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Atypical demyelinating lesions in patients with multiple sclerosis

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Abstract We describe an atypical MRI appearance of multiple sclerosis (MS). Lesions characterized on T2-weighted images by a well-defined rim of increased signal intensity and a concentric region of higher signal intensity were seen in 6 of 132 patients with MS. On T1-weighted images these lesions were evident as regions of low signal intensity, often with a rim of contrast enhancement or increased signal in-

tensity. These appearances tended to be shown by new, evolving lesions.

Key words Demyelination · Multiple sclerosis · Magnetic resonance imaging

Introduction

Typical MRI appearances of multiple sclerosis (MS) include focal zones of abnormally high signal intensity in the cerebral white matter which have oblong, cylindrical or “string of beads” appearances and often a close anatomical relationship to the lateral ventricles [1–8]. Contrast enhancement has been described [9–12]. Atypical lesions, resembling tumors, are reported [13, 14]. Ring-like lesions characterized by a ring of high signal intensity on moderately T1-weighted images have been described in clinically active MS [15]. We noted atypical inhomogeneous lesions, dissimilar to the ring lesions previously reported in cases of MS. The purpose of this report is to describe the appearance of these lesions, which may be solitary in some cases, and may be mistaken for a neoplasm.

Material and methods

The MR images of 132 patients being investigated or followed for MS were reviewed retrospectively to determine the frequency of target-shaped lesions containing a focal region of abnormally high signal intensity on and a well-defined central concentric region of higher signal intensity on T2-weighted images. Images, obtained on

a 1.5 T imager, included a sagittal localizer spin-echo (SE) image obtained with TR 500, TE 20 and then a series of approximately 40 axial SE images with 5 mm slice thickness and 1 mm skip, 20 cm field of view, 256 × 256 matrix, 2 excitations, cardiac gating, TR about 2000 and TE 20 and 80 ms. In some cases, gadopentetate injection was administered, and 5-mm-thick SE images with TR 500, TE 20 obtained subsequently (contrast-enhanced T1-weighted images). The clinical records were reviewed in each case.

Results

We identified 6 patients with lesions with the target configuration. Of these, 4 fulfilled the criteria for probable or definite MS; 2 had a clinical diagnosis of MS without fulfilling these criteria. There were 2 patients with more than one target lesion. The lesion has two well-defined zones: an outer ring of high signal intensity (with T2 weighting) and an inner ring of higher signal intensity. On T1-weighted images, the outer ring has slightly higher intensity than white matter; the inner zone has a lower signal intensity, nearly isointense with cerebrospinal fluid. Each lesion is characterized by well-defined borders separating it from adjacent white matter and also separating the central region of higher signal intensity. None of the lesions displaced adjacent

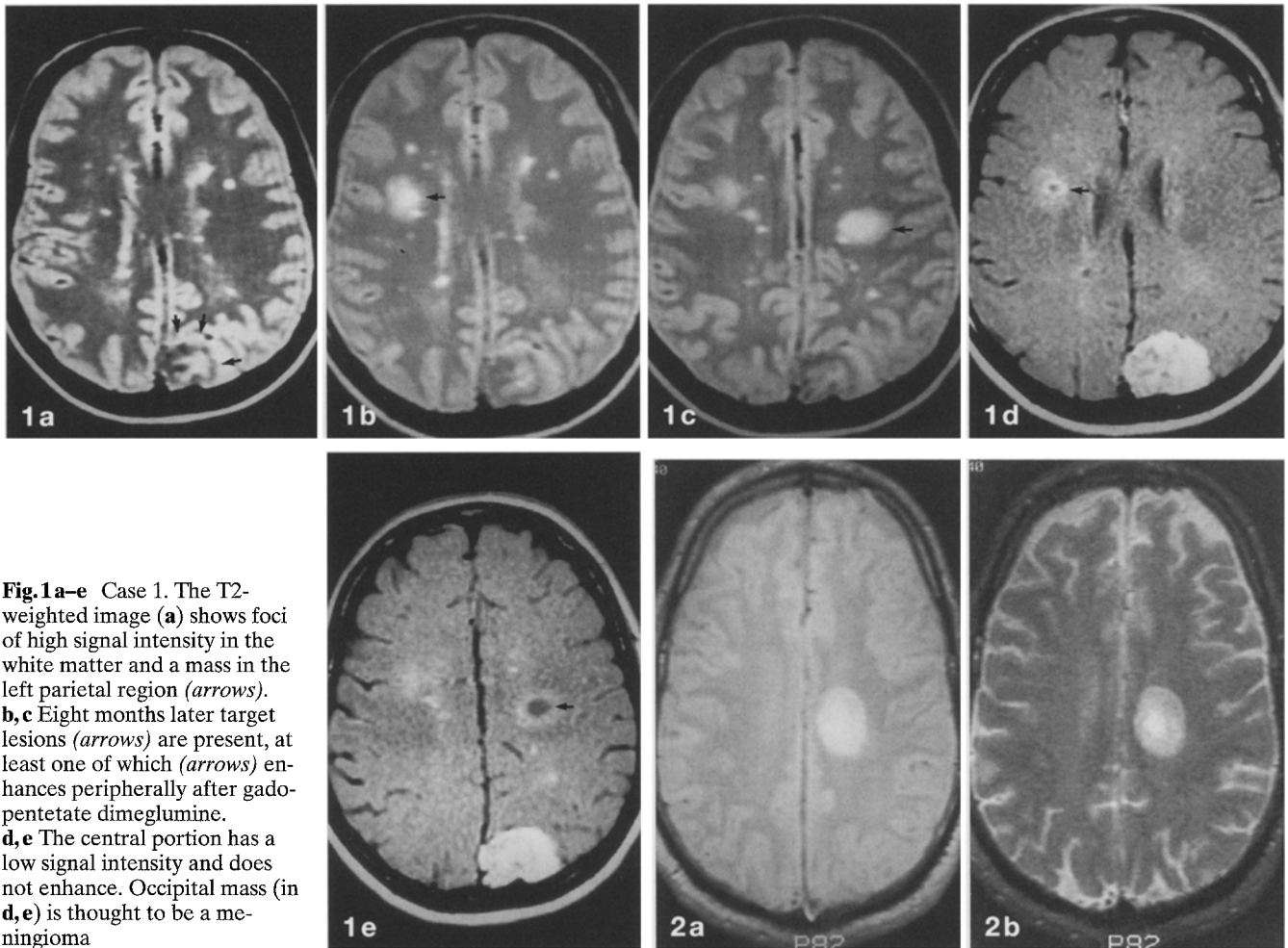


Fig. 1 a-e Case 1. The T2-weighted image (a) shows foci of high signal intensity in the white matter and a mass in the left parietal region (arrows). b, c Eight months later target lesions (arrows) are present, at least one of which (arrows) enhances peripherally after gadopentetate dimeglumine. d, e The central portion has a low signal intensity and does not enhance. Occipital mass (in d, e) is thought to be a meningioma

Fig. 2 a, b Case 2. Typical target lesion in the left parietal lobe on proton density (a) and T2-weighted (b) images. Multiple periventricular lesions were seen at other levels

cerebral structures. In one patient two of the lesions showed contrast enhancement, but in the other patient who received contrast medium, the target lesion did not enhance. Of two patients we followed up, one showed a change in appearance and reduction in size of the lesions within a year. One appeared during a follow-up examination and was not present 10 weeks earlier. In all cases, the target lesion was accompanied by other lesions taking the more usual form of homogeneous foci of abnormal signal intensity in white matter.

Case reports

Case 1

A 43-year-old woman with a diagnosis of probable MS was being followed at regular intervals because of a presumed meningioma. MRI revealed multiple periventricular high signal intensity lesions

consistent with MS (Fig. 1). A mass which enhanced markedly after intravenous contrast medium was also present. None of the presumed MS plaques enhanced. During routine follow-up 10 months later, MRI showed two target lesions in regions of the white matter devoid of lesions on the previous study. Intravenous gadopentetate dimeglumine, 0.1 mmol/kg, was administered for assessment of the presumed meningioma. Both the mass and the target lesion enhanced. The center of the target, which did not enhance, had a low signal intensity on the T1-weighted images, approximately isointense with cerebrospinal fluid.

Case 2

A 47-year-old man complained of numbness and tingling over the right side of his body. CT revealed two subtle low density areas in the left periventricular region that enhanced markedly with contrast medium. MRI showed multiple periventricular lesions of high signal intensity on T1 and T2-weighted images. Using CT-directed stereotactic methods, a mass with a target appearance (Fig. 2) in the region of the atrium of the left lateral ventricle was biopsied. Microscopy of the specimens revealed perivascular infiltrates containing lymphocytes and occasional polymorphonuclear cells, with local necrosis and demyelination, consistent with an MS plaque. CT 1 month later showed lesions similar to the target lesion in the left periventricular region, but with no contrast enhancement.

Follow-up MRI 8 months and 2 years later showed decrease in size of some lesions and disappearance of the target lesion. No contrast enhancement was observed.

Discussion

The lesion we observed in 6 cases has not been described previously in MS although it has been illustrated [13]; it differs from the large atypical lesions previously described [13–15]. The lesion is characterized by a target configuration with a central high intensity zone surrounded by a halo of lower signal intensity on T2-weighted images. Low signal intensity on T1-weighted images corresponds to the central zone. Contrast enhancement may be seen in the peripheral portion of the lesion. In each of our cases, the diagnosis of demyelinating disease was made on the MR images because of other lesions typical of MS. If the target lesion is present as a solitary finding as in one case we reviewed, the di-

agnosis of neoplasm may be suspected. The atypical demyelinating lesions that we describe do not tend to displace adjacent sulci or ventricles unlike cerebral neoplasms. The lesion differs from the “ring-like” lesion described by Powell [15] which had a high signal intensity on T1-weighted images, attributed to paramagnetic substances.

The inhomogeneous target lesion may represent an edematous plaque with a necrotic center. The low magnetization ratio observed in the central portion of one early demyelinating plaque with a similar appearance [13] is consistent with necrosis. The enhancement in the surrounding lower signal intensity portion is consistent with inflammation and/or edema. The shrinking of lesions in two cases and the contrast enhancement in another suggest that the lesions may represent an early or active stage of the demyelinating process. The appearance of disappearance of target lesions correlated poorly with clinical changes in our patients, as in other studies [10, 11, 16].

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