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SHORT ABSTRACT

Diagnosis of Multiple Sclerosis

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Keywords: Multiple sclerosis; Magnetic Resonance imaging; Diagnosis

Multiple sclerosis (MS) is a progressive inflammatory, demyelinating and neurodegenerative autoimmune disease of the central nervous system, which leads to chronic progressive and irreversible disability in most patients. Unfortunately, there is still no cure nor are there preventive measures for MS. However, more than 12 disease-modifying drugs with different modes of action offer considerable options to reduce relapse rate and severity, and in some cases by slowing the progression of disability. This provides opportunities but also challenges for improving (individualized) patient management, which require establishing an early and accurate diagnosis of the disease [1], and proper monitoring of disease evolution, treatment efficacy and safety [2].

The exact diagnosis of MS still remains challenging in some cases as there is no single test (including biopsy) that can provide a definitive diagnosis of this disease. In the last 30 years the neurological community has therefore adopted diagnostic criteria for MS, which have been modified several times following new evidence and experts' recommendations. These diagnostic criteria include clinical and paraclinical tests capable of demonstrating demyelinating lesions within the central nervous system disseminated in space (DIS) and time (DIT), and capable of excluding alternative diagnosis that could mimic MS either clinically or radiologically.

Although, based on its high sensitivity, magnetic resonance (MR) imaging has become the key diagnostic paraclinical tool in the diagnosis of MS, many imaging findings are not specific for the disease [3]. Therefore, differential diagnosis is a key issue in this context [4, 5]. The perivenular distribution pattern and increase iron deposition in MS lesions has been a target to address this issue, particularly when MR systems operating at higher magnetic field strengths (≥3T) are used. A relatively new sequence, susceptibility weighted imaging (SWI), which has shown high sensitivity for detecting iron containing tissues and small veins due to their paramagnetic properties, has added value for these purposes, particularly when co-registered and mixed with standard pulse sequences such as T2-FLAIR coining the term FLAIR*. Recent experience with the implementation of SWI at 3.0T/7.0T in MS has shown that most focal chronic, and some acute, demyelinating lesions can be depicted as areas of low signal intensity likely representing iron deposition, and that a substantial proportion of MS lesions shows a central vein (**Figure 1**). Future studies will have to demonstrate whether the incorporation of these imaging findings will further improve the specificity of MR imaging in the diagnosis of MS [1].

Another strategy for improving diagnostic accuracy is the incorporation of other important aspects of MS pathology such as the presence of cortical pathology. Cortical lesions are abundantly present in MS and may be better detected with dedicated pulse sequences such

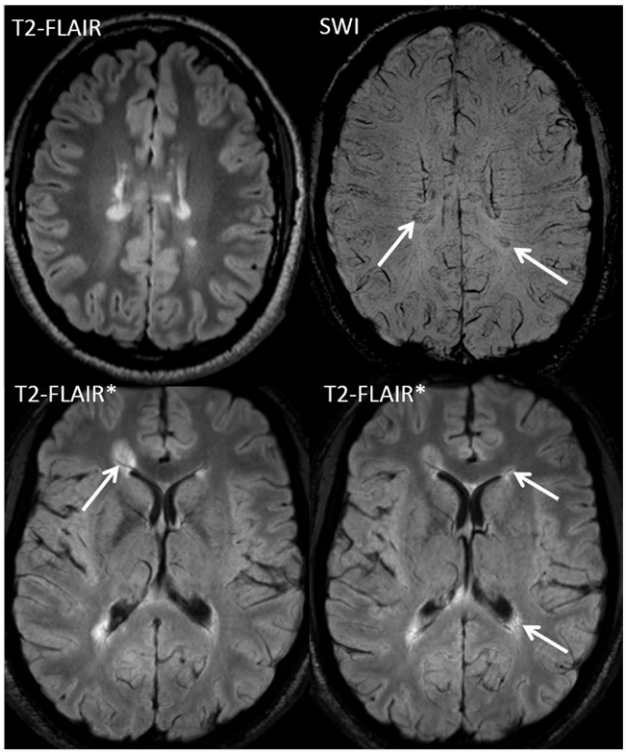

Figure 1: Patient presenting with a clinically isolated syndrome. Brain MR imaging shows typical demyelinating lesions of the type seen in multiple sclerosis, involving the periventricular white matter. Observe the presence of hypointense rims in multiple of these lesions likely reflecting iron deposition, on the susceptibility-weighted images (SWI) (arrows), and of central veins on T2-FLAIR* images (arrows).

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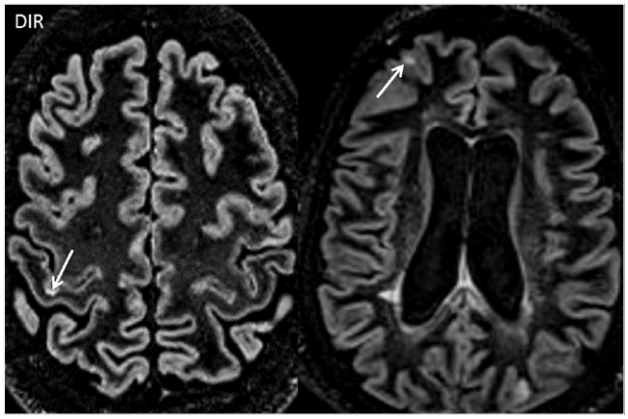

Figure 2: Patient presenting with a clinically isolated syndrome. Double inversion recovery images (DIR) shows, in addition to typical periventricular lesions, two cortical lesions (arrows).

as the double inversion recovery (DIR) or phase-sensitive inversion-recovery sequences (PSIR). The advantage of these sequences becomes even more obvious when higher magnetic field strengths are used. This higher sensitivity may have some clinical relevance as identification of at least one intracortical lesion may allow a more accurate identification of patients presenting with a clinically isolated syndrome at risk of converting to clinically definite MS (**Figure 2**) and therefore, has been proposed as an added diagnostic criterion for demonstrating DIS [6]. However, imaging of cortical lesions at standard clinical field strength, even when using DIR and/or PSIR sequences, is still suboptimal as a result of their limited sensitivity and reproducibility. Thus, while these sequences have made a major contribution for detecting focal cortical lesions in MS, providing important insights into the occurrence of cortical pathology, substantial research efforts are still needed before considering this technique within the standardized MR imaging protocol in the diagnostic work-up in clinical practice.

Competing Interests

The author has no competing interests to declare.

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