Definition of Terms:

- Muscle Spasm/Muscle Guarding
- Asymmetric Range of Motion
- Nonverifiable Radicular Root Pain
- Reflexes/Sensory Loss/Atrophy
- EMG/NCV
- Alteration of Motion Segment Integrity
Muscle Spasm/Muscle Guarding

A. Muscle Spasm is a sudden involuntary contraction of a muscle or a group of muscles. To differentiate true muscle spasm from voluntary muscle contraction, the individual should not be able to relax the contractions. The spasm should be present standing as well as in the supine position and frequently causes a scoliosis.

B. Muscle Guarding is a contraction of a muscle to minimize motion or agitation of the injured or diseased tissue. It is not true muscle spasm because the contraction can be relaxed. In the lumbar spine, the contraction frequently results in loss of the normal lumbar lordosis, and it may be associated with reproducible loss of spinal motion.
Asymmetric motion of the spine in one of the three principal planes is sometimes caused by muscle spasm or guarding. If an individual attempts to flex the spine, he or she is unable to do so moving symmetrically; rather, the head or trunk leans to one side. To qualify as true asymmetric motion, the finding must be reproducible and consistent and the examiner must be convinced that the individual is cooperative and giving full effort.
Nonverifiable Radicular Root Pain

Nonverifiable pain is pain that is in the distribution of a nerve root but has no identifiable origin; ie, there are no objective physical, imaging, or electromyographic findings.
For Reflex abnormalities to be considered valid, the involved and normal limb(s) should show marked asymmetry between arms or legs on repeated testing.

Sensory findings must be in a strict anatomic distribution. Motor findings should be also consistent with the affected nerve structure(s).

Atrophy is measured with a tape measure at identical levels on both limbs. For reasons of reproducibility, the difference in circumference should be 2 cm or greater in the thigh and 1 cm or greater in the arm, forearm, or leg.
EMG/NCV

Unequivocal electrodiagnostic evidence of acute nerve root pathology includes the presence of multiple positive sharp waves or fibrillation potentials in muscles innervated by one nerve root.

However, the quality of the person performing and interpreting the study is critical. Electromyography should be performed only by a licensed physician qualified by reason of education, training, and experience in these procedures. Electromyography does not detect all compressive radiculopathies and cannot determine the cause of the nerve root pathology.

On the other hand, electromyography can detect noncompressive radiculopathies which are not identified by imaging studies.
Alteration of Motion Segment Integrity

Motion segment alteration can be either loss of motion segment integrity (increased translational or angular motion) or decreased motion secondary to developmental fusion, fracture healing, healed infection, or surgical arthrodesis. An attempt at arthrodesis may not necessarily result in a solid fusion but may significantly limit motion at a motion segment.

Motion of the individual spine segments cannot be determined by a physical examination but is evaluated with flexion and extension roentgenograms.
Determining Appropriate Method of Assessment of Impairment:

DRE (diagnosis related estimates) is the principal methodology used to evaluate an individual who has had a distinct *injury*. 
Range of Motion

**ROM** (range of motion) method is used in several situations:

1. When an impairment is not caused by an injury
2. Multi-level involvement in the same spinal region
3. Alteration of motion segment integrity at multiple levels
4. Recurrent radiculopathy caused by a new disk or recurrent disk in the same spinal region
Diagnosis Related Estimates (DRE): Patient at MMI

- DRE Lumbar Category I (0% impairment):
- DRE Lumbar Category II (5-8% whole person impairment): ADL/Pain above level of impairment
- DRE Lumbar Category III (10-13% whole person impairment):
- DRE Lumbar Category IV (20-23% whole person impairment)
DRE Lumbar Category I (0% impairment):

No significant clinical findings,
no observed muscle guarding or spasm,
no documentable neurologic impairment,
no documented alteration in structural integrity, and
no other indication of impairment related to injury or illness;
no fractures
DRE Lumbar Category II (5-8% impairment):

Clinical history and examination findings are compatible with a specific injury; findings may include significant muscle guarding or spasm observed at the time of the examination, asymmetric loss of range of motion, or nonverifiable radicular complaints, defined as complaints of radicular pain without objective findings; no alteration of the structural integrity and no significant radiculopathy.

Radiculopathy resolved by conservative treatment.

Compression Fracture less than 25% of the vertebral body;
DRE Lumbar Category III (10-13% impairment):

Significant signs of radiculopathy, such as dermatomal pain and/or in a dermatomal distribution, sensory loss, loss of relevant reflex(es), loss of muscle strength or measured unilateral atrophy above or below the knee compared to measurements on the contralateral side at the same location; impairment may be verified by electrodiagnostic findings.

Radiculopathy resolved by surgery, patient is asymptomatic.

Compression Fracture 25-50%
DRE Lumbar Category IV (20-23% impairment):

Loss of motion segment integrity defined from flexion and extension radiographs as at least 4.5 mm of translation of one vertebra on another or angular motion greater than 15 degrees at L1-2, L2-3, and L3-4 greater than 20 degrees at L4-5, and greater than 25 degrees at L5-S1; may have complete or near complete loss of motion of a motion segment due to developmental fusion, or successful or unsuccessful attempt at surgical arthrodesis.

Compression Fractures greater than 50%
DRE Lumbar Category V (25-28% impairment):

Meets the criteria of DRE lumbosacral categories III and IV; that is, both radiculopathy and alteration of motion segment integrity are present; significant lower extremity impairment is present as indicated by artrophy or loss of reflex(es), pain, and/or sensory changes within an anatomic distribution (dermatomal), or electromyographic findings as stated in lumbosacral category III and alteration of spine motion segment integrity as defined in lumbosacral category IV. Compression Fractures greater than 50%
ROM Method: Use of inclinometers

**Figure 15-8** Two-Inclinometer Technique for Measuring Lumbar Flexion and Extension

The inclinometers are placed over T12 and the sacrum (S1), the anatomical landmarks.

- a. neutral position
- b. flexion
- c. extension
- d. straight leg raising (used for validation purposes)
# Specific Spine Disorders

<table>
<thead>
<tr>
<th>Disorder</th>
<th>% Impairment of the Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cervical</td>
</tr>
</tbody>
</table>

## I. Fractures

A. Compression of one vertebral body.
   - 0%-25%: 4
   - 26%-50%: 6
   - > 50%: 10

B. Fracture of posterior element (pedicle, lamina, articular process, transverse process).
   
   *Note:* An impairment due to compression of a vertebra and one due to fracture of a posterior element are combined using the Combined Values Chart (p. 604). Fractures or compressions of several vertebrae are combined using the Combined Values Chart.

C. Reduced dislocation of one vertebra.
   - If two or more vertebrae are dislocated and reduced, combine the estimates using the Combined Values Chart.
   - An unreduced dislocation causes impairment until it is reduced; the physician should then evaluate the impairment on the basis of the individual's condition with the dislocation reduced.
   - If no reduction is possible, the physician should evaluate the impairment on the basis of the range-of-motion and neurologic findings according to criteria in this chapter and Chapter 13, The Central and Peripheral Nervous System.

   - Cervical: 5
   - Thoracic: 3
   - Lumbar: 6

## II. Intervertebral disk or other soft-tissue lesion

- Diagnosis must be based on clinical symptoms and signs and imaging information.

A. Unoperated on, with no residual signs or symptoms.

B. Unoperated on, with medically documented injury, pain, and rigidity* associated with none to minimal degenerative changes on structural tests.†

C. Unoperated on, stable, with medically documented injury, pain, and rigidity* associated with moderate to severe degenerative changes on structural tests;† includes herniated nucleus pulposus with or without radiculopathy.

D. Surgically treated disk lesion without residual signs or symptoms; includes disk injection.

E. Surgically treated disk lesion with residual, medically documented pain and rigidity.

F. Multiple levels, with or without operations and with or without residual signs or symptoms.

G. Multiple operations with or without residual signs or symptoms
   1. Second operation
   2. Third or subsequent operation

   - Add 1% per level
   - Add 2%
### Specific spine disorders

#### III. Spondyloysis and spondylolisthesis, not operated on

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Spondyloysis or grade I (1%-25% slippage) or grade II (26%-50% slippage) spondylolisthesis, accompanied by medically documented injury that is stable, and medically documented pain and rigidity with or without muscle spasm.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Grade III (51%-75% slippage) or grade IV (76%-100% slippage) spondylolisthesis, accompanied by medically documented injury that is stable, and medically documented pain and rigidity with or without muscle spasm.</td>
<td></td>
</tr>
</tbody>
</table>

#### IV. Spinal stenosis, segmental instability, spondylolisthesis, fracture, or dislocation, operated on

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Single-level decompression without spinal fusion and without residual signs or symptoms</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Single-level decompression without spinal fusion with residual signs or symptoms</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Single-level spinal fusion with or without decompression without residual signs or symptoms</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Single-level spinal fusion with or without decompression with residual signs and symptoms</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Multiple levels, operated on, with residual, medically documented pain and rigidity. 1. Second operation 2. Third or subsequent operation</td>
<td></td>
</tr>
</tbody>
</table>

Add 1% per level

Add 2%

Add 1% per operation
### Table 15-15 Determining Impairment Due to Sensory Loss

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description of Sensory Deficit</th>
<th>% Sensory Deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>No loss of sensibility, abnormal sensation, or pain</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Distorted superficial tactile sensitivity (diminished light touch), with or without minimal abnormal sensations or pain, that is forgotten during activity</td>
<td>1-25</td>
</tr>
<tr>
<td>3</td>
<td>Distorted superficial tactile sensitivity (diminished light touch and two-point discrimination), with some abnormal sensations or slight pain, that interferes with some activities</td>
<td>26-60</td>
</tr>
<tr>
<td>2</td>
<td>Decreased superficial cutaneous pain and tactile sensibility (decreased protective sensibility), with abnormal sensations or moderate pain, that may prevent some activities</td>
<td>61-80</td>
</tr>
<tr>
<td>1</td>
<td>Deep cutaneous pain sensitivity present; absent superficial pain and tactile sensibility (absent protective sensibility), with abnormal sensations or severe pain, that prevents most activity</td>
<td>81-90</td>
</tr>
<tr>
<td>0</td>
<td>Absent sensibility, abnormal sensations, or severe pain that prevents all activity</td>
<td>100</td>
</tr>
</tbody>
</table>

**b. Procedure**

1. Identify the area of involvement using the dermatome charts (Figures 15-1 and 15-2).
2. Identify the nerve(s) that innervate the areas (Table 15-12 and Figures 15-12 and 15-46).
3. Grade the severity of the sensory deficit or pain according to the classification above.
4. Find the maximum impairment of the extremity due to sensory deficit or pain for each spinal nerve (Table 15-9) and brachial plexus (Table 15-14).
5. Multiply the severity of the sensory deficit by the maximum impairment value to obtain the extremity impairment for each spinal nerve involved.

*Adapted from Medical Research Council.*

### Table 15-16 Determining Impairment Due to Loss of Power and Motor Deficits

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description of Muscle Function</th>
<th>% Motor Deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Active movement against gravity with full resistance</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Active movement against gravity with some resistance</td>
<td>1-25</td>
</tr>
<tr>
<td>3</td>
<td>Active movement against gravity only, without resistance</td>
<td>26-50</td>
</tr>
<tr>
<td>2</td>
<td>Active movement with gravity eliminated</td>
<td>51-75</td>
</tr>
<tr>
<td>1</td>
<td>Slight contraction and no movement</td>
<td>76-99</td>
</tr>
<tr>
<td>0</td>
<td>No contraction</td>
<td>100</td>
</tr>
</tbody>
</table>

**b. Procedure**

1. Identify the motion involved, such as flexion, extension, etc.
2. Identify the muscles performing the motion and the spinal nerve(s) involved.
3. Grade the severity of motor deficit of individual muscles according to the classification given above.
4. Find the maximum impairment of the extremity due to motor deficit for each spinal nerve structure involved (Tables 15-15, 16-11, 16-13, and 17-37).
5. Multiply the severity of the motor deficit by the maximum impairment value to obtain the extremity impairment for each spinal nerve involved.

### Table 15-17 Unilateral Spinal Nerve Root Impairment Affecting the Upper Extremity*

<table>
<thead>
<tr>
<th>Nerve Root Impaired</th>
<th>Maximum % Loss of Function Due to Sensory Deficit or Pain</th>
<th>Maximum % Loss of Function Due to Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>C5</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>C6</td>
<td>8</td>
<td>35</td>
</tr>
<tr>
<td>C7</td>
<td>5</td>
<td>35</td>
</tr>
<tr>
<td>C8</td>
<td>6</td>
<td>45</td>
</tr>
<tr>
<td>T1</td>
<td>5</td>
<td>20</td>
</tr>
</tbody>
</table>

* For description of the process of determining impairment percent, see text.

### Table 15-18 Unilateral Spinal Nerve Root Impairment Affecting the Lower Extremity*

<table>
<thead>
<tr>
<th>Nerve Root Impaired</th>
<th>Maximum % Loss of Function Due to Sensory Deficit or Pain</th>
<th>Maximum % Loss of Function Due to Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>L4</td>
<td>5</td>
<td>34</td>
</tr>
<tr>
<td>L5</td>
<td>5</td>
<td>37</td>
</tr>
<tr>
<td>S1</td>
<td>9</td>
<td>20</td>
</tr>
</tbody>
</table>

* For description of the process of determining impairment percent, see text.
ROM Method: Patient at MMI

Combine above whole person impairments as per pg. 604, AMA Guides, 5th Edition.
Almaraz/Guzman

Almaraz/Guzman I: An impairment rating strictly based on AMA Guides is rebutted by showing that such an impairment rating would result in a permanent disability reward that would be inequitable, disproportionate, and not a fair and accurate measure of the employee’s permanent disability. Repealed.

Almaraz/Guzman II: Impairment rating may be arrived at by making comparisons and drawing analogies to scheduled ratings within the four corners of the AMA Guides: Anthony Ferras vs. United Airlines.