

TOOLKIT FOR SCI Neurology Assessment

A clinical guideline for the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI)

**RATIONALE AND TIPS FOR COMPLETION** 

March 2024 | Version 3

# TOOLKIT FOR NEUROLOGY ASSESSMENT

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# Background

The complex and heterogenous nature of spinal cord injury (SCI) can make neurological assessment challenging. The level of the spinal cord injury or lesion combined with its severity can lead to varying degrees of deficit, making no two injuries the same. It is important for those assessing individuals after SCI to use the appropriate tool(s) and include a comprehensive assessment of motor and sensory functioning.

The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI), now in its eighth edition, represents the gold standard for neurological assessment of motor and sensory function after SCI. Developed by the American Spinal Injury Association (ASIA) and now overseen by the International Standards Committee within ASIA, it allows clinicians and patients to have a common language to talk about SCI, provides a neurological diagnosis for prognostication and can track ongoing neurological functioning (1). It is also a powerful research tool to measure the effectiveness of treatment techniques and protocols aimed at neuro-recovery. A number of studies have tested the validity and reliability of the tool, both for the traumatic and non-traumatic SCI populations (2-5). Although out of the scope of this toolkit, there is also a growing body of evidence supporting the use of ISNCSCI in the pediatric SCI population (6,7). At a system level, ISNCSCI is recommended in national clinical guidelines and standards such as The Canadian Spinal Cord Injury Practice (Can-SCIP) Guidelines (8).

Despite being an international SCI standard of care, ISNCSCI data collected within the Canadian SCI Registry, otherwise known as the Rick Hansen SCI Registry (RHSCIR), has shown that ISNCSCI exam completeness and timing in Canada varies widely. RHSCIR is a longitudinal research study which tracks the experiences and outcomes of individuals with SCI from time of injury through acute care, rehabilitation to community reintegration and beyond. As of December 2023, RHSCIR contains data on nearly 13,000 individuals living with SCI in Canada. Currently, 30 facilities across Canada contribute to RHSCIR, of which 12 offer rehabilitation services, 16 offer acute services, and two offer combined services. Historically RHSCIR has captured only those individuals with traumatic SCI, but those with non-traumatic SCI admitted to inpatient rehab were added in 2021. RHSCIR is a powerful source of information that helps track the effectiveness of specific treatments, practices, or programs. It allows facilities to understand how their patients compare to others across the country and answers important clinical and research questions, alongside being able to track trends within clinical practice over time.

This toolkit is designed for clinicians working in SCI to support the clinical use of ISNCSCI and its integration into routine clinical practice. It outlines the rationale for ISNCSCI use, as well as how it can benefit hospital programs and patients alike. It offers practical tips and resources, not only for clinicians doing the exam, but also as a guide to help support broader clinical implementation.

We welcome any feedback about this toolkit. Please email clinical@praxisinstitute.org To learn more about RHSCIR, please visit www.praxisinstitute.org/research-care/key-initiatives/national-sci-registry

# Neurological Assessment Using ISNCSCI

#### **2A. EXAM OVERVIEW**

ISNCSCI evaluates key motor and sensory pathways along the length of the spinal cord to decipher the level and severity of injury. Assessment information gathered can be used to determine a single Neurological Level of Injury (NLI) and classify the severity of the SCI using a grading system known as the ASIA Impairment Scale (AIS).

In practice, the exam is broken into three parts:

- 1) Motor exam
- 2) Sensory exam
- 3) Anorectal exam

Each part has its own assessment criteria, grading and considerations.

The sensory exam tests sensation on pre-defined testing points within 28 bilateral dermatomes. For the motor exam, muscle strength is tested in key myotomes in both the upper and lower body. Although theoretically part of both the motor and sensory exam, the anorectal exam evaluates the preservation of sensation of the anorectal wall and voluntary contraction of the anal sphincter, as well as sensation in the S4/5 dermatome located near the mucocutaneous junction of the perianal area.

It is important clinicians completing the exam have adequate knowledge and skill of how to perform the component being tested to ensure correct diagnosis and neurological classification (9,10).



# **2B. WHY IS THIS INFORMATION IMPORTANT?**

#### Benefits for Clinicians & Patients:

- Allows clinicians and patients to have a common language to talk about SCIs, as well as provides important information for patient and family education
- Helps us to understand which motor and sensory pathways (or tracts) are functioning normally, which are impaired or which are non-functional at the time of testing through assessment of myotomes and dermatomes
- Helps us to understand early after injury if there has been sparing of the spinal cord tracts carrying motor and sensory information, which is important for predicting what functional activities the patient will be able to perform in the future
- Allows the use of tools for prognostication to support clinical decision making
- Provides a systematic way to monitor change in function; for example, an ascending single neurological level can be the first sign that the patient has a post-surgical complication
- Helps identify the risk of secondary complications, such as autonomic dysreflexia and pressure injuries

#### Benefits for Programs:

- Regular and consistent ISNCSCI exams can help to ensure proper continuity of care between health care professionals
- Collection of ISNCSCI data at standard time intervals allows comparison to other facilities and national data, as well as supports requirements for program level SCI accreditation
- ISNCSCI data can be a powerful tool in reporting metrics to hospital administrators as it allows correlation of program expenditures (e.g. equipment, regular and overtime staffing requirements, etc.) with neurological diagnosis, as well as other demographic data
- Can be used as a predictor of length of stay

#### Benefits for Research:

- Tracks diagnosis, progression and neurological recovery of SCI and informs prognostication
- Commonly used to determine inclusion/exclusion and is often the primary outcome in SCI clinical trials



# 2C. WHAT HAPPENS ONCE AN ISNCSCI EXAM IS COMPLETED?

First and foremost, the information collected from ISNCSCI exams becomes a legal part of the patient's medical record. It should be used for ongoing neurological monitoring, patient education and to help inform discussions around prognosis and expected outcomes.

For facilities participating in RHSCIR, once you complete the assessment and document the data on the clinical form, your facility's RHSCIR coordinator will collect this information and input the data into the registry database along with additional relevant clinical information. The national RHSCIR team at the Praxis Spinal Cord Institute has developed a number of practices to ensure patient confidentiality is maintained and strict privacy policies and procedures are followed. RHSCIR's team of clinical and data experts at the Praxis Spinal Cord Institute will provide you and your program with data entry, analysis services, and nationally benchmarked reports free of charge. This wealth of information assists in providing validated and supported evidence-based practice with the potential to improve efficiencies in the health care system and ultimately improve outcomes for individuals living with SCI. De-identified data from your facility will be tabulated along with other information collected in RHSCIR (e.g. neurology, length of stay, etc.) and reported back on a biannual basis to provide information on patients within your facility.



To access your facility's Neurology clinical reports, contact us at <a href="mailto:clinical@praxisinstitute.org">clinical@praxisinstitute.org</a> or contact your local RHSCIR Coordinator.

# Exam Considerations

## 1. WHO SHOULD RECEIVE AN ISNCSCI EXAM?

- Anyone with a suspected or confirmed SCI (1).
- Appropriate for use in both traumatic and non-traumatic injuries (5).

#### 2. WHEN SHOULD IT BE ADMINISTERED?

• ISNCSCI can be used across the care continuum to track neurological function and change over time.



## A neurological assessment (which includes the use of ISNCSCI) is recommended at these timepoints:

#### Acute Care

- A baseline full ISNCSCI exam should ideally be completed within 24 hours of admission (8) or as soon as feasibly possible (11).
- The Health Standards Organization's (HSO) SCI Standards recommend the following for neurology assessment in the acute phase (12):
  - Hourly for the first 24hrs (or until injury is stabilized)
  - Every 4 hours thereafter
  - Any perceived or recognized change in neurological function
- E-ISNCSCI can be used as a screening tool for early determination of the NLI & AIS, as well as for ongoing serial monitoring (13).

#### Rehabilitation

- Any care transition involving a change in the service environment (e.g. admission to rehab, discharge to community) (12).
- Any perceived or recognized change in neurological function (12).
- E-ISNCSCI can be used for ongoing serial monitoring.

#### Community

- A neurological exam should be done on an annual basis to track change in neurological function over time, and to monitor for complications such as Syringomyelia
- E-ISNCSCI can be used for ongoing serial monitoring.

See Section 8 for more information on the Expedited ISNCSCI (E-ISNCSCI).

# Timing of the first exam, prognostication and spinal shock

Spinal shock may affect the reliability of neurological examinations at very early timepoints post injury. Spinal shock is described as the sudden but temporary loss of reflexes and muscle tone below the level of injury that occurs after an acute onset of SCI. One of the first reflexes to return after spinal shock is the bulbocavernosus reflex (BCR) (14) and an accurate neurological classification is technically precluded until this point (15). It is important to recognize this potential limitation.

**NOTE:** BCR testing is not part of the ISNCSCI and is outside the scope of this toolkit. Further information on BCR testing can be found here (16).

Understanding when the exam occurs in the recovery process is also crucial when discussing prognosis (17). Almost all individuals will show some degree of spontaneous recovery, however the amount of recovery observed may differ between individuals in the hours to days following injury for different injury levels and severity (18). For example, greater changes in neurology are often observed in incomplete injuries (AIS, B, C & D) compared to complete injuries (AIS A) (17,19). AIS conversion is also significantly more likely when baseline exams are completed soon after injury (<4hrs) (15).

Each neurological exam offers a snapshot of a person's impairment at the time of testing, and this information is key to inform clinical management and prognosis. However, appreciating the timing of the first exam and the reliability of the scores at very early timepoints (i.e., first few hours) should not be overlooked, particularly in the presence of factors interfering with a patient's cognition and communication (19). Barriers may exist to getting a fully complete exam, particularly during acute admission given the complexity of care during this phase. Some of these barriers and ways to mitigate them are discussed in the section below "what do I need to know prior to the exam".

## 3. DO I HAVE THE RIGHT SKILLS AND TRAINING?

Training is required to perform ISNCSCI exams accurately, and ensures the reliability and validity of exams in clinical practice and research (10). The American Spinal Injury Association's (ASIA's) E learning Program (InSTeP) is a five-module online course developed by the International Standards Committee and is designed for clinicians to support performing accurate and consistent neurological examinations. InSTeP should be completed as a minimum requirement for those doing the exam either clinically or for research. Hands on training is also essential to ensure accuracy and further develop the skills necessary to perform the exam (10).

## 4. WHAT DO I NEED TO KNOW PRIOR TO THE EXAM?

It is important to consider factors which might affect the accuracy of the exam or the ability to complete a full exam. Anticipating these in advance can help you to plan when best to conduct the exam, and if any other resources or interventions are required in advance. Considering all variables which may affect your assessment scores will ensure exam results are interpreted correctly.

#### **Non-SCI Conditions**

Any condition that may impact the sensory and/or motor function but is unrelated to the SCI needs to considered prior to and while completing the exam. An example of this is a brachial plexus injury. Assessment scores affected by a non-SCI condition should be tagged with an asterisk (\*) and an explanation of the non-SCI condition provided in the comments box on the ISNCSCI clinical worksheet. Further information on how to document non-SCI conditions and how to interpret scores for classification can be found here (20).

#### **Medications**

Being able to follow commands and provide feedback to the examiner's questions is essential for an accurate exam. Certain medications (e.g. sedatives, strong analgesics) may impair level of consciousness and limit the ability of a patient to fully participate in the exam. If appropriate and safe to do so, weaning sedation (e.g. in the ICU) may be considered prior to doing the exam or the exam may need to be performed at a later time when clinically appropriate.

#### Pain

Pain can be a considerable barrier to completing a full exam. Assessing pain levels can ensure adequate pain relief is administered in advance and if possible, timing the exam so it is done when pain management is optimized. It also important to consider neuropathic pain and areas of hypersensitivity as these may affect the ability to test certain myotomes/dermatomes.

#### **Cognitive Impairment/ Communication**

Adequate comprehension is key to an accurate exam. Those with a cognitive impairment (e.g. traumatic brain injury) may lack the capacity to understand what is being asked of them. Use of communication aids might be helpful if a person is unable to communicate verbally or consider using an interpreter if a language barrier exists. Reducing environmental stressors may also be conducive to getting a more complete exam (e.g. excess noise, interruptions or distractions).

Communication aids can also be utilized for those unable to verbally communicate while being mechanically ventilated. Completing the exam with individuals with an endotracheal tube or tracheostomy may require additional planning (e.g. weaning sedation, safe environment, extra time) but should not be considered as a primary reason not to do the exam.

#### **Past Medical History**

Conditions which may affect a person's motor and sensory function (e.g. arthritis, diabetes, previous injuries) should be considered as well as being aware of the person's pre-injury baseline motor and sensory impairments. Assessment scores affected by any non-SCI condition should be tagged with an asterisk (\*). A person may also have a previous SCI or stroke with existing underlying deficit.

# 5. IS IT THE RIGHT TIME?

The time it takes to complete the exam can vary widely depending on the patient's cognitive and physical state, your experience with the exam as well as other care that may be taking place at the same time. Most experienced examiners can complete this exam within 20-50 minutes (depending on the injury level and severity) in a patient who is alert and able to participate in the exam. However, the exam can take considerably longer in patients who are experiencing delirium, pain, fatigue or other symptoms that affect their capacity to participate.

**IMPORTANT:** If portions of the exam are completed at different times, this must be documented in the "comments" box on the ISNCSCI form. Make sure the dates and times are well documented if the exam is broken up.

## 6. DO I HAVE THE RIGHT EQUIPMENT?

The simplicity of the equipment required to perform the exam means that it can be performed in virtually any clinical setting and phase of care. This makes it an accessible tool for assessing motor/sensory neurological deficit after SCI and able to be used in conjunction with more sophisticated diagnostics such as MRI or CT (when available) to further characterize the SCI.

#### Things you will need:

- Tapered wisp of cotton (from a clean cotton swab or Q tip\*)
- Clean standard safety pin\*
- ISNCSCI clinical form (see below)
- Personal protective equipment as required
- Correct examination surface (patient ideally lies supine with the head of the bed flat)

#### **TOP TIP**

- Complete when the patient is well rested, for example first thing in the morning before the patient mobilizes/has physio or occupational therapy.
- Although ideally the full exam is completed in one go, it can be broken down into two or three parts if the patient needs to rest. The motor, sensory and rectal portions of the exam can be completed on the same day but a few hours apart.



\*Single patient use

# 7. HOW SHOULD I DOCUMENT ASSESSMENT FINDINGS?

Documentation of exam scores on the ISNCSCI clinical worksheet (available on ASIA's website) is encouraged as it provides a systematic way of documenting exam results and ensures all assessment areas are completed (21). The comments box can be used to document any deviations in testing or other clinical considerations (e.g. patient fatigue, sedation levels etc.), so that other clinicians performing the exam in the future can replicate what was done to ensure different findings can be interpreted accurately and aren't due to other factors.

The comments box should also be used to document non-SCI conditions and if scores tagged with an \* should be considered normal or not normal for classification. More information about how to document non-SCI conditions can be found here (20).

REMEMBER: The date and time of the exam should always be documented.



Cite: Rupp et al.: ISNCSCI: Revised 2019.https://doi.org/10.46292/sci2702-1

Access this worksheet online here

# Motor Examination

**IMPORTANT:** This document is not meant to replace current tools for teaching the exam (see clinical resource section); rather it will focus on areas of difficulty examiners often struggle with and how to address them. ASIA offers a comprehensive e-learning course on how to perform the motor exam in InSTeP.

NOTE: It may be useful to have the ASIA ISNCSCI exam motor guide when reviewing this part of the toolkit.

#### WHAT IS THE MOTOR EXAM?

10 key muscles chosen to represent individual myotomes (C5-T1 and L2-S1) are tested bilaterally and graded for strength. The full list of key muscles can be found in the ISNCSCI exam motor guide. A full motor exam also includes assessment of Voluntary Anal Contraction (VAC), details of which are covered in Section 6, Anorectal exam.

**IMPORTANT:** Assessment scores impacted by a non-SCI condition should be tagged with an asterisk (e.g. 4\*). More information on the use of \* for non-SCI conditions can be found here.

**REMEMBER:** The patient must be positioned in supine. The head of bed should be flat when possible. If an alternative position is required, make a note of the position used for the exam in the "comments" box on the ISNCSCI worksheet.

#### **MOTOR 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 moderate resistance in a muscle specific position
5	(Normal) active movement, full ROM against full resistance in a muscle-specific position expected from an otherwise unimpaired person
NT	Not testable (i.e., due to immobilization, severe pain such that the patient cannot be graded, amputation of limb, or contracture of >50% of the range of motion)
	of >50% of the range of motion)

0\*, 1\*, 2\*, 3\*, 4\*, NT\* = Non-SCI condition present

#### **MOTOR EXAM TOP TIPS**

- It is recommended to test in a rostral-caudal (head to toe) sequence.
- Start in the grade 3 testing position (see motor exam guide) or at the testing position for the last known grade on a prior exam.
- The examiner's hand position and the patient's body position for each myotome test is important; please refer to the InSTeP online training modules or the ISNCSCI Motor Exam guide for correct positioning.
- Remember that a grade of 5, or full strength, is the full/normal strength you would expect for that patient. This means that a grade 5 for a 20-year-old female will be different than a grade <u>5 for a 90-year-old male.</u>

#### **COMMON MOTOR SUBSTITUTIONS**

One of the functional skills patients learn very early on is the substitution for muscles that are weak or paralyzed by those that are stronger.

Here are some examples of substitutions that can often "trick" testers. Pictures in this section are from ASIA's InSTeP E-learning module.

### C6 — Wrist Extension

Patients who do not have active wrist extension will try to use of gravity and forearm supination to passively extend the wrist.

### How can I prevent this? Make sure to stabilize the wrist in neutral for grades 0, 1 and 2.



# C7 – Elbow Extension

Patients who do not have active elbow extension will often externally rotate their shoulder and relax the arm when in an anti-gravity position, OR use a quick contraction and relaxation of biceps in a gravity-eliminated position to achieve passive elbow extension and mimic active elbow extension by the triceps.

#### How can I prevent this?

For grades 0, 1 and 2, make sure the arm is fully internally rotated (start with the arm across the chest) and ensure that the forearm stays parallel to the ground.



## C8 — 3rd Distal Phalanx Flexion

Patients who do not have active finger flexion will actively extend their wrist, which results in shortening of the flexor tendons of their fingers and passive finger flexion. They also sometimes use the other finger flexors (that attach closer to the palm and flex the first finger joint) to mimic the motion.

#### How can I prevent this?

Ensure that the wrist, knuckle and first finger joints are all properly stabilized. The handling for this can be a bit awkward, so don't be afraid to use your forearm to stabilize their wrist, leaving your hands free for testing.



### T1 – Pinky Finger Abduction

Patients who do not have active finger abduction will use their finger extensors to straighten and extend their finger.

#### How can I prevent this?

Palpate the "meat" or muscle belly on the side of the hand. You should feel the muscle tensing under your hand; also, watch the top surface of the hand in the grades 0, 1 and 2 position – is the finger moving up toward the ceiling, or out to the side? It should be moving out to the side.



# L4 – Dorsiflexion

Patients who do not have active dorsiflexion will use their toe extensors to dorsiflex their ankle, when they should be using the tibialis anterior muscle.

#### How can I prevent this?

Palpate the tibialis anterior tendon, which is at the front of the ankle. It is quite thick and should pop out against your hand. If you only notice the smaller, thinner toe tendons further down the foot popping out, the ankle may still move, but only a very small amount.



# L5 — Great Toe Extension

Patients who do not have active great toe extension will plantarflex their foot and their toe will passively be extended because that muscle is tight (sometimes called the 'reverse tenodesis' phenomenon) OR patients will flex their great toe, and relax the muscle, which looks like active toe extension.

#### How can I prevent this?

Stabilize the ball of the foot with your fingers, while feeling the extensor tendon of the great toe with your thumb. Active toe extension will cause the tendon to pop out against your hand.



# S1 – Plantarflexion

In the grade 3 test position, patients who do not have active plantar flexion may instead flex their hip up toward their chest, which will passively lift the heel off the bed.

#### How can I prevent this?

Patients who use this strategy will pull the whole leg away – repeat the test if you feel the weight of the ball of their foot pull away from your hand. You should feel the ball of the foot push into your hand when they actively dorsiflex.



# WHAT CAN THE MOTOR EXAM TELL US?

## Physiologically

- Provides information about which motor levels or myotomes are functionally normally, impaired or non-functional for key muscles tested.
- A measurement of Corticospinal Tract function, one of the motor pathways in the spinal cord.

# Prognostically

- Defines motor complete or incomplete injuries (AIS A/B versus AIS C/D).
- An initial motor incomplete injury has greater chance for further neurological recovery than for those with a motor complete injury (11).
- Myotomes L3 and L5 are involved in the prediction of independent ambulation at 1-year for traumatic SCI (22,23).

# Clinically

- Informs assessment for safe ambulation and/or need for transfer aids.
- Determines degree of motor function/strength in tested muscles.
- Anticipated care dependency i.e. what tasks a person may or may not be able to do.



# Sensory Examination

#### WHAT IS THE SENSORY EXAM?

The sensory exam consists of 28 bilateral dermatomes which are tested for both light touch and pin prick sensation. In addition, deep anal pressure (DAP) assesses the somatosensory of the pudendal nerve S4/5. For further details on how to assess DAP, please see Section 6 Anorectal Exam.

Full details of the key sensory points to test can be found here.



### SENSORY EXAM TOP TIPS

- It is important to ensure that the patient's eyes are closed to ensure accuracy of test.
- Ensure timing of verbal questions is alternated (e.g. not only asking for feedback when touching so question is a verbal cue that you are touching them).
- Make sure that you are not touching the patient at a location other than the one you are testing.
- Testing light touch first, especially for the first-time examinee and those who do not recall a previous exam, may allow for a more comfortable experience (24).
- Allow time for the patient to respond before moving onto the next dermatome. For patients with impairments, it may take longer than normal to perceive sensory stimulation.
- There are only 2 questions to ask when completing each of the sensory tests. The most common error with the sensory exam is not asking both important questions during each test.

# Light Touch is tested by:

Tapered wisp of cotton (typically using a cue tip) lightly stroked across an area not to exceed 1cm of skin.

## LIGHT TOUCH GRADING

• Patient does not correctly & reliably report being touched

Patient correctly reports being touched but

1 describes the feeling as different than on the face (greater, lesser, hypersensitive, allodynic)

Patient correctly report being touched

2 & describes the feeling as being the same as on the face

0\*, 1\*, NT\* = Non-SCI condition present

# The following instructions can be used for the light touch exam:

- 1. Let me know when you feel me touching you.
- 2. Does it feel the same as your face?

If the patient indicates that they feel you touching them and answers "yes" to question 2, then grade that sensory point as a 2.

If the patient indicates that they feel you touching them but answers "no" to question 2, **then grade it as a 1**.

If the patient doesn't indicate that they feel you touching them (make sure they are awake and understand your request), grade it as a o.

**IMPORTANT:** A baseline should first be established on the persons face as a reference to what is normal sensation.

**IMPORTANT:** Assessment scores impacted by a non-SCI condition should be tagged with an asterisk (e.g. 1\*). More information on the use of \* for non-SCI conditions can be found here (20).

**REMEMBER:** The patient must be positioned in supine. The head of bed should be flat when possible. If an alternative position or testing location on the dermatome is required, make a note of the position used for the exam in the "comments" box on the ISNCSCI worksheet.

# Pin Prick (sharp/dull discrimination) is tested by:

- Performed with a disposable safety pin that is stretched apart to allow testing on both ends.
- Pointed end used to test for sharp and the rounded end for dull.

## **PIN PRICK GRADING**

• Patient does not reliably distinguish between sharp & dull ends of the pin (or doesn't feel it)

Patient reliably distinguishes between sharp & dull ends of the pin but the sharpness

1 feels different than the face (greater, lesser, hypersensitive, allodynic)

Patient reliably distinguishes between sharp& dull ends of the pin & states the intensity

is the same as that on the face

0\*, 1\*, NT\* = Non-SCI condition present

**IMPORTANT:** A baseline should first be established on the persons face as a reference to what is normal sensation.

**IMPORTANT:** Assessment scores impacted by a non-SCI condition should be tagged with an asterisk (e.g. 1\*). More information on the use of \* for non-SCI conditions can be found here (20).

**REMEMBER:** The patient must be positioned in supine. The head of bed should be flat when possible. If an alternative position or testing location on the dermatome is required, make a note of the position used for the exam in the "comments" box on the ISNCSCI worksheet.

# The following instructions can be used for the pin prick (i.e. sharp/dull discrimination) exam:

- 1. Let me know if you feel either the sharp or dull end of the safety pin.
- 2. Does it feel the same as your face?

If the patient can reliably differentiate between the sharp and dull end of the safety pin and answers "yes" to question 2, then grade that sensory point as a 2.

**NOTE:** If the patient answers inconsistently when differentiating between the sharp and dull end of the safety pin, you should test the sensory point enough to determine if the patient answers correctly 8/10 times. If they achieve this you should score them as having answered correctly.

#### **PIN PRICK TOP TIP**

As soon a patient gets 2 incorrect answers to the sharp/dull discrimination, you can stop testing the sensory point being assessed.

If the patient can reliably differentiate between the sharp and dull end of the safety pin but answers "no" to question 2, then grade it as a 1.

If the patient cannot reliably differentiate between the sharp and dull end the safety pin or is unable to feel it, **grade it as a 0**.

**IMPORTANT:** The pin prick exam is often scored incorrectly. To receive a grade of 1 or 2 for pin prick, the patient must be able to reliably differentiate between sharp and dull. They receive a grade 1 if they can tell the difference between sharp and dull, but it is less sharp or more sharp than their face. If they can feel the pin but cannot discriminate between sharp and dull, they receive a grade of 0.

# WHAT DOES THE SENSORY EXAM TELL US?

# Physiologically

- Which sensory levels or dermatomes are functioning normally, are impaired or non-functional.
- A measurement of Spinothalamic Tract function, one of the most important sensory pathways in the spinal cord.

# Prognostically

- Sensory incompleteness indicates a more favorable prognosis in terms of motor recovery (19).
- Perception of pin prick appears to have the closest correlation with motor recovery (25).

# Clinically

- Informs what level of motor function you may expect in the torso (e.g. for balance, ability to independently clear secretions, etc.). As there are no key muscles tested in the thoracic region, we defer to the sensory exam and assume similar motor function at these levels.
- Identify those at risk of Autonomic Dysreflexia (AD) (NLI, T6 & above).
- Identify areas of hypersensitivity or pain.



# Anorectal Exam

### WHAT IS THE ANORECTAL EXAM?

The anorectal exam can cause anxiety for the patient and it is important to be aware of cultural sensitivities. Providing the patient with a verbal explanation of why the exam is being performed as well as an explicit description of what it entails prior to performing the exam is essential to obtaining informed consent (verbal) as well as obtaining accurate assessment findings.

Please review the InSTeP module on the anorectal exam to ensure not only correct technique but also a sensitive and appropriate approach to informing the patient about the exam prior to completing it.

#### There are two parts to the anorectal exam:

#### **1. THE EXTERNAL EXAM**

S<sub>3</sub> and S<sub>4-5</sub> sensory testing, which has the same components as the sensory exam discussed above – light touch sensation and pin prick discrimination.

#### 2. THE INTERNAL EXAM

A gloved and lubricated index finger is inserted (2-3 cm for adults) through the anus into the rectum and held motionless (to avoid further BCR stimulation).

**S**3

S4/5

# **VOLUNTARY ANAL CONTRACTION (VAC)**

- Voluntary contraction of the anal sphincter.
- Felt by examiner after insertion of index finger through the anus into the rectum.

#### **Directions:**

Ask the patient to squeeze your finger like they are holding back a diarrhea bowel movement.

#### VAC is scored as either absent or present.

**NOTE:** Presence of the bulbocavernosus reflex can be misinterpreted as a "voluntary" contraction.

### VAC TOP TIP

Ask the patient to "squeeze your finger, then relax and then squeeze again" to ensure VAC is present. In very tense patients you may need to cue them to relax to begin as they may already have contracted the sphincter. If you are unsure but think there might be a weak contraction, score VAC as "no" and write "may have weak anal contraction" in the "comments" box on the ISNCSCI form.

## **DEEP ANAL PRESSURE (DAP)**

- Assessed by inserting the examiner's index finger and applying gentle pressure to the anorectal wall.
- Assesses somatosensory components of the pudendal nerve S4/5.

#### Directions:

Apply gentle pressure to the anorectal wall with your index finger or use your thumb to gently squeeze the anus against your index finger and ask "let me know when you feel me touching you".

#### DAP is scored as either absent or present.

**IMPORTANT:** DAP may be the only evidence of an incomplete injury (i.e. in the absence of S<sub>3</sub> or S<sub>4</sub>-5 sensation).

#### DAP TOP TIPS

- If light touch or pin prick is present at S4/5, then testing of DAP is not required.
- Given the subjective nature of this exam and the importance of the findings, ensure that the patient can actually feel by removing your finger from the rectum (without the patient knowing) and again ask if they can feel you touching them.

# WHAT IS SACRAL SPARING & WHY IS IT IMPORTANT?

Sacral sparing is the presence of any sensation at the S4/5 dermatome and/or preservation of VAC or DAP. Sacral sparing constitutes a clinically incomplete SCI.

#### It is important for three reasons:

- It is essential to determine the AIS. By definition, any anal sensation or voluntary contraction defines an incomplete injury. This is because the anorectal exam includes the last nerves to leave the spinal cord, so any anal sensation or voluntary contraction is evidence that some motor or sensory impulse is being conducted through the injured part of the spinal cord.
- 2. Informs the determination of neurogenic bowel and bladder to help direct appropriate management strategies.
- 3. It is the most important factor to determine a prognosis for further recovery of neurological function given it determines whether the SCI is complete or incomplete (AIS A vs. B-D).

#### **Reason for false negative result**

- Presence of anal tone at rest. Presence of anal tone, although helpful in determining whether the patient has an upper or lower motor neuron injury, does not indicate presence of voluntary motor function and is not part of the ISNCSCI exam.
- Reflex anal contraction confused mistaken as a voluntary contraction.
- Contraction of other pelvic muscles such as the gluteal muscles (this will be felt at the top of the examiners finger instead of around it).

#### **Reason for false negative result**

• Can occur with well-preserved function in a patient who cannot relax.



# SCI Classification

ISNCSCI assess the degree of motor and sensory impairment following an SCI and classifies an injury by both level and severity, in order to diagnosis the neurologic injury and inform ongoing management strategies. The severity grading system used, known as the ASIA Impairment Scale (AIS), evaluates the degree of deficit below the level of injury, and the Neurological Level of Injury (NLI) provides the last level of normal motor and sensory functioning. Clinically, the NLI and AIS (e.g. C5 AIS B) can provide valuable insights into expected level of function and prognosis.

**NOTE:** A step by step guide to ISNCSCI classification is outside the scope of the toolkit. Please refer to the classification module on InSTeP or review the ISNCSCI worksheet.

**REMEMBER:** It is important to differentiate the **NLI** from the **bony injury level** (if there is one) as they may not be the same.

#### Access the worksheet online here

# **ISNCSCI CLASSIFICATION DETERMINES**

### **Sensory Levels**

The most caudal intact dermatome for both pin prick and light touch sensation. Determined for left & right side separately.

### **Motor Levels**

The lowest key muscle that has a grade of at least 3, provided all key muscles above are intact (i.e. grade of 5). Determined for left & right side separately.

# **Neurological Level of Injury**

The most caudal segment with normal sensory and motor function on **both** sides of the body.

## **Complete or Incomplete**

Whether any motor or sensory function exists in the lowest sacral segments. This is known as sacral sparing (definition in anorectal section) and constitutes an incomplete injury.

## ASIA Impairment Scale Grade (AIS)

A = Complete, B = Sensory Incomplete, C&D = Motor incomplete, E= Normal (only used if an individual had a SCI with deficits previously. NOTE: deficits in proprioception, etc. may remain in these patients).

# Zone of Partial Preservation (ZPP)

Refers to those dermatomes and myotomes caudal to the sensory and motor levels that remain partially innervated.

# **ISNCSCI ALGORITHM**

The ISNCSCI Algorithm is a tool which utilizes the bedside exam scores determined by performing the exam to electronically score and classify a spinal cord injury using the ISNCSCI Eighth Edition (Revised 2019) scoring rules (26). Please note that prior to use for clinical purposes (e.g. diagnosis, informing care decisions) the results should be verified by a clinician.

The Algorithm is designed to produce an SCI classification consistent with the ISNCSCI.



Access the algorithm online here

# Expedited ISNCSCI (E-ISNCSCI)

A known barrier to the use of ISNCSCI is the time it can take to complete the exam, given the number of items tested. Based on this feedback, ASIA's International Standards Committee developed a rigorous, shortened exam option known as the E-ISNCSCI. It recommended for use in certain clinical or research situations but **is not intended to replace the full exam** (13).

E-ISNCSCI provides a more rapid option for determination of the NLI and AIS. It utilizes the same motor and sensory exam techniques as the full ISNCSCI, but allows omission of a large percentage of the individual exam components to follow the minimum number of steps required to get an AIS grade and NLI. It also allows the option to substitute the rectal exam with the S1 myotome/dermatome, as this has been shown to be a good predictor of sacral sparing (~85-90% accuracy (13)).

Clinically, in addition to the steps outlined in the E-ISNCSCI, a full motor exam maybe useful to monitor for changes that may otherwise be missed in the abbreviated version of the exam.

#### **TOP TIP**

Any change in neurological function requires completion of the full ISNCSCI exam.

### **Examples of use:**

- Screening exam for early determination of NLI and AIS.
- Daily exams for ongoing monitoring.
- Periodic follow up exams in those without new neurological complaints or changes in functional status.

Steps on how to complete the E-ISNCSCI can be found here.

# Clinical Implementation

RHSCIR data has shown that the degree of ISNCSCI completion varies at different timepoints. When broken down, the sensory and anorectal portions of the exam are more frequently missed compared to the motor exam, despite being a key requirement for defining the AIS classification and for prognostication. Support for ISNCSCI adoption at a local level, clinician education and confidence doing the exam, as well as certain care and organizational factors can all influence its use (27).

### Some of these barriers include:

#### Care factors

- Intubation and/or sedative medications
- Polytrauma
- Pain
- Invasive nature of the rectal exam
- Language or cognitive barrier

#### Organizational factors

- Lack of awareness of when and why the exam should be used
- Not used as a standard of care
- Workforce without the required skill or training

#### **Exam limitations**

- Does not assess strength in all muscle groups required for function.
- Does not test Proprioceptive pathways.
- Subjectivity of the sensory exam incorrect sensory level can change NLI and potentially AIS grade.
- The exam can be lengthy to complete with a variety of test elements.
- Low Glasgow Comma Scale (GCS), concurrent Traumatic Brain Injury (TBI) or any sort of cognitive impairment may mean the patient cannot reliability participate in the examination.

# **TIPS FOR IMPLEMENTATION**

## **Routine Integration**

The regular application of ISNCSCI into clinical practice across the multidisciplinary team can create a collective accountability for its use. Certain parts of the exam naturally lie within different disciplines and therefore a multidisciplinary approach is one way to improve completion. Although ideally the exam is completed by a single clinician, this approach can lessen the workload on one discipline to get a fully complete exam. Identifying efficiencies in workflows and streamlining care such as doing the anorectal exam while performing routine bowel care can be another way of minimizing the burden on patients and staff.

Those not directly involved in performing the exam but who participate in care planning and delivery after SCI should also have a basic understanding of when and why the exam is performed, as well as the associated classification terminology and what it means for their patients. The neurological classification as well as the raw exam scores can provide clinicians with valuable information to help to direct care and inform ongoing management. The exam can be used to anticipate care needs, staffing and equipment requirements, and inform risk assessments for pressure injuries, respiratory compromise and autonomic dysreflexia.

# Training

Studies have shown that formal and rigorous training improves knowledge and skill of the ISNCSCI exam. Given competent examiners are a pre-requisite for reliable and valid assessments, it is important those performing the exam have the correct knowledge and skill to do so (10). Continued training and the use of resources such as the ISNCSCI worksheet, computerized algorithms (ISNCSCI algorithms) and continued training are essential to ensure accurate scoring, scaling and classification of the ISNCSCI (28).



# Clinical Resources & References

# RESOURCES

Common errors made during the ISNCSCI examination (YouTube video) https://www.youtube.com/watch?v=PpgGzIhCpuI

ISNCSCI Eighth Edition Booklet (open source) https://meridian.allenpress.com/tscir/article/27/2/1/465525/International-Standards-for-Neurological

ISNCSCI Worksheet (including translations) https://asia-spinalinjury.org/isncsci-worksheet-now-available-in-other-languages/

Modified ISNCSCI Worksheet for Canadian SCI Registry (modified with permission from ASIA) https://praxisinstitute.org/research-care/neurology-toolkit-resources/

Motor and Sensory Guidebook https://asia-spinalinjury.org/wp-content/uploads/2016/02/Motor\_Exam\_Guide.pdf https://asia-spinalinjury.org/wp-content/uploads/2016/02/Key\_Sensory\_Points.pdf

ASIA E-Learning Centre (InSTeP & WeeSTeP) https://asia-spinalinjury.org/learning/

ISNCSCI Algorithm https://www.isncscialgorithm.com/

E-ISNCSCI https://asia-spinalinjury.org/expedited-isncsci-exam/

ASIA's ISNCSCI Patient Brochure https://asia-spinalinjury.org/wp-content/uploads/2022/12/11.18.22-ISNCSCI-Patient-Brochure.pdf

SCIRE Professional https://scireproject.com/outcome/ais/

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