

MULTIPLE SCLEROSIS

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)...MS also damages the nerve cell bodies, which are found in the brain’s *gray matter*, as well as the axons themselves in the brain, spinal cord, and optic nerve (the nerve that transmits visual information from the eye to the brain)” (National Institute of Neurological Disorders and Stroke [NINDS], 2014). Additionally, as the disease progresses, the brain’s cortex shrinks, a condition called 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. Plaques can be as small as a pinhead or as large as the size of a golf ball” (NINDS, 2014).

It is believed that something, perhaps a virus or another environmental agent, renders the T-cells unable to distinguish myelin from a foreign body, thus causing them to attack the myelin sheath (Mayo Clinic, 2012). However, much research is still needed to understand why this phenomenon occurs.

There is no known cure for MS although a person affected with the disease can have a long life expectancy after diagnosis. Early diagnosis, treatment, and intervention can help diminish the symptoms which can range from mild to severely debilitating symptoms.

Symptoms

MS can cause damage at any single point or at multiple points on the central nervous system. Because of this, symptoms can vary greatly, but most commonly, symptoms of Multiple Sclerosis include:

- Numbness or weakness in one or more limbs
- Partial or complete loss of central vision, usually in one eye, often with pain during eye movement (optic neuritis)

- Double vision or blurring of vision
- Tingling or pain in parts of the body
- Electric-shock sensations that occur with certain head movements
- Tremor, lack of coordination or unsteady gait
- Slurred speech
- Dizziness
- Heat sensitivity (change in body temp can worsen other symptoms)
- Bowel and bladder control problems

Later symptoms can be accompanied by those listed above, or can manifest by themselves:

- Fatigue
 - Mood changes such as depression or euphoria
 - Inability to concentrate or multitask effectively
 - Difficulty with decision making, planning, prioritizing at work or in private life
- (Mayo Clinic, 2012; NINDS, 2014).

“Most people with multiple sclerosis, particularly in the beginning stages of the disease, experience relapses of symptoms, which are followed by periods of complete or partial remission of symptoms” (Mayo Clinic, 2012).

Risk Factors

Currently, the exact cause of MS remains unknown, but many theories have identified factors for increased risk:

Genetic predisposition

Although it is not hereditary, having someone with MS in your immediate family, such as a parent or sibling, increases the likelihood of developing MS to a 1 in 3 chance compared to the general population, which is closer to a tenth of 1 percent (Mayo Clinic, 2012; National Multiple Sclerosis Society [NMSS], n.d.e).

Environmental factors

MS is more common in Europe, southern Canada, northern United States, New Zealand, and southeastern Australia. That being said, the incidence of MS is greater in cooler climates than warmer climates. Interestingly, the likelihood of

developing the disease is affected by an individual's migration, decreasing in likelihood if, during adolescence, one migrates from a high risk climate to a low risk climate, and vice-versa (Mayo Clinic, 2012). In fact, some researchers have found a correlation between a high level of sun exposure and decreased incidence of MS. Typically; those who live in areas that have less sun exposure and lower average temperatures develop the disorder. Since sunlight helps human skin produce vitamin D, researchers believe that vitamin D may help regulate the immune system (NINDS, 2014).

Infectious agents

“It is possible that a virus or other infectious agent is the triggering factor in MS. More than a dozen viruses and bacteria – including measles, canine distemper, human herpes virus-6, Epstein-Barr, and Chlamydia pneumonia – have been or are being investigated to determine if they are involved in the development of MS, but none have been definitively proven to trigger MS” (NMSS, n.d.e).

Sex

Women's likelihood of developing MS is twice that of men's. This ratio has remained unchanged since 2008 (Mayo Clinic, 2012; Multiple Sclerosis International Federation [MSIF], 2013).

Race

Caucasians, in particular those of northern European descent, tend to be at greater risk of developing MS. Individuals of Asian, African, or Native American descent have the lowest risk (Mayo Clinic, 2012).

Age

“Multiple sclerosis can occur at any age, but most commonly affects people who are ages 20 to 40” (Mayo Clinic, 2012). The average age that MS presents itself is 30 years old, though 2-5% of people with MS are diagnosed before the age of 18 (MSIF, 2013).

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. The reasons for this are currently unclear” (NINDS, 2014).

Autoimmune and inflammatory processes

For those who have MS, inflammation of tissue combined with antibodies in blood fight normal components of the body. This is also true of some other autoimmune diseases. Genetic studies are finding that MS results from a disturbed regulation in the immune system (NINDS, 2014). It is still unclear what the triggering mechanism is that causes the immune system to malfunction and why it tends to occur with more frequency under certain conditions.

Prevalence

Because the symptoms of MS can range in severity from very mild to extremely debilitating, it is often difficult to diagnose. Individuals can have MS for many years without a definitive diagnosis. The actual number of MS sufferers is not certain but it is estimated that 250,000 to 350,000 people in the United States have been diagnosed with MS. This estimate would suggest that around 200 new diagnoses occur each week (NINDS, 2014). Worldwide, MS affects approximately 2.3 million people (NMSS, n.d.d). Prevalence in North America overall is approximately 140 per 100,000 (MSIF, 2013, p.9).

The U.S. Census Bureau estimates the population numbers for the KCF counties of interest as follows:

2013 Population Estimate	
County	# Persons
Bandera	20,601
Bexar	1,817,610
Comal	118,480
Kendall	37,766
Total	1,994,457

(U.S. Census Bureau, 2014)

Using that data, there could be approximately 2,792 individuals living in the KCF counties of interest who are suffering from Multiple Sclerosis.

“Estimates of MS populations vary, and specific numbers are difficult to confirm through healthcare organizations. Many groups estimate that 400,000 individuals in the United States have MS, although this number could be much higher” (Multiple Sclerosis Association of America [MSAA], 2013).

Diagnosis

In order to properly diagnose a person with MS, a physician must rule out all other possibilities first. This is because MS has many symptoms that can be caused by a variety of other illnesses. A brief overview of how MS is currently diagnosed follows.

Criteria for diagnosis

There are no specific criteria, such as symptoms or physical abnormalities, that determine whether or not an individual has MS. A physician *must* find a number of different things in order to make a diagnosis:

- Evidence of damage in at least two separate areas of the central nervous system, which includes the brain, spinal cord and optic nerves
- Evidence that the damage occurred at two different points in time
- Rule out all other possible diagnoses

(NMSS, n.d.a)

Tools That Aid Diagnosis

Having a full medical history (including a neurological exam) and blood tests can help a physician to make an accurate diagnosis of MS. The physician must:

- Take a careful history to identify any past or present symptoms that might be caused by MS.
- Gather information about birthplace, family history, environmental exposures, history of other illnesses and places traveled that might provide further clues.
- Perform a variety of tests to evaluate mental, emotional and language functions, strength, coordination, balance, reflexes, gait, vision, and the other four senses.

(NMSS, n.d.a)

Optical coherence tomography (OCT)

This is a non-invasive and pain-free imaging technique used to see retinal structures at the back of the eye. MS often targets the optic nerve and can lead to optic neuritis (inflammation of the optic nerve that can cause lesions along nerve pathways)

(NMSS, n.d.a).

Magnetic Resonance Imaging (MRI)

MRI scans of the head and spine are used to visualize the characteristic lesions of MS. “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” (NINDS, 2014).

Cerebrospinal Fluid (CSF)

This clear, colorless fluid covers the brain and spinal cord and cushions the brain inside the skull. A spinal tap can be used in order to acquire CSF for testing. The CSF of a person with MS may contain abnormally high IgG antibodies, specific proteins called oligoclonal bands, and/or certain kinds of proteins that are the products of myelin breakdown. That being said, 5-10 percent of persons with MS never show these CSF abnormalities (NMSS, n.d.a).

Visual Evoked Potentials (VEP)

Evoked potentials tests measure electrical activity in the brain. To detect the slowing of electrical signals caused by demyelination, wires are placed on the scalp and the response to stimuli is recorded. “VEP is used to identify impaired transmission along the optic nerve pathways, which is a fairly common early finding in MS, even in someone who has never been aware of any visual symptoms” (NMSS, n.d.a)

Treatments

Although there is no known cure for Multiple Sclerosis, treatments are available that can help reduce the severity of symptoms.

Modifying disease course

There are ten “disease-modifying agents” that the U.S. Food and Drug Administration (FDA) has approved to slow disease activity and progression. These ten medications include:

- Beta interferons – slow the progress of MS as well as reduce the number and severity of attacks
 - Avonex (interferon beta-1a)
 - Betaseron (interferon beta-1b)
 - Extavia (interferon beta-1b)
 - Rebif (interferon beta-1a)
- Copaxone (glatiramer acetate) – works to block immune system attacks on myelin
- Gilenya (fingolimod) – traps immune cells in lymph nodes
- Novantrone (mitoxantrone) – immunosuppressant
- Tecfidera (dimethyl fumarate) – inhibits immune cells
- Tysabri (natalizumab) – inhibits blood/brain barrier exchange
- Aubagio (teriflunomide)—can reduce attacks and lesions

(Mayo Clinic, 2014; NMSS, n.d.c)

Strategies to treat attacks

When a patient is suffering from an attack caused by MS, they usually take corticosteroids in order to reduce inflammation. Plasmapheresis can be used in more severe cases. This involves a plasma exchange where the patient’s blood is removed, the blood cells separated from the plasma and remixed with a plasma-like solution, and then infused back into the body (Mayo Clinic, 2014).

Treating symptoms

There are many different techniques currently in use to treat the wide variety of symptoms of MS. Most treatments include medications aimed at helping a specific symptom. For example, Dalfampridine (Ampyra) is used to help patients improve their walking speeds, but the medication is known to cause seizures. Other medications include muscle relaxants, fatigue reducers, pain reducers, and bladder or bowel control medications. For those psychological issues, anti-depressants may also be prescribed (Mayo Clinic, 2014).

Treatment centers

According to the National Multiple Sclerosis Society (n.d.b), there are 16 MS Centers/Clinics in Texas. Of these, only two are located in the KCF counties of interest and both are in San Antonio:

- The Multiple Sclerosis Center of South Texas
- Neurology Center of San Antonio

The University of Texas Health Science Center at San Antonio (UTHSCSA) announced in August of 2011 that a MS clinic with specialists would be coming to the Medical Arts & Research Center (MARC) (UTHSCSA, 2011). This particular clinic works with many different kinds of ailments, including individuals who have neuromuscular disorders, seizures, stroke, epilepsy, cerebrovascular disorders, neuro-immunology issues, and neuro-ophthalmological issues (UTHSCSA, 2014).

New Research

There are currently several different studies that have helped to better understand and better treat Multiple Sclerosis. One of these studies has shown promise in reversing symptoms and reversing some of the damage caused by the depletion of myelin. The study, published May 15, 2014, shows that after injecting stem cells into the spinal fluid of mice with an MS-type of disease, the disease symptoms were reduced. Although the stem cells were rejected, they proved that by stimulating the mouse's oligodendrocyte precursor cells (OPCs) in the brain, there may be a way to reverse MS by re-stimulating the immune system (National Society for Stem Cell Research, 2014).

Another study using stem cell research published in the journal *Nature* (2013) used mouse skin stem cells and reprogrammed them to become myelin-making cells. This research has shown that in the future, for those individuals suffering from MS, the damage may be reversible (Nature, 2013).

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