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Magnetic Resonance Imaging of Central Nervous System and Paranasal Sinuses in Multiple Sclerosis Patients: Findings From a Survey of Clinical Records in Kermanshah Province

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Abstract

Background and Objectives: T Multiple sclerosis (MS) is the most common demyelinating disease of the central nervous system (CNS) with more than 5.2 million people across the world being afflicted with. Magnetic resonance imaging (MRI) is a valuable tool in the diagnosis of MS. This study surveys the results of MRI of the CNS and paranasal sinuses in the sample of MS patients in Kermanshah province, Iran.

Methods: The clinical records of a total of 294 patients admitted to the Neurology Ward of Farabi hospital of Kermanshah city (Western Iran) between 2004 and 2014 and diagnosed to be afflicted with MS were surveyed. The data were collected using a checklist prepared based on the McDonald Wibers standard criteria. The checklist consisted of 37 items, related to the MRI data of the CNS and paranasal sinuses of MS patients. The data were collected in four domains, including the most common early clinical signs of the patient, distribution of lesions, affliction with sinusitis, and demographic characteristics. The collected data were summarized using descriptive statistical methods.

Findings: MRI identified MS plaques in 94.90% of the patients. Female, married, housekeeping, and undergraduate patients and the patients with 21-40 years of age had the highest frequency among the MS patients (59.5%, 50.2%, 70.6%, 42%, and 72%). Hands and feet anaesthesis was the most frequently seen early signs (63.80%), followed by visual impairment (42.3%) and ataxia (12.6%). The most frequently involved anatomic site was the white matter surrounding the ventricles (77.50%), followed by centrum semiovale (75.4%), and corpus callosum (17.1%). We also found that 16% of the patients afflicted with MS had sinusitis, with the most frequent anatomical sites afflicted in them being sphenoid sinuses (63.8%).

Conclusions: Our study provided further evidence that the MRI is an accurate and reliable method for diagnosing MS. No gross differences in the frequency of MS disease among age, sex, and lesion pattern groups compared to other studies were identified. Observing sinusitis in patients afflicted with MS is suggestive of their random association.

Keywords: Multiple sclerosis (MS), Paranasal sinuses, Magnetic resonance imaging (MRI), Central nervous system (CNS)

Background and Objectives

Multiple sclerosis (MS) is a chronic neurological disease associated with inflammation and degeneration of the myelin covering of the central nerves. According to the statistical data released by the International MS Association, 5.2 million individual across the globe are afflicted with MS, with 85% of them having the progressive and recurrent type. Overall, US$25 million are spent on the treatment of these patients, on a daily basis in the world.[1] The frequency of this disease peaks in young people who are within the age range of 20-35 years, and it plagues females twice as high as males.[2] The signs and symptoms of the disease differ based on the affected site in the nervous system. These signs vary from the mild manifestations such as vertigo, ataxia, anesthesia in the hands and feet, facial

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paralysis, muscular rigidity, spasm, pain and insomnia, to severe convulsion and loss of vision. Despite significant progresses in the etiology of diseases, the cause of MS remains unknown. Geographic, genetics, immune system problems, and viral factors are considered the most significant risk factors of the disease.[3-5] The complications and reactions occurring in patients are dependent on the affected anatomical site. By determining the exact location of MS plaques, magnetic resonance imaging (MRI) has emerged as the gold standard for diagnosis of MS. This imaging method is capable of accurately identifying MS lesions in each stage (acute and chronic) of the disease.[6,7] Early diagnosis and treatment may help alleviate disease progress, prevention of persistent lesion formation, and decrease of treatment costs.[8] MRI indicates two specific features of MS lesions: (1) the distribution pattern and (2) the distinct limits and number of the lesions.[9-11]

Considering the key role of MRI in diagnosis of MS, this study was conducted to provide information on the mode of involvement of the plaque lesions in the anatomic area of the MS patients' central nervous system (CNS), and characteristics of the most afflicted patients diagnosed by MRI. The ultimate goal of the study was to obtain useful data for future centralized treatment plans in the surveyed province.

Methods

This is a cross-sectional descriptive study, which was conducted on 293 patients admitted to the Neurology Ward of Farabi hospital of Kermanshah during a 10-year interval (2004-2014) and diagnosed to be afflicted with MS. The demographic data, clinical signs, and MRI results were obtained from the patients' clinical records. The data collection instrument was a checklist prepared according to the McDonald Wibers standard criteria. The checklist consisted of 37 closed-ended items related to the MRI data of the CNS and paranasal sinuses of MS patients. The items addressed four domains: the most common early clinical signs of the patient (questions 1-7), mode of distribution of lesions (questions 8-26), affliction with sinusitis (questions 27-31), and demographic characteristics (32-37). Positive imaging evidence on the lesion plaques was denoted by 1 and lack of such evidence was denoted by 0. The data were summarized and analyzed using descriptive statistical methods.

Results

In total, MRI identified MS plaques in 94.90% of the patients. Table 1 shows the demographic characteristics of the patients. The highest frequency of observed plaques was related to the patients with the age of 21-40 years (72%), females (70.60%), and the married patients (65.90%), housekeeper patients (50.2%) and patients with high school education (38.2%).

Table 2 presents frequency of early signs identified by MRI. Hands and feet anaesthesis was the most frequently seen early signs (63.80%) followed by visual impairment (42.3%) and ataxia (12.6%).

Pathological plaques of MS in the MRI of both male and female patients were abundant (92.50%). Table 3 presents frequency distribution of the MS plaque lesions over the anatomical sites of the nervous system. As seen, the most frequently involved anatomic site is

Table 1. The Educational and Professional Characteristics of the Study Subjects

Variable	No.	%
Education (n = 293)		
Illiterate	17	5.8
Elementary	49	16.7
Secondary	49	16.7
High school	123	42
Academic	55	18.8
Jobs (n = 293)		
Retired	5	1.7
Worker	5	1.7
Educating	20	6.8
Employee	27	9.2
Self-employment	29	9.9
Unemployed	60	20.5
Housekeepers	147	50.2

Table 2. The Frequency of Early Signs of MS Among the Study Subjects

Early Signs in Patients With MS	No.	%
Hands and feet anaesthesis	187	63.8
Visual impairment	124	42.3
Ataxia	37	12.6
Headache and vertigo	36	12.3
Facial paralysis	18	6.1
Nausea and vomiting	14	4.8
Panic attack	11	3.8

the white matter surrounding the ventricles (77.50%), followed by centrum semiovale (75.4%), and corpus callosum (17.1%).

We also found that 16% of the patients afflicted with MS had sinusitis. As shown in Table 4, the most frequent anatomical sites afflicted with MS in these patients was sphenoid sinuses (63.8%), followed by maxillary sinus (21.3%) and ethmoid sinus (10.6%).

Discussion

Our study confirms that MRI can successfully diagnose plaques in MS patients. Consistent with our results, Swanton et al identified a diagnosis rate of 90% when using MRI.[12] Non-observance of plaque lesions in a few cases is often related to failure in accurate following of the imaging test protocol by the radiologist or problems related to the apparatus used.[13]

In this investigation, most MS patients were found to have a positive family history of the disease. Consistently, Rezaie and Panahi reported that 73.30% of MS patients have positive family history of the disease.[14] However, whereas we found the most common early clinical sign to be anesthesia of hands and feet, Rezaie and Panahi reported no tangible distribution of MS plaques.

In our patients, most of the MS lesions were seen in the white matter surrounding the ventricles, congruent with observations by Wasay et al.[15] In addition, our results are also concordant with those from the study of Jinochova et al who found a larger number of plaques in the patients younger than 40 years compared with older patients.[16]

We also found that the brainstem involvement largely occurs in the white matter surrounding the ventricles among males, and in the semi-oval center among females. By contrast, Daghighi and Nemati reported the mostly involved region in males to be brachium pontis and in females to be the spinal cord.[9]

Table 3. The Frequency Distribution of the MS Plaque Lesions Over the Anatomical Sites of the Nervous System in the Study Subjects

Anatomical Sites Afflicted With Plaque Lesions	No.	%
Temporal lobe	12	4.1
Hemisphere	11	3.8
Subcortical	9	3.1
Thalamus	8	2.7
Corona radiata	7	2.4
Brachium pontis	6	2
Optic radiate	6	2
Basal ganglia	5	1.7
White matter surrounding the ventricles	227	77.5
Centrum semiovale	221	75.4
Corpus callosum	50	17.1
Pons	37	12.6
Spinal cord	36	12.3
Brain stem	32	10.9
Cerebellum	16	5.5
Parietal lobe	13	4.4

Conclusions

Our study provided further evidence that the MRI is accurate and reliable method for diagnosing MS. MRI successfully identified MS phenotypes based on age, occupation, the anatomical site affected, early clinical manifestations, and family history of affliction. No gross differences in the frequency of MS disease among age, sex, and lesion pattern groups were identified compared to other studies. Observing sinusitis in patients afflicted with MS is suggestive of their random association.

Abbreviations
(MS): multiple sclerosis; (MRI): magnetic resonance imaging; (CNS): central nervous system.

Competing Interests
The authors declare no competing interests.

Authors' Contributions
The authors made the same contributions to this study.

Table 4. The Frequency of Anatomical Sites Afflicted With Sinusitis in Study Subjects

The Anatomical Sites Afflicted With Sinusitis	No.	%
Sphenoid sinus	30	63.8
Maxillary sinus	10	21.3
Ethmoid sinus	5	10.6
Frontal sinus	2	4.3

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