Introduction

Early after its introduction, MR imaging was found to be highly sensitive for white matter disease. Even before paramagnetic agents became available, MR imaging thus gained an important role in diagnosis and treatment planning of multiple sclerosis (MS) [1, 2, 3]. After the introduction of paramagnetic agents, such as gadolinium-DTPA, the new imaging method was increasingly used to diagnose or therapeutic decision making. Twenty patients with clinically proven multiple sclerosis were examined with optimized imaging protocols in a 1.5- and a 0.23-T MR scanner within 48 h. Images were assessed independently by two neuroradiologists. No statistically significant interrater discrepancies were observed. A significantly lower number of white matter lesions could be identified in low-field MR imaging both on T1- and on T2-weighted images (T2: high field 700, low field 481; T1: high field 253, low field 177). A total of 114 enhancing lesions were discerned in the high-field MR imaging as opposed to 45 enhancing lesions in low-field MR imaging. Blood-brain barrier disruption was identified in 11 of 20 patients in the high-field MR imaging, but only in 4 of 20 patients in low-field MR imaging. Since a significantly lower lesion load is identified in low-field MR imaging than in high-field MR imaging, and blood-brain barrier disruption is frequently missed, caution must be exercised in interpreting a normal low-field MR imaging scan in a patient with clinical signs of multiple sclerosis and in interpreting a scan without enhancing lesions in a patient with known multiple sclerosis and clinical signs of exacerbation.

Abstract  As low-field MR imaging is becoming a widely used imaging technique, we aimed at a prospective assessment of differences in imaging quality between low- and high-field MR imaging in multiple sclerosis patients possibly interfering with diagnostic or therapeutic decision making. Twenty patients with clinically proven multiple sclerosis were examined with optimized imaging protocols in a 1.5- and a 0.23-T MR scanner within 48 h. Images were assessed independently by two neuroradiologists. No statistically significant interrater discrepancies were observed. A significantly lower number of white matter lesions could be identified in low-field MR imaging both on T1- and on T2-weighted images (T2: high field 700, low field 481; T1: high field 253, low field 177). A total of 114 enhancing lesions were discerned in the high-field MR imaging as opposed to 45 enhancing lesions in low-field MR imaging. Blood-brain barrier disruption was identified in 11 of 20 patients in the high-field MR imaging, but only in 4 of 20 patients in low-field MR imaging. Since a significantly lower lesion load is identified in low-field MR imaging than in high-field MR imaging, and blood-brain barrier disruption is frequently missed, caution must be exercised in interpreting a normal low-field MR imaging scan in a patient with clinical signs of multiple sclerosis and in interpreting a scan without enhancing lesions in a patient with known multiple sclerosis and clinical signs of exacerbation.

Keywords  MR imaging · Low field strength · MRI · Multiple sclerosis
the assessing MR radiologists subjectively favored the imaging quality at the higher field strength in some studies. Another study compared ultra-low field strength MR imaging (0.064 T) with high-field MR imaging (HFMR; 1.5 T) in a variety of pathologies of the cranium suggesting an overall lower diagnostic sensitivity at ultra-low field strength as compared with high field strength, whereas low-field imaging and CT were rated as equivalent [10]. Another study performed on autopsy material compared MR imaging at a field strength of 0.3 and of 1.5 T in the diagnosis of temporomandibular joint disruption showing a superiority of the higher field strength when comparable scan times were used [11].

To the best of our knowledge, there has been no study thus far which compares the diagnostic sensitivity of MR imaging in MS patients at open system scanners with low field strength (in our study 0.23 T) with that of central bore scanners at 1.5 T.

### Materials and methods

Twenty patients (11 women and 9 men) were included in this prospective study. Mean age was 35.4 years (age range 19–64 years). Informed consent was obtained from all patients after extensive explanation of the nature of the respective MR procedures and the purpose of the study. The study was approved by the ethics committee (Review Board on Medical Ethical Issues) of our university. Magnetic resonance imaging was performed using a 1.5- as well as a 0.23-T scanner equipped with standard, linear polarized head coils (Outlook and Edge, Marconi Medical Systems, Cleveland, Ohio; gradients: Outlook 12 mT/m; Edge 27 mT/m). The scan parameters were optimized at each scanner to provide best possible images at clinically acceptable scan times. Comparable scan protocols were performed with both scanners within 48 h. Sequences included T2-weighted axial sequences, T1-weighted axial sequences before and after administration of gadolinium-DTPA and a sagittal fluid-attenuated inversion recovery (FLAIR) sequence. In the low-field imager, no fast spin-echo sequences were available at the time of the study. We therefore applied a gradient-echo se-