

Modified slides

Diseases of the spine

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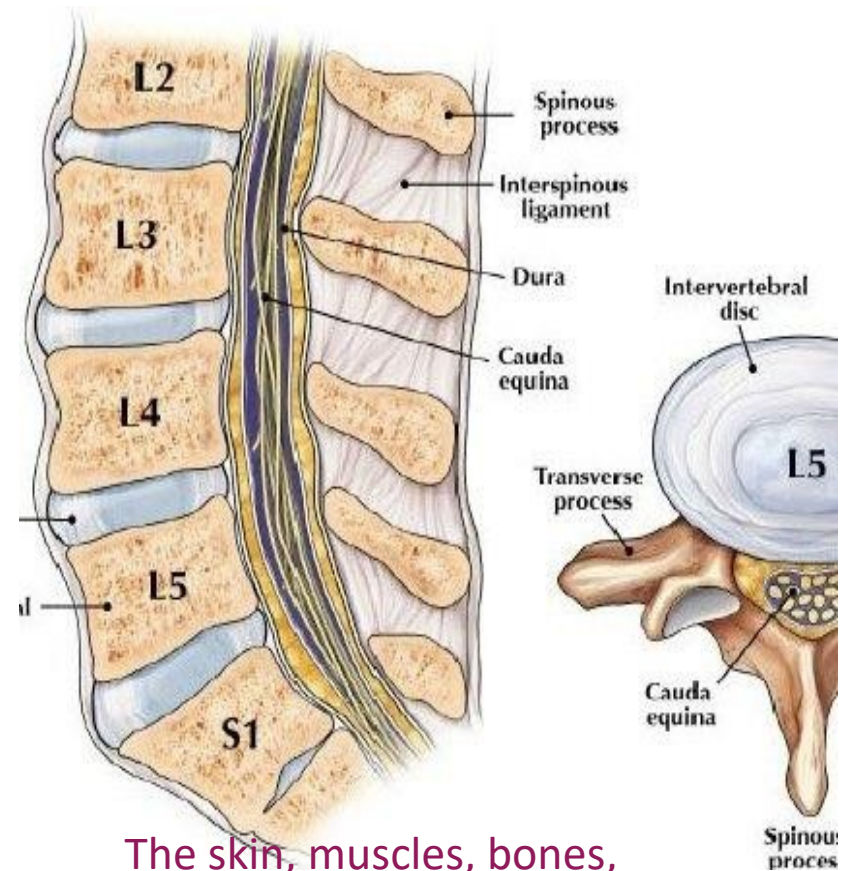
What do we mean by the word (SPINE)?

Two integrated systems

1-A musculoskeletal system (vertebral bodies, discs, ligaments, muscles).

2-A neurological system (Spinal cord; which begins from foramen magnum (C1) and ends at the lower edge of L1 + spinal canal that continues until s2).

Both are integrated functionally and anatomically



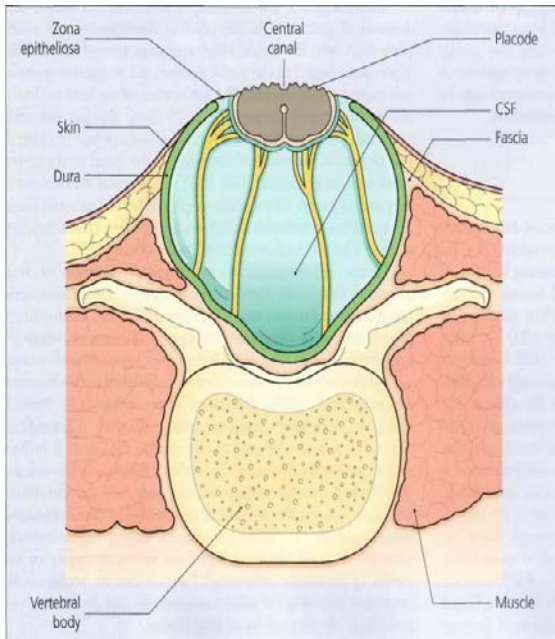
The skin, muscles, bones, ligaments, dura and CSF are all present to protect the spinal cord; thus any disease that involves the bony part can involve the neurological part.

Types of diseases that can involve the spine

Diseases are generally classified into 6 types:

1-Congenital-neural tube defects
e.g,--Myelomeningocele

Diseases that the patients are born with and they mostly develop during embryogenesis.



One of the most common congenital defects that we deal with is **Spina Bifida** (الفقرة المشقوقة) and in this condition, for whatever the cause, we don't have complete formation of the vertebrae.

We have two types of spina bifida:

1) First one is Spina Bifida Occulta (occulta =hidden); patients with this type show very mild symptoms or are asymptomatic and they live their lives normally, but for some reason they go and get an X- Ray and accordingly the condition is diagnosed.

The X-Ray usually shows incomplete formation of the laminae and spinous processes, such defects are commonly seen at the level of L5 and S1.

It occurs in about 10-15% of the population (considered as a very high percentage); that's why some people consider it as an anatomical variation and not a disease.

2) Second one is spina bifida aperta and this one is clinically apparent at birth (it appears as the picture in the previous slide); it's caused by neural tube defect.

- Most commonly appears as **Myelomeningocele**; caused by an incomplete closure of the neural tube (Dura, bones, muscles and skin are all not formed).
- Myelo refers to the spinal cord, meningo refers to the meninges and cele means sac.
- These patients have variable amount of lower limb weakness ranges from weakness to paralysis (it depends on the location of the defect), their sensations are also affected as well as the bladder because the bladder and the inner tone are controlled by the spinal cord.

- There is no specific cause for this malformation; it is rather multifactorial and one of the causes is familial. Also, folic acid deficiency **before** pregnancy can contribute to the development of this condition.

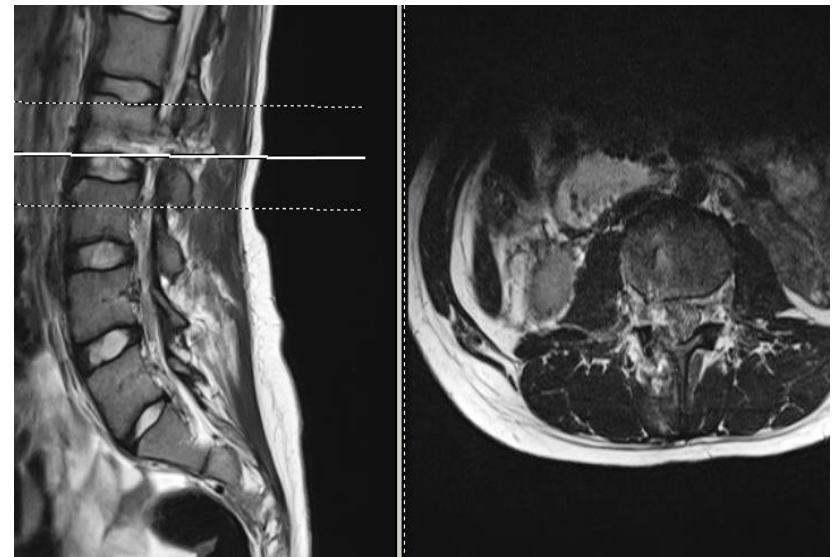
In addition, drugs can contribute to the disease, especially anti-epileptic drugs (eg. Valproic acid).

- Surgeons can't give much help in such a condition, they can't do a nerve transplant or put the spinal cord back to its position... All they can do is repair; they remove the sac (it contains CSF) to prevent meningitis and they cover the region with a skin flap.
- Accordingly, the aim of surgery in these cases is: 1-preventing meningitis 2-provide normal skin covering to give a better cosmetic appearance
- Surgery won't improve the lower limb weakness or the control of sphincters.

2-Traumatic

- Bone and ligamentous injuries_+spinal cord injuries

CT scan (sagittal)



Spinal cord injuries

- Spinal cord injuries can involve cervical, thoracic or lumbar spine.

We have vertebral fractures in this case, but the main issue is the spinal cord injury in the neck (Notice the MRI in the middle) that caused the patient to become quadriplegic



The most common spinal tumors are the ones that involve the bone (extradural).

3-Neoplastic (benign or malignant)

Can be classified anatomically into:

1-Extradural

tumors (most commonly caused because of metastasis)

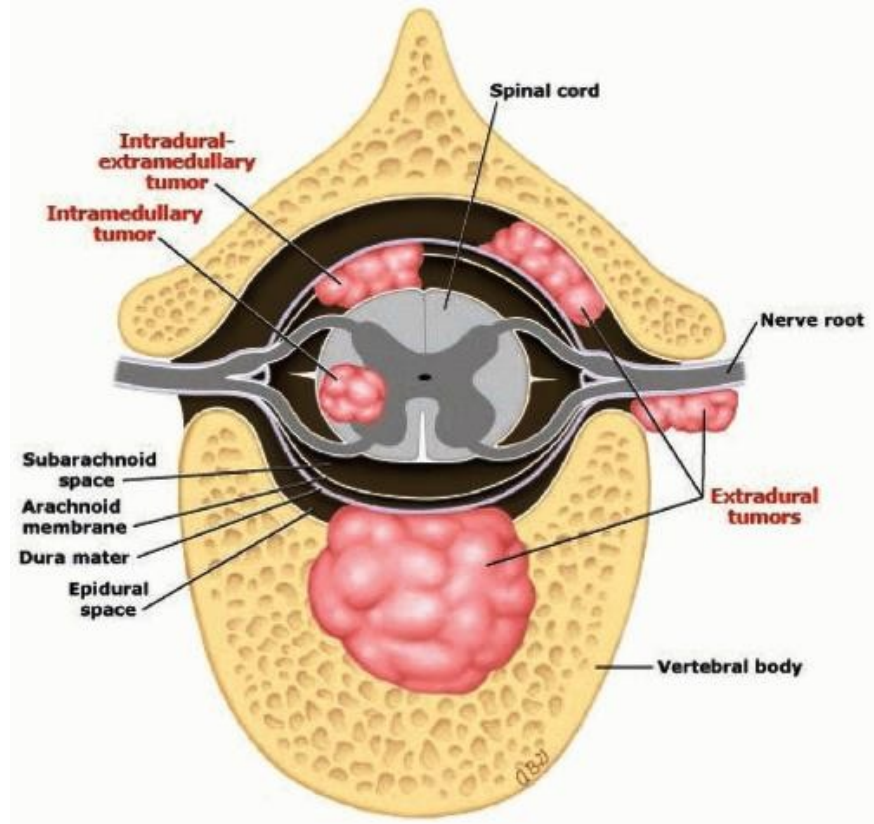
2-Intradural

(extramedullary)

-usually benign and can be resected completely-

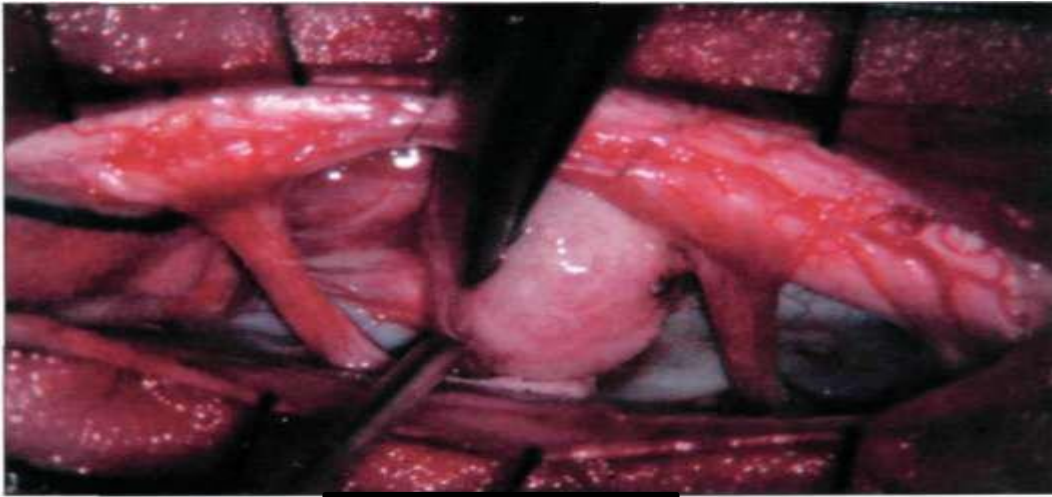
3-Intramedullary

(Rare and it's difficult to resect it completely)

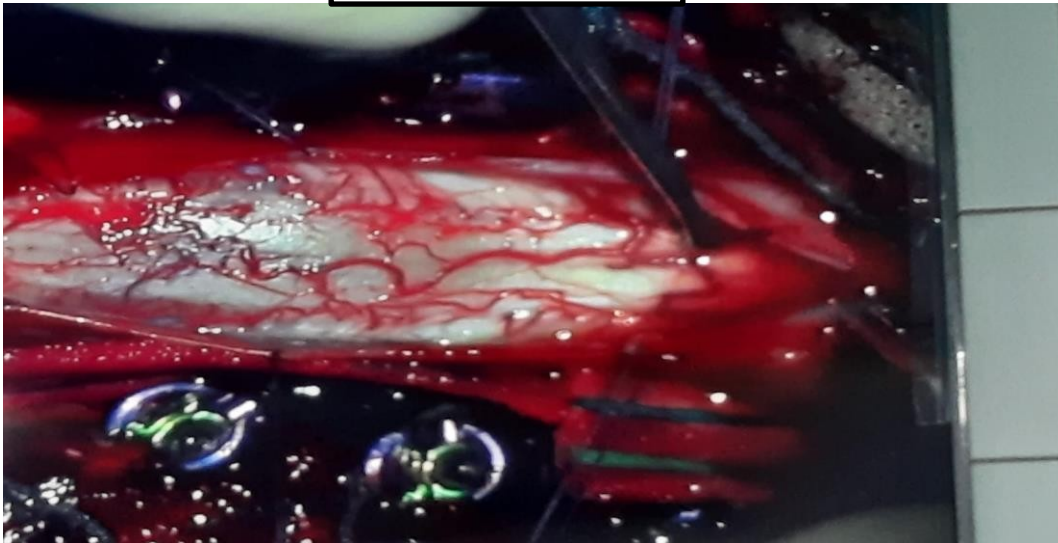


Medullary refers to the spinal cord

Intradural (extramedullary)
Meningioma



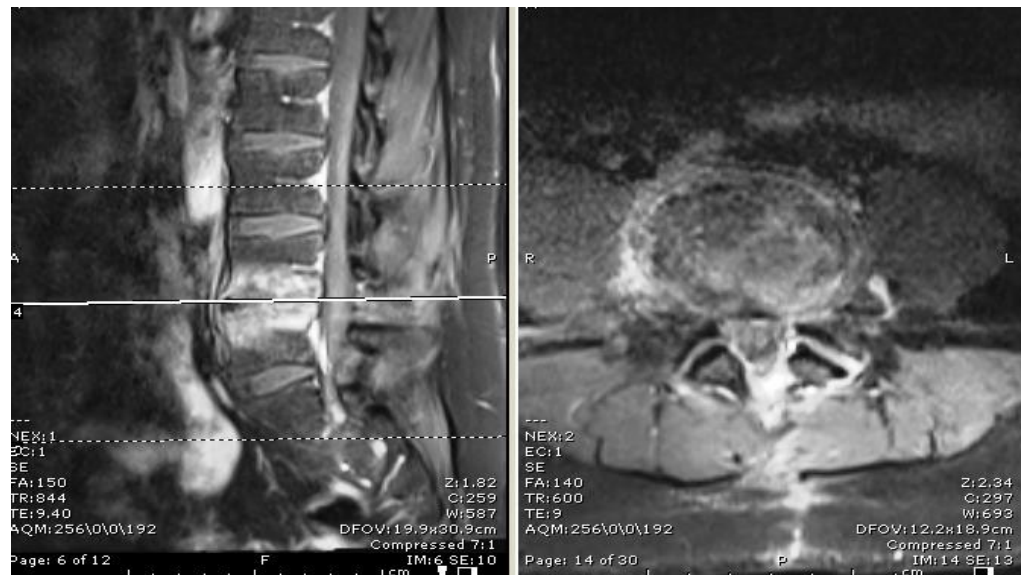
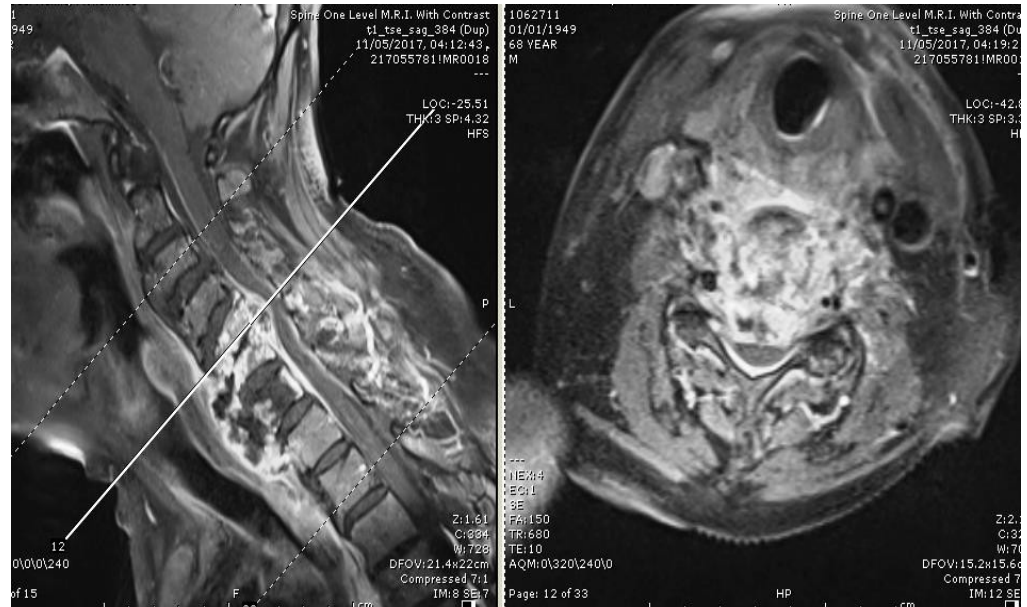
Intramedullary



4-Infalmmatory

Infectious and non-infectious.

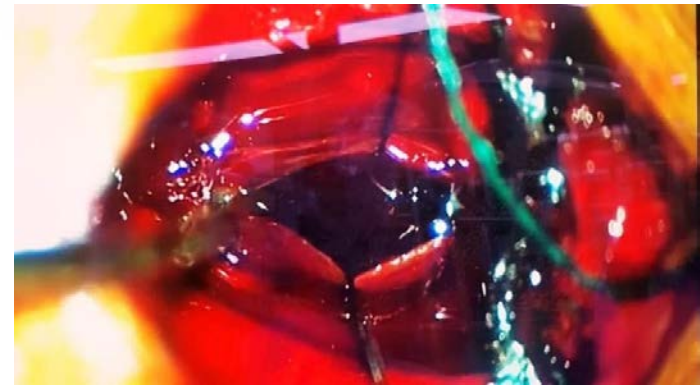
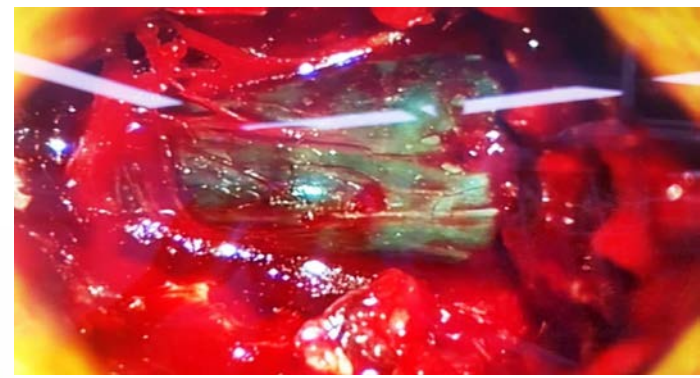
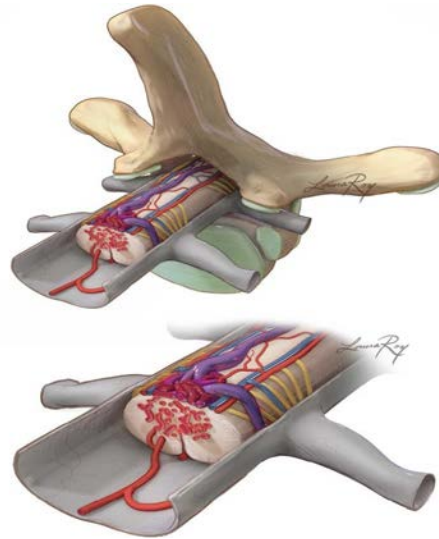
- Infections of the spine are either primary or secondary.
- Secondary spine infections are the ones associated with surgeries for example or other procedures such as taking a biopsy.
- Primary spine infections are often seen as we have 2 endemic diseases in our region (Middle east) that are: Tuberculosis (Pott's disease) and Brucellosis.
- The mean treatment for the infections is a long course antibiotics.



5- Vascular diseases

Rare

We have 2 major vascular diseases: Ischemia (it's very rare to have ischemia in arteries of the spinal cord) and the other one is bleeding.

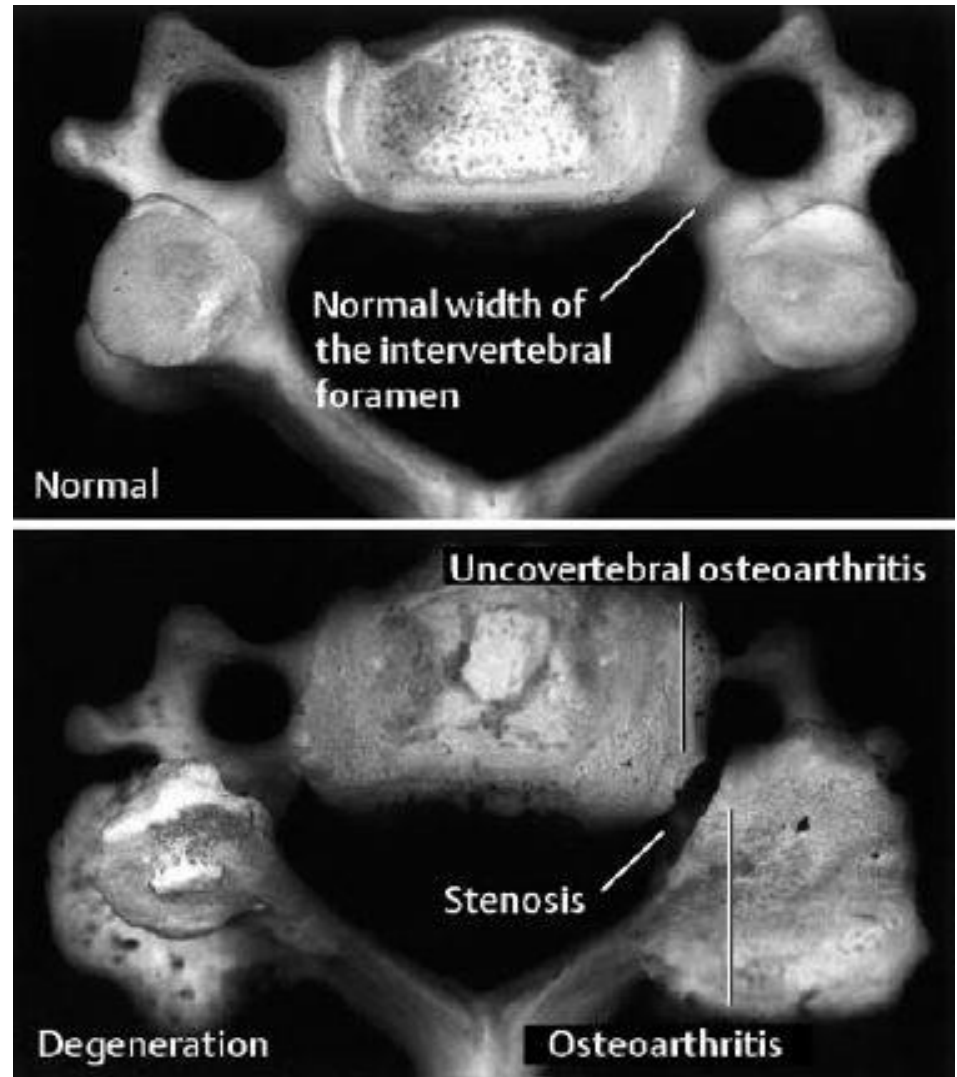


- There is a condition that is called arteriovenous malformation(AVM); which results from the development of irregular connections between arteries and veins thus causing bleeding .

More elaboration on AVM : Normally, blood flows through arteries that become arterioles then capillaries then venules then veins and the purpose of this process is to regulate BP. However, in the case of AVM and because of the irregular connections, the blood coming from arteries goes directly to veins that have thinner walls and might rupture eventually due to higher BP.

6 -The degenerative spinal(disc)diseases

- Are the most common
- A spectrum of diseases
- All are **age related**—tear and wear
- Some use the term spondylosis
- These changes diffusely involve the :
 - Intervertebral disc
 - The joint --facet
 - The bone
 - The ligament and soft tissues
 - Osteophytes



The degenerative spinal(disc)diseases

- Degenerative spine conditions involve the gradual loss of normal structure and function of the spine over time. They are usually caused by aging, but may also be the result of tumors, infections or arthritis. Pressure on the spinal cord and nerve roots caused by degeneration can be caused by:
Slipped or herniated discs

Degenerative spinal diseases

- 1) Disc herniation_prolapse.
- 2) SpinalCanal stenosis.
- 3)Spondylolesthesis.

Intervertebral disc herniation (Abnormal protrusion)

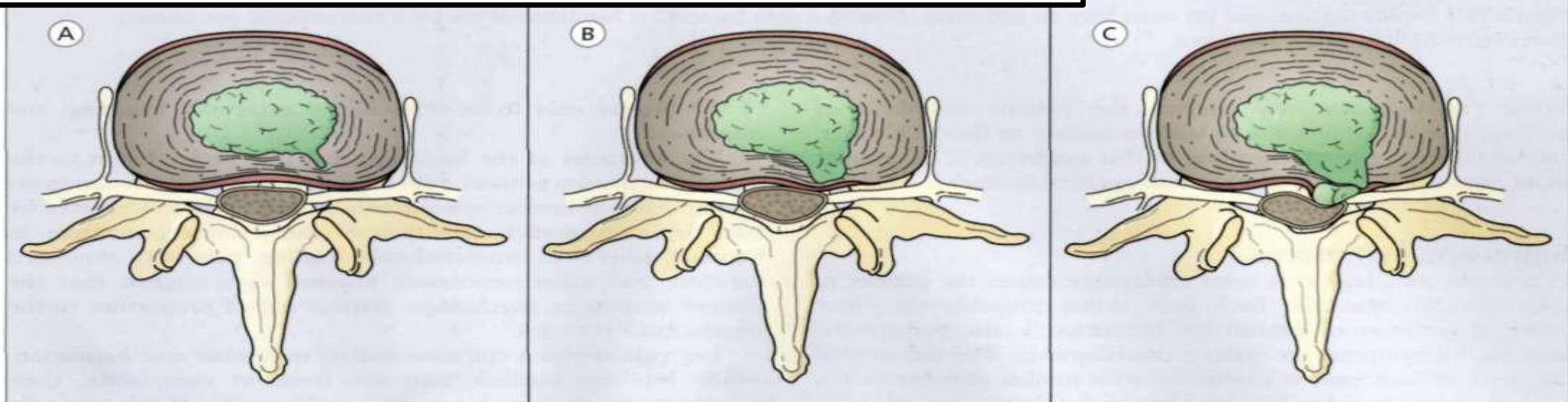
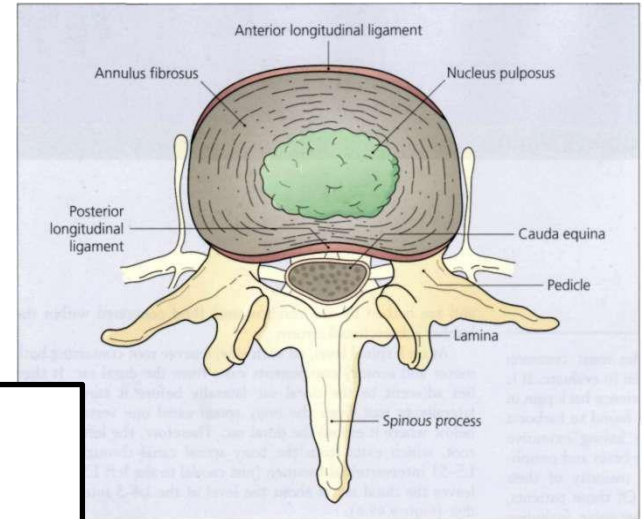
90% lumbar (Lumbar spine holds most of the body weight).

9% cervical

1% thoracic(dorsal)

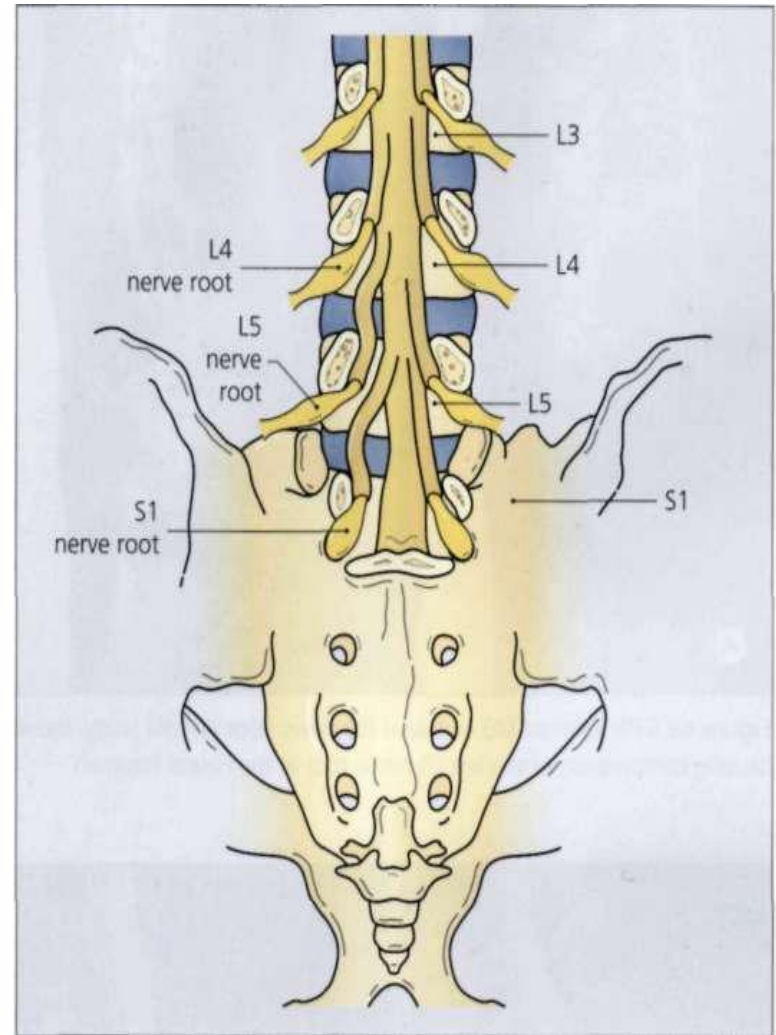
The major structure of the disc is a ring (annulus fibrosus) surrounding the nucleus pulposus; when we have a herniation, the annulus becomes weaker and the nucleus protrudes.

This herniation isn't a problem when the protrusion is to the front or to the sides. Meanwhile, when the nucleus herniates posteriorly towards the spinal canal, it causes pain and the patient comes with disc herniation symptoms.

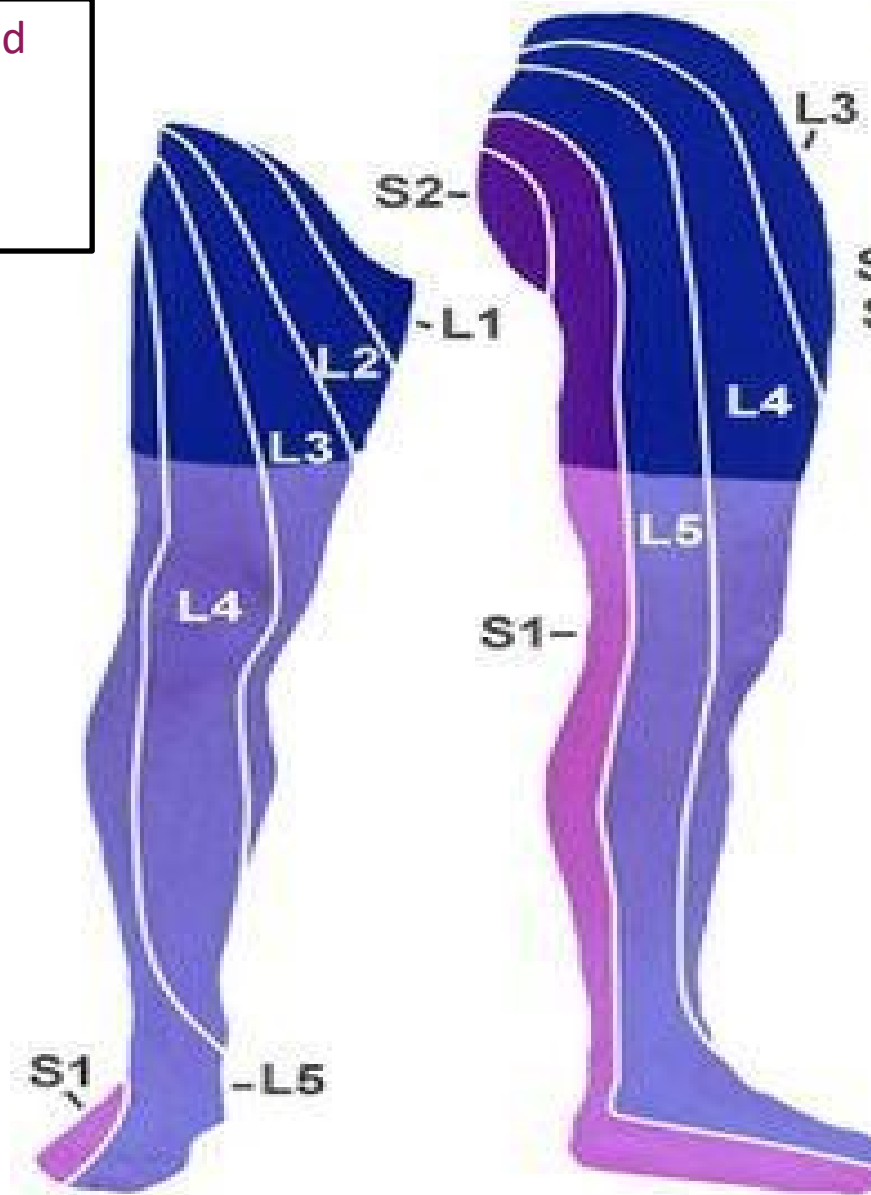


Lumbar disc herniation-symptoms and signs:

- 1) Axial back pain (low back pain that is caused by reflex muscle spasm)
- 2) Root pain –**sciatica** (L4L5/L5S1)
- 3) Symptoms of roots dysfunction (when it compresses the nerves enough to cause injury to the roots) – numbness (Sensory component), weakness (Motor) or sphincteric disturbances (Autonomic).



The pain that is radiated from the back to the lower limb is called sciatica (عرق النسا).



It is very important to know exactly where does the patient has pain to determine which disc has herniated

Physical signs

Straight leg raising test;
30-60 degrees (between
the leg and bed), at
which a radiating pain is
triggered, is considered
highly specific assistive
for disc prolapse.

Side note: a symptom is a manifestation of disease apparent to the patient himself, while a sign is a manifestation of disease that the physician perceives.



Neurological deficits

Disc	Nerve root	Pain	Paresthesias, numbness	Weakness	Reflexes
L3-4	L4	Lower back buttock lateral/ anterior thigh, anterior leg	Anterior thigh, anterior leg	Quadriceps femoris femoris (extension of knee)	Knee jerk diminished or absent
L4-5	L5	Lower back, buttock, lateral thigh, anterolateral calf, occasionally groin	Anterolateral calf to great toe	Extensor hallucis longus (extension of great toe)	Usually no changes
L5-S1	S1	Lower back, buttock, lateral thigh and calf	Lateral calf to small toe	Gastrocnemius (plantarflexion of ankle)	Ankle jerk diminished or absent

- Then we should test sensations and motor reflexes of the lower limb to determine the level of injury to nerves, if present (dermatomes and myotomes).
- For ex.; weakness in the dorsoflexion of the foot and big toe implicates L5 injury, weakness in the little toes dorsoflexion and plantarflexion implicates S1 injury, and so on.
- After that, we ask for imaging.

Investigations

Spine MRI-is the best

MRI is the best imaging type for spinal cord because it show soft tissue.
Notice here the herniation is of L4-5 disc and that there is nothing left of the spinal canal.



Treatment

Conservative nonsurgical;
(usual treatment)

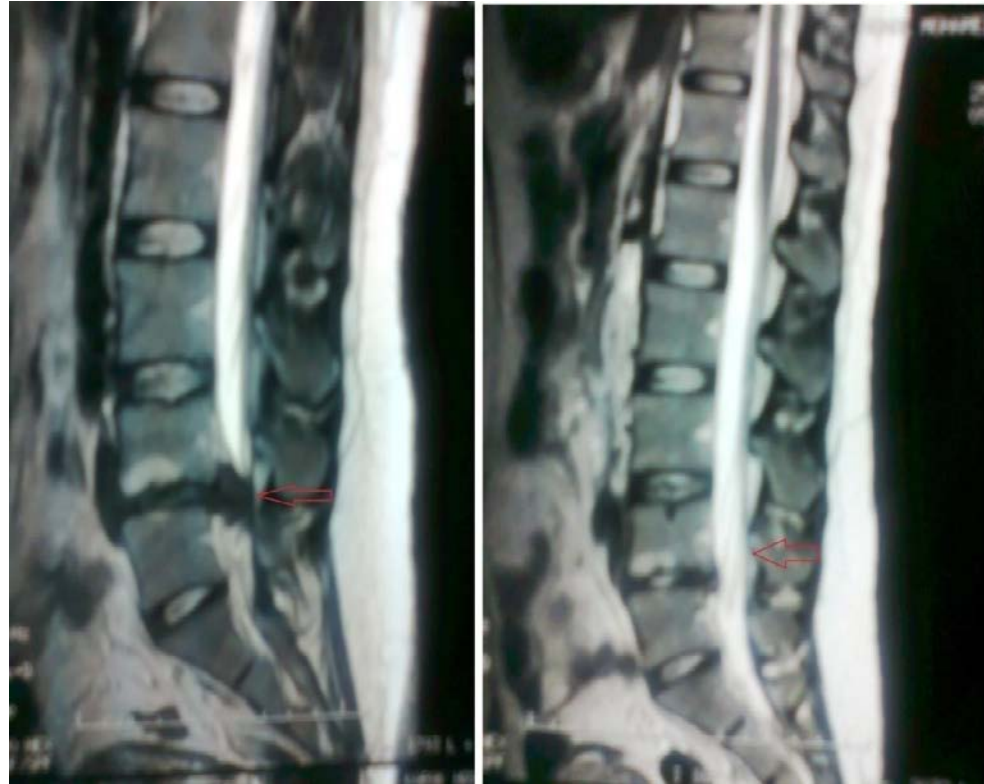
NSAIDs (such as ibuprofen, voltaren), muscle relaxants and bed-rest for a few days.

Physiotherapy may be initiated.

Success —up to 80%.

Many theories explain the success:
inflammation resolution,
1-inflammatory process and enzymes may melt the cartilage.

2- Disc has no blood vessels, it is nourished by diffusion from the endplate; therefore, herniation may cause ischemia that leads to disc necrosis.



Surgery

-Microdiscectomy

Indications:

-Severe sciatica: **intractable pain with failure of treatment.**

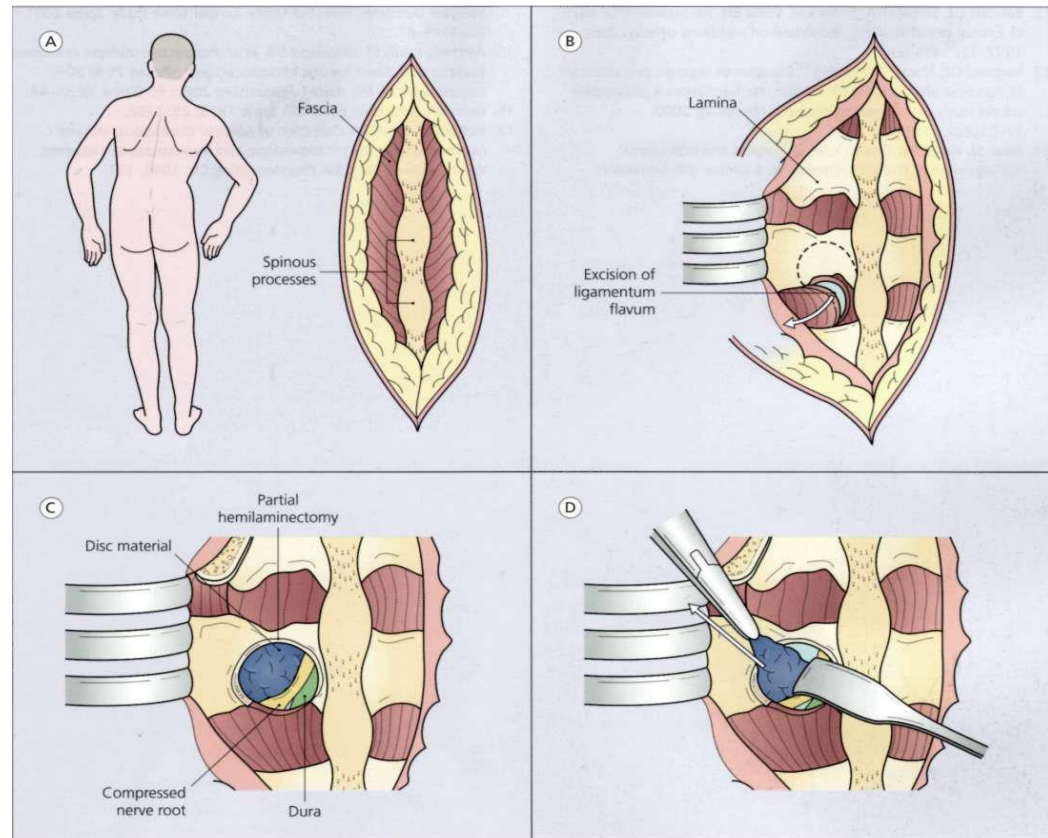
-Neurological deficit-
weakness; **compression leads to ischemia which cause neural necrosis (complete loss of the nerve; late stage).**

-Initial weakness (first 48hrs) is the ideal timing to perform the surgery and save the nerve.

Later on, the patient might not improve after the surgery.

-Endoscopic microdiscectomy is common nowadays.

-There's a chance of recurrence.



Side note: sciatica refers to pain, weakness, numbness, or tingling in the leg (caused by injury to or pressure on the sciatic nerve).





This should be a video for the surgery, I've got you a one close to it :))
<https://www.youtube.com/watch?v=RjJdKOmQVf4>

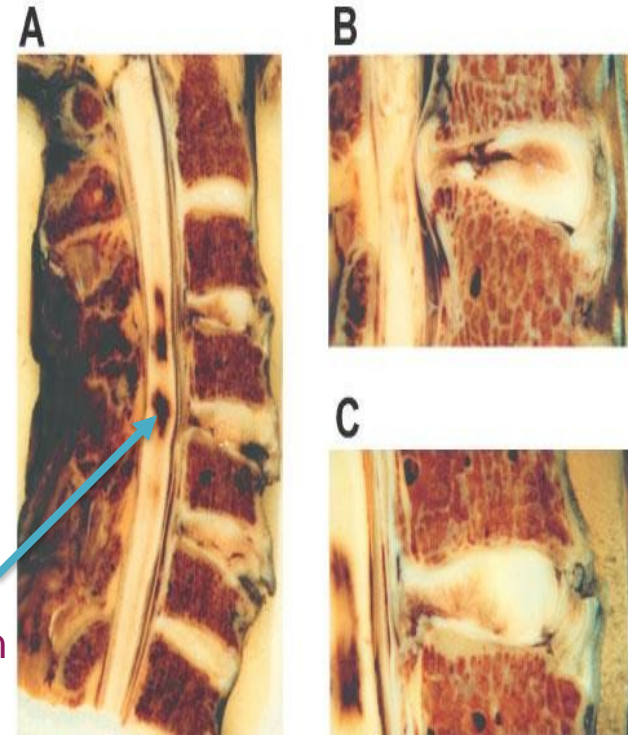
Cervical disc prolapse

It can produce:

- 1-Radiculopathy—root compression
- 2-Myelopathy-spinal cord compression (much more severe because the cord contains the long tracts that serve the upper and lower limbs).

Unfortunately, radiculopathy is more painful (spinal cord is less sensitive to pain), the patient usually presents in late stages of myelopathy.

Cervical differs from lumbar, it has spinal cord, the disc can compress the cord and cause myelopathy too. In lumbar, we only have roots, so only radiculopathy can occur.



Here, the autopsy shows spinal cord infarction caused by chronic compression and is irreversible.

Cervical radiculopathy

In lumbar disc prolapse, the most common is L5-S1, while in cervical, the most common is C5-C6.

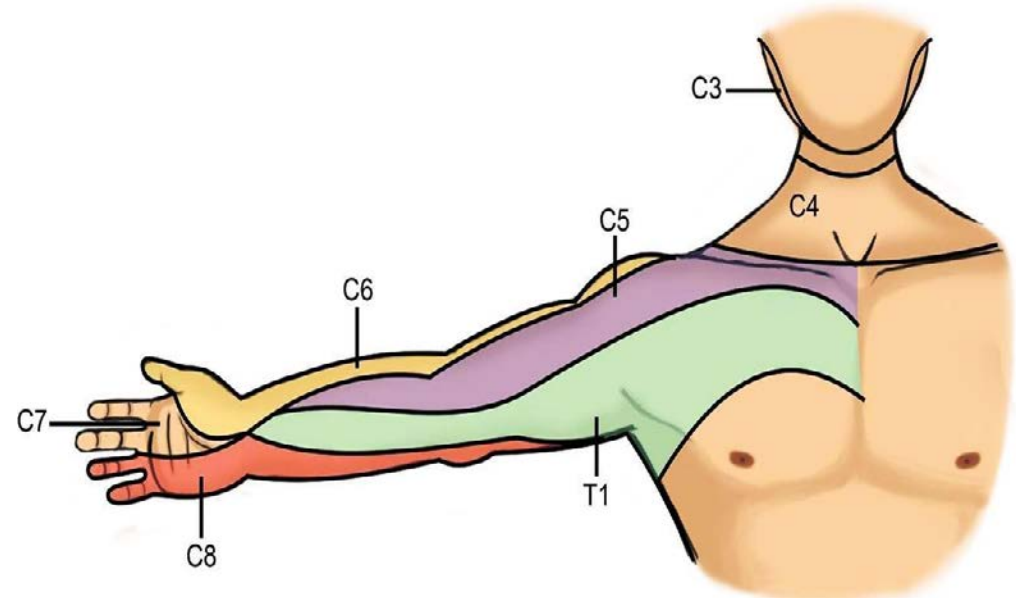
In C6 compression, the pain course is neck-lateral arm and forearm- thumb.

Middle fingers→C7.

Little fingers and medial arm and forearm→C8.

Sometimes, there is pain without weakness.

Upper Extremity Dermatome Anterior View



Nerve Root Motor Function	
Nerve Root	Test
C5	Elbow Flexion
C6	Wrist Extension
C7	Wrist Flexion, Finger Extension
C8	Finger Flexion
T1	Finger Abduction

Root Values for Tendon Reflexes	
Root Value	Tendon Reflexes
C5	Biceps
C6	Brachioradialis
C7	Triceps

Left C5-C6 PID

PID: Prolapsed intervertebral disc

MRI is the best investigator just like the lumbar region. This patient is expected to have pain in his left arm.



Cervical myelopathy

Will affect both upper and lower limbs-with all signs of upper motor neuron lesion

Common symptoms

Clumsy or weak hands

Leg weakness or stiffness

Neck stiffness

Pain in shoulders or arms

Unsteady gait

Common signs

Weakness of the hand musculature

Hyperreflexia

Lhermitte sign (electric shock-like sensation down the center of the back following flexion of the neck)

Sensory loss

Compression on the central disc that caused atrophy of the spine.



Treatment of cervical disc prolapse

1- Anterior

Cervical discectomy and fusion(ACDF); the cervical disc is removed and bone grafts and/or implants (cage, plates) are placed to provide stability and strength. In the lumbar area, you can move the root as you like because there is no cord, unlike the cervicothoracic area, you can't go posterior and move the cord as you'll cause paralysis of the patient.

Or (Posterior for the cervical area/ no discectomy from behind)

2-Laminectomy (decompression); creates space by removing the lamina.



Lumbar canal stenosis (chronic degenerative disease)

-Long standing circumferential stenosis (not compression) of the lumbar canal

-Caused by

1-Diffuse disc bulge

2-Ligaments hypertrophy

3-Facet joint hypertrophy

-The typical presentation is progressive *neurogenic claudication*-pain in the lower limbs upon walking

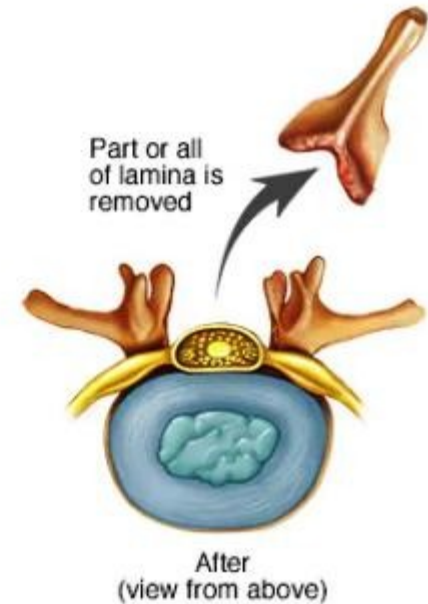
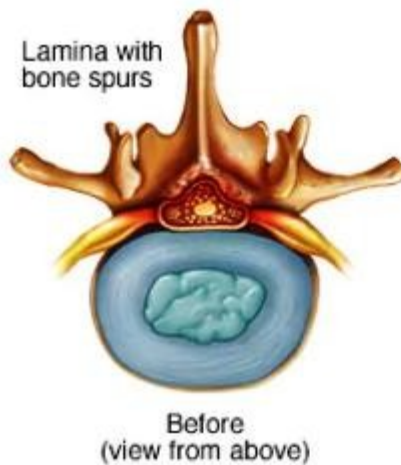
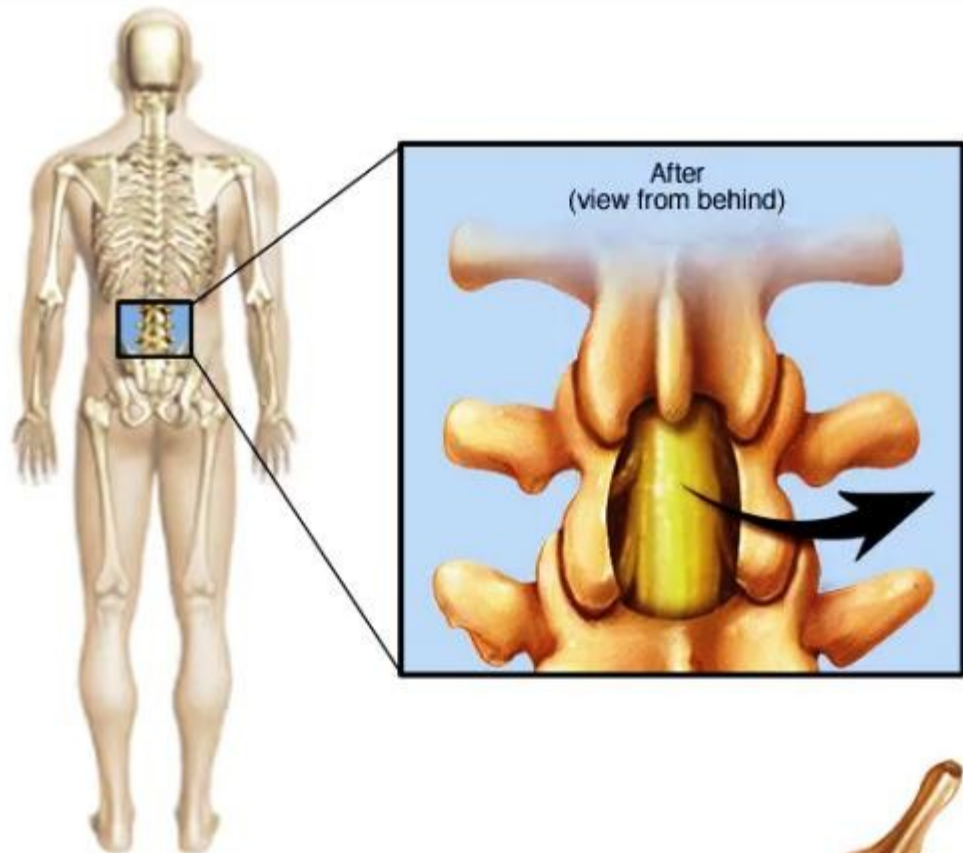
-It is a disease of elderly population (need breaks after walking a few metres). The root goes through stenosis not compression, it takes a long time so the nerve has time to adapt, when the patient walks and the nerve root gets activated, lots of blood reaches as the arteries are thick walled. However, the veins are thin walled, so the blood doesn't go back, venous congestion happens and the nerve root stops working.

There is something called vascular claudication in peripheral vascular diseases. It's related to blood supply rather than nerves (muscle ischemia).



Treatment

Is usually surgical laminectomy (progressive disease affecting elderlies).



Spondylolesthesis

The forward or anterior displacement of a vertebra over the vertebra inferior to it.

The commonest cause of the disease is facet degeneration (could be caused by disc degeneration).

-Will cause:

low back pain_+ lumbar radiculopathies

Can't be differentiated clinically, we must perform imaging.

-Surgical treatment (more complex surgery).

Laminectomy and fixation to stabilize the slipping vertebrae.



Spondylolisthesis is a forward slippage of the upper vertebra over the lower one.

This an L4-5 spondylolisthesis.



Hope to see you in our theatre in
2025-2026 ناعاش الله



Good luck :))

