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Unusual CT and MR Appearance of an Epidermoid Tumor of the Cerebellopontine Angle

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Summary: We present a case of an unusual epidermoid tumor of the cerebellopontine angle that appeared hyperdense on CT scans and hyperintense on T1- and T2-weighted MR images. We believe that these imaging characteristics were caused by a high protein concentration within the contents of the cyst.

Intracranial epidermoid tumors generally appear as well-defined lobulated hypodense masses on CT scans (1, 2). On MR studies, they typically display hypointensity on T1-weighted images and hyperintensity on T2-weighted images (2). Occasionally, they may appear hyperdense on noncontrast CT scans (3–14). Although many cases of hyperdense epidermoid tumors have been reported, few that appeared hyperintense on T1-weighted MR images have been documented (13, 14). We report a case of a dense epidermoid that displayed hyperintensity on T1-weighted MR images.

Case Report

A 49-year-old man was admitted to the hospital because of a left-sided facial paresthesia. Neurologic examination showed only hypesthesia on the left side of the face. A noncontrast CT scan disclosed a hyperdense mass of the left cerebellopontine angle (Fig 1A). Attenuation values of the lesion were 48 to 50 HU. On spin-echo MR images, obtained on a 1.5-T unit, the lesion was hyperintense on T1- and T2-weighted sequences (Fig 1B and C). A frequency-selective fat-suppression technique did not suppress the signal of the lesion (Fig 1D). Contrast-enhanced T1-weighted images showed no appreciable enhancement (Fig 1E).

At surgery, a shiny multilobulated cystic mass was seen filling the left cerebellopontine angle. The trigeminal nerve was surrounded by the tumor. The cyst comprised a greenish semiliquid material containing debris. At biochemical analysis, the total protein concentration was 29.1 g per 100 mL, and the triglyceride level was 32 mg per 100 mL. Further chemical analysis was not available.

Microscopically, the wall of the tumor was composed of a keratinizing squamous epithelium and a thin layer of fibrous connective tissue. The cyst was filled with keratinous debris arranged in laminated layers. There was no evidence of prior hemorrhage. Focal rupture of the cystic wall with foreign body reaction and fibrosis was seen. The tumor was diagnosed as an epidermoid cyst.

Discussion

Intracranial epidermoid tumors are congenital cystic lesions that arise from epithelial inclusions at the time of neural tube closure or during formation of the secondary cerebral vesicles (4, 15). They are most common in the cerebellopontine angle and suprasellar and parasellar regions (15). The cysts are consistently circumscribed, with a smooth or irregularly nodular capsular surface, and are usually filled with soft, white material, which is the result of progressive desquamation and breakdown of keratin from the epithelial lining (16). At CT, therefore, they generally appear as well-defined lobulated hypodense masses (1). On the other hand, the contents are sometimes described as thick, viscid, and dark brown or gray (16).

Many cases of intracranial dense epidermoid tumors have been reported in the English-language literature (3–14). According to one report (8), the hypodense epidermoids have a pearly appearance with white, waxy material rich in cholesterol crystals, while the hyperdense epidermoids are grossly cystic and contain fluid of various colors. The physiochemical basis of hyperdensity of the tumor is not clear; proposed causes include proteinaceous contents of the cyst (6, 8), prior bleeding into the cyst (5), abundance of polymorphonuclear leukocytes (12), saponification of the debris to calcium soaps (4), and deposition of ferrocalcium complex or iron-containing pigment (4).

The linear relationship between CT density and protein concentration of fluid has been documented (17). Based on the results of biochemical analysis of the cystic fluid in our case, we believe that the high protein level of the cyst's contents was the primary cause of the hyperdensity seen on CT scans. Focal rupture of the cystic wall associated with foreign body reaction was seen histologically. Nagashima et al (8) suggested that high protein concentration might be

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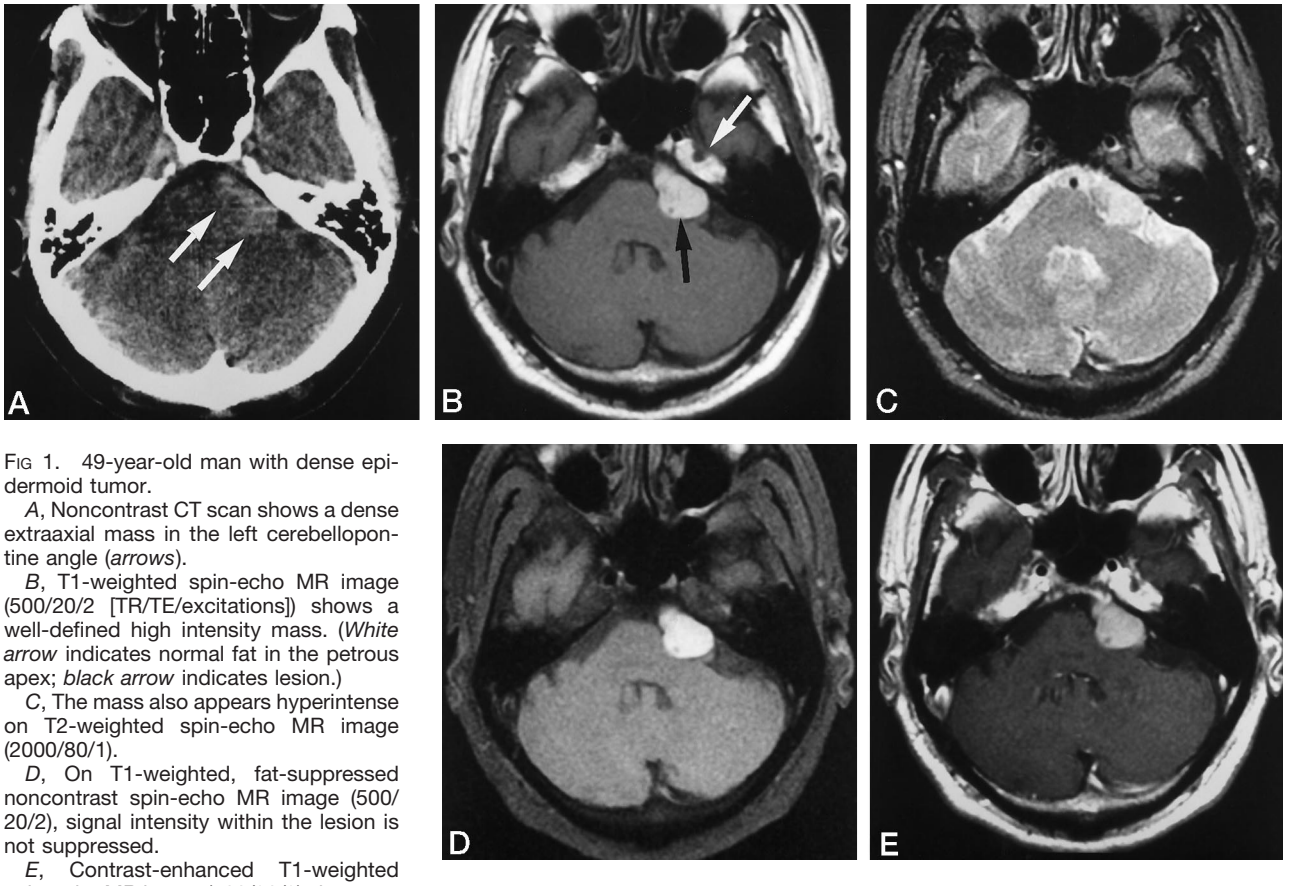

FIG 1. 49-year-old man with dense epidermoid tumor.

A, Noncontrast CT scan shows a dense extraaxial mass in the left cerebellopontine angle (*arrows*).

B, T1-weighted spin-echo MR image (500/20/2 [TR/TE/excitations]) shows a well-defined high intensity mass. (*White arrow* indicates normal fat in the petrous apex; *black arrow* indicates lesion.)

C, The mass also appears hyperintense on T2-weighted spin-echo MR image (2000/80/1).

D, On T1-weighted, fat-suppressed noncontrast spin-echo MR image (500/20/2), signal intensity within the lesion is not suppressed.

E, Contrast-enhanced T1-weighted spin-echo MR image (500/20/2) shows no appreciable enhancement after administration of contrast material.

due to a proliferative and exudative defense reaction to recurrent minor leaks of the lipidic material through the capsule. A similar explanation may be applicable in the present case.

At MR imaging, epidermoid tumors are generally hypointense on T1-weighted sequences and hyperintense on T2-weighted sequences (2). MR signals depend on the relative composition of cholesterol and keratin of the cystic contents: generally, the cholesterol in an epidermoid is in a solid state and appears hypointense on T1-weighted images (1). Horowitz et al (18) found that epidermoid tumors with short T1 values had a high lipid content and were nonenhancing masses with negative Hounsfield numbers on CT scans whereas those with long T1 values had a much lower lipid content and appeared as a water-density mass on CT scans. To our knowledge, the MR imaging appearance of dense epidermoids has been infrequently reported. Gualdi et al (13) described a parasellar dense epidermoid that was inhomogeneously hypointense on T1-weighted MR images and had no signal on T2-weighted images. Another epidermoid of the cerebellopontine angle was reported to be hyperdense on CT scans, hyperintense on T1-weighted MR images, and hypointense on T2-weighted images (14). In that case, signal intensity on the T2-weighted images was different from the findings in our case. Suggested causes of the hyperintensity on T1-weighted images include high protein concentration, mild calcification, and paramagnetic effects (19–22). According to Ahmadi et al (19), a protein level of 9.0 g or greater per 100 mL can increase the signal intensity of the cystic fluid on T1-weighted MR images. As the protein concentration of lysozyme solution increases, there is a gradual increase and then decrease in signal intensity on T1-weighted images. On T2-weighted images, the signal intensity decreases with increasing protein concentration (23). A relatively high protein concentration (20 to 25 g per 100 mL) of sinonasal secretions has high signal intensity on both T1- and T2-weighted images (23). The primary causes of the variable signal intensity of sinonasal secretions on T2-weighted images are the protein contents, the amount of free water, and the viscosity (23). Depending primarily on the percentage of protein and free water it contains, the proteinaceous fluid of epidermoids can have variable signal intensity on T2-weighted images. In this case, MR studies showed a hyperintense mass on T1- and T2-weighted images, and protein concentration of the cystic contents was 29.1 g per 100 mL. Therefore, we assumed that a relatively high protein concentration was the major factor for the hyperintensity on T1- and T2-weighted sequences.

Conclusion

In our case of an epidermoid tumor that was hyperdense on CT scans and hyperintense on both T1- and T2-weighted MR images, a relatively high protein concentration of the cystic contents probably was responsible for the unusual MR appearance.

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