

Autonomically incomplete SCI following motor/sensory complete paralysis: Electrodiagnostic evidence and clinical implications

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Background:

Current clinical practice relies on bedside motor/sensory testing, assuming autonomic level/completeness mirrors this. This default position may not always be true and has implications for clinical secondary complications (dysreflexia, orthostatic hypotension, neurogenic bladder/bowel/skin).

Objective:

Describe preserved sympathetic neural firing patterns below the level of spinal cord injury.

Design:

Physiologic laboratory testing

Methods:

Following complete spinal cord injury (AIS A), detailed autonomic characterization was performed with isometric hand grip to fatigue and hand/foot cold pressor test (above/below level of injury). Muscle sympathetic nerve activity was recorded below the level of injury along with continual heart rate/blood pressure. Resting baselines were compared to testing condition to identify preserved sympathetic activity. Health history was further recorded for clinical autonomic complications.

Results:

Low levels of baseline sympathetic nerve activity were observed at rest (2.2 spikes/100 heartbeats). Isometric hand grip did not increase baseline sympathetic firing rate, though following completion (with accompanying blood pressure fall), sympathetic activity increased 7-fold for 100 heartbeats. Hand cold pressor test, where the hand is immersed in ice, showed a decrease in below level sympathetic activity during the test. Again, in the 100 subsequent heartbeats, sympathetic firing increased 7-fold. Foot cold pressor test did not increase sympathetic firing during the test or after. History of clinical autonomic complications were well below expected.

Clinical History:

T2 AIS A of 25 years duration. Less than 3 UTIs treated with antibiotics ever. No history of pressure injuries. Bowel program consistently lasts <60 minutes on average. No hospitalizations within in last 15 years. One symptomatic episode of autonomic dysreflexia since injury (broken leg).

Conclusion:

Following motor/sensory complete SCI, electrodiagnostics can identify preserved autonomic activity. This activity appears to be selectively engaged in the setting of large blood pressure decreases and autonomically incomplete SCI appears related to minimal clinical complications.

References:

1. Draghici AE, Taylor JA. Baroreflex autonomic control in human spinal cord injury: physiology, measurement, and potential alterations. *Autonomic Neuroscience*. 2018;209:37-42.
2. Berger MJ, Dorey T, Nouraei H, Krassioukov AV. Test-retest reliability of the Valsalva maneuver in spinal cord injury. *The Journal of Spinal Cord Medicine*. 2020 Aug 14:1-8.
3. Previnaire JG, Soler JM, Leclercq V, Denys P. Severity of autonomic dysfunction in patients with complete spinal cord injury. *Clinical Autonomic Research*. 2012 Feb;22(1):9-15.
4. Berger MJ, Kimpinski K, Currie KD, Nouraei H, Sadeghi M, Krassioukov AV. Multi-domain assessment of autonomic function in spinal cord injury using a modified autonomic reflex screen. *Journal of neurotrauma*. 2017 Sep 15;34(18):2624-33.
5. Hubli M, Bolt D, Krassioukov AV. Cold pressor test in spinal cord injury—revisited. *Spinal cord*. 2018 Jun;56(6):528-37.

