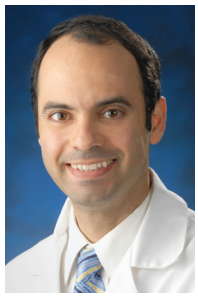


Symptoms: Pain and Drainage

By Hamid R. Djalilian, MD

A 60-year-old woman comes to the office with a complaint of persistent pain and drainage from the ear for the past six months. She has difficulty hearing from that ear but no dizziness or tinnitus, she says.

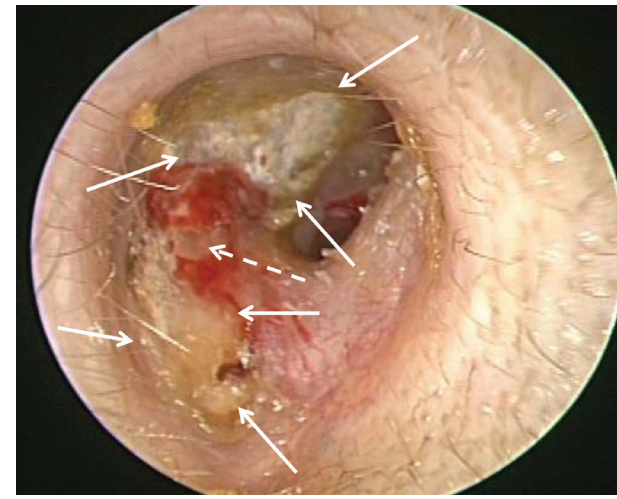
The problem started a few years ago with plugging in the ear, the patient reports. She had a myringotomy and tube placement.

After that, she experienced a persistent perforation of the tympanic membrane, which required a tympanoplasty, and has had pain and drainage ever since. Her medical history is significant for mild hypertension and hypercholesterolemia.

The patient's otoscopic examination is shown on the right.

What is your diagnosis? See p. 26.

Dr. Djalilian is director of neurotology and skull base surgery and associate professor of otolaryngology and biomedical engineering at the University of California, Irvine.



Otoscopic examination of the patient's right ear showed two areas of necrotic bone, outlined by arrows. The skin of the ear canal has granulation, highlighted by the dashed arrow, and is unhealthy.

Diagnosis: Exposed Bone in Canal

By Hamid R. Djalilian, MD

Continued from p. 24

Otoscopic examination of the patient demonstrates areas of the bony ear canal that lack skin coverage. These areas will be hard on palpation, as they are associated with devitalized bone.

The bone of the ear canal primarily obtains its blood supply through the periosteum (covering of the bone). The secondary blood source comes from adjacent areas through very small blood vessels that penetrate the bone.

When there is a significant disruption of the blood supply and an area of bone dies, overlying skin is lost.

While this problem sometimes develops spontaneously, exposed bone in the ear canal generally is not a good sign. A possible cause is the loss of blood flow to the ear canal bone as an effect of radiation.

This condition, called osteoradionecrosis, generally is considered a result of the radiation alone or the performance of ear surgery in a patient who previously was irradiated.

The type of radiation associated with osteoradionecrosis generally is used for head and neck cancer or intracranial tumors, and it usually is given at a relatively high dose.

Several years after radiation therapy, there is a loss of the small perforating arteries that supply blood to the ear canal bone, which leads to the disappearance of the bone in that area and, subsequently, a loss of the overlying skin. Once the skin is lost, the dead bone becomes visible on examination.

Loss of bone also can occur after any type of surgical trauma that compromises the vasculature of the ear canal. Therefore, it is critical for otologic surgery to be as minimally invasive and atraumatic as possible when performed on patients with previous head and neck radiation therapy.

The surgeon needs to obtain the radiation maps that the radiation therapists used during treatment to know exactly how much radiation reached different parts of the ear canal. Uncovering the skin in the areas that had the most radiation should be avoided as much as possible.

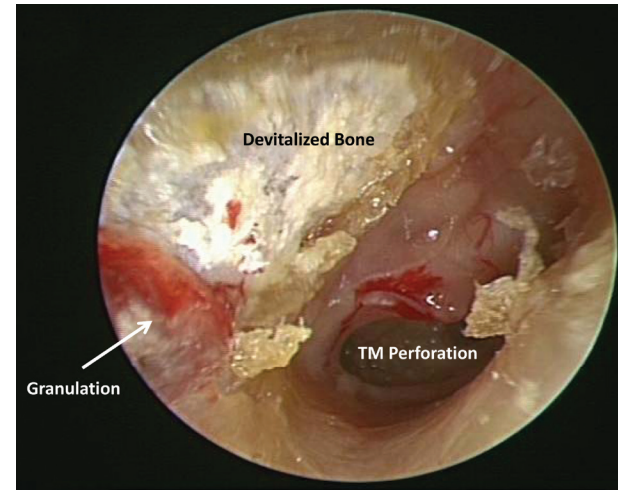
Another condition in which dead bone is seen on patient examination is canal cholesteatoma. Such patients have erosion of the ear canal and destruction of ear canal bone.

Pieces of dead bone, called sequestrum, are seen floating in the ear canal. Usually, these areas of bone are removable and not fixed, unlike the dead bone seen in osteoradionecrosis.

POSTSURGICAL LOSS OF BLOOD SUPPLY

In this patient, the visible areas of bone were caused by a loss of blood supply to the ear canal after surgery. When performing surgery on the ear canal, one must take ultimate care to prevent injury to the canal skin.

Despite one's best efforts, though, there generally is an elastic retraction of ear canal skin when an incision is made in the ear canal, leading to small gaps in coverage over the bone.



A deeper view of the same patient's ear canal demonstrates a tympanic membrane perforation.

Since that ear canal skin is lifted with the underlying periosteum, these areas of bone will lose their periosteal blood supply until the skin and periosteum regenerate. During this time, the perforating arterioles supply blood from the surrounding bone to the ear canal.

The otologic drill generally rotates at a speed of 80,000 RPM, generating significant heat. The surgeon must use constant irrigation to cool down the bone and prevent damage.

If irrigation is not done properly, heating and burning of the bone can occur. The generated heat can cause a loss of the perforating arterioles that feed the bone, resulting in the disappearance of the bone itself.

In the presence of devitalized bone, the skin and periosteum do not grow back, leaving the dead bone exposed in the ear canal. This exposed bone causes problems with recurrent infections and debris collection.

Normally, the skin of the ear canal slowly transports the overlying dead skin layer (keratin) and cerumen outward. Areas of exposed devitalized bone disrupt the flow of keratin and cerumen, and the keratin accumulates over these areas, causing obstruction.

The patient has to be very careful to prevent water exposure in the ear canal, which is a significant challenge for those wearing molded hearing aids.

Treatment of postsurgical exposed bone involves the removal of the dead bone down to normal bleeding bone. Skin or a fascia flap can provide full coverage and restoration of the normal ear canal contour.

Occasionally, skin grafting of the ear canal can help if much of the canal skin is missing. Grafting has to be performed after the devitalized bone is removed.