

Neurological Assessment

The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) is a clinician administered, standardised, neurological exam for classifying spinal cord injury (SCI). Sensory and motor function is assessed to determine the severity of damage as well as the neurological level of injury, sensory scores, motor scores and zones of partial preservation. The ISNCSCI was developed by the American Spinal Injury Association (ASIA) and detailed information can be found at [ASIA e-Learning Center - American Spinal Injury Association \(asia-spinalinjury.org\)](https://www.asia-spinalinjury.org/). In addition to the ISNCSCI, further neurological assessment should be completed which includes, but is not limited to, manual muscle testing of all relevant muscles, assessment of joint range of movement, tone, spasticity, quality of movement patterns, proprioception, mode of ventilation/respiratory pattern, posture, and balance.

The “ASIA Assessment”

The ISNCSCI is commonly referred to as the ASIA (American Spinal Injury Association) assessment and classifies the severity of neurological impairment and completeness of SCI on the ASIA Impairment Scale (AIS). The assessment includes examination of sensation, including light touch and pain (pin prick) and examination of motor function (5 key muscles in the upper limb and 5 key muscles in the lower limb) and the sacral examination which includes sensation of the S4/5 dermatome and assessment of voluntary anal contraction (VAC) and deep anal pressure (DAP). The sacral examination is completed by the medical team and is required to determine the AIS grade.

Completing the assessment

What you need:

- ISNCSCI assessment form ([International Standards for Neurological Classification of SCI \(ISNCSCI\) Worksheet - American Spinal Injury Association \(asia-spinalinjury.org\)](https://www.asia-spinalinjury.org/))
- Neurotip for sensation assessment of pin prick (pain)
- Cotton tip for sensation assessment of light touch

Positioning:

- Completed in supine

Sensory assessment

Key sensory points within each dermatome from C2 to S4/5 are assessed bilaterally using light touch and pin prick (i.e., sharp-blunt discrimination). The individual's face is used as a normal reference point throughout the assessment.

Scoring:

| | |
|-------------|--|
| 0 | Absent |
| 1 | Altered, either decreased/impaired sensation or hypersensitivity |
| 2 | Normal |
| NT | Not testable |
| 0*, 1*, NT* | Non-SCI condition present |

Light touch assessment

What is being assessed: the individual's ability to accurately discriminate between touch & no touch

Verbal cueing: "Am I touching?" as cotton tip is dragged lightly across 1cm of skin at the key sensory point on the dermatome

Response: "Yes or No"

If accurate discrimination between touch and no touch is achieved, then touching the key point on the dermatome is compared to touching the normal reference point (e.g. face) to determine if sensation is impaired (score = 1) or normal (score = 2). If unable to differentiate between touch and no touch, then sensation is absent (score = 0) at that dermatome.

Pin Prick assessment

What is being assessed: the individual's ability to accurately discriminate pain i.e. between sharp-blunt sensations

Verbal cueing: "Sharp or blunt" as neurotip, held perpendicular to the body segment, is pressed into the skin, changing between the sharp and blunt ends at various times

Response: "Sharp or blunt"

If accurate discrimination between the sharp end of the neurotip and blunt end of the neurotip is achieved, then the sharp end of the neurotip is compared to the sharp sensation on the normal reference point (e.g., face) to determine if sensation is impaired (score = 1) or normal (score = 2). If unable to differentiate between sharp and blunt, then sensation is absent (score = 0) at that dermatome.

Motor Assessment

Key muscle groups in the upper and lower limbs are assessed bilaterally including elbow flexors, wrist extensors, elbow extensors, finger flexors, finger abductors, hip flexors, knee extensors, ankle dorsiflexors, long toe extensors and ankle plantar flexors.

Grading muscle power:

| | |
|-------------------------|---|
| 0 | No motor function |
| 1 | Palpable contraction |
| 2 | Active movement, able to achieve full range of motion with gravity eliminated |
| 3 | Active movement, able to achieve full range of motion against gravity |
| 4 | Active movement able to achieve full range of motion against gravity and with moderate resistance |
| 5 | Normal strength. Active movement, able to achieve full range of motion against gravity with full resistance applied |
| 5* | Considered to have normal strength if identified inhibiting factors were not present (i.e. pain) |
| NT | Not testable |
| 0*, 1*, 2*, 3*, 4*, NT* | Non-SCI condition present |

An isometric contraction is used to assess grade 4 and 5 muscle strength in specific positions for each muscle group.

Note: Abnormal motor and sensory scores should be marked with * to indicate an impairment due to a non-SCI condition. The comments box is used to explain the condition and the examiner should indicate how the score was rated for the purpose of classification (e.g., * considered normal for purpose of classification due to presence of non-SCI related condition such as orthopaedic injury)

Sacral Examination

The sacral examination is completed by the medical team. Sensation at S4/5 dermatome (left and right) is scored for light touch and pin prick as per sensory scoring above. Awareness of deep anal pressure (DAP) is examined through insertion of the examiners index finger and applying gentle pressure to the anorectal wall. Consistently perceived pressure is graded as being present or absent (i.e., scored as yes or no on the worksheet). Voluntary anal contraction (VAC) is examined to complete the motor examination. The external anal sphincter is tested based on reproducible voluntary contractions of the anal sphincter muscles around the examiner's finger inserted into the rectum. VAC is graded as being present or absent (i.e., scored as yes or no on the worksheet).

Sensory and Motor Levels and Neurological Level of Injury

Sensory Level

The sensory level is the most caudal, intact dermatome for both light touch and pin prick sensation. The right and left sides may differ, so the sensory level should be determined for each side. If sensation is abnormal at C2 and intact on the face, the sensory level should be recorded as C1. If sensation is intact on one side (or both) for light touch and pin prick in all dermatomes (C2 through to S4/5), the sensory level for that side should be recorded as intact and "INT" is recorded on the worksheet.

Motor Level

The motor level is defined as the lowest key muscle that has a grade of at least 3, providing the key muscles groups above are intact i.e., graded as 5. The right and left sides may differ, so the motor level should be determined for each side.

Neurological Level of Injury (NLI)

The NLI is the most caudal segment with intact sensation and antigravity motor function on both sides of the body, provided that there is normal (intact) sensory and motor function rostrally. The NLI is the most rostral of the sensory and motor levels determined above.

ASIA Impairment Scale

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 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 and has some sparing of motor function more than three levels below the ipsilateral motor level on either side of the body. Less than half of the key muscles motor function below the NLI have a grade less than or equal to 3.

D = Motor Incomplete

Motor incomplete status as defined above, with at least half (half or more) of key muscle functions below the s NLI having a muscle grade greater than 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.

Steps in Classification (as per worksheet)

1. Determine the sensory levels for right and left sides
2. Determine the motor level for right and left sides
3. Determine the neurological level of injury
4. Determine whether the injury is complete or incomplete (i.e., absence or presence of sacral sparing)
5. Determine AIS grade

- Determine the zone of partial preservation (ZPP). The ZPP is only used in injuries with absent motor (no VAC) or sensory function (no DAP, no light touch and no pin prick sensation) in the lowest sacral segments (S4/5) and refers to those dermatomes and myotomes caudal to the sensory or motor levels that remain partially innervated.

Helpful Resources

Instructions

- [American Spinal Injury Association Impairment Scale \(AIS\): International Standards for Neurological Classification of Spinal Cord Injury \(ISNCSCI\) - SCIRE Professional \(scireproject.com\)](#)

ASIA form

- [ASIA-ISCOS-Worksheet_10.2019_PRINT-Page-1-2.pdf \(asia-spinalinjury.org\)](#)

Motor Exam

- [Motor Exam Guide.pdf \(asia-spinalinjury.org\)](#)

Sensory Exam

- [Key Sensory Points.pdf \(asia-spinalinjury.org\)](#)

Example

- [E-ISNCSCI - American Spinal Injury Association \(asia-spinalinjury.org\)](#)

Common mistakes

- [Common Errors Made During the ISNCSCI Examination \(ASIA Exam\) - YouTube](#)

Link to algorithm

- [ISNCSCI Algorithm Calculator to score the ASIA Impairment Scale :: ISNCSCI Algorithm Calculator](#)