



# Positron Emission Tomography/Computed Tomography Findings in Malignant Otitis Externa

## Malign Eksternal Otitte Positron Emisyon Tomografi/Bilgisayarlı Tomografi Bulguları

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### Abstract

Malignant otitis externa (MOE) is an infrequent but severe invasive infection of the external auditory canal generally caused by *Pseudomonas aeruginosa*, which mostly affects elderly diabetic patients. Progression of the disease may lead to osteomyelitis of the skull base resulting in potentially fatal intracranial complications. Herein, we describe PET/CT findings of a patient who was referred to PET/CT department for evaluation of skull base osteomyelitis.

**Key Words:** Positron emission tomography/computed tomography, malignant, external otitis

**Conflicts of Interest:** The authors reported no conflict of interest related to this article.

### Özet

Malign eksternal otit (MEO) genellikle yaşlı diyabetik hastalarda çoğunlukla *Pseudomonas aeruginosa* nedeniyle oluşan dış kulak yolunun nadir fakat ağır invaziv bir enfeksiyonudur. Hastalığın ilerlemesi kafa tabanı osteomyeliti ve ölümcül olabilen ağır kafa içi komplikasyonlara neden olabilir. Bu yazıda kafa tabanı osteomyelitinin değerlendirilmesi amacıyla PET/BT bölümüne gönderilen bir hastanın PET/BT bulgularını tanımlamaktayız.

**Anahtar Kelimeler:** Pozitron emisyon tomografi/bilgisayarlı tomografi, malign, eksternal otit

**Çıkar Çatışması:** Yazarlar bu makale ile ilgili olarak herhangi bir çıkar çatışması bildirmemiştir.

### Introduction

Malignant otitis externa (MOE) is an infrequent but severe infectious disorder that is generally caused by *Pseudomonas aeruginosa*, mostly affecting elderly diabetic patients. Progression of the disease from the external auditory canal leads to osteomyelitis of the skull base, cranial nerve palsies and some other intracranial complications such as dural sinus thrombosis, meningitis and cerebral abscess (1). This life-threatening condition can be difficult to diagnose and treat.

### Case Report

A 61-year-old woman with history of diabetes mellitus for 30 years, presented with resistant severe otalgia, purulent otorrhea and cranial nerve palsies (partial V, VII, IX, XII). Her MR imaging was suspicious for temporal bone osteomyelitis secondary to external otitis. No clinical improvement was seen despite appropriate antibiotic treatment, so the patient was referred to PET/CT department with suspicion of skull base osteomyelitis. Fifty milliliters of oral CT contrast agent diluted into 1500 ml water was administered overnight, prior to the study.

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The patient was imaged by an integrated PET/CT camera (Siemens Biography LSO HI-REZ PET/CT scanner, Chicago, IL), 60 minutes after injection of 15.1 mCi (558.7 MBq) F-18 FDG. The CT portion of the study was done without intravenous contrast medium, just for defining anatomic landmarks and making attenuation correction on PET images. FDG PET/CT images showed heterogeneous increased uptake of F-18 FDG in the right temporal bone (Figure 1a) extending from the right external auditory canal to the right temporal bone, right side of the occipital bone and C1 vertebra (Figure 1b), which was consistent with osteomyelitis. Increased uptake of FDG was seen in the right temporal muscle, splenis capitis muscle and posterior scalp demonstrating soft tissue involvement (Figure 1a).

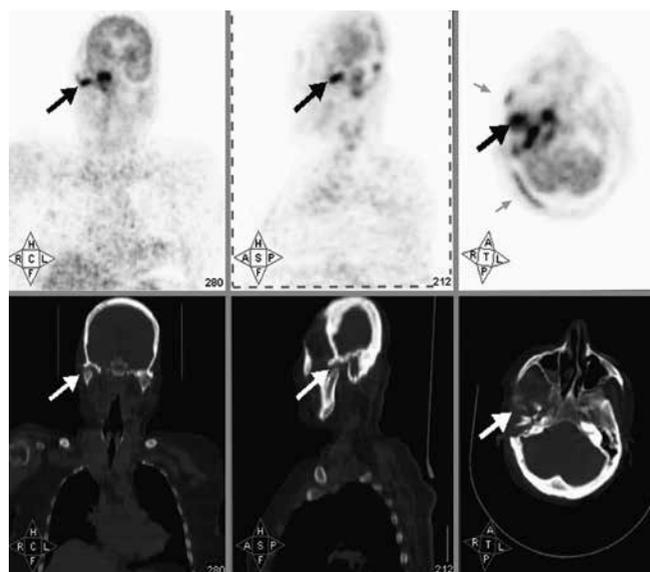
## Discussion

MOE is a rare but life-threatening infection. Clinical symptoms and laboratory findings are not specific. The diagnosis mostly relies on history, imaging studies and biopsy. Differential diagnosis includes carcinoma of the auditory canal and temporal bone, granulomatous diseases (tuberculosis, sarcoidosis), Paget's disease, nasopharyngeal malignancies and fibrous dysplasia (2). Carcinoma of the auditory canal and temporal bone may have similar clinical, CT and MR findings with MOE, and biopsy is necessary for differential diagnosis. It is also important to diagnose MOE from other conditions such as otitis externa or chronic otitis media that do not require such aggressive therapy and usually respond to standard treatment.

Once the diagnosis of MOE is ascertained, it is crucial to evaluate disease spread, including both bone and soft tissue

involvement (3). There is no single modality that can accurately evaluate both the extent of the disease and the response to treatment (3,4). The generally accepted standard includes CT for evaluation of bony structures, and MRI for soft tissue. However CT scan does not demonstrate bone erosion until at least 30% of the trabecular bone has been lost (5), and cannot be used for evaluation of therapy response since bone does not mineralize with cure (6). MR has the advantage of superior demonstration of soft tissue, particularly dural enhancement and involvement of medullary bone spaces, but it also cannot be used for assessment of bone erosion and treatment monitoring (4). Tc-99 MDP scan is used for revealing early osteomyelitis. Ga-67 is useful for monitoring response to therapy (7). However, these conventional nuclear medicine studies lack anatomic detail and require long imaging times that limit their use. SPECT/CT with Tc-99 MDP adds sufficient anatomic detail to standard bone scintigraphy that enables exact localization of the osteoblastic activity, but is of limited value in detecting soft tissue involvement. The radiolabelled in-111 or technetium white blood scintigraphy can be used for evaluation of osteomyelitis. However, they both are time consuming, laborious procedures, with poor quality images, and false negativity in the presence of low grade infection (8,9).

In addition to the widespread application of FDG PET/CT imaging in oncology, its role in infectious diseases is evolving. FDG PET/CT may not differentiate malignant or granulomatous diseases from infection. But when diagnosis of MOE is clinically made by biopsy or by other imaging modalities, F-18 FDG PET can be helpful in determining disease extent. It is possible to evaluate both soft tissues and bony structures by FDG PET/CT imaging in MOE (10).



**Figure 1a.** Coronal, sagittal, axial FDG PET/CT images of the skull base showed heterogeneous increased uptake of F-18 FDG in right temporal bone (black and white arrows). Increased uptake of FDG is seen in the right temporal muscle, splenis capitis muscle and posterior scalp (grey arrows).



**Figure 1b.** MIP image of the patient showing hypermetabolic activity extending from the external auditory canal to the skull base and C1 vertebra. Slightly hypermetabolic superior jugular and jugulodigastric lymph nodes are seen on the right side suggesting reactive lymph nodes (the focus in the right inguinal region is due to urinary contamination).

In our case, the infection revealed by PET/CT is more widespread than that detected by MRI. FDG PET/CT may also be used in evaluation of treatment response. FDG PET/CT is more preferential in clinical imaging as compared to Ga-67, which is usually used for therapy monitoring, due to its rapidity, better image quality and lesser radiation burden. Further studies are required to assess the role of FDG PET/CT as a first-line diagnostic imaging study in MOE.

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