



Symptom: Ear Drainage for Three Months

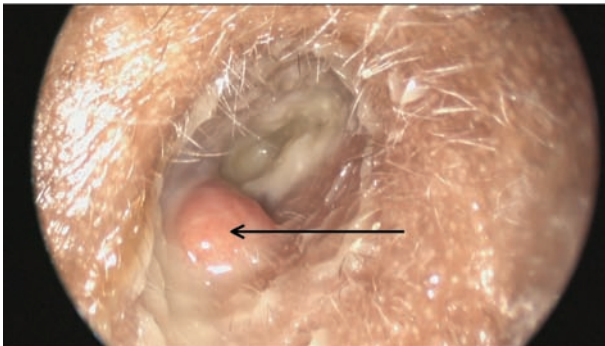
By Hamid R. Djalilian, MD

A 67-year-old patient comes into the office with a complaint of ear drainage that has lasted for three months. His primary care physician had treated him with a topical antibiotic eardrop for a suspected swimmer's ear. "But I don't even swim," the patient states. He subsequently had

oral antibiotic therapy for the drainage, but his symptoms still did not improve.

The patient has significant pain in his ear and has been taking acetaminophen with codeine to control it. Upon questioning, he states that the pain wakes him up at night.

He also says that he has been checking his blood sugars at home, and they have been very high recently. An otoscopic image of his ear is to the left.



The patient's ear canal has pus and red, beefy granulation tissue at the bony-cartilaginous junction.

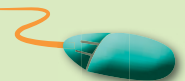
What is your diagnosis? See p. 8.

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By Caitlin E. Veri, EarQ

Diagnosis: Skull Base Osteomyelitis

By Hamid R. Djalilian, MD

Continued from p. 6

Skull base osteomyelitis (SBO) is characterized by infection of the temporal bone and the bone of the skull base. This condition most commonly originates in the external auditory canal. Due to its life-threatening nature, it was termed malignant otitis externa several decades ago. In recent years, however, there has been a move away from this description because the condition is not a true malignancy and its mortality has decreased substantially.

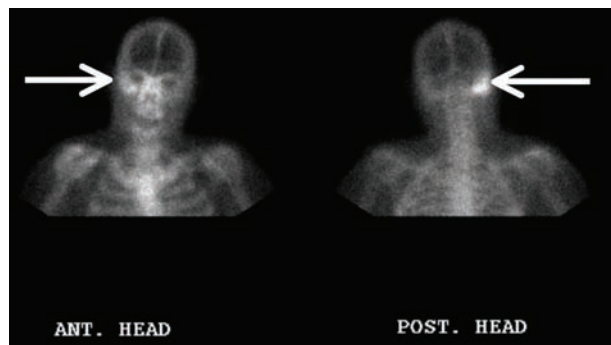
The term necrotizing otitis externa (NOE) has been used to describe this condition as well, although some have categorized NOE as a necrotizing infection that is limited to the external auditory canal and does not involve the skull base. Skull base osteomyelitis is the best description for this condition and is the primary term neurotologists use to refer to it.

The most common causative organism in skull base osteomyelitis is *Pseudomonas aeruginosa* originating in the ear canal. Other causes include *Staphylococcus epidermidis*, *Klebsiella*, *Proteus*, *S. aureus*, and fungi such as *Aspergillus spp.* Traditionally, a combination of intravenous antibiotics has been the treatment of choice.

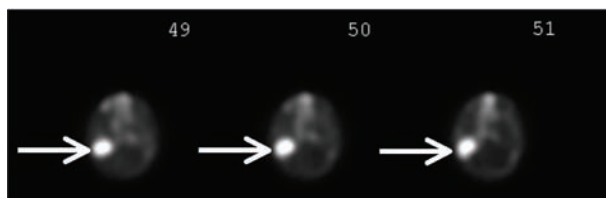
The infection generally occurs in patients with diabetes or an immunocompromising condition, such as HIV, transplantation, or myelodysplastic syndromes. While SBO has been described in patients with normal immune function, their documented clinical course was significantly shorter.

In skull base osteomyelitis, the patient initially develops an external auditory canal infection, which then penetrates the skin and involves the underlying temporal bone. The infection can spread through the temporal bone into the skull base, potentially involving the entire skull base.

As the infection progresses, the involvement of the foramina (openings in the bone of the skull base) for various cranial nerves leads to their paralysis. The facial nerve is the one most commonly involved.



This technetium⁹⁹ image of the patient shows increased uptake of the nuclear medicine radioisotope indicative of infection in the bone (arrow). The images are from the front (left) and the back (right).



This technetium⁹⁹ SPECT image shows sliced images of the head. The right temporal bone is on the left side of the image and shows increased uptake of the radioisotope, indicating significant infection in the temporal bone (arrow). Three representative sliced images are shown.

Diagnosis of this condition requires a high index of suspicion. The patient must be admitted to the hospital and given a technetium⁹⁹ nuclear medicine bone scan to demonstrate the infection in the bone.

A gallium⁶⁷ nuclear medicine bone scan is the best method for monitoring therapeutic progress and resolution of skull base osteomyelitis. Gallium scanning is performed at diagnosis and again at six weeks. An erythrocyte sedimentation rate blood test is used for acute monitoring in the hospital to demonstrate response to antibiotics.

Granulation tissue in the external auditory canal is a common feature of skull base osteomyelitis. The red/purple fleshy tissue is classically seen at the bony-cartilaginous junction on the floor of the ear canal, as it was in this patient. Granulation tissue gradually involutes as the infection resolves.

Given that carcinoma of the temporal bone can mimic skull base osteomyelitis and present with an external auditory canal mass, a biopsy may be indicated if the granulation tissue persists. Tissue associated with carcinoma of the external auditory canal tends to be more solid in structure, yet friable, as opposed to the smooth surface and compressible nature of the granulation tissue seen in skull base osteomyelitis. The granulation tissue is also pedunculated, which is not the case with carcinoma of the external auditory canal.

Treatment of skull base osteomyelitis requires intravenous antibiotics for six to eight weeks. At the six-week mark, a gallium⁶⁷ scan is done to ensure complete clearing of the bony infection. Rarely, in patients who show persistent infection despite long-term antibiotic treatment, hyperbaric oxygen therapy may be used to improve outcome.

Severe, deep-seated pain in the ear canal should raise suspicion for this condition, with pain that wakes up the patient at night a commonly seen feature. The patient may or may not have granulation tissue, though its presence supports the diagnosis. Someone with suspected skull base osteomyelitis should be referred urgently to an otolaryngologist for admission to the hospital, confirmation of the diagnosis using a technetium⁹⁹ bone scan, and commencement of intravenous antibiotic therapy. 