



**PBL**

*Central Nervous System*

Writer: Noor Ashraf

Corrector: Shahed Atiyat

Doctor: Qusai Saleh

## Diseases of the spine



- ✓ Why there is diversity in specialties that deal with the spine? (Orthopedics, neurosurgery, pain management)?

Because diseases of the spine are very common, especially degenerative diseases and because diseases of the spine are not yet well established (as per management and surgical interventions).

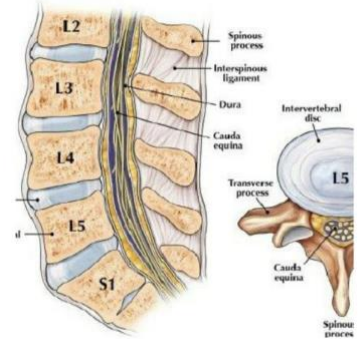
- ✓ What do we mean by the word? (SPINE)?

### Two integrated systems

**1-A musculoskeletal system** (vertebral bodies, laminae, ligaments and intervertebral discs)

**2-A neurological system** (spinal cord and nerve roots inside of it)

**Both are integrated functionally and anatomically** (even pathologically).



### Types of diseases that can involve the spine:

Can be classified into one of these 6 categories: -according to the age of onset-

The Dr will focus on **congenital** and **degenerative**.

### 1-Congenital-neural tube defects

The baby is born with it; you know that the spinal cord is formed from the neural tube from day 14 to 27/28 of gestation.

Neural plate then neural folds and grooves then complete closure of neural tube, any fault in these processes will lead to these defects. -spinal dysraphism

e.g Myelomeningocele

- **Spina bifida occulta** = hidden

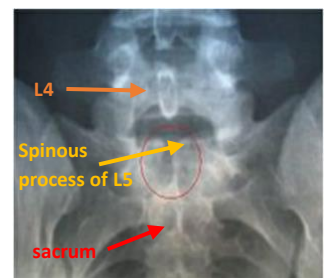
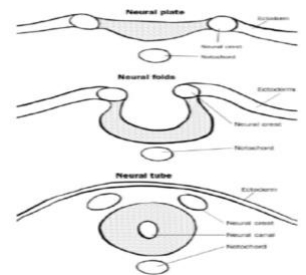
**-Definition:** congenital absence of spinous processes and a variable amount of lamina, no visible exposure of neural tissue.

It is the most benign and doesn't have an effect that much on the person.

Incidence is 10-15% of the population, therefore, some consider it as congenital variation not a disease.

-Occurs in L5 or S1 vertebrae in about 20% of otherwise normal people.

-Often incidental finding in 99.9% of cases but (in minor form the only evidence of its presence may be a small dimple with a tuft of hair arising from it, some type of cord malfunction called tethered cord which is very rare).



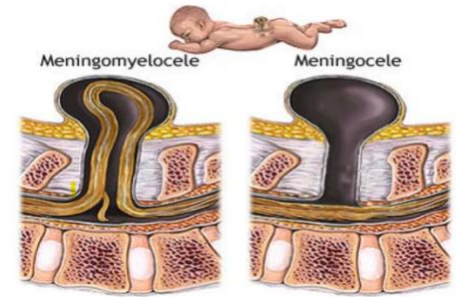
This is an AP view / X-ray

- **Spina bifida aperta** aperta= ظاهر

Meninges are bulging through this opening outside.

1. **Meningocele** → Meningocele happens when a sac of fluid comes through an opening in your baby's back, but the spinal cord isn't in the sac. There's usually little or no nerve damage.

2. **Myelomeningocele** → part of their spinal cord and nerves are in the sac and are damaged and there is no lower limb movement.



**Risk factors:**

- Nutritional
- Drugs

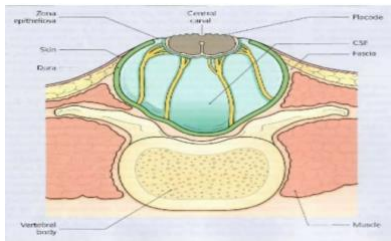
\* Maternal folate deficiency.

-During the formation of the neural tube, so early in the pregnancy when the mother doesn't even know she's pregnant yet.

\* Prior history of a child with myelomeningocele (5% risk) familial factor.

\* Presence of relatives with a history of myelomeningocele.

\* Valproic acid= anti-epileptic drug (1-2% risk if taken during pregnancy)



This is a baby with myelomeningocele.

القبيلة النخاعية السحائية

-There is a membrane, no skin, you can see CSF inside the sac, and the spinal cord with nerve roots floating.

### Associated Conditions:

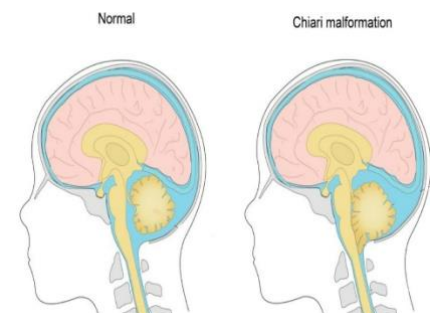
• **Hydrocephalus:** accumulation of CSF inside the ventricles

And **Chiari II Malformation:** myelomeningocele + hydrocephalus

Some parts of the brain stem and cerebellum in the posterior cranial fossa especially the vermis or tonsils herniate into foramen magnum.

(80% of cases).

- Neurogenic bladder.
- Urinary Incontinence.
- Stool Incontinence.
- Meningitis. If surgery wasn't done.

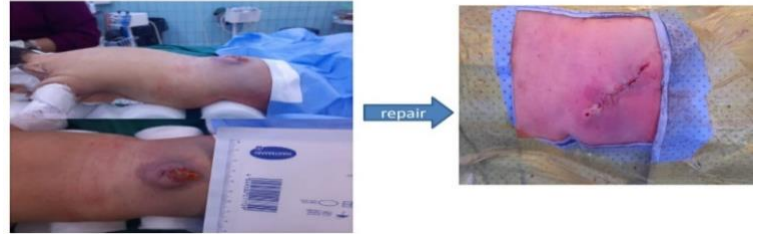


## Treatment--repair

- **Aims:** - to prevent meningitis  
-cosmetic and nursing care

*Surgery will not improve the lower limbs.*

*The state of paralysis will stay the same.*

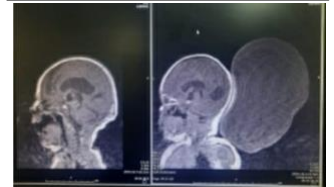


- **Encephalocele**

Instead of the sac bulging in the back it bulges in the cervical area.



MRI pre- and post-operation

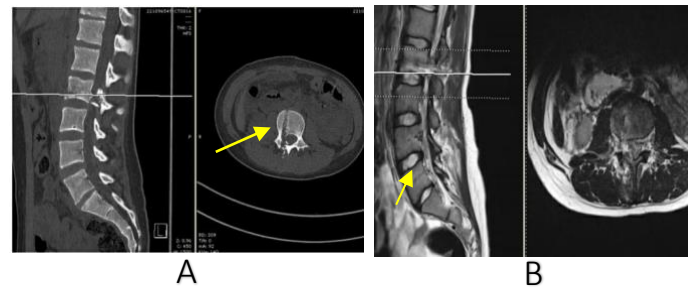


## 2-Traumatic

- Bone and ligamentous injuries  $\pm$  spinal cord injuries.

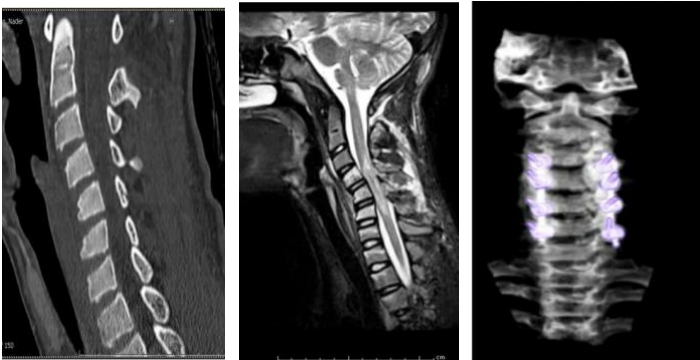
Pic A: CT scan

Pic B: sagittal MRI scan (on the left of B) the right is axial (same for A), shows the soft tissue and structures clearly, note the discs.



This patient has a gunshot wound in her spine (note the bullet fractured the vertebra) it affected the nerve roots, so she had weakness in hip flexors.

### ✓ Spinal cord injuries



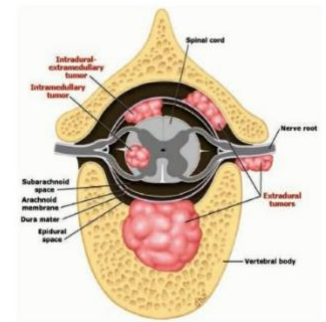
- This patient had a wall collapse on him.
- The middle picture is MRI; it shows the cord as abnormal with "contusions".
- Unfortunately, this child was almost quadriplegic. With difficulty in breathing because the phrenic nerve C3-C5 was affected and it supplies respiratory muscles, the Dr decompressed his spine in the surgery.
- Paresis means weakness.

### 3-Neoplastic

Can be classified anatomically into:

**1-Extradural tumors:** usually metastatic, (most common spine tumor) ,50% of autopsies made on people with malignancies found to have spine metastasis. Usually causes severe lower back pain.

**2-Intradural extramedullary:** outside spinal cord e.g. meningioma & nerve sheath tumors, both are benign and can be resected.

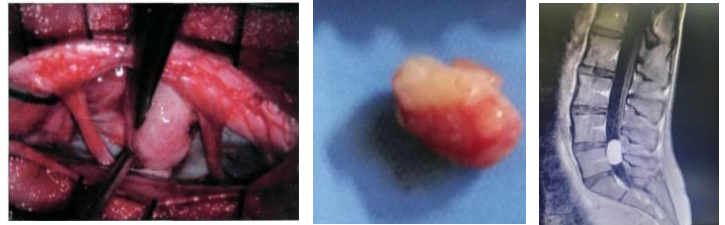


**3-Intramedullary astrocytoma & ependymoma**

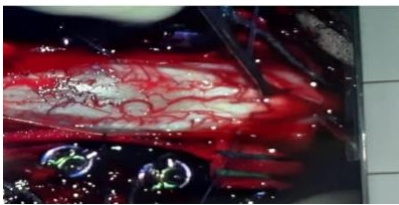
Only glial cells regenerate.

Most common brain tumor is astrocytoma.

Not always accessible.



These pictures are for a tawjihi patient, she had intradural extramedullary meningioma as seen in MRI.



This is for an old patient, extradural ependymoma. She improved but still has weakness.

### 4-Inflammatory

Infectious and noninfectious

Usually not treated with surgery.

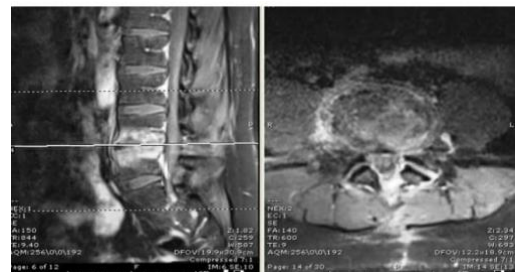
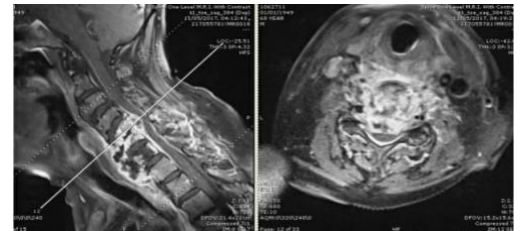
Areas with inflammation appear white on contrast imaging.

Infection of the spine can be **primary** (the patient didn't have surgery).

In our region, we have two endemic causes of infections in the spine:

- 1- Tuberculosis
- 2- Brucellosis (contaminated cheese and milk)

Also, infection can be secondary if the patient had surgery previously in his spine.



## 5- vascular diseases ... RARE

Are either ischemic or hemorrhagic, infarction of the spine is very rare it has a rich blood supply.

Hemorrhage is also rare, but it happens in arteriovenous malformation AVM: it is a bad communication between artery and vein.

AVM bleeding in the brain is more common (steal phenomena) when the malformed vessel takes from a major vessel.

Pic: Hemorrhage in spinal cord. The blue color in the dura means there is blood inside it.



## 6 -The degenerative spinal (disc ) diseases

-Are the most common

-A spectrum of diseases

-All are age related—tear and wear استهلاك

-Some use the term spondylosis

-These changes diffusely involve the:

- Intervertebral disc. loss of elasticity
- The joint –facet.
- The bone.
- The ligament and soft tissues

Can present with symptoms or not.

• 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-Canal stenosis.

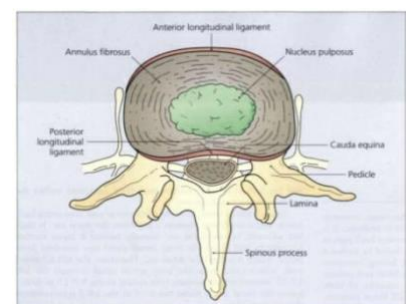
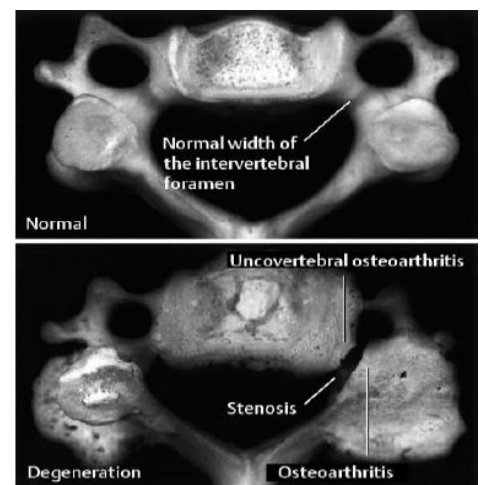
3-Spondylolesthesis.

### Intervertebral disc herniation

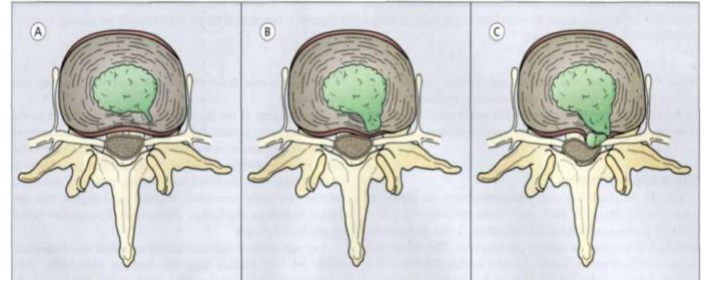
90% lumbar

9% cervical

1% thoracic (dorsal)



- ✓ Disc consists of annulus fibrosis and nucleus pulposus
- ✓ Herniation: protrusion of structures through a defect.
- ✓ Can compress nerve roots producing neurological symptoms.
- ✓ Surgical intervention for thoracic disc herniation is very difficult.



### Lumbar disc herniation - symptoms and signs:

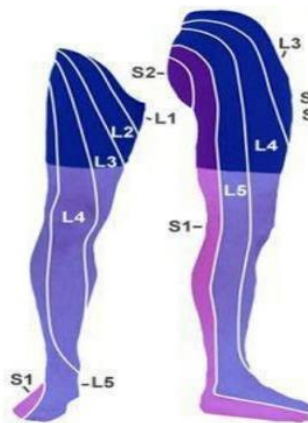
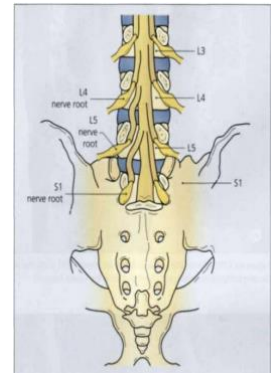
Depends on what root is affected.

If the disc is very large covering all cauda equina it will make cauda equina syndrome.

1- **Axial back pain** due to muscle spasm as a reflex mechanism since the disc itself isn't innervated.

2- **Root pain – sciatica (L4L5/L5S1)** pain that radiated from back to lower limbs (territory of sciatic nerve)

3- If it is severe enough: **Symptoms of roots dysfunction** –numbness, paresthesia, weakness or sphincteric disturbances (sensory, motor, autonomic -> cauda equina syndrome)



○ This is dermatomal distribution, if the patient complains of pain in his back radiating to his posterior thigh and to the dorsum of the foot, clinically this is L5-sciatica. Then do imaging to confirm.

○ Disc compresses on root not nerve causing radiculopathy اعترال جذور الأعصاب

○ It is different from peripheral neuropathy.

○ Injury to the sciatic nerve is a neuropathy.

○ When the disc compresses its root → radiculopathy

### **Physical signs**

1- **Straight leg raising test**

30-60 degrees

To confirm that the patient's pain is from the disc not just muscle pain or other causes eg. Knee problem.



The patient with sciatica has limitations while doing this test so he has it because it is very specific and sensitive to disc pain.

**Neurological deficits** examine power, sensations and deep tendon reflexes by a hammer

No need to memorize this table here.

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) dorsiflexio	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

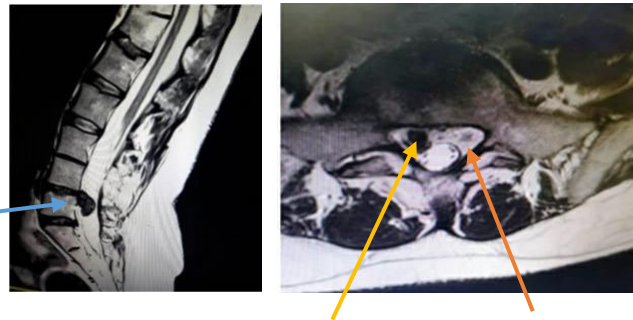
✓ **Investigations**

**Spine MRI** is the best it shows soft tissue.

orange arrow: this root is fine and intact.

yellow arrow: this root is damaged.

L5-S1 disc



✓ **Treatment**

Conservative nonsurgical.

Success —up to 80%

Treatment includes rest(relevant), use of NSAIDs is essential to treat the inflammation.

The pic is for patient from Al-Karak that had complete resolution of her disc problem without surgical intervention.



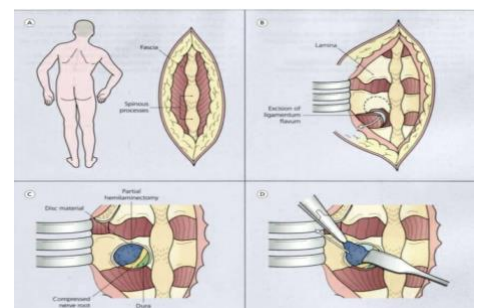
(Right pic is after), there are a lot of theories why this happens, one of them is that disc's inflammation releases enzymes around it that causes lysis of this viscous material. Or that since the disc is not vascularized by vessels, it receives nutrients by diffusion from endplate arterioles.

Take home message: not every patient needs surgery, in fact it should be the last resort if the patient is deteriorating and not responding to non-surgical treatments at all. Select the patient who needs surgery correctly due to proper indications.

**Surgery:** after you wait on the patient few weeks, if there's no improvement, proceed to surgery

**-Microdiscectomy Indications:** you have to do proper physical exam

-severe sciatica





-neurological deficit-weakness

-emergency: in foot drop patients because if surgery is delayed it will become permanent due to ischemia. And in acute cauda equina syndrome cases \*sciatica and urinary retention for 24-48 hrs , after surgery is done the improvement is minimal because it became permanent and turned to fibrous tissue. Remember that nerves do not regenerate.

Previously, this surgery was done by making a big incision and have to pass through all muscle tissue but nowadays it is only a small incision- 2cm- under the microscope with minimal scarring. It is one of the most common procedures with a 95% success rate. Especially with sedentary lifestyle (minimal movement and walking).



Go back to the lecture's video to see the surgery video “)

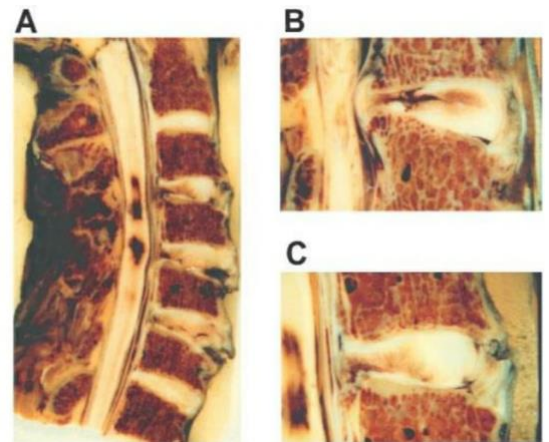
### ✓ Cervical disc prolapse

It can produce:

1-Radiculopathy—root compression pain radiates from neck to upper limbs.

2-Myelopathy-spinal cord compression if the disc is central.

The pictures are autopsy studies showing spinal contusions.

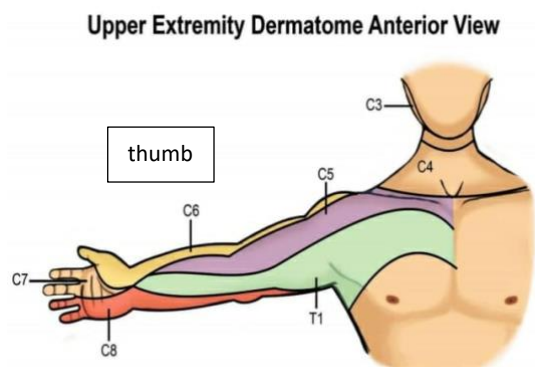


Cervical radiculopathy: radiates from neck to upper limbs

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

← \*Memorize this table\*

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



## Left C5-C6 PID



Orange arrow: spinal cord

This is cervical coronal section.

Root on the left is compressed (green)

Patient has pain in his left arm till thumb

C6 → extension

## ✓ Cervical myelopathy

Will affect both upper and lower limbs-with all signs of upper motor neuron lesion, cord is atrophied, symptoms appear late.

### Common symptoms

Clumsy or weak hands

Leg weakness or stiffness

Neck stiffness

Pain in shoulders or arms

Unsteady gait

The corticospinothalamic tract is affected

### Common signs

And posterior column

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



## Treatment of cervical disc prolapse:

1-Cervical discectomy and fusion (ACDF)

Or

2-laminectomy

Usually, it is done anteriorly but some cases from posterior view.

Cervical area doesn't have roots like lumbar, so it is more difficult to manipulate.



All the previous degenerative diseases are acute but this ↓ is not.

### ✓ Lumbar canal stenosis

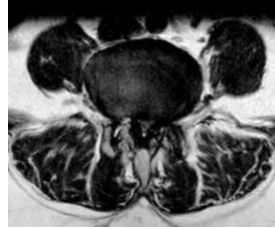
-Long standing circumferential stenosis of the lumbar canal, chronic.

-Caused by:

1- diffuse disc bulge, ligamentum flavum enlarges due to aging

2- ligaments hypertrophy

3- facet joint hypertrophy



-The typical presentation is progressive **neurogenic claudication**-pain in the lower limbs upon walking due to venous congestion. There is another type of claudication → vascular due to peripheral artery disease (muscle cramps)

العرج المتقطع

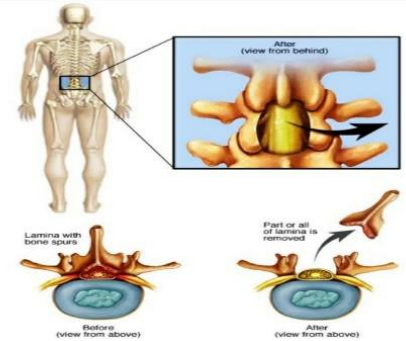
-It is a disease of the elderly population.

Treatment to improve quality of life and should be done early.

Is usually surgical laminectomy.

توسيع القناة الشوكية

We do modified laminectomy because laminectomy is a general term.



### ✓ Spondylolesthesis

The problem is in the ligaments and joints which will lead to slipping of the disc.

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

-Will cause:

➡ low back pain\_+ lumbar radiculopathies.

-Surgical treatment: we try to avoid surgery because we need to fixation of joints by screws.

➡ Laminectomy and fixation



***Hope to see you in our theatre in***

**ان شاء الله 2024-2025**



**Good luck”)**

