

Imaging Multiple Sclerosis

C31

Objectives

- ❖ What are Nerves?
- ❖ What is Multiple Sclerosis (MS)?
- ❖ What are symptoms of MS?
- ❖ What are the risk factors of MS?
- ❖ What Imaging modalities can help diagnose MS and how?
- ❖ What are some treatment options for MS?
- ❖ What does is the outlook for patients with MS?

Thesis

This presentation will discuss the anatomy of the nervous system, how it is affected by MS, symptoms of MS, its risk factors, what imaging modalities can assist in diagnosing it and how, treatment options of MS, and what the outlook for patients with MS looks like.

All about the Nerves

Neurons: excitable cells that allow the brain and spinal cord to communicate with the rest of the body ⁶

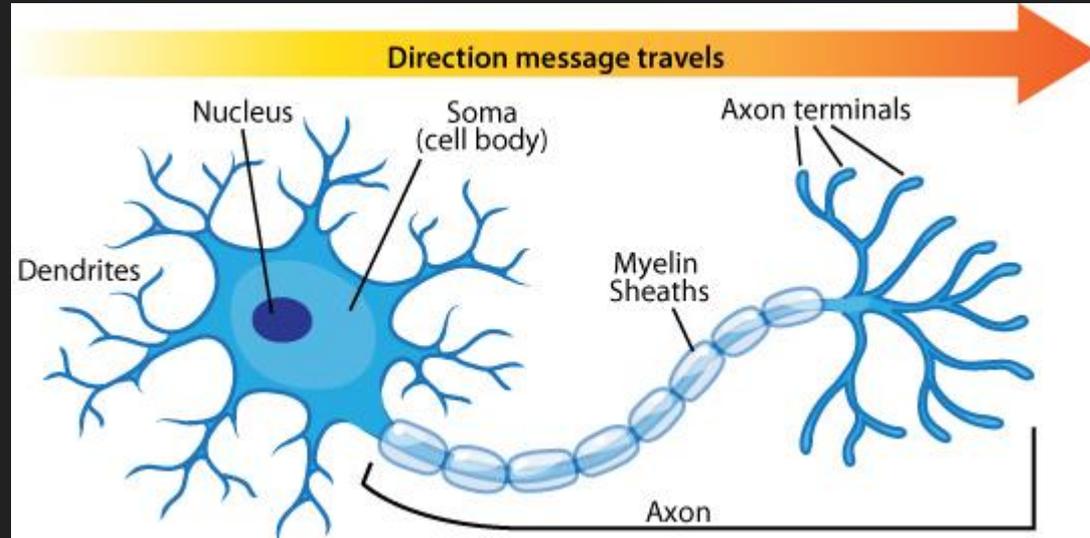
Parts of the Neuron:

Dendrites: receive the messages from axons of other nerves ⁷

Cell Body (Soma): carries genetic information, maintains structure, and provides energy to carry out functions ⁷

Axon: long structure that carries the signal across the neuron ⁶

Myelin Sheath: fatty substance that coats the axon and helps the axon conduct signal ⁷



https://askabiologist.asu.edu/sites/default/files/resources/articles/neuron_anatomy.jpg

What is MS?



<https://images.onhealth.com/images/slideshow/multiple-sclerosis-s1-brain-spinal-cord-nerves.jpg>

- ❖ Autoimmune disease
 - Body attacks itself
 - Attacks and destroys myelin
- ❖ Nerves are left exposed
 - Slowed or blocked signals
- ❖ Communication problems between the central nervous system and the rest of the body
 - Eventually permanent
- ❖ Idiopathic⁴

MS Symptoms

- ❖ Depression & mood swings ⁵
- ❖ Forgetfulness ⁵
- ❖ Dizziness ⁵
- ❖ Lack of coordination & difficulty walking ⁴
- ❖ Fatigue ⁴
- ❖ Tremors ⁴
- ❖ Tingling and numbness in extremities ⁴
- ❖ Paralysis ⁴

- ❖ Spasms & tremors ⁵
- ❖ Pain & stiffness ⁴
- ❖ Gait ⁵

Brain

Eyes

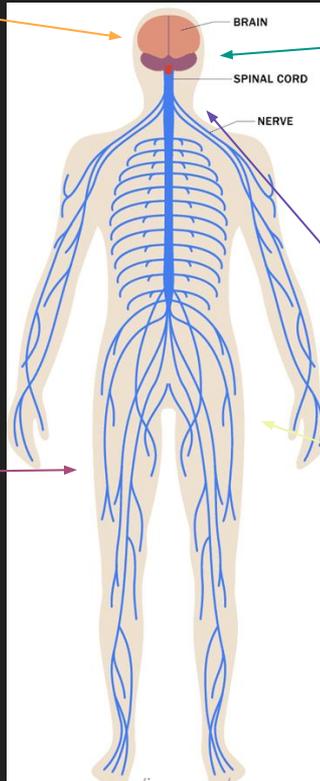
- ❖ Blurry or double vision ⁵
- ❖ Loss of vision or blindness ⁴
 - Usually in one eye
- ❖ Eye pain ⁴

Mouth

- ❖ Slurred speech ⁵
- ❖ Difficulty with word expression ⁴

Excretory

- ❖ Bladder dysfunction ⁴
- ❖ Sexual dysfunction ⁴
- ❖ Bowel dysfunction ⁴

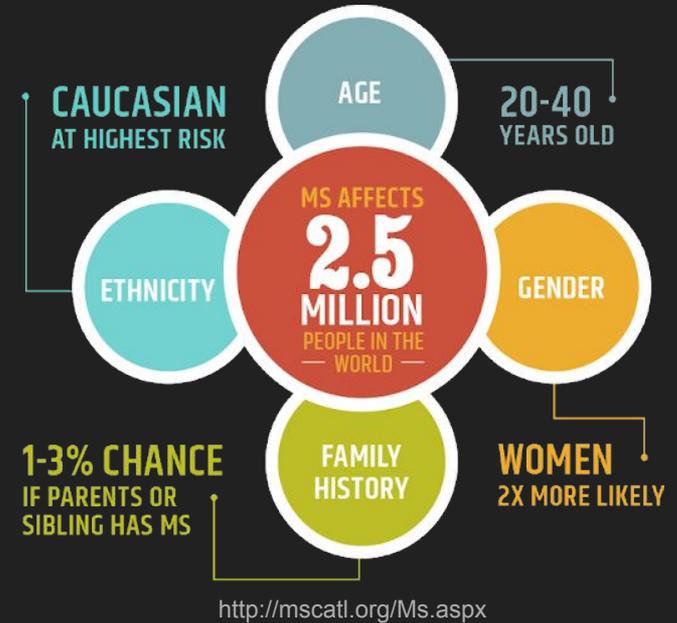


Risk Factors

- ❖ 0.1% risk for average person in the US ⁴
- ❖ Occurs between the ages of 16-55 years ⁴
- ❖ Women twice as likely ²
- ❖ Close family members with disease increase risk by 1-3% ²



https://www.taringa.net/+salud_bienestar/la-esclerosis-multiple-em_131iyc

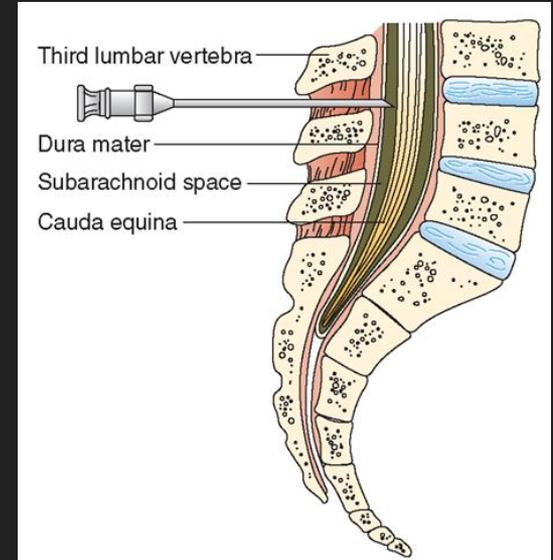


- ❖ More common in countries with moderate temperatures (US, Canada, Europe) ⁴

Diagnostic X-ray and MS

❖ Lumbar Puncture

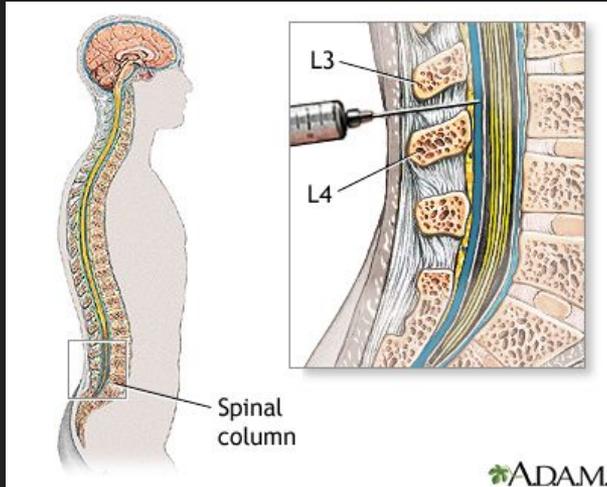
- Done in diagnostic x-ray under fluoroscopy
- A radiologist uses a hollow needle to aspirate a sample of CSF* from the subarachnoid space of the spinal canal
 - Between L3 and L5
- Area is numbed with a local anesthetic
- The patient must not be on blood thinners
 - Reduce bleeding risk
- Procedure is done using sterile technique
 - Reduce risk of infection ³



<http://www.examnotes.com/images/Lumbar%20puncture%202.jpg>

*Cerebral spinal fluid: liquid that surrounds the brain and spinal cord for nutrients and protection

Diagnostic X-ray cont.



[9242.jpg](#)



Lab Testing

- CSF* sent over to lab to be tested for MS indicators
 - Elevated levels of antibodies
 - Specific proteins
 - High white blood cell count (up to 7x higher)

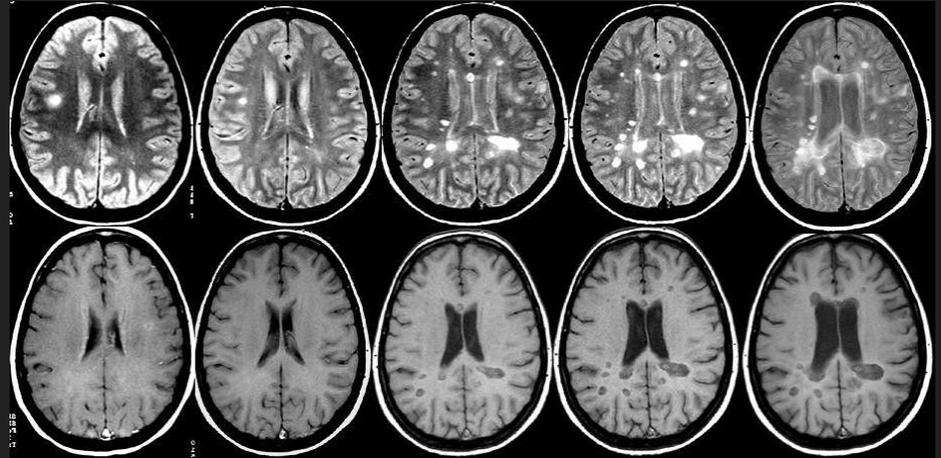


But not all individual with MS have abnormalities in their CSF

- About 50%³

MRI and MS

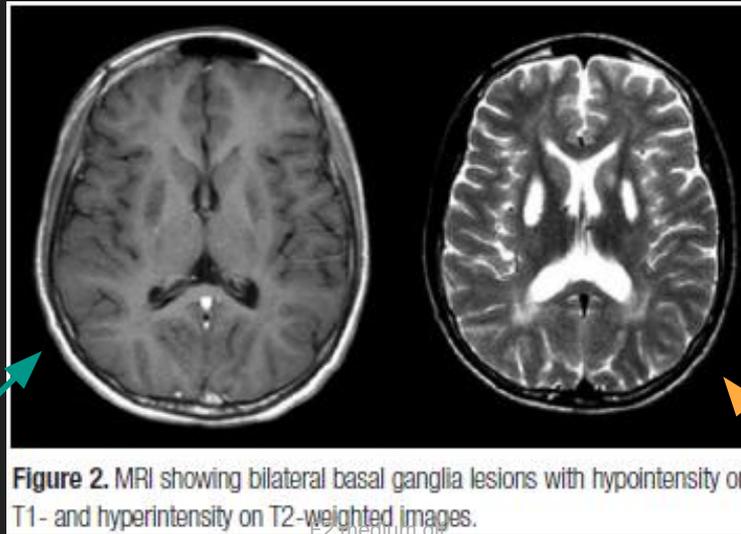
- ❖ Magnetic Resonance imaging is the most effective way to diagnose MS, and used to visualize effects and inflammation on the brain and spinal cord ¹
- Contrast is often used to better visualize lesions*
 - Gadolinium is injected via IV to enhance images
 - Lesions appear as light or dark objects depending on the window used
 - Rads can determine the age of lesions and which are active ³



[71d4cab51f3ed3391dab3045dcb57ef9.jpg](#)

***Lesions**: indicator of demyelination in the brain or spinal cord

MRI Cont.



❖ T1 weighted exam

- Visualize new growing active lesions
- Indicates disease progression
- Useful for early diagnosis
- Areas of permanent damage appear as “dark holes”³

❖ T2 weighted exam

- Visualize new and old lesions
- Indicates long term effects
- Lesions appear as bright spots
- Hyperintense lesions diagnosed and indicate higher levels of disability³

Treatment for MS

❖ Corticosteroids

- Reduces nerve inflammation
- Provides some relief for vision problems or severe weakness
- Can cause bad side effects
 - Weight gain
 - Sleeping problems
 - High blood pressure ⁵

❖ Physical Therapy

- Staying active can prevent severe flares
- Stretching and light aerobic exercise encouraged ⁵

❖ Plasma Exchange

1. Remove blood
2. Separate blood cells and plasma
3. Add protein solution to plasma
4. Return to body
 - a. Suggested when symptoms are new or getting worse ⁵



<https://health.usf.edu/medicine/neurology/clinicalprograms/multiple-sclerosis/symptoms-ms>

Outlook for MS Patients

- ❖ Multiple sclerosis is a relapsing and remitting disease
 - Improvement of symptoms and disease relapse comes and goes
 - Can last weeks, months, or years
- ❖ 2 Types
 - Primary-progressive MS
 - Gradual onset and progression of symptoms without remission
 - Secondary-progressive MS
 - Disease progression varies greatly
- ❖ Disease is idiopathic and there is currently no cure ⁴
- ❖ Drugs and treatments help manage symptoms and prevent flares ⁵



<https://www.medicalnewstoday.com/articles/327113>

Conclusion

- ❖ Multiple Sclerosis is an idiopathic autoimmune disease
- ❖ It destroys the myelin sheath on the neuron
- ❖ It directly affects the brain and spinal cord causing communication issues throughout the body
- ❖ Symptoms can vary, and can relapse or remit depending on each individual
- ❖ MS is diagnosed through a spinal tap or MRI scans
- ❖ Treatment varies from plasma exchange, physical therapy, or steroids

Let's see what you remember

What part of the neuron is affected by MS?



What causes MS?



What is an indication of demyelination on an MRI?



Resources

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4. Stuart, William H. "What Is MS?" *MULTIPLE SCLEROSIS CENTER OF ATLANTA*, 2020, mscatl.org/Ms.aspx.
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7. Vandergrindt, Carly. "What Are Neurons?" *Healthline*, 20 July 2018, www.healthline.com/health/neurons#parts.