

## **Earwax and Ear Canal Infections**

### **Structure and Function of the External Ear Canal**

The external ear canal is a unique structure in the human body. It is a tube, at the bottom of which is the eardrum or tympanic membrane. Most cavities that are this deep are wet and lined by a specialized type of skin that always stays wet, just as the lining of your mouth is wet all the time. These wet cavities, however, are constantly cleansed by the fluids they create and by the movement of food, fluids, or air through them. The ear canal is blind-ended so nothing can pass through it to keep it clean, and it must stay open all the time to allow sound to pass freely through the tympanic membrane. If it were wet all the time, it would likely get infected. The ear canal is lined by dry skin, just like the skin that covers the rest of the body, and has a special way of cleaning itself that involves migration of the skin lining from a point at the center of the eardrum all the way to the outer portion of the ear canal.

Over the course of our lifetimes, we shed about 90 pounds of skin, most of which gets washed away in the shower. The ear canal is not easily cleaned from the outside, so we depend on this system of epithelial migration to clear the sloughed skin layers. If the eardrum did not clean itself out, the outer layers of the skin, which are constantly peeling off, would accumulate in the ear canal and block it, making the ear useless for hearing. If we take a spot of India ink and put it on the center of the eardrum and come back three weeks later to look at it, the spot of ink will have broken apart and moved to the edges of the eardrum, appearing somewhat like the numbers on a watch face. Three weeks later, there would be no ink left on the eardrum. All the ink will have migrated out onto the ear canal walls, and within a few months, all of the ink will have left the ear canal altogether. This migration of epithelium is not unlike the migration of our fingernails across our nail beds. The mechanism of migration is poorly understood.

### **How the Ear Canal Cleans Itself**

In some individuals, the system of epithelial migration is disrupted, and the sloughing skin layers may not clean out. The ear canal may slowly fill with skin (keratin) which will continue to accumulate, causing pressure to build up in the ear canal. This causes the bone around the ear canal to erode under the pressure of the expanding mass of keratin. This problem is not uncommon after radiation therapy for brain problems in which the radiation must pass through the outer ear. These patients must come to the office of an ear, nose, and throat physician to have accumulating skin removed, not only to prevent further erosion of bone, but to prevent infection and maintain hearing.

The skin of the ear canal is very thin, especially in the medial 2/3 of the canal, which is made of bone. This is, in fact, the very closest the outside air or water can get to bone anywhere on the body. Most all bone has a specialized skin of its own called periosteum which is capable of producing new bone during growth and healing. When cold air or water continually gets in the ear canal, the periosteum under the very thin skin of the ear canal becomes refrigerated. This

causes the capillaries in the periosteum to dilate and a refrigeration periostitis develops, causing extra bone to be formed. An experienced ear doctor can generally tell by examining the ear whether a patient has spent a lot of time in the water in their lifetime because of the way the bone has grown in the canal. If the bony walls of the canal grow so much that there is only a small space between the opposing walls, it is easy for skin or water to get trapped between the walls and for infection to occur. This is a common problem among divers and surfers. When infections become too frequent, or hearing loss results, the ear canal must be drilled open again in an operative procedure called canalplasty. The medical term for the excess bone growth in the ears, in this group of patients is called **exostosis**.

### **Earwax**

What is commonly known as **ear wax** is a mixture of cerumen and skin. Cerumen glands are at the bottom hair follicles, which are only found in the outer third of the ear canal. Cerumen formed in these glands is essential for the normal health of the ear. This cerumen melts and forms a coating all over the skin of the ear canal, even deep inside over the drumhead. This protects the ear canal skin from getting wet and boggy, just the way the wax of a paper cup protects the paper becoming saturated. Because of this, water that enters the ear canal will bead up rather than soak into the skin and can roll back out of the ear canal. If the wax gets washed out of the ear because of frequent swimming, showering, or excessive use of wax-removing drops, the skin of the ear may become moist bacteria that are always present in the ear canal may flourish, causing an infection. This is what a painful swimmer's ear is. Swimmer's ear is also commonly known as **otitis externa** (see below).

Cerumen also helps to prevent infection in the ear by inhibiting the growth of both bacteria and fungus with its slightly acidic pH. The wax in the ear canal may be dry or wet, yellow, brown, or black. The wax that builds up in the ear canal is usually a mixture of the skin migrating out of the canal and the cerumen forming in the cerumen glands of the outer part of the canal. Normally, this wax will come out of the ear canal on its own, but as we age, the ear wax tends to become more dry and stiff and may tend to pile up in the ear canal rather than flow out of it on the conveyor belt of migrating skin. It should only be removed if it is becoming bothersome from a comfort standpoint, is blocking sound getting into the ear, or is preventing inspection of an ear. Often, softening the wax is all that is necessary to allow the ear to clean itself naturally. There are many products on the market to soften wax and they work in different ways. Some work by wetting the skin flakes imbedded in the ear wax which causes them to swell and to break the plug of hardened ear wax apart. Simple water will do this quite well but will leave the ear canal wet and prone to infection. Wetting the skin with peroxide both breaks up the wax plug and sterilizes the canal so that a secondary infection is avoided. Simple oil, such as baby oil or mineral oil, can often be used successfully to soften the cerumen portion of the plug, and if used just a few times a year, can prevent repeated visits to the doctor's office to have

occluding ear wax removed. Filling the ear canals with baby oil on the 1<sup>st</sup> day of every season can soften wax enough to prevent problems in many individuals.

Oil or peroxide-based drops should only be used if the eardrum is intact. Oil or peroxide that passes through a hole in the eardrum (or tympanostomy tube) will cause pain and may cause infection.

In many cases, attempts to use cotton-tipped swabs to clean the ear has the unintended effect of pushing the wax deep into the ear canal against the eardrum. When this occurs, it may be difficult to clean wax from the canal using conventional methods such as a wax curette or flushing the ear canal and the wax must be carefully removed by an experienced ear physician using a microscope designed for ear work.

### **Otitis Externa**

Otitis externa is an inflammation of the ear canal. This is the outer part of the ear that ends at the level of the eardrum. This should not be confused with a middle ear infection (otitis media) that occurs behind the eardrum. Otitis externa is almost always accompanied by pain or itching that is made worse by moving the outer ear. This condition is almost always caused by a bacteria called pseudomonas and can usually be successfully treated with antibiotic ear drops. In swimmer's ear, the ear canal never has a chance to dry out. Bacteria that normally colonize the external canal flourish in the moist environment, causing pain, drainage, and swelling. The ear canal skin can become so inflamed that the swollen walls of the canal collapse on themselves, making it difficult for antibiotic drops to get in. In these cases, it may be necessary to put a wick in through the swollen canal to draw the antibiotics into where they can do their work. In these cases, oral antibiotics may also be helpful.

People who spend a lot of time in the water and who are prone to otitis externa can prevent infections by using ear drops made of alcohol and vinegar after swimming. This acidifies and dries the canal and prevents excessive growth of bacteria.

Otitis externa can also occur if skin and wax accumulate in the ear canal and get wet. The debris in the ear canal traps the moisture and creates a breeding ground for bacteria. Although the infection will generally settle down with antibiotic drops, it may recur if the ear canal is not thoroughly cleaned of debris.

### **Fungal Otitis Externa**

In some cases, the ear canal can become colonized with yeast or mold. The general symptoms are itching and clear drainage. Most patients try antibiotic drops without success because the antibiotic has no activity against fungi. The problem is often cleared up with drops that have particular activity against fungi. In others, recurrent visits for meticulous cleaning and treatment of the ear canal are necessary to eradicate the infection.

Patients generally develop fungal otitis externa because the ear canal becomes chronically moist. Treatments may be ineffective if the cause of the excess moisture cannot be identified and controlled. Three common culprits are

a hole in the eardrum, dermatitis at the outer end of the ear canal, and hearing aid use. A hole in the eardrum allows humidity to evaporate from the moist middle ear. The increased humidity in the ear canal creates a perfect environment for yeast or fungi to flourish. Dermatitis may cause cracking and oozing of the skin that can similarly humidify the ear canal.

Both of these causes may be made worse by hearing aids which block the ear canal and trap more moisture. In many cases, fungal otitis externa will recur quickly unless these sources of humidity are treated. Some patients with hearing loss wear their hearing aids 18 hours a day. They accumulate moisture in their blocked ear canals and can become colonized with yeast. Effectively treating the ears may involve removing the hearing aid for a part of the day to allow the canal to dry in addition to treatments in the office. Hearing molds sometimes have to be modified with vents and treatment sometimes has to be modified to the use of only dry antifungal powders or acidifying powders and meticulous ear cleanings to be effective.