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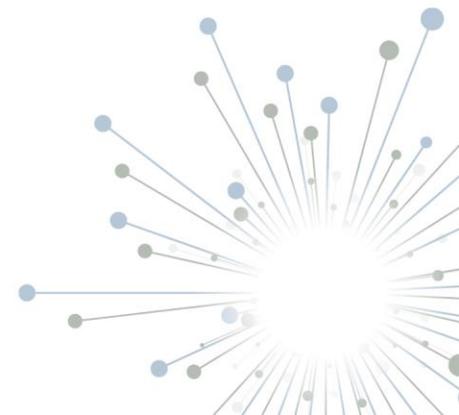
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The Misdiagnosis of Multiple Sclerosis: What Nurses Need to Know

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Key Points: The Diagnosis of Multiple Sclerosis

- Diagnosis is made using a combination of the patient history, neurologic examination, MRI and additional tests when needed.
 - The diagnosis can be made after the first attack but may require a period of observation to confirm or exclude the diagnosis.
 - Additional testing such as OCT, VEP, and CSF sampling via lumbar puncture may be needed to support the diagnosis.
 - It is prudent for MS mimics to be considered especially with RED FLAGS. Misdiagnosis can happen and the diagnosis might need to be changed as new information is revealed.
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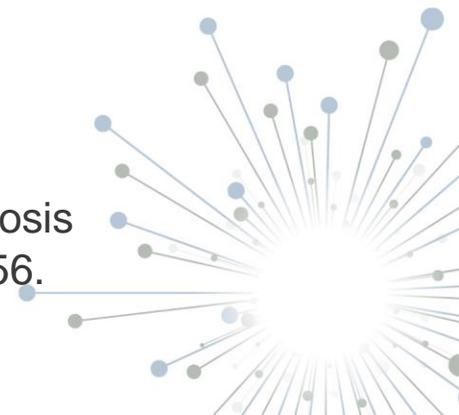


Incidence of MS Misdiagnosis



- Accurate MS diagnosis can be challenging
- 18% of new MS patients in two clinics were determined to be misdiagnosed
- Misdiagnosis is associated with atypical clinical or imaging findings
- Misdiagnosed patients receive years of unnecessary MS medications
- Migraine is the most common alternate diagnosis

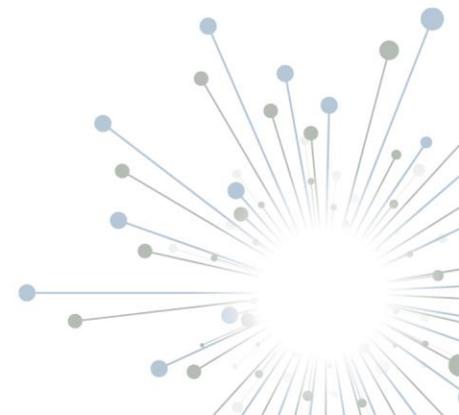
Kaisey, M, Solomon AJ, Luu, M, Giesser, BS, Sicotte, NL. Incidence of multiple sclerosis misdiagnosis in referrals to two academic centers. *Multiple Sclerosis and Related Disorders*. 30: May 2019. 51-56.





2016-17 International Panel on Diagnosis of Multiple Sclerosis



- **Jeffrey Cohen – Co-Chair**
 - **Alan Thompson – Co-Chair**
 - Stephen Reingold
 - Brenda Banwell
 - Frederik Barkhof
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New Data Motivated Convening the International Panel



- MRI, CSF, and other paraclinical tests
- Performance of the 2010 McDonald Criteria in diverse populations
- Relationship of MS and other diseases with overlapping clinical or imaging features (e.g. NMOSD)
- Challenges making the diagnosis in individuals with non-classical presentations (e.g. RIS)
- Frequency and consequences of misdiagnosis



General Principles in the 2017 Revisions of the McDonald Criteria



- Major changes were not anticipated
- Simplify or clarify components of the 2010 Criteria
- Facilitate earlier diagnosis when MS is likely but not diagnosable with the 2010 Criteria
- Preserve the specificity of the 2010 Criteria and promote appropriate application to reduce misdiagnosis
- Ensure any proposed changes do not weaken the Criteria and are supported by reasonable evidence

Misdiagnosis and Differential Diagnosis



- The potential differential diagnosis of MS is broad
- Misdiagnosis of MS remains an issue in clinical practice ¹⁻⁴
- In a recent multicenter case series, aside from NMOSD, most often were common conditions with nonspecific symptoms, signs, MRI findings ⁴
- Misdiagnosis can have harmful consequences ⁴

¹ Murray TJ, Murray SJ. Can Med Assoc J 1984;131:336-7. ² Poser CM. Lancet 1997;349:1916. ³ Carmosino MJ et al. Arch Neurol 2005;62:585-90. ⁴ Solomon AJ et al. Neurology 2016;87:1393-9

Considerations to Avoid Misdiagnosis



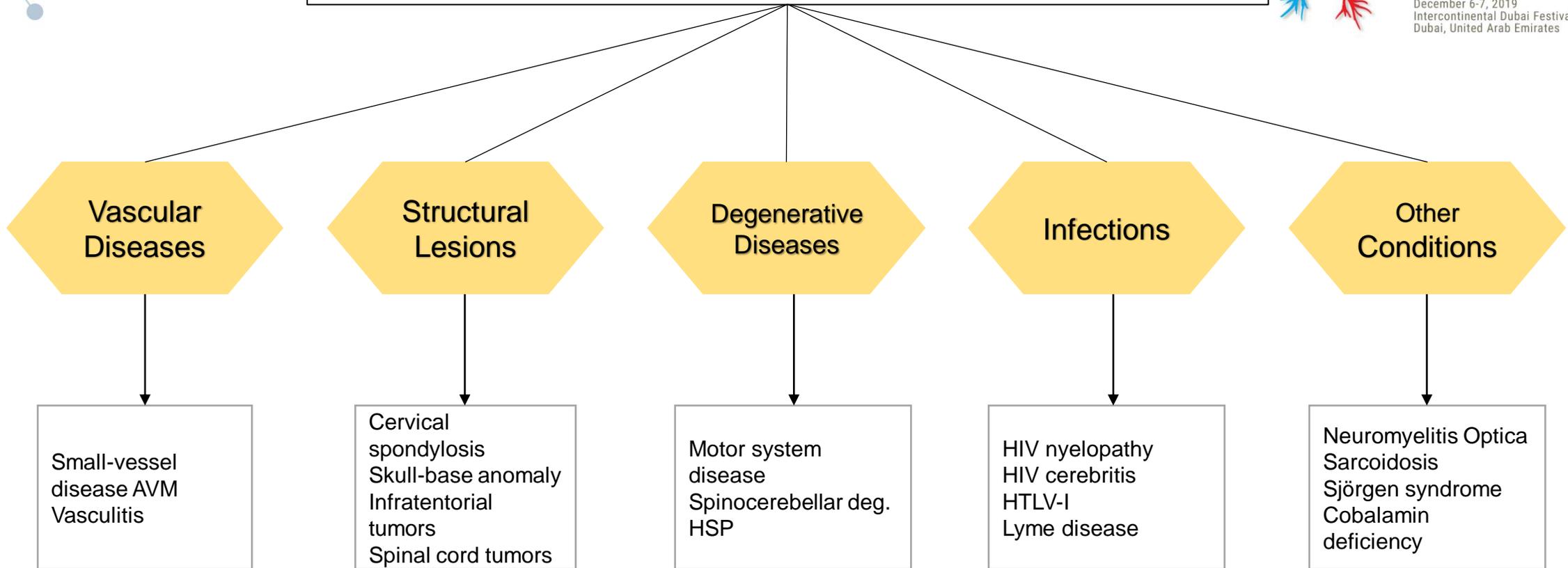
- Recognize that the McDonald criteria were developed and validated to identify MS or high likelihood of MS in patients with a typical CIS, not to differentiate MS from other conditions
- Integration of the history, examination, imaging, and laboratory evidence by a clinician with MS-related expertise remains fundamental in making a reliable diagnosis of MS or an alternative diagnosis.

Considerations to Avoid Misdiagnosis



- Besides merely confirming DIS/DIT, diagnostic rigor in the interpretation of clinical data and test results is necessary
- In the absence of a clear-cut typical CIS:
 - Accept historical events lacking objective corroboration with caution
 - The diagnosis should be confirmed by additional clinical and radiological follow-up
 - Consider postponing the diagnosis or institution of therapy to accumulate additional evidence

Conditions Commonly Mistaken for Multiple Sclerosis

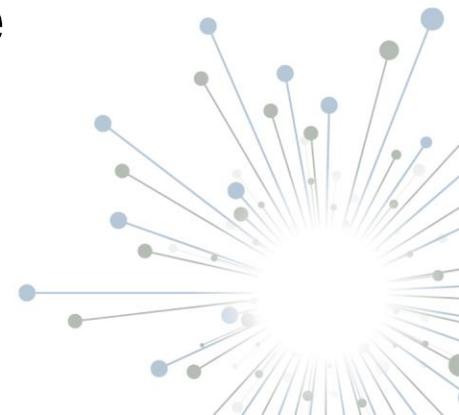




Lyme Disease



- Found in North America
- Transmitted through a tick bite via deer
- Early symptoms include fatigue, fever, headaches, muscle and joint aches
- Late symptoms include numbness and tingling in the hands and feet, cognitive problems, short term memory loss, speech issues
- Those in areas known to have Lyme Disease or those who traveled to those areas should be evaluated.





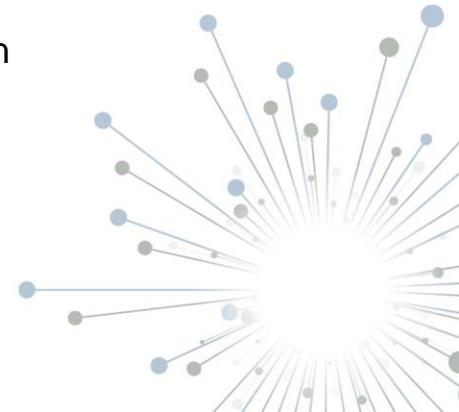
Migraine



- The most commonly misdiagnosed condition mimicking MS (1)
- Pain is intense, throbbing with light, sound, smell sensitivity
- Nausea and vomiting; blurred vision
- Light-headedness and fainting
- Migraine headaches commonly occur in MS (2)
- Associated with pain as well as depression and may be difficult to diagnose

(1) Kaisey, M, Solomon AJ, Luu, M, Giesser, BS, Sicotte, NL. Incidence of multiple sclerosis misdiagnosis in referrals to two academic centers. *Multiple Sclerosis and Related Disorders*. 30: May 2019. 51-56.

(2) Sahai-Srivastava, S, Wang, SL, Ugurlu, C, Amezcua, L. Headaches in multiple sclerosis: Cross-sectional study of a multiethnic Clinical Neurology and Neurosurgery. April 2016. 71-75.

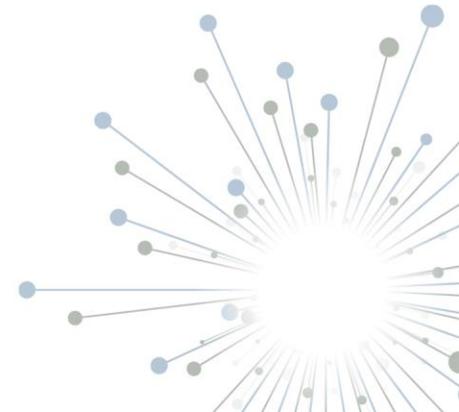
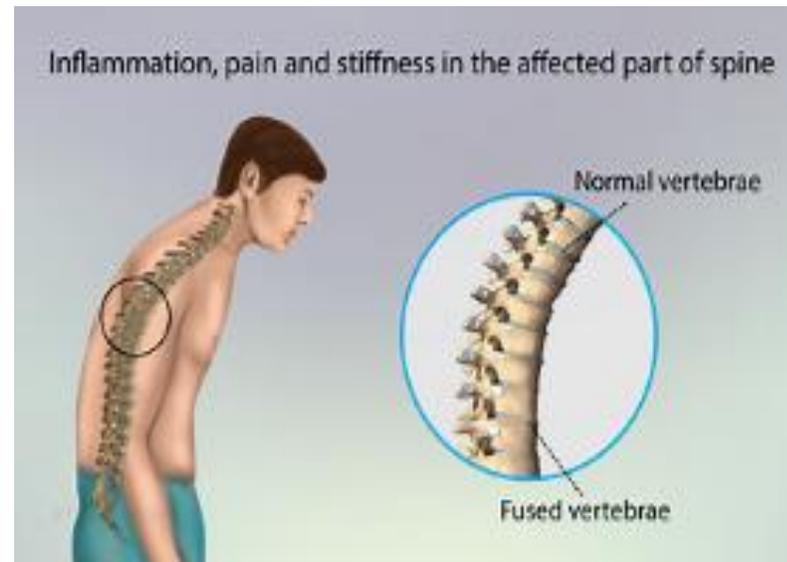


Radiologically Isolated Syndrome

- People with radiologically isolated syndrome do not have the symptoms of MS
- They have lesions on their brain on MRI similar to those found in MS
- Many but not all will later develop progressive MS
- That is why researchers may be an early indicator of MS
- There are no treatment guidelines for RIS
- Up to 10% of people misdiagnosed with and being treated for MS may have RIS

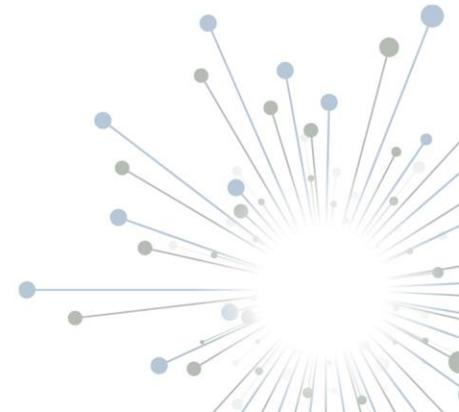
Spondylopathies

- Spondylopathies are a collection of disorders of the vertebrae that involve inflammation
- One example is ankylosing spondylitis which causes joint pain and fatigue.



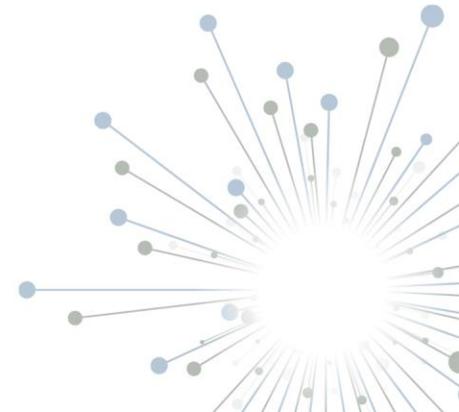
Neuropathy

- Neuropathy or nerve damage can be misdiagnosed as MS
- Refers to peripheral neuropathy or damage to the nervous system outside the brain and spinal cord.
- May be sensory, motor, autonomic with loss of coordination, weakness, walking problems.



Conversion or Psychogenic Disorders

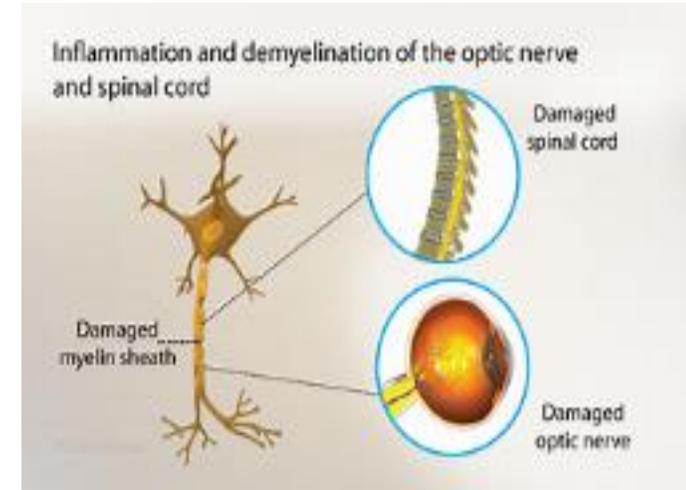
- Psychological stress is converted into a physical problem
- There is no medical cause found.
- A study published in September 2016 in Neurology found that 11% of subjects definitely or probably had a conversion of psychogenic disorder.



Neuromyelitis Optic Spectrum Disorder

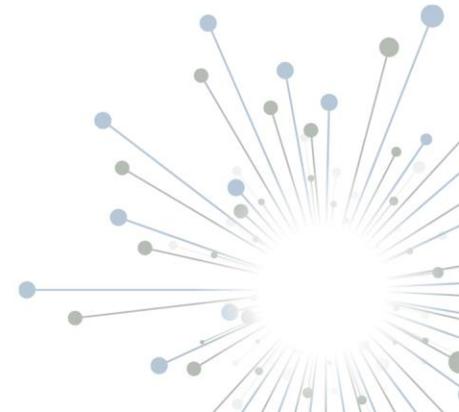


- NMOSD is an inflammatory disease which attached myelin
- Symptoms similar to MS but includes vision loss in one or both eyes, numbness or loss of sensation in arms and legs, bowel and bladder problems, vomiting, hiccups.
- New diagnostic techniques and treatments are becoming available



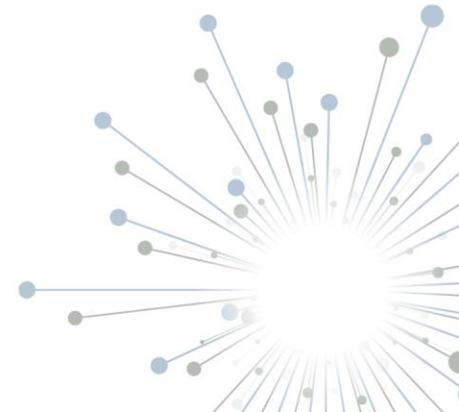
Lupus Erythematosus

- Chronic autoimmune disorder which affects women more than men
- Causes muscle pain, joint swelling, fatigue and headaches
- Hallmark is a butterfly-shaped rash on cheeks and nose (only 50% develop the rash)
- No single diagnostic test; called the “great imitator”



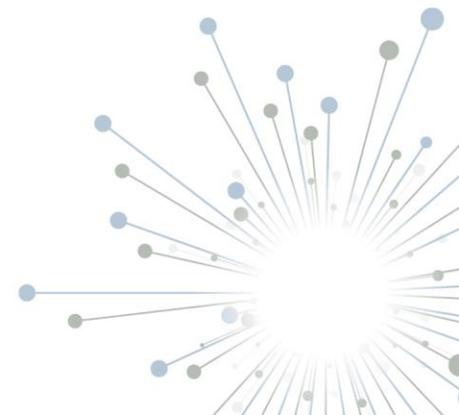
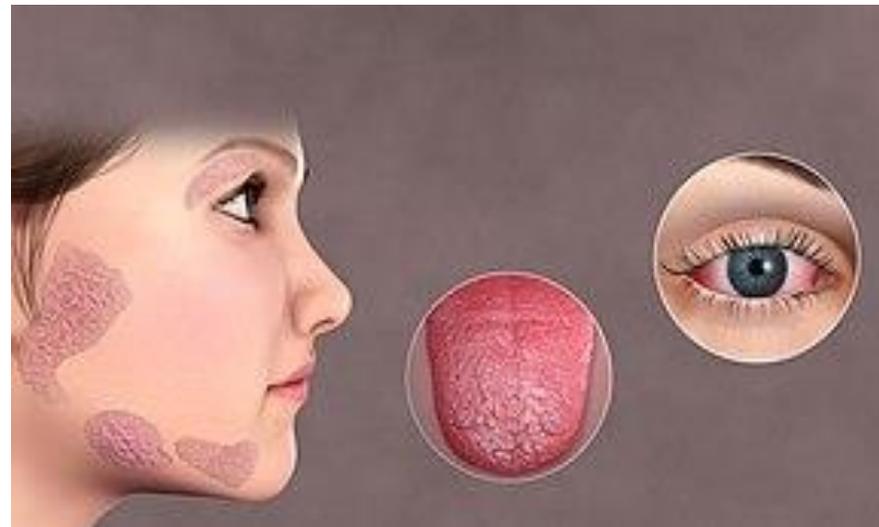
Fibromyalgia

- Fibromyalgia and MS have similar symptoms including headaches, joint and muscle pain, numbness and tingling of extremities, memory problems and fatigue.
- More common in women than in men.
- Does not cause brain lesions on MRI.



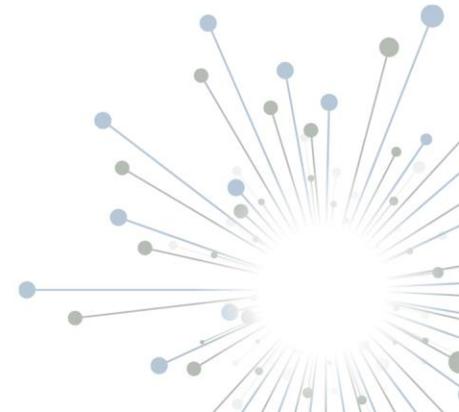
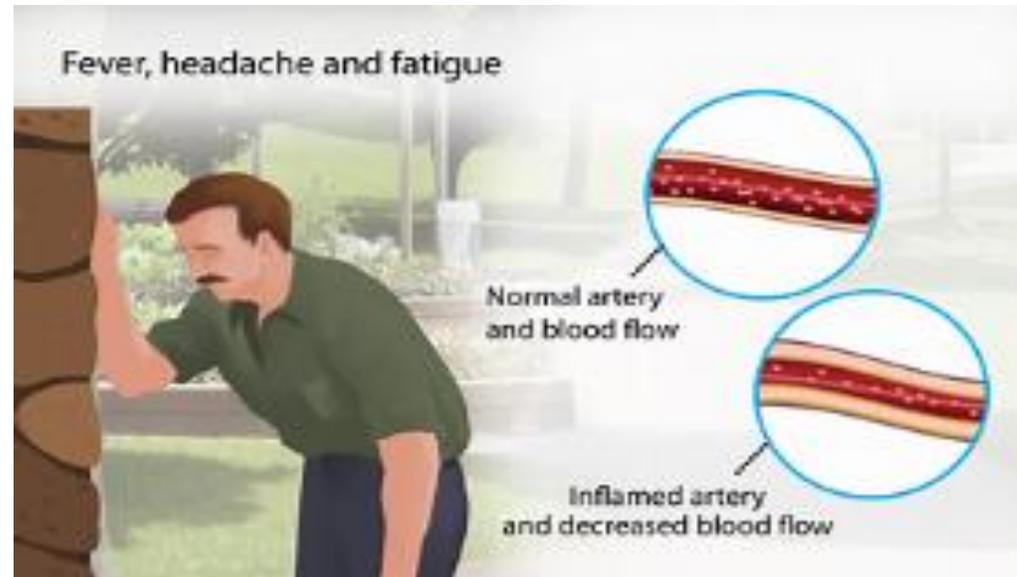
Sjogrens Syndrome

- Many symptoms of Sjogrens Syndrome overlap: fatigue, musculoskeletal pain
- More common in women than in men.
- Telltale signs are dry eyes and mouth.



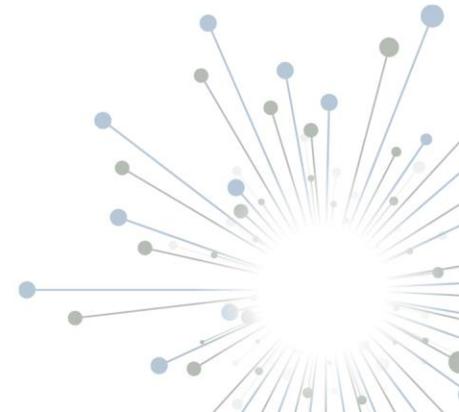
Vasculitis

- Inflammation of the blood vessels that may cause symptoms that mimic MS.
- Symptoms can include pain, numbness, tingling, weakness in limbs, cognitive problems.



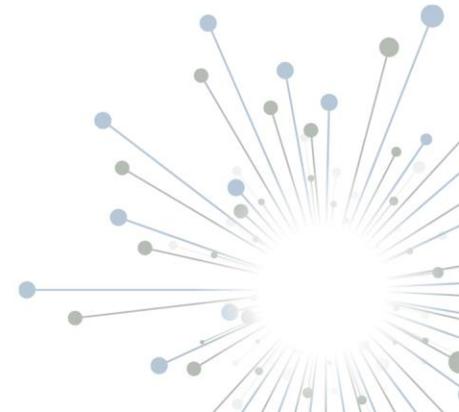
Myasthenia Gravis

- A chronic autoimmune disease that causes muscle weakness that comes and goes but tends to progress over time.
- Caused by a defect in the transmission of nerve impulses to muscles.
- First signs are drooping eyelids and double vision.
- Can cause difficulty in walking, speaking, chewing and swallowing.



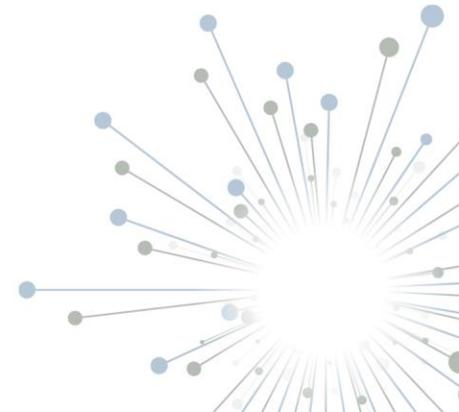
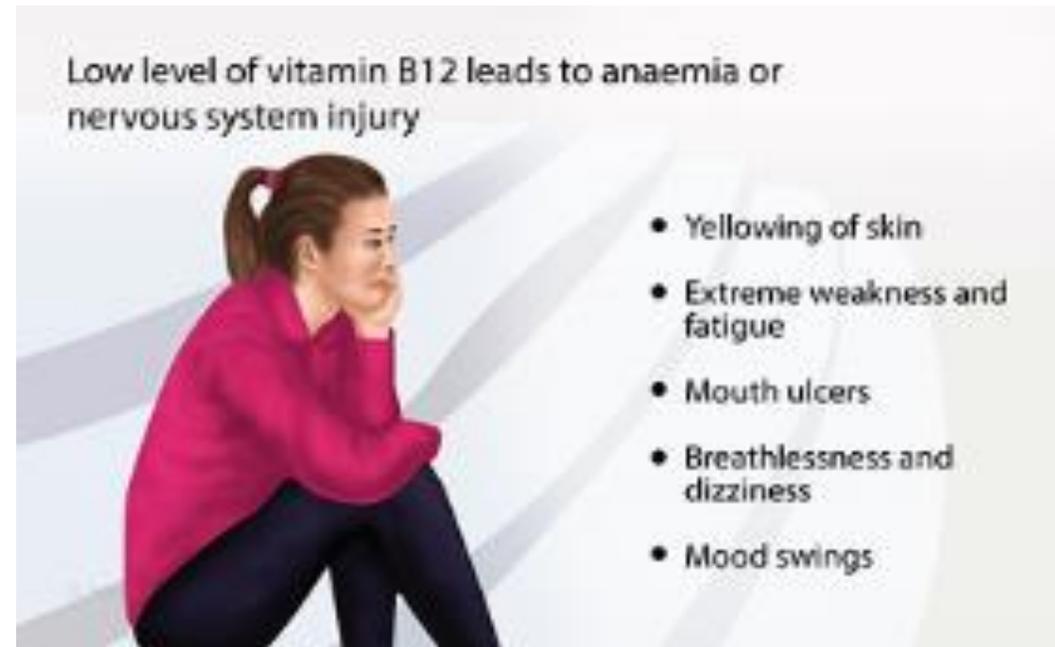
Sarcoidosis

- Inflammatory autoimmune disease that shares some symptoms with MS including fatigue and decreased vision.
- Commonly affects lungs, lymph nodes and skin (cough, wheezing, lymphedema, sores, discoloration of skin)



Vitamin B12 Deficiency

- Can cause MS-like symptoms such as fatigue, mental confusion, numbness and tingling in hands and feet.
- B12 plays a role in the metabolism of fatty acids to maintain myelin sheath.



Acute Disseminated Encephalomyelitis (ADEM)

- Severe inflammatory attack affecting the brain and spinal cord.
- Symptoms include fever, fatigue, headache, nausea, vomiting, vision loss, and difficulty walking.
- Comes on rapidly after a viral or bacterial infection.
- Children more likely to have ADEM whereas MS more usual in adults.

COMMON CAUSES OF ADEM

Post-infectious

<i>Viral</i>	<i>Bacterial</i>
<ul style="list-style-type: none">• Measles• Mumps	<ul style="list-style-type: none">• Myoplasma• Salmonella Typhi
<ul style="list-style-type: none">• Cytomegalovirus• Rubella• Hepatitis A• Chicken Pox	

Post Vaccination

Viral

- Influenza Vaccine
- Small Pox Vaccine



RECORDED WITH SCREENCAST MATIC



Conclusions

1

The 2017 revisions further refine the well established McDonald Criteria with an appropriate tradeoff between sensitivity and specificity

2

Appropriate application of the McDonald Criteria criteria is necessary to avoid misdiagnosis

3

MS remains a clinical diagnosis, requiring rigorous synthesis of clinical, imaging, and laboratory data by a clinician with MS-related expertise

