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Glomus tympanica and other intratympanic masses: Role of imaging

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Tumors and tumorlike conditions in the temporal bone are numerous. Glomus tumors (nonchromaffin chemodectomas and paragangliomas) are the most common neoplasms of the middle ear and are second in frequency to only vestibular schwannomas within the temporal bone. Computed tomography and magnetic resonance imaging studies provide valuable information in determining the location and extension of middle ear glomus tumors as well as other potential mimics, such as facial nerve schwannoma, meningioma, extension of intralabyrinthine schwannoma into the middle ear, aberrant course of the internal carotid artery, exposed or high-riding jugular bulb, extramedullary hematopoiesis, adenoma, adenocarcinoma, papilloma, cholesterol granuloma, metastases, and tuberculous otitis media. This article reviews imaging characteristics of glomus complex tumors and selected potential mimics.

Introduction

Tumors and tumorlike conditions in the temporal bone are numerous (Table). Glomus complex tumors (nonchromaffin chemodectomas and paragangliomas) are the most common neoplasms of the middle ear and are second in frequency to only vestibular schwannomas within the temporal bone. There are other potential mimics of glomus complex tumors in the middle ear, such as facial nerve schwannoma, meningioma, extension of intralabyrinthine schwannoma into the middle ear, aberrant course of the internal carotid artery, exposed or high-riding jugular bulb, extramedullary hematopoiesis, adenoma, adenocarcinoma, papilloma, cholesterol granuloma, metastases, and tuberculous otitis media. In this article, we review the imaging characteristics of glomus complex tumors and selected potential mimics.

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Imaging

Computed tomography (CT) scanning and magnetic resonance imaging (MRI) have been used extensively in the diagnosis of the temporal bone lesions.[1-6] CT scan provides unsurpassed resolution of the bony structures of the temporal bone and the base of the skull. However, its limited soft tissue characterization restricts the differentiation of certain lesions, such as intratympanic serous fluid vs hemorrhagic fluid (cholesterol granuloma and hemotympanum). Even contrast enhancement may not be well appreciated on CT scans owing to the size of the often small lesions within the already small tympanic cavity. MRI, owing to its high contrast resolution, can often reveal intense contrast enhancement, characteristic of glomus complex tumors even when small (Figure 1).

MRI is superior to CT scans in providing an exact delineation of a tumor (Figure 1) and better differentiation of tumor from inflammatory tissue and areas of hemorrhage. In addition, the relationship of glomus tumor to the adjacent jugular vein, internal carotid artery, membranous labyrinth, facial nerve, and intracranial structures can be better

Table Tumors and tumorlike conditions of the middle ear and mastoid (Modified from Mafee et al.[1])

- Glomus tumor; glomus tympanicum and extension of glomus jugulare into the middle ear
- Facial nerve primary and secondary tumors
- Intratemporal meningioma (primary and ectopic arachnoid granulations) and extension of intracranial meningioma
- Extension of intralabyrinthine schwannoma or vestibular schwannoma into the middle ear
- Osteoma (rare) and fibrous dysplasia (see companion article by J. Tan in this issue of the journal)
- Hemangioma (rare)
- Adenoma and adenocarcinoma (rare)
- Primary and secondary inverted papilloma (rare)
- Choristoma (rare)
- Ectopic course of the internal carotid artery (aberrant course)
- Bulging, exposed jugular bulb into the middle ear
- Cholesterol granuloma
- Aneurysm of the intratemporal portion of the internal carotid artery
- Extramedullary hematopoiesis (thalassemia, sickle cell disease)
- Wegener granulomatosis (rare)
- Extension of nasopharyngeal carcinoma through the eustachian tube
- Extension of squamous cell carcinoma or adenocarcinoma of the external canal into the middle ear
- Granulation tissue
- Tuberculoma
- Aural polyps (polypoid granulation tissue arising from either the external auditory canal or the middle ear mucosa
- Leukemic infiltration
- Lymphoma including multiple myeloma
- Extension of parotid tumor into the middle ear
- Extension of primary cholesteatoma of the petrous bone into the middle ear
- Extension of cholesterol granuloma of the petrous bone into the middle ear
- Metastases (breast, prostate, lung, thyroid, and kidney)
- Posttraumatic juxtafacial nerve reactive fibrous tissue (rare)
- Extension of petromastoid tumor into the middle ear (Langerhans cell histiocytosis, aggressive fibromatosis, rhabdomyosarcoma, chondrosarcoma, osteogenic sarcoma, and chordoma)

demonstrated by MRI.[2,7] However, bone erosion of large glomus tympanicum into the jugular fossa and surrounding tissues is better evaluated by CT scan. In general, CT including CT angiography and CT venography) or MRI including magnetic resonance (MR) angiography and MR venography may be sufficient for the diagnosis of glomus complex tumors; however, the combination of CT and MRI in the diagnosis and management of glomus complex tumors has proved to be exceedingly useful.

Glomus complex tumors

Glomus complex tumors are composed of nests of cells separated by numerous vascular channels in a fibrous matrix.[7] These vascular channels give rise to a characteristic MR appearance when the tumor is large. This is seen on MR images as multiple areas of low-signal flow voids related to the high velocity of rapid arterial and venous blood flow present in the matrix of these tumors,[7] which is at times referred to as a "salt-and-pepper" appearance (refer to the companion article by A. Stassolla et al. in this issue of the journal). This vascularity is thought to be the cause of the common presentation of pulsatile tinnitus.

When large, it may be difficult to differentiate a glomus tympanicum and a glomus jugulare. When small however, each arises from a characteristic location. The glomus tympanicum arises from glomus tissues (glomera of the chemoreceptor system) in the middle ear, typically on the cochlear promontory, closely associated with the tympanic branch (Jacobson nerve) of the ninth cranial nerve and the auricular branch (Arnold nerve) of the vagus nerve. Both nerves are supplied by the anterior tympanic artery, a branch of the ascending pharyngeal artery.[1] When small, a glomus tympanicum appears on otoscopy as a small, red mass in the anteroinferior quadrant of the tympanic cavity. On CT and MRI scans, glomus tympanicum appears as an enhancing mass in the hypotympanum or the mesotympanum (Figure 1). The glomus jugulare (Figure 2), in contrast, arises from glomus tissues (bodies) located in the jugular foramen and jugular bulb region (jugular fossa).[1-6] This location typically results in erosion of the floor of the tympanic cavity, unusual for a small glomus tympanicum. Owing to this low location, depending on its superior extent into the hypo-protympanum, the glomus jugulare is a variably visible on otoscopy as a red mass.

Other tumors and tumorlike conditions of the middle ear

Primary and secondary tumors (perineural spread of head and neck cancers) of the facial nerve are estimated to cause about 5% of all cases of peripheral facial paralysis.[1] The CT and MRI characteristics of facial nerve tumors are often