

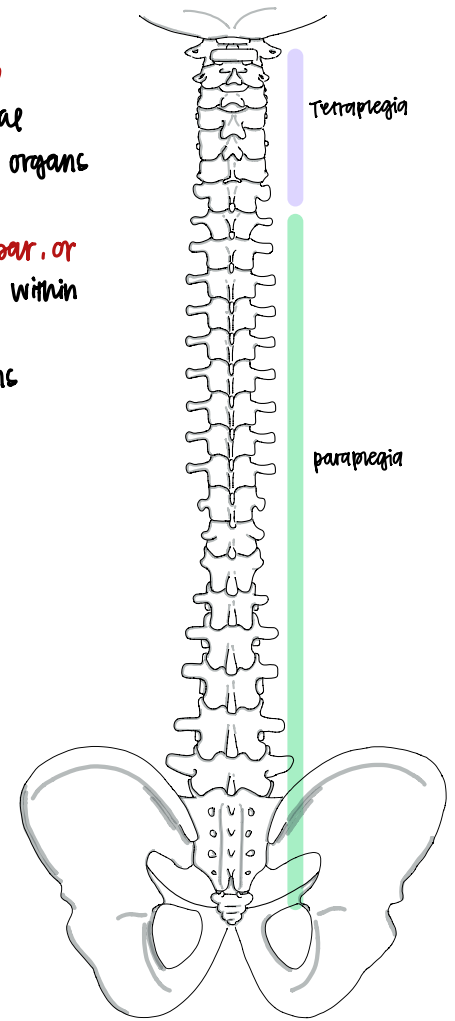
# HOW TO CLASSIFY A

# SPINAL CORD

# INJURY

## NOMENCLATURE & CLASSIFICATION




- **tetraplegia**: impairment or loss of motor and/or sensory function in the **cervical** segments due to damage of neural elements within the spinal canal
  - ↳ usually means person has impairment of function in arms, legs, trunk, & pelvic organs
  - ↳ doesn't include brachial plexus injuries or peripheral nerve injuries
- **paraplegia**: impairment or loss of motor and/or sensory function in the **thoracic, lumbar, or sacral** neurological segments due to damage of the neural elements within the spinal canal
  - ↳ usually means person has impairment of function in legs, trunk, & pelvic organs
    - No impairment in upper extremities
  - ↳ does include injuries to cauda equina and conus medullaris
  - ↳ doesn't include lumbosacral plexus injuries or peripheral nerve injuries
- **complete injury**: **absence of sensory and motor function** in the lowest sacral segment (no anal wink / no deep anal sensation)
- **incomplete injury**: **partial preservation of sensory and/or motor functions** is found below the neurological level and includes the lowest sacral segment
- **sacral sensation**: sensation at the anal mucocutaneous junction and deep anal sensation
  - ↳ test of motor function → presence of voluntary contraction of the external anal sphincter upon digital examination
    - basically stick your finger in person's anus & ask them to contract ...
  - ↳ **may be the only evidence of an incomplete SCI**
- **spinal shock**: when spinal cord basically shuts down initially after injury
  - ↳ complete loss of reflex activity occurs **below level of injury**
  - ↳ occurs immediately after injury
  - ↳ duration varies from 1 week → 3 months post injury
  - ↳ flaccid paralysis below level of lesion
    - ↳ no bowel or bladder tone
  - ↳ increased spasticity may indicate resolution of spinal shock
  - ↳ cannot determine if lesion is complete or incomplete during spinal shock!
- **zone of partial preservation**: dermatomes & myotomes caudal to the neurological level that remain **partially innervated**
  - ↳ recorded as the exact segments with impaired sensory and motor function found below the lowest normal segment
  - ↳ **ONLY FOR COMPLETE INJURIES**



- **skeletal level**: level where the most vertebral damage is found
- **neurological level**: most caudal segment with normal sensory & motor functions bilaterally
  - ↳ go BELOW this level, you will see impairments for dermatomes & myotomes
  - ↳ 4 different segments:
    - R sensory                      • L sensory
    - R motor                         • L motor
  - ↳ each segment is evaluated separately
- ★ skeletal level & neurological level are often not the same

**CLASSIFICATION OF SCI**

- **ISNCSI (ASIA)**: International standards for neurological classification of spinal cord injury
  - ↳ published by ASIA (American Spinal Injury Association)
  - ↳ purpose:
    - to have a universal definition of level, completeness of injury, & classification
    - describes level of impairment (AIS A,B,C,D)
    - to provide a format of testing to improve reliability and accuracy between raters
    - reliability of national database / multi-center research
  - ↳ **sensory exam**: ★ TESTS DEEP ANAL PRESSURE, SHARP/DULL, & LIGHT TOUCH
    - determines the most caudal normally innervated dermatome on both sides of the body
    - evaluates:
      - ↳ spinothalamic tract (anterolateral) = sharp/dull and pain/temp
      - ↳ DCML = light touch, light pressure

	sharp/dull 	light touch 	deep anal sensation 
<b>METHOD</b>	<ul style="list-style-type: none"> <li>• use a standard safety pin</li> <li>• face is a reference point for normal</li> <li>• have patient close eyes</li> <li>• start at C2 &amp; work DOWN</li> <li>• apply light pressure w/o pin movement after making contact</li> <li>• ensure random order of sharp &amp; dull sides of pin</li> <li>• need 8/10 correct answers to document as intact</li> </ul>	<ul style="list-style-type: none"> <li>• use tapered wisp of cotton</li> <li>• face is a reference point for normal</li> <li>• have patient close eyes</li> <li>• start at C2 &amp; work DOWN</li> <li>• cotton applied distance &lt;1cm</li> <li>• ask pt to localize sensation</li> <li>• do NOT ask leading questions</li> <li>• need 8/10 correct answers in transitional areas to document as intact</li> </ul>	<ul style="list-style-type: none"> <li>• <b>MOST IMPORTANT PART OF THE WHOLE EXAM</b> <ul style="list-style-type: none"> <li>↳ tells us if complete or incomplete SCI</li> </ul> </li> <li>• put on gloves &amp; insert your finger into their rectal area</li> <li>• don't go past DIP</li> <li>• "let me know when you feel my finger"</li> <li>• ask patient to squeeze</li> <li>• patient describes sensory awareness (touch/pressure)</li> </ul>
<b>GRADING</b>	<ul style="list-style-type: none"> <li>0 → absent (unable to distinguish sharp/dull)</li> <li>1 → impaired (can tell difference but feels different from cheek)</li> <li>2 → normal (can distinguish sharp/dull, feels same as face)</li> </ul>	<ul style="list-style-type: none"> <li>0 → absent (doesn't correctly/reliably report being touched)</li> <li>1 → impaired (correctly reports being touched but feels different from cheek)</li> <li>2 → normal (correctly reports being touched &amp; describes same feeling as cheek)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>absent</b> <ul style="list-style-type: none"> <li>↳ may indicate a complete SCI, but need to complete the rest of ISNCSI first</li> </ul> </li> <li>• <b>present</b> <ul style="list-style-type: none"> <li>↳ automatically on incomplete SCI</li> </ul> </li> </ul>

★ if key sensory point is unable to be tested, use another point within dermatome & document } if completely unable to test, document as "NT" for not tested

↳ **motor exam:** \*TESTS 10 KEY MUSCLES

- determines the most caudal motor segment intact bilaterally
  - ↳ intact innervation = grade of  $\geq 3$  AND the next rostral key muscle has a grade of 5
  - ↳ for myotomes that are not represented by key muscles, the motor level is presumed to be the sensory level
- Completed by testing 10 key muscles on each side

• **method:**

- ↳ perform with patient in supine
- ↳ start at C5 on one side and work down
- ↳ it is NOT NECESSARY to place each muscle in all testing positions
- ↳ be aware of substitution patterns
- ↳ stabilize proximally on grade 4 & 5 and palpate the muscle you're testing

• **grading:**

- ↳ 0: no visible or palpable contraction
- ↳ 1: any visible or palpable contraction
- ↳ 2: muscle is able to move at least once, through full ROM (or max allowable ROM) in gravity-eliminated position
- ↳ 3: muscle is able to move, at least once, against gravity
- ↳ 4: patient can complete grade 3 with some resistance against examiner
- ↳ 5: patient is able to exert normal resistance against examiner
- ↳ 5+: examiner feels patient could exert normal resistance in absence of pain, disuse, etc.
- ↳ NT: not testable, muscle is unavailable

key muscles		
C	5	elbow flexors
C	6	wrist extensors
C	7	elbow extensors
C	8	long finger flexors
T	1	small finger abductors
L	2	hip flexors
L	3	knee extensors
L	4	ankle dorsiflexors
L	5	great toe extensors
S	1	ankle plantar flexors

↳ **ASIA IMPAIRMENT SCALE:**

- **ASIA A:** Complete SCI
  - ↳ no sensory or motor function is preserved in the sacral segments
  - ↳ No VAC or DAP
- **ASIA B:** sensory incomplete, motor complete (considered a complete SCI)
  - ↳ sensory function is preserved below the neurological level and includes the sacral segments S4-5 (light touch, sharp/dull, or DAP) AND no motor function is preserved more than 3 levels below the motor level on either side of the body
  - ↳ may present like ASIA A but has sensation below the level of the lesion and no motor function below that level → **as a result, need to do ZPP for ASIA B patients!**
- **ASIA C:** motor incomplete,  $< 1/2$  muscles below NLI  $\geq 3/5$ 
  - ↳ motor function is preserved below the neurological level
- **ASIA D:** motor incomplete,  $> 1/2$  muscles below NLI  $\geq 3/5$ 
  - ↳ motor function is preserved below the neurological level
- **ASIA E:** normal motor and sensory function

\* to be motor incomplete ASIA C or D, motor function must be present in either the lowest sacral segment OR more than 3 levels below motor level ( $> 3$  key muscles)

# HOW TO FILL OUT THE ISNCSCI

## ↳ EXAMPLE:



INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY (ISNCSCI) ASIA ISCOS

Patient Name: \_\_\_\_\_ Patient # \_\_\_\_\_ Date/Time of Exam \_\_\_\_\_  
 Examiner Name \_\_\_\_\_ Signature \_\_\_\_\_

RIGHT		MOTOR KEY MUSCLES		SENSORY KEY SENSORY POINTS		SENSORY KEY SENSORY POINTS		MOTOR KEY MUSCLES		LEFT	
				Light Touch (LT)	Pin Prick (PP)	Light Touch (LT)	Pin Prick (PP)				
UER (Upper Extremity Right)		C2	2	2	2	2	2	C2	2	2	C2
		C3	2	2	2	2	2	C3	2	2	C3
		C4	2	2	2	2	2	C4	2	2	C4
		C5	5	2	2	2	2	C5	5	2	C5
		C6	5	2	2	2	2	C6	5	2	C6
		C7	5	2	2	2	2	C7	5	2	C7
		C8	5	2	2	2	2	C8	5	2	C8
		T1	5	2	2	2	2	T1	5	2	T1
		T2	2	2	2	2	2	T2	2	2	T2
		T3	2	2	2	2	2	T3	2	2	T3
		T4	2	2	2	2	2	T4	2	2	T4
		T5	2	2	2	2	2	T5	2	2	T5
		T6	2	2	2	2	2	T6	2	2	T6
		T7	2	2	2	2	2	T7	2	2	T7
		T8	2	2	2	2	2	T8	2	2	T8
		T9	2	2	2	2	2	T9	2	2	T9
		T10	2	2	2	2	2	T10	2	2	T10
		T11	1	1	1	1	1	T11	1	1	T11
		T12	0	0	0	0	0	T12	0	0	T12
		L1	0	0	0	0	0	L1	0	0	L1
LER (Lower Extremity Right)		L2	0	0	0	0	0	L2	0	0	L2
		L3	0	0	0	0	0	L3	0	0	L3
		L4	0	0	0	0	0	L4	0	0	L4
		L5	0	0	0	0	0	L5	0	0	L5
		S1	0	0	0	0	0	S1	0	0	S1
		S2	0	0	0	0	0	S2	0	0	S2
		S3	0	0	0	0	0	S3	0	0	S3
		S4-5	0	0	0	0	0	S4-5	0	0	S4-5
VAC (Voluntary anal contraction) (Yes/No)		N		N		N		N		N	
RIGHT TOTALS (MAXIMUM)		25	35	35				35	35	25	
MOTOR SUBSCORES		UER 25 + UEL 25 = UEMS TOTAL 50		LER 0 + LEL 0 = LEMS TOTAL 0		RLT 35 + LLT 35 = LT TOTAL 70		RPP 35 + LPP 35 = PP TOTAL 70		LEFT TOTALS (MAXIMUM)	
NEUROLOGICAL LEVELS		1. SENSORY R T10 L T10		2. MOTOR R T10 L T10		3. NEUROLOGICAL LEVEL OF INJURY (NL) T10		4. COMPLETE OR INCOMPLETE? C		5. ASIA IMPAIRMENT SCALE (AIS) A	

### 1. Neurological levels:

- ↳ for both sensory & motor, look for the most caudal segment with normal sensory & motor functions
- **sensory**: on the L, the most caudal normal (2/2) segment is T10 (the R side happens to be the same level)
- **motor**: on the L, the most caudal normal segment is T1, BUT since there are no myotomes represented by key muscles from T2-L1, the motor level is presumed to be the sensory level, which is T10 (the R side also happens to be the same)

### 2. Neurological level of injury:

- ↳ the most caudal segment with both sensory & motor function bilaterally.
- ↳ T10 is the neurological level in this case → lowest level w/ full function
- ex) if sensory was T10 on R & L and motor was T5 on R & L, the neurological level would be T5.

### 3. Complete or incomplete SCI:

- ↳ look at VAC, sensory points, and DAP
- if the line spells NOOOON, it is a complete injury AND ASIA A
- if the line has a Y in VAC or DAP, it is an incomplete injury with at least ASIA B
- ↳ **VAC, sensory points, and DAP**: for this case, it spells "NOOOON" so it is a complete SCI

### 4. ASIA Impairment Scale:

- ↳ see notes above on how to decide!
- ↳ **ASIA: A** because it is a complete SCI

### 5. Zone of partial preservation:

- ↳ for complete SCI only!
- ↳ sensory & motor levels caudal to the NL that remain partially innervated
- ↳ **ZPP**: T11 for all in this case → T11 is the most caudal segment that's >0 for sensory, and then use the same concept for motor as determining the motor level (no myotomes T2-L1 → use sensory)