Cleveland Clinic

Mellen Center Approaches: MRI imaging

Initial MRI scan:

Q: When should an MRI of the brain be obtained?

A: In virtually all situations, a cranial MRI is an essential part of the evaluation for the diagnosis of MS, for three main reasons:

- To confirm the suspected diagnosis of MS
- To exclude alternative diagnoses
- To serve as a baseline evaluation and/or as staging the disease process

Q: Is an MRI essential to the diagnosis of multiple sclerosis, or can other additional testing and clinical features suffice?

A: We obtain MRIs in all cases as above, unless there is a specific contraindication for obtaining the MRI (for example presence of MRI incompatible pacemaker). In cases where MRIs can not be obtained, we generally obtain as much additional testing as possible. We are more cautious regarding the certainty of the diagnosis in such patients, and rely more heavily on CSF results and evoked potentials to support the diagnosis. If the contraindication for MRI is removed at a later time, we would recommend obtaining an MRI at that point.

Q: Do we ever diagnosis MS in a patient with a normal MRI?

A: We would be hesitant to diagnosis MS in a patient with a good quality MRI (at least 1.5 Tesla magnet strength) showing a normal brain and spinal cord (cervical cord and thoracic cord). However, due to the potential limitations of conventional MRI, particularly with regard to grey matter pathology, there will be rare exceptions to this rule. However, in most cases, repeatedly normal imaging raises strong doubts about an MS diagnosis, particularly in a patient with long standing neurological disability. In the face of compelling clinical suspicion of MS, we monitor such individuals closely with clinical exams and repeat ancillary testing such as VER and CSF analysis.

Q: What is the Mellen approach to a radiologically isolated syndrome, or the incidental finding of classic MS by MRI including enhancing lesions?

A: We recommend clinical and imaging follow-up in these situations, depending on the extent and inflammatory nature of the findings. It is believed that the vast majority of these individuals will go on to develop clinical signs and symptoms of MS given a long enough time period. A recent publication indicated that about 30% were confirmed as having MS within two years. Certain factors, including enhancing lesions and spinal cord lesions, lead to increased likelihood of clinically definite MS. At the Mellen Center if repeated imaging shows definite new lesion formation, we would consider instituting disease modifying therapy in such patients.

RESOURCES

Lebrun C, Bensa C, Debouverie M, et al. Unexpected MS: follow-up of 30 patients with magnetic resonance imaging and clinical conversion profile. *JNNP* 2008;79:112-113

Q: When should an MRI of the cervical or thoracic spine be obtained?

A: We recommend an initial cervical spine MRI with and without contrast in patients suspected of having MS when the head MRI gives equivocal results. Spinal MRI provides increased specificity in patients with an abnormal brain MRI or increased sensitivity in patients with a negative brain MRI. This is particularly true with older individuals and those with numerous

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risk factors for non-specific white matter changes associated with hypertension, smoking, diabetes, high cholesterol and age over 55. Also, if symptoms or signs could be explained by spinal cord disease, then spinal cord MRI is required to rule out non-MS cord pathology. Additionally, some typical MS patients also have concurrent spinal cord compression that may affect their management (e.g. cervical spondylosis). We will obtain thoracic spine imaging when there is a specific indication (for example, thoracic myelopathic symptoms, mid thoracic back pain, or when imaging of other areas of the CNS do not show demyelinating lesions in a patient strongly suspected of having MS). Due to potential issues of artifact and patient motion, the quality of scans is particularly important with spinal MRI, and higher field strengths (1.5 or higher) are preferred for the cord.

Q: In which circumstances should a follow-up MRI scan be obtained?

A: It can be extremely useful to monitor sub-clinical disease as well as response to therapy by obtaining MRIs periodically during the course of routine follow up care of MS patients. We obtain repeat MRI in five specific circumstances:

a) Patients with an MRI typical for MS, in whom we are initiating disease modifying therapy. This serves as a baseline for monitoring therapy.

b) Patients on disease modifying therapy, to determine MRI disease worsening despite treatment. Most Mellen Center clinicians monitor patients at a frequency between 6-12 months, individualized according to disease severity and activity when disease modifying agents are started as well as type of disease modifying medication. (Please see the individual Mellen Approaches for the timing of onset of therapeutic effect with each agent)

c) Patients with possible MS (e.g. clinically isolated syndrome or nonspecific MRI abnormalities) who need MRI follow up for diagnosis.

d) MS patients who decline therapy, but need monitoring to determine disease progression for treatment recommendations.

e) Patients with a very active initial MRI in which close follow up is needed to assess for radiological stabilization.

Q: How often and for how long should individuals with CIS not on disease modifying agents, be followed by cranial MRI?

A: In a clinically stable CIS patient not on DMT, we generally perform a follow-up MRI annually for 5 years, but our practice varies on this point. Some clinicians tend to lengthen the follow-up period between MRIs in the absence of clinical symptoms or new MRI lesions after that time period, depending on the clinical circumstances.

Q: Do you recommend an MRI during a relapse of MS?

A: We ***do not*** generally obtain an MRI of the brain or spinal cord during an MS relapse if the symptoms and signs are consistent with MS and there are no atypical features. The exceptions to this rule would be if the patient is on immunomodulating therapies that increase the risk of PML. In addition, if the patient has an altered level of consciousness or other problems such as a severe headache, sudden stroke-like onset etc., then we would obtain an MRI as soon as possible. It should also be noted that contrast enhancement can be affected by corticosteroid administration for up to 6 weeks or more after treatment. Another exception would be if the initial attack was not clearly MS or the initial MRI was normal. Many practitioners obtain an MRI at least 8-10 weeks after a relapse to look for silent or sub-clinical MRI activity in order to potentially consider modifying therapy. We recommend the 8-10 week minimum delay both to allow for the relapse to subside and to allow time for the corticosteroid effect on contrast enhancing lesions to resolve.

Acquisition/Technical considerations:

Q: What are the technical requirements for obtaining an MRI of the brain, spine including field strength?

A: We recommend that where possible MRIs, particularly spinal MRIs, be obtained on machines of at least 1.5 Tesla strength. Higher field strength MRI improves resolution and may increase yield in terms of lesion counts. All MR studies should include at least a sagittal FLAIR, as well as axial FLAIR non-gapped images, to cover the whole brain. We also recommend pre-and post-contrast enhanced images where contrast is permissible. The Consortium of MS Centers MRI guideline provides technical parameters that can be used for MS imaging; we use a modification of these

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guidelines at our center. These have been revised and are available on the CMSC website. We further recommended that follow-up MRIs be obtained on the same magnet and with similar software, to allow for 'apples to apples' comparisons rather than attempting comparing slices obtained with gaps to those obtained with no gaps, etc.

RESOURCES

http://www.mscare.org/?page=MRI_protocol

Other issues:

Q: What is the role of contrast agents and their safety?

A: In general contrast agents are safe and it is preferred to obtain MRI of the brain and spinal cord with a gadolinium chelated contrast agent. These agents afford an indirect measure of inflammatory activity in MS, assuming that gadolinium contrast enhancing lesions demonstrate alterations in the blood brain barrier, and assist in ensuring that alternative diagnoses are well addressed. Gadolinium can cause allergic reactions that should be treated per standard protocols. Gadolinium is should be avoided in pregnancy. It is recommended that a serum creatinine be obtained in those individuals where indicated by institutional and American College of Radiology guidelines. We follow our institution's policy for hydration and use of gadolinium in these patients, which are based on age, GFR, and the presence of risk factors such as diabetes, known renal disease, etc. Gadolinium can rarely cause nephrogenic sclerosing fibrosis, but this is seen only in patients with severe renal disease and only in a tiny fraction of patients treated with gadolinium.

The FDA recently reported that it is investigating the risk of brain deposits following repeated gadolinium-based contrast agents for magnetic resonance imaging. At present there is no data on health safety risks from such studies, however this is an area of ongoing research. Our approach is to carefully assess the risk benefit for MRI imaging with gadolinium and where possible to defer gadolinium use. We await further guidance from the FDA on this issue.

Technical questions may be referred to the Mellen MRI technologists who are excellent resources- Derek and John at 216.445.3281 (Katie Murphy, departmental assistant).

RESOURCES

Mendoza FA et al. Description of 12 cases of nephrogenic fibrosing dermopathy and review of the literature. Seminars in arthritis and rheumatism 2006;35:238-249

http://www.fda.gov/Drugs/DrugSafety/ucm455386.htm

Q: Can you obtain an MRI in pregnancy or in a woman who is breast feeding?

A: There are very rare situations that require obtaining an MRI in a pregnant woman. The use of contrast is contraindicated during pregnancy. Patients who are breast feeding do not need to express their milk according to the most recent guidelines. We discuss such cases individually with our neuroradiological colleagues.

Q: Do you recommend scanning MS patients with intrathecal pumps and other implanted devices?

A: We have a protocol for scanning patients who have implanted baclofen pumps. In general, the pump is deactivated by the MRI, and then restarts automatically, but should always be checked by qualified personnel after the study. There are conditional protocols that can allow patients with certain deep brain and spine stimulators, as well as vagal nerve stimulators and bladder stimulators to have limited MR imaging using specifically approved scanning protocols. We recommend significant caution in scanning these individuals. MRI staff can review the information on the make and model for the specific device, as protocols and restrictions are evolving with time.

Q: When do you scan patients on natalizumab or other immunomodulating therapies that may increase the risk of progressive multifocal leukoencephalopathy?

A: At each natalizumab infusion visit the TOUCH program requires questioning about new symptoms which might indicate the presence of PML. We do MRI of the brain with and without gadolinium as soon as possible if there are clinical changes of concern in such patients. We also do regular (6-12 month) MRI imaging in such patients to confirm clinical efficacy and monitor for PML. As other immunomodulating therapies that may increase PML risk become utilized, a similar approach should be used. See natalizumab Mellen Center Approach.