Multiple Sclerosis Patients

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Abstract

Young adults are most commonly affected by Multiple Sclerosis (MS), a multifaceted and complex condition that affects their capacity for job and social interaction. For MS patients, bodily and cognitive impairments are the main causes of a poor Quality of Life (QoL). In MS, the prevalence of Cognitive Impairment (CI) varies from 34% to 65%, based on the age at disease onset and the length of the disease. Furthermore, the definition of CI and the amount of neuropsychological batteries used both affect this prevalence in different ways. It has been suggested that a number of factors, including disease phenotype (relapsing or progressive), fatigue, depression, the degree of brain tissue damage, and motor-cognitive reserve, significantly contribute to the decline in total cognitive function. The growing body of research indicates that patient with MS have deficits in less studied cognitive areas like theory of mind, pragmatics, metacognition, prospective memory, etc., which could be impacted in the lack of overall CI. More recent computerised cognitive testing methods have made it possible to use battery designs that are more thorough. Due to the unreliability of studies with bigger sample sizes, their application is still somewhat restricted.

Keywords: Multiple sclerosis • Electroencephalography • Information processing speed

Introduction

We still don't completely understand the pathological brain changes connected to CI in MS. The use of cutting-edge, novel imaging methods exposed the neural bases of both the overall CI and the impairment in a few specific cognitive areas. In both cross-sectional and longitudinal analyses, it was discovered that cortical and subcortical grey matter atrophy, fibre tract interruption, functional alterations, and consequently synaptic dysfunction, had varying contributions to CI. Effective CI treatment methods are still missing, though. Clinical trials using efficient molecules in other neurodegenerative diseases have been disappointing, despite the effectiveness of disease-modifying therapy in preventing cognitive decline. It's interesting that cognitive neurorehabilitation in MS has shown encouraging results using either traditional neuropsychological methods or computerized neuropsychological training and serious video games. The goal of this study was to reveal the pathological changes underlying cognitive disability and to cast more light on CI in MS.

Seven valuable works on various facets of CI in MS have been submitted by authors, including five original articles and two reviews on pediatric and neuroradiological correlates of CI in MS. These provided information on the etiopathogenesis, biomarkers, evaluation, and prevention of CI in MS.

Virgilio and coworkers specifically looked into the role of vitamin D deficiency in CI in MS, particularly in terms of Information Processing Speed. (IPS). In the research, a significant number of MS patients (87%) exhibited hypovitaminosis D, and 23% had CI. While no patients with adequate amounts of vitamin D had CI, those with CI exhibited severe hypovitaminosis D. In addition, they discovered a connection between vitamin D levels at diagnosis and CI scores that held true even after accounting for sun exposure, MRI baseline features, and disability after a mean 2-year follow-up, indicating that low vitamin D levels may have an impact on both cognition and early disability in newly diagnosed MS patients. Similar to this, Reia and colleagues used the Framingham risk score, which indicates the 10-year likelihood of getting macrovascular disease, to examine the relationship between cardiovascular risk and neuropsychological performance in MS in a retrospective study. Particularly when analysing the Framingham risk score components of sex and total cholesterol levels, they discovered that each point increase in the Framingham risk score correlated to a lower score on the verbal learning test, with lower cognitive scores being associated with male gender and high lipid levels. Therefore, given the potential impacts on cognitive function, the authors recommended that the impact of lifestyle and pharmaceutical interventions on cardiovascular risk factors should be taken into consideration in the management of MS [1,2].

In an intriguing study by Paolicelli and colleagues, which is related to papers on potential CI biomarkers in MS, they conducted a pilot study using Magnetoencephalography (MEG) and High Density (hd) Electroencephalography (EEG) to assess the acoustic P300 features in a cohort of early MS patients [3]. Using Rao's Brief Repeatable Battery, CI was evaluated (BRB). In comparison to HCs, a P300 peak in pwMS had a longer latency, and the amplitude of the P300 was inversely correlated with tiredness. The authors came to the conclusion that in People with Multiple Sclerosis (pwMS), the phenomenon of cortical adaptation to early dysfunction could maintain cognitive performance on the P300 acoustic task, while the onset of fatigue could potentially result in amplitude drop in P300, indicating its potential utility as a biomarker.

Instead, Govindarajan and associates concentrated on cutting-edge MRI methods and how they relate to the attentional components as assessed by the Attention Network Test for Interactions. (ANT-I) [4]. In young MS subjects with paediatric or young-adult onset and moderate disease severity, they looked at changes in cortical thickness and deep grey matter through volumetric changes. Participants with MS had substantially smaller thalamic volumes. Slower reaction times in the alerting component of MS significantly correlated with the right pallidum's decreased volume, whereas slower reaction times in the executive control component significantly correlated with the left putamen's diminished volume and decreased thickness in MS. The results showed an interesting correlation between the grey matter changes and patients' ability to pay attention both early in the disease process and in those who did not have attentional processing issues. So, before the start of cognitive deficits, subcortical grey matter volume atrophy and changes in cortical thickness could be thought of as an early marker of MS pathophysiology.

Finally, Pitterri et al investigated how task demands may affect the slowing of Information Processing Speed (IPS), which is thought to be the primary cognitive deficit in MS [5]. They created three tasks and used a videogame on a tablet to execute them. On the videogame tasks, it was discovered that the pwMS performed considerably worse than HC, being on average slower and less accurate. Additionally, the accuracy decline as a function of the visual attentional load was considerably more pronounced in the pwMS, indicating a greater susceptibility to increased task demands. The correlations supported the videogame's validity as a tool to evaluate IPS in pwMS, indicating a significant role for computerised assessment tools in clinical practise.

The two fascinating evaluations are excellent resources for brushing up on two key facets of MS.

Portaccio et al. in particular made clear that paediatric patients are especially vulnerable to cognitive impairment as a result of disease-related damage and failure of age-expected brain development [6]. Despite the lack of a common definition of cognitive impairment and the use of various tests, cognitive impairment has in fact been consistently documented in about one-third of paediatric MS patients. Additionally, there is still a dearth of research aimed at identifying the risk factors (such as demographic, clinical, and radiological features) or protective factors (such as cognitive reserve and leisure activities) for cognitive decline. Mood disorders can also have an adverse impact on young pwMS' quality of life as well as their academic performance.

In their analysis, Portaccio et al. concentrated on MRI features and linked CI to both abnormal brain network activation patterns and damage to particular brain compartments. Importantly, longitudinal studies have lately shown that, in addition to the direct damage caused by MS, cognitive dysfunction is also significantly influenced by the failure of age-expected brain growth as well as White Matter (WM) and Grey Matter (GM) maturation.

Last but not least, Petracca and colleagues provided an updated overview of the most recent research on the structural, functional, and metabolic correlates of CI in adults with MS, concentrating on the mechanisms sustaining damage accrual and on the identification of helpful imaging markers of cognitive decline [7].

Many structural and functional correlates of cognitive impairment in MS have recently been characterised thanks to the development of novel MRI sequences and modelling techniques, offering new tools for disease monitoring and revealing new possible therapeutic targets. The importance of advanced neuroimaging as a tool for examining pathological changes in vivo is still undeniable, and new advancements in this area will gradually deepen our knowledge of cognitive involvement in MS, even though many questions remain unanswered.

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