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Central Nervous System Magnetic Resonance Imaging Findings in Amyotrophic Lateral Sclerosis

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Summary. Magnetic resonance imaging (MR) of the brain was performed in five patients with amyotrophic lateral sclerosis (ALS) and the findings were evaluated. Two patients had asymmetrical areas of increased signal intensity in the white matter. Such changes are not specific, but some possible explanations for these findings in ALS are considered.

Key words: MRI – Amyotrophic lateral sclerosis – White matter abnormalities

Introduction

Amyotrophic lateral sclerosis (ALS) is a devastating disorder of the central nervous system characterized by involvement of both upper and lower motor neurons. A study by positron emission tomography has indicate that ALS with upper motor neuron involvement extends beyond the corticospinal tract [3]. Magnetic resonance imaging (MRI) is a useful tool for the detection of central nervous lesions, and has proved to be more sensitive than computed tomography (CT) [2]. It may be also helpful in detecting clinically unsuspected lesions [9]. We studied patients with ALS to determine whether abnormalities were present on MRI.

Patients and Methods

Four women and one man (aged 42–70 years) were studied. All had a clinical diagnosis of ALS established from the history, physical examination, electromyographic studies and muscle biopsy. Other suspected diagnoses were excluded by appropriate laboratory tests, including serum protein and immunoelectrophoresis, CSF examination and screens for lead intoxication. MRI was performed in all the patients using a Hitachi G 50 scanner with a superconducting magnet, 0.5 Tesla field strength. MRI were evaluated for signal abnormalities in the periventricular region, both hemispheres, the cerebellum, and the brain stem. All had 5 or 10 mm axial contiguous slices and T2-weighted images were obtained with an echo time of 20–120 ms and a repetition time of 2000 ms. CT of the brain was also performed on each patient within 1 month of the MRI study.

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Results

Several high signal lesions were observed in the white matter on the T2-weighted images in two cases (Figs. 1, 2). These areas were limited to the white matter and there were no other lesions. These two patients, aged 42 and 44 years, did not differ from the other patients on clinical grounds. The remaining three patients had completely normal MRI scans. However, CT scans of all five patients were considered to be normal.

Discussion

The sensitivity of MRI is superior to that of CT. MRI has only recently come to the fore as a clinical diag-

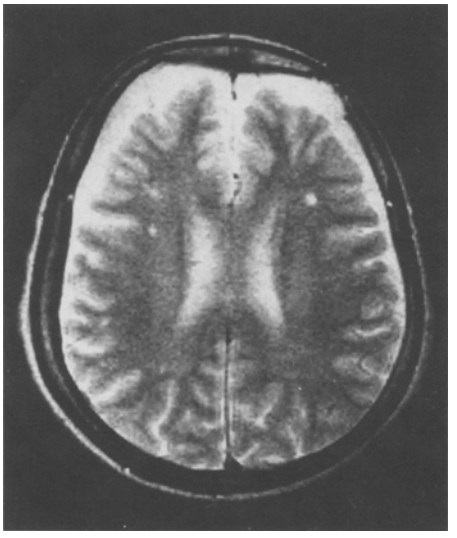

Fig. 1. MRI of case 1. Note three small discrete lesions in the white matter (TR = 2000 ms, TE = 80 ms)

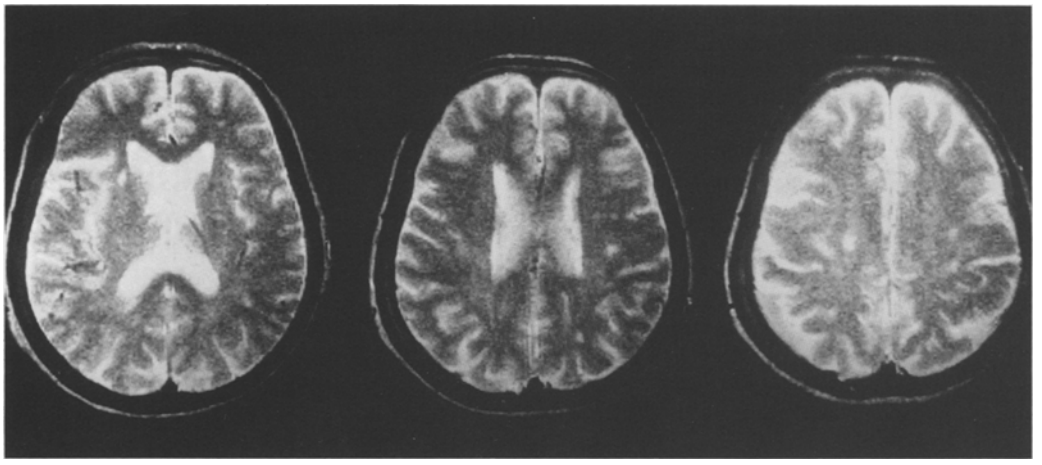

Fig. 2. MRI of case 2. High signal lesions in white matter, predominantly in periventricular area (TR = 2000 ms, TE = 80 ms)

nostic tool, and its uses have only begun to be defined [2, 9]. In ALS, the principal neuropathological finding is a loss of nerve cells in the anterior horns of the spinal cord and motor nuclei of the lower brain stem [6]. The corticospinal tract is also degenerated, most evidently in the lower parts of the spinal cord, but also up through the brain stem to the posterior limb of the internal capsule and corona radiata. There is loss of Betz cells in the motor cortex. However, the extent and severity of these changes are variable [1, 7, 8]. In the literature on MRI in ALS, only single studies has been reported by Goodin et al. [5]. In five patients with clinically definite ALS they found symmetrical areas of increased signal intensity on MRI, extending from the cortex, through the corona radiata, posterior limb of the internal capsule, and cerebral peduncles into the pons in two patients. They stressed that these MRI abnormalities correlated with the pathological changes found by others in the central white matter of patients with ALS. In our series, two patients had asymmetrical areas of increased signal intensity limited to the white matter without other lesions. It is well known that multifocal white matter lesions are frequent non-specific findings in MRI and 5%–30% of normal subjects aged over 50 years have asymptomatic white matter lesions, which are seen more frequently in those with risk factors for cerebral vascular disease [4]. However, our two patients were under 50 years of age, normotensive, and had no risk factors for cerebrovascular disease.

We believe the lesions seen on MRI relate to the neuropathological changes that can occur in the central white matter. Regardless of the physiological or pathological basis of the lesions that we found, it is important to recognize that ALS, and possibly other degenerative diseases of the central nervous system, may be associated with central white matter lesions found on MRI. Diagnostic confusion with diseases such as multiple sclerosis may occur infrequently, but some patients with ALS are first seen with a primarily upper motor neuron disorder, and the presence of white matter lesions on MRI should not be overestimated. It is also important to recognize that ALS, and possibly other degenerative diseases of the central nervous system, may be associated with central nervous lesions on MRI. We have planned studies to assess the changes in MRI over time in individual patients with ALS, which are necessary to indicate whether or not such changes are related to ALS.

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