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Comparison of Cognitive and Linguistic Functions among Multiple Sclerosis Patients and Healthy Controls

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Abstract

Introduction: Multiple Sclerosis (MS) is an incapacitating neurological disease with diverse signs, consisting of difficult or unclear articulation of speech and cognitive and linguistic deficits. The purpose of this study was to compare the cognitive and linguistic functions among MS individuals and healthy controls.

Method: The present descriptive and cross-sectional study was performed at Shahid Motahari Clinic of Shiraz, Iran, in 2018-2019. The participants were selected by using a purposeful sampling method from September 2018 to December 2018, at the MS centers of neurology departments. The Persian aphasia test was used as the research instrument to evaluate the cognitive functions in MS patients. The data were analyzed using the SPSS version 23 software.

Results: The results of the present study revealed that the processing of all subscales, except for transcription, letter and word dictation, and sentence dictation, were significantly different between healthy and unhealthy individuals. Moreover, the results showed that the production of the focused sentence were worse in unhealthy individuals compared to healthy individuals ($P < 0.05$).

Conclusion: The results of this study showed that patients with MS were involved in linguistic and cognitive problems. Language and speech therapists who interact with these patients need to be aware of cognitive-linguistic disorders and consider this in their assessment, management, and intervention.

Keywords: Multiple Sclerosis, Cognitive Functions, Persian Aphasia Test

Introduction

Multiple Sclerosis (MS) is a chronic and developing disease of the central nervous system characterized by inflammatory damage to the myelin sheath. It has progressive psychological and pathophysiological deficits and disrupts essential cognitive domains such as information processing speed, memory, attention, executive functions, and visual perceptual functions [1]. Cognitive abnormality or impairment expands irrespectively to physical inability [2]. This is connected with multiple MRI markers, in particular, grey matter pathology, both in terms of central damages and volume reduction [3]. Trenova et al. expressed that inflammatory demyelination and neuro-degeneration causes brain decline and cognitive deficiencies in up to 75% of the patients [4].

Decreased cognitive performance speed and episodic memory decline are associated with additional problems in verbal fluency and visual analysis. Therefore, these patients, who often have difficulty with multitasking and word-finding, have received less attention [5].

These patients have grammatical difficulties in producing sentences to languages requiring movement to higher close connections within those frameworks, although they are best implemented in canonical forms production [6].

Migliore et al. have recently found the cognitive scopes for improved understanding of cognitive dysfunction patients. Another classification could be more accurate in identifying

overt cognitive dysfunction MS patients [7]. Lacy and colleagues showed a significant but negligible connection between cognitive impairment and clinical inability, independent of the illness period [8]. In this regard, previous studies have shown the delay in response time and the defects in the speed of mental data processing resulting in memory loss in these patients [9, 10]. In comparison, patients with MS have more common illnesses in older children than healthy controls [11]. Moreover, patients with early-onset MS display a more serious cognitive decline than patients with MS return, suggesting the role of disease flow in cognitive impairment progression. [12].

A variety of neuropsychiatric studies have compared the clinical forms of cognitive functions in patients with MS [13, 14]. A research analyzed by Ntoskou et al. showed that both groups of participants (patients and healthy) did not contrast with a comprehensive cognitive impairment, but contrasted with primary verbal encoding, speed of mental processing, inhibition of response, and change of collection. The MS subjects also varied in terms of initial verbal content-encoding, learning curve, delay in verbal knowledge, speed processing, and response inhibition. These patients differ from controls in several degrees of cognitive impairments [13]. Furthermore, on individualized measures, Ntoskou et al. distinguished the increased regulation of the condition in the developing MS population. The Aphasia test is affected by memory processing speed and verbal battery capacity, suggesting the observed deterioration is not merely linguistic [13].

The Greek phonological verbal fluency test has been used by Messinis et al. to show the differences in verbal ability among patients with MS. The authors certified the significant contribution of the administrative technique known as "switching," which was used to magnify word production, in the differences testified in the work of the two groups [14]. Cognitive deficiency has relevant implications due to their effect on daily living, quality of life etc. Over recent years, the topic of cognitive disability in MS patients has developed a major research concern. The goal of this study was to highlight the cognitive disorders in MS patients and to take beneficial steps in the treatment of this disease and because cognitive disorders are the most common MS-related disorder. Accordingly, the advantage of understanding these conditions and their link to MS disease can help neurologists resolve these problems in patients with cognitive impairments.

Method

The present descriptive-analytical, cross-sectional research was conducted in 2018-2019 at Shahid Motahari Clinic in Shiraz, Iran. The sample was collected using a purposeful sampling method at Shahid Motahari Clinic's MS centers of neurology departments from September 2018 to December 2018. This research included 100 MS diagnosed patients (as per McDonald's criteria) and 100 safe controls (HC) [15]. Additionally, the mean age of the patients was twenty-eight years and three months, and the control group was twenty-eight years and two months.

The MS sample of this study can be considered as a representative of the MS referred to MS centers community. The HC community included hospital staff (doctors, nurses, clerks, and servants) and their relatives. Inclusion requirements included no neurological condition other than MS such as autism, disorders of the extrapyramidal system and mental retardation and brain tumors, age ranges 18 to 60 years, and a written permission to participate in the research.

Psychiatric disorders, such as those linked to mental illness or its treatment, were considered as the criterion for exclusion. All proposals were considered as the ethical requirements, including the acquisition of informed consent and the confidentiality of patient information.

The tools used in this study were as follows:

The Persian Aphasia Battery Test (WABT): This test is one of the commonly used batteries to evaluate language function and has high internal consistency, test-retest reliability, and validity [16]. This tool has six key language competencies that can assess aphasia's existence, form, and severity. In 25 subtests and 217 separate objects, it measures language profiles for fluency, comprehension, repetition, naming, accessible vocabulary, reading and writing skills [17].

The test scoring method is that a (zero) score is considered for no answers, a (one) score is considered for a correct answer, and a (negative) score is considered for a false. Thus, linguistic profiling is plotted on the basis of correct patient responses, and the resulting linguistic profile can be the basis for the diagnosis of the dyslexic syndrome and the severity of different language skills. On the other hand, by analyzing incorrect answers, the patient's errors can be quantitatively evaluated and used in the rehabilitation stages. The data were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics (student t-test and Pearson correlation test) using SPSS ve.23 software. A statistically relevant P-value < 0.05 has been found.

Results

In this research, 200 cases (100 MS cases and 100 healthy people) were measured. The mean age of participants was 28.24 ± 2.43 in the MS group and 28.38 ± 3.63 in the healthy group. Therefore, there were no significant differences between the two groups in regards to the age of participants.

As stated in Table 1, the greater number of the participants in both groups was women and based on Fisher's exact test, statistically, there were no significant differences between the MS group and the healthy group in terms of the frequency of distribution of gender and education.

According to table 2, it was observed that in all subscales there was a significant difference between M±SD of the MS group and the control group except for transcription (10±0; 10±%5), letter and word dictation (9/9±%9; 9/9±%5), and sentence dictation (9.86±1; 9.95±%5) respectively.

Table 1. Demographic Characteristics of Patients with MS and Controls

Variable	Group	Frequency	Percentage
Sex	Male	96	48
	Female	104	52
Education	BA	77	38.5
	MA	110	55
	Ph.D.	13	6.5
Occupation	Employed	165	82.5
	Unemployed	35	17.5

Table 2. Independent T-test Analysis of Cognitive Function Differences in MS Patients and Controls

Variable	Group	M±SD	T	P
Word Identifying	Patient	9.53 ±1.2	3.8	0.001
	Control	10±0		
Understanding Body Organs	Patient	9/9±%35	2.56	0.001
	Control	10±0		
Right and Left Limb Recognition	Patient	9.4±8.1	3.2	0.001
	Control	10±0		
Simple Commands	Patient	9.8±%68	52	0.001
	Control	10±0		
Understand Complex Concepts	Patient	9.5±1.2	3.5	0.001
	Control	9/9±%35		
Understand the Short Story	Patient	7.5±2.4	6.9	0.001
	Control	9.4±1.4		
Psychologically Speaking	Patient	8.5±2	7.6	0.001
	Control	10±0		
Automatic Speech	Patient	9.4±1.5	2.4	0.001
	Control	9.8±%82		
To Keep Saying the Song Pieces	Patient	7.4±1.9	7.4	0.001
	Control	9.1±1.3		
Repeat Words	Patient	9/9±%38	2.3	0.001
	Control	10±%2		
Repeat Expressions	Patient	9.83±%47	2.68	0.001
	Control	9.97±%22		
Read the Words	Patient	9/9±%44	2.4	0.001
	Control	10±%14		
One-word Answers	Patient	9/9±%45	3.1	0.001
	Control	10±0		
Reading and Naming	Patient	9/9±%25	3	0.001
	Control	10±0		
Naming	Patient	8.4±2.57	5.9	0.001
	Control	9.98±%2		
Oral Reading of Sentences	Patient	9.6±%72	.8	0.001
	Control	10±%1		
Identify Letters and Words	Patient	9.4±1.3	4/4	0.001
	Control	10±0		
Phonetic Association	Patient	9.7±%69	3.8	0.001
	Control	10±0		
Match the Word with the Picture	Patient	9/9±%35	2	0.001
	Control	10±0		
Reading Comprehension	Patient	6.1±2.4	9.02	0.001
	Control	8.5±1.2		
Transcription	Patient	10±0	1	NS
	Control	10±%5		
Dictation of Letters and Words	Patient	9/9±%9	%39	NS
	Control	9/9±%5		
Dictation of Sentences	Patient	9.86±1	%79	NS
	Control	9.95±%5		

Discussion

In this study, the cognitive performance of MS patients with healthy subjects without brain injury was compared. The results showed that the output of all subscales was substantially different between healthy and ill individuals except for transcription, letter, text word, and sentence dictation. The results showed that patients with MS produced concentrated sentences which were worse than healthy people. There are several reports consistent with this study's findings [19-20].

The MS patients usually have cognitive impairments, often affecting speech, finding words, or remembering the pronunciation of words. In line with this study, recent research has shown that patients with MS and healthy groups with similar demographic characteristics are different in terms of naming verbs and nouns [21]. The results showed that MS patients used verbs more difficult than the control group. There was also a statistically significant difference between the two groups in terms of the output of instrumental and non-instrumental verbs. This is while in the MS patients, instrumental verbs were more hardly reminded [21]. In comparison to this finding, the medical association was initially slow to accept them as a key clinical symptom of MS because of the delicate nature of cognitive impairments in patients with MS and the difficulty in recognizing these deficits during a standard clinical exercise. Additionally, they claimed that cognitive deficits were a very unusual phenomenon in MS patients which only existed in advanced cases with a high degree of physical incapacity, and were related to subcortical dementia [22]. Other studies have shown that cognitive dysfunction is also linked to MS patients' MRI signs, and memory can be damaged even before (or without) physical disability [5, 13, 23, 24, 25].

Language domain involves activities such as the naming objects, word-finding, fluency, grammar, syntax, and receptive language [23]. Language deficits in MS patients were observed less than episodic memories or data processing rates. Although some papers suggest a healthy functioning of this group [24], recent studies show that the prevalence of language deficits in patients with MS is between 20% and 58% [13] . According to Noffs et al., The severity of dysarthria in MS patients is generally associated with the overall severity of neurologic deficits, including physical and cognitive deficits [25]. Ferdova and colleagues found that there was a relationship between self-reported speech difficulty, problems with thinking, reading, and writing in patients with MS [26]. Also, studies have shown that this problem has a destructive impact on the functioning of patients [27].

The most affected behaviors appear to be phonological and semantic fluidity, but the executive functions have an important impact on research into verbal fluidity. In addition, many of the impairments were found alongside unstable executive syndrome [10]. In the intervention study, the authors found that complicated sentences seem to be difficult for MS patients. They have shown that more complicated ways of training make fewer complex structures easy to learn [6]. Furthermore, the inability to live independently in healthcare, jobs, education, and social environments deserves the attention of experts to provide a strategy to resolve the issues facing this community to enhance their quality of life and greater independence [13]. It should be noted that in these patients' treatment, more attention is given to cognitive aspects [28]. In this study, the sample size of the two groups was relatively small compared to previous studies in this area, affecting several outcomes to some extent. Secondly, the findings cannot be extended to other patients with MS.

Conclusion

In the present research, the comparison of both groups was evaluated on either the cognitive domain or language tasks. The findings showed that individuals with MS indicated lower levels of performance on determined cognitive tasks. However, the most important cognitive differences between MS patients and healthy participants were confirmed. This finding revealed that MS patients had more vigorous deficits than healthy participants, which becomes progressively poor as the severity of the disease proceeds and MS patients convert to healthy participants. In order to create solid evidence, additional data and better-planed studies are required.

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