Imperial College London

Multiple sclerosis – clinical presentation

Paolo A. Muraro, MD PhD
Clinical Reader in Neuroimmunology and Honorary Consultant Neurologist

Imperial College London

Learning objectives

- Describe the different clinical courses and their frequency
- List the variety of neurological symptoms seen in MS
- Review the different imaging, clinical and laboratory tests that are used to diagnose MS

Outline of lecture

- MS definition
- Epidemiology and social impact
- Clinical presentation and symptoms
- Clinical criteria for diagnosis
- Differential diagnosis
- Diagnostic procedures
  - CSF
  - MRI
  - Electrophysiological testing
- MS clinical subtypes
- Prognosis
- Complications

Multiple sclerosis: definition

- A chronic inflammatory multifocal demyelinating disease of the central nervous system of unknown cause resulting in loss of myelin and oligodendroglial and axonal pathology
- Typically affecting young adults with exacerbating-remitting pattern or chronic progressive evolution

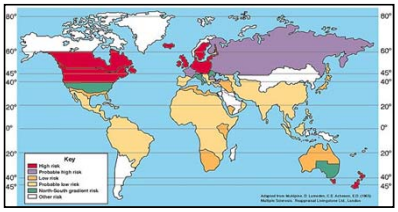
MS: Frequency and distribution

- More common in women than in men (~3:2 to 2:1)
- Onset typically between age 20 - 50
- Uneven geographic distribution
- Prevalence rates range between 80 and 240 in 100,000 in Northern European and –American countries
- Incidence: 3-5 cases/100,000/year

MS: epidemiology

- Latitude gradient
- More common in people of Northern European descent (Viking effect)
- Rare in native Americans, Australian aboriginals and Japanese
- Clusters
- “Epidemics” (British Invasion of Far Oer islands); controversial
- Migration studies

Distribution of MS in the World



Genetic factors

Environmental factors → **Pathogenesis** ← **Viral infections**

(latitude gradient - low sunlight exposure?)

(Epstein Barr virus?)

Hormones

MS – genetic factors

- Concordance rates
  - 25-30% in monozygotic twins
  - 2.3% in dizygotic twins
  - 1.9% in non-twin siblings
- Genetic susceptibility from a polygenic trait including mostly immune genes including:
  - HLA-DR2 (a.k.a. DR15 Dw2, or DRB1*1501 /DRB5*0101)
  - IL-7R
  - IL-2R alpha

Environmental factors

- MS in migrants:
  - Migrants aged 15 or older from Northern European high-risk areas to South Africa (low risk) took with them high frequency of origin
  - Migrants aged <15 had the lower frequency of native-born South Africans (Dean and Kurtzke 1971)
- Infectious agents, particularly viruses (→immunology)
- Vitamin D and sunlight exposure
- Smoking
- Many other hypotheses/claims

MS: social impact

- Usually presenting between the ages of 20 and 40 years
- After stroke, Parkinson's disease and MS are the two commonest disabling diseases of the CNS in the UK
- In young adults, most common non-traumatic cause of disability
- Most frequent demyelinating disease of the central nervous system (CNS)
- In the UK ~85,000 people have MS
- 2-3 millions have MS worldwide

MS: main clinical manifestations and their *tempo*

- Symptoms result from disruption of myelinated tracts in the CNS
  - Visual
  - Motor
  - Sensory
  - Cognitive and psychiatric
  - Bowel, bladder
  - Sexual
- Onset: hours to days
- Recovery: days to months

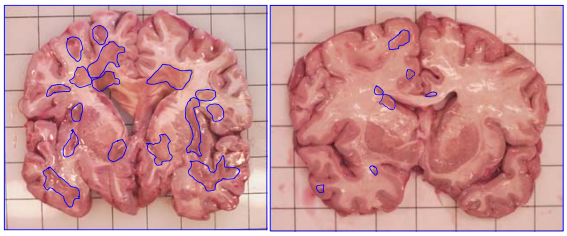
Common disturbances in MS

- Optic neuritis
  - Monocular vision loss
- Spinal cord lesion
  - Weakness of limbs with spasticity and hyperreflexia
  - Paraesthesiae, pain or sensory loss in limbs or trunk
  - Lhermitte's sign (electric shock radiating down back and triggered by neck flexion)
  - Urinary urgency and incontinence
- Brainstem lesion
  - Diplopia
  - Paraesthesiae, pain (incl.trigeminal neuralgia) or numbness of face or tongue
  - Vertigo and nystagmus
  - Dysarthria
- Cerebellar lesion
  - Incoordination of limbs
  - Ataxic gait
- Cerebral lesions
  - Impairment of concentration or memory
  - Hemiparesis
  - Hemisensory loss
  - Visual field defect
- Severe fatigue

Adapted from Pender, MJA 2000

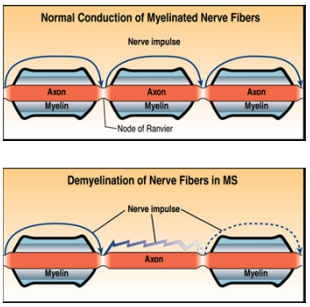
Why are symptoms so varied

Because the amount and location of damage to the nervous system is different in each person with MS

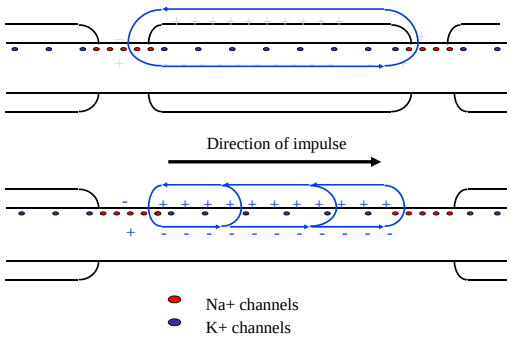


Disease duration <20 years, age 44 | Disease duration 35 years, age 71

Effects of demyelination on nerve impulse conduction



Courtesy of Dr J Rose, Univ. of Utah

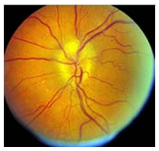


MS: objective signs

- Weakness, spasticity, pyramidal signs
- Sensory loss
- Impaired coordination, action and intention tremor
- Unilateral visual loss
- Conjugate eye movement disorders: diplopia, nystagmus

Examples of abnormal findings at neurological examination

Retrobulbar optic neuritis (2/3 of cases)



Optic neuritis with papillitis (1/3 of cases)

Intention tremor and dysmetria (cerebellar dysfunction)

Diagnosis of MS

- Primarily a clinical diagnosis. Requires:

1. **Exclusion of other likely causes**
2. Evidence of **dissemination in space and time** of CNS lesions

A few of the many other CNS inflammatory disorders

- **Systemic immune diseases affecting the CNS**
  - Neurosarcoidosis
  - Systemic lupus erythematosus
  - Anti-phospholipid syndrome
  - Sjogren's syndrome
- **CNS-specific inflammatory syndromes**
  - Acute disseminated encephalomyelitis
  - Neuromyelitis optica

McDonald's diagnostic criteria

2005 Revised McDonald MS Diagnostic Criteria[1]

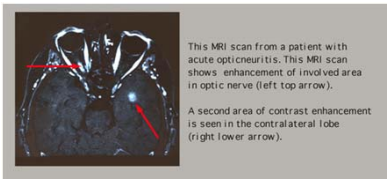
CLINICAL (ATTACKS)	OBJECTIVE LESIONS	ADDITIONAL REQUIREMENTS TO MAKE DX
2 or more	2 or more	None. Clinical evidence alone will suffice; additional evidence desirable but must be consistent with MS
2 or more	1	Dissemination in space by MRI ***or*** 2 or more MRI lesions consistent w/ MS plus positive CSF ***or*** await further clinical attack implicating other site
1	2 or more	Dissemination in time by MRI ***or*** second clinical attack
1	1	Dissemination in space by MRI ***or*** 2 or more MRI lesions consistent with MS plus positive CSF **AND** dissemination in time by MRI ***or*** second clinical attack
0 (progression from onset)	1 or more	Disease progression for 1 year (retrospective or prospective) **AND** 2 out of 3 of the following: • Positive brain MRI (9 T2 lesions ***or*** 4 or more T2 lesions with positive VEP) • Positive spinal cord MRI (2 or more focal T2 lesions) • Positive CSF

[1]Polman et al. Diagnostic Criteria for Multiple Sclerosis: 2005 Revisions to the "McDonald" Criteria. *Annals of Neurology* (2005) 58: 840-846

Diagnosis of MS

- MRI
- Cerebrospinal fluid (CSF) analysis
  - Increased production of Immunoglobulin in CSF
  - Oligoclonal bands
- Electrophysiology
  - Visual evoked potentials (VEP)

MRI – optic neuritis

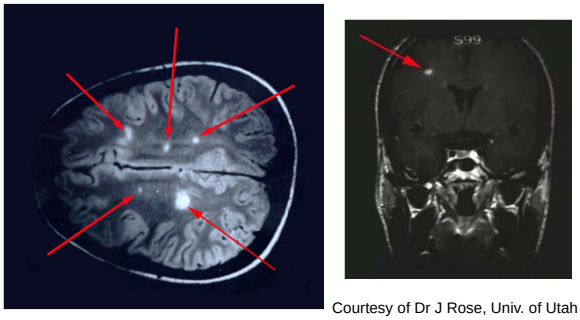


This MRI scan from a patient with acute opticneuritis. This MRI scan shows enhancement of involved area in optic nerve (left top arrow).

A second area of contrast enhancement is seen in the contralateral lobe (right lower arrow).

Courtesy of Dr J Rose, Univ. of Utah

MRI in MS – multiple areas of hyperintense signal



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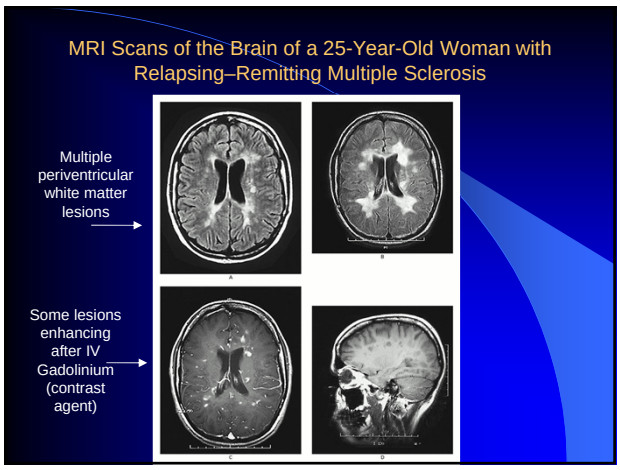
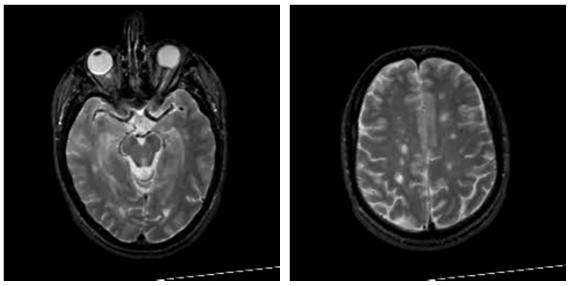
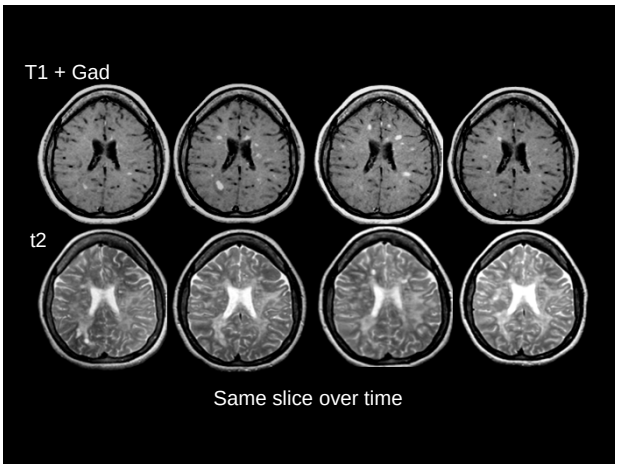


MRI lesions evolving over a period of 1 year in a patient with MS



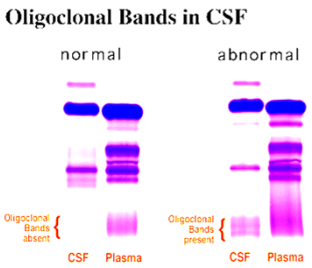
Cinematic view of 12 monthly images © The whole brain Atlas



CSF abnormalities in MS

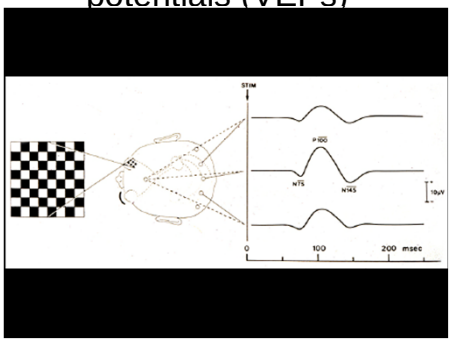
- White cells counts (normal or) mildly (10-20 cells/mm3) increased, >50 WBC suspect alternative diagnosis
- 90% lymphocytes, 5% PMN
- Protein normal in 2/3 of cases, minor (0.5-0.7 g/L) protein increase in about 1/3
- Increased IgG, elevated IgG index
- **Oligoclonal bands** of IgG selectively in CSF
  - Sensitive test: positive in >95% of clinically definite MS (Andersson et al 1994) when IEF is used
  - Unspecific

CSF oligoclonal studies

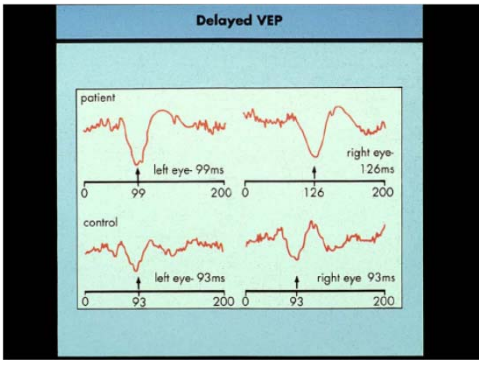


Courtesy of Dr J Rose, Univ. of Utah

Electrophysiology: Visual evoked potentials (VEPs)



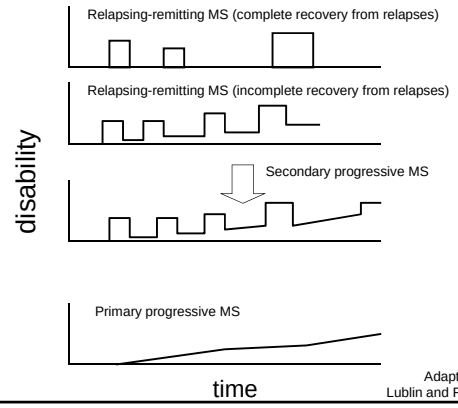
VEPs



MS clinical subtypes

- "Pre-MS"
  - Clinically isolated syndrome
    - Often optic neuritis
- Main clinical subtypes of definite MS
  - **Relapsing Remitting (RR)** 80-85% of cases at onset
    - Becomes **Secondary Progressive (SP)** in ~80% of cases
    - Remains "benign" MS in ~10-15%
  - **Primary progressive (PP)** 15-20%

Clinical subtypes of multiple sclerosis



Adapted from Lublin and Reingold, 1996

Spectrum of severity of disease phenotype

Clinical evolution extremely variable

Benign MS (little or no disability after 15 years of disease)
Lublin and Reingold 1996

Disease severity

Malignant MS (death in 5 years from diagnosis)

??? Long term prognosis

Patients expectations

Clinical management

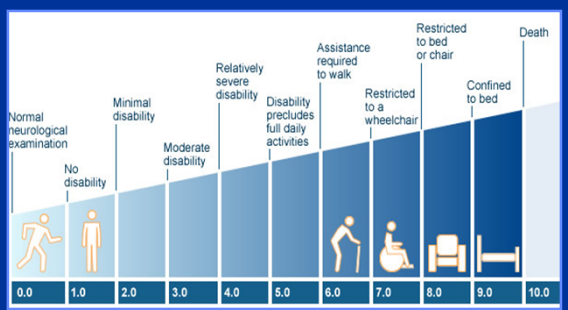
MS: predicting outcome

No single feature or test has good predictivity

Good prognostic features
- Young onset
- Female
- Optic neuritis or only sensory symptoms at onset
- Low frequency of attacks
- Complete symptom remission
- Long first interattack interval

Bad prognostic features
- >40 years at onset
- Male
- Insidious pyramidal tract involvement
- Prominent cerebellar involvement
- Frequent attacks
- Rapid development of fixed disability

Disability Status Scale (Kurtzke 1955)



Measuring disability – the EDSS

- Expanded Disability Status Scale (Kurtzke)
- From 0 (healthy) to 10 (death due to MS) in 0.5 intervals
- Landmark EDSS scores
  - EDSS 1.0 = no disability, minimal sign
  - EDSS 2.0 to 6.0 = minimal to moderately severe disability
  - EDSS 6.0 = need cane to walk about 100 m
  - EDSS 7.0 = wheelchair
  - EDSS 8.0 = bed-bound

Secondary complications of MS

- Depression
- Urinary tract infection
- Limb contractures due to spasticity
- Gastroparesis and intestinal pseudo-obstruction
- Accelerated lumbar spondylosis due to abnormal posture
- Aspiration pneumonia and bronchopneumonia
- Pulmonary thromboembolism
- Pressure sores

Adapted from Pender, MJA 2000

Recommended reading

Reference book:

- McAlpine's Multiple Sclerosis, Fourth Edition, Churchill Livingston, 2005 (in CX library)

Review articles:

- Noseworthy JH, Lucchinetti C, Rodriguez M, Weinshenker BG. Multiple sclerosis. *N Engl J Med* 2000;**343**(13): 938-52.
- Compston & Coles (2008) Multiple Sclerosis. *Lancet*. 372(9648):1502-17.

3 take-home points

- Inflammatory+demyelinating+degenerative disease of the
- Diagnosis is primarily clinical, and supported by MRI and CSF analysis
- Diverse clinical forms and poorly predictable long term outcome

Questions?