Posterior Temporal Bone Arachnoid Granulations: CT and MR Imaging Findings

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Abstract

Background: Arachnoid granulations (AGs) are growths of the arachnoid membrane that function as passive filters through which cerebrospinal fluid (CSF) drains into the dural venous sinuses. For an unknown reason, during development, some AGs do not terminate in a venous sinus; rather they come to lie against a bony surface within the skull, and may result in boney erosion leading to a spontaneous CSF leak and possibly meningitis. AGs located in the posterior temporal bone are rare and may be mistaken for various aggressive neoplasms. Only a few case reports have been reported on the imaging characteristics of these lesions, but clinical or pathological correlation has not been provided in these studies, and therefore these are "presumed" AGs.

Objective: Present a case series of posterior temporal bone arachnoid granulations, including two pathologically or surgically proven cases. Review the characteristic imaging findings of posterior temporal bone arachnoid granulations and their differentiating features from other posterior temporal bone pathologies, especially endolymphatic sac tumors.

Methods: Diagnostic imaging studies, including CT and MRI, were retrospectively analyzed in patients with presumed posterior temporal bone arachnoid granulations and in two patients with surgically or pathologically proven arachnoid granulations. A comprehensive literature review was performed including the histology and pathology of arachnoid granulations, their prevalence and imaging appearance in the posterior temporal bone and the differential diagnosis.

Results: The radiologic appearance of arachnoid granulations in typical locations is well established and they are rarely mistaken for other pathologies. When seen in atypical locations; however, arachnoid granulations can be a source of diagnostic and therapeutic confusion. Rarely, presumed arachnoid granulations have been reported to involve the posterior temporal bone, where they present as focal erosions of the posterior petrous bone. These can be mistaken for various aggressive neoplasms including endolymphatic sac tumor, paraganglioma, chordoma, chondrosarcoma and metastases. Although described previously in the literature, lesions with the characteristic appearances of arachnoid granulations are usually presumed without requiring pathological correlation. We demonstrate two cases which are surgically or pathologically proven, supporting prior hypotheses in the literature that these represent arachnoid granulations.

Conclusions: The posterior temporal bone is an atypical location for arachnoid granulations and can lead to diagnostic confusion. Familiarity with the characteristic imaging appearance of arachnoid granulations in this location can help avoid misinterpretation of a more aggressive pathology.

Case #1

A 55-year-old healthy female presented with new onset recurrent bouts of vertigo. An MRI showed a nonenhancing, multiloculated, extra-axial cystic mass which is isointense to CSF within the lateral aspect of the cerebellopontine angle cistern and associated with extension through the posterior cortex of the petrous portion of the right temporal bone (**Figure 1**). No restricted diffusion was present to suggest epidermoid (not shown). The recommendation for surgical removal was made in order to prevent further complications such as CSF leak and also to potentially alleviate any impact the lesion might be having on the endolymphatic sac which could be leading to her dizziness. A right retrosigmoid approach craniotomy was performed and a cystic lesion lined with pathologically-confirmed arachnoid tissue eroding into the temporal bone was found.

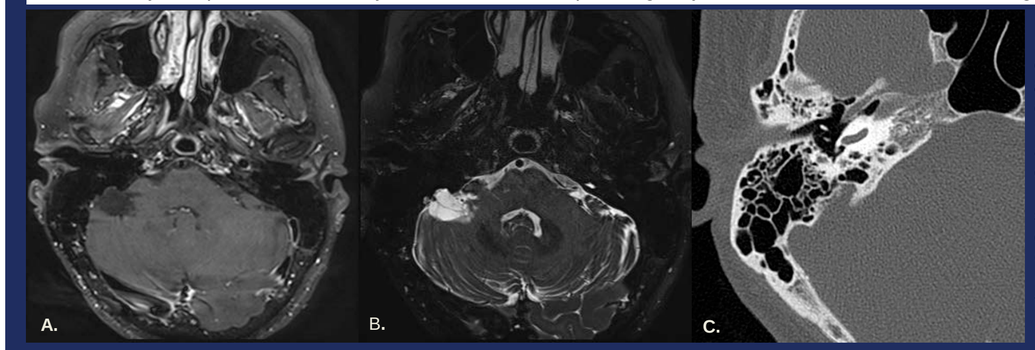

Figure 1: Case #1 of a pathologically-confirmed posterior temporal bone arachnoid granulation. (A) Gadolinium-enhanced fat-suppressed axial T1-weighted image demonstrates a nonenhancing, extra-axial mass that is isointense to CSF and extends through the posterior cortex of the right temporal bone. (B) High-resolution fat-suppressed axial T2-weighted sequence demonstrates the mass to be isointense to CSF. (C) High-resolution axial CT of the right temporal bone confirms bony erosion of the posterior wall, *without* bone spicules.

Case #2

A 36-year-old healthy female with a history of papillary thyroid cancer presented with a history of right ear fullness associated with the feeling of "sloshing" of liquid in her ear of several months duration. She denied hearing loss, vertigo, otalgia, otorrhea, and facial nerve weakness. Audiogram was normal. An MRI showed a lesion involving the posterior aspect of the right petrous ridge at the expected location of the endolymphatic sac (**Figure 2**). The mass was isointense to CSF on T1- and T2-weighted images and enhanced only minimally along the rim of the lesion. There was evidence of fluid or membrane thickening in several right mastoid air cells. High-resolution CT scan of the temporal bones showed a focal lytic lesion centered on the posterior petrous ridge where the cortical margin was eroded. Although arachnoid granulation was suspected, the patient preferred to undergo surgery instead of observation because of her cancer history and to prevent complications from a CSF leak. A mastoidectomy was performed and drainage of CSF was noted during the operation. Characteristically appearing arachnoid granulation was identified eroding through the posterior fossa dural plate approximately 4 mm inferior to the superior petrosal sinus. Using a diamond burr, the rest of the bone around the defect was taken down to the bone just over the dura. Using a Schindler elevator, retrograde dissection around the lesion was done until we were confident that this was indeed benign arachnoid granulation. The defect was then repaired with muscle and fascia.

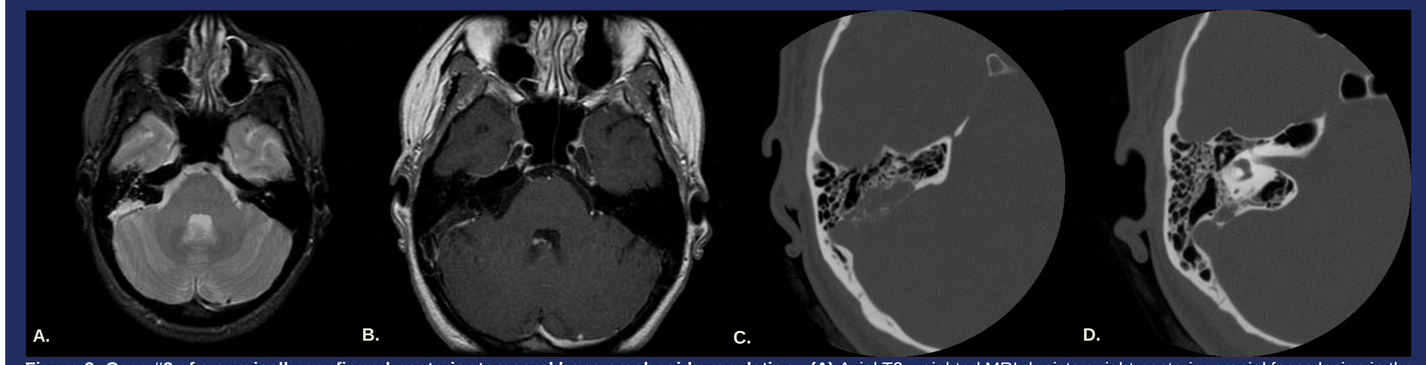

Figure 2: Case #2 of a surgically-confirmed posterior temporal bone arachnoid granulation. (A) Axial T2-weighted MRI depicts a right posterior cranial fossa lesion in the area of the endolymphatic sac. Signal is isointense to CSF. (B) Axial T1 post-contrast MRI demonstrates faint dural rim enhancement but no suspicious solid or nodular enhancement. **(C)** High-resolution temporal bone CT shows a focal lesion centered in the posterior right petrous temporal bone with geographic cortical erosion extending into the adjacent mastoid air cells. **(D)** The mass is centered well above the level of the vestibular aqueduct, which argues against endolymphatic sac tumor.

Differential Diagnosis

The **chief** differential is an

Endolymphatic Sac Tumor
(**Figure 3**)

Other considerations include paragangliomas, chordomas, chondrosarcomas, metastases

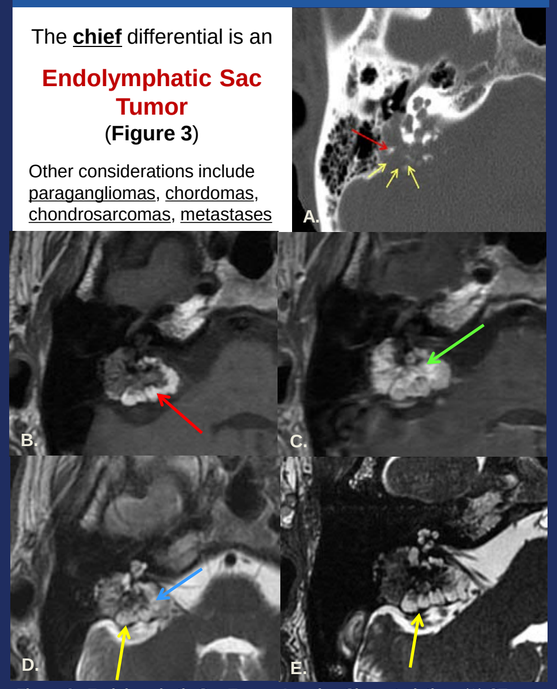

Figure 3: Endolymphatic Sac Tumor Imaging Characteristics. (A) CT scan demonstrating permeative osseous destruction (yellow arrows) and central spicules of calcification are commonly seen (red arrow). Typical MRI imaging characteristics are demonstrated. (B) T1WI: Peripheral T1 hyperintensity is common, often in the shape of small T1 hyperintense cysts (red arrow). (C) On post-contrast T1-weighted MRI, the central non-cystic component of the mass enhances avidly (green arrow). (D) T2-weighted image demonstrates heterogeneous T2 hyperintensity (blue arrow). Peripheral hemosiderin is seen as a T2 hypointense rim (yellow arrow). (E) The peripheral cysts and hemosiderin rim (yellow arrow) are better appreciated on a high-resolution FIESTA sequence.

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