematous otitis externa
Necrotising otitis externa	Malignant otitis externa; progressive necrotising otitis; invasive external otitis; skull base osteomyelitis
Herpetic otitis externa	
Radiation-associated otitis externa	

Anatomy and physiology

The external auditory canal (ear canal) is divided into a lateral cartilaginous portion which forms the outer third, and a medial bony portion which forms the inner two thirds of the canal. The canal is approximately 2.5 cm long with a diameter of 5–9 mm. The skin of the cartilaginous canal contains hair follicles, sebaceous glands and apocrine ceruminous glands which form cerumen (wax). The floor of the cartilaginous canal contains the connective-tissue clefts, called the fissures of Santorini, along which infection can spread to the parotid gland, infratemporal fossa and skull base. The skin of the bony canal is much thinner, more firmly bound to the periosteum and, hence, is more sensitive to touch than the cartilaginous portion.

The ear canal is normally colonised by bacteria, principally *Staphylococcus*, *Corynebacterium* species and streptococci.[2] Fortunately, the external ear canal has a few natural defences which prevent infection. The pH of the external ear canal is in the acidic range of 5–5.7.[3] Cerumen is hygrophobic, thereby preventing water from penetrating the skin and causing maceration, and it also contains lysozymes that inhibit fungal and bacterial growth.[3] While cerumen prevents infection, when it becomes too excessive it causes wax impaction leading to retention of debris and infection. The epithelium of the ear canal has unique migratory properties which enables it to carry debris out of the ear canal.[4] A number of factors affect the natural defence mechanisms and predisposes individuals to otitis externa (Table II).[5]

Table II: Predisposing factors for otitis externa[5]

Anatomic factors causing canal obstruction	Stenosis of ear canal; exostoses
Skin diseases	Eczema; psoriasis; seborrhoea; dermatoses of external ear canal
Environmental factors	High humidity of ambient air
Trauma	Cotton earbuds; cerumen removal; hearing aids; earplugs; foreign bodies
Systemic diseases	Diabetes mellitus; immunosuppression (e.g. HIV); chemotherapy
Other factors	Water in ear canal; swimming; irritants (e.g. soap, shampoo); radiation; purulent otitis media; prior surgery of ear canal

Most causative organisms are bacterial of which *Pseudomonas Aeruginosa* is the most common (11–63%), followed by *Staphylococcus Aureus* (11–34%).[2,3,6] Acute focal otitis externa (furunculosis) is caused by *Staphylococcus Aureus*.[6] Fungi are more common in chronic otitis externa, with *Aspergillus* accounting for 60–90% and *Candida* species for 10–40%.[7,8] Predisposing factors for fungal otitis externa include immunosuppression and diabetes mellitus.

Diagnosis

Typical presenting symptoms are pain, otorrhoea and a sensation of blockage caused by oedema of the ear canal.[5] The pain is quite severe and is caused by irritation of the periosteum of the

bony ear canal.[5] Tenderness when moving the tragus or pinna is a classic symptom. Erythema and induration can spread to the surrounding skin in more severe cases.[5]

Furunculosis is easily diagnosed by noting a circumscribed swelling of the outer cartilaginous portion of the ear canal which contains the ceruminous glands and hair follicles involved in the process of infection.

Eczematous and chronic generalised otitis externa typically has itchiness as a key symptom. With chronic otitis externa, symptoms usually last for three months or longer.[5]

Necrotising otitis externa usually occurs in diabetic or immunocompromised patients and is characterised by pain which is refractory to routine analgesia and is typically worse at night.[5] Clinical findings include granulation tissue in the external auditory canal, especially at the bony-cartilaginous junction. Extension of the infection beyond the auditory canal can cause lymphadenopathy, trismus and facial nerve and other cranial nerve palsies.

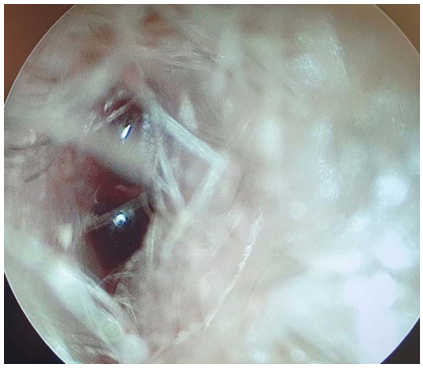

Figure 1: Diabetic patient with necrotising otitis externa of the left ear canal showing extensive oedema and granulation tissue

Otitis externa is diagnosed based on history and examination with the typical signs mentioned above. Mild fever may be present, but fever > 38 °C indicates that the infection has spread beyond the ear canal.[5] The pinna, surrounding lymph nodes and skin should also be examined. The diagnosis is classically confirmed by pain induced either by pressure on the tragus or by manipulation of the pinna. An aural discharge may be present and this may be swabbed for microscopy, culture and pathogen sensitivity testing. Otoscopic or otomicroscopic examination of the ear canal with visualisation of the tympanic membrane is important. It is crucial to determine the integrity of the tympanic membrane and to exclude underlying middle ear disease. Occasionally, patients may present with erythema and induration of the postauricular region which may mimic mastoiditis. Tuning fork tests may reveal conductive hearing loss if the ear canal is completely obstructed.

A high index of suspicion for necrotising otitis externa is required in patients with diabetes mellitus or in immunocompromised patients who present with intractable pain, often worse at night. The presence of a fever of > 38°C, granulation tissue in the ear canal or cranial nerve fallout (7 and 9 to 12) warrants urgent referral to an otorhinolaryngology service.

Treatment of uncomplicated otitis externa

The treatment of uncomplicated acute otitis externa consists of cleaning the ear canal, applying topical antiseptic or antimicrobial treatment and providing adequate analgesia.[5]

Topical treatment

Regardless of the topical agent which is used, 65–90% of patients improve clinically within 7–10 days.[9] In a Cochrane meta-analysis of randomised controlled trials, antiseptic agents and antibiotics were equally effective.[10] In addition, no difference was found between using single agents or a combinations of agents, with or without additional corticosteroids.[10] There is some evidence that ototopical acetic acid may require two additional days to resolve the symptoms compared to other agents and it is less effective if required for more than seven days.[11]

The correct administration of ototopicals is important. The patient should lie down with the affected ear facing upward and remain in that position for about five minutes after the topical therapy is administered. Water precautions should be advised for 10–14 days. Patients should be discouraged from cleaning their ears with cotton earbuds as this causes microtrauma.

A limited number of topical preparations to treat otitis externa are available in South Africa (Table III).

In cases where there is extensive oedema of the ear canal, it may be necessary to insert a wick or packing in the ear canal so that topical agents can reach the deeper canal skin. Drops should be applied to the wick three times daily. While topical steroids is often used in these cases to reduce oedema and inflammation, only a few randomised control trials have shown a benefit.[12-14] The ear canal should be re-examined and cleaned every 2–5 days until the oedema has resolved and the wick can be removed.

Traditionally (and even today), a gauze wick soaked with ***ichthammol and glycerine*** can also be inserted into the ear canal in cases of severe oedema. Ichthammol has an antiseptic (antistaphyloccal) action while glycerine has hygroscopic properties.[15,16] While some randomised control trials reported a statistically significant improvement in pain when using a topical antibiotic combined with steroid compared to 10% ichthammol and glycerine packing, a study by Hornigold et al. failed to find any significant difference.[17-19]

Quadriderm is a dermatological preparation which contains Gentamicin Topical, Clioquinol Topical, Betamethasone Topical and Tolnaftate Topical. It is often used at our institution as empiric treatment or when a causative organism cannot be identified. It works well where an underlying dermatosis is present and is also used with ribbon gauze as an ear pack when there is extensive oedema of the ear canal.

Aural toilet

Acute otitis externa is often associated with copious debris as well as discharge material in the ear canal which can obstruct the ear canal (in addition to the oedema), thereby rendering topical therapy ineffective. Consensus guidelines by the American

Table III: Topical preparations to treat otitis externa available in South Africa

Approved and licensed in South Africa (not available in state hospitals)	***Cilodex, Xindex:*** Ciprofloxacin and dexamethasone 0.3%/0.1%
Not licensed for ears but available in state service (specialists only)	***Ofloxacin 0.3% eye drops:*** Though unlicensed for ears, it is often prescribed together with prednisolone acetate 1% for Pred Forte drops ***Quadriderm ointment:*** active ingredients include Gentamicin Topical, Clioquinol Topical, Betamethasone Topical and Tolnaftate Topical
On essential drug list (available for non-specialist use)	***Acetic acid 2%*** ***Glycerine and ichthammol (G&I)***

Academy of Otolaryngology recommend that debris be removed to achieve effectiveness of topical antibiotics.[5,10]

Aural toilet is usually not done in the primary healthcare setting and is only important with an extensive volume of debris which impedes topical therapy reaching the skin of the ear canal. Atraumatic cleansing of the ear canal consists of suctioning exudate from the ear canal, ideally by an otolaryngologist under microscopic vision. The tympanic membrane should be examined if possible to exclude an underlying perforation.[5] Lavage should be avoided especially where the integrity of the tympanic membrane cannot be verified (due to debris or oedema) or in patients with diabetes (due to a risk of necrotising otitis externa).[5]

Systemic antibiotics

Systemic antibiotics have not been shown to be more effective compared to topical agents alone with treatment of uncomplicated otitis externa. These antibiotics also increase the risk of systemic side effects and encourage generation of resistant organisms.[2,20]

Systemic antibiotics should be used when infection has spread beyond the ear canal causing surrounding cellulitis or in patients who are diabetic, immunocompromised or who have had previous radiotherapy.[5] In such cases, a pus swab should be taken and empiric systemic antibiotics that are effective against *Pseudomonas Aeruginosa* and *Staphylococcus Aureus* should be given until it can be tailored to the results of the culture and sensitivities. Such patients should urgently be referred to an otolaryngologist for further treatment.

With localised otitis externa, or furunculosis, oral antibiotics can be prescribed in addition to insertion of a wick or ribbon gauze soaked with antibiotic drops. The causative organism is often *Staphylococcus Aureus*.[6] When an abscess has formed it is necessary to drain it.

Most patients will show symptomatic improvement after 24 hours of treatment. If there is no improvement within 48–72 hours, first evaluate for compliance and patency of the ear canal and if these are present but symptoms worsen or persist, then referral to an otolaryngologist is necessary. As a general rule topical therapy should be administered for 7–10 days.[5]

Figure 2: Otitis externa which has extended beyond ear canal

Treatment of chronic otitis externa including eczematous otitis externa

Chronic otitis externa presents mainly with itching in the ear canal and/or aural discharge, and severe pain is rare.[21] The diagnosis is made when these symptoms are present for more than three months. There are two main clinical forms: (i) a scaly, dry ear canal with hypertrophic tissues; or (ii) a moist, oedematous and erythematous ear canal.[21,22] Chronic otitis externa can have many aetiologies: idiopathic or autoimmune diseases with systemic involvement such as amyloidosis, sarcoidosis or granulomatosis with polyangiitis; localised infections of the external ear (e.g. fungal otitis externa or unresolved bacterial otitis externa); or the presence of an underlying skin disease (like atopic dermatitis or psoriasis) where both ears can be affected.[21,22] Active middle ear disease with frequent discharge can also cause chronic otitis externa.[21,22] Itching can cause patients to manipulate the ear canal causing excoriation, leading to acute inflammation. Recurrent episodes then causes progressive fibrosis and narrowing of the ear canal.[22]

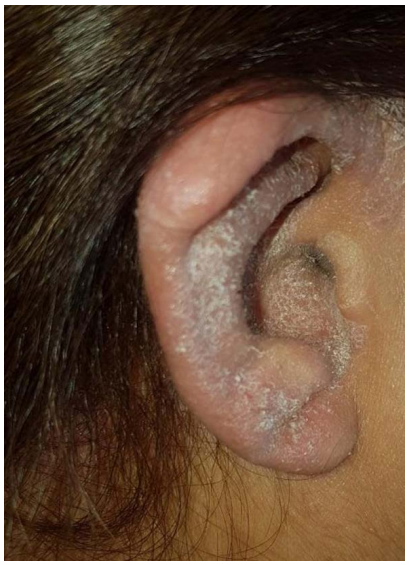

Figure 3: Psoriasis affecting the pinna and ear canal causing otitis externa

Figure 4: Chronic otitis externa with moist oedematous ear canal

Figure 5: Chronic otits externa with otomycosis. Fungal hyphae can be seen on otoscopy

The goals of treatment are to address the underlying cause and to suppress any chronic inflammatory process. All potential irritants (e.g. soap and shampoo) should be kept away from the ear canal and it should be kept dry. Any underlying systemic disease should be treated. Swabbing for culture to exclude underlying bacterial or fungal infection is recommended. With acute exacerbations, topical antibacterial or antifungal treatment may be required. At our institution, *Quadriderm* has been used very effectively as empiric treatment for acute exacerbations. If there is an underlying systemic dermatosis, then referral to a dermatologist is required. Surgical canalplasty may be indicated to widen the ear canal if it is stenotic.

Otolaryngology referral

Patients who require insertion of a wick for oedema of the ear canal or who require cleaning of the ear canal require referral. Patients with predisposing risk factors for necrotising otitis externa (e.g. diabetes, HIV or chemotherapy), in whom infection has spread beyond the ear canal or patients who has have intractable pain, require urgent referral to an otolaryngological service.

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