

# Swimmer's Ear: An Ear Canal Infection

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Exposure to excess moisture can cause several types of skin problems. The most prevalent aquatic dermatosis is a condition known as external otitis, or swimmer's ear. Swimmer's ear can be extremely uncomfortable.<sup>1</sup> Until it resolves, the patient must refrain from further aquatic activities. Fortunately, it is a relatively minor otic condition that can be prevented by following simple measures.

## Physiology

The external ear canal is a closed pouch with an inner lining of stratified squamous epithelium. The thickness of the epithelial barrier is not uniform. Toward the outer third of the ear, the lining is thick and supported by a base of cartilage. This is the location for hair follicles and the cerumen glands. (Cerumen performs a protective function against damage to the outer ear canal.) In the inner two thirds of the canal, the epithelium is much thinner and rests on periosteal bone.

## Etiology

Four primary etiologic factors influence the occurrence of swimmer's ear.

### **Presence of Moisture:**

In most cases, normal exposure to water during bathing or showering does not cause an otic condition. When water enters the acoustic meatus, it usually drains spontaneously as a result of routine movements of the head.<sup>2</sup> Any residual water evaporates quickly since body temperature keeps the ear canals warm. Thus, transient exposure to water is harmless.

### **Duration of Exposure:**

A second major determinant for contracting swimmer's ear is the duration of exposure to moisture. Should sufficient moisture be trapped in the ear for a sufficient period, swimmer's ear is almost a certainty. When water enters the terminal two thirds of the canal, it cannot be easily removed. Sustained exposure to moisture allows maceration and destruction of the thinner epithelium of the inner otic canal. Spending prolonged time underwater (e.g., underwater swimming, deep sea diving, synchronized swimming or scuba diving) is causal, and may explain why external otitis is five times more common in swimmers than in those who do not swim.<sup>1</sup> In addition, chlorine accelerates keratin degradation, increasing the risk of swimmer's ear while swimming in a pool as opposed to swimming in lakes, ponds, or the ocean.<sup>2</sup>

**Infection:** A third determinant is infection by microorganisms. When ears are wetted but the water is sterile, swimmer's ear does not occur. When sports and other activities and recreation occur in contaminated water (e.g., pools, ponds, or lakes), microorganisms enter the ear.<sup>3</sup> However, this does not invariably lead to swimmer's ear because retention leading to maceration must also occur, as previously mentioned. Once protective keratin cells are lost or damaged, underlying living cells are susceptible to attack by pathogens.

**Temperature:** A final contributing factor is the temperature of the ear canal. The temperature is close to that of core body temperature, and is conducive to the rapid growth of microorganisms.<sup>1</sup>

## Risk Factors

Minor injury may also be a part of the picture. The onset of swimmer's ear brings problems such as inflammation and pruritus of the otic canal. Attempts to relieve the intense itching through scratching with the fingernails or a rigid object can further abrade tissues and carry organisms into the wound. In a landmark 1974 study, investigators discovered that initial invaders were Gram-positive, with a gradual evolution to Gram-negative predominance.<sup>4</sup> The end result of the sequence leading to infection is a localized or diffuse skin infection, similar to furunculosis or cellulitis, which occurs as a result of the infection dissecting into the cartilaginous section of the anterior ear canal.<sup>2</sup>

The risk also rises when a person has any problem that leads to moisture retention in the ear canal, such as tortuous or abnormally narrow otic canals, or bony growths that partially occlude the canal lumen. Scales produced in the ear canal from any of several dermatoses can retard moisture evaporation and enhance retention. These could include seborrheic dermatitis, psoriasis, eczema, contact dermatitis, or neurodermatitis.<sup>1,2</sup> If the person has a partial cerumen impaction, it is possible that water could become trapped between the impaction and the tympanic membrane. As the impaction is exposed to water, it may absorb moisture and expand, completely occluding the otic canal. The water trapped behind the impaction would increase the risk of swimmer's ear. However, total cerumen removal is counter-productive, as the ear canal requires the lubrication cerumen provides.

Changes in otic pH may increase the risk of swimmer's ear. The normal pH is 4.5, which helps inhibit the growth of microorganisms.<sup>1</sup> However, any time the pH changes from acidic to basic, the ear loses this natural protection. A pH change can occur when there is debris present, when the ear is syringed with water, or when the ear canal is washed with soap.

Caucasians are more prone to develop swimmer's ear than Asians.<sup>5</sup> This is because the ear canal in Caucasians is narrower and has a more pronounced S-shape than the ear canal in Asians.<sup>5</sup> Both of these factors favor moisture retention. Those who are genetically prone to produce large amounts of cerumen also have a greater risk of swimmer's ear, since the risk of impaction is increased.<sup>6</sup>

Misguided otic cleaning efforts can also predispose a patient to swimmer's ear. When the ear is functioning properly, the upper layer of dead cells migrates outward. Insertion of rigid or semirigid objects (e.g., cotton swabs) into the ear canal can disrupt this normal self-cleaning mechanism of the ear. The keratinized skin layer can turn back upon itself, with shed cells being carried toward the tympanic membrane rather than toward the outer ear opening.<sup>6</sup> Doubling of the depth of the keratinized layer decreases the bore of the otic canal and favors moisture retention.

## Symptomatology

Manifestations of swimmer's ear may occur shortly after the aquatic activity or several days later.<sup>1</sup> The patient initially notices a full and wet feeling in the ear. Pain, pruritus, and swelling begin. The pain may be worse when the patient moves his or her jaw from side to side or puts pressure on the external ear. Pain can be intense since the skin overlying the bone in the proximal outer ear canal lacks subcutaneous tissue and is closely bound to the periosteum.<sup>6</sup> Even a slight inflammation can produce extreme discomfort.

An otic exudate may begin to appear, the consistency varying from thin to thick. A thickish consistency may indicate the presence of a fungal infection.<sup>5</sup> The exudate may also produce dermatitis on the facial area proximal to the ear opening.

Hearing may be compromised as a result of accumulated debris in the ear. In the rare situation in which the tympanic membrane has been perforated (either accidentally or through the insertion of tympanostomy tubes), the infection may extend to the middle ear. The patient also experiences fever and enlarged cervical lymph glands.

## Prevention

As with all medical conditions, prevention is preferable to treatment. Many suggested interventions focus on drying the ear directly after exposure to water. For instance, after diving or swimming, a patient may try to gently dry the ear canal, followed by application of a thin layer of mineral oil.<sup>2</sup> Shaking the head sharply or jumping up and down with the head cocked to the side may force excess fluid out. Blowing air into the ear with a blow dryer or a hand fan can be helpful also.

One editorial advises gently clearing the auditory canal of skin scales or cerumen plugs that would facilitate moisture retention.<sup>2</sup> However, removal must not be so vigorous as to damage the epithelial tissues. It may also be helpful to coat the outer ear canal with a substance that could prevent water from contacting the tissues, thereby preventing maceration. Ear plugs coated with petrolatum may accomplish this goal.<sup>2</sup> However, if too much petrolatum enters the ear, it can turn into a retention matrix for debris and moisture. Furthermore, if plugs exert sufficient pressure on the otic canal, thus making it water-tight, they may also be causing ischemia of the ear canal lining. They may also push cerumen ahead of them, increasing the risk of impaction.

Attempts to remove cerumen from the outer ear canal inward should be avoided. Cotton-tipped applicators are widely thought to be safe and effective in removing cerumen, but are not.<sup>1</sup> In fact, they force cerumen deeper into the canal and can damage the canal's delicate lining, increasing the risk of swimmer's ear.

## Treatment

No nonprescription product has been found to be safe and effective for swimmer's ear at this time. However, the physician has several therapeutic choices. Alcohol is a desiccating agent which may help dry water in the ear if used as an otic drop. Acetic acid can help return the pH to one less favorable for the proliferation of microorganisms. One prescription otic drop combines 2% acetic acid with hydrocortisone 1%.

Antibiotic otic drops become useful when the patient progresses to the exudative phase. If a cellulitis has started, oral antibiotic therapy is also required. Oral analgesics help pain, and corticosteroids reduce associated inflammation and swelling.

Moisture retention in the ear canal is one of the etiological factors in swimmer's ear. The duration of contact with water is a major determining factor. The longer a sufficient amount of water is trapped in the ear, the greater the chances of developing swimmer's ear.

Occasionally, impacted cerumen might increase the risk of swimmer's ear. A cerumen impaction is most likely due to improper methods of ear cleansing, such as insertion of cotton-tipped applicators, pens, etc. The patient may notice a feeling of fullness in the ear, partial hearing loss, or a popping sound when chewing. The problem may be remedied by use of several nonprescription products containing carbamide peroxide. The patient should be instructed to follow all directions on the label, including the gentle use of an otic syringe, to remove the impaction. However, if the patient notices a discharge, has a perforated eardrum, or has recurrent outer ear infections, a doctor should remove the earwax using a blunt instrument, an instrument with a loop on the end, or a vacuum device to prevent further damage.

## PATIENT INFORMATION

Your ear has several sections. The eardrum separates the outer ear canal from the inner ear. The outer ear canal contains hair follicles and glands that produce earwax. It has a slight S-shape in most people. This outer ear is normally relatively free of organisms. However, there are times you can develop a bacterial infection of the outer ear. Swimmer's ear is one such infection. It occurs when your ear is exposed to moisture for a prolonged period. Activities such as deep sea diving, underwater swimming, synchronized swimming, or scuba diving can lead to swimmer's ear.

**Prevention:** General advice for caring for the ears can help prevent swimmer's ear. You should never attempt to remove earwax by using methods that could be dangerous. The somewhat oily nature of earwax has a protective function in helping keep the inner skin of the ear lubricated. If you constantly try to remove all of the earwax, it strips the skin of its protective oily barrier. You also may cause damage to the skin by injuring it when you remove earwax with rigid objects such as toothpicks, paper clips, pencils, and pens.

When you bathe or shower, you should only cleanse the outer ear by using a washcloth. You should not insert cotton swabs in the ear canal. They seem to work because they become discolored with a small amount of earwax, but the majority of the wax is pushed more deeply into the ear, where it can cause a plug known as an impaction.

It is important to try to remove water gently from the ears after swimming or diving. You might try to tilt the head to the side and jump up and down sharply to force water from the ear. Shaking the head vigorously may achieve the same objective. Fanning or blow drying the ear canal may help.

**Symptoms:** You can recognize swimmer's ear by the extreme discomfort it causes. You may notice that your ear feels full or clogged and that your hearing has been somewhat impaired. You may experience itching or pain. If pain is present, it may be worse when you place pressure around the outer ear or pull the ear lobe. In addition, a malodorous discharge may come from the ear.

**Treatment:** To prevent further damage, resist any inclination to scratch the ear canal. Make an appointment with a physician. He or she may use one of several therapies. An ear drop can kill the microorganisms causing the infection. You may be given a prescription for an oral antibiotic or antibacterial product, as well as an analgesic for the pain. A steroid may also be prescribed to help decrease swelling.

You or a child may have had ear tubes inserted to prevent ear infections. These tubes create an artificial hole in the eardrum to equalize pressure; however, this opening also allows water to enter the middle ear while swimming. You should discuss underwater activities with the physician who placed the tubes prior to beginning the activity. You may be advised to use any of several methods to prevent water from entering the ear.

Remember, if you have questions, Consult Your Pharmacist.

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