Purpose:
The purpose of the MRI protocol is to improve efficiency in MRI patient management – to increase the rate of exam completion and to decrease the number of return patient visits for incomplete scans. Individual sequences within an exam protocol are to be designated by the radiologist as core sequences, supplemental sequences and elective sequences. When scanning a patient, the MRI technologists will execute each protocol sequences in the order of their priority. Exam protocol design remains the exclusive domain of the MRI radiologist.

Protocol Classification:
Sequences should be categorized, listed and performed in the order of importance relative to their contribution to a “complete exam” and to their importance in answering the clinical question posed by the referring provider.

- **Core sequences** – These sequences form the basic blocks of a diagnostic exam, and if not obtained can result in missed diagnoses relative to the primary clinical question. The core sequences should constitute a “complete and diagnostic” scan. If each of the core sequences in a given exam protocol are performed and are of diagnostic quality, the exam could be read as a complete exam without calling the patient back.
  - These sequences should be repeated if degraded by motion.
  - If all of these sequences are not of diagnostic quality or are not obtained, the patient should be recalled to complete the exam with sedation, with pain meds, or on an open scanner as appropriate.
  - If all of the core sequences are not obtained, a preliminary report should be generated and should note that the patient is being rescheduled to complete the exam.
  - If the patient refuses or is unable to return, then the exam should be dictated as an incomplete exam and limitations of the study should be explicitly stated in the report.

- **Supplemental sequences** – These sequences supplement the core exam and increase the sensitivity of MRI for some disorders in some patients. They may enhance the visualization of certain pathologic processes or help in the characterization of certain abnormalities. For example, STIR images might improve the detection of inflammation,
and diffusion weighted images can help characterize some uncommon pathologic processes.

- Patients do not need to be recalled to complete these sequences unless requested by the radiologist or referring provider. In some cases, findings on the core sequences may indicate that these sequences would be useful, additional clinical information may become available, or the referring provider may request that they be completed.
- If these sequences are not obtained, the exam should be dictated as a complete exam, and note made in the technique section as to the reason they were not obtained.
- If the patient is being recalled, this should be noted in the report.

Elective sequences – These sequences have a lower probability of adding significant information relative to the primary diagnosis or to the patient’s clinical symptoms. They may be performed because of referring provider preference, however, are not expected to add significant information in the given clinical situation. For example, flexion and extension upright spine MRI images are not expected to add significant information in patients with isolated back pain, and contrast-enhanced images are not expected to add significant information in spine patients with previous fusion.

- Patients do not need to be recalled to complete these sequences unless requested by the radiologist or referring provider.
- If these sequences are not obtained, the exam should be dictated as a complete exam, and note in the technique section as to the reason they were not obtained.
- If the patient is being recalled, this should be noted in the report.

Protocol Design and Execution:

- Core sequences should constitute the first 3-4 sequences of the protocol and are executed first. If they are nondiagnostic, they should be repeated prior to performing supplemental and elective sequences. If these sequences are completed and are of diagnostic quality, the patient does not need to be recalled unless the radiologist requests that the additional sequences should be performed.
- Supplemental sequences should follow core sequences in the scan order. If possible, supplemental sequences should be attempted prior to getting the patient off the table. A nondiagnostic supplemental sequence does not need to be repeated if the schedule does not allow. Patients do not need to be recalled to repeat or perform these sequences unless requested by the radiologist or provider.
- Elective sequences should follow supplemental sequences in the scan order. These sequences should be attempted if the schedule allows. A nondiagnostic supplemental sequence does not need to be repeated if the schedule does not allow. Patients do not need to be recalled to repeat or perform these sequences unless requested by the radiologist or provider.
Special Considerations:

- **Contrast enhanced sequences** may or may not be designated as core sequences depending on the area being scanned, the clinical question and the referring provider. If a patient is having difficulty completing the exam, supplemental sequences and elective sequences can be skipped in order to give contrast and complete the contrast enhanced sequences.

- **Provider preference** is a major consideration in sequence design. Neurologists and neurosurgeons will often consider contrast enhanced sequences essential to a complete exam regardless of the indication. If ordered, contrast enhanced sequences are ordered by a neurologist or neurosurgeon, they should be considered core sequences unless otherwise indicated. Other provider preferences may exist.

- **Radiologist consultation** may be necessary and prescans may need to be obtained in special circumstances.

Implementation:

1. The chief technologist or their designate will print subspecialty protocols and review with the radiology section heads to designate the protocol sequences as noted above.
2. The radiologist section leader will want to distribute to their team to get further input and buy-in.
3. The chief technologist or their designate will then review the protocols and educate the MRI technologists at each center concerning the changes.
4. New protocols entered in the scanners.
5. Technologist will begin to follow the protocols, consulting with their subspecialty radiologist when questions arise.

Example: MRI Lumbar Spine protocols:

1. **2T Open, 1.5T and 3T MRI lumbar spine for back pain or radiculopathy:**
   1. T2 FSE sagittal sequences (Core)
   2. T1 FSE sagittal sequences (Core)
   3. T2 FSE axial sequences (Core)
   4. T1 FSE axial sequences (Supplemental)
   5. STIR sagittal sequences (Supplemental)

2. **0.6T Open Upright MRI lumbar spine with flexion and extension for back pain:**
   1. T2 FSE sagittal sequences (Core)
   2. T1 FSE sagittal sequences (Core)
   3. T2 FSE axial sequences (Core)
   4. T1 FSE axial sequences (Supplemental)
   5. T2 extension-based sagittal sequences (Elective)
   6. T2 flexion-base sagittal sequences (Elective)

3. **0.6T Open Upright MRI lumbar spine with extension for stenosis in a patient over 40 years:**
1. T2 FSE sagittal sequences (Core)
2. T1 FSE sagittal sequences (Core)
3. T2 FSE axial sequences (Core)
4. T1 FSE axial sequences (Supplemental)
5. T2 extension-based sagittal sequences (Supplemental)

1.2T open, 1.5T and 3T MRI lumbar spine for evaluation of suspected neoplasm or for evaluation of a fragility fracture:

1. T2 FSE sagittal sequences (Core)
2. T1 FSE sagittal sequences (Core)
3. T2 FSE axial sequences (Core)
4. STIR sagittal sequences (Core)
5. T1 FSE axial sequences (Supplemental)

1.2T open, 1.5T and 3T MRI lumbar spine with and without contrast following surgery ordered by a primary care provider:

1. T2 FSE sagittal sequences (Core)
2. T1 FSE sagittal sequences (Core)
3. T2 FSE axial sequences (Core)
4. T1 FSE axial sequences (Core)
5. STIR sagittal sequences (Supplemental)
6. T1 sagittal sequence with IV contrast (elective)
7. T1 axial sequence with IV contrast (elective)

1.2T open, 1.5T and 3T MRI lumbar spine with and without contrast following surgery ordered by a spine surgeon or neurologist:

1. T2 FSE sagittal sequences (Core)
2. T1 FSE sagittal sequences (Core)
3. T2 FSE axial sequences (Core)
4. T1 FSE axial sequences (Core)
5. STIR sagittal sequences (Supplemental)
6. T1 sagittal sequence with IV contrast (Core)
7. T1 axial sequence with IV contrast (supplemental)

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This is a guideline, not a policy. It is a summary and distillation of relevant literature and subspecialty guidelines. The purpose of the CDI Quality Institute guidelines is to promote quality and continuity, where appropriate for medical practices within the CDI/Insight enterprise, and to provide relevant and up to date background information to support the development of policies within each individual practice. Guidelines should be adjusted for local standards of care, associated hospital or network policies, hospital versus outpatient settings, different patient populations and your own risk tolerance. Guidelines should also be modified to account for new information or publications that become available between revisions.