Aneurysmal Bone Cyst of the Temporal Bone: MR Findings

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Summary: MR findings in a case of aneurysmal bone cyst of the temporal bone are described. MR can suggest the diagnosis of aneurysmal bone cyst and also give ancillary information that is helpful for surgical treatment.

Index term: Temporal bone, cysts

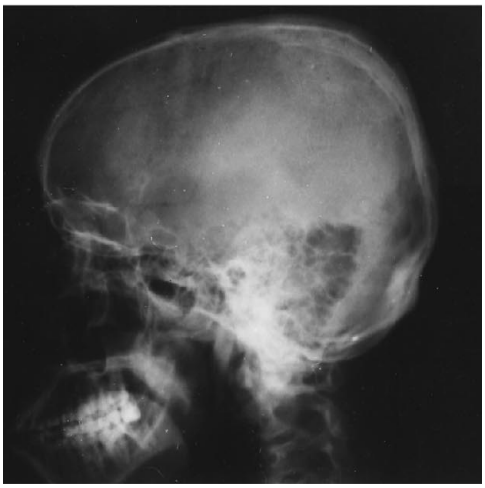
Aneurysmal bone cysts are expansile, lytic, nonneoplastic bone lesions consisting of multiple thin-walled, cystic cavities containing blood. Jaffe and Lichtenstein coined the term in 1942, to describe a peculiar bone lesion with a vascular lining and a characteristic "soap bubble" radiologic picture of expanded bone (1). They are more often seen in vertebrae and flat bones, and less commonly are seen in the shaft of long bones. Aneurysmal bone cyst of a skull bone is a rare entity and occurs mainly in the first 3 decades of life. A search of the literature since 1942 reveals 59 cases of aneurysmal bone cyst involving skull bones, of which 10 involved the temporal bone (2–10) (F. Legent et al, "Aneurysmal Cyst of Petrous Bone: Apropos of a Case," *Ann Otolaryngol Chir Cervicofac* 1988; 105:591–596, English abstract). We report a case of a giant aneurysmal bone cyst of the temporal bone diagnosed with magnetic resonance (MR) imaging and the postsurgical follow-up.

Case Report

A 28-year-old man had headache, diminished hearing, and pain around the left ear for 1 year. Then swelling and a tingling sensation developed around the left ear with a persistent semisolid discharge. A previous attempt at surgical excision of the presumptive mass was abandoned on encountering a vascular mass.

Plain x-ray films in posteroanterior and lateral views were thought to be unremarkable (Fig 1A and B). Unenhanced MR imaging with conventional spin-echo sequences was carried out in three orthogonal planes on a 0.5-T magnet (Magnetom, Siemens, Germany). T1-

A



B

Fig 1. *A* and *B*, Posteroanterior and lateral views of skull x-rays show hyperpneumatization of right mastoid air cells.

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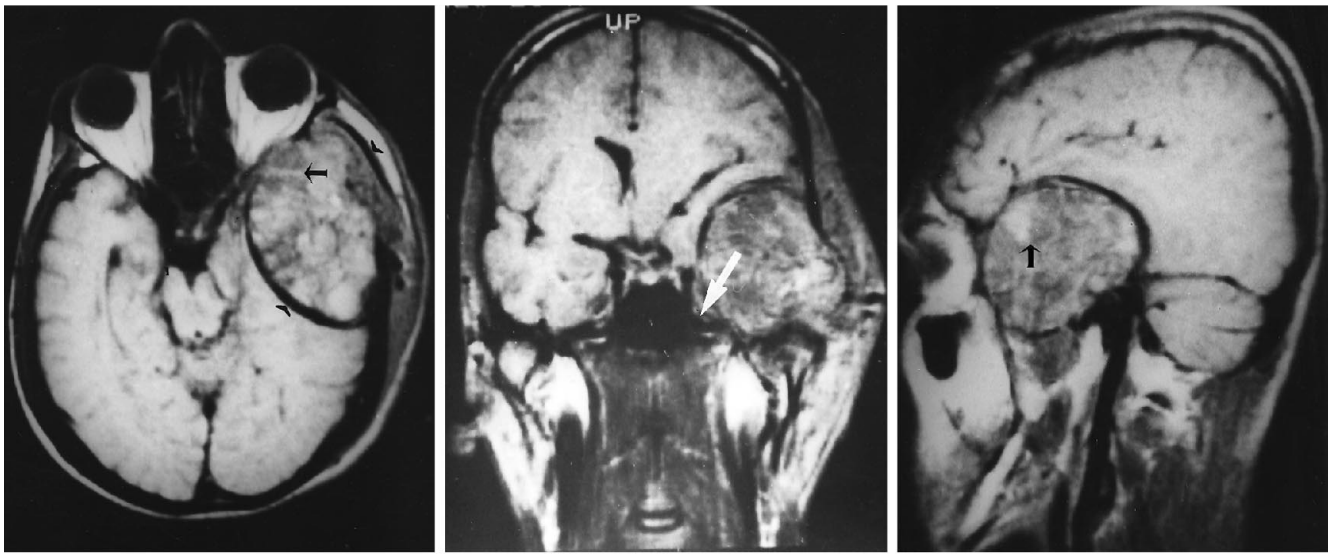


Fig 2. T1-weighted (650/22/2) spin-echo MR images.

A, Axial image shows the mass expands mainly in the intracranial direction. A fluid level (*arrow*) and internal septae separate multiple cysts of variegated signal intensities. Well-defined low-intensity rim (*arrowheads*) surrounds the lesion. The left cerebral peduncle is compressed.

B, Coronal image shows a smaller extracranial extension corresponding to the site of a previous incision. The precavernous segment of the left internal carotid artery (*arrow*) abuts the medial boundry of the mass. The left lateral ventricle is compressed. Overlying scalp and temporalis muscle are thickened and edematous.

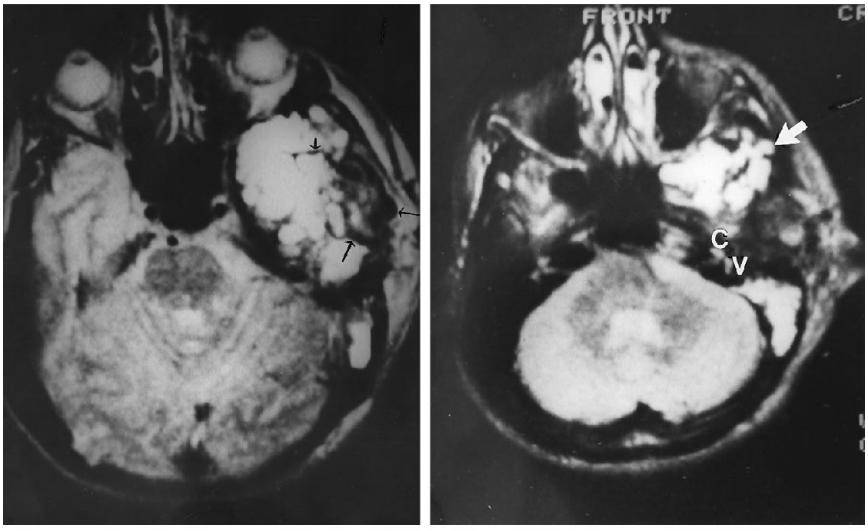
C, Sagittal image shows multiple lobulations of low to high signal intensity surrounded by low-signal rim and possible fluid-fluid level (*arrow*).

weighted (650–750/22/2 [repetition time/echo time/excitations]), proton density–weighted (2500/30/1), and T2-weighted (2500/90/1) images were obtained.

The scan showed a well-defined expansile mass with multiple internal septations, involving the left temporal bone. The lesion expanded predominantly inward, suggesting a primary intracranial neoplasm. A well-defined hypointense rim surrounded the entire lesion with sharp interfaces with bordering tissue. On T1-weighted images, multiple internal lobulations with both low and high signal intensities were seen. There was a suggestion of fluid-fluid levels within a few lobulations (Fig 2A–C). With T2 weighting, all these "cysts" showed marked increase in signal intensities. Thin, low-signal rims were seen around them. Small "diverticula"-like projections were seen arising from larger cysts. All of this gave a "bubbly" appearance to the mass (Fig 3A and B). The arteries feeding the mass and the relationship of the mass to dural venous sinuses were seen clearly (Fig 3A). The mass extended to the left mastoid air spaces and anterior portion of the middle ear. There was marked compression of the left temporal lobe and thence the left parietal lobe and cerebral peduncle. The temporalis muscle and scalp were thickened and edematous (Figs 2B and 3A).

On a computed tomography scan (not shown), marked erosion of the left temporal bone was associated with a large, heterogenously enhancing, mixed-attenuation-density, predominantly intracranial mass lesion. The presence of multiple internal septations was better seen on the post-contrast study. The edematous temporalis muscle and scalp were indistinguishable from the mass. No definite calcification of the inner wall was identified. On a carotid angiogram, branches of superficial temporal and middle meningeal artery were seen to supply the tumor in a spoke-wheel fashion from a deviated arch of the left external carotid artery. Preoperative radiation therapy was given in 15 fractions of 200 cGy by static technique by means of 6-MV x-rays on a linear accelerator to reduce vascularity.

At surgery, the outer table was soft, whereas the inner table was not well defined. A well-defined soft fibrous capsule was seen surrounding the tumor. The vascular mass was removed piecemeal with biopsy forceps and suction. The medial extent of the mass reached the cavernous sinus and precavernous segment of the left internal carotid artery as predicted by MR images (Fig 2B). On histopathologic examination, large vascular spaces separated by fibrous septa containing spindly and ovoid stromal cells and many multinucleated giant cells were seen. Extravasated red blood cells, hemosiderin, granulation tissue, and inflammatory cells were seen in the stroma. Small areas of osteoid tissue were seen. Lack of abnormal mitotic activity or anaplasia of stomal elements excluded a malignant condition (Fig 4A and B).



A B

Fig 3. T2-weighted (2500/90/1) axial spin-echo MR images.

A, The multiple high-signal-intensity cysts are outlined by a thin low-signal-intensity rim. Note the "bubbly" appearance of the lesion. Curvilinear low-signal structures around and within the mass (*arrows*) could represent septations within the lesions or branches of the left external carotid artery supplying the lesion.

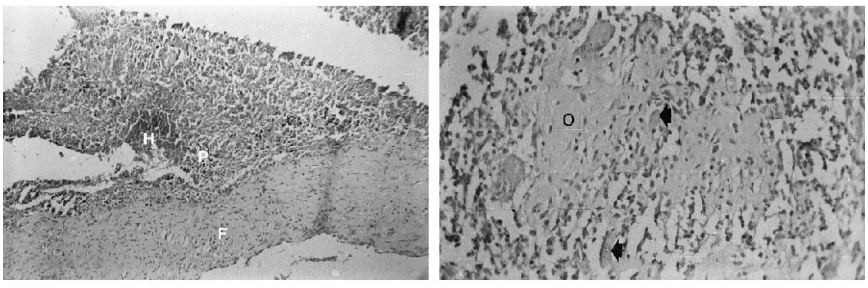
B, Smaller "diverticula" arise from the periphery of larger cysts (*arrow*). Intrapetrous extension of the lesion is seen in close proximity to cochlea (*C*) and vestibule (*V*).

Discussion

The aneurysmal bone cyst described in this case is unusual, because the plain x-rays of the skull are unremarkable. A typical "soap-bubble" or "blow-out" appearance is described by several authors in an aneurysmal bone cyst of a skull bone (3, 6). A few previous case reports describe normal plain skull roentgenograms (11, 12). Aneurysmal bone cysts of the calveria usually produce symmetrical ballooning of both the inner and outer tables of the bone (6). However, in the present case, the bulk of the mass has expanded inward.

In this study, there was suggestion of fluid-fluid levels within a few cystic cavities on axial and sagittal images. This may also be seen on computed tomography and was thought to be specific for aneurysmal bone cyst (13). However, fluid-fluid levels are also seen in telangiectatic osteosarcoma, chondroblastoma, and giant cell tumor (14). They are also reported in other osseous conditions, such as some cases of fibrous dysplasia, simple bone cyst, recurrent malignant fibrous histiocytoma, and classical osteosarcoma (15). Therefore, the presence of fluid-fluid levels within a bony lesion is a nonspecific sign by itself. It indicates settling of blood products within cysts caused by prior hemorrhage (16). However, when associated with other signs, it is a good diagnostic pointer.

The presence of numerous well-defined cystic cavities of variable signal intensities surrounded by a thin hypointense rim is reported in MR case reports of aneurysmal bone cyst situated elsewhere in the skeleton (14, 16). The variability in signal intensities may be due to intracystic hemorrhage of variable age. This will result in the degradation of blood products in various stages in different cysts and hence the variability in signal intensities. The presence of small cystic projections from larger cysts labeled as "diverticula" has been reported before in MR case reports of aneurysmal bone cyst elsewhere in the body (14, 16). All these characteristics of internal architecture give a typical bubbly appearance to the aneurysmal bone



A B

Fig 4. *A*, Photomicrogram shows larger vascular space walled by fibrous connective tissue (*F*). Cavity is filled with polymorphonuclear cells (*P*), osteoclastic giant cells, fibroblasts, and hemorrhagic areas (*H*) (magnification, ×10).

B, Focal areas of connective tissue matrix made up of reactive osteoid (*O*). Some scattered osteoclastic giant cells are seen (*arrows*) (magnification, ×40).

cyst. This is consistent with a previous observation elsewhere in the body (17).

There was an absence of bone tissue in the medial wall of the tumor on histopathology even though it appeared as a well-defined low-intensity structure on MR images (Figs 2A and 3A). This may indicate that the low-signal-intensity rim on MR represents a thick fibrous layer, calcified or noncalcified, periosteal membrane. The extent of the lesion was better seen on MR because of multiplaner imaging and greater soft tissue discrimination. It was possible to assess its proximity to internal ear structures (Fig 3B). The relationship between the mass and various vascular structures such as the dural venous sinuses and various segments and branches of internal and external carotid arteries was seen clearly (Figs 2B, 3A–B). On MR, the soft tissue–tumor interface was well defined. The edematous scalp and temporalis muscle showed markedly high signal intensities on T2-weighted images and did not have the internal architecture of aneurysmal bone cyst.

Thus a constellation of the following is strongly suggestive of a diagnosis of aneurysmal bone cyst: (*a*) a young patient within the first 3 decades of life; (*b*) an expansile bone lesion with internal septations; (*c*) a well-defined, low-signal-intensity rim; (*d*) multiple well-defined cystic lobulations of varying signal intensities surrounded by a thin, low-signal-intensity rim; (*e*) a few fluid-fluid levels within some of these cysts; (*f*) "diverticula"-like outpouchings from the periphery of some of the larger cysts; and (*g*) a "bubbly" appearance on MR imaging. The MR appearance may suggest the diagnosis and be helpful in treatment planning of aneurysmal bone cyst. We believe it should be the modality of choice for evaluation of aneurysmal bone cyst.

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