Imaging of malignant external otitis

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Authors: S. Jendoubi, M. Jrad, F. Lassoued, F. Laabidi, H. Ben Chlig, A. Zaidi, O. Azaiez, M. Ben Massoued, H. Mizouni; Tunis/TN
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Learning objectives

• Make a brief anatomical reminder of the temporal bone and the different way of extension of the infection from the external ear.
• Illustrate the role of CT and MRI for the diagnosis and the staging of infection in malignant otitis externa (MOE).

Background

Malignant otitis externa, also called necrotizing external otitis, is a rare but life threatening disease that affects elderly patients with diabetes and other immunocompromised states.

It is an osteomyelitis of the temporal bone and skull base, which takes its origin from the external ear canal and spread to the mastoid, middle ear, temporomandibular joint and into the soft tissues beneath the skull base.

The germ involved in the most of case is *Pseudomonas aeruginosa*.

Complications of this disease are septic thrombophlebitis, cranial nerve palsy, meningitis and cerebral abscess.

It should be suspected in patients with persistent external otitis that causes severe otalgia and otorrhea with granulation tissue in the external auditory canal at the bone-cartilaginous junction.

Clinical suspicion must lead to imaging, CT and MRI, which show some specific signs and help for the extension of the disease and its complication.

CT protocol:

The standard examination consists of acquisition in the axial and coronal planes in bone and soft tissue windows.

Intravenous contrast may be helpful evaluating the adjacent soft tissues and the venous sinus.

In this case pre impregnation by a product of iodinated contrast 60 mL and then 30 mL bolus should be performed.

CT should study the temporal bone, petrous apex and mastoid; it shows:

• Soft tissue thickening in the external auditory canal.
· Bone erosion of the temporal bone and skull base.
· Inflammatory changes in the mastoid or in temporomandibular joint.
· Fluid in middle ear.
· Extension to infra temporal fossa, nasopharynx petros apex and carotid canal.

**MRI protocol:**

MRI protocol includes T2-weighted image, T1-weighted image without fat saturated (axial) and Fat Saturated T1 after Gadolinium sequences (axial and coronal).

It shows infiltration of deep cervical areas associated with infiltration of the bone marrow of skull base.

Infiltration presents such an "inflammatory" signal: hyposignal on T1-weighted image, hypersignal on T2-weighted images and intense contrast Gadolinium enhancement.

Fat Saturated T1 after Gadolinium sequences improves the detection of infection.

MRI helps to detect the temporomandibular joint arthritis and the venous thrombophlebitis. MRI can also search for an extension the holes in the skull base, by showing infiltration and enhancement of the stylo-mastoid foramen (VII), the condylar canal (XII), the jugular foramen (mixed nerves IX, X, XI) and the foramen lacerum.

**Findings and procedure details**

The external auditory canal is fibrocartilaginous in its lateral third and bony in its medial two third surrounded by the tympanic portion of the temporal bone.

The infection may extend to the cartilaginous portion of the external auditory canal and through Santorin fissures reach the temporal bone causing osteitis.

Malignant otitis externa starts from the external auditory canal and progresses:

- Posterioly through the petro-squamous suture, to the mastoid, the peri mastoid soft tissues and the stylo mastoid foramen.

- Anteriorly into the temporomandibular joint through Santorini fissure.

- Medially to the petrous bone apex

- Superiorly to the endocranium through foramina of skull base
 Inferiorly to soft tissue of sub temporal area

It can extend to the middle ear: and then through the jugular foramen and tegmen tympani to the endocranium and through Eustachian tube to the walls of the nasopharynx and soft tissues of deep cervical areas.

Because of its anatomic location in the temporal bone, the facial nerve is usually the first nerve to be involved followed by glossopharyngial, vagal and hypoglossal nerve.

Cranial nerve involvements indicate a poor prognosis.

Septic thrombi mainly come from the propagation of thrombophlebitis via emissary veins of the mastoid.

Abscesses can develop in the epidural space, brain parenchyma and the prevertebral space.

Our study was retrospective including 19 patients with MEO hospitalized at Rabta hospital in Tunis, Tunisie, during 2007-2013.

CT and MR imaging were performed in all patients at diagnosis and at 6 months after treatment.

The median age was 65 years. The sex ratio was 2/1. All patients belonged to a risk group: 15 were diabetics and 4 in immunocompromised states. The infection was caused by *Pseudomonas aeruginosa* in 96% of cases.

On CT soft-tissue thickening in the external auditory canal was noted in all patients, bone destruction and inflammatory changes in the mastoid in 6 patients, bone erosion of the temporo-mandibular joint in one case.

MRI showed soft tissue thickening of the external auditory canal in patients (fig.1a and b). Soft tissue inflammatory changes of the deep facial spaces of the head was seen in 11 patients. The parapharyngial space was infiltrated in all cases (fig.2a and b).

Deep cervical areas were involved in five cases.

In 2 patients,CIS 3D axial image showed a cochleo vestibular's signal extinction (fig.3).

Lateral sinus thrombophlebitis was seen in four patients (fig.4).

Bone erosion was best seen on CT scans but did not normalize with cure .

However, bone changes were seen on MRI in three cases (fig. 5).

Soft-tissue changes were best seen on MRI and improved but did not disappear completely with treatment.
Images for this section:

Fig. 1: a-Axial T1 weighted image, b-Axial T2 weighted image: stenosing soft tissue thickening in the right external auditory canal.
**Fig. 2:** Axial T1 gadolinium weighted image: Right otitis externa extended to the soft tissues of para pharyngial space and the medial pterygoidal muscle.

**Fig. 3:** CIS 3D axial image: Extension of the thickening of the external auditory canal to the middle and inner ear: cochleo vestibular's signal extinction.
Fig. 4: Axial T1 Gado with fat saturation: Right lateral sinus thrombophlebitis. Meningitis enhancement.
**Fig. 5:** Coronal T2 (a) and T1 (b) gadolinium weighted image: Right otitis externa with hypersignal in the articular tuberosity and the condyle of the right temporomandibular joint.
Conclusion

Necrotizing external otitis is an uncommon and invasive infection of the temporal bone originating in the external acoustic canal.

MR and CT are complementary modalities for evaluation of this entity, with the bone windows at CT to show the destructive process, and MR imaging to demonstrate extension to soft tissue and associated complications.

Personal information

References