

Communication

Not peer-reviewed version

Anorectal Examination Can Be Crucial in Classifying Spinal Cord Injuries, but There Is Much More to Explore—It Is One Piece of the Puzzle, but Not the Entire Puzzle

[Alfredo A. Lopes](#)*, [Augusta Silva](#), João Luz

Posted Date: 25 March 2026

doi: 10.20944/preprints202603.1996.v1

Keywords: spinal cord injury; AIS A; anorectal examination; discomplete spinal cord injury; Neurological Classification; rehabilitation



Preprints.org is a free multidisciplinary platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This open access article is published under a [Creative Commons CC BY 4.0 license](#), which permit the free download, distribution, and reuse, provided that the author and preprint are cited in any reuse.

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Communication

Anorectal Examination Can Be Crucial in Classifying Spinal Cord Injuries, but There Is Much More to Explore—It Is One Piece of the Puzzle, but Not the Entire Puzzle

Alfredo A. Lopes ^{1,*}, Augusta Silva ² and João Luz ³

¹ CIR, ESS, Polytechnic of Porto, and Centro Hospitalar Universitário de Santo António, Unidade Local de Saúde de Santo António, Departamento de Neurociências, Porto, Portugal.

² CIR, ESS, Polytechnic of Porto, Portugal

³ Southern Center for Physical Medicine and Rehabilitation, São Brás de Alportel, Portugal

* Correspondence: adl@ess.ipp.pt

Abstract

The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) are widely used to classify spinal cord injuries, with the absence of deep anal pressure and voluntary anal contraction defining complete injury (AIS A). However, growing evidence challenges the reliability and validity of anorectal examination as the sole determinant of injury completeness. Several studies demonstrate that individuals clinically classified as AIS A may retain residual sensory or motor conduction detectable through neurophysiological methods, such as somatosensory and motor evoked potentials. These findings question the clinical and prognostic value of the complete versus incomplete distinction and highlight limitations in current classification approaches. This paper argues for a more integrative assessment framework that combines standard clinical examination with neurophysiological data and patient-reported outcomes. Such an approach may improve sensitivity in detecting residual neural function, enhance prognostic accuracy, and support more individualized rehabilitation strategies. Furthermore, shifting toward a model that emphasizes preserved function and neuroplastic potential may provide a more meaningful understanding of spinal cord injury. Ultimately, refining rather than replacing existing standards could lead to a more comprehensive and clinically relevant classification system.

Keywords: spinal cord injury; AIS A; anorectal examination; discomplete spinal cord injury; Neurological Classification; rehabilitation

The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) are standardised guidelines that describe how to assess and classify spinal cord injuries. They were developed by the American Spinal Injury Association (ASIA) and the International Spinal Cord Society. It is a global reference in clinical practice and spinal cord injury research, and was developed with the aim of standardising the neurological assessment of spinal cord injuries (Kirshblum et al, 2014).

The official ISNCSCI definition defines the American Impairment Scale A (AIS A) as the absence of any sensory or motor function in the sacral segments, including the absence of Deep Anal Pressure (DAP) and Voluntary Anal Contraction (VAC) (Kirshblum et al, 2014). However, there are some controversies and evidence pointing to limitations in this approach, questioning the validity and reliability of the anorectal examination as the sole determinant of complete neurological spinal cord injury (AIS A) (Awad, et al, 2020; Wahlgren, et al, 2021; Awad, et al, A., 2015; Sherwood, et al, 1992; Chiu, et al, 2024). They also question whether the distinction between complete and incomplete spinal cord injury is really useful for predicting patients' functional recovery, as in the study by van

Middendorp et al, (2009), a multicentre prospective study involving 432 patients with spinal cord injury, who were assessed in the acute phase (up to 15 days after injury), revealed that although sacral preservation criteria are useful, not all components have the same prognostic value and that S4–S5 sensitivity and voluntary anal contraction are more effective in predicting functional recovery than the general classification of complete or incomplete injury.

The assessment of anal sensitivity, deep anal pressure, and voluntary anal sphincter contraction is essential to determine whether the spinal cord injury is complete or incomplete, which is fundamental for the AIS classification (Donovan, 2018). However, Marino (2018) questions the usefulness of the anorectal examination, pointing out that it may be unreliable, especially in patients with cognitive impairment, explaining that the components of the examination, such as DAP and VAC, have limited reliability and may not accurately reflect the preservation of sensory or motor function. Furthermore, the definition of ‘sacral sparing’ used to determine whether the injury is complete or incomplete is based on limited data and may not accurately predict patients’ functional recovery, and that the anorectal examination used in the classification of spinal cord injuries should be replaced by other more reliable neurological tests in many cases.

Thus, scientific articles and clinical reports began to document “incomplete spinal cord injury”, i.e., situations in which there is neurophysiological evidence of residual conduction despite being clinically classified as a complete AIS A injury. For example, the study by Awad et al, (2020) investigated residual sensory conduction in individuals with clinically complete spinal cord injury using somatosensory stimulation and fMRI, and demonstrated that about half (50% of complete clinical cases) of the cases had evidence of residual sensory conduction, suggesting the presence of ‘incomplete SCI.’ Or the cross-sectional study by Wahlgren et al. (2021), where techniques such as sensory evoked potentials (SSEPs), laser evoked potentials, motor evoked potentials (MEPs), sympathetic skin responses, and EMG were used in patients with clinically complete SCI, and found that there is neurophysiological evidence of incompleteness in a significant proportion of clinical cases (17–39%).

There is also a case study that presents preserved somatosensory conduction in a complete cervical spinal cord injury (Awad et al, 2015). This clinical case presents preserved somatosensory conduction, despite the standard clinical examination being consistent with AIS A. Or the study by Sherwood et al, (1992) which describes the original definition of ‘incomplete SCI’, with neurophysiological evidence of remaining connections (EMG, reflexes, response to stimuli) in clinically complete lesions.

Similarly, the Chiu et al, (2024) study demonstrated that evoked potentials can reveal residual conduction even when clinical examination suggests an absence of function, i.e., the presence of detectable somatosensory evoked potentials (SSEPs) in AIS A patients was associated with better functional outcome, indicating that somatosensory evoked potentials may reflect residual conduction not captured in clinical examination.

Thus, precision instruments, such as somatosensory evoked potentials (SSEPs), can assess afferent (sensory) conduction through the dorsal columns to the cortex; laser evoked potentials (LEPs) assess the spinothalamic pathway (pain/temperature); Motor Evoked Potentials (MEPs) that assess corticospinal efferent conduction; High Sensitivity EMG (Motor Unit Analysis) that assesses subclinical motor activity; Sacral and Polysynaptic Reflexes that demonstrate segmental integrity; Sympathetic Skin Response (SSR) that assesses the descending autonomic pathway or fMRI and Functional Neuroimaging that assess cortical activation in response to stimuli below the lesion are used to detect cases of incompleteness, however, they are difficult to apply in regular clinical practice (Nierula et al, 2024).

Nevertheless, some authors have attempted to associate manifestations witnessed by individuals with possible incomplete spinal cord injury, such as neuropathic pain, spasticity, and/or abnormal sensations, but without success due to small sample sizes and, consequently, low statistical power to establish this link. The results revealed strong neurophysiological evidence of incomplete spinal cord injury in 17% (4/23) of participants. If also accepting ‘possible evidence’, the incomplete

group comprised 39% (9/23). The remaining 61% showed no neurophysiological evidence of incompleteness. However, if also counting reports of subjective sensation elicited during neurophysiological testing in the absence of objective findings, 52% (12/23) showed indication of incomplete spinal cord injury (Wahlgren et al, 2021).

These results raise a pertinent question: would it not be important to collect the clinical manifestations reported by patients with AIS A injury and then combine with neurophysiological information?

This perspective highlights the need to move towards a more sensitive and integrative approach in the neurological assessment of spinal cord injury. Rather than replacing existing instruments such as the ISNCSCI, this reflection supports their refinement through the incorporation of complementary dimensions, including neurophysiological data and systematically collected patient-reported clinical manifestations. Such integration could enhance the sensitivity of current tools, allowing clinicians to detect residual conduction that is not captured by standard examination, and ultimately contribute to a more accurate classification of injury severity.

Furthermore, advancing towards a more comprehensive assessment model may allow the development of structured functional profiles that better reflect the true neurological and functional status of individuals with spinal cord injury. By combining clinical examination with electrophysiological findings and patient-reported experiences, it may be possible to build a more faithful representation of each patient's condition. This, in turn, could improve prognostic accuracy, support more individualized rehabilitation strategies, and contribute to a more clinically meaningful understanding of what constitutes "complete" versus "incomplete" spinal cord injury.

Importantly, this reflection also invites a shift in perspective - from a deficit-oriented model to one that actively seeks to identify preserved capacities and latent potential for recovery. Rather than focusing predominantly on confirming the absence of function through standardized tests, clinical assessment should increasingly aim to detect how the nervous system responds and adapts to sensory input. This approach aligns with contemporary motor control and neuroscience frameworks, which emphasize the adaptive, dynamic nature of the nervous system. By exploring responsiveness to different sensory modalities and identifying subtle signs of preserved integration or modulation, clinicians may gain insight into the system's capacity for reorganization. Such a perspective not only enhances the sensitivity of assessment but also provides a more meaningful foundation for guiding rehabilitation, centred on the individual's adaptability and potential for functional recovery.

In conclusion, although the absence of DAP and VAC remains the official criterion for AIS A classification, there is literature that questions the reliability and validity of these tests in isolation, and shows that this absence does not necessarily imply absolute absence of conduction or neurological connectivity below the injury. In other words, they do not always translate into a 'physiologically complete injury,' as there are reported cases of patients classified as AIS A but with partial preservation of neural pathways that were not captured by the standard ISNCSCI exam.

No single method is sufficient, and it may be important to include in AIS A cases the search for conditions of incompleteness through a convergence of the patient-reported clinical manifestations and neurophysiological information, to complete the puzzle.

References

- Kirshblum, S. C., Biering-Sørensen, F., Betz, R., Burns, S., Donovan, W., Graves, D. E., Johansen, M., Jones, L., Mulcahey, M. J., Rodriguez, G. M., Schmidt-Read, M., Steeves, J. D., Tansey, K., & Waring, W. (2014). International standards for neurological classification of spinal cord injury: cases with classification challenges. *Topics in spinal cord injury rehabilitation*, 20(2), 81–89. <https://doi.org/10.1310/sci2002-81>
- Awad, A., Levi, R., Waller, M., Westling, G., Lindgren, L., & Eriksson, J. (2020). Preserved somatosensory conduction in complete spinal cord injury: Discomplete SCI. *Clinical neurophysiology : official journal of the International Federation of Clinical Neurophysiology*, 131(5), 1059–1067. <https://doi.org/10.1016/j.clinph.2020.01.017>

- Wahlgren, C., Levi, R., Amezcua, S., Thorell, O., & Thordstein, M. (2021). Prevalence of discomplete sensorimotor spinal cord injury as evidenced by neurophysiological methods: A cross-sectional study. *Journal of rehabilitation medicine*, 53(2), jrm00156. <https://doi.org/10.2340/16501977-2774>
- Awad, A., Levi, R., Lindgren, L., Hultling, C., Westling, G., Nyberg, L., & Eriksson, J. (2015). Preserved somatosensory conduction in a patient with complete cervical spinal cord injury. *Journal of rehabilitation medicine*, 47(5), 426–431. <https://doi.org/10.2340/16501977-1955>
- Sherwood, A. M., Dimitrijevic, M. R., & McKay, W. B. (1992). Evidence of subclinical brain influence in clinically complete spinal cord injury: discomplete SCI. *Journal of the neurological sciences*, 110(1-2), 90–98. [https://doi.org/10.1016/0022-510x\(92\)90014-c](https://doi.org/10.1016/0022-510x(92)90014-c)
- Chiu, A. K., Bustos, S. P., Hasan, O., Henry, L. E., Oster, B. A., Ratanpal, A. S., Padovano, R., Brush, P. L., Pease, T. J., Smith, R. A., Jauregui, J. J., Bivona, L. J., Cavanaugh, D. L., Koh, E. Y., Vaccaro, A. R., & Ludwig, S. C. (2024). Lower Extremity Somatosensory Evoked Potentials Predict Functional Outcomes in Complete Traumatic Cervical Spinal Cord Injury. *World neurosurgery*, 182, e301–e307. <https://doi.org/10.1016/j.wneu.2023.11.104>
- van Middendorp, J. J., Hosman, A. J., Pouw, M. H., EM-SCI Study Group, & Van de Meent, H. (2009). Is determination between complete and incomplete traumatic spinal cord injury clinically relevant? Validation of the ASIA sacral sparing criteria in a prospective cohort of 432 patients. *Spinal cord*, 47(11), 809–816. <https://doi.org/10.1038/sc.2009.44>
- Donovan W. H. (2018). The importance of the anal exam in neurologic classification of spinal cord injury. *Spinal cord series and cases*, 4, 4. <https://doi.org/10.1038/s41394-017-0014-y>
- Marino R. J. (2018). The anorectal exam is unnecessary!. *Spinal cord series and cases*, 4, 3. <https://doi.org/10.1038/s41394-017-0013-z>
- Nierula B, Stephani T, Bailey E, Kaptan M, Pohle L-MG, Horn U, et al. (2024) A multichannel electrophysiological approach to noninvasively and precisely record human spinal cord activity. *PLoS Biol* 22(10): e3002828. <https://doi.org/10.1371/journal.pbio.3002828>

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.