Consortium of Multiple Sclerosis Centers

Consortium of MS Centers
MRI Protocol for the Diagnosis and Follow-up of MS

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June 2003

I. CLINICAL GUIDELINES for Brain and Spinal Cord MRI in MS

Suspected MS:
Baseline evaluation:
- Brain MRI recommended (with gadolinium)
- Spinal Cord MRI if presenting symptoms are at the level of the spinal cord and have not resolved, or if the Brain MRI is non-diagnostic.

Follow-up evaluation:
- Brain MRI recommended to demonstrate new disease activity

Established MS indications:
Baseline evaluation:
- Brain MRI recommended (gadolinium optional)

Follow-up of MS:
- Unexpected clinical worsening
- Re-assessment of disease burden before starting or modifying therapy
- Suspicion of a secondary diagnosis

II. MRI PROTOCOLS for Brain and Spinal Cord

Field Strength: 1.0 Tesla or higher recommended for brain or spinal cord.
(Note: 1T open ring magnets have an effective field strength of approximately 0.7 Tesla and are only recommended when patients can not tolerate the closed magnet).

Slice Thickness: $\leq$ 3mm and no gap and in plane resolution of $\leq$ 1mm x 1 mm for both Brain and spinal cord. (Note: $\leq$ 5mm and no gap is acceptable for Brain MRI for centers that are unable to acquire 3mm slices in the allotted time).

Scan Orientation and Coverage:
Reproducible coverage and orientation for the axial slices using the subcallosal line as a reference on an appropriate Sagittal localizer is critical for longitudinal comparisons.

Brain MRI Sequences:
1st: Sagittal FLAIR (fluid attenuating inversion recovery).
2nd: Axial PD/T2 (proton density and T2 weighted T1 usually $\leq$ 30ms and TE2 $\geq$ 80ms)
3rd: Axial FLAIR
4th: Gadolinium enhanced T1 (if suspicious lesions seen on FLAIR).

Note: all 4 sequences recommended for a diagnostic MRI in suspected MS. The Sagittal FLAIR and gadolinium enhanced T1 are optional in the follow-up study for established MS.

Spinal Cord Sequences:
1st: Sagittal PD/T2
2nd: Sagittal pre-Gad T1
3rd: Sagittal post-Gad T1
4th: Axial post-Gad T1 through suspicious lesions.
5th: Axial T2 through suspicious lesions.

Gadolinium:
- The recommended dose is 0.1 mmol/kg IV
- The minimum delay after giving gadolinium is 5 minutes before acquiring the axial T1 weighted axial post contrast images.
- Gadolinium does not need to be given for a spinal cord MRI if it follows a contrast Brain MRI study.

Time saving strategies:
- Omit the axial Fast Spin Echo PD
- Only cover the corpus callosum with the Sagittal FLAIR.
- Acquire the axial FLAIR after giving gadolinium and before the axial T1 weighted axial post contrast images.

Report:
The report should use common language and be descriptive including:
- Lesion number, location, size, shape, character and a qualitative assessment of brain atrophy.
- Comparison with previous studies for new, enlarging and/or enhancing lesions and atrophy.
- Interpretation and differential diagnosis.

An optional standardized reporting table may be helpful to the radiologist and neurologist.

Archival and Storage:
Copies of these MRI studies should be retained permanently and be available. They should be stored in a standard format (example DICOM). It may be useful for patients to keep their own studies on portable digital media.

Table: Comprehensive MS MRI Report

BRAIN MRI	MRI date:	MRI date:	MRI date:	MRI date:
	Baseline	Follow-up	Follow-up	Follow-up
With gadolinium (check)				
Normal (check)				
Total number of T2 lesions (> 3mm)				
New T2 lesions compared to baseline	NA			
Periventricular lesions				
Juxtacortical lesions				
Infratentorial lesions				
Corpus callosum lesions				
Enlarging lesions	NA			
Total number of enhancing lesions				
Non-enhancing T1 hypointense lesions				
Brain Atrophy (no, mild, moderate, severe)				
Other finding				

NA: not applicable;

International Criteria for MS diagnosis (3 out of 4 of the following on brain MRI):

- 1 gd-enhancing lesion or 9 T2 lesions
- 1 infratentorial lesion
- 1 juxtacortical lesion
- 3 periventricular lesions

Diagnostic Follow-up MRI at $\geq$ 3 months following clinical attack (either of):

- 1 gd-enhancing lesion or 1 new T2 lesion

SPINAL CORD MRI	MRI date:	MRI date:	MRI date:	MRI date:
With gadolinium (check)				
Normal (check)				
Number of T2 lesions				
Number of enhancing lesions				
Atrophy (no/yes; level)				
Other finding				

Adapted from Dr. J. Simon