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SHORT COMMUNICATION

Temporal bone meningiomas: emphasizing radiologic signs to improve preoperative diagnosis

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Abstract

Purpose Temporal bone meningioma is an extremely rare disease. Lack of clinical attention due to its rarity might lead to delayed diagnosis. This short communication aims to emphasize radiologic signs of temporal bone meningiomas to improve preoperative diagnosis.

Methods Radiological characteristics of temporal bone meningiomas are discussed.

Results Temporal bone meningioma is characterized by diffuse "hairy" trabecular hyperostosis without the destruction of trabecular structures, bone thickening, and irregular surface margins of the temporal bone on computed tomography. The dural tail sign is a unique feature of temporal bone meningioma on magnetic resonance imaging.

Conclusion Otolaryngologists certainly should be aware of characteristic radiologic signs of temporal bone meningiomas. Using modern computed tomography and magnetic resonance imaging protocols enables with a high degree of accuracy to distinguish temporal bone meningiomas from other more common entities in this location.

Keywords Temporal bone meningioma · Computed tomography · Magnetic resonance imaging · Diagnosis · Trabecular hyperostosis · Dural tail sign

Introduction

Temporal bone meningioma (TBM) is an extremely rare disease; to date, only a very limited number of case series and case reports have been published [1–8]. Lack of clinical attention due to its rarity might lead to delayed diagnosis. TBM might grow for many years without any clinical presentations. After invading the middle ear cavity, nonspecific clinical signs (ear secretion, polyps, and granulations of external auditory canal, conductive or mixed hearing loss), imitating chronic inflammatory ear process would arise [1, 2, 4, 6]. Because clinical signs are usually not suggestive for cholesteatoma (tympanic membrane perforation is not present in most cases), temporal bone computed tomography (TBCT) is not performed within the first months of symptoms. Only after symptoms persist even after adequate treatment, TBCT is performed. On this point, it is essential that radiologists and otolaryngologists are familiar with suggestive radiological signs of TBM on TBCT. Otherwise, radiological signs might be overlooked, and the patient might be misdiagnosed. Published case reports and case series show that misdiagnosing of TBM is not an uncommon situation, and in most patients of reported cases, diagnosis of TBM was stated after surgical intervention [1–8]. When TBM, according to TBCT signs is suspected, magnetic resonance imaging (MRI) should be performed to support the diagnosis.

This short communication aims to bring to mind/recall radiologic (TBCT and MRI) characteristics of TBM and discuss differences with other pathologies of the temporal bone. So that, diagnosis of TBM is considered before surgical procedure, and treatment options are discussed and proposed to the patient by a multidisciplinary team, including otolaryngologist, neurosurgeon, and radiation

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oncologist. Mainly, the possibilities of modern MRI protocols have not been summarized thoroughly in the literature so far.

Temporal bone meningioma on computed tomography

TBM is characterized by diffuse "hairy" trabecular hyperostosis without the destruction of trabecular structures, bone thickening and irregular inner surface margins in the middle and posterior cranial fossa over the mastoid or tympanic cavity [1, 5] (Figs. 1, 2). If TBM is located in the jugular bulb area, another common finding is the widening and/or destruction of the temporal bone in this area [1]. After invading the middle ear cavity, TBM presents as soft-tissue mass encasing middle ear ossicles without its erosion or destruction [5].

TBM bone changes on TBCT can be mistaken with fibrous dysplasia in this area. However, preservation of internal trabecular architecture in TBM distinguishes it from the so-called "ground-glass attenuation" seen in typical fibrous dysplasia [5, 7].

Cholesteatoma, glomus tumor, and granulation tissue represent another temporal bone pathologies, which could be confused with TBM. However, TBM lacks the bone (e.g., scutum) and ossicular chain destructive changes representative for cholesteatoma. Likewise, CT scans show little bone erosion in TBM in contrast to glomus tumor, where bone erosion is more common. Besides that, cholesteatoma, glomus tumor, and granulation tissue lack of trabecular hyperostosis and temporal bone thickening characteristic for TBM [1, 5, 7].

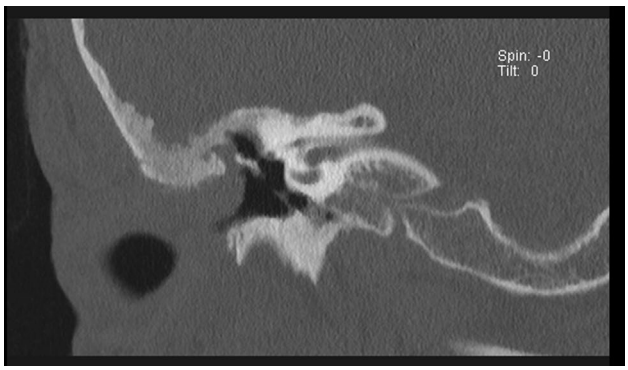

Fig. 1 Temporal bone computed tomography, unenhanced scan, multiplanar coronal reconstruction. Typical thickening and trabecular hyperostosis of the temporal bone is present. The internal architecture of temporal bone is altered, and irregularity of the inner table with small hairy spicules is evident

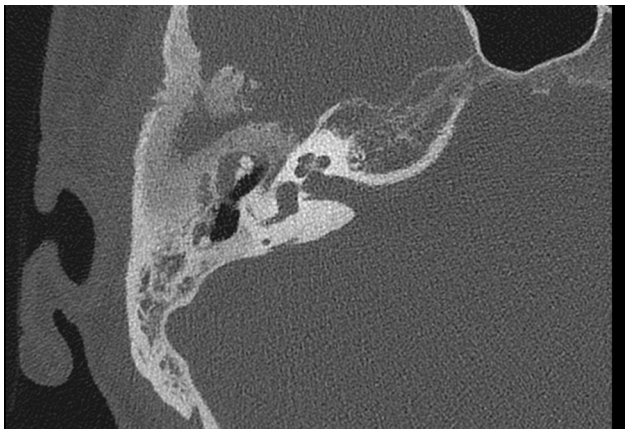

Fig. 2 Temporal bone computed tomography, axial unenhanced scan. Trabecular remodeling of a pyramid extending into squama of the temporal bone is present. A typical calcification of the soft-tissue mass is evident

Temporal bone meningioma on magnetic resonance imaging

TBM is characterized by rapid and long-lasting homogenous soft-tissue enhancement after administration of the gadolinium contrast agent in the T1-weighted image. The involved temporal bone also enhanced with the preserved appearance of the internal architecture [5, 7, 9, 10]. Another unique feature of TBM is the so-called "dural tail sign" (Fig. 3). The dural tail sign is en-plaque linear dural enhancement along

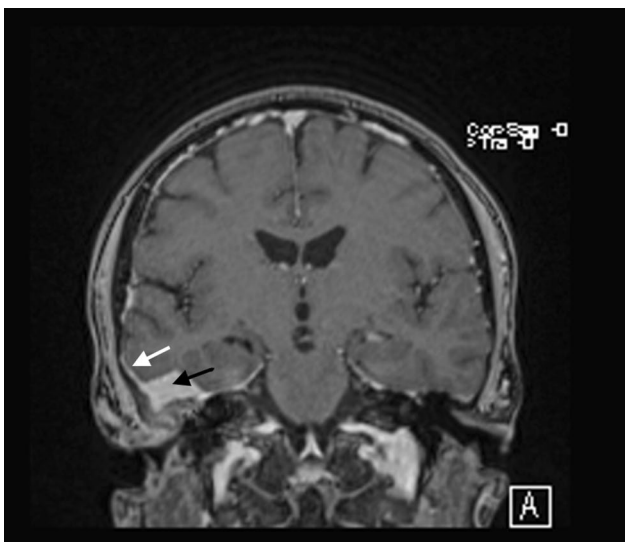

Fig. 3 Magnetic resonance imaging, multiplanar reconstruction-coronal contrast-enhanced T1 GRE MR scan. A homogeneously enhanced tumor (black arrow) invading temporal bone is present. Moreover, flat reinforcement of the surrounding dura mater, so-called "dural tail sign" is evident (white arrow)

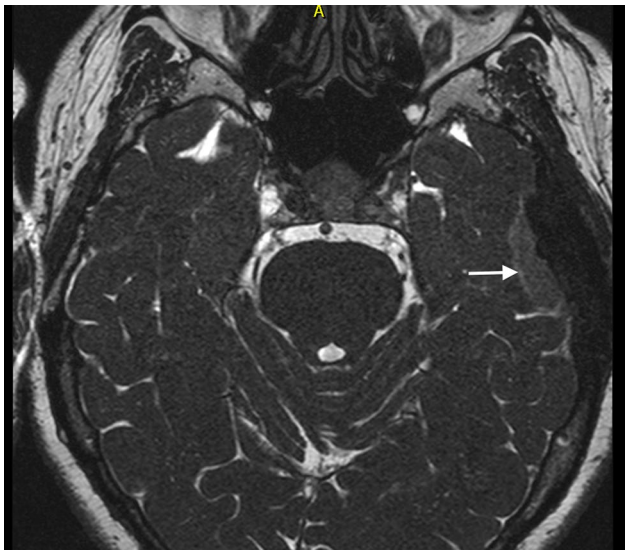

Fig. 4 Magnetic resonance imaging, axial native T2-weighted scan, CISS sequence. A typical band of cerebrospinal fluid between the intra-axial space (brain tissue) and the extra-axial tumor originating from the meninges is evident (white arrow)

the floor of the middle or posterior cranial fossa. It is due to the origin of the tumor from arachnoid cells [7, 9]. This feature is absent in fibrous dysplasia, cholesteatoma, granulation changes, and other affections. TBM is typically an extra-axial tumor, originating from tissues outside the glial and neuronal cells. Therefore, a band of a cerebrospinal fluid signal between the brain structure and the tumor can often be detected [9].

T2-weighted gradient echo (ciss) is another useful protocol for the differentiation of intra-axial and extra-axial tumors and assessment of the relationship to the brain nerves [10] (Fig. 4). Glomus jugulare paraganglioma can be distinguished on the basis of the suggestive appearance of "pepper and salt" or serpentine flow voids [7, 11]. Furthermore, a diffuse weighted image is a reliable marker for the detection of cholesteatoma [12].

Conclusions

TBM is a very rare temporal bone pathology. Otolaryngologists certainly should be aware of its characteristic radiologic signs. Using modern TBCT and MRI protocols enable a high degree of accuracy to distinguish TBM from other more common entities in this location. It is crucial, because the treatment and prognosis of TBM differ significantly from that of other more common entities in this location and should be discussed with patients before surgery thoroughly.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent with anonymous using of radiological findings for publication was obtained from all individuals.

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