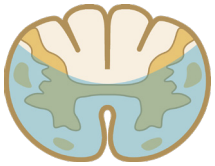
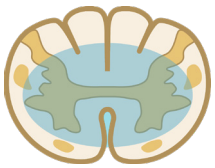
Spinal Injury Comparison Chart

	INJURY AND MECHANISMS	CLINICAL CHARACTERISTICS
Spinal Cord Concussion	A twisting or stretching injury that shuts down nerve transmission in the cord. Neurological deficits occur immediately after spinal trauma. An unusual injury.	A complete and sudden loss of motor function and sensation below the neurological level of injury (NLI) followed by full neurological recovery within 72 hours. No structural damage to the cord is evident on CT/MRI. A diagnosis of cord concussion can only be made once symptoms resolve.
SCIWORA	SCIWORA is an acronym for Spinal Cord Injury WithOut Radiographic Abnormality. In a SCIWORA (a.k.a. SCIWNA) injury, the cord is damaged, but the spinal bones are aligned and unfractured and the ligaments are intact. SCIWORA can occur in adults, but because of developmental differences in pediatric spinal structures, SCIWORA is most common in kids less than 8 years old. In a SCIWORA injury, the cord is stretched and damaged during a traumatic event, yet the ligaments and spinal bones pop back into place, leaving no evidence of injury on plain films or CT scans.	SCIWORA patients experience varying degrees of loss of sensation and function beyond the lesion, often associated with intense pain. Symptoms progress over several hours as the zone of edema and contusion expands. Because edema and contusions resolve over time, patients may experience some symptom improvement.
Epidural/Subdural Hematomas	Like the brain, the spinal cord is covered by three meningeal layers: the pia, arachnoid, and dura mater. As in the brain, bleeding can occur between these layers. Below C2, the spinal canal narrows rapidly and is almost entirely filled by the cord. There is no room for blood accumulation between the meninges.	Subdural and epidural hematomas are space-occupying lesions that compress the cord, compromise blood flow, and obstruct CSF circulation. Clinical findings are determined by the level of injury, the amount of blood in the canal, and its speed of accumulation. Look for progressive (rather than sudden) loss of neurological function.
Vascular Injury	Just as the brain can stroke because of carotid or vertebral artery trauma, injury or infarction to one or more of the vessels that supply the spinal cord will infarct the delicate cord. Unfortunately, the cord's blood supply seems backward. The anterior 2/3 of the spinal cord is supplied by a single spinal artery; no backup vessel exists. In contrast, the posterior 1/3 of the cord is perfused by two spinal arteries. Thus, the much smaller posterior cord has collateral circulation available if one vessel is damaged.	This pattern of vascular distribution leaves the anterior cord particularly vulnerable to infarction when its only artery is injured. Look for progressive loss of motor function and sensation below the NLI. In addition to direct vascular injury, spinal cord stroke can occur in trauma patients as a result of aortic injuries, aortic cross-clamping (e.g., during resuscitative thoracotomy), and with REBOA insertion because each of these conditions or interventions disrupts blood flow to the cord.
Complete Cord Injuries	Among younger patients, MVCs and other high-energy mechanisms are the usual SCI etiologies. In older adults, it's low-level falls. Although blunt trauma is by far the most common mechanism of complete cord injury, penetrating trauma has a much worse prognosis. Almost all penetrating SCI patients will sustain a complete cord lesion. Complete paraplegia–20% of SCIs Complete tetraplegia–12% of SCIs	Patients experience a sudden, total, and permanent loss of all motor function and sensation below the NLI. As edema and contusion resolve, the functional level of injury may improve (lower). Conversely, inadequate spinal motion restriction and episodes of hypoxemia or hypotension can raise the level of cord injury, exacerbating deficits. Every spinal level preserved will have a significant impact on a patient's long-term lifestyle.

Spinal Injury Comparison Chart *(page 2)*

	INJURY AND MECHANISMS	CLINICAL CHARACTERISTICS
Incomplete Cord Injuries	Incomplete cord injuries are more common than complete injuries, especially when the lesion is in the cervical region. There are four incomplete cord syndromes (see below). Patients with partial cord injuries retain some degree of function or sensation. Incomplete paraplegia–20% of SCIs Incomplete tetraplegia–47% of SCIs	Whether a lesion is complete or incomplete can only be determined once spinal shock has resolved. Any sign of preserved sensation or motor function in the perianal area (known as "sacral sparing") indicates the lesion is incomplete and is a good prognostic finding. Test for bulbocavernosus and anal reflexes to identify sacral sparing.
Anterior Cord Syndrome 	Anterior cord syndrome (an incomplete injury) is usually the result of hyperflexion or axial loading. Such forces cause the vertebrae to dislocate or shatter, forcing bone backward against the anterior portion of the spinal cord, which directly damages delicate neural tissue. Alternatively, anterior cord syndrome can be caused by anything that reduces perfusion to the single anterior spinal artery, because there is no collateral circulation.	Anterior cord syndrome affects all the functions patients care about the most. There is complete absence of motor function, as well as loss of pain and temperature sensations beyond the NLI. However, the senses of vibration and proprioception (knowing where the body is in space) are preserved. The prognosis for recovery after an anterior cord injury is poor.
Posterior Cord Syndrome 	Posterior cord syndrome—the rarest of the incomplete cord injuries—usually results from extreme hyperextension. The posterior cord (a.k.a. the dorsal column) is supplied by two spinal arteries, providing collateral circulation when one is damaged, potentially reducing injury severity.	Motor function and most sensations are preserved. Only the less important senses of vibration and proprioception are lost. Therefore, patients can have a relatively good functional outcome. Nevertheless, loss of proprioception makes walking difficult unless patients can see their feet.
Central Cord Syndrome 	Central cord syndrome is the most common of the incomplete cord injuries in adults, particularly older adults with spinal stenosis. This syndrome generally results from hyperextension, which squeezes the cord, referring most of the force to the cord's center.	Patients experience a strange form of paraplegia in which motor and sensory losses are greater in the upper extremities than in the lower. Fine hand movement is commonly affected, often permanently. Because edema and contusion may initially be pronounced, symptoms can improve over time as these conditions resolve.
Brown-Séquard Syndrome 	Brown-Séquard syndrome (a.k.a. hemicord syndrome or lateral hemisection) is a partial severing of the spinal cord, usually due to penetrating trauma. This incomplete cord syndrome can also be the result of disc herniation or hyperextension.	Patients present with preserved motor function and decreased sensation on one side of the body and impaired motor function with preserved sensation on the opposite side. When caused by penetrating trauma, the prognosis for recovery is poor, whereas injuries due to disc herniation may demonstrate improvement.
Lower Spinal Syndromes	Some injuries impact just the terminal portion of the spinal cord (the conus medullaris) or the group of nerve roots stemming from the distal end of the spinal cord (the cauda equina). Injuries affecting only the cauda equina (a.k.a. the horse's tail) are not true SCIs. Look for these injuries in trauma patients with low L-spine or pelvic fractures.	Conus medullaris and cauda equina syndromes are separate injuries, but they share overlapping anatomy and clinical presentation. Symptoms include: sudden-onset severe back or pelvic pain; perianal anesthesia; symmetric lower extremity motor weakness with hyperreflexia; and bowel, bladder, and sexual dysfunction. These patients may have preserved bulbocavernosus and anal reflexes.

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Spinal Injury Comparison Chart *(page 3)*

	INJURY AND MECHANISMS	CLINICAL CHARACTERISTICS
Spinal Shock	Spinal shock is the immediate but temporary loss of all spinal reflex activity below the level of a total or near-complete spinal cord injury. Symptoms usually resolve over several hours or a few days as muscle tone and anal reflexes return. The higher the cord lesion, the faster spinal shock resolves. In a patient with an incomplete cord syndrome, determining the extent of injury is not possible until spinal shock subsides.	Findings beyond the NLI include flaccid areflexia (no muscle tone), paralysis (no voluntary motor function), absence of sensation (hypoesthesia), loss of autonomic function, and bowel and bladder dysfunction. Once spinal shock abates, tone returns. Patients develop hyperreflexia, flexion contractures, and spastic paralysis requiring splints, braces, passive range of motion, antispasmodic drugs, and sometimes an implanted baclofen pump to control spasticity.
Neurogenic Shock	Neurogenic shock is distinctly different from spinal shock, although onset occurs at the same time and results from the same injury. Neurogenic shock is a form of distributive shock caused by impaired signal transmission to the sympathetic chain ganglia. Loss of sympathetic stimulation produces inadequate organ and tissue perfusion due to bradycardia, massive vasodilation, and relative hypovolemia in patients with cord injuries at or above T6. Neurogenic shock begins shortly after injury and resolves within 1-6 weeks.	The lack of sympathetic compensation makes neurogenic shock findings very different from other shock etiologies, causing problems with cardiac output due to both bradycardia and vasodilation. Look for a widened pulse pressure but good peripheral perfusion despite hypotension. Many routine care interventions (e.g., turning, suctioning) aggravate bradycardia. First, administer a moderate fluid challenge to fill the enlarged pipes and increase circulating volume. Then give vasopressors to restore vascular tone and keep MAP in the high-normal range.

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