International Doctoral School
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Searching for early markers of treatment response in patients with multiple sclerosis with a focus on neuropsychological and radiological parameters

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This study aims to identify new neuropsychological and radiological markers for personalising MS therapy in the future.

Introduction:

Multiple sclerosis (MS) is a chronic disease of the central nervous system with an incompletely established etiopathogenesis. At present, a complete cure of MS is not possible, but the number and variety of therapies available to modify the course of the disease are gradually increasing. Unfortunately, at the onset of the disease there are still no tools available that can accurately predict disease activity, the rate of progression of neurological disability and monitor the effectiveness of therapy. Cognitive impairment even at an early stage of the disease has been shown to be one of the factors correlating with progression of CNS atrophy in MS. The importance of magnetic resonance imaging (MRI) in the assessment of the clinical status of MS patients is increasing all the time. Recently, so-called 'non-standard' techniques including volumetric measurements of selected structures of the brain and spinal cord are becoming increasingly important enabling precise measurement of progression of atrophy of the CNS.

Research hypotheses:

1. Cognitive impairment is diagnosed at an early stage of MS.
2. Cortical inflammatory/demyelinating lesions and brain atrophy correlate with cognitive impairment in the early stage of MS.
3. Measurement of several parameters including: brain atrophy, number of cortical lesions using double inversion recovery (DIR) sequence in MRI and assessment of cognitive functions in the first years of MS may help predicting the clinical course of MS already at early stages of the disease and consequently choose best therapeutic algorithm.

Assessment of population of patients with MS treated in Universtity Hospital No. 1 in Lodz according to the current SMPT database.
Inclusion criteria: patients diagnosed with the relapsing-remitting multiple sclerosis (RRMS) according to McDonald 2017 criteria, who have been on disease-modifying therapy (DMT) for up to 3 years prior to the start of the study.
n = 223

Exclusion criteria: patients without double inversion recovery (DIR) sequences in 3T MRI scans
n = 103

Eligible MS patients with MRI DIR sequences (adult female and male patients)
n = 120

Neuropsychological functions assessed at the first study time point using battery of tests such as Brief International Cognitive Assessment for MS: BICAMS – SDMT, CVLT2, BVMTR and MoCA (Table 1).
Fatigueness assesed by FSMC, MFIS scales and depression by Beck Depression Inventory.
Detailed data on the patients' clinical condition, possible therapy modifications and their causes, demographic data and information on the impact of the disease on the type and amount of professional work performed by the patients were collected.
(29.04.2024) n = 85

Shinoda, Koji et al., 2020

Figure 2. Examples of cortical lesions on 3-dimensional double inversion recovery (DIR) images from two patients with MS. (**A–C**) Arrowheads indicate an intracortical lesion that does not appear to extend into the subcortical white matter. (**D–F**) Arrows indicate a leukocortical lesion that involves both the grey and white matter.

Carrot
Sweater
Hammer
Baseball
Football
Chisel
Pants
Beans
Shoes
Screwdriver
Basketball
Corn
Saw
Golf
Dress
Lettuce

Trial 1 __/16
Trial 2 __/16
Trial 3 __/16
Trial 4 __/16
Trial 5 __/16
Total Learning __/80

Table 1.
Cognitive domains measured by tests included in neuropsychological batteries used in MS

Domain	Test	Battery
Information Processing Speed, Attention	Symbol-Digit Modalities Test (SDMT)	BICAMS
Verbal Learning, Memory	California Verbal Learning Test (CVLT2)	BICAMS
Visuospatial Learning, Memory	Brief Visuospatial Memory Test (BVMTR)	BICAMS
Global Cognitive Assessment: memory, attention, processing speed, executive function, language, visuo-spatial abilities, and abstraction.	Montreal Cognitive Assessment (MoCA)	-

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