(VAC) Voluntary Anal Contraction

**Sensory Subscores**

- **Light Touch (LTR)** + **Light Touch (LTL)** = **LT TOTAL**
- **Pin Prick (PPR)** + **Pin Prick (PPL)** = **PP TOTAL**

**Motor Subscores**

- **UER** + **UEL** = **UEMS TOTAL**
- **LER** + **LEL** = **LEMS TOTAL**

**Neurological Levels**

1. **Sensory**
2. **Motor**
3. **Neurological Level of Injury (NLI)**
4. **Complete or Incomplete?**
5. **Asia Impairment Scale (AIS)**

**Motor Key Muscles**

- **Elbow flexors (C5)**
- **Wrist extensors (C6)**
- **Elbow extensors (C7)**
- **Finger flexors (C8)**
- **Finger abductors (little finger)**
- **Hip flexors (L1)**
- **Knee extensors (L2)**
- **Ankle dorsiflexors (S1)**
- **Long toe extensors (L3)**
- **Ankle plantar flexors (S2)**
- **Sensory Key Points**

**Sensory Key Points**

- **Light Touch (LTR)**
- **Pin Prick (PPR)**
- **Light Touch (LTL)**
- **Pin Prick (PPL)**

**Comments**

(Non-key Muscle? Reason for NT? Pain?)

**Key Sensory Points**

- **Dorsum**
- **Pain**

**Voluntary Anal Contraction**

- **DAP**

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**Steps in Classification**

The following order is recommended for determining the classification of individuals with SCI.

1. Determine sensory levels for right and left sides. The sensory level is the most caudal, intact dermatome for both pin prick and light touch sensation.

2. Determine motor levels for right and left sides. Defined by the lowest key muscle function that has a grade of at least 3 (on supine testing), providing the key muscle functions represented by segments above that level are judged to be intact (graded as a 5). Note: in regions where there is no myotome to test, the motor level is presumed to be the same as the sensory level, if testable motor function above that level is also normal.

3. Determine the neurological level of injury (NLI) This refers to the most caudal segment of the cord with intact sensation and antigravity (3 or more) muscle function strength, provided that there is normal (intact) sensory and motor function rostrally respectively. The NLI is the most cephalad of the sensory and motor levels determined in steps 1 and 2.

4. Determine whether the injury is Complete or Incomplete. (i.e. absence or presence of sacral sparing)
   - If voluntary anal contraction = No and all S4-5 sensory scores = 0 AND deep anal pressure = No, then injury is Complete. Otherwise, injury is Incomplete.

5. Determine ASIA Impairment Scale (AIS) Grade:
   - Is injury Complete? If YES, AIS=A and can record ZPP (lowest dermatome or myotome on each side with some preservation)
   - Is injury Motor Complete? If YES, AIS=B
     - No = voluntary anal contraction or motor function more than three levels below the motor level on a given side, if the patient has sensory incomplete classification)
   - Are at least half (half or more) of the key muscles below the neurological level of injury graded 3 or better?
     - No = AIS=C
     - Yes = AIS=D

If sensation and motor function is normal in all segments, AIS=E Note: AIS E is used in follow-up testing when an individual with a documented SCI has recovered normal function. If at initial testing no deficits are found, the individual is neurologically intact; the ASIA Impairment Scale does not apply.

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**ASIA Impairment Scale (AIS)**

A = Complete. No sensory or motor function is preserved in the sacral segments S4-5.

B = Sensory Incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-5 (light touch or pin prick at S4-5 or deep anal pressure) AND no motor function is preserved more than three levels below the motor level on either side of the body.

C = Motor Incomplete. Motor function is preserved at the most caudal sacral segments for voluntary anal contraction (VAC) OR the patient meets the criteria for sensory incomplete status (sensory function preserved at the most caudal sacral segments (S4-5) by LT, PP or DAP), and has some sparing of motor function more than three levels below the ipsilateral motor level on either side of the body. (This includes key or non-key muscle functions to determine motor incomplete status.) For AIS C – less than half of key muscle functions below the single NLI have a muscle grade ≥ 3.

D = Motor Incomplete. Motor incomplete status as defined above, with at least half (half or more) of key muscle functions below the single NLI having a muscle grade ≥ 3.

E = Normal. If sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had prior deficits, then the AIS grade is E. Someone without an initial SCI does not receive an AIS grade.

**Sensory Grading**

0 = Absent
1 = Altered, either decreased/impaired sensation or hypersensitivity
2 = Normal
NT = Not testable

**Muscle Function Grading**

0 = total paralysis
1 = palpable or visible contraction
2 = active movement, full range of motion (ROM) with gravity eliminated
3 = active movement, full ROM against gravity
4 = active movement, full ROM against gravity and moderate resistance in a muscle specific position
5* = (normal) active movement, full ROM against gravity and sufficient resistance to be considered normal if identified inhibiting factors (i.e. pain, disuse) were not present.

**When to Test Non-Key Muscles:**

In a patient with an apparent AIS B classification, non-key muscle functions more than 3 levels below the motor level on each side should be tested to most accurately classify the injury (differentiate between AIS B and C).

<table>
<thead>
<tr>
<th>Movement</th>
<th>Root level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder: Flexion, extension, abduction, adduction, internal and external rotation</td>
<td>C5</td>
</tr>
<tr>
<td>Elbow: Pronation</td>
<td>C6</td>
</tr>
<tr>
<td>Wrist: Flexion</td>
<td>C7</td>
</tr>
<tr>
<td>Finger: Flexion at proximal joint, extension.</td>
<td>C8</td>
</tr>
<tr>
<td>Thumb: Flexion, extension and abduction in plane of thumb</td>
<td></td>
</tr>
<tr>
<td>Finger: Flexion at MCP joint</td>
<td></td>
</tr>
<tr>
<td>Thumb: Opposition, adduction and abduction perpendicular to palm</td>
<td>T1</td>
</tr>
<tr>
<td>Hip: Adduction</td>
<td>L2</td>
</tr>
<tr>
<td>Hip: External rotation</td>
<td>L3</td>
</tr>
<tr>
<td>Hip: Extension, abduction, internal rotation</td>
<td>L4</td>
</tr>
<tr>
<td>Knee: Flexion</td>
<td></td>
</tr>
<tr>
<td>Ankle: Inversion and eversion</td>
<td></td>
</tr>
<tr>
<td>Toe: MP and IP extension</td>
<td></td>
</tr>
<tr>
<td>Hallux and Toe: DIP and PIP flexion and abduction</td>
<td>L5</td>
</tr>
<tr>
<td>Hallux: Adduction</td>
<td>S1</td>
</tr>
</tbody>
</table>

**International Standards for Neurological Classification of Spinal Cord Injury**

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