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N Fujita, N Hirabuki, N Kashiwagi, Y Watanabe and H
Nakamura

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Epidermoid Tumor of the Cerebellopontine Angle: Signal Loss in the Contralateral Cistern

Norihiko Fujita, Norio Hirabuki, Nobuo Kashiwagi, Yoshiyuki Watanabe, and Hironobu Nakamura

Summary: We report a case of an epidermoid tumor of the right cerebellopontine angle (CPA) in which the contralateral CPA cistern showed abnormal, low signal intensity on T2-weighted fast spin-echo MR images. Diffusion-weighted images showed the epidermoid tumor of the right CPA extending to the prepontine cistern. The cause of the abnormal signal intensity was proved to be an artifactual signal loss due to cerebrospinal fluid flow by phase-contrast MR imaging.

Intracranial epidermoid tumors typically are shown by magnetic resonance (MR) imaging as an isointense to slightly hyperintense mass relative to cerebrospinal fluid (CSF), with a vaguely inhomogeneous appearance (1-5). Because the signal difference between epidermoid tumor and CSF is small, delineation of epidermoid tumors from surrounding CSF is often difficult on conventional spin-echo images, and CSF flow phenomena may mimic an epidermoid tumor (6). The following report details a case of an epidermoid tumor of the right cerebellopontine angle (CPA) in which CSF flow phenomenon resulted in abnormal, low signal intensity in the contralateral CPA cistern on T2-weighted fast spin-echo (FSE) images.

Case Report

A 69-year-old woman had a 4-year history of episodic pain in the right side of the jaw and tongue. Trigeminal neuralgia in the V3 distribution was diagnosed and the patient was placed on carbamazepine, which produced pain relief. However, because of recent exacerbation of symptoms, she was admitted to undergo microvascular decompression. MR imaging with a 1.5-T unit (General Electric, Milwaukee, Wis) was performed for the preoperative evaluation. On the axial T2-weighted FSE images (Fig 1A and B), an area of abnormal, low signal intensity was noted in the left CPA cistern on the asymptomatic side, but the right CPA cistern on the symptomatic side appeared to have normal CSF intensity. On the T1-weighted images (Fig 1C and D), no difference in signal intensity was noted between the right and left CPA cisterns. Although the cause of the abnormal signal intensity of the left CPA cistern on the T2-weighted images was not investigated further, the patient underwent posterior fossa exploration because of the clinically definite symptoms. At surgery, a well-delineated tumor with a shiny, pearly appearance was found in the right CPA cistern. The tumor, which was partially removed, surrounded the cisternal portion of the right trigeminal nerve and extended to the prepontine cistern. The diagnosis of epidermoid tumor was confirmed by histopathologic examination of the surgical specimen. Seven days after the surgery, a follow-up MR examina-

tion was performed. The area of abnormal, low signal intensity in the left CPA cistern seen in Figure 1A and B was not changed in appearance on the postoperative T2-weighted FSE axial images, and the T1-weighted images obtained after administration of contrast material showed no abnormal enhancement (not shown). To evaluate the extent of the epidermoid tumor found at the posterior fossa exploration, diffusion-weighted spin-echo imaging was performed. The residual epidermoid tumor, shown as an area of high signal intensity in the right CPA and prepontine cisterns, did not extend to the left CPA cistern (Fig 1E and F). A third examination, including cine phase-contrast MR imaging, was performed to investigate the cause of the abnormal, low signal intensity of the left CPA cistern. The phase-contrast images were obtained with a velocity-encoding value of 5 cm/s in axial orientation at the level of the cisternal portion of the trigeminal nerve. There was no flow in the right CPA or prepontine cisterns, as expected, owing to the presence of the epidermoid tumor. A normal to-and-fro flow pattern of CSF was recognized in the left CPA cistern, and a portion of high velocity exceeding the velocity-encoding value of 5 cm/s was noted at the CSF systolic (craniocaudal flow) phase (Fig 1G).

Discussion

Intracranial epidermoid tumors are well-delineated cystic lesions that have an irregular lobulated outer surface and insinuate along CSF cisterns. They typically have long T1 and T2 relaxation times, and the MR signal intensity may closely approach that of CSF on conventional spin-echo images, thus leading to diagnostic uncertainty and poor delineation of the tumor margin. Apart from the similar signal intensity characteristics on conventional spin-echo images, slow flow-sensitive pulse sequences, such as diffusion-weighted imaging (7) or fast imaging with steady-state free precession (5), are reported to be effective for distinguishing epidermoid tumors from CSF cisterns, reflecting the solid nature of the former and the pulsatile bulk flow of the latter.

In this patient, who presented with right trigeminal neuralgia, we missed an epidermoid tumor of the CPA cistern on the symptomatic side on the preoperative routine MR examination (Fig 1A-D). This was thought to have been caused by the minimal mass effect of the epidermoid tumor in addition to the almost identical signal characteristics to those of CSF. Although the postoperative diffusion-weighted images (Fig 1E and F) confirmed the presence of a residual epidermoid tumor in the right CPA and prepontine cisterns, the cause of the abnormal, low signal intensity of the contralateral CPA cistern remained unknown. Because the abnormal intensity was only seen on the T2-weighted FSE images, we postulated that the

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From the Department of Radiology, Osaka University Medical School, 2-2, Yamadaoka, Suita-City, Osaka 565, Japan. Address reprint requests to Norihiko Fujita, MD.

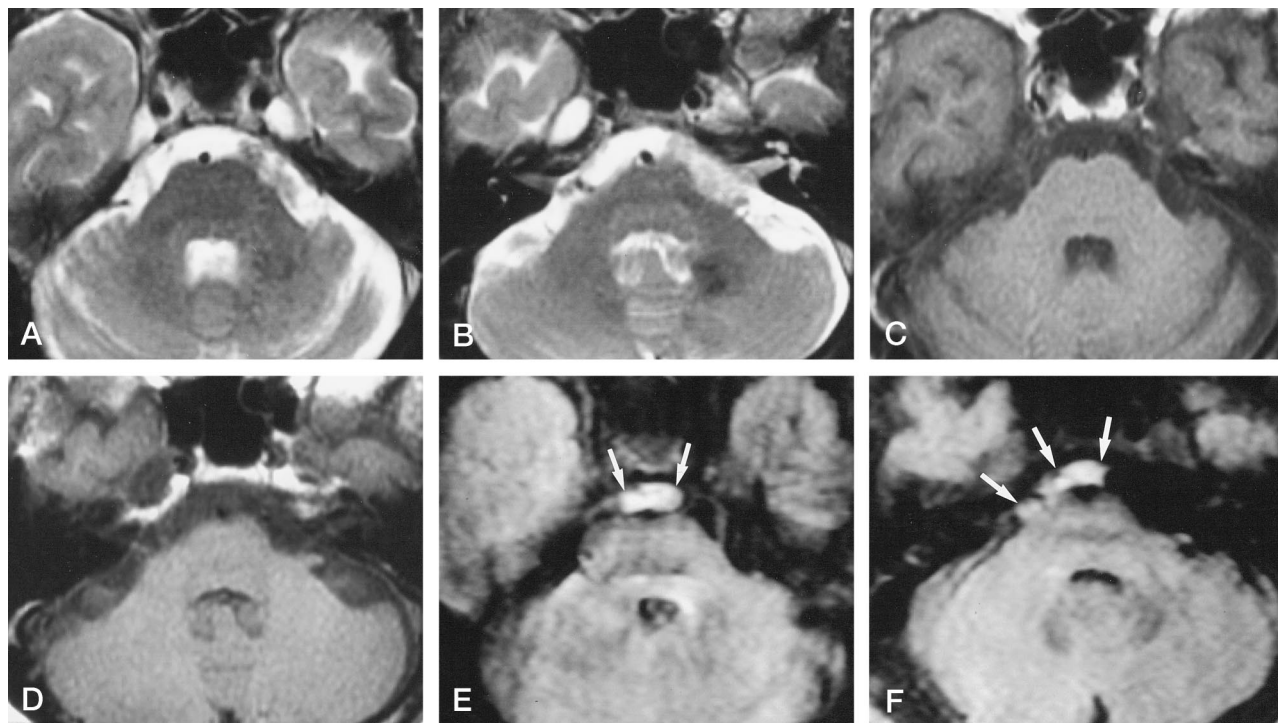


FIG 1. A 69-year-old woman with right trigeminal neuralgia.

A and B, Preoperative T2-weighted axial FSE MR images (4000/90/2 [repetition time/echo time/excitations], echo train length = 8) show an area of abnormal, low signal intensity in the left CPA cistern. The right CPA cistern appeared to have normal CSF intensity.

C and D, Preoperative T1-weighted axial spin-echo images (650/11/2) show no difference in signal intensity between the right and left CPA cisterns.

E and F, Postoperative diffusion-weighted axial spin-echo images at similar levels as A and B (2222 [gated]/100/1, b value = 338 s/mm²) show the residual epidermoid tumor (arrows) in the right CPA and prepontine cisterns as an area of high signal intensity. The left CPA cistern shows normal low signal intensity, reflecting high apparent diffusion coefficients of CSF.

G, Velocity image during CSF systolic (craniocaudal flow) phase at similar level as A obtained by cine phase-contrast technique (33/13.4/1, velocity-encoding = 5 cm/s) shows no flow in the right CPA and prepontine cisterns and normal to-and-fro flow pattern of CSF in the left CPA cistern. A portion of high velocity (arrow) exceeding the velocity-encoding value of 5 cm/s was shown as an area of low signal intensity within a surrounding high-intensity area, which results from velocity aliasing.

cause would be a CSF flow phenomenon relating to the pulse sequence we used.

A third MR examination was performed to examine this hypothesis. The cine phase-contrast MR image of CSF flow (Fig 1G) revealed a normal to-and-fro flow pattern of CSF in the left CPA cistern, indicating that the abnormal signal intensity resulted from a CSF flow phenomenon. A portion of high velocity exceeding the velocity-encoding value of 5 cm/s was noted at the CSF systolic (craniocaudal flow) phase (Fig 1G). We measured CSF flow of the right and left CPA cisterns in seven volunteers using the same phase-contrast pulse sequence, but such a high velocity (exceeding 5 cm/s) was not observed during the entire cardiac cycle, indicating that the CSF flow of the left CPA cistern might be exaggerated because of the presence of the epidermoid tumor of the right CPA and prepontine cisterns.

In our institution, FSE imaging has been routinely used for obtaining T2-weighted images of the brain, as in other institutions in which FSE imaging is available. In the commercially supplied FSE sequence, flow-dependent phase-shift compensation (flow compensation) via modification of the gradient waveforms (8) was not possible either in the section or read directions. For axial imaging of the brain, it was applied in the section direction, because the dominant direction of CSF flow

is craniocaudal. Despite the use of flow compensation, FSE imaging is known to suffer from signal loss of flowing spins as compared with conventional (non-FSE) spin-echo sequences (9, 10). While only the spin-echo signals are significant in conventional spin-echo sequences, FSE imaging usually combines data from many echo signals consisting of spin echo and stimulated echo. Therefore, complete flow compensation for each echo is difficult to achieve, resulting in destructive interference of many echo signals, and hence, in artifactual signal loss of flowing spins (10). Furthermore, the use of multiple echoes in FSE imaging leads to increased time-of-flight signal loss, also being a contributing factor for signal loss of flowing spins. Therefore, we postulate that the abnormal, low signal intensity in the left CPA cistern shown in Figure 1A and B was caused by the vulnerability of FSE imaging to signal loss of flowing spins in association with the exaggerated CSF flow there.

The CPA is the most common site of occurrence of intracranial epidermoid tumors, accounting for 5% of masses in this region (11). In this case, we observed abnormal, low signal intensity of the CPA cistern on one side on T2-weighted FSE images and the presence of an epidermoid tumor in the contralateral CPA cistern that appeared to have normal CSF intensity. Although this phenomenon occurred in this case, we

are not suggesting that it is present in all epidermoid tumors. Although more experience is needed before we can know how frequently it is observed, demonstration of this phenomenon might raise the possibility of this particular tumor and suggests further evaluation with slow flow-sensitive sequences, such as diffusion-weighted or phase-contrast imaging.

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