

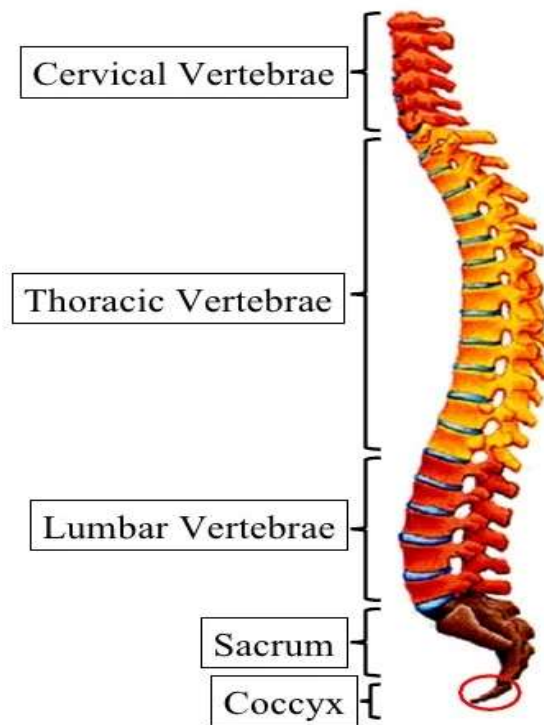
Abnormal Conditions of the Spinal Column

A brief look into a few
common spinal injuries.

R. Mitchell, RN, PHN, MSN



A brief recap of the Spinal Anatomy and Spinal Cord with peripheral Nerves



Functions of the Vertebral Column:

- Forms a tube which houses and protects the spinal cord
- Provides protective channels for the lower spinal nerves
- Supports the weight of the body and head

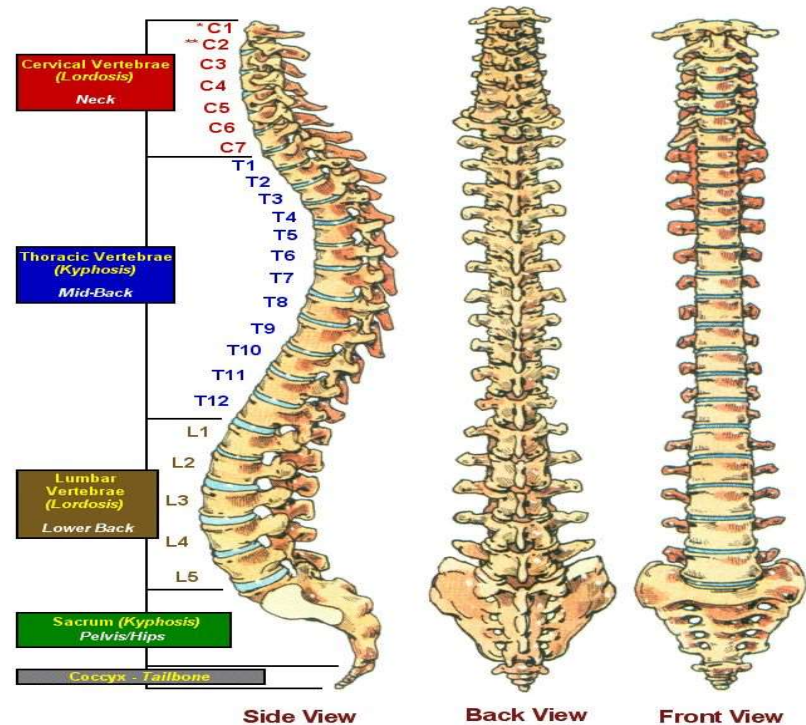
How many vertebrae in the human spinal column?

There are 7 cervical(neck) vertebrae, 12 Thoracic vertebrae(upper to mid back), 5 Lumbar vertebrae(lower back), and 4 coccygeal vertebrae forming the tailbone.

Again, the spine protects the spinal cord.

The spine also acts as the supporting structure for the lungs and the most of the body, as well as a major hub for muscle, ligament, the skull, and bony attachments like the rib cage.

The Spinal Column Diagram

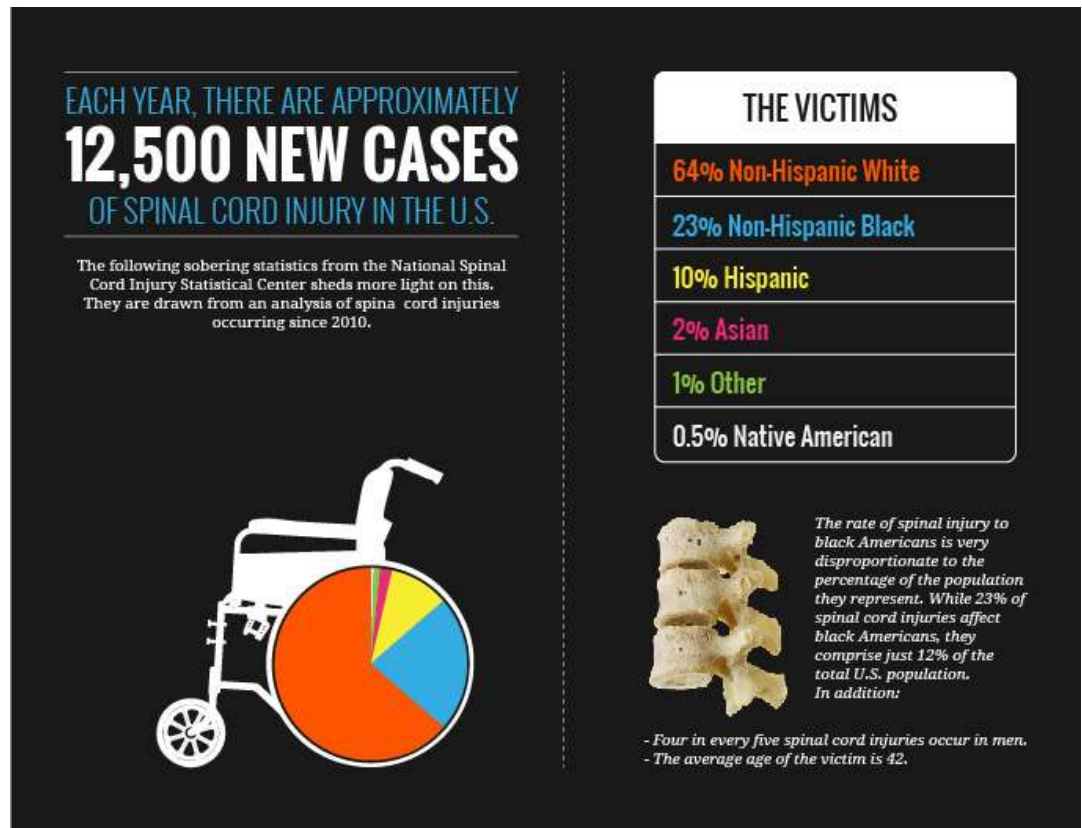


* C1 , the "atlas", holds the globe of the skull.
** C2 , the "axis", permits head turning and tilting.

What makes you more likely to have a spine injury?

1. **Occupation**
2. Degenerative Disc diseases, Arthritis, Spinal Stenosis, and Herniated intervertebral discs.
3. The elderly (mostly men) represent a disproportionate number of spinal injuries annually, 60% of which is of a traumatic fall as mechanism.
4. **1.62 million instrumental spinal surgeries** are performed per year
5. **In the United States**, of people with back pain, 29% believe it is due to stress, 26% blamed weak muscles, and 26% blamed their work.

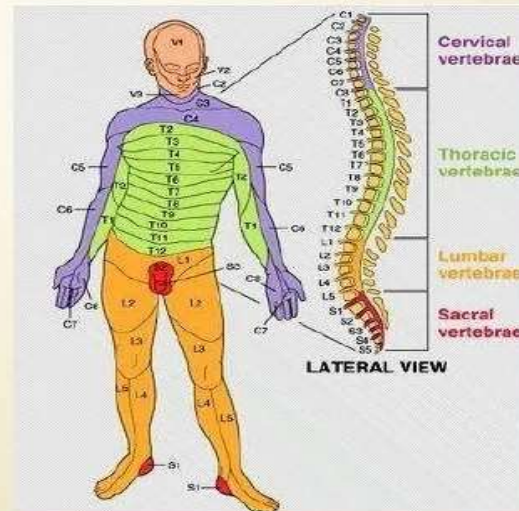
www.brainandspinalcord.org/spinal-cord-injury-statistics/



The spinal cord and associated Dermatomes

SPINAL CORD FUNCTION

- The Spinal Cord is a long, thin bundle of nervous tissue and support cells connected to the brain and located along your back and neck
- The spinal cord receives and transmits electric signals throughout the entire body and then back to the brain
- The spinal cord is protected by the vertebrae, which are bones running down your back, and also by cerebral spinal fluid, which helps to cushion the nerve tissue

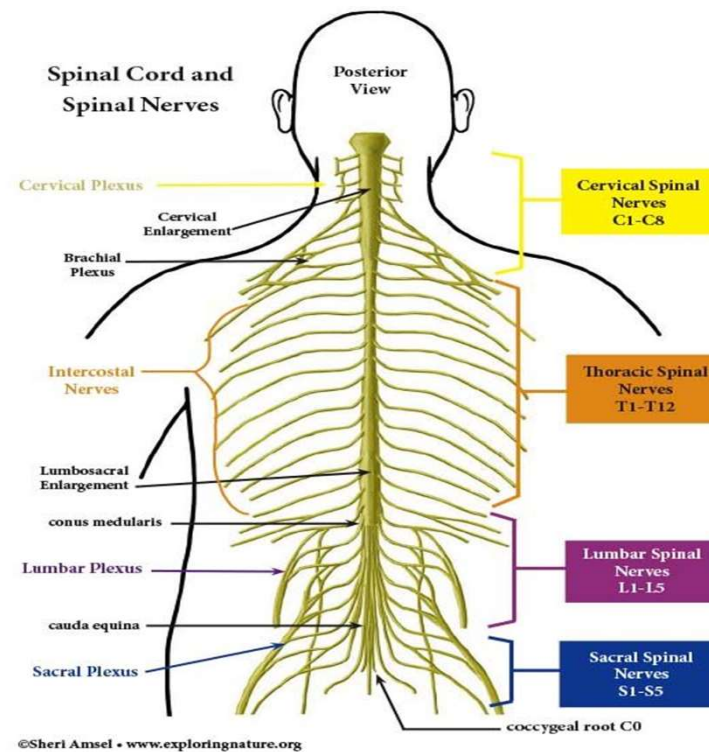


Spinal nerves and Dermatomes...continued

- **What is a Dermatome?**
- A dermatome is **an area of skin that is mainly supplied by a single spinal** nerve. There are 8 cervical nerves (note C1 has with no dermatome), 12 thoracic nerves, 5 lumbar nerves and 5 sacral nerves. Each of these spinal nerves relay sensation from a particular region of the skin to the brain.
- <https://www.physio-pedia.com/Dermatomes>

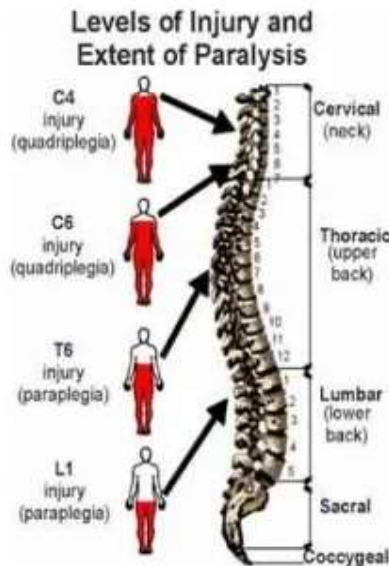
Destruction or damage to a spinal nerve can be assessed at the dermatome corresponding to the spinal nerve.

Graphic view of the spinal cord and nerves



The spinal cord, nerves, and level of injury

SPINAL CORD TRANSECTION



Results in loss of all sensation and voluntary movement inferior to the lesion

Paraplegia

Paralysis of lower body including both lower extremities
Results from spinal cord transection between cervical and lumbosacral enlargements

Quadruplegia

Paralysis of all four limbs
Results from spinal cord transection superior to C3

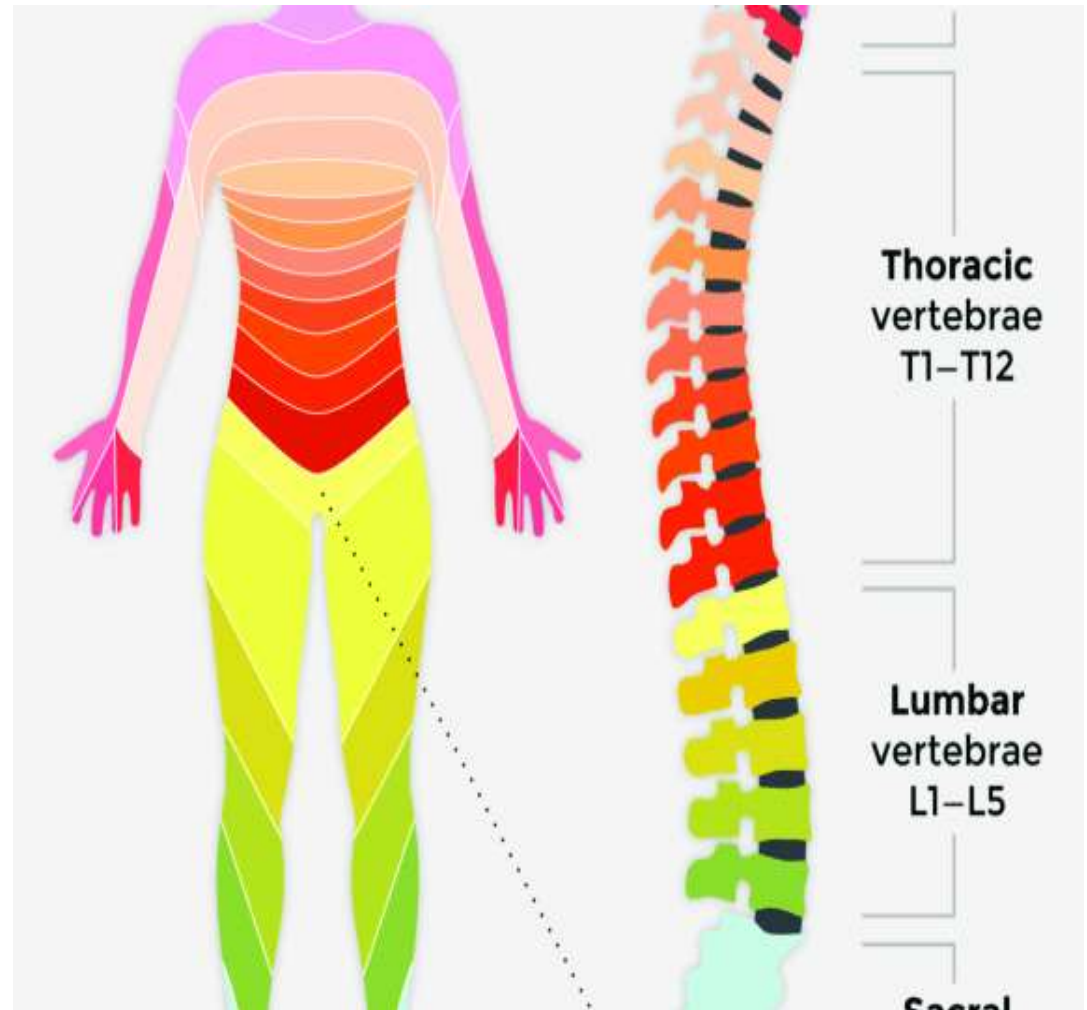
Dermatome and level of injury corresponding to outflowing nerves

The progression of nerves and bodily region follows a descending pattern.

A cord transection at any level usually means that sensation and motor function below the level of damage is permanently severed. In other words communication is cut off.

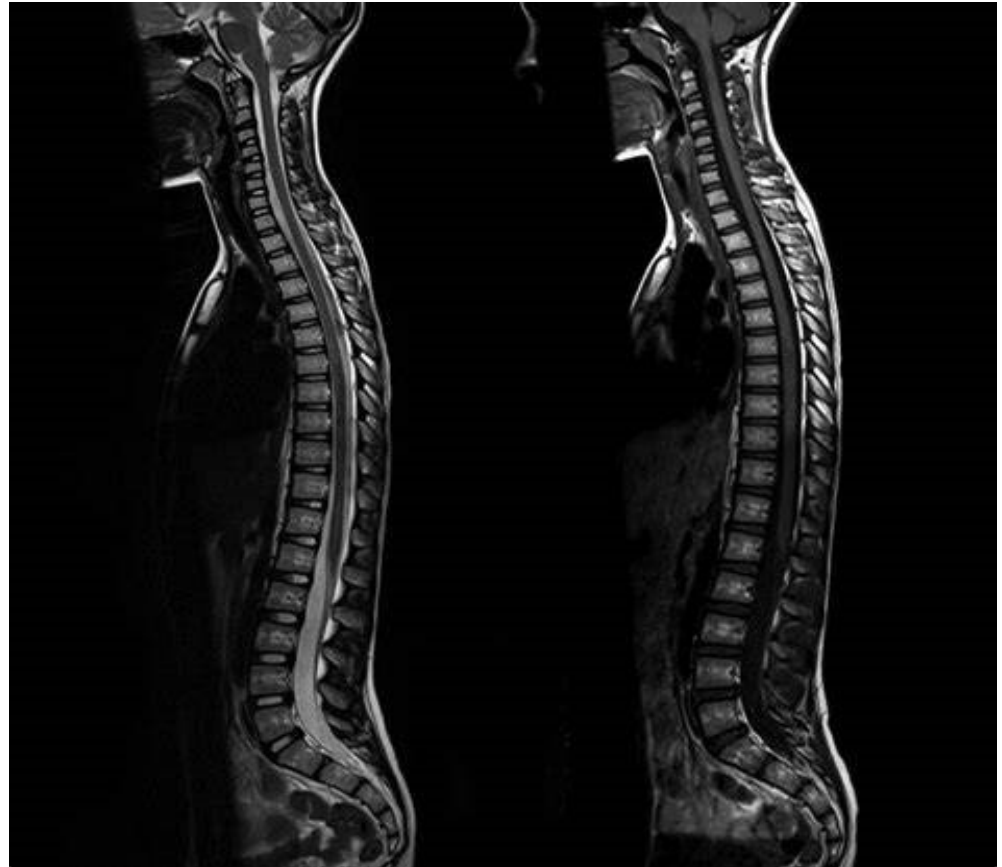
A transection at the level of the cervical cord means there is no longer function from that point to everything below.

The lower the level of injury the better off you are as far as overall function.



A normal spine on MRI from a sagittal view

This is the best shot I could locate showing the entire spine from top to bottom. Notice there appears to be no vertebral breakdown or movement of the vertebrae out there normal appearance and positioning, nor cord/nerve impingement.



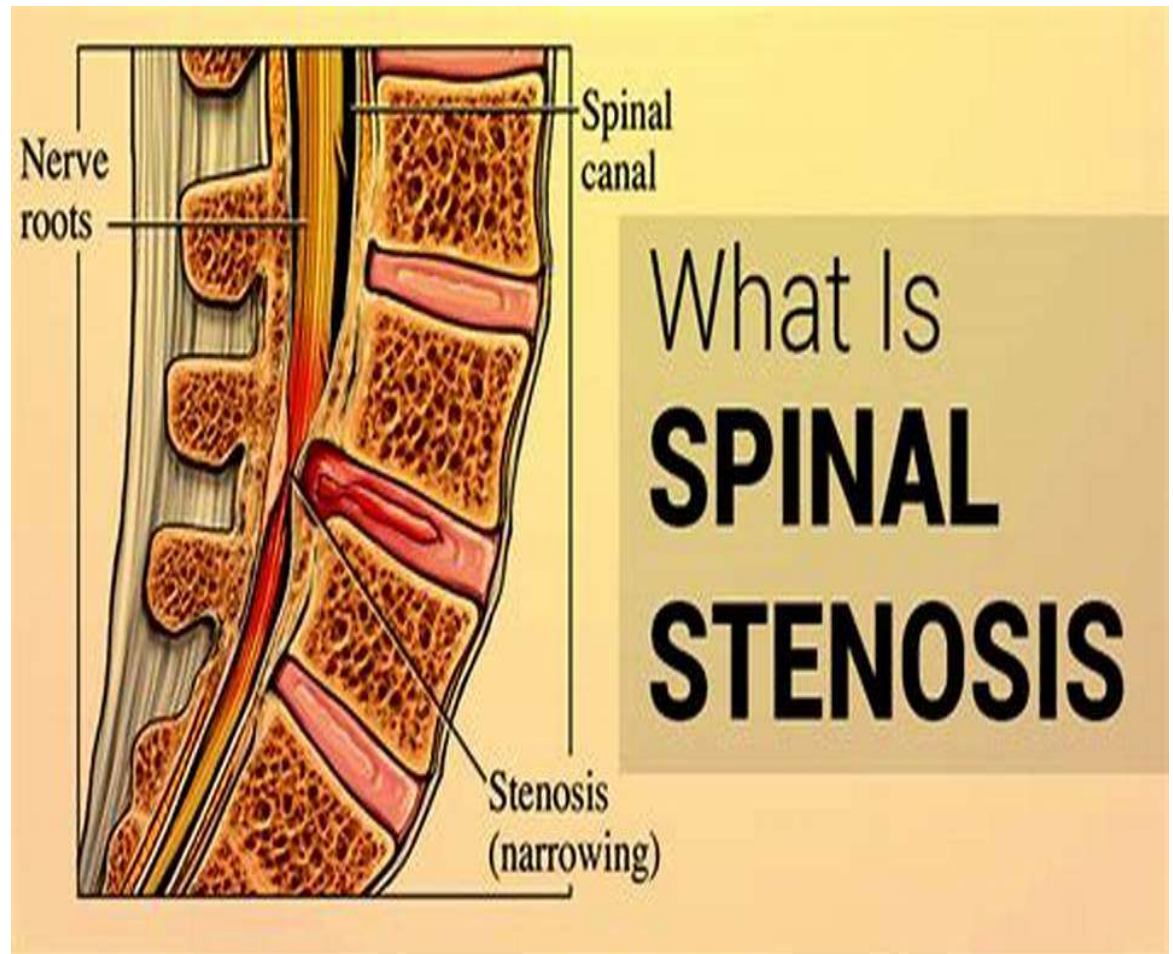
Common Abnormalities of the Spine: Spinal Stenosis

What is it? With aging or by disease, the spinal canal (the space where the cord passes through) can narrow, resulting in what is known as stenosis (meaning a narrowing, from the Greek)

Causes? Spinal stenosis occurs when bulging discs or arthritic bone spurs, or any thickened tissue in the surrounding area, compress and impinge on the spinal canal, or nerves flowing out of that region.

Symptoms? Include pain, numbness and sometimes tingling sensations, and weakness to affected extremity(ies).

Treatments? PT, Rest, medications, injections, and last course....surgery.



Spinal Stenosis in side view MRI

Red circle denotes the spinal stenosis of the cervical region of the spine.

Appear to be at the C4-C5 region and the bulging that is doing the narrowing appears to be caused by ruptured or bulging disc and possibly bone spur involvement.

This picture is also a good example of herniated disc as well as spinal stenosis.





Herniated/bulging Disc

What is it? A condition which results from rupture of the disc between the bones of the spine and the soft inner portion of the disc (nucleus pulposus of the disc) protrudes outside through the hard outer ring (annulus). This causes pain when a nerve is compressed.

Cause? Herniated nucleus pulposus instead develops largely as a result of degenerative changes that weaken the discs. This process essentially follows these primary steps: A herniated nucleus pulposus is a fairly common condition, and it's even possible to have it without experiencing symptoms.

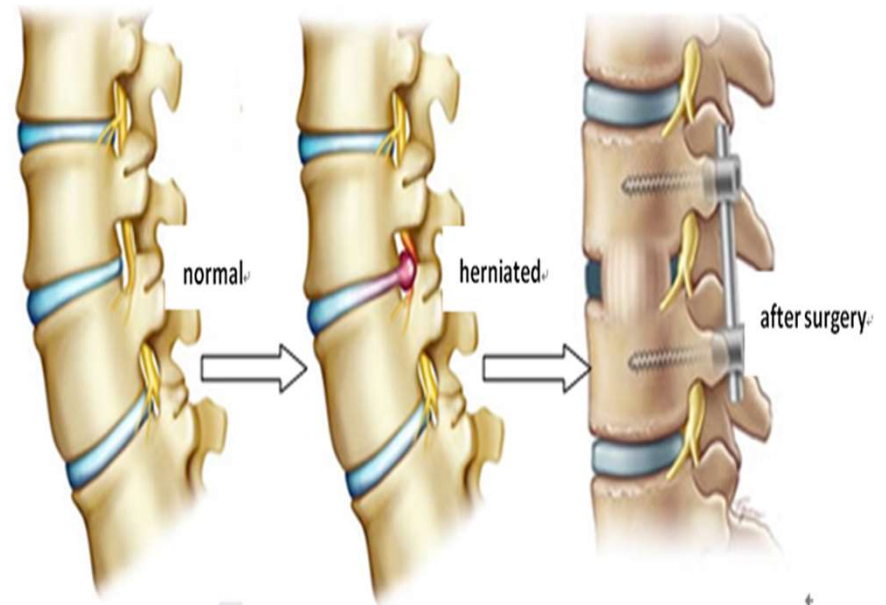
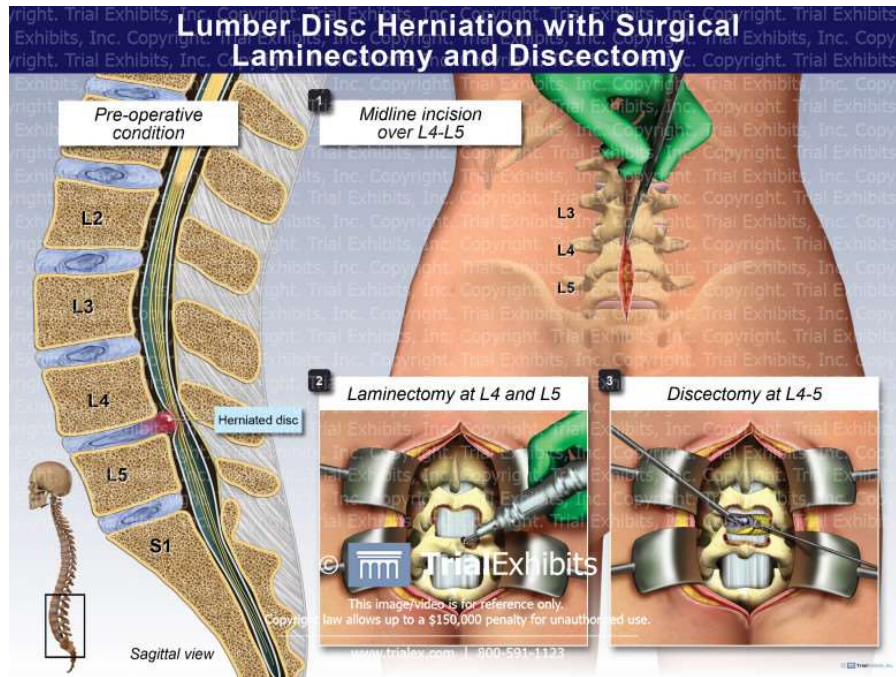
Treatments are similar to spinal stenosis.



Bulging disc vs. spinal stenosis comparison

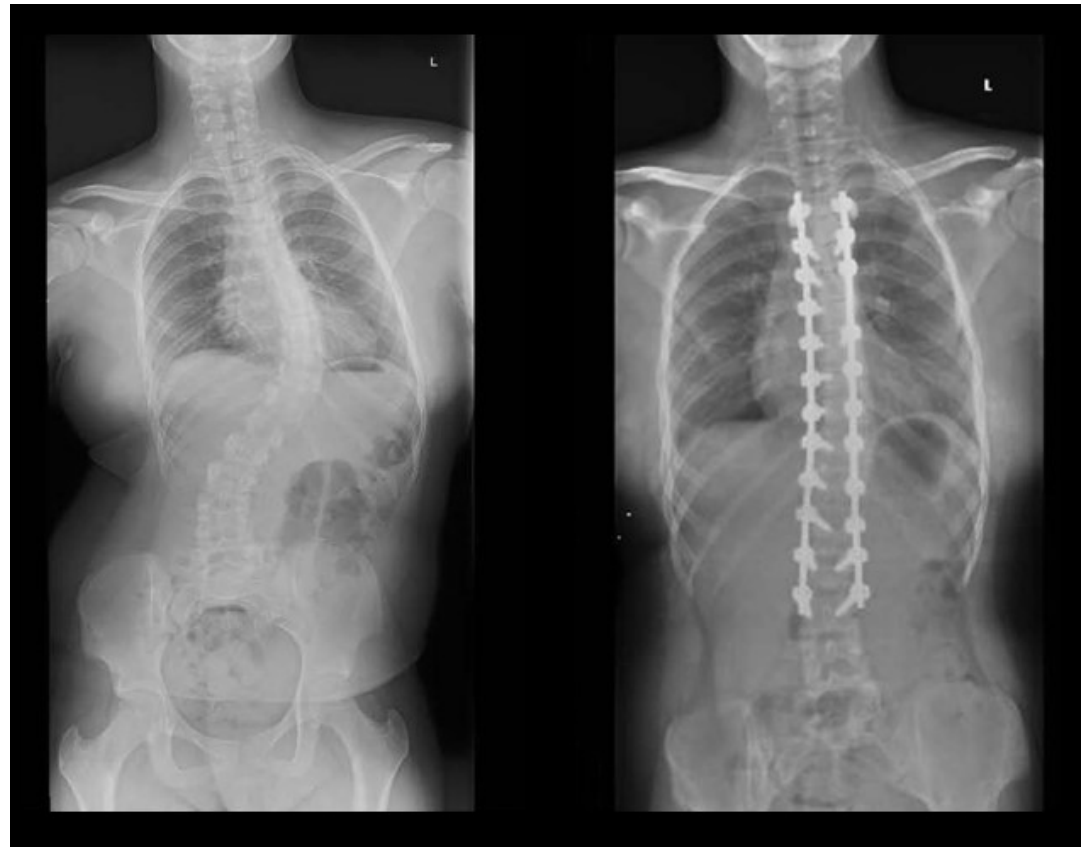


Two different surgical interventions for spinal decompression of bulging discs and stenosis

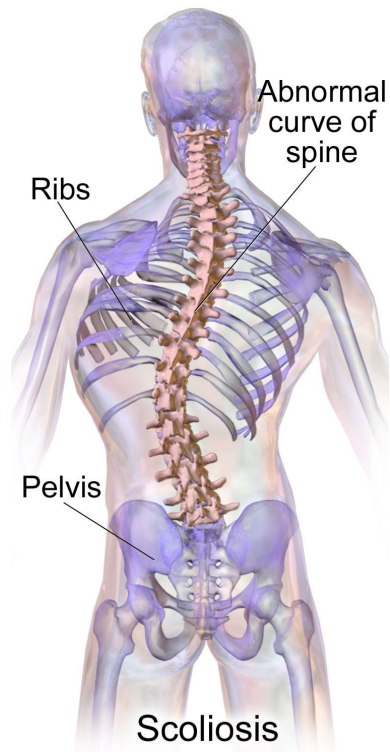


Scoliosis and corrective surgery to repair this deformity

What is Scoliosis? A condition characterized by sideways curvature of the spine or back bone, often noted during growth spurt just before a child attains puberty. **What are the implications for health and well being?** These individuals will have greater prevalence of back pain than the general population. This condition can hamper breathing and cardiovascular function due to the abnormal tilt and compression by the rib cage. **Treatments?** In most scoliosis cases treatment is conservative and involves bracing the spine. The more advanced cases usually require surgery, especially if internal systems are threatened. Surgery can be quite extensive and recovery somewhat painful with a long rehab process.



The Scoliotic curve and what bracing looks like in some cases of conservative treatment

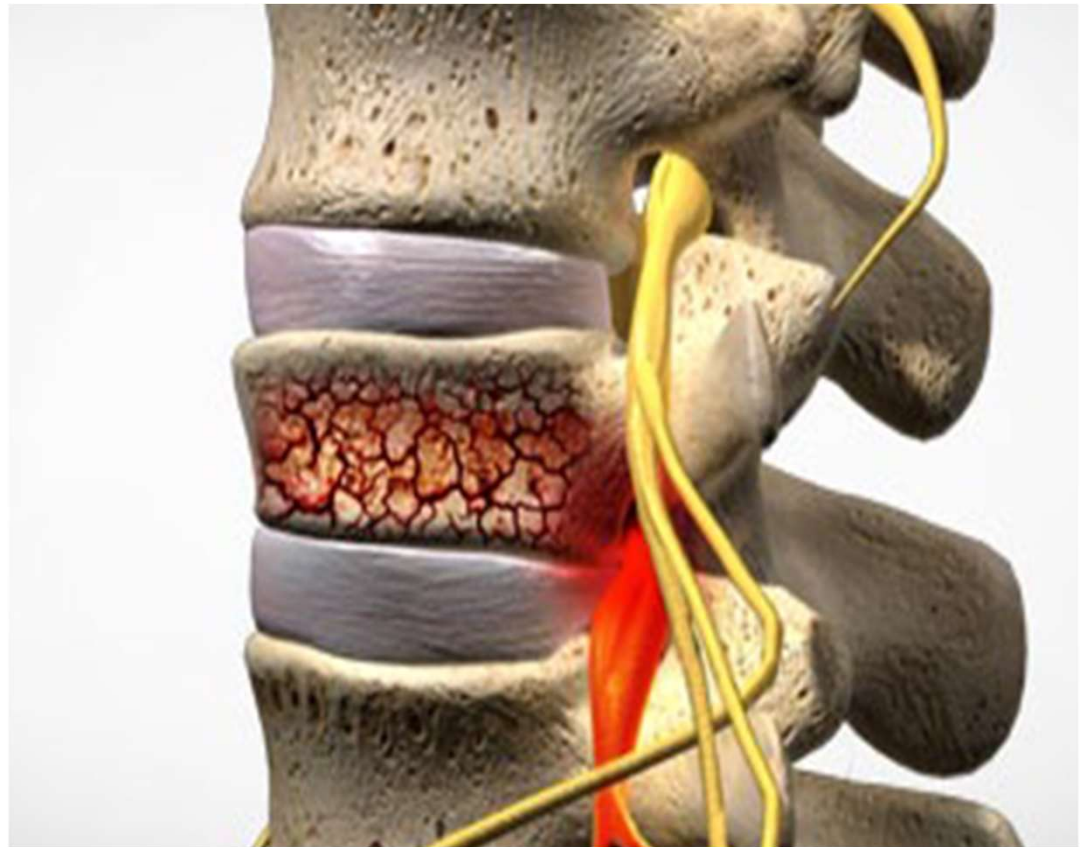


Compression fracture and age related risk

A **compression fracture** is a type of broken bone that can cause your vertebrae to collapse, making them shorter. This often happens to the front of the vertebrae but not the back, causing you to stoop forward over time. [hopkinsmedicine.org](https://www.hopkinsmedicine.org)

It's easy to think [back pain](#) is just part of getting older. But be careful. If you're nearing age 60, it may be a sign that you have tiny [cracks](#) in the bones called vertebrae that form your [spine](#). When these small hairline [fractures](#) add up, they can eventually cause a vertebra to collapse, which is called [spinal compression fracture](#).

[webmd.com](https://www.webmd.com) [Causes compression fx.](#)



Causes of compression fractures

Softened bones are usually at the heart of the problem of compression fractures.

Osteoporosis causes the softening or thinning of the bone matrix. People over 50, usually women, but not exclusively, are at the age of concern for osteoporosis.

The two groups at greatest risk are those with osteoporosis and those with cancer of the bones. Multiple myeloma and lymphoma are two aggressive cancers that can involve the bones. A bone fracture is usually how these cancers are discovered.

Greatest Risks? Age > 50, White and Asian populations are at greater risk, peri/post-menopause, thin and malnourished, and smokers.

webmd.com [Compression fractures](#)

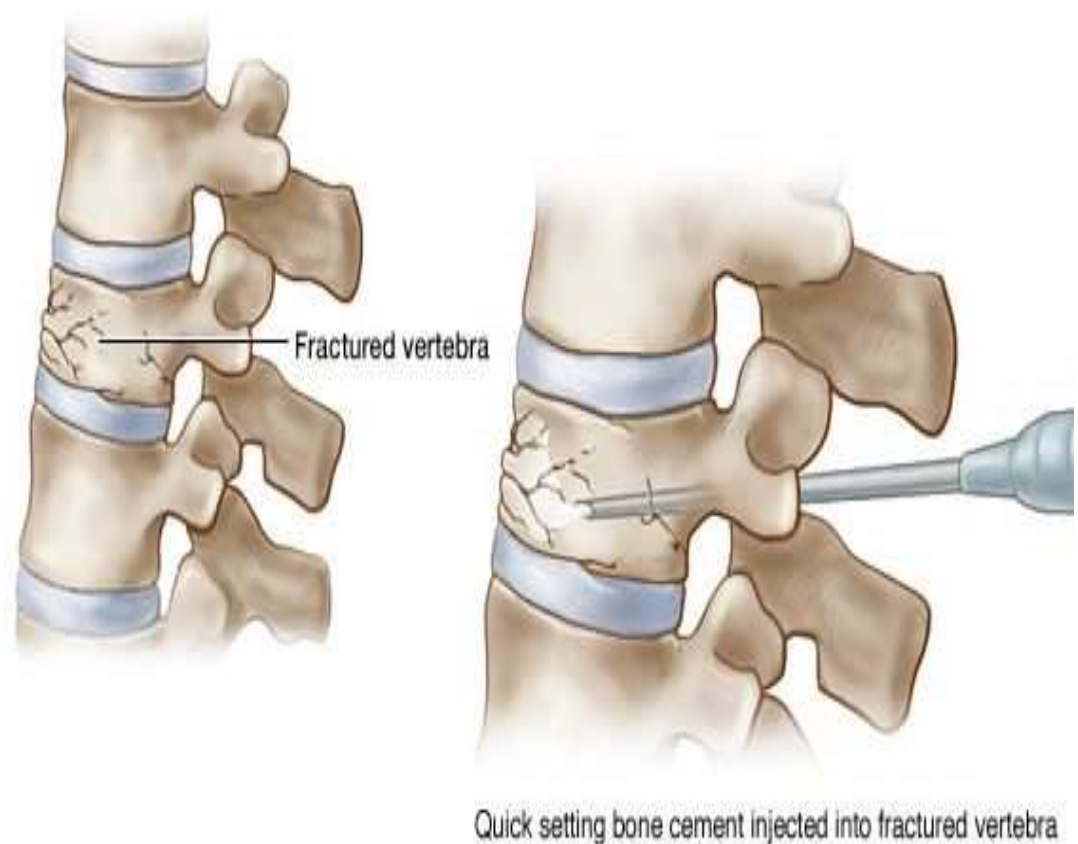


Treatments for compression fracture

Medical approach: Most fractures are treated with immobilization in a brace or corset for up to 12 weeks. Bracing helps to reduce pain and prevent deformity.

Surgical approach: **Vertebroplasty** is a new surgical procedure that may be used to treat compression fractures. In this procedure, the surgeon inserts a catheter into the compressed vertebra. The catheter is used to inject the fractured vertebrae with bone cement, which hardens, stabilizing the vertebral column. This procedure has been shown to reduce or eliminate fracture pain, enabling a rapid return to mobility and preventing bone loss due to bed rest. However, it does not correct the spinal deformity.

my.clevelandclinic.org



Kyphoplasty: another treatment for compression fracture

Kyphoplasty involves inserting a tube into the vertebral column under X-ray guidance, followed by the insertion of an inflatable bone tamp. Once inflated, the tamp restores the vertebral body back toward its original height, while creating a cavity to be filled with bone cement. The cement seals off cracks and cavities, and prevents the vertebra from re-collapsing. After the cavity is filled, the tube is removed and the incision stitched. Since August 1998, hundreds of patients have been treated at The Cleveland Clinic with kyphoplasty.

Stabilization can also be achieved by removing broken vertebra and replacing them with a plate, screws, or cage.

my.clevelandclinic.org



Balloon insert into fractured vertebra



Balloon inflated inside damaged vertebra



Special material injected into fractured vertebra

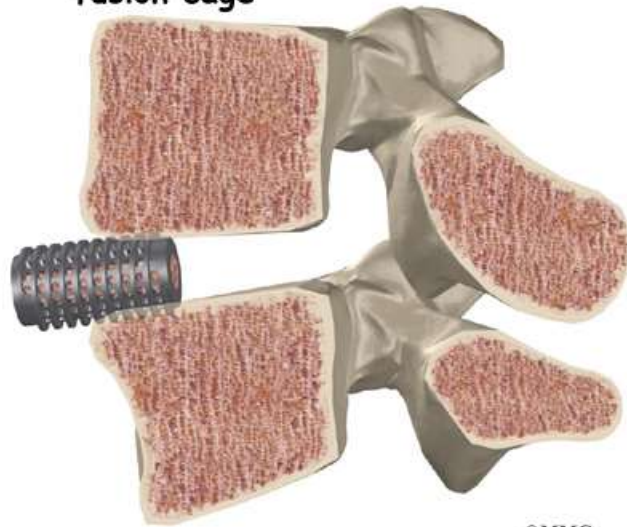


Special material hardens, stabilizing vertebra

Typical hardware used to fuse and repair spinal injuries

Bone inside a back cage

Bone graft inside fusion cage



©MMG

Another type of interbody fusion cage



Two other techniques to stabilize vertebral segments

Anterior/Posterior fusion

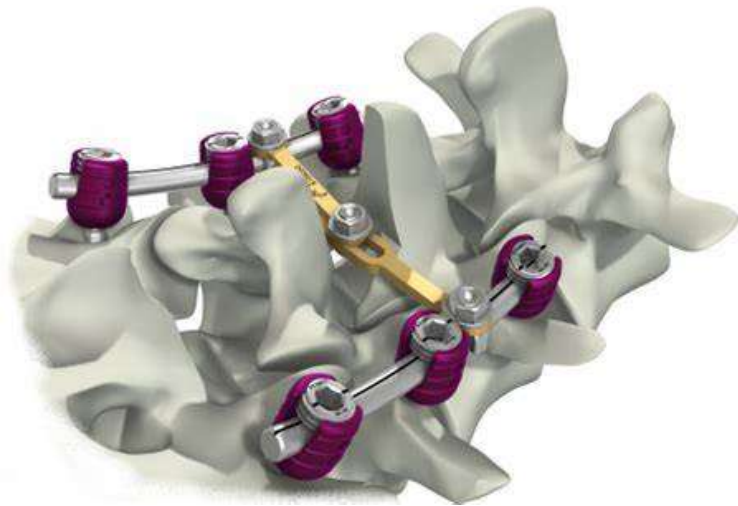


Anterior Fusion with interbody cages

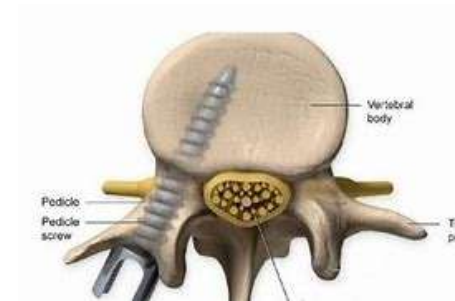


Posterior Fusion with Pedicle screws

Fusion with Pedicle screws

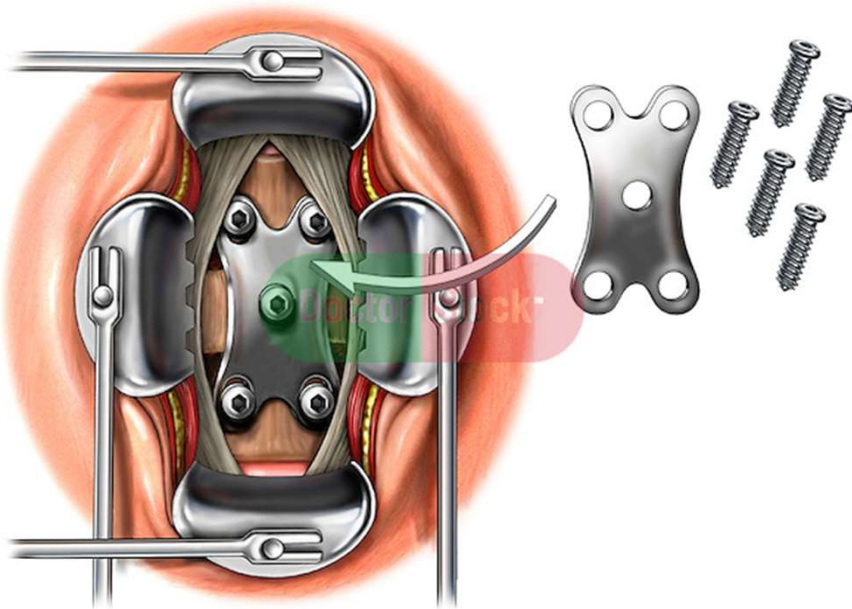


Cut away of Pedicle screw placement

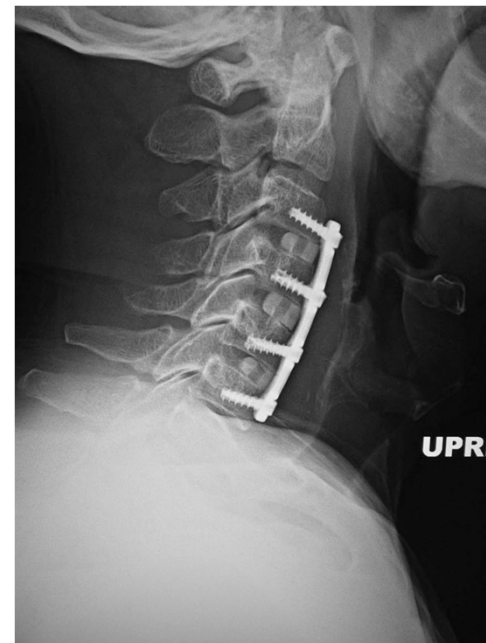


Cervical Fusion and fixation, Anterior aspect

Plate and screws Anterior fusion



X-ray image of Anterior fusion

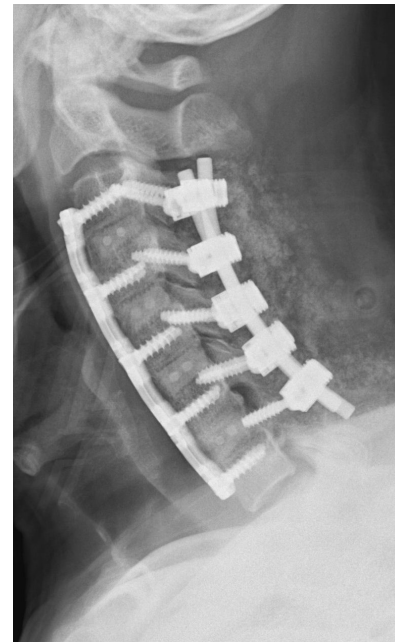


Anterior and Posterior fusion approach

X-ray exam



X-ray exam



Alternative Tx's: Epidural Steroid injections



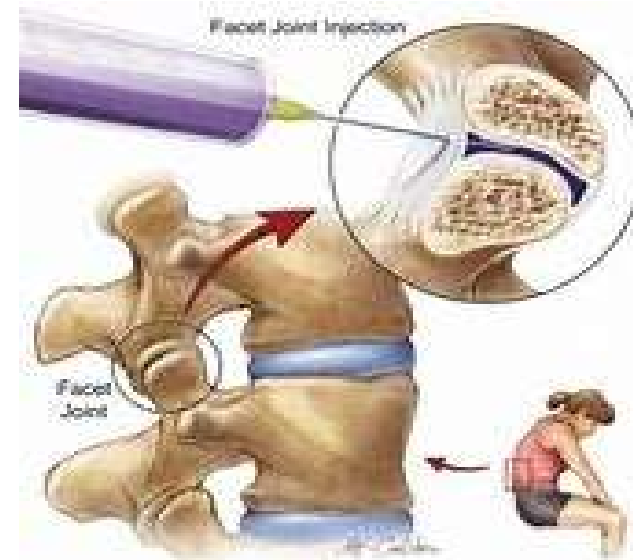
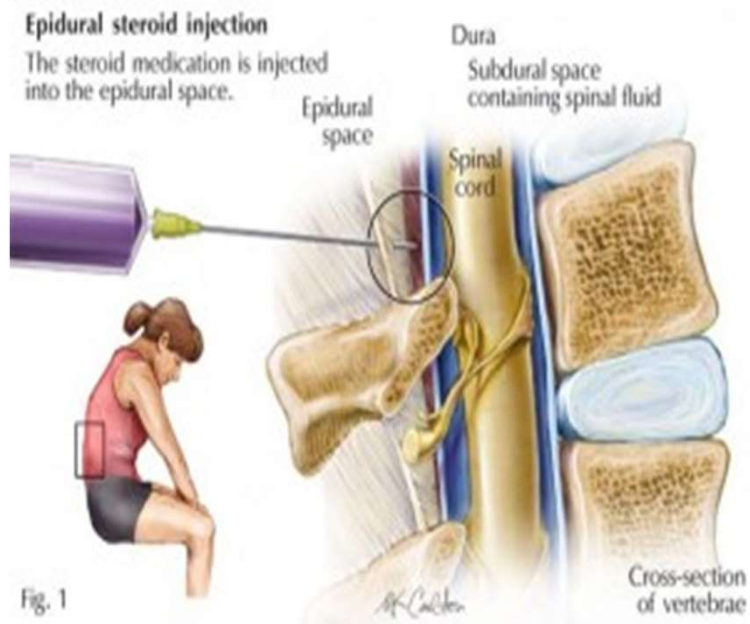
Sciatica Back Pain Relief

Epidural steroid injection is used in combination with a comprehensive rehabilitation program to provide long-term pain relief and also to prevent further disk herniation.

ePainAssist.com

ePainAssist.com

Epidural and Facet Joint Injections for pain



Physical Therapy

- Physical Therapy is the foundation of spinal cord injury rehabilitation.
- PT focuses on improving mobility through targeted exercises.
- PT will evaluate functional abilities and create individual specific programs designed to maximize mobility/movement, strength, and range-of-motion.
- [Spinal Cord Injury Treatment: Goals, Methods, and Research \(flintrehab.com\)](http://flintrehab.com)

Physical Therapy for Spinal injury



Prevention

- **Common sense prevention**(seat belts, don't mix alcohol with driving, wearing helmets during certain activities)
- **Home Safety**: including de-clutter rooms, lighting, secure stair rails, grab bars in the bathroom, and non-slip mats or rugs.
- **Activity/Exercise**: Wear gear needed for protection, when diving check depths first or go in feet first, Exercise using gym weights or machines you should know your limitations, first.
- Lastly, evaluate any actions that might pose a risk to your head and spine. Again, common sense.
- [Spinal Cord Injury Prevention \(spineuniverse.com\)](http://spineuniverse.com)

Questions????