Radiologic Evaluation of MS

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The MO of MR in MS
This is your brain

http://www.nemcrad.com/neuro/T2axial
This is your brain

Axial view, just above

Lateral ventricle

Grey matter

Atrium

White

Splenium, c.c.

T2 weighted -> water white

Fat dark

http://www.nemcrad.com/neuro/T2axial
This is your patient’s brain

5/4/03 T2-weighted axial

Grey matter
White
Splenium, c.c.
Lateral ventricle
atrium
This is your patient’s brain

Lateral ventricle
atrium

Grey matter

White

Splenium, c.c.

5/4/03 T2-weighted axial
Our patient: R.B., 19 y.o. RHM

10 day history of:

- Neck pain radiating down right arm
- UE weakness, numbness and tingling
- No LE sensory/motor deficits
- No dysphagia, vision changes, bowel, or bladder sx. CN intact. No recent illnesses.
MS- basics

• Demyelinating disease of CNS
• Relative preservation of axons/periph N’s
• Mechanism?
  – Autoimmune?
  – Inflammatory?
  – Post-infectious?
MS- clinical features

• Think MULTIPLE
  – Multiple attacks (relapsing-remitting)
  – Multiple CNS lesions/functional deficits
• Symptoms are variable- depends on location
MS- clinical features

• Classic features
  – Feelin- paresthesias
  – Reelin- incoordination, vertigo
  – Seein- blurred/double vision-INO/optic neuritis
  – Peein- frequency, incontinence
MS- clinical features

• Classic features
  – Kermit Klein
  – Lhermitte’s Sign
    • Electric sensation down vertebrae->limbs upon neck flexion

http://www.poster.net/muppets/muppets-kermit-clein-frog-4001140.jpg
Radiology of MS- why MRI?

- MS is a soft-tissue disease
- Study of choice- MRI
- MRI yields
  - Location
  - Acute or chronic
  - Good sensitivity.
MRI - basics

- Tissues differentiated by response to magnetic field/radiofrequency pulses
- MR evaluation of MS - T2, or T1 with contrast
  - T2-weighted MRI gives bright signal for H₂O-good for seeing inflammatory changes present in MS lesions
  - Gadolinium IV contrast- bright on T1- signifies acute breach of BBB (lasts 2-6 weeks)
MS- radiologic evaluation

• MRI more sensitive than symptoms
  – Pathology well-established by the time before dx criteria are fully met
  – Clinically isolated syndromes (CIS), ex. optic neuritis with no other symptoms
• Early treatment may be more effective
R.B. has CNS lesions typical of MS

- Ovoid periventricular mass
- Involves corpus callosum
- Gray matter sparing
- No hydrocephalus, midline shift
An ovoid periventricular mass

5/4/03, FLAIR image,
Acute T1-enhancing lesion

T1-weighted sagittal image with gadolinium
Acute T1-enhancing lesion

T1-weighted coronal image with gadolinium
R.B. had two lesions at presentation

• Parieto-occipital, paraventricular
• Enhancing spinal cord lesion at C1-C2 reported from a study from an outside hospital 2 days prior to admission
• Multiple lesions, multiple symptoms
DDx of White Matter Disease

- **Infectious**- HIV encephalitis, PML, Lyme disease, syphilis
- **Inflammatory**- sarcoidosis, systemic lupus erythematosis (SLE), acute disseminated encephalomyelitis (ADEM), Behcet’s disease, polyarteritis nodosa
- **Neoplasm**
- **Vascular**- stroke, hypertension
Narrowing down the DDx of MS

- Focal periventricular mass rules out
- Gray matter spared/no mass effect rules out
- No suggestive history rules out

- (Encephalitis)
- Infarct, neoplasm
- HIV, Lyme
- SLE, sarcoidosis, PML
Hospital Course: 5/03

- Patient dramatically improved on IV steroids
- Discharged 3 days after admission
Abnormal MRI in MS-bottom line

- Multiple lesions (≥3)
- At least one > 5 mm diameter
- At least one periventricular or infratentorial
- Sensitivity and specificity 80s-90s%
- Remember- MS is a clinical diagnosis
Differential diagnosis of MS

Periventricular white Matter lesions

T2

Differential diagnosis of MS-HTN

Periventricular and corpus callosum

Differential diagnosis of MS-SLE

Differential diagnosis of MS-CVD

R.B.: readmitted 6/20/03

• Patient re-presented with 1 wk Hx of progressive throbbing headache, imbalance
• On day of admission- vertigo, vomiting
• Strength and sensation normal (hyperesthesia in feet)
• LP- 197 WBC, 11 RBC
Case: RB, 19 year old male
Case: RB, 19 year old male

New lesion, inferior cerebellar peduncle near 4th ventricle

6/20/03 T1/Gd
Hospital course-latest admission

- Much improved on IV steroids
  - Walking normally
  - Discharged after 3 days.
- On prednisone slow taper (3 months)
- Current diagnosis: ADEM- biopsy for final pathological diagnosis deferred
ADEM vs MS

- ADEM = more acute onset and resolution than MS
- Usually preceded by infection or immunization
- Monophasic by definition
- Distinction often can only be made in retrospect
Summary

• MS is a demyelinating disease of the CNS
• MRI is the imaging study of choice
  – Good sensitivity for lesions
  – Acute vs. chronic
• MS is characterized by multiple clinical attacks over time and physical lesions
• Diagnosis takes time and is ultimately clinical
Future directions in MS radiology

• Magnetization transfer (MT)
  – measure cross-relaxation = interaction of magnetization between water molecules and macromolecules- ex lipids of white matter
  – May more specifically reflect changes in myelin proteins- pick up MS lesions earlier than T2.

• FLAIR (fluid-attenuated inversion recovery)
  – Suppresses bulk fluid signal- lesions enhance but bulk fluid (ex. CSF) remains dark
References

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