**SUMMARY**

Multiple sclerosis (MS) is the most frequent idiopathic inflammatory demyelinating disease of the central nervous system. Magnetic resonance imaging is the most important paraclinical parameter in the diagnosis of MS. If the MR criteria for dissemination in time and space are positive, the early diagnosis of MS may be established already after one clinical event; thus, MRI has an important impact on the initiation of early therapy in MS. Moreover, MRI is essential in monitoring disease activity and therapy effects. Atypical inflammatory demyelinating diseases include ADEM, neuromyelitis optica (Devic disease), Baló's concentric sclerosis, Schilder's disease, Marburg's disease, tumefactive demyelinating lesions, and acute transverse myelitis. These entities may be separated from MS by a different clinical course and a particular appearance on MRI. Occasionally, these variants merge with MS.
1.1 Multiple Sclerosis

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Introduction

Multiple sclerosis is a chronic autoimmune condition of the central nervous system (CNS) characterized by blood–brain barrier breakdown, inflammation, myelin damage, and axonal loss. The pathogenesis of MS is unknown; apart from a genetic predisposition, previous virus infections are thought to be relevant. Multiple sclerosis is estimated to affect 2.5 million individuals worldwide. Multiple sclerosis typically presents in young Caucasian adults, with a peak between 20 and 40 years. There is increasing evidence for first manifestations of MS at older ages as well. Multiple sclerosis is twice as common in women than men. The clinical courses include relapsing-remitting (RRMS), secondary progressive (SPMS), primary progressive (PPMS), and progressive-relapsing (PRMS) MS. Patients with RRMS exhibit neurological symptoms that remit over a period of weeks to months with or without complete recovery. A large proportion of patients with RRMS evolve after 10–15 years to the SPMS form of the disease, in which neurological deficits become fixed and cumulative. In contrast, patients with PPMS exhibit a continuous steady progression of neurological symptoms from the onset of the disease without periods of relapse or remission. Patients with PRMS also experience steady disease progression from the outset with or without superimposed relapses and remissions.

The clinical diagnosis of MS requires evidence for at least two anatomic distinct lesions consistent with (CNS) white matter damage in an individual with a history of at least two distinct episodes of focal neurological dysfunction (so-called symptom dissemination in time and space). These criteria are not difficult to demonstrate in well-established MS, but considerable problems can arise early in the course of the disease, and it is not possible to make a definite clinical diagnosis of MS when the patient first presents with a clinically isolated syndrome even if it is typical of MS (e.g., unilateral optic neuritis, internuclear ophthalmoplegia, or partial myelopathy). In recent years, new drugs have been introduced in the treatment of MS which have been proven to especially treat early stages of the disease. In order to establish an early diagnosis of MS and therefore initiate early treatment, new diagnostic criteria, including paraclinical parameters, have been introduced. Magnetic resonance imaging has become the most important of these paraclinical parameters. Already after one clinical event and positive MRI criteria, the diagnosis of MS may be established and treatment initiated; thereby, MRI has immediate impact on early treatment of MS.

1.1.1 Epidemiology, Clinical Presentation, and Therapy

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1.1.1.1 Epidemiology

Multiple sclerosis (MS) is a chronic inflammatory demyelinating disease of the central nervous system (CNS) that affects mainly young adults and is yet the most frequent cause of invalidity at an early stage. The proportion of women to men affected is about 2–3:1, and disease most frequently occurs between the ages of 20 and 40 years but also during childhood or after the age of 50 years.

The prevalence of MS varies considerably around the world, increasing with the distance from the equator. It is highest in northern Europe, southern Australia, and the middle part of North America, with 80–150 per 100,000 persons. Germany also belongs to high prevalence regions with about 120,000 to 150,000 MS patients. There has been a trend toward an increasing prevalence and incidence, particularly in southern Europe. It is uncertain to which extent the observed increases are explained by an enhanced awareness of the disease and improved diagnostic techniques, but in some areas of northern Europe incidence has actually declined. The reasons for the variation in the prevalence and incidence of MS worldwide are not well understood. Environmental and genetic factors probably play a role. People who migrate from high- to low-prevalence areas during childhood only take on the risk of the host country, and vice versa; however, the nature of putative environmental factors remains unclear in numerous case-control studies.

1.1.1.2 Genetics

Evidence that genetic factors have a substantial effect on susceptibility to MS is unequivocal. The concordance rate is highest among monozygotic twins (about 30%) and only about 2–5% among dizygotic twins; however,