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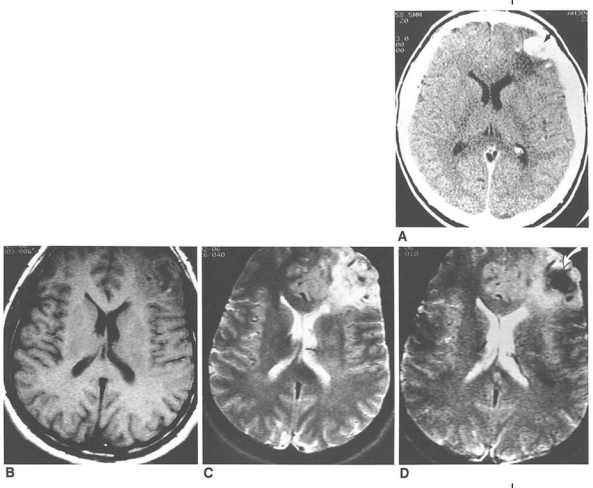

Calcified Intracranial Lesions: Detection with Gradient-Echo-Acquisition Rapid MR Imaging

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Seventeen patients with partially calcified intracranial lesions, as documented by CT, were evaluated with MR imaging at 1.5 T. All patients were imaged with both conventional spin-echo techniques and reduced flip-angle gradient-echo-acquisition (GEA) sequences, during which a signal is acquired in the absence of a 180° radiofrequency pulse. GEA parameters were implemented so that T2* effects were maximized on these scans. In all 17 patients GEA images showed marked hypointensity throughout the entire area of calcification, matching the calcified region as seen on CT. In contrast, spin-echo findings in the calcified portions of the lesions were extremely variable, precluding confident identification of calcification on these images. The depiction of regions of calcification as marked hypointensity on GEA images can be ascribed to T2* shortening from static local magnetic field gradients at interfaces of regions differing in magnetic susceptibility, a phenomenon that is well documented in vitro, when various diamagnetic solids are placed in aqueous suspension. However, we cannot exclude the possible additional role of accompanying paramagnetic ions, which sometimes are present with diamagnetic calcium salts in various intracranial calcifications. Since the hypointensity due to calcification on GEA images is not specific, noncontrast CT could be used to confirm its presence.

Although this lack of specificity and the artifacts that emanate from diamagnetic susceptibility gradients at or near air–brain interfaces somewhat limit the application of GEA techniques, we suggest that rapid MR imaging using GEA sequences can consistently demonstrate intracranial calcification, and that this technique thus seems to be a useful adjunct to conventional spin-echo imaging.

Although spin-echo (SE) MR imaging has rapidly evolved into the most sensitive imaging technique for detection of most intracranial diseases [1, 2], one of its deficiencies lies in its well-recognized inability to detect calcification consistently [1–4]. Since the detection of calcification within certain intracranial lesions can provide important differential information, and because CT is highly sensitive for calcification, this has been regarded as a limitation of MR, both as a screening tool for certain diseases and as an aid to specific diagnosis.

Recently, investigators have used gradient-echo signal acquisition (GEA) rather than conventional SE techniques to maximize the detection of lesions having magnetic susceptibility differences, since T2* effects due to static field gradients created by these susceptibility differences are rephased by the 180° radiofrequency pulse used in SE sequences [5–9]. This technique has been especially useful in demonstrating previously undetectable signal intensity information from SE MR imaging at low to mid-field strengths [5, 8]. Furthermore, it is well documented in vitro that the introduction of various particulate solids into suspension creates abrupt magnetic susceptibility gradients that change static local magentic fields slightly, and consequently shorten T2* [10–14]. Early in our experience with reduced flip-angle GEA rapid MR imaging, we noted that calcified choroid plexus was consistently and markedly hypointense on GEA images, whereas these same areas were usually not delineated by SE images (Fig. 1). This observation prompted

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MR Imaging of Cerebellopontine Angle and Internal Auditory Canal Lesions at 1.5 T

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The high-field, thin–section (3–5 mm) MR imaging characteristics of 49 cerebellopontine angle and internal auditory canal lesions were reviewed. The diverse abnormalities include 20 acoustic neurinomas, eight neurinomas of other cranial nerves (six involving the fifth cranial nerve and two involving cranial nerves IX–XI), seven meningiomas, five subdural fluid collections, four brainstem tumors with exophytic components, three glomus jugulare tumors, one epidermoid tumor, and one basilar artery aneurysm. T1-, T2-, and proton-density-weighted images were obtained in all cases.

T1-weighted images most accurately showed the margins of the seventh and eighth nerves in the internal auditory canal and were most sensitive in detecting small tumors in the cerebellopontine angle. Differentiation of meningioma from acoustic neurinoma by MR was provided most reliably by separation of the meningioma from the porus acusticus and seventh and eighth nerves and not by signal-intensity differences. A hypointense vascular rim was noted on MR in seven of 13 extracanalicular acoustic tumors and in three of seven meningiomas.

Recent reports of MR imaging of the normal anatomy and of lesions of the cerebellopontine angle (CPA) and internal auditory canal (IAC) at low [1–5] and moderate [3, 6–8] magnetic field strengths have been most encouraging. Absence of beam-hardening artifacts, multiplanar imaging capability, and greater intrinsic soft-tissue contrast are emphasized as significant advantages of MR imaging relative to high-resolution CT in the assessment of tumors of the CPA and IAC. MR at 0.35 T was as accurate as gas CT in the diagnosis of all sizes of acoustic tumors [7]. The ability to demonstrate the normal contents of the IAC by MR facilitated differentiation of acoustic tumors from meningiomas and other lesions originating in the CPA [4, 7]. MR is now considered the diagnostic study of choice for the evaluation of patients with suspected acoustic neurinoma [3, 4, 9].

Prior reports of high-field-strength (1.5 T) MR of the CPA and IAC included only a few abnormal patients [10], described very small or intracanalicular tumors [11], or combined results of moderate (0.5 T) and high-field-strength imaging with 10-mm slice thickness [12]. We report the results of a large series of patients with diverse abnormalities of the CPA and IAC imaged exclusively at a high field strength with thin sections (3–5 mm).

Materials and Methods

We evaluated retrospectively 1000 consecutive brain MR examinations and identified 33 patients with 49 CPA and IAC lesions. Multiple lesions were found in five patients with known neurofibromatosis. One additional patient without neurofibromatosis had multiple lesions. The patients were 3–79 years old; 16 were females and 17 were males. The abnormalities included 20 acoustic neurinomas, eight additional cranial nerve tumors (six involving cranial nerve V and two involving cranial nerves IX–XI), seven meningiomas, five postoperative subdural fluid collections (three hematomas, two CSF hygromas), three glomus jugulare tumors, one epidermoid tumor, and one basilar artery aneurysm. Four patients with intraaxial

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