SPINAL CORD INJURY

Sci

A damage of the spinal cord that causes changes in its function, either temporary or permanent.

⚠️ Risk factor 🧊 Male & Female

About Spinal cord injury

Spinal cord injury is any damage to the spinal cord, which have impact on its function temporary or permanently. These changes translate into loss of muscle function, sensation, or autonomic function (a division of the that supplies smooth muscle and glands, and thus influences the function of internal organs) in parts of the body served by the spinal cord below the level of the lesion.

Injuries (Pic. 1) can occur at any level of the spinal cord (Pic. 2) and can be classified as complete injury, a total loss of sensation and muscle function, or incomplete, meaning some nervous signals are able to travel past the injured area of the cord. Depending on the location and severity of damage along the spinal cord, the symptoms can vary widely, from pain or numbness to paralysis (a loss of muscle function) to incontinence (the loss of bladder control).

In the majority of cases the damage results from physical trauma such as car accidents, gunshots, falls, or sports injuries, but it can also result from nontraumatic causes such as infection, insufficient blood flow, and tumors.

Complications that can occur in the short and long term after injury include muscle atrophy (a decrease in the mass of the muscle), pressure sores, infections, and respiratory problems.

Treatment of spinal cord injuries starts with stabilizing the spine and controlling inflammation to prevent further damage. Other interventions can vary widely depending on the location and extent of the injury, from bed rest to surgery. In many cases, spinal cord injuries require substantial, long-term physical and occupational therapy in rehabilitation, especially if they interfere with activities of daily living.

The prognosis ranges widely, from full recovery in rare cases to permanent tetraplegia also called quadriplegia (paralysis that results in the partial or total loss of use of all four limbs and torso) in injuries at the level of the neck, and paraplegia (an impairment in motor or sensory function of the lower extremities) in lower injuries.

Symptoms

Signs (observed by a clinician) and symptoms (experienced by a patient) vary depending on where the spine is injured and the extent of the injury.

A section of skin innervated through a specific part of the spine is called a dermatome (Pic. 3), and injury to that part of the spine can cause pain, numbness, or a loss of sensation in the related areas. Paraesthesia, a tingling or burning sensation in affected areas of the skin, is another symptom. A person with a lowered level of consciousness may show a response to a painful stimulus above a certain point but not below it.

A group of muscles innervated through a specific part of the spine is called a myotome, and injury to that part of the spinal cord can cause problems with movements that involve those muscles. The muscles may contract uncontrollably, become weak, or be completely paralysed.
The specific parts of the body affected by loss of function are determined by the level of injury.

**Cervical**

Spinal cord injuries at the cervical (neck) level result in full or partial tetraplegia. Depending on the specific location and severity of trauma, limited function may be retained.

Additional signs and symptoms of cervical injuries include low heart rate, low blood pressure, problems regulating body temperature, and breathing dysfunction. If the injury is high enough in the neck to impair the muscles involved in breathing, the person may not be able to breathe without the help of mechanical ventilator.

**Thoracic**

In addition to the problems found in lower-level injuries, thoracic (chest height) spinal lesions can affect the muscles in the trunk.

Injuries at the level of T1 (1st thoracic vertebra) to T8 (8th thoracic vertebra), result in inability to control the abdominal muscles. Trunk stability may be affected; even more so in higher level injuries. The lower is the level of injury, the less extensive is its effects.

Injuries from T9 (9th thoracic vertebra) to T12 (12th thoracic vertebra), result in partial loss of trunk and abdominal muscle control.

Thoracic spinal injuries result in paraplegia, but function of the hands, arms, and neck are not affected.

**Lumbosacral**

The effects of injuries at or above the lumbar or sacral regions of the spinal cord (lower back and pelvis) include decreased control of the legs and hips, genitourinary system, and anus.

People injured below level L2 (2nd lumbar vertebra) may still have use of their hip flexor (a muscle that serves to flex or bend a part of the body) and knee extensor (a muscle that serves to extend or straighten a part of the body) muscles. Bowel and bladder function are regulated by the sacral region.

It is common to experience sexual dysfunction after injury, as well as dysfunction of the bowel and bladder, including fecal and urinary incontinence. It is also possible for the bladder to fail to empty, leading to a potentially harmful buildup of urine. One sign of spinal cord injury that emergency providers may find is priapism (a painful, involuntary, prolonged erection unrelated to sexual stimulation and unrelieved by ejaculation).

**Associated diseases**

**Central cord injury (CCS)**

Central cord syndrome is considered the most common incomplete spinal cord injury. Central Cord Syndrome is a condition that is associated with sacral sparing and it is characterized by motor weakness that affects more the upper extremities than the lower limbs.

**Brown-Séquard syndrome**

Brown–Séquard syndrome causes weakness in upper/lower limbs on the same side, and loss of temperature and pain on opposite side.

Trauma and spinal cord tumours are the most common cause of this syndrome.

**The cauda equina syndrome (CES)**

The cauda equina syndrome is a serious pathologic condition that is caused by compression of these nerve
It can cause various symptoms such as back pain, sciatica, motor weakness, and sensory deficits, but the term cauda equina syndrome is used only when bladder, bowel, and/or sexual dysfunction, and/or saddle anesthesia occur. Some patients may go on to develop permanent weakness, sensory deficits, and incontinence.

Post-traumatic syringomyelia

Post-traumatic syringomyelia (a term referring to a disorder in which a cyst or cavity forms within the spinal cord) is a progressive degenerative disorder that is a well-recognized sequela of spinal cord injury. The pathophysiology may be due to vascular, hemorrhagic, or direct mechanical trauma from the original injury, leading to formation of a cavity.

Complications

Complications of spinal cord injuries include pulmonary edema, respiratory failure, neurogenic shock (low blood pressure, occasionally with a slowed heart rate), and paralysis below the injury site.

In the long term, the loss of muscle function can have additional effects from disuse, including atrophy of the muscle. Immobility can lead to pressure sores, particularly in bony areas, requiring precautions such as extra cushioning and turning in bed every two hours (in the acute setting) to relieve pressure. In the long term, people in wheelchairs must shift periodically to relieve pressure.

Another complication is pain, including nociceptive pain (indication of potential or actual tissue damage) and neuropathic pain, when nerves affected by damage convey erroneous pain signals in the absence of stimuli.

Spasticity, the uncontrollable tensing of muscles below the level of injury, occurs in 65–78% of chronic SCI.

Another problem lack of mobility can cause is loss of bone density and changes in bone structure. Loss of bone density (bone demineralization), thought to be due to lack of input from weakened or paralysed muscles, can increase the risk of fractures. Conversely, a poorly understood phenomenon is the overgrowth of bone tissue in soft tissue areas, called heterotopic ossification. It occurs below the level of injury, possibly as a result of inflammation.

Another potentially deadly threat to respiration is deep venous thrombosis (DVT), in which blood forms a clot in immobile limbs; the clot can break off and form a pulmonary embolism, lodging in the lung and cutting off blood supply to it. DVT is an especially high risk in SCI, particularly within 10 days of injury, occurring in over 13% in the acute care setting. Preventative measures include anticoagulants (chemical substances that prevent or reduce coagulation of blood), pressure hose, and moving the patient's limbs.

Urinary tract infection (UTI) is another risk that may not display the usual symptoms (pain, urgency and frequency); it may instead be associated with worsened spasticity. The risk of UTI, likely the most common complication in the long term, is heightened by use of indwelling urinary catheters. Catheterization may be necessary because SCI interferes with the bladder’s ability to empty when it gets too full, which could trigger autonomic dysreflexia (a potentially dangerous and, in rare cases, lethal clinical syndrome, resulting in acute, uncontrolled high blood pressure) or damage the bladder permanently. The use of intermittent catheterization to empty the bladder at regular intervals throughout the day has decreased the mortality due to kidney failure from UTI in the first world, but it is still a serious problem in developing countries.

Risk factors

Spinal cord injuries are most often caused by physical trauma. Forces involved can be hyperflexion (forward movement of the head); hyperextension (backward movement); lateral stress (sideways movement); rotation (twisting of the head); compression (force along the axis of the spine downward from the head or upward from the pelvis); or distraction (pulling apart of the vertebrae). Traumatic SCI can result in contusion, compression, or stretch injury.

Prevention

Efforts to prevent spinal cord injury (SCI) include individual measures such as using safety equipment, societal measures such as safety regulations in traffic. Vehicle-related SCI is prevented with measures including societal
and individual efforts to reduce driving under the influence of drugs or alcohol, distracted driving, and drowsy driving. Other efforts include increasing road safety (such as marking hazards and adding lighting) and vehicle safety, both to prevent accidents (such as routine maintenance and antilock brakes) and to mitigate the damage of crashes (such as head restraints, air bags, seat belts, and child safety seats).

Falls can also be prevented by making changes to the environment, such as nonslip materials and grab bars in bathtubs and showers, railings for stairs, child and safety gates for windows.

Sports injuries can be prevented with changes to sports rules and equipment to increase safety, and education campaigns to reduce risky practices such as diving into water of unknown depth or head-first tackling in association football.

**How it can affect fertility**

**Male fertility**

Spinal cord injury occurs most often to young men. Following SCI, most men are infertile due to a combination of erectile dysfunction, ejaculatory dysfunction and semen abnormalities. Erectile dysfunction may be treated by the same therapies that are used in the general population. Similarly, the same treatments that are effective to assist conception in couples with non-SCI male factor patients are effective in assisting conception in SCI male-factor patients. The most apparent differences in male-factor symptoms between SCI and non-SCI patients are the high occurrences of anejaculation and atypical semen profiles in men with SCI.

Methods available to assist ejaculation in men with SCI include penile vibratory stimulation and electroejaculation (EEJ). Use of surgical sperm retrieval as the first line of treatment for anejaculation in men with SCI is controversial. Most men with SCI have a unique semen profile characterized by normal sperm concentration, but abnormally low sperm motility. Toxic substances in the semen contribute to this problem. Despite impaired sperm parameters, pregnancy outcomes using sperm from men with SCI are similar to pregnancy outcomes using sperm from non-SCI men.

**Female fertility**

Women’s fertility is not usually affected, although precautions must be taken for safe pregnancy and delivery.

The numbers of women with SCI giving birth and having healthy babies are increasing. Around a half to two-thirds of women with SCI report they might want to have children, and 14–20% do get pregnant at least once. Although female fertility is not usually permanently reduced by SCI, there is a stress response that can happen immediately post-injury that alters levels of fertility-related hormones in the body. In about half of women, menstruation stops after the injury but then returns within an average of five months—it returns within a year for a large majority.

Pregnancy is associated with greater-than-normal risks in women with SCI, among them increased risk of deep vein thrombosis, respiratory infection, and urinary tract infection. Assistive devices may need to be altered and medications changed. For women with injuries above T6, a risk during labor and delivery that threatens both mother and fetus is autonomic dysreflexia, in which the blood pressure increases to dangerous levels high enough to cause potentially deadly stroke.

Reduced sensation in the pelvic area means women with SCI usually have less painful delivery; in fact, they may fail to realize when they go into labor. If there are deformities in the pelvis or spine caesarian section may be necessary. Babies of women with SCI are more likely to be born prematurely, and, premature or not, they are more likely to be small for their gestational time.

**Prognosis**

Spinal cord injuries generally result in at least some incurable impairment even with the best possible treatment. The best predictor of prognosis is the level and completeness of injury, as measured by the ASIA impairment scale (Pic. 4). The neurological score at the initial evaluation done 72 hours after injury, is the best predictor of how much function will return.
Most people with ASIA scores of A (complete injuries) do not have functional motor recovery, but improvement can occur. Most patients with incomplete injuries recover at least some function. Of the incomplete SCI syndromes, Brown-Séquard and central cord syndromes have the best prognosis for recovery and anterior cord syndrome has the worst.

One important predictor of motor recovery in an area is presence of sensation there, particularly pain perception. Most motor recovery occurs in the first year post-injury, but modest improvements can continue for years; sensory recovery is more limited. Recovery is typically quickest during the first six months. Spinal shock, in which reflexes are suppressed, occurs immediately after the injury and resolves largely within three months but continues resolving gradually for another 15.

Sexual dysfunction after spinal injury is common. Problems that can occur include erectile dysfunction, loss of ability to ejaculate, insufficient lubrication of the vagina, and reduced sensation and impaired ability to orgasm. Although sexual dysfunction is very common after SCI, many people learn ways to adapt their sexual practices so they can lead satisfying sex lives.

Although life expectancy has improved with better care options, it is still not as good as the uninjured population. The higher the level of injury, and the more complete the injury, the greater the reduction in life expectancy. Mortality is very elevated within a year of injury.

Find more about related issues

Diagnoses

**Anejaculation**
The pathological inability to ejaculate in males, with (orgasmic) or without (anorgasmic) orgasm. 
Learn more at: [www.fertilitypedia.org/therapy/diag/anejaculation](http://www.fertilitypedia.org/therapy/diag/anejaculation)

**Ejaculatory disorders**
A class of sexual disorders defined as the subjective lack of normal ejaculation. 
Learn more at: [www.fertilitypedia.org/therapy/diag/ejaculatory-disorders](http://www.fertilitypedia.org/therapy/diag/ejaculatory-disorders)

**Erectile dysfunction**
The inability (that lasts more than 6 months) to develop or maintain an erection of the penis during sexual activity. 
Learn more at: [www.fertilitypedia.org/therapy/diag/erectile-dysfunction](http://www.fertilitypedia.org/therapy/diag/erectile-dysfunction)

**Retrograde ejaculation**
The semen, which would normally be ejaculated via the urethra, is redirected to the urinary bladder. 
Learn more at: [www.fertilitypedia.org/therapy/diag/retrograde-ejaculation](http://www.fertilitypedia.org/therapy/diag/retrograde-ejaculation)

Gallery
Cervical Spine magnetic resonance imaging (MRI) of patient with SCI. There is fracture and dislocation and also spinal cord compression.

The human vertebral column and its regions. (C- cervical, Th-thoracic, L- lumbar, S- sacral).
Skin regions with respect to the routing of their afferent nerves through the spinal cord.

| Motor strength | ASIA impairment scale for cord injury  
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<tr>
<td>Grade 1</td>
<td>Complete injury. All motor or sensory function is preserved in the spinal segments T6 or T6 or higher.</td>
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<tr>
<td>Grade 2</td>
<td>Incomplete injury. Sensory function is preserved below the level of injury, including all somatic segments.</td>
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<tr>
<td>Grade 3</td>
<td>Full range of tendon (joint) stretch</td>
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<tr>
<td>Grade 4</td>
<td>Motor complete. Motor function is preserved below the level of injury and more than half of muscles tested below the level of injury have a muscle grade less than 3 (see motor strength scoring, left).</td>
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<tr>
<td>Grade 5</td>
<td>Motor complete. Motor function is preserved below the level of injury and more than half of muscles tested below the level of injury have a muscle grade of 3 or more.</td>
</tr>
<tr>
<td>Grade 6</td>
<td>Motor complete. Motor function is preserved below the level of injury and all but at least two key muscles below the neurological level have a muscle grade of 3 or more.</td>
</tr>
<tr>
<td>Grade 7</td>
<td>Motor complete. Motor function is preserved below the level of injury and all but at least two key muscles below the neurological level have a muscle grade of 3 or more.</td>
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Sources

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