Multiple sclerosis: Medical and psychosocial aspects, etiology, incidence, and prevalence

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Abstract. This article provides an overview of the etiology, incidence, and prevalence of multiple sclerosis (MS), one of the most common neurological disorders in the world. The author describes the demographic characteristics of people who incur MS, discusses the auto-immune processes that cause damage to the central nervous system, reports the most frequently occurring symptoms, and presents treatment and symptom management strategies that have proven efficacious in reducing the extent of disability associated with this chronic and unpredictable disease.

Keywords: Multiple sclerosis, medical and psychological aspects, chronic illness

1. Introduction

Multiple sclerosis (MS) is one of the most common neurological diseases in the world. It is a degenerative disease of the central nervous system, primarily affecting the brain and the spinal cord. MS destroys the fatty tissue called myelin that surrounds white matter tracts (i.e., axons) in multiple locations in the brain and along the spinal cord. Myelin facilitates the axons’ conduction of electrical impulses back and forth between the brain and the rest of the body via the spinal cord [7,24]. Where MS destroys or compromises the myelin, these electrical impulses, which coordinate all mental and physiological processes, are not conveyed as they should be. This slowed or blocked conduction of electrical impulses can have a negative impact on virtually every physical, sensory, mental, and emotional activity.

Smith and Schapiro [25] described the demyelination that occurs in MS as similar to the disruption of an impulse that would occur if the rubberized coating surrounding an electrical wire were torn or cut. Such damage interferes with the transmission of electricity, which is what happens in individuals with MS.

For people with MS, the result is often observed as uncoordinated and/or awkward responses to environmental stimuli [24]. As patches of myelin deteriorate, they are replaced by scar tissue. The resulting lesions, or plaques, further interrupt the conduction of nerve impulses, sometimes creating a progressive and degenerative course of symptoms.

Symptoms associated with MS vary widely, and they are principally determined by the location and size of the lesions in the person’s brain and spinal cord [9,24]. For example, frontal and parietal lobe lesions often result in cognitive and emotional problems, whereas plaques in the cerebrum, brain stem, and spinal cord tend to cause problems related to the physical functioning of the extremities [6,7]. Visual impairments may result from lesions on the optic nerves or the occipital lobe. It is important to note that no two people with MS experience the same symptoms and course of illness [3]. Additional information concerning the medical aspects of MS can be found in Managing the Symptoms of Multiple Sclerosis [24], Multiple Sclerosis: The Questions You Have – The Answers You Need [11], Multiple Sclerosis: Diagnosis, Medical Manage-
The precise cause of MS remains unknown but experts generally believe that MS stems from a combination of immunologic, environmental, and genetic factors. Although studies show that certain groups (e.g., women, people of Northern European descent, people living in the Northern Hemisphere) are more likely to acquire MS than others, how and why MS originates in an individual remain less certain. Medical scientists have determined that MS involves an autoimmune process; that is, the immune system abnormally directs itself against the central nervous system. Although the exact antigen to which immune cells are directed has not been identified, researchers have discovered which immune cells become sensitized, the process by which they turn on the central nervous system, and which receptors on the cells are attracted to the myelin sheath.

Epidemiological studies and migration patterns indicate that people who were born in regions where there is a high prevalence of MS and who move to lower prevalence areas acquire the MS risk of their new homes, provided that the move takes place before the age of 15 [13]. From these data, some scientists have inferred that there is an environmental agent that activates prior to puberty and predisposes one to develop MS in early or middle adulthood. Because initial exposure to many viruses occurs during childhood, and because viral factors have been linked to many other demyelinating autoimmune responses, some experts believe that viral “triggers” precipitate the onset of the illness.

Although MS is not entirely hereditary, having a first-degree relative (e.g., a parent or sibling) who has the illness increases one’s risk of acquiring MS by a factor several times that of the risk in the general population [3,25]. Being the daughter of a person with MS makes one ten times more likely than the general population to have MS [3,25]. The HLA gene group is where some of the genes linked to MS are found. Epidemiological studies have revealed higher MS prevalence rates in temperate regions than in warmer climates. Countries that have particularly high rates of MS include the United Kingdom, Canada, Germany, Denmark, Norway, Sweden, Finland, and the United States [13,25]. Within the United States, epidemiologists have cited the 37th Parallel (which divides the American population roughly in half) as a geographic demarcation that separates areas characterized by high and low MS risks [22]. Two-thirds of the American MS population reside in the northernmost 50 percent of the general populace, with the states of Vermont and Washington reporting the nation’s highest prevalence rates [7,24]. The incidence and prevalence of MS vary significantly along racial lines, as well. Poser [20] pointed out that MS is extremely uncommon among Asian peoples, unknown in African blacks, and relatively infrequent among African Americans. He also noted that people of Hispanic descent are far less likely to develop MS than those of Germanic, Anglo-Saxon, and Scandinavian lineages.
complexity underscores why scientists have not pinpointed the illness’ precise cause.

3. Courses and progression

The nature, severity, and number of symptoms related to MS vary widely among individuals, and the patterns of symptom manifestation, which are typically observed as cycles of relapses and remissions, cannot be generalized from one person to another. These patterns have, however, been broadly codified to provide a clearer understanding of the different courses of MS that people experience. Current classification standards in the field of neurology describe four types or courses of MS: (a) relapsing-remitting, (b) primary progressive, (c) secondary progressive, and (d) progressive relapsing [1,7,24,26].

3.1. Relapsing-remitting MS

Smith and Schapiro [25] described relapsing-remitting MS as marked by discernible “flare-ups” (also called relapses, exacerbations, or attacks), lasting from days to weeks, with or without asymptomatic periods, beginning at the onset of the disease. These episodes involve acute worsening in neurological functioning, and they may be totally unpredictable. They are followed by partial or complete recovery periods (i.e., remissions). Fraser et al. [7] pointed out that these sporadic exacerbations occur at an average rate of approximately one time every 17 months. Disability may result from incomplete recoveries following relapses, but relapses tend not to become progressively severe or intense over time. Schapiro [24] noted that about 80 percent of MS cases begin as relapsing-remitting MS, making it far and away the most common form of the disease at the time of diagnosis.

3.2. Primary progressive MS

Primary progressive MS is observed when the person experiences a slow but steady decline in functioning from the onset of the disease. In this course, there do not appear to be noticeable relapses or remissions [26]. If a person does experience a remission, it is usually temporary and improvement in symptoms is minor. Primary progressive MS is commonly diagnosed in people who develop the disease after their 40th birthday [24], and this group makes up about 10 percent of the MS population with equal ratios of females to males [7].

3.3. Secondary progressive MS

Secondary progressive MS is characterized by initial relapsing-remitting MS that subsequently develops into a steady progressive course, with or without flare-ups, remissions, or plateaus [1,26]. Over time secondary progressive MS results in a decline in the person’s general health status, and remissions become less frequent [7]. It is estimated that about two-thirds of people diagnosed with relapsing-remitting MS eventually develop the secondary progressive form of the disease [7]. Currently, physicians are not able to predict who will develop secondary progressive MS based on the initial onset of the disease [25].

3.4. Progressive relapsing MS

In progressive relapsing MS, the person experiences a steady and progressive course of declining health over time, but she or he also has clear and significant exacerbations or relapses that occur without warning [26]. Symptoms are always present, but they may intensify or decrease in severity from time to time [24]. Coupled with the steady progression of symptoms, this cycle of exacerbation can be truly debilitating. This type of MS is relatively rare and occurs in approximately five percent of cases [26].

4. Diagnosis

Until fairly recently, the diagnosis of MS was inferred from presenting symptoms as there is no genetic, bacterial, or viral test that can make the diagnosis [7]. Because central nervous system lesions can result from conditions other than MS (such as cancer, nutritional deficiencies, or traumatic brain injuries), neurologists would first eliminate all other possible reasons for lesions before making a diagnosis of MS. Hence, the differential diagnostic process was often long and laborious [6]. Not surprisingly, non- and mis-diagnoses were fairly common, and many patients were sent home with “possible” and “probable” MS to wait for their symptoms to progress before they could receive definitive diagnoses [8].

Over the past two decades, however, the advent and continued refinement of magnetic resonance imaging (MRI) and positron emission tomography (PET) have enabled neurologists to make accurate MS diagnoses in a timely manner, sometimes even before the person evinces any symptoms [6]. The current standard criteria used to diagnose MS are known as McDonald.
Multiple sclerosis: Medical and psychosocial criteria [7,24]. These criteria require multiple abnormalities on MRI and PET scans in the central nervous system (CNS). In descending order of prevalence, the CNS abnormalities observed in people with MS affect the following functional areas: sensation and energy, vision, strength and mobility, coordination, balance, bowel and bladder processes, sexuality, cognition, and affect and emotion. Although the McDonald criteria permit diagnoses before people have experienced MS-related symptoms, this is not common because it is the symptoms of MS that prompt people to seek medical attention in the first place.

The MRI and PET scans have also shown promise in predicting the frequency, duration, and intensity of exacerbations of MS following diagnosis [19]. Even though not all symptoms of MS reported in clinical consultation are directly attributable to MRI and PET scan abnormalities, neurologists are able to make MS diagnoses with greater speed and accuracy than ever before. Medical technology has dramatically reduced the time interval between initial symptoms and diagnosis, thereby enabling rehabilitation professionals to initiate early intervention strategies during the disease’s preliminary stages.

5. Physiological effects

Physiological symptoms of MS include fatigue, mobility problems, spasticity, numbness and tingling in the extremities, general weakness, visual impairments, bowel and bladder dysfunction, and sexual dysfunction. As previously noted, patterns of symptoms have been attributed to the location and size of lesions in the central nervous system and are specific to the individual [7]. Even within the individual with MS, physiological and other effects may come and go without warning, appear in various combinations, or intensify in a seemingly random pattern [10]. Any physiological symptom(s) of MS may be observed in concert with or in the absence of any other(s).

5.1. Fatigue

The most common effect of MS is unquestionably fatigue [2,24]. Fatigue has been defined as an overwhelming sense of tiredness, lack of energy, and feelings of exhaustion in excess of what might be expected for the associated level of activity [19]. Although it does not always present itself as a single, easily identifiable symptom, fatigue affects people with MS in several specific ways. Schapiro [24] identified three distinct types of fatigue that are commonly observed in people with MS: deconditioned, “short-circuiting,” and MS fatigue. Each has unique signs and self-care implications.

5.1.1. Deconditioned fatigue

When a person with MS experiences weakness, heat sensitivity, and fatigue he or she may become less active over time. This lack of activity creates a vicious circle, in which the person becomes even weaker and more tired [25]. Over time, the body becomes deconditioned to physical activity, muscles can atrophy, and secondary complications of inactivity often manifest themselves. These secondary complications include weight gain, hypertension and other circulatory problems, arthritis, and heart disease. When noticed early in the disease process, deconditioned fatigue can be alleviated by an overall wellness program that includes individualized exercise and nutrition plans.

5.1.2. Short-circuiting

According to Schapiro [24], “short-circuiting” fatigue or muscle fatigue results from physically over-taxing oneself. He noted that demyelination along neural pathways leads to interruptions in the smooth transmission of electrical impulses to the extremities. This inefficiency results in temporary weakness of the limbs, which then produces the slowing and eventual stoppage of physical activity until the person with MS has rested and regained his or her energy. “Short-circuiting” fatigue is primarily physiological in nature and stopping activity to allow the nerves and muscles to rest is the way to manage this form of fatigue [25]. Unlike deconditioned fatigue, which is often progressive in nature and can result in permanent debilitation, “short-circuiting” fatigue is temporary, episodic, and managed fairly effectively by rest and relaxation.

5.1.3. MS fatigue

Smith and Schapiro [25] described lassitude as MS fatigue because it seems to be endemic to people coping with the illness. MS fatigue is typified by an overwhelming sense of exhaustion or tiredness that affects the individual suddenly and without warning. These bouts of complete, physiological and psychological tiredness and incapacity may last for a few hours or for several days. Some people report that relaxation or rest mitigates these symptoms, but others have reported that these solutions do not work for them. Lassitude of this type usually responds to neurochemical medications, and/or an individualized aerobic exercise
program [25]. It is also important to note that MS fatigue is linked, often bi-directionally, to medication side effects, depression, and sleep disturbances.

Generally, all types of fatigue that are commonly reported by people with MS are exacerbated by stress and by an increase in body temperature. Because exercise, being outside in hot weather, and taking hot baths have been shown to increase fatigue among people with MS, these activities should be monitored or avoided whenever possible. Also, stress management regimens have proven to be effective means of controlling fatigue and allowing the person with MS to conserve energy for necessary daily living activities.

5.2. Motor disturbances

A number of physiological symptoms are related to motor disturbances in people with MS, including spasticity, weakness, and ataxia. These lead to general coordination, balance, and mobility impairments [2,24]. The extent and type of these effects vary widely among (and even within) people with MS, but motor disturbances are typically among the first manifestations of the illness.

5.2.1. Spasticity

Spasticity is a disruption in the coordination of muscle contraction and relaxation. This is a common symptom of MS because of damage in the descending motor pathways that carry impulses from the spinal cord to control muscular reflexes. When lesions occur along these pathways, they cause opposite muscles within a group to contract and relax simultaneously, or spasm. Spasms are most common in the legs (flexor and extensor muscles), and people with MS most frequently experience spasticity at night [2,25].

5.2.2. Weakness

MS is often characterized by a loss of strength in major muscle groups such as those of the arms and legs. Smith and Schapiro [25] noted that observed weakness in people with MS more often results from poorly transmitted neural impulses than from deterioration of the muscles themselves. However, misconduction of impulses makes it difficult for the person with MS to fully utilize the affected muscles, and prolonged under-utilization can cause the muscles to atrophy.

Backaches are a common secondary symptom of MS, most often attributable to strain resulting from compensation for weakness and fatigue in the legs [24]. Ataxia, one’s inability to move the arms and walk in a coordinated fashion, is another frequently observed effect of MS-related weakness.

In combating muscular weakness, priority must be placed on conserving energy for activities of daily living and symptom management. Because some exercises exacerbate muscle weakness and the sensation of people with MS should always consult their physicians and/or physical therapists before initiating a physical conditioning program.

5.2.3. Ambulation

Ambulation, the simple act of walking and getting around, is often impaired by such symptoms of MS as balance problems, hyperextension of the knees, and instability of the legs. A condition called foot drop [24], in which toes touch the ground prior to the heel, is caused by weak muscles in the foot. Ambulation problems in people with MS can range from mild difficulties to a complete inability to stand or walk on one’s own. Canes, motorized scooters, and other mobility aids are often employed by people with MS who experience difficulty with ambulation.

5.3. Numbness and tingling

Numbness and tingling in the extremities among people with MS can range from “pins and needles” sensations to itching in an isolated area of skin or a more severe and painful condition termed trigeminal neuralgia [25]. A “pins and needles” sensation down the back and legs may occur when one bends his or her neck. Although not painful, the sensation can be bothersome. Trigeminal neuralgia involves the onset of sudden, sharp pain in one side of the face. It results from the discharge of impulses from the brain stem. The accompanying pain typically lasts for only 10 to 15 seconds, but it is characteristically followed by a facial contraction, or tic [2].

5.4. Tremor

Tremor in the extremities and head is another common physiological effect of MS, one that is manifested in a wide range of movement from fine, less noticeable tremors to more obvious, gross oscillations [24]. Tremors occur in approximately 75 percent of people with MS and are most often seen in the upper limbs. They can be significantly disabling, affecting limb function, gait, and balance [19]. Functionally speaking, tremors can have a deleterious impact on common work-related fine motor tasks such as writing, key-boarding, and handling small objects.
5.5. Visual impairments

Visual impairments in individuals with MS are most often temporary conditions that manifest in blurred or double vision, although in some cases functional blindness may result. They result from optic neuritis (i.e., inflammation of the optic nerve) and are frequently marked by dull color vision, diminished visual acuity, and a reduced visual field [24]. Optic neuritis is one of the most common early symptoms of MS [1,24], and it is often indicative of a more benign form of the illness. Other MS-related visual impairments result from weakening of the eye muscle and nystagmus (i.e., eye jerking). MS-related visual impairments often lead to a diminished ability to drive or travel independently, which can cause major difficulties in terms of employment and community living.

5.6. Bowel and bladder dysfunction

Bowel and bladder dysfunctions are frequent, frustrating, and often embarrassing effects of MS. Polman et al. [19] indicated that some degree of bladder dysfunction occurs in at least 70 percent of those diagnosed with MS, and up to two-thirds of all people with MS complain of some degree of bowel dysfunction. These difficulties include urgency, dribbling, hesitancy, frequency, constipation, and incontinence. Bowel and bladder dysfunctions can have a negative impact on a person’s daily living regimen, but they often can be effectively managed through medications and/or diet.

5.7. Sexual dysfunction

Sexual dysfunction affects up to 85 percent of men and up to 74 percent of women diagnosed with MS [5]. The effects of sexual dysfunction can be pervasive, often manifesting in psychological and family problems in addition to their physiological accompaniments. Often associated with fatigue, specific sexual problems frequently encountered by people with MS include retarded and premature ejaculation, decreased vaginal and penile sensation, impotence, vaginal dryness, anorgasmia, decreased sex drive, and slowed response and arousal time [19].

6. Psychological effects

As if the physiological accompaniments of MS were not intrusive enough, the illness often has a negative impact on one’s psychological functioning. Psychological problems related to MS can be divided into three categories: (a) cognitive dysfunction, (b) affective disorders, and (c) adjustmental issues. Texts by Kalb [11] and Fraser et al. [6] offer more comprehensive descriptions of the psychological effects of MS.

6.1. Cognitive dysfunction

Although once considered symptomatic of only the most severe cases of MS, cognitive dysfunctions have been established as a common symptom of all stages and types of disease [10,18,24]. Smith and Schapiro [25] and Polman et al. [19] estimated that as many as 60-65 percent of people diagnosed with MS experience some degree of measurable cognitive change. These changes can affect attention, conceptual reasoning, executive function, and memory. Roessler, Rumrill and Hennessey [21] found that more than 40 percent of people with MS identified moderate-to-severe cognitive problems. Because MS destroys myelin anywhere in the central nervous system, its associated cognitive impairments cover a wide gamut. The MRI scan is the best predictor of cognitive status; the greater the number and the more extensive the lesions that are detected, the more likely the person is to have cognitive impairments as a result of MS [15]. Cognitive effects tend to be specific and localized to observable brain lesions; MS does not typically precipitate a decline in general intellectual ability [19].

6.2. Affective disorders

A sizable proportion of the overall psychological impact of MS can be viewed in terms of affective disorders that accompany the illness. Polman et al. [19] noted that “psychiatric morbidity is increased in MS, with over 50 percent of patients being symptomatic at some stage” (p. 85). The most common affective symptoms include irritability, difficulty concentrating, anxiety, bipolar disorder, and depression. Foremost among these is depression. Approximately one-half of all people with MS experience at least one major depressive episode during the course of the illness [16]. Clearly, depression is established as a major psychological symptom of MS, but it has yet to be determined whether depressive episodes result from neurological abnormalities or manifest themselves as a psychological response to a serious illness. Bipolar disorder is characterized by cyclical patterns of severe depression interspersed with periods of mania and/or euphoria and...
is diagnosed in approximately 15 percent of people with MS [14]. Euphoria, a persistent feeling of well-being and optimism in spite of negative circumstances, is often exhibited by people with MS in isolation of other symptoms [16]. Anxiety disorders and other neu- rses are also common, although they are often treated effectively with anti-anxiety medication [16].

Another common psychological symptom of MS is pathological laughing and weeping. A person with MS may break into laughter or begin to weep with slight or no provocation, regardless of his or her underlying mood state. Such emotional outbursts can be functionally disabling in and of themselves, making even rudimentary tasks of daily living extremely difficult to perform [14].

6.3. Psychological adjustment

In addition to the cognitive and affective symptoms of MS, the wide-ranging physiological effects of the illness and its capricious course make the process of adjusting to such a debilitating disease a very difficult task. A number of factors influence one’s overall psychological adjustment to MS. A primary determinant of adjustment is the perceived intrusiveness of the illness – that is, the cumulative effect of (a) functional deficits, physical disabilities, and stressful life events; (b) the unique constellation of signs, symptoms, and treatment constraints associated with an individual’s condition; (c) disease activity, life satisfaction, coping style, and knowledge of MS; and (d) personality and social support systems [12]. This long list of intrusiveness factors clearly reflects the individual and often unpredictable nature of adjustment to MS.

The far-reaching psychological accompaniments of MS solidify its designation as one of the most difficult diseases to cope with, adjust to, and, ultimately, accept [23]. The nature and progression of physiological and neurological symptoms exact a significant toll on those diagnosed with MS, as well as on their families and friends, and the adjustmental and social issues inherent to MS remain among the most difficult effects of the illness to treat.

7. Treatment

Just as no certainty exists as to the cause of MS, no vaccine or treatment modality has been reliably demonstrated to prevent the onset of the illness, progression of central nervous system lesions, or development of new lesions. Moreover, no medical procedure has been developed to alter or dissipate existing lesions. However, adrenocorticotropic hormones and corticosteroids (i.e., prednisone), along with emergent medications such as Avonex, Betaseron, Copaxone, Novantrone, Rebif, and Tysabri [26] have been shown to reduce the severity of exacerbations among some people with MS. Such treatments as fat-free diets, sunflower oil, bee stings, and vitamin supplements have not proven efficacious in definitive clinical trials.

Most MS treatments have been oriented toward catalyzing the body’s own immune responses to neurological irregularities. One of the problems in evaluating the efficacy of such treatments is that it is impossible to determine whether improvements or remissions are the results of the treatment or of the natural course of the illness. Physicians have the ability to specify MS treatment regimens to an individual’s course and symptoms [17,24], but the search continues for curative treatments that will prevent or arrest the underlying agents of the disease.

8. Conclusion

MS is one of the most prevalent neurological disorders known to medical science. Characterized by an unpredictable course, the illness destroys white matter tracts in the central nervous system. Depending on where the nerve damage occurs, people with MS evince a wide range of physiologic and psychological symptoms, including fatigue, mobility problems, spasticity, numbness and tingling in the extremities, general weakness, visual impairments, bowel and bladder dysfunction, sexual dysfunction, cognitive disabilities, depression, anxiety, and diminished self-efficacy.

Diagnosing MS has become much easier in recent years with the advent of magnetic resonance imaging and positron emission tomography, but the medical community has been unable as yet to determine the underlying cause of the disease. There is presently no cure for MS, but certain recent chemotherapeutic regimens have shown encouraging success in extending the duration of remissions and demintensifying exacerbations of the illness.

Women are about twice as likely as men to develop MS, and the illness predominates among individuals of white, northern European descent. The geographic distribution of MS is also worth noting; two-thirds of the American MS population reside in the northernmost 50 percent of the United States populace.
MS is distinct from other diseases in etiology, course, range of symptoms, and populational demography. It also has a unique, often deleterious impact on personal and social functioning. To the extent that a person’s work role constitutes an important element of personal and social functioning, the impact of MS on career development is an important consideration for vocational rehabilitation professionals.

References
