

The Anatomy of Spinal Cord Injury (SCI)

What is the Spinal Cord?

The spinal cord is that part of your central nervous system that transmits messages between your brain and your body. The spinal cord has two major nerve pathways that help your brain control your body:

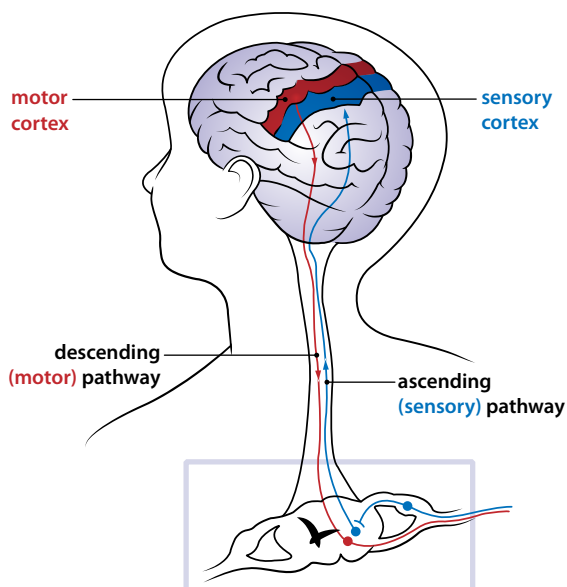
1. Motor Nerve (descending) Pathway

This carries information from the brain downwards to initiate movement and control body functions. This is coloured red in the diagram. Any damage to the motor nerve pathways, within the spinal cord, will result in the brain not being able to initiate movement and control within the body below the damaged site. This is known as paralysis.

2. Sensory Nerve (ascending) Pathway

This carries sensory information from the body upwards to the brain such as touch, skin temperature and pain. This is coloured blue in the diagram. If the sensory nerve pathways are also damaged then the brain cannot feel the body below the damaged area.

Major Nerve Pathways of the Spinal Cord



The spinal cord resembles a cable which is about the thickness of your little finger and is approximately 52 cm long. It begins at the base of the brain and runs down the length of the back ending behind the 1st lumbar vertebra.

Like the brain, the spinal cord is a very delicate structure and can be easily damaged by trauma. To protect them from the risks of everyday life, the brain is protected by the skull and the spinal cord by the spinal column. However for everyday activities we need our spine to be very flexible, allowing twisting and bending to occur.

This is possible, by the spinal column being made up of 33 individual bones called vertebrae and 31 pairs of nerves.

Cervical 7 vertebrae and 8 pairs of nerves that serve the arms

Thorax 12 vertebrae and 12 pairs of nerves that serve the torso

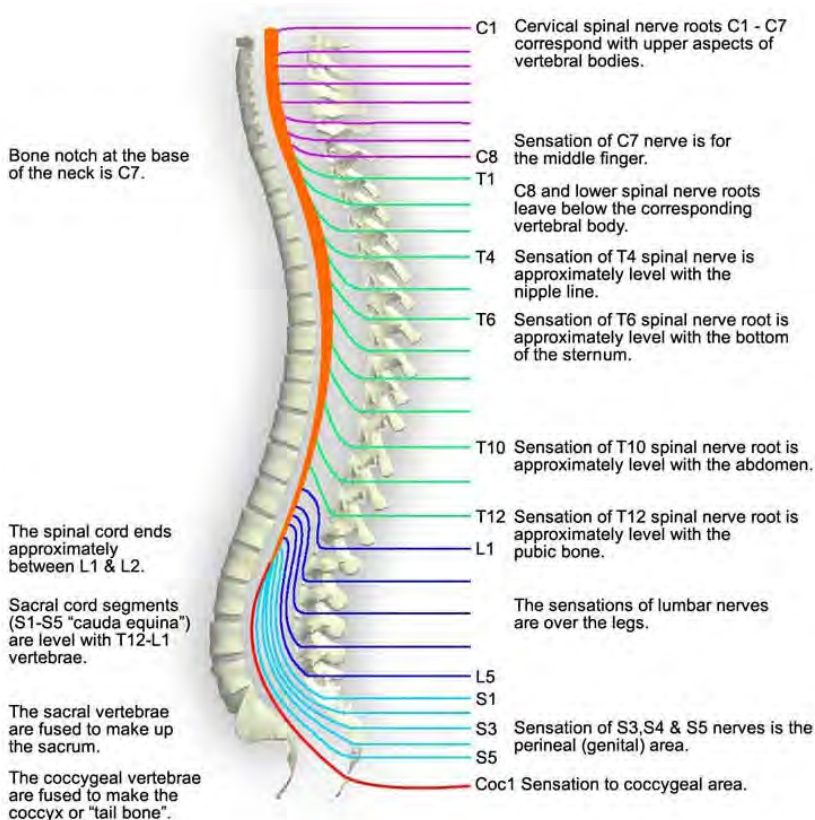
Lumbar 5 vertebrae and 5 pairs of nerves that serve the upper and anterior (front) sections of the legs

Sacral 5 vertebrae and 5 pairs of nerves that serve the posterior (back) section of the legs, the bowel and the bladder

Coccygeal 4 vertebrae and 1 pair of nerves

Each vertebra is separated by disc or cartilage. These discs act as shock absorbers and prevent the vertebrae from grinding together.

The higher the spinal injury the more muscles become paralysed.



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What is spinal cord injury (SCI)?

This is where the spinal cord is damaged following major trauma to the spinal cord from a variety of causes. In the majority of cases the cord is crushed destroying nerve cells and nerve tracts or pathways at that specific level within the cord.

The level of injury is the exact point in the spinal cord at which damage has occurred. The levels are determined by counting the nerves from the top of the neck downwards, and these nerves are grouped into four different areas, Cervical, Thoracic, Lumbar and Sacral.

Tetraplegia or (and) Quadriplegia

Tetraplegia: If your spinal cord has been damaged in your cervical region (neck), all four limbs are affected.

Paraplegia: If your spinal cord has been damaged below the level of T1, both your legs are paralysed but this does not affect the hands and arms.

Spinal cord injuries are classified as either complete or incomplete.

A 'complete' spinal cord injury means there is complete loss of movement and feeling below the level of the injury. There are no messages getting past the area of damage.

It usually takes a significant trauma to the spinal column, such as a complete dislocation, or 3 column fracture to the vertebra to cause a complete injury. This causes the spinal cord to be crushed and completely compromised.

An 'incomplete' spinal cord injury means there is either some voluntary contraction of the anal ring, and or some deep anal sensation. This is often accompanied by some voluntary movement and sensation with in the limbs below the spinal cord injury level. Only part of the spinal cord has been damaged and some messages are getting through.

Different types of incomplete injuries

There are different types of incomplete injuries:

- Central Cord Syndrome
- Anterior Cord Syndrome
- Brown Sequard Syndrome
- Posterior Cord Syndrome
- Conus Medullaris Syndrome
- Cauda Equina Syndrome

Central Cord Syndrome

As we get older we develop arthritis in our neck with the ligaments, discs and joints of the neck stiffening, and osteophytes (extra bone formations) forming within the spinal canal.

This means there is less space for the spinal cord and increases the risk of significant injury to the cord following relatively

minor injuries. This could be as simple as falling from a standing position and hyper-extending the neck. The spinal cord then becomes stretched over these osteophytes (extra bone formations) causing central bleeding and swelling within the cord.

Someone with central cord syndrome can usually control their legs better than their arms. These individuals sometimes recover enough to walk a little but often continue to have major problems with their arm function.

Anterior Cord Syndrome

Normally this is caused by the fractured vertebra crushing the front of the spinal cord. The nerve pathways at the front of the spinal cord are damaged resulting in these patients being fully paralysed with the loss of hot and cold or pain sensation. The pathways at the back remain undamaged. These pathways transmit sensation from the body to the brain regarding light touch to the skin, vibration sense and the ability to know the position your joints are in without needing to look at them i.e. elbow straight or bent.

Brown Sequard Syndrome

This kind of incomplete injury is caused when one half of the spinal cord is damaged more than the other. It could be caused by one side of the vertebra unilaterally dislocating while the other side stays in place, or it could be due to a stabbing injury where the penetrating object damages one side of the cord.

This results in paralysis of that side of the body, along with a loss of light touch, and joint position sense. However the paralysed leg continues to feel sharp or blunt, hot or cold as these sensations travel to the brain on the opposite side of the cord. The other side of the body remains under voluntary control and can still feel light touch and joint position. It cannot, however, feel hot or cold, or sharp or blunt as these sensations travel to the brain on the opposite side of the spinal cord.

Posterior Cord Syndrome:

This is a very rare incomplete injury and usually is caused by a medical mishap such as a tumour or lack of blood supply. The only part of the cord to be damaged are the posterior nerve pathways.

There is good voluntary muscle power and they can feel hot or cold, sharp or blunt but they have no light touch, vibration or joint position sense. They therefore find it very difficult to control movement, as they cannot feel the ground beneath their feet or they cannot tell how hard to hold a delicate object etc.

Conus Medullaris Syndromes

Here a fracture of the T11/T12 vertebra has damaged the spinal cord at the level of the 5th Lumbar nerve. This means that the cord below the injury level still has its spinal reflexes particularly to the bladder and rectum. The legs however remain paralysed as the peripheral nerves from L1 to S2 are damaged and so the muscles receive no nerve impulses from the spinal cord and are therefore flaccid.

Cauda Equina Syndrome

A substantial fracture or dislocation of the L1 vertebra will damage the peripheral nerves from L1 to S4/5 and so the legs are paralysed. The muscles receive no nerve impulses from the spinal cord and are therefore flaccid. This also means that the bladder and rectum, and or anus also exhibit a flaccid paralysis.

Further Information

If you have any questions about your spinal cord injury, please speak to the staff.