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CASE REPORT

Evaluation of an Individual with Multiple Sclerosis and Hemiatrophy in Terms of Muscle Strength, Balance, and Quality of Life: A Case Report

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Abstract

This report presents the case of a 35-year-old male patient with hemiatrophy, a rare condition accompanying the diagnosis of multiple sclerosis (MS), in terms of muscle strength, balance, and quality of life. The patient presented with an Expanded Disability Status Scale level of 4 and left hemiatrophy with a diagnosis of MS. According to the muscle strength measurements, the left upper and lower extremity muscles were weaker compared to the right extremity. The present report highlights that hemiatrophy, although uncommon in MS, may impact functional outcomes such as muscle strength, balance, quality of life, and depression. The evaluation of hemiatrophy may contribute to the existing literature.

Keywords: Balance, hemiathrophy, multiple sclerosis

Introduction

Multiple sclerosis (MS) is a chronic autoimmune disease characterized by axonal loss and demyelination in the central nervous system (1). The involvement of diverse components of the central nervous system can result in motor, sensory, visual, and autonomic symptoms (2). Individuals with MS frequently experience motor impairments, including diminished muscle strength and balance deficits (3,4). These symptoms contribute to a decline in the quality of life (5).

Hemiatrophy may occur in a variety of conditions, including neurodegenerative and autoimmune disorders (6). The common neurological symptoms observed in hemiatrophy syndromes include epilepsy, headache, facial pain, motor deficits, and dizziness (6). Magnetic resonance imaging (MRI) findings under such conditions often reveal structural and signal abnormalities in various brain regions, including the frontal lobe, parietal lobe, subcortical areas, temporal lobe, occipital lobe, and brainstem (6). Although there are similarities in the brain regions affected by hemiatrophy and MS, hemiatrophy is not typically associated with the diagnosis of MS. In this study, we evaluated and shared the relevant care experience with a person with hemiatrophy associated with MS, with a focus on factors such as muscle strength, limb circumference, balance, and quality of life.

Case Report

A 35-year-old right-handed man, diagnosed with secondary progressive MS, with an Expanded Disability Status Scale score of 4. He had no family history of neurodegenerative disease. As a part of the neurological examination, the sensory functions, reflexes, balance, and coordination were assessed. Sensory testing revealed a sensory loss in the face and distal extremities. The assessment of reflexes revealed a reduction in the patellar

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tendon reflex. Balance was assessed during unipedal standing, which indicated a weakened balance on the left foot when compared to the right. He was diagnosed with MS in 2015. He had no history of any other disease. The patient has had hemiatrophy in the left extremity for a prolonged period, with significant progression observed in the last 5 years. His initial MS problems, which included walking difficulties and the loss of balance, began in 2004. He was diagnosed with MS in 2015 after experiencing symptoms such as right eye blurriness, loss of balance, and abnormal gait. The symptoms of disorders related to balance and strength loss increased by 2020. The patient has had a neurogenic bladder problem since 2015. The loss of strength and balance increased in 2020 and 2021 following the coronavirus disease (COVID). Throughout the past 2 months, he has also complained of dysphagia. In 2015, interferon beta-1a (44 mcg subcutaneously, thrice a week) was initiated. A change to fingolimod treatment was made effective in 2017 for an increase in the disease activity. Because of the side effects, the treatment plan was modified to include cladribine in 2019. In 2023, he began ocrelizumab and continued the treatment to this day. In 2020 and 2021, the patient suffered from COVID-19. Since 2015, the patient has developed atrophy in the left-lower extremity, left upper extremity and left facial muscles, and left-sided respiratory muscles relative to the other side (Figures 1A-C). The patient's images are shown in Figure 1.

To assess atrophy, a physiotherapist measured the circumferences of the right and left extremities bilaterally using a tape measure at the sites on the quadriceps, gastrocnemius, arm, and forearm, which have the greatest amount of muscle tissues. Muscle strength was assessed by performing a manual muscle test and a back-leg dynamometer (TKK 5402 BACK-D). The quality of life was assessed by using the MS Quality of Life-54 (MSQOL-54) questionnaire, which assessed the effects of MS on cognitive function and fatigue. The MSQOL-54 is a quality of life survey developed by adding 18 items to the Short Form-36, which is specifically aimed at MS (7). The assessment includes two subcategories: the composite mental health score and the physical health score. Each heaading has a number ranging from 0 to 100 (8). Balance was assessed by using the Berg Balance Scale (BBS), which is composed of 14 components, each scored from 0 to 4, with a total possible score of 56 (9). MRI was performed to evaluate the spread of the pathological process in terms of space and time. This imaging technique is essential for ruling out other disorders (10). MRI is also crucial for diagnosing MS, determining a treatment plan, and monitoring changes over time (11). The measurements of muscle atrophy and muscle strength were performed in 2015 and 2023.

The measurements of the extremity circumference showed that the left upper and lower extremities were more atrophic in the

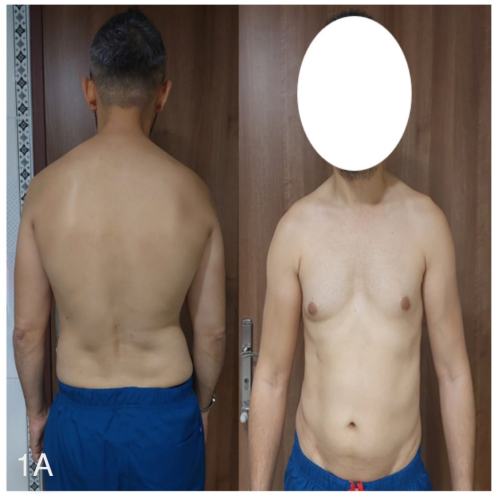

Figure 1A. Pictures of patient

Figure 1B. Pictures of patient

Figure 1C. Pictures of patient

Figure 1. Images of the patient showing **A)** marked weakness in the respiratory and back muscles on the left side, **B)** atrophic appearance in the left leg, particularly in the quadriceps and gastrocnemius muscles, **C)** atrophy in the left facial muscles

Table 1. Results of limb circumference measurement

	2015 (years)			2023 (years)		
Body circumference	**Right side**	**Left side**	**Difference**	**Right side**	**Left side**	**Difference**
Gastrocnemius (cm)	39	38.5	**0.5**	38.5	36	**2.5**
Quadriceps (cm)	48	47.5	**0.5**	47	42	**5**
Biceps (cm)	30	29.6	**0.4**	29.7	28.5	**1.2**
Forearm (cm)	27.5	27	**0.5**	27.3	24.9	**2.4**

Table 2. Upper extremity and lower extremity muscle strength measurement results

Upper extremity muscle strength	Right side	Left side	Lower extremity muscle strength	Right side	Left side
Shoulder flexion	5	4	Hip flexion	4+	3-
Shoulder abduction	5	4	Knee flexion	4	3
Elbow extension	5	4	Knee extension	4	3
Elbow flexion	4+	4	Foot dorsiflexion	5	3-
Wrist flexion	5	4	Foot plantar flexion	5	4
Wrist extension	5	4			
Finger flexors	5	5			
Finger extensors	3+	3+			

year 2015 and 2023 (Table 1). The measurements of muscular strength revealed that the muscles of the left upper and lower extremities were weaker than those of the right in the years 2015 and 2023 (Table 2). The mean of the three measurements with the back-leg dynamometer was 43 kg. The BBS score was 33, theMSQOL-54 composite physical health score was 30.46, and the composite score for mental health was 45.94. MRI findings revealed significant brainstem involvement (Figures 2A, 2B). MRI images are shown in Figures 2A, 2B.

Discussion

Hemiatrophy is characterized by the loss of muscle mass on one side of the body. MS is associated with various neurological and musculoskeletal diseases (6). It is a demyelinating disease of the central nervous system that often leads to asymmetric neurological findings (1). Consequently, the co-occurrence of both conditions is theoretically possible, although there are limited case reports in the literature addressing this specific association.

In the present case, the patient with MS experienced a decline in muscle strength, balance, and quality of life due to hemiatrophy, a condition that is not typically observed in MS patients. The quality of life score indicated a decrease in the patient's overall quality of life. However, as no pre-and post-comparisons were made, it remains unclear whether the outcome is directly associated with hemiatrophy.

MRI findings of the individual revealed brainstem involvement. In cases of hemiatrophy, ipsilateral facial and extremity involvement can occur, which may share similarities with other syndromes such as Parry-Romberg syndrome (PRS). It is also possible to observe additional signs, including cognitive impairment and epilepsy. Although the atrophy of the left side of the face and left extremities in this case presented some similarities to PRS, it is important to note that these features are not exclusive to any one syndrome (6).

Past studies have highlighted the possibility that severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection exacerbates spinal and brain demyelination at different illness stages (12). The impact of SARS-CoV-2 on the central nervous system is believed to trigger a post-infection neuroimmune response that initiates the demyelination process (12). In this instance, it is believed that the demyelination process may have been intensified due to the history of COVID-19.

The rare form of MS that exhibits characteristics distinct from other demyelinating diseases is referred to as tumefactive MS. Neurological symptoms may develop in a rapidly progressive manner in such cases. One such manifestation is hemiatrophy, which is characterized by a weakness that is localized to one side of the body (13). However, the ipsilateral limb atrophy recorded in the present case was an uncommon occurrence in MS patients. Therefore, additional diagnosis and long-term follow-up are warranted in the case of left hemiparesis with marked neurological and physical decline in a patient diagnosed with MS in 2015.

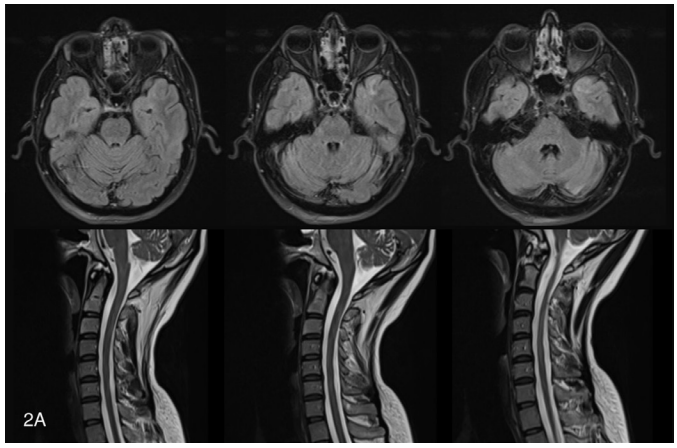

Figure 2A. MRI findings of the patient

MRI: Magnetic resonance imaging

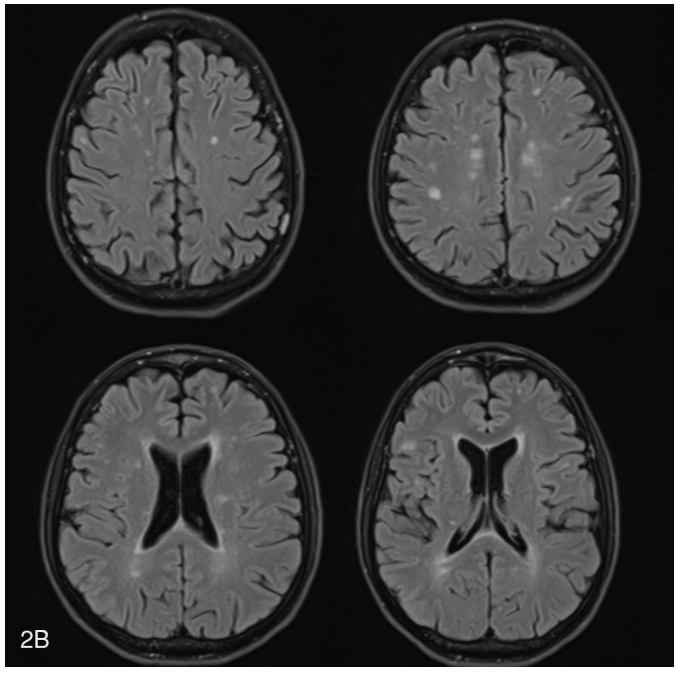

Figure 2B. MRI findings of the patient

Figure 2. A) Axial FLAIR sequence MRI of the brain showing hyperintense lesions in the periventricular white matter, **B)** sagittal T2-weighted MRI of the cervical spinal cord demonstrating hyperintense lesions consistent with multiple sclerosis, the FLAIR sequence MRI of the brain in the upper axial plane revealed hyperintense lesions in the periventricular and subcortical white matter

MRI: Magnetic resonance imaging, FLAIR: Fluid attenuated inversion recovery

Ethics

Informed Consent: Informed consent was obtained from the patient in accordance with the Declaration of Helsinki.

Footnotes

Authorship Contributions

Surgical and Medical Practices: G.S., H.A., M.F.Y., Concept: G.S., H.A., M.F.Y., Design: G.S., H.A., M.F.Y., Data Collection or Processing: G.S., H.A., Analysis or Interpretation: G.S., H.A., M.F.Y., Literature Search: G.S., H.A., Writing: G.S., H.A.

Conflict of Interest: All the authors declare no conflicts of interest.

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