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Imaging of post-traumatic hearing loss☆

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KEYWORDS
Trauma;
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Abstract
Objective: Hearing loss is the most frequent complication of temporal bone trauma. The role of the radiologist is of great importance; the adequacy and selection of the imaging technique, as well as its correct interpretation, are crucial to establish the diagnosis, prognosis and enable the selection of appropriate treatment. With the aim of systematizing the most relevant concepts in the evaluation of image studies in this scenario, this review will be outlined according to the hearing loss type. The potential lesions of its components will be assessed; In each case the most appropriate imaging technique will be suggested and the findings will be described and depicted.
Conclusion: In postraumatic hearing loss, computed tomography is the initial technique of choice and will allow the detection of alterations that cause conductive hearing loss; magnetic resonance imaging will be useful in the evaluation of sensorineural hearing loss.

PALABRAS CLAVE
Traumatismo;
Hipoacusia;
Hueso temporal;
Vía auditiva;
Tomografía computarizada multidetector;
Resonancia magnética

Imagen de la hipoacusia postraumática

Resumen
Objetivo: La hipoacusia es la complicación más frecuente del traumatismo del hueso temporal. El papel del radiólogo es de gran importancia; la adecuación y la selección de las pruebas radiológicas, así como su correcta interpretación, son cruciales para establecer el diagnóstico y el pronóstico, y para seleccionar el tratamiento idóneo. Con el objetivo de sistematizar los conceptos más relevantes en la valoración de los estudios de imagen en este contexto, se esquematizará el desarrollo del tema según el tipo de hipoacusia que condicione el traumatismo. De forma ordenada se valorarán las potenciales lesiones de sus componentes; en cada caso se sugerirá la técnica de imagen para su evaluación y se describirán e ilustrarán los hallazgos.

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Conclusión: En la hipoacusia postraumática, la tomografía computarizada es la técnica de elección inicial y permitirá la detección de alteraciones que condicionen hipoacusia conductiva; la resonancia magnética es útil en la valoración de la hipoacusia neurosensorial.

Introduction

Hearing loss is an important consequence of traumatic brain injuries and a disability that should be systematically assessed by analyzing the different components of the auditory pathway. It is estimated that it affects around al 24–81% of patients with temporal bone traumas.[1] Hearing losses can be categorized into conductive, or neurosensorial; the conductive hearing loss is the result of damage to the outer ear, and the neurosensorial hearing loss is the result of damage to the inner ear or the central auditory pathway.

Traditionally, the role of the radiologist in the assessment of the temporal bone trauma was limited to detecting the fractures and classifying them as transverse or longitudinal based on the direction of the main trace with respect to the petrous part of the temporal bone.[2] However, today, on top of using other classification systems such as those based on the involvement of the otic capsule with greater therapeutic and prognostic implication,[3,4] we are able to assess other components of the auditory pathway that can be damaged without the existence of a temporal bone fracture, such as the ossicular chain, the inner ear, or the central auditory pathway.

> *We should remember that* when dealing with temporal bone fractures, the direction of the trace, the portion affected, and the involvement of the otic capsule should be described.

We need to have a complete anatomical knowledge of the auditory system and the possible lesion mechanisms. We should also know what radiologic imaging modalities are available and what their indications are. In most cases, choosing the right imaging modality and making correct interpretations of the findings will allow us to establish functional diagnoses and prognoses, and eventually choose the optimal therapy. In general, the computed tomography (CT) scan is the initial modality of choice for the management of temporal bone traumas, since it allows fast, minimal manipulations of the patient who may have severe lesions, with sub-millimeter resolution. The deferred magnetic resonance imaging (MRI) allows us to assess the inner ear, the central auditory pathway, and other possible complications.

In an attempt to systematize the most relevant concepts in the assessment of imaging studies in this scenario, we will be reviewing this topic based on to the type of hearing loss conditioned by the trauma. The potential lesions of its components will be assessed in an orderly fashion; in each case the most appropriate imaging modality will be suggested, and the findings will be described and depicted.

Conductive hearing loss

It is due to alterations in both the outer and inner ears. Among these lesions we find the accumulations of blood deposits or debris, fractures located in the external auditory canal, and damage to the ossicular chain. During the first days following the trauma, the hearing loss is not easy to assess, especially in the presence of hemotympanum causing the reduced, temporary sound transmission. Should the hearing loss persist after the hemotympanum has been resolved and the tympanic membrane has been re-established, then we should suspect structural damage to the ossicular chain.[5]

The CT scan allows us to make accurate assessments of the temporal bone and is considered the imaging modality of choice.[6,7] The hemotympanum can make the assessment of the ossicular chain a difficult task. Making comparisons with the healthy side together with the use of multiplanar and volumetric reconstructions is useful for visualization purposes.

Accumulations in the outer and middle ears

These accumulations are mainly hemorrhages and are relatively common in temporal bone fractures, and can be the early sign of one subtle fracture easily misdiagnosed (Fig. 1). The hemotympanum can be accompanied by otorrhagia when in the presence of tympanic perforation. The conductive hearing loss is transient and usually resolves within 5–6 weeks.[5,6]

Fractures in the external auditory canal

There can be temporal bone fractures running across the external auditory canal, or isolated fractures in the anterior wall due to mandibular condyle impaction (Fig. 1).[8] They should not be interpreted as tympanosquamous and petrotympanic fissures, which is why knowing their trajectory and appearance is a must.

Ossicular chain dislocations

They are much more common than ossicular fractures. The CT scan allows us to perform accurate assessments of the ossicular chain, which in turn allows us to perform assessments of the actual position and movement of the small bones.