NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURIES (ASIA/ISNCSCI SCALE, REVISED 2015)

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In 1992, the ASIA classification was recognized by the International Medical Society of Paraplegia (IMSOP), acquiring the status of International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI-92) [10-12]. Since then, the ASIA classification has undergone several reviews and updates, the last of which was in 2015 [13-21]. At present, it is recognized by almost all organizations worldwide involved in spinal cord injuries [1, 20, 21].

Although the ASIA/ISNCSCI standards had been established for traumatic impairments of the spinal cord, they are also used for evaluating the neurological status of patients with other pathological spinal conditions, such as those with tumors and infections.

The aim of this study is to introduce practitioners to the 2015 version of ASIA/ISNCSCI.

General characteristics of the ASIA/ISNCSCI classification.

With the ASIA/ISNCSCI classification, neurological examination is strictly standardized and is conducted with the patient lying on their back. The level of spinal cord injury is determined as with neurological testing. All the obtained results are written in a standardized form. Figures 1 and 2 demonstrate the original form and testing instructions presented on the website of the American Spinal Injury Association [20, 21], and Figures 3 and 4 show the translated Russian version.

The algorithm for spinal cord assessment involves the consecutive determination of the following injuries: sensory levels of injury on the left and right, motor levels of injury on the left and right, neurological level of injury, extent of the injury (complete or partial), and level of spinal cord injury.

The system of sensory testing is based on the dermatome map. A dermatome is an area of skin innervated by a particular segment of the spinal cord. A total of 28 key sensory points correlate to each of the spinal cord segments: C2-1 cm around the occipital prominence, C3-supraclavicular fossa, C4-top of the acromioclavicular joint, C5-lateral side of the antecubital fossa, C6-thumb (dorsal surface, proximal phalange), C7-middle finger (dorsal surface, proximal phalange), C8-little finger (dorsal surface, proximal phalange), T1-medial side
of the antecubital fossa, T2-top of the axilla, T3-third intercostal space on the midclavicular line, T4-fourth intercostal space on the midclavicular line (nipple level), T5-fifth intercostal space on the midclavicular line, midway between the nipple and the xiphoid, T6-xiphoid level on the midclavicular line, T7-upper-fourth of the space between the xiphoid and the navel (on the midclavicular line), T8-midway between the xiphoid and the navel (on the midclavicular line), T9-lower-fourth of the space between the xiphoid and the navel (on the midclavicular line), T10-navel level on the midclavicular line, T11-midway between the navel and the inguinal ligament (on the midclavicular line), T12-middle of the inguinal fold (on the midclavicular line), L1-midway between T12 and L2, L2-halfway between the middle of the inguinal ligament and the medial condyle of the femur, L3-medial condyle of the femur above the knee, L4-top of the medial malleolus, L5-dorsal surface of the foot down to the level of the third metatarsophalangeal joint, S1-lateral surface of the heel, S2-middle of the popliteal space, S3-ischial tuberosity, S4-S5-perianal zone (<1 cm around the anal edge).

Tactile sensitivity is assessed by touch with a piece of cotton or a brush (this tests the function of the posterior columns of the spinal cord), and pain sensitivity is assessed by pricking (to test the function of the spinothalamic tract). Sensitivity is scored from 0 – no sensation, 1 – disordered/modified sensation (reduced or hypersensitivity), to 2 – normal sensation. The obtained scores are added together. The maximum score for sensitivity on each side is 56. NT, which stands for “not tested,” is used if it is impossible to assess sensitivity (in cases of immobilization, acute pain, limb amputation, and contraction affecting...
> 50% of the normal scope of mobility). If it is impossible to differentiate a prick from a touch, it is assessed as absence of pain sensitivity.

The level of sensory injury is determined as the most caudal dermatome with intact pain and tactile sensitivity.

In addition, sensory function of the most caudal segments of the spinal cord (S4-S5) is determined by slight finger pressure on the anorectal wall (anorectal pressure). Testing of anorectal sensitivity is necessary to define if there is complete or partial injury.

The system of motor function testing is based on the estimation of muscle strength in 10 key groups of muscles correlated to spinal cord segments: C5-forearm flexors, C6-wrist extensors, C7-forearm extensors, C8-finger flexors, T1-muscles retracting fingers (little finger), L2-femur flexors, L3-knee extensors, L4-ankle flexors, L5-great toe extensors, S1-plantar foot flexors. The T2-T12 myotomes are not tested. Muscle strength is estimated on each side using a 6-point Medical Research Council (MRC) scale (Table 1). The obtained scores are combined. The maximum score for the 10 segments on each side is 50. If strength cannot be tested for some reason, then NT is used. Motor function of the most caudal spinal cord segments (S4-S5) is tested by eliciting anal contraction on rectal touching.

**Motor level is defined as the most caudal spinal cord segment, with the strength of key muscles not less than 3 points, provided that the muscles of the segment above have normal strength (5 points).**

In the areas where there are no indications for myotome testing, the level of motor injury is estimated using the sensory scale, provided that the tested motor function above this level complies with the standard.

The neurological level of injury is determined based on the assessment of sensory and motor function.

**The level of neurological injury is the most caudal spinal cord segment with intact sensory function and key muscle strength of 3 points and higher if there is normal (initial) sensory and motor function in the rostral segments. Neurological level is the most cranial of sensory and motor levels.**

After estimating the function of the most caudal spinal cord segments (S4-S5), it is necessary to determine if the impairment is complete or partial. The impairment is considered complete if there is no voluntary contraction of the anus and no sensation of anorectal pressure. If contraction of the anal sphincter is possible, spinal cord injury is deemed partial regardless of any other data. In complete injuries, partially undamaged areas are fixed (the dermatome with the lowest location on each side or myotome with partial innervation).

The final stage is estimation of the level of spinal cord injury, according to the ASIA Impairment Scale (AIS) (Table 2).

**Table 1**

<table>
<thead>
<tr>
<th>Score</th>
<th>Muscle strength characteristic</th>
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<tbody>
<tr>
<td>0</td>
<td>Complete palsy</td>
</tr>
<tr>
<td>1</td>
<td>Palpable or visible muscle contraction</td>
</tr>
<tr>
<td>2</td>
<td>Complete active movements without overcoming gravity</td>
</tr>
<tr>
<td>3</td>
<td>Complete active movements overcoming gravity</td>
</tr>
<tr>
<td>4</td>
<td>Complete active movements overcoming gravity and small external resistance</td>
</tr>
<tr>
<td>5</td>
<td>(Normal) complete active movements overcoming gravity and maximum external resistance</td>
</tr>
</tbody>
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**Table 2**

<table>
<thead>
<tr>
<th>Level of impairment</th>
<th>Criteria</th>
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<tr>
<td>A Complete</td>
<td>no sensory or motor functions in segments S4–S5</td>
</tr>
<tr>
<td>B Partial with retained sensitivity</td>
<td>sensation under the neurological level is retained, including segments S4–S5 (touch or prick or anorectal pressure); no motor function more than three levels below motor level on both sides.</td>
</tr>
<tr>
<td>C Partial with retained movements</td>
<td>motor (voluntary anal contraction) or sensory (touch or prick, or anorectal pressure) function of segments S4–S5 is retained; partial motor function at more than three levels below the ipsilateral motor level on both sides; less than half of the key muscles below the neurological level have strength ≥ 3 points.</td>
</tr>
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**Table 1**

Muscle strength assessment based on the MRC scale (Medical Research Council Scale, 1981)

**Table 2**

Scale of Spinal Cord Impairment Severity (AIS)
**Level of impairment** | **Criteria**
---|---
**D** | Partial with retained movements. Motor (voluntary anus traction) or sensory (touch or prick, or anorectal pressure) function of segments S4–S5 is retained; there is motor function at more than three levels below the ipsilateral motor level on both sides; half or more of key muscles below neurological level have strength of ≥3 points.

**E** | Norm sensitive and motor function of all spinal cord segments comply with the norm.

**Note:** In patients with injury class determined as B: for more accurate classification (differentiation between B and C), secondary muscles more than three levels below the motor level on both sides are tested. Persons who have no spinal cord injury are not tested using this scale.

**Conclusion**

At present, the ASIA classification is the most relevant way of estimating the neurological status of patients with spinal cord injury. Its main advantages include strict standardization of neurological examination in patients lying on their back, having the minimum sufficient scope of neurological examination for determining the level of impairment, quantitative interpretation of the obtained results, availability of a standardized form for neurological examination, and the possibility of conducting neurological testing not only by a neurologist, but also by other specialists (traumatologist and vertebrologist). These advantages make the results of neurological examination more authentic and comparable. The main disadvantage of using the ASIA scale is the testing duration. Therefore, in time-poor situations, clinicians often prefer to use the less precise qualitative Frankel’s scale.

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**References**


INTERNATIONAL STANDARDS FOR МЕЖДУНАРОДНЫЕ СТАНДАРТЫ НЕВРОЛОГИЧЕСКОЙ КЛАССИФИКАЦИИ ТРАВМЫ СПИННОГО МОЗГА (ШКАЛА ASIA/ISNCSCI, ПЕРЕСМОТР 2015 ГОДА)

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Стандартизация неврологического осмотра и формулирования неврологического заключения при спинальной травме является актуальной проблемой нейротравматологии. В настоящее время практически все организации в мире, занимающиеся проблемой спинальной травмы, используют международные стандарты неврологической классификации травмы спинного мозга (International Standards for Neurological Classification of Spinal Cord Injury, сокращенно ISNCSCI), разработанные Американской ассоциацией спинной травмы (ASIA) и утвержденные в 1992 году. Стандарты ASIA/ISNCSCI представляют собой унифицированную количественную систему оценки неврологического статуса у пациентов с травматическими повреждениями спинного мозга. С 1992 года шкала ASIA/ISNCSCI неоднократно пересматривалась и обновлялась. Демонстрируется пересмотренная и обновленная в 2015 году версия международных стандартов неврологической классификации травмы спинного мозга, представленная на сайте Американской ассоциации спинной травмы, переведенная на русский язык и инструкция тестирования.

Ключевые слова: травма спинного мозга, международные стандарты неврологической классификации травмы спинного мозга, Американская ассоциация спинной травмы, неврологический уровень, шкала ASIA.
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