## General Imaging Characteristics

1. Imaging study date and time(24 hour clock)
2. Imaging scanner manufacturer name *(choose one):*

General Electric

Hitachi

GE

Philips

Siemens

Toshiba

Other, specify

1. Imaging scanner model name:
2. Imaging scanner strength *(choose one):*

0.3T

0.7T

1.0T

1.5T

3.0T

Other, specify

1. Imaging scanner software version number
2. MR Anatomic Area (*more than one acceptable*):

Cervical  Lumbar  Thoracic

1. Image quality *(choose one):*

Good Fair Non-diagnostic

1. Pre-existing Hardware/Surgery

FM = foramen magnum; S=sacrum; L-lumbar cord; C=cervical cord

* 1. Interbody fusion?

Yes

No

If yes, provide an upper limit of instrumentation [Range1 FM-S1]

and lower limit [Range1 FM-S1]

* 1. Anterior plating?

Yes

No

If yes, provide an upper limit of instrumentation [Range1 FM-S1]

and lower limit [Range1 FM-S1]

* 1. Lateral mass fixation?

Yes

No

If yes, provide an upper limit of instrumentation [Range1 FM-S1]

and lower limit [Range1 FM-S1]

* 1. Sublaminar wiring?

Yes

No

If yes, provide an upper limit of instrumentation [Range1 FM-S1]

and lower limit [Range1 FM-S1]

* 1. Pedicle screws?

Yes

No

If yes, provide an upper limit of instrumentation [Range1 FM-S1]

and lower limit [Range1 FM-S1]

* 1. Rods?

Yes

No

If yes, provide an upper limit of instrumentation [Range1 FM-S1]

and lower limit [Range1 FM-S1]

* 1. Disc or corpectomy cages?

Yes

No

If yes, provide an upper limit of instrumentation [Range1 FM-S1]

and lower limit [Range1 FM-S1]

* 1. Laminar hooks?

Yes

No

If yes, provide an upper limit of instrumentation [Range1 FM-S1]

and lower limit [Range1 FM-S1]

* 1. Occipital plates?

Yes

No

* 1. Other, specify \_\_\_\_\_

1. Exam pulse sequence inventory
   1. Sag T1

Yes

No

* 1. Sag proton density (PD)

Yes

No

* 1. Sag T2

Yes

No

* 1. Sag gradient recalled echo (GRE)

Yes

No

* 1. Sag susceptibility weighted imaging (SWI)

Yes

No

* 1. Axial T2

Yes

No

* 1. Axial GRE

Yes

No

* 1. Axial SWI

Yes

No

* 1. Magnetic resonance angiogram (MRA)

Yes

No

* 1. Diffusion tensor imaging (DTI)

Yes

No

## Spinal Injury Features

1. Injury type Blunt Penetrating  Unknown
2. Subluxation/translation level [Range2 FM-S1]

Measure (posterior wall vertebral body in mm):

[0-20 mm]

1. Angulation level [Range2 FM-S1]
2. Extra-axial fluid
   1. Upper limit [Range2 FM-S1]
   2. Lower limit [Range2 FM-S1]
   3. Point of maximum compression [Range2 FM-S1]
3. Vertebral fracture
   1. Upper level [Range1 C1-S1]
   2. Lower level [Range1 C1-S1]
4. Traumatic Herniated Nucleus Polposus (HNP)
   1. Level [Range3 C2/3 – L5/S1]
   2. Type?

Disrupted only Central Paracentral Foraminal

1. Ligamentous Injury/Rupture
   1. Anterior longitudinal

Normal

Ruptured

Injured

Indeterminate

Indicate Level [Range3 FM – S1]

* 1. Posterior longitudinal

Normal

Ruptured

Injured

Indeterminate

Indicate Level [Range3 FM – S1]

* 1. Ligamentum flavum

Normal

Ruptured

Injured

Indeterminate

Indicate Level [Range3 FM – S1]

* 1. Interspinous

Normal

Ruptured

Injured

Indeterminate

Indicate Level [Range3 FM – S1]

* 1. Supraspinous

Normal

Ruptured

Injured

Indeterminate

Indicate Level [Range3 FM – S1]

* 1. Musculature

Normal

Ruptured

Injured

Indeterminate

Indicate Level [Range3 FM – S1]

1. Degenerative Features
   1. Developmental Stenosis?

Yes

No

If yes, provide an upper limit of abnormality [Range1 C2-S1]

and lower limit [Range1 C2-S1]

* 1. Ossification of the posterior longitudinal ligament (OPLL)

Yes

No

If yes, provide an upper limit of abnormality [Range1 C2-S1]

and lower limit [Range1 C2-S1]

* 1. Diffuse idiopathic skeletal hyperostosis (DISH)

Yes

No

If yes, provide an upper limit of abnormality [Range1 C2-S1]

and lower limit [Range1 C2-S1]

* 1. Ankylosing spondylitis

Yes

No

If yes, provide an upper limit of abnormality [Range1 C2-S1]

and lower limit [Range1 C2-S1]

* 1. Cervical spondylitis

Yes

No

If yes, provide an upper limit of abnormality [Range1 C2-S1]

and lower limit [Range1 C2-S1]

## Canal/Cord Measurements

1. Sagittal canal diameter rostral to injury [Range 0–20] MM
   1. Level [Range1 C2– S1]

N/A

1. Sagittal canal diameter injury [Range 0–20] MM
   1. Level [Range2 C2 – S1 ]

N/A

1. Sagittal canal diameter caudal to injury [Range 0–20] MM
   1. Level [Range1 C2 – S1 ]

N/A

1. Cord diameter rostral to injury: Sagittal [Range 1-15] MM x Transverse [Range 1–15] MM
   1. Level [Range1 C2 – S1 ]

N/A

1. Cord diameter injury: Sagittal [Range 1-15] MM x Transverse [Range 1–15] MM
   1. Level [Range2 C2 – S1 ]

N/A

1. Cord diameter caudal: Sagittal [Range 1-15] MM x Transverse [Range 1–15] MM
   1. Level [Range1 C2 – S1 ]

N/A

Figure 1 Acute SCI Features - Please see Table 1 for range values

Method for locating the level of
injury on sagittal MR images using the sublevel designators given in Range4. Locations are named for the nearest vertebral segment. Each segment is subdivided into four parts: the upper one-third of the vertebral body, the middle one-third of the vertebral body, the lower-one-third of the vertebral body, and the intervertebral disk below the named body. Using this convention, an abnormality at the level of the C5/6 interspace is designated as C5.4 whereas an abnormality which is located at the same level as the upper one-third of the C4 vertebral body is designated as C4.1 etc. Using convention in diagram, in which each vertebral level is subdivided into thirds with the interspace as a fourth subpart. E.g. C5.1, C5.2, C5.3, C5.4.Convention: [division][level].[sub-part]
(From Flanders et al. Radiology 1996, 201-549-655.)


Method for locating the level of injury on sagittal MR images using the sublevel designators given in Range4. Locations are named for the nearest vertebral segment. Each segment is subdivided into four parts: the upper one-third of the vertebral body, the middle one-third of the vertebral body, the lower-one-third of the vertebral body, and the intervertebral disk below the named body. Using this convention, an abnormality at the level of the C5/6 interspace is designated as C5.4 whereas an abnormality which is located at the same level as the upper one-third of the C4 vertebral body is designated as C4.1 etc. Using convention in diagram, in which each vertebral level is subdivided into thirds with the interspace as a fourth subpart. E.g. C5.1, C5.2, C5.3, C5.4.Convention: [division] [level] [sub-part]

(From Flanders et al. Radiology 1996, 201-549-655.)

1. Edema Top
   1. Level [Range4 FM – L3.3 ]

N/A

1. Heme Top
   1. Level [Range4 FM – L3.3 ]

N/A

1. Center
   1. Level [Range4 FM – L3.3 ]

N/A

1. Heme Bottom
   1. Level [Range4 FM – L3.3 ]

N/A

1. Edema Bottom
   1. Level [Range4 FM – L3.3 ]

N/A

1. Edema Length
   1. Integer Range [1-50 ] MM

N/A

1. Heme Length
   1. Integer Range [1-50 ] MM

N/A

1. Cord Transection

Yes

No

If yes, provide level [Range4: FM-T12]

## Chronic SCI Features

1. Cord atrophy

Yes

N/A

If yes specify, the following:

* 1. Upper Level [Range4 FM– L3 ]
  2. Lower Level [Range4 FM– L3 ]
  3. Caliber [Integer range 1-10] MM

1. Syringomyelia

Yes

N/A

If yes specify, the following:

* 1. Upper Level [Range4 FM – L3 ]
  2. Lower Level [Range4 FM – L3 ]
  3. Caliber [Integer range 1-15] MM
  4. Length [Integer range 1-60] MM

1. Myelomalacia

Yes

N/A

If yes specify, the following:

* 1. Upper Level [Range4 FM – L3 ]
  2. Lower Level [Range4 FM – L3 ]
  3. Caliber [Integer range 1-15] MM
  4. Length [Integer range 1-60] MM

1. Cord tethering

Yes

No

If yes specify, the following:

* 1. Upper Level [Range4 FM – L3 ]
  2. Lower Level [Range4 FM – L3 ]

CDE Fixed Value Ranges

Figure 2 CDE Fixed Value Ranges

| Range1 - Bodies | Range2 – Bodies & Interspaces | Range3 - Interspaces | Range4 - sublevels |
| --- | --- | --- | --- |
| FM | FM | FM | FM |
| C1 | C1 | C2-3 | C2.1 |
| C2 | C2 | C3-4 | C2.2 |
| C3 | C2-3 | C4-5 | C2.3 |
| C4 | C4 | C5-6 | C2.4 |
| C5 | C4-5 | C6-7 | C3.1 |
| C6 | C5 | C7-T1 | C3.2 |
| C7 | C5-6 | T1-2 | C3.3 |
| T1 | C6 | T2-3 | C3.4 |
| T2 | C6-7 | T3-4 | TBD |
| T3 | C7 | T4-5 | C7.1 |
| T4 | C7-T1 | T5-6 | C7.2 |
| T5 | T2 | T12-L1 | C7.3 |
| T6 | TBD | TBD | C7.4 |
| T7 | T12 | L5-S1 | T1.1 |
| T8 | T12-L1 | TBD | T1.2 |
| T9 | TBD | TBD | T1.3 |
| T10 | L5 | TBD | T1.4 |
| T11 | L5-S1 | TBD | TBD |
| T12 | S1 | TBD | L5.1 |
| L1 | TBD | TBD | L5.2 |
| L2 | TBD | TBD | L5.3 |
| L3 | TBD | TBD | L5.4 |
| L4 | TBD | TBD | S1 |
| L5 | TBD | TBD | TBD |
| S1 | TBD | TBD | TBD |

## General Instructions

This CRF includes data typically recorded when performing MRI. This technique is used to visualize detailed internal structures in the body and brain.

Important note: None of the data elements included on this CRF Module are classified as Core (i.e., required for all SCI studies to collect). All data elements are classified as supplemental (i.e., non Core) and should only be collected if the research team considers them appropriate for their study. Please see the Data Dictionary for element classifications.

## Specific Instructions

### Specific Instructions - Technical Information

1. Image Quality: Based on degree of imaging artifact, signal-to-noise ratio (SNR) etc. Select “Good” if all imaging sequences are complete and free of artifacts. Select “Fair” if some of the imaging series are degraded. Select “Non-diagnostic” if the spinal cord is not clearly visible on T2 and GRE sequences.
2. Pre-existing Hardware/Surgery: Indicate all types of pre-existing instrumentation/fusion at included in the area imaged. Provide a upper and lower limit (most cephalad and caudad levels of instrumentation from foramen magnum [FM] to sacrum).
3. Exam Completeness: Based upon minimum acceptable pulse sequences i.e sagittal T1, T2, GRE and axial T2, GRE.

### Specific Instructions – Spinal injury Features

1. Subluxation/translation: Loss of alignment at a specific level based upon center of injury. Defined at an interspace or specific level. (FM = foramen magnum). Range FM-S1. Provide an absolute measure of subluxation from posterior aspect of vertebral body relative to nearest adjacent body.
2. Angulation: Pathologic angulation at a specific level based upon center of injury. Defined as an interspace or specific level (e.g C4, C4/5, C5 etc.). Use range2 C1-S1.
3. Extra-axial fluid: The presence or absence of fluid (hematoma) in the extra-axial space (subdural or epidural) causing compression of the cal sac and contents. Upper limit range C1-S1, lower limit range C1-S1, and point of maximum compression range C1-S1.
4. Vertebral fracture: Disruption of cortical margins, marrow edema, retropulsed bone fragments or subsidence. Designated by vertebral level. When a single level is involved, upper and lower level are identical. Upper limit Range1 C1-S1 and lower limit Range1 C1-S1.
5. Traumatic HNP: Existence of a traumatic disc herniation at the center of injury. Select disrupted if the disc margins are indistinct (inner/outer annulus non-contiguous), disc space is widened and internal signal of disc on T2WI is higher in signal than contiguous disc spaces. Range C2/3 – L5/S1.
6. Ligamentous injury/rupture: Discontinuity of any of the ligamentous structures indicative of rupture. Defined as a visible gap in the otherwise continuous ligamentous structures visible on sagittal T2 weighted images. Increased signal in the interspinous, supraspinous or paraspinal musculature is indicative of injury.
7. Degenerative features: Using a subjective assessment, gauge whether the following pre-existing degenerative conditions are present: *developmental stenosis* narrowed mid sagittal canal diameter at the level of the mid aspect of the vertebral bodies; ossification of the posterior longitudinal ligament (OPLL) which is manifested by a continuous longitudinal oriented structure of low signal intensity on T2WI & T2WI applied to the posterior surface of the vertebral bodies and interspaces; diffuse idiopathic skeletal hyperostosis (DISH)

### Specific Instructions – Canal/Cord Measurements

1. To obtain sagittal canal diameter rostral to injury, on sagittal T2WI, measure from mid – posterior cortex to spino-laminar line at a normal level rostral to injury. Measured level is designated by vertebral level or interspace, e.g. C4, C4/5.
2. To obtain sagittal canal diameter injury, on sagittal T2WI, measure from mid – posterior cortex to spino-laminar line at midpoint of injury or point of maximal compression. Measured level is designated by vertebral level or interspace, e.g. C4, C4/5.
3. To obtain sagittal canal diameter caudal to injury, on sagittal T2WI, measure from mid – posterior cortex to spino-laminar line at a normal level caudal to injury. Measured level is designated by vertebral level or interspace, e.g. C4, C4/5.
4. To obtain cord diameter rostral to injury, on axial T2WI, obtain spinal cord perpendicular diameter measurements (sagittal and transverse) in millimeters at a normal level *rostral* to the midpoint of injury. Measured level is designated by vertebral level or interspace, e.g. C4, C4/5. Select not applicable (NA) if no axial images are available or if images are non-diagnostic.
5. To obtain cord diameter injury, on axial T2WI, obtain spinal cord perpendicular diameter measurements (sagittal and transverse) in millimeters at midpoint of injury. Measured level is designated by vertebral level or interspace, e.g. C4, C4/5. Select not applicable (NA) if no axial images are available or if images are non-diagnostic.
6. To obtain cord diameter caudal to injury, on axial T2WI, obtain spinal cord perpendicular diameter measurements (sagittal and transverse) in millimeters at a normal level *caudal* to the midpoint of injury. Measured level is designated by vertebral level or interspace, e.g. C4, C4/5. Select not applicable (NA) if no axial images are available or if images are non-diagnostic

### Specific Instructions –Acute SCI Feature

1. To obtain edema top, on sagittal T2WI, record the anatomic location of the rostral boundary of edema. Using convention in diagram, in which each vertebral level is subdivided into thirds with the interspace as a fourth subpart. E.g. C5.1, C5.2, C5.3, C5.4. Convention: [division][level].[sub-part]
2. To obtain heme top, on sagittal T2WI or GRE, record the anatomic location of the rostral boundary of hemorrhage. Using convention in diagram, in which each vertebral level is subdivided into thirds with the interspace as a fourth subpart. E.g. C5.1, C5.2, C5.3, C5.4. Convention: [division][level].[sub-part]
3. To obtain center, on sagittal T2WI, record the anatomic location of the midpoint of injury. Using convention in diagram, in which each vertebral level is subdivided into thirds with the interspace as a fourth subpart. e.g. C5.1, C5.2, C5.3, C5.4. Convention: [division][level].[sub-part]
4. To obtain heme bottom, on sagittal T2WI or GRE, record anatomic location of the caudal boundary of hemorrhage. Using convention in diagram, in which each vertebral level is subdivided into thirds with the interspace as a fourth subpart. e.g. C5.1, C5.2, C5.3, C5.4. Convention: [division][level].[sub-part]
5. To obtain edema bottom, on sagittal T2WI, record the anatomic location of the caudal boundary of edema. Using convention in diagram, in which each vertebral level is subdivided into thirds with the interspace as a fourth subpart. e.g. C5.1, C5.2, C5.3, C5.4.
6. To obtain edema length, on sagittal T2WI, using electronic calipers, provide the rostral – caudal length of edema in millimeters using Edema top and Edema Bottom as delineators.
7. To obtain heme length, on sagittal T2WI or GRE, using electronic calipers, provide the rostral – caudal length of hemorrhage in millimeters using heme top and heme bottom as delineators.

### Specific Instructions – Chronic SCI Features

1. To determine whether there is **cord atrophy**, on sagittal T2 imaging, there will be a focal diminished caliber of the spinal cord. Record the upper and lower locations and the minimum diameter in millimeters.
2. To determine whether syringomyelia is present, there should be cavitation of the spinal cord with a well-defined region of high signal intensity on sagittal T2WI and corresponding low signal intensity on T1WI – isointense to CSF. Provide upper and lower limits, maximal longitudinal and cross sectional diameter in millimeters.
3. To determine whether myelomalacia is present, there will be a persistent area of increased signal in substance of spinal cord on sagittal T2WI which is not isointense to CSF, poorly marginated and not low in signal on T1WI. Provide an upper and lower level and length in millimeters.
4. To determine whether cord tetheringis present, on sagittal TW1, there will be persistent deformity of the spinal cord in an otherwise intact dural envelope. Features include angulation of the spinal cord with adherence to a portion of the dural envelope and loss of CSF interface. Provide an upper and lower level.

Addendum:

The recommended calculation for maximum canal compromise (%) is derived from the following formula:

Where:

Di = Anteriorposterior canal diameter at the level of maximum injury.

Da = Anteriorposterior canal diameter at the nearest normal level above the site of injury.

Db = Anterior-posterior canal diameter at the nearest normal level below the site of injury.

The recommended calculation for maximum spinal cord compromise (%) is derived from the following formula:

Where:

di = Anteriorposterior spinal cord diameter at the level of maximum injury.

da = Anteriorposterior spinal cord diameter at the nearest normal level above the site of injury.

db = Anterior-posterior spinal cord diameter at the nearest normal level below the site of injury.

(From Furlan et al. Spine 2007;32:2083–2091)