

## Pseudocyst of Temporal Bone and Posterior Cranial Fossa Caused by Cholesterol Granuloma†

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**= Abstract =** Accurate preoperative diagnosis of temporal bone lesion is critical because the surgical approaches used for this region are different depending upon the specific disease process involved. While CT and MRI have improved the accuracy of preoperative diagnosis of temporal bone pathology, these imaging studies are most helpful when used in conjunction with one another. This case showed a pseudocyst of the temporal bone and posterior cranial fossa caused by a blockage of aditus ad antrum due to cholesterol granuloma. The patient was a 33-year-old man with a right-sided temporo-occipital headache. Computed tomography revealed a mass involving the temporal bone and posterior cranial fossa with central bony density. On MRI, the mass showed isosignal intensity with respect to the brain on T1-weighted image, hyperintense signal to the brain on T2-weighted image, peripheral enhancement on gadolinium enhanced image. Histologically, the mass showed a cholesterol cleft, multinucleated giant cells and a fibrotic capsule without endothelial lining. The patient had no postoperative difficulty and was discharged without problems.

**Key Words:** *Cholesterol granuloma, Pseudocyst, Temporal bone.*

### INTRODUCTION

Lesions of the temporal bone are clinically silent for long periods with patients often complaining of vague and nondramatic symptoms that delay diagnosis. Headache from dural traction, atypical facial pain, mixed hearing loss, vertigo, eustachian tube dysfunction,

middle ear effusion may be initial manifestation of an extensive temporal bone lesion. These lesions, especially benign cystic ones, frequently achieve significant size with marked bony erosion before diagnosis is made.

The differential diagnosis of temporal bone lesion is difficult task. The list of diagnosis includes primary tumors, such as cholesterol granuloma, cholesteatoma, meningioma, schwannoma, glomus tumor, cartilaginous tumor, lymphoma, histiocytosis X, mucocele, metastatic disease, mucocele. Primary lesions of temporal bone in these disease are usually non-enhancing on CT scans including cholesterol granuloma, primary cholesteatomas, mucocele, and asymmetric pneumatization. Discernment of pathologic processes in this area and evaluation of their extent is critical in diagnosis and

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preoperative planning.

Greater physician's awareness and increased technologic capability are leading to more effective management of pathologic conditions involving the temporal bone area. Modern imaging techniques permit accurate preoperative differential diagnosis when high resolution computed tomography(CT) are used in conjunction with gadolinium-enhanced magnetic resonance imaging(MRI).

We present our experience with a case showed pseudocyst of temporal bone and posterior cranial fossa. Current imaging techniques have proven to be a valuable and adequate means of preoperative treatment planning.

### CASE REPORT

A 33-year-old man had complained of right-sided temporo-occipital headache for two years prior to the present admission. The nature of headache was continuous, not throbbing and did not respond to analgesics. Nausea and vomiting were absent. Fourteen years ago, the patient was noted to have right-sided otorrhea, but it subsided soon after administration of oral antibiotics. There was no family history of otologic disease. Physical examination on admission revealed a central healed perforation of the right tympanic membrane. The left ear was normal. There were no abnormal findings on cranial nerve examination. Tinnitus, nystagmus, vertigo, facial nerve palsy and otorrhea were absent. The results of EKG, chest X-ray, and laboratory analysis were normal. Pure tone audiometry showed a moderately mixed hearing loss(Bone conduction : 35 dB PTAs, Air conduction : 70 dB PTAs, Right side). The result of left side hearing test was within normal range. In the right side auditory brainstem response, there was a 0.4 msec latency delay between wave I and wave V compared to the left side. Vestibular function test revealed right sided nonfunctioning labyrinth.

A high-resolution CT scan with contrast enhancement revealed a mass(2.5 cm X 3.0 cm

in diameter) involving the mastoid bone and posterior cranial fossa with central bony density(Fig. 1). On T1-weighted image, the mass was isosignal with respect to the brain and T2-weighted image revealed a hyperintense mass. Gadolinium enhanced image revealed peripheral rim enhancement(Fig. 2).

Total excision of the pseudocyst including the cholesterol granuloma obstructing the aditus was performed via transmastoid approach. Operative findings also revealed a large cyst involving the mastoid bone and posterior cranial fossa. It had destroyed a most part of the mastoid cavity, and produced a defect in the tegmental bone. The sigmoid sinus was displaced posterolaterally by the cyst. The cyst had an adhesion with the sigmoid sinus, the dura of the posterior cranial fossa and middle cranial fossa. The content of the pseudocyst was serosanguinous fluid with bone fragment. The cystic mass was totally removed. After removal of the cyst, the granulation tissue was visible on the aditus. The granulation had a dark brownish, or occasionally yellowish color with obvious glistening character. After removal

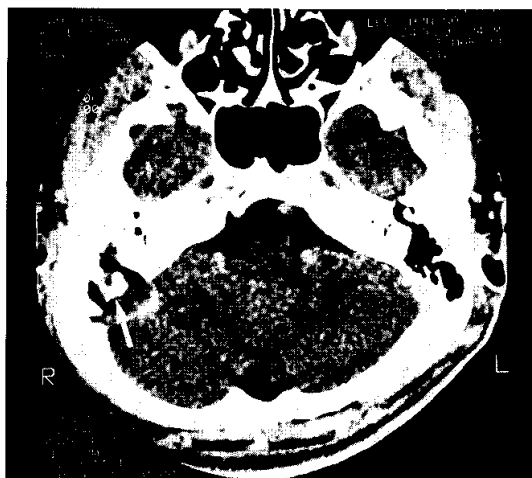


Fig. 1. CT scan obtained after intravenous injection of contrast media shows a mass with central bony density(2.5cm X 3.0cm) in temporal bone which extends to posterior cranial fossa. Note: central bony density(arrow).

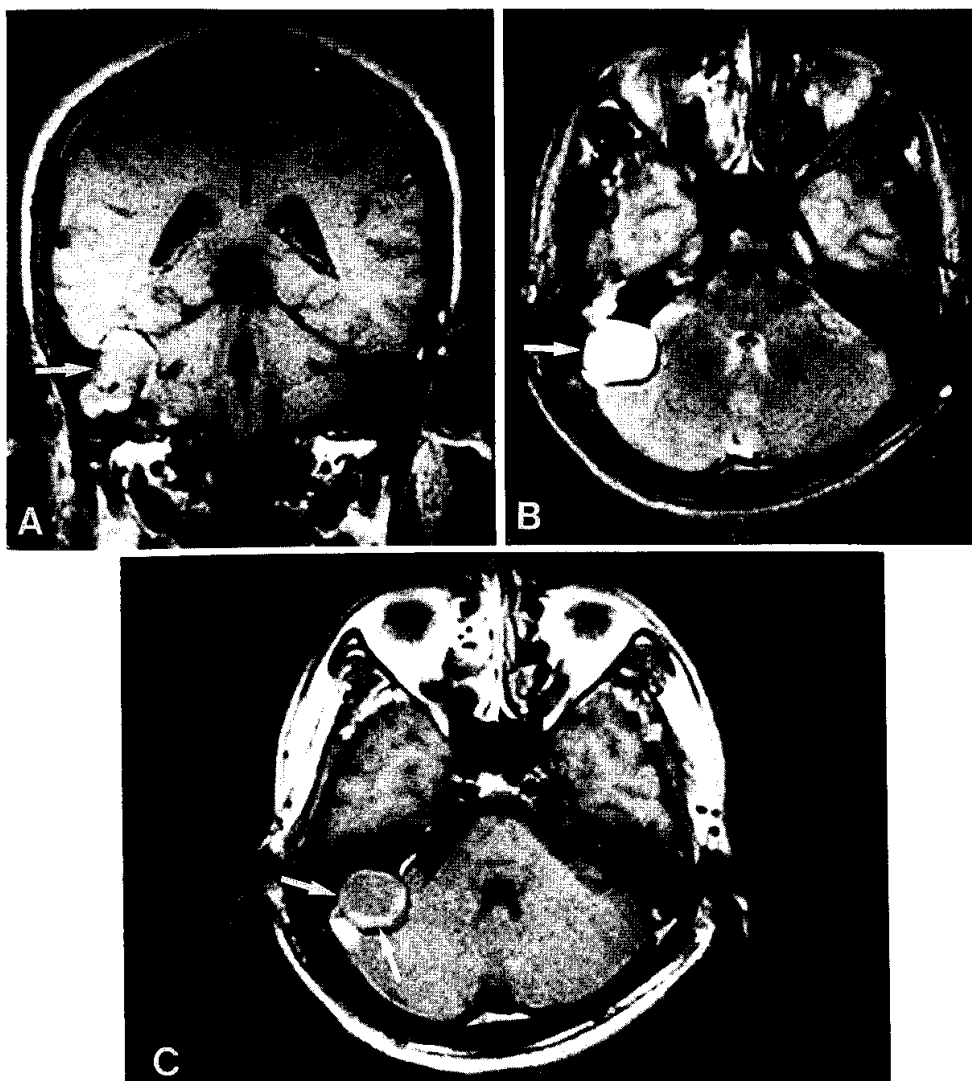


Fig. 2. On MRI, the mass (arrow) appears as isosignal intensity to brain on T1-weighted image (A), and high signal intensity on T2-weighted image (B). Gadolinium enhanced MRI reveals peripheral rim enhancement (arrow) (C).

of cholesterol granuloma in aditus, posterior tympanotomy was performed. The malleus and incus were fixed with new bone formation. The incus and head of the malleus was removed. The incus was remodelled and positioned between stapes head and the tympanic membrane with Gelfoam support. On immediately postoperative CT scans, there was no hematoma or residual mass (Fig. 3). The pathologic examin-

ation showed cholesterol clefts, multinucleated giant cells and fibrotic capsule without endothelial lining (Fig. 4). The patient had no postoperative problem and was discharged four days later.

## DISCUSSION

Accurate preoperative diagnosis of pos-

terior cranial fossa and mastoid bone is important because the surgical approaches used for this region are different depending upon the specific disease process involved. because CT scan is most useful in the evaluation of bone destruction and MRI is most useful in characterization of the mass in this region, these imaging studies are most helpful when used together. Factors that are considered in differential diagnosis by imaging are the site of lesion, enhancing pattern, density, and borders of lesion. Primary lesions of temporal bone are usually non-enhancing on CT scans ; these lesions include cholesterol granuloma, primary cholesteatomas, mucocele, and asymmetric pneumatization.

Cholesterol granuloma is the descriptive histologic term for tissue response to a foreign body(i. e. , cholesterol crystals). Three primary factors are theorized to be essential in its formation in the temporal bone : interference with drainage, hemorrhage, and inadequate aeration(Nager and Vanderveen 1976). Stagnant blood leads to hemoglobin breakdown, forming cholesterol crystals. These crystals incite a giant cell reaction, fibrosis, and vascular proliferation(Corriero 1982; Nomura 1984; Sheehy *et al.* 1969). On CT scans, cholesterol granulomas look



Fig. 3. CT scan obtained after surgical removal shows no residual mass or hematoma in posterior cranial fossa.

like punched-out lesions that are isodense with the brain and do not enhance(Lo *et al.* 1984). However, there may be occasionally rim enhancement with intravenous contrast. On MRI, both  $T_1$ -weighted and  $T_2$ -weighted images are hyperintense with respect to the brain. The hyperintensity on both  $T_1$ -weighted and  $T_2$ -weighted images is unique to cholesterol granuloma. These lesions do not enhance with gadolinium infusion.

On CT scans, primary cholesteatomas are less dense than the brain and exhibit no enhancement with intravenous contrast media. Since primary cholesteatomas expand into the area of least resistance, they have variable shapes with an irregular surface. On MRI, primary cholesteatomas are inhomogenous and

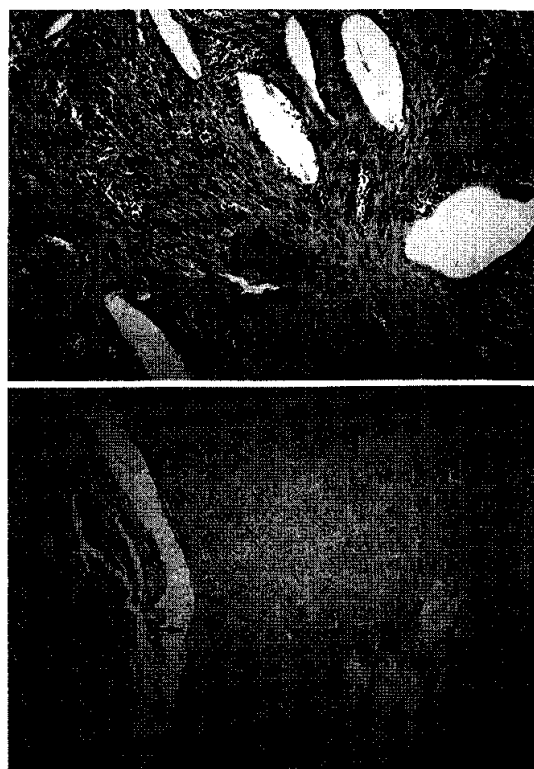


Fig. 4. The pathologic examination showed cholesterol clefts, multinucleated giant cells(arrow)(A) and fibrotic capsule without endothelial lining(arrow)(B), hematoxylin and eosin staining X100(A), X200(B).

hypointense to the brain on T<sub>1</sub>-weighted images, and homogeneous and hyperintense to the brain on T<sub>2</sub>-weighted images. Primary cholesteatomas do not enhance with gadolinium infusion. This lower signal intensity is the key in differentiation from cholesterol granuloma on MRI (Valvassori *et al.* 1984; Lo *et al.* 1984).

Cholesterol granuloma must be differentiated from cholesteatomas because of the differences in their management principles. Treatment of cholesterol granuloma can be limited to drainage of the cyst and insertion of a stent for permanent aeration. But the treatment principle for the cholesteatoma is surgical removal.

On CT scans, mucocele appears as a non-enhancing lesion limited to the air cell system (Osborn and Pavkin 1979). On MRI, it appears as hypointense relative to the brain on T<sub>1</sub>-weighted image and hyperintense on T<sub>2</sub>-weighted image.

This case showed a pseudocyst involving the mastoid bone and posterior cranial fossa caused by blockage of aditus by cholesterol granuloma. On CT scans, the pseudocyst appears as isodense mass with rim enhancement and showed extensive bone erosion. On MRI, it appears as isosignal intensity to brain on T<sub>1</sub>-weighted images and high signal intensity to the brain on T<sub>2</sub>-weighted images. The pseudocyst does not enhance with gadolinium infusion.

Extensive erosion of bone and huge cyst formation are not characteristic features of a cholesterol granuloma. In rare instance, however, erosion of bone may lead to extensive destruction of the temporal bone, even in the absence of the usual manifestation of chronic ear disease. This case report portrays this unusual variant.

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