



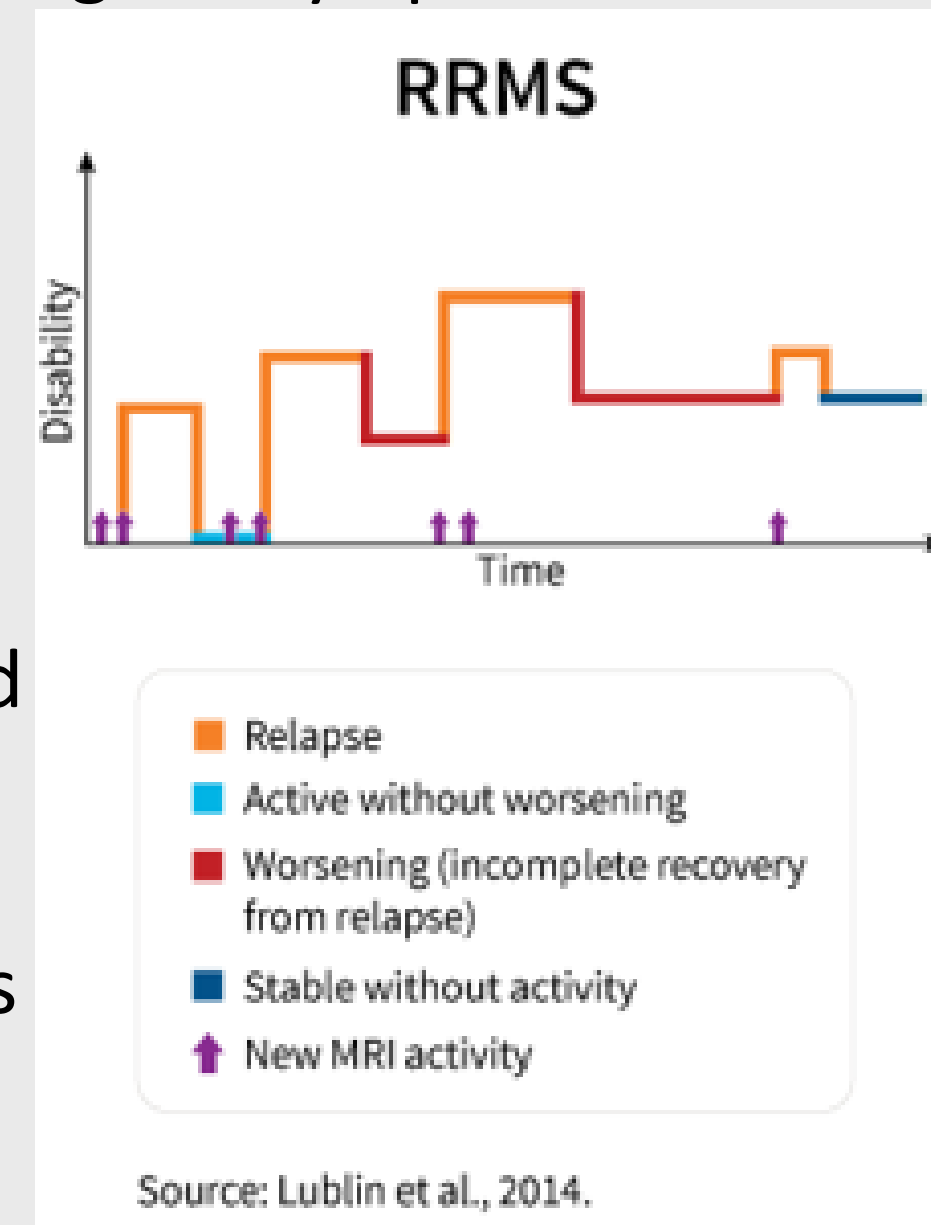
MS THE MENACE

Relapsing-Remitting Multiple Sclerosis



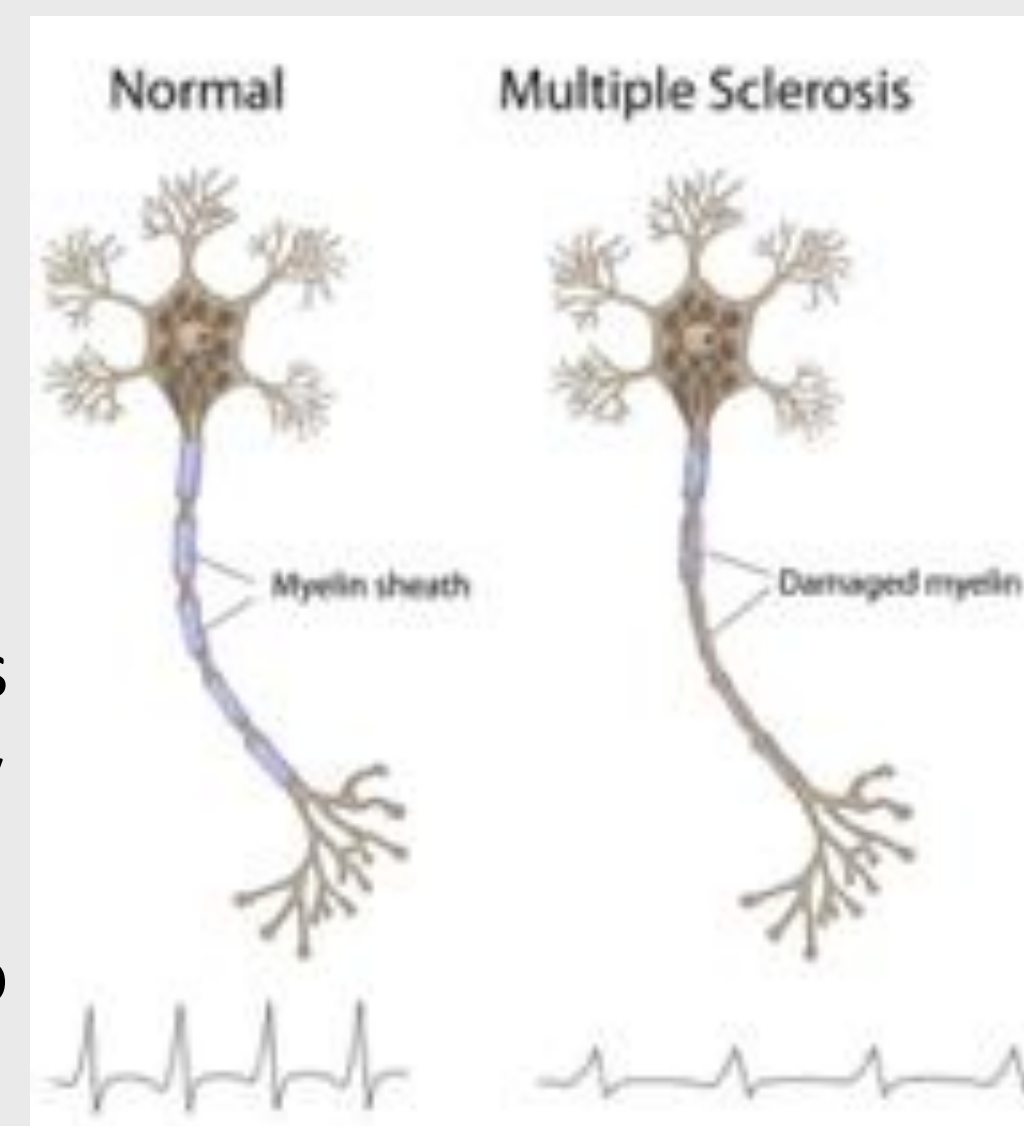
WHAT IS IT?

Relapsing-Remitting Multiple Sclerosis (RRMS) is the most common type of multiple sclerosis. It is clearly defined as attacks of new or increasing neurological symptoms.¹ As time goes on, symptoms may disappear or continue and become permanent. The image to the right shows a timeline of how symptoms appear and disappear during relapse and remission. Compared to other forms of MS, patients with RRMS tend to develop more brain lesions that appear on Magnetic Resonance Imaging (MRI).¹ The image also shows when new MRI activity tends to become prevalent. With the use of MRI, it is possible to diagnose and locate brain lesions, also called plaques or scars. A patient that is diagnosed will continue to receive MRI imaging to monitor any changes. Receiving a lumbar puncture is effective in diagnosing RRMS, even though it is not as common as getting an MRI. Cerebrospinal Fluid (CSF) studies confirm demyelinating of the nervous system.² After diagnosis, a treatment plan is the next step. Due to RRMS being unpredictable, there are multiple ways a patient can receive treatment.



CAUSES

RRMS is thought to be both an autoimmune and neurodegenerative condition.³ It is caused when the body's immune system attacks myelin and nerve fibers. Instead of fighting off foreign bodies or harmful cells, the immune system gets confused and attacks the Central Nervous System (CNS). The white blood cells get past the blood brain barrier and attach to myelin.⁴ The image to the right compares a healthy nerve to one that has been attacked. The myelin sheath that wraps around the nerve is destroyed and causes inflammation. This is referred to as demyelination. Once the myelin sheath is damaged, nerve impulses slow down, or even stop. The body can only repair the damage to some extent, causing the nerves to become necrotic and die. Inflammation causes lesions in the brain and sometimes the spinal cord.



SYMPTOMS

During the remission phase, symptoms may disappear or become stable. During the relapse phase, new symptoms or sudden increases in old symptoms must last at least 24 hours to classify as flare ups.⁵ Due to the variable location of damage, not one patient experiences the same symptoms. There is a wide variety of symptoms that a patient can experience, such as fatigue and bowel or bladder problems.

- One of the most common symptoms is fatigue. Although fatigue occurs in about 80% of people, the cause is unknown.⁶ Fatigue differs with specific "neurological symptoms, fluctuates with heat, exercise and can be elevated by a short period of rest."⁵
- Others will experience vision problems, such as blurry or double vision. Patients who experience vision problems related to RRMS, are at a higher risk of either partially or completely losing their eyesight.⁷ With most symptoms, there are different approaches when it comes to finding treatments. Occupational and physical therapy are both important to help get back into daily life, as well as medications.

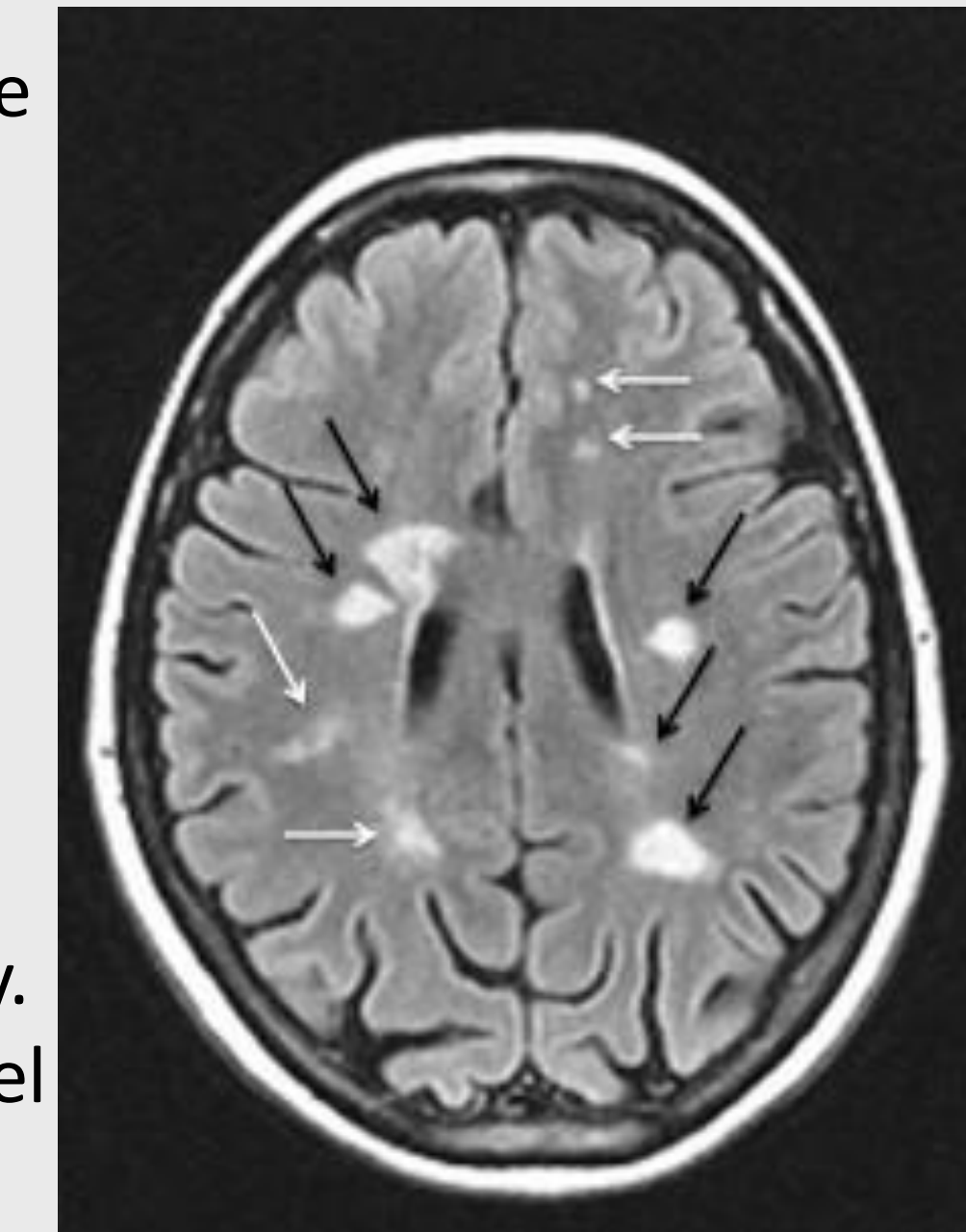
TREATMENTS

- Although RRMS is not curable, there are ways to decrease inflammation and the progression of the symptoms and disease. The Food and Drug Administration (FDA) has passed multiple medications that are effective with RRMS.
 - LEMTRADA is an intravenous infusion, or a drip medication. Patients who take Lemtrada take it in two treatment doses, twelve months apart. It reduces the number of relapses by about 70%.⁸ Lemtrada works by decreasing the immune cells that are involved when the immune system attacks myelin. It attaches to the immune cells and kills them, and once those immune cells grow back, research claims that those cells will not cause more damage to the nerves.⁸
 - BETASERON (Interferon Beta-1b) is another form of treatment for patients with RRMS. Betaseron comes in a powder form and is mixed with liquid and injected subcutaneously every other day.⁹ It may prevent immune cells from crossing the blood brain barrier, stopping them from reaching the neurons in the CNS.⁹ When taking Betaseron, an occurrence of a second flare up has decreased to 28% and has also reduced the number of newly active brain lesions.⁹

MRI AIDED DIAGNOSIS

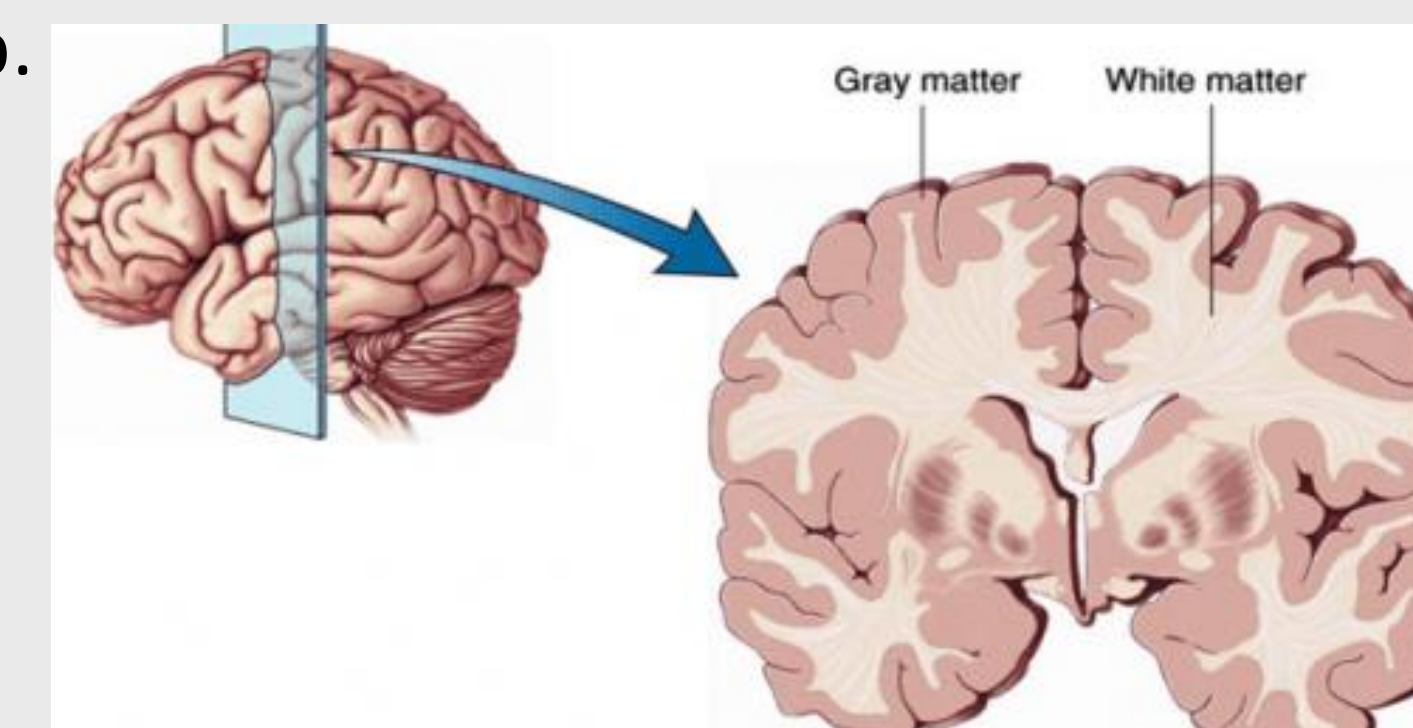
Since RRMS differs from patient to patient, there is no single test that will diagnose it. An MRI is one of the most common ways to diagnose RRMS.

- MRI is used to both diagnose and monitor RRMS and is the most common and least invasive way to detect demyelination. MRI uses strong magnetic fields to measure water content in the body. Healthy myelin is fatty and will repel water, as demyelinated nerves retain more water.¹⁰ Initial images of the brain are obtained pre-contrast and Gadavist is then injected and helps to detect and visualize areas that have been disrupted by the blood brain barrier or abnormal vascularity of the CNS.¹¹ Gadavist causes the veins and arteries to show up bright white on an MRI image, making it easier for the Radiologist to determine pathology.



When a patient has a relapse, they will undergo multiple MRIs of the brain to observe any changes. Often, a doctor will also want an MRI of their spine because brain lesions are known to spread through the spinal cord.

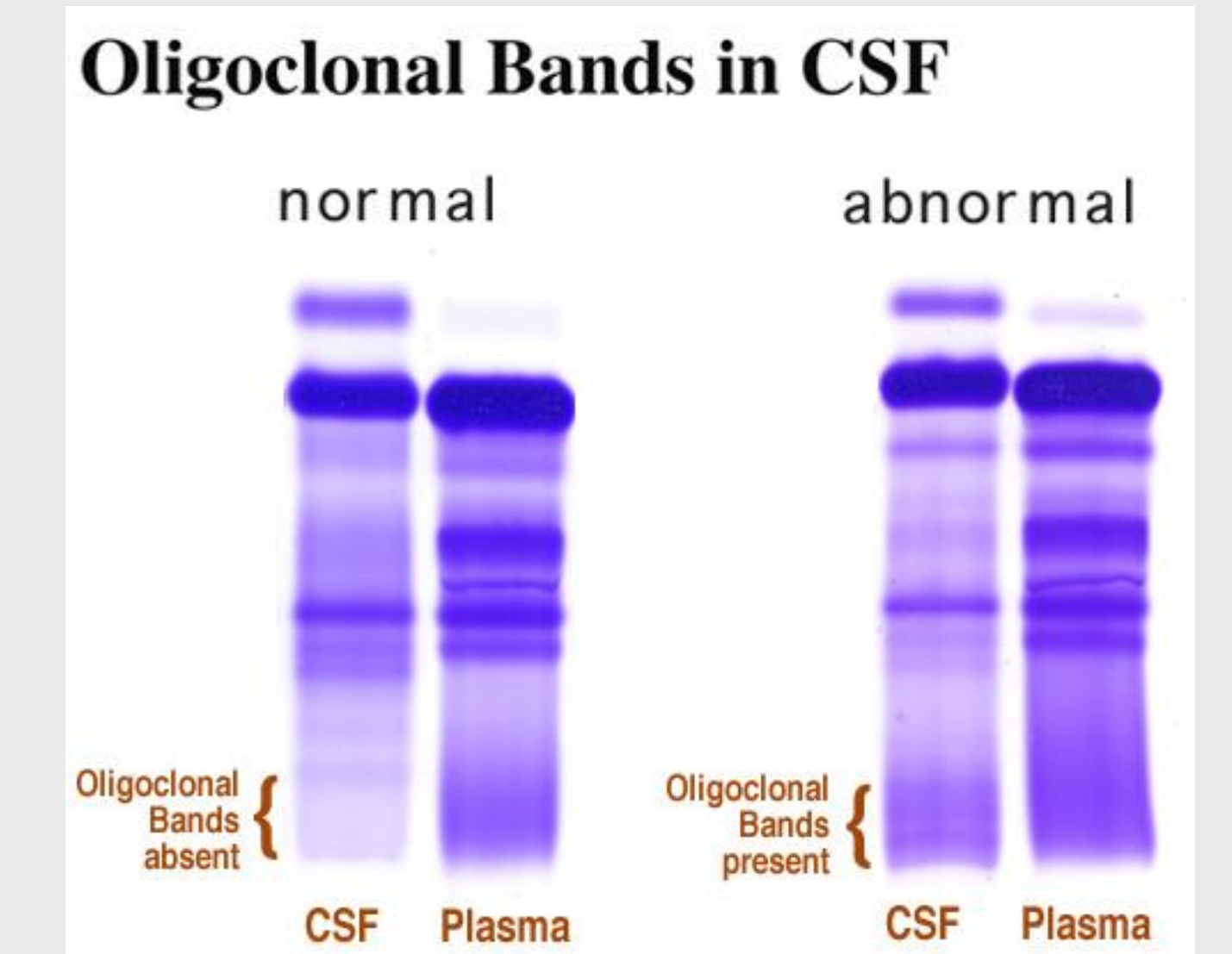
- A brain is made up of two types of tissues, white and gray matter. White matter gets its white color from the fatty myelin. White matter is made of nerve fibers, or axons, which conduct the electrical signals. Damage to these axons cause the electrical signals to slow down or possibly stop.



- Gray matter is also said to be affected by RRMS. Gray matter is made up of neurons from the CNS. White matter carries the messages from point A to point B, as gray matter is point A and point B. As the white matter is damaged, the gray matter loses its connection and eventually dies. Therefore, RRMS causes inflammation in the white matter and atrophy, or the shrinking of the brain, in the gray matter.¹²

LUMBAR PUNCTURE

A lumbar puncture, or a spinal tap is a more invasive way to diagnose RRMS. An abnormal result indicating RRMS is the presence of oligoclonal bands in CSF. An oligoclonal band is a type of protein called immunoglobulin.¹³ Oligoclonal band patterns are "remarkably stable within an individual with RRMS over many years."¹⁴ Immunoglobulin protein is present in the cells of the immune system and acts as antibodies. Presence or an increase in this protein indicates an abnormal functioning immune system and inflammation in the CNS. Oligoclonal banding in CSF has a high specificity and sensitivity for RRMS.



Although a lumbar puncture is an effective way to diagnose RRMS, an abnormal response in the immune system detected in CSF fluid is also common in other diseases.¹⁴ Studies show that with patients that have been diagnosed with RRMS, about 5-10% did not show abnormalities in their CSF fluid.¹⁴ During a relapse, the protein level is known to increase.

- Since patients with RRMS experience different symptoms and relapse times, it is difficult to diagnose. Oftentimes, both a spinal tap and an MRI are used to confidently diagnose RRMS versus other diseases that may encounter similar signs and symptoms.

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