



Patient Education

Multiple Sclerosis

by: NeuroCare.AI

What is Multiple Sclerosis (MS)?

Multiple sclerosis (MS) is a **neuroinflammatory disease** that affects myelin, a substance that makes up the membrane (called the myelin sheath) that wraps around nerve fibers (axons).

The myelin sheath helps to speed nerve impulses traveling within the nervous system. Myelinated axons are commonly called white matter. As the disease progresses, the brain's cortex shrinks (cortical atrophy).

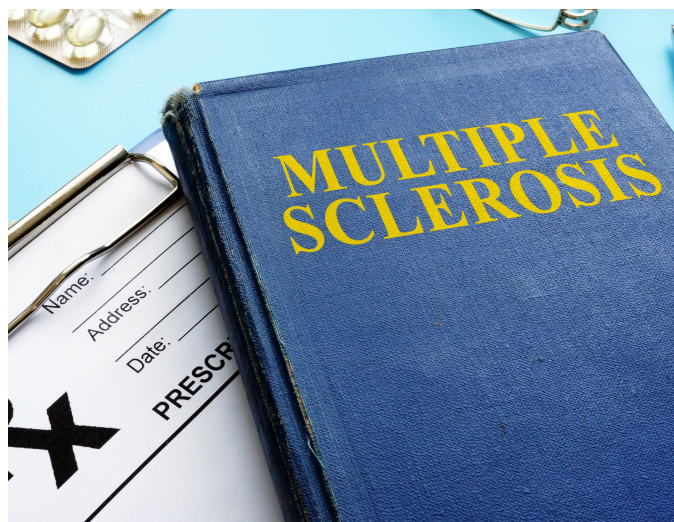
The term multiple sclerosis refers to the **distinctive areas of scar tissue (sclerosis or plaques)** that are visible in the white matter of people who have MS. These plaques can be marked in MRI images. These are the result of an inflammatory process in the brain that causes immune system cells to attack myelin.

MS affects the brain and spinal cord, which can lead to a variety of symptoms, such as problems with vision, arm or leg movement, sensation, or balance. It's a chronic disorder that occasionally results in disability.

People with MS typically live

5 to 10 years less

than the usual person, however, this difference seems to be closing over time.



Prevalence of MS

Experts think there are currently

250,000 to 350,000

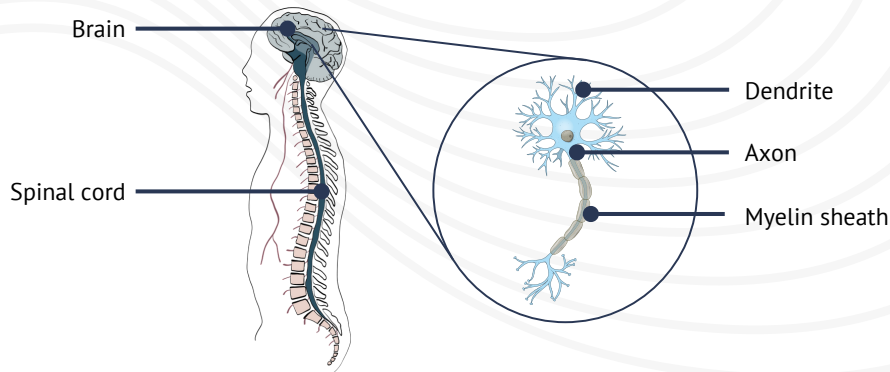
people in the United States diagnosed with MS. This estimate suggests that approximately 200 new cases are diagnosed every week.

Studies of the prevalence of MS indicate that the rate of the disease has increased steadily during the twentieth century.

MS is more common in women than men at about **2 to 3 times**. It most often appears when people are between **30 to 40 years old** although it can develop at any age.

MS: Autoimmune Disease of the CNS

The Central Nervous System (CNS)

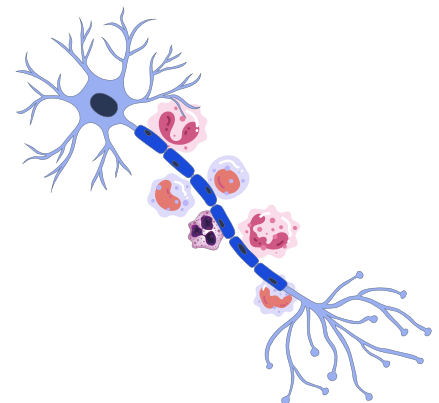


The central nervous system (CNS) is made up of the **brain and the spinal cord**. The basic units of CNS are called neurons. The neurons are the basic building blocks of the CNS and it is these cells that send and receive messages to and from other cells or organs in order to control our body functions.

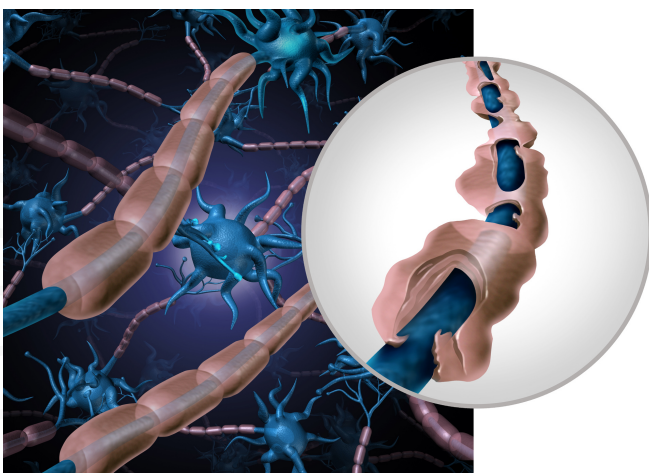
The axons are long cords that extend from the neurons. They are coated with **myelin sheath**, a fatty insulation.

What is an Autoimmune Disease?

The immune system protects the body from disease and infection by attacking germs that get into the body, such as viruses and bacteria. **Autoimmune disease** happens when the body's natural defense system can't tell the difference between your own cells and foreign cells, causing the body to **mistakenly attack normal cells**. In MS, the immune system is mistakenly attacking the myelin sheath in CNS.



Impact of Demyelination



The myelin sheath is like the **protective cover** around your charger cable that allows a smooth flow of electricity to the device. Similarly, the **myelin sheath** allows electrical impulses to transmit quickly and efficiently along the nerve cells.

In the case of MS, it attacks the myelin sheath in the brain and spinal cord. When the myelin sheath is destroyed, it can lead to **disruption in the messages traveling along the nerves** and **Wallerian degeneration**, a process where nerves start to die.

The damaged myelin sheath is then manifested by neurologic symptoms including problems with vision, arm and leg movement, sensation or balance.



Signs and Symptoms of Multiple Sclerosis

The symptoms of MS usually begin over one to several days, but in some forms, they may develop more slowly. They may be **mild or severe** and may go away quickly or last for months. Because symptoms come and go in the majority of people with MS, the presence of symptoms is called an **attack**, or in medical terms, an **exacerbation**. Recovery from symptoms is referred to as **remission**, while a return of symptoms is called a **relapse**.

First Symptoms



Doubled or blurred vision



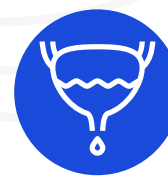
Weak, stiff muscles



Tingling or numbness



Clumsiness/difficulty in staying balance



Bladder control problems



Dizziness that doesn't go away

Later Symptoms



Mental or physical fatigue



Mood changes such as depression/euphoria



Changes in the ability to concentrate or to multitask



Difficulty making decisions, planning, or prioritizing at work or in private life.

Risk Factors of MS

The exact cause of MS is **unknown**. It is an autoimmune disorder that **has risk factors and potential triggers**. The end result of the disease is damage to the myelin sheath within the central nervous system. But how that happens, and why, are questions that challenge researchers.

Immune system. It is believed that the immune system could be:

- fighting some kind of infectious agent (for example, a virus) that has components which mimic components of the brain (molecular mimicry)
- destroying brain cells because they are unhealthy
- mistakenly identifying normal brain cells as foreign

Genetic susceptibility. Susceptibility to MS may be inherited. Studies of families indicate that relatives of an individual with MS have an increased risk for developing the disease.

Sunlight and vitamin D. A number of studies have suggested that people who spend more time in the sun and those with relatively high levels of vitamin D are less likely to develop MS. Researchers believe that vitamin D may help regulate the immune system in ways that reduce the risk of MS.



Risk Factors of MS

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Smoking. A number of studies have found that people who smoke are more likely to develop MS. People who smoke also tend to have more brain lesions and brain shrinkage than non-smokers.

Infectious factors and viruses. A number of viruses have been found in people with MS, but the virus most consistently linked to the development of MS is Epstein Barr virus (EBV), the virus that causes mononucleosis.

Autoimmune and inflammatory processes. Tissue inflammation and antibodies in the blood that fight normal components of the body and tissue in people with MS are similar to those found in other autoimmune diseases. Along with overlapping evidence from genetic studies, these findings suggest that MS results from some kind of disturbed regulation of the immune system.



Investigations for diagnosing MS

There is no single test used to diagnose MS. Doctors use a number of tests to rule out or confirm the diagnosis. There are many other disorders that can mimic MS. Therefore it is very important to perform a thorough investigation before making a diagnosis.



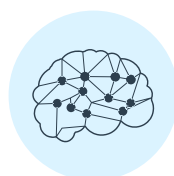
Medical history and physical examination



Detailed neurological examination



MRI scan



Evoked potential tests



CSF Analysis



Blood tests

MRI. In addition to a complete medical history, physical examination, and a detailed neurological examination, a doctor will order an MRI scan of the brain and spine **to look for the characteristic lesions of MS**. Then a special dye or contrast agent is injected into a vein and the MRI is repeated. In regions with active inflammation in MS, there is disruption of the blood-brain barrier and the dye will leak into the active MS lesion.

Evoked Potential Tests. Doctors may also order this tests which use electrodes on the skin and painless electric signals **to measure how quickly and accurately the nervous system responds to stimulation**.

CSF Analysis. In addition, doctors may request a lumbar puncture (sometimes called a "spinal tap") to obtain a sample of cerebrospinal fluid (CSF). This allows them **to look for proteins and inflammatory cells associated with the disease** and to rule out other diseases that may look similar to MS, including some infections and other illnesses.

Blood Tests. Usually, blood tests are done **to rule out any other potential reasons of your symptoms**.



Treatment Goals

MS is a **lifelong condition** that may cause serious disabilities. This condition has no absolute cure unlike bacterial infections which can be treated with antibiotics. But in many cases, the MS symptoms can be possibly treated.

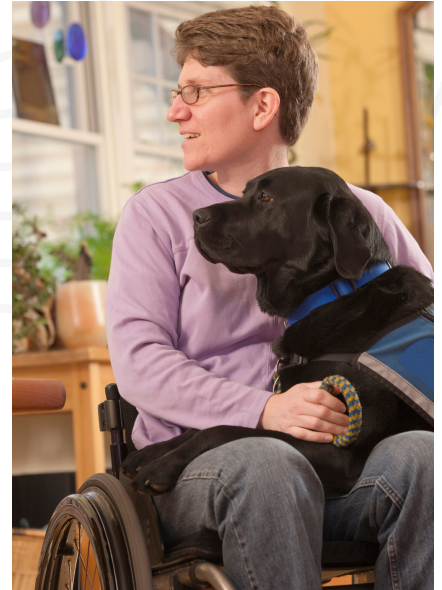
It can be a challenging condition to live with so the primary goal of treatment is to **improve the quality of life for people living with this condition.**

The goals of treatment are:

ACUTE ATTACKS. To decrease the severity of the attacks and to prevent causing permanent damage; to speed up recovery

SYMPTOMATIC TREATMENT. To manage individual symptoms like problems with vision and movement, depression, epilepsy, etc.

DISEASE-MODIFYING AGENTS. To reduce the number of relapses and to slow the disease progression using medicines called disease-modifying therapies



Treatment for MS

There is still no cure for MS, but there are treatments for **acute attacks**, medications and therapies **to improve symptoms**, and recently developed drugs **to slow the worsening of the disease.**

ACUTE ATTACKS

The usual treatment for an acute MS attack is to inject high doses of a **steroid drug**, such as methylprednisolone, intravenously (into a vein) over the course of 3 to 5 days. It may sometimes be followed by a tapered dose of oral steroids. Intravenous steroids **quickly and potently suppress the immune system and reduce inflammation.** Clinical trials have shown that these drugs hasten recovery.



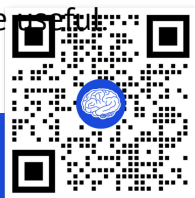
SYMPTOMATIC TREATMENT

MS can cause a range of symptoms that can be **treated individually.**



Vision problems. Eye and vision problems are common in people with MS but rarely result in permanent blindness. Periodically resting the eyes may be helpful.

Tremor. People with MS sometimes develop tremors, or uncontrollable shaking, often triggered by movement. Assistive devices and weights attached to limbs are sometimes helpful for people with tremors. Deep brain stimulation and drugs such as clonazepam also may be helpful.



Treatment for MS

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Problems with walking and balance. Many people with MS experience difficulty walking. Use of a cane, walker, or another assistive device are beneficial. Physical therapy can also reduce walking problems in many cases.

Fatigue. Fatigue may be reduced if the person receives occupational therapy to simplify tasks and/or physical therapy to learn how to walk in a way that saves physical energy or that takes advantage of an assistive device. Some people benefit from stress management programs, relaxation training, membership in an MS support group, or individual psychotherapy.

Pain. People with MS may experience several types of pain during the course of the disease. Treatments may include heat, massage, ultrasound treatments, and physical therapy to correct faulty posture and strengthen and stretch muscles; prescription of anticonvulsant or antispasmodic drugs, and other drugs that help to reduce central pain.

Problems with bladder control and constipation. The most common bladder control problems encountered by people with MS are urinary frequency, urgency, or the loss of bladder control. Urologists can help with the treatment of bladder-related problems. A number of medical treatments are available. Constipation is also common and can be treated with a high-fiber diet, laxatives, and other measures.

Sexual issues. People with MS sometimes experience sexual problems and these can be corrected with medications. Psychological counseling also may be helpful.

Depression. Studies indicate that clinical depression is more frequent among people with MS than it is in the general population or in persons with many other chronic, disabling conditions. It is most often treated with selective serotonin reuptake inhibitor (SSRI) antidepressant medications, which are less likely than other antidepressant medications to cause fatigue.

Cognitive changes. A number of neuropsychological tests have been developed to evaluate the cognitive status of individuals with MS. Based on the outcomes of these tests, a neuropsychologist can suggest ways to manage different cognitive challenges.



Treatment for MS

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DISEASE-MODIFYING AGENTS

The current FDA-approved therapies for MS are designed to modulate or suppress the inflammatory reactions of the disease. These drugs are called disease-modifying agents. These medicines help people with MS to have fewer and less severe relapses; aim to lessen the degree of damage and scarring to the myelin sheath which accounts for MS relapses. These treatments also assist to **reduce the progression of MS disability**.

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