

SPINAL SHOCK

KEY POINTS

- Spinal shock is a total or near-total areflexia with the complete loss or suppression of motor function and sensation distal to the anatomical lesion.
- Spinal shock can persist from days to weeks, and it can be prolonged due to toxic or septic syndromes.
- The end of spinal shock for most patients is seen with the early return of the deep plantar reflex and with the bulbocavernosus, cremasteric, ankle jerk, Babinski sign, and knee jerk recovering in a progressive order.

Spinal shock refers to the sudden and transient depression of neural function below the level of an acute spinal cord lesion after injury.¹ The term is often a source of confusion for providers, frequently applied incorrectly to describe hypovolemic shock and/or neurogenic shock, leading to the risk of patient mismanagement. Spinal shock causes a temporary or permanent, complete or near-complete segmental interruption of neurotransmission. It is seen as a total or near-total areflexia, as well as the complete loss or suppression of motor function and sensation distal to the anatomical lesion.² Assumptions on the extent of injury based on physical exam during spinal shock are unreliable. Do not delay emergent, decompressive interventions.

Spinal shock following SCI is associated with a high energy fracture-dislocation, ligamentous injury, and rotational distraction. It is most common in men (80 percent) and the young (average age 29 years).³ Major mechanisms of injury associated with spinal shock include motor vehicle crashes (45 percent), and SCI associated with domestic injuries or falls (34 percent).³ Controversy exists regarding the association of spinal shock with patient prognosis; however, the magnitude of spinal shock is proportional to the severity and rapidity of anatomic injury.⁴

- The temporal evolution of SCI with spinal shock is well described from animal model studies.⁴
- Initially hemorrhage and protein extravasation are seen at the spinal level of direct injury.
- By four hours, central hemorrhagic necrosis is present in the entire central gray matter and the adjacent white matter.

- By 24 hours, the central gray matter and most of the white matter are necrotic.
- Edema of the spinal cord peaks by day three to six, and it may persist for up to two weeks.
- Two months following injury, only the outer rim of white matter is present.
- By one to two years, cavity healing occurs with the resorption of necrotic debris and autolysis due to lysosomal accumulation.

For less severe injuries, the surrounding white matter, with associated long neuronal tracts, may be preserved, potentially leading to an incomplete injury pattern. Rapidly enacted interventions for preservation (e.g., decompression and stabilization) are needed to avoid secondary injury related to hypoxemia or hypotension.

The loss of reflex function is common at the spinal cord level associated with direct injury. However, the more distal the origin of the cord reflex is from the site of injury, the higher the likelihood for preservation. Some patients with high cervical cord injuries are reported to retain distal sacral reflexes, specifically the bulbocavernosus and the anal wink.⁴ Do not confuse these spared reflexes with the sacral sparing associated with a partial SCI. Patients with spinal shock and a complete SCI lack sacral sensation. Reflexes immediately cranial to the injury may also become depressed because of the loss of ascending, distal cord influence.

Spinal shock can persist from days to weeks, and it can be prolonged due to toxic or septic syndromes. During the recovery period, neuronal healing, collateralization, and reorganization may occur. With the SCI-related lack of supraspinal inhibition, the re-innervation of posterior root axons can lead to spastic muscle spindle reflexes.⁴ Reflexive muscle spasticity does not indicate the end of spinal shock, it indicates the reorganization of local reflex arcs.

A lack of consensus exists to define the end of spinal shock. Providers may interpret the end of spinal shock from one of the following:⁵

- The appearance of the bulbocavernosus reflex, occurring within several days of injury,
- The return of deep tendon reflexes which can take several weeks,
- The return of reflexive bladder function.