# Updates for the International Standards for Neurological Classification of Spinal Cord Injury

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**KEYWORDS**

• Spinal cord injury • International Standards • Classification • Neurologic level

**KEY POINTS**

- The latest changes to the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) were made in 2011 and 2013.
- The purpose of the ISNCSCI remains to allow for accurate communication between clinicians and researchers working in the field of spinal cord injury (SCI).
- The ISNCSCI continues to evolve based on feedback from professionals in SCI.

## HISTORICAL BACKGROUND AND REVISIONS

Accurate communication between clinicians and researchers working with SCI patients requires that standards be used in the classification of neurologic impairment.[1] Such a standardized method is important to help document the course of recovery and the effect of interventions in the treatment of SCI, including regeneration.[2] To this end, the American Spinal Injury Association (ASIA) first developed and published the *Standards For Neurological Classification Of Spinal Injury Patients* in 1982,[1] which has since become the most widely used classification in the field.

Prior to this, in an attempt for consistency of definitions in 1969, a questionnaire was completed by leading physicians in the field of SCI to establish international agreement on neurologic terminology for SCI and to compare their opinions on the best time to accurately predict outcome after SCI. Their recommendations were

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published, but there was no agreement on the overall classification of SCI.[3] Several classifications for SCI were subsequently proposed based on bony patterns of injury, mechanism of injury, neurologic function, and functional outcome.[4–10] In 1969, Frankel and colleagues[11] described a 5-grade system of classifying traumatic SCI, with a division into complete (A) and 4 incomplete (B–E) injury grades. The purpose of this article was to describe results of postural reduction in the treatment of SCI, and they described their classification as "crude." ASIA's first booklet of the *Standards For Neurological Classification Of Spinal Injury Patients*,[1] published in 1982, incorporated the Frankel grades A–E along with an introduction of motor testing of key muscle groups and sensory testing in 29 dermatomes. These standards defined or described the following:

- Clarification of injury based on neurologic complete and incomplete injuries based on sparing below the level of injury
- Neurologic zone of injury (NLI)
- Quadriplegia, quadraperesis, paraplegia, and paraparesis
- Zone of injury up to 3 neurologic segments at the point of damage to the spinal cord where there is frequently some preservation of motor and/or sensory function
- Anatomic incomplete clinical syndromes (eg, central cord syndrome [CCS])

The standards from 1982 were refined by ASIA over the next 10 years, involving input from SCI clinicians and researchers.[12–15] Changes included the use of specific key areas with anatomic landmarks to define the sensory level, combining the S4 and S5 dermatomes into a single S4-5 dermatome (perianal area), reducing the total number of dermatomes to 28, and redefining the zone of injury as the zone of partial preservation (ZPP) of sensory and/or motor function. Other changes included having only the elbow flexors examined to test the C5 myotome, clarification of muscle grading in the determination of motor levels, and clarification of the Frankel classification in terms of the degree of incompleteness (Frankel grade C vs D) as recommended by Tator and colleagues.[13] Use of the terms, *quadraparesis* and *paraparesis*, was discouraged because they imprecisely described incomplete lesions.

In 1992, the fourth revision of the ISNCSCI was published.[16] The key change of this major revision was the replacement of the Frankel classification with the ASIA Impairment Scale (AIS), with a major change in adopting the sacral sparing definition to determine the completeness of the injury. The sacral sparing definition of the completeness of the injury was considered a more stable definition, because fewer patients convert from incomplete to complete status over time postinjury.[17] The AIS, similar to the Frankel scale, described 5 different severities of SCI. Other features of the 1992 revision included

- Incorporating the Functional Independence Measure (FIM)
- Printing of the key sensory points
- Testing pinprick and light touch separately on a 3-point scale
- Sensory index scoring
- Motor level changed such that a grade 4 on testing was no longer considered normal, unless it was examiner judgment that certain inhibiting factors, such as pain, positioning of the patient, hypertonicity, or disuse inhibited full effort
- Modification of the definition of the ZPP
- Optional tests (position sense, vibration, and additional muscles to better localize the level of the lesion) were added
- *Tetraplegia* introduced, as preferred to the term, *quadriplegia.*