Multiple Sclerosis Fast Facts

Multiple sclerosis [skler-oh-sis] (MS) is a progressive disease of the nervous system resulting from the inflammation and degeneration of nerves. In developed countries, MS is the primary cause of neurological disability in young and middle-aged people. Worldwide, MS affects an estimated 2.3 million. The cause is unknown and although factors that may increase risk have been identified, attempts to curb disease progression have so far met with failure. However, we are at a turning point in scientific advancement with the emergence of promising new therapies that could help us shift the odds in our favor against this devastating disease.

Multiple sclerosis (MS) can hit without warning. Affecting people in midlife, it produces not only life-changing physical symptoms but also neuropsychiatric and mental health problems. The disease occurs due to inflammation and degeneration in the central nervous system (CNS) and, in most cases, is characterized by periods of relapse and remission. Neurons are damaged progressively over time and lose their insulating sheath of myelin [my-uh-lin]. Although the cause remains unknown, malfunctions in the immune system are central to MS.

The prevalence of MS is gauged by rates of diagnosis. Unfortunately, this may underestimate the actual disease burden as there is a lack of published data from many countries. Countries in North America and Europe appear to have a greater disease burden, and this follows a latitudinal gradient, whereby countries above the equator show higher rates of the disease.

MS is also 2 to 3 times more likely to affect women than men. In Denmark, where a registry of MS cases has been kept for around 70 years, an increase in incidence in women has been observed while the rate in men has remained relatively stable. Since the ratio of MS in prepubertal children is 1:1, sex hormones may influence disease onset. Understanding and measuring disease prevalence in different populations can be extremely valuable in helping us understand more about the disease pathogenesis.

Many environmental factors that may increase the risk of MS have been identified. These include low levels of ultraviolet (UV) light exposure, lack of vitamin D in the diet, infection with Epstein-Barr virus (EBV), smoking, and migration. Latitude and UV exposure are known to correlate with the disease, but in countries with limited sunlight where populations consume high amounts of dietary vitamin D, the prevalence of MS is lower than would be expected. Studies have also pointed to slower rates of disease progression with high vitamin D intake.

Clinicians have observed a strong correlation between EBV infection and MS, with a possible two-fold greater risk in people who have been previously infected with EBV. While the mechanisms behind this increased risk are yet to be fully established, it may be that EBV infection triggers autoimmunity and causes the immune system to mistakenly attack its own nerve cells.

Genetics are also known to play a role in MS, but no causative gene has been found. Nevertheless, a heritable element is assumed to be present, as people have a higher risk if a family member has been diagnosed. Genes which code for a component of immune cells called the major histocompatibility [hiss-toe-compat-ih-bility] complex are variable between populations and races. In Caucasians, a particular version of this gene may increase susceptibility, but further research is necessary to confirm this association.

Neuropathological examinations have revealed numerous physical characteristics of the disease and have shaped the way we understand MS. The CNS is made up of two types of tissue: grey and white matter.

While grey matter contains the cell bodies of neurons, white matter consists predominantly of the myelinated, axonal projections which link the CNS to the muscles and effector organs of the body. Myelin is a fatty sheath which surrounds nerves and insulates the electrical signal being propagated. Myelin is essential for maintaining fast and efficient nerve communication.

Lesions in white matter are typically seen in MS due to the destruction of myelin and surrounding inflammation. These vary in size and number between patients, becoming progressively worse with time. More detailed analysis of MS brains has revealed grey matter lesions also exist and become more prominent in the long-term.

These changes are associated with synaptic damage in the cortex and are likely responsible for the cognitive effects and irreversible disability observed in MS. We are discovering more about the disease pathology as technologies such as MRI and brain imaging advance, but there is still a lot to learn.

The loss of oligodendrocytes [oll-ih-GOE-dend-roh-cytes] in newly formed lesions is thought to progress myelin destruction and inflammation. As these cells produce new myelin, it makes sense that their disappearance is associated with worsening of the disease.

Acute MS lesions appear abruptly and predominate in the early, relapsing phase of the disease. They contain a large number of activated immune cells, correlating with myelin breakdown and disruption of blood vessels. Lesions eventually become chronic in the long-term and appear devoid of myelin with few oligodendrocytes.

Components of the non-specific immune system known as macrophages play a significant role in damaging myelin, although the nature of this attack is unclear. Their activity is thought to be directed by T cells and facilitated by the release of cell contents as cells are broken down. However, other scientists believe that T cells are less important than previously assumed, and our knowledge of MS pathogenesis is an evolving and ever-changing landscape.

Regardless of the initiating factor, myelin loss occurs rapidly after symptoms begin to show. Nerve impulses are slowed and, in some cases, completely blocked, resulting in the neurological symptoms of progressive muscle weakness.

In the relapsing phase, recovery can be seen temporarily due to the remyelination which naturally occurs. Unfortunately, this default response to myelin loss is not able to keep up as the damage becomes more extensive. However, elucidating the mechanisms of remyelination would be extremely helpful in the development of new MS therapies. Indeed, a drug which can promote remyelination known as anti-LINGO1 completed phase II trials for a different disease, with promising results. Future trials of this drug could represent an exciting new avenue in the development of much-needed treatment for MS.

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