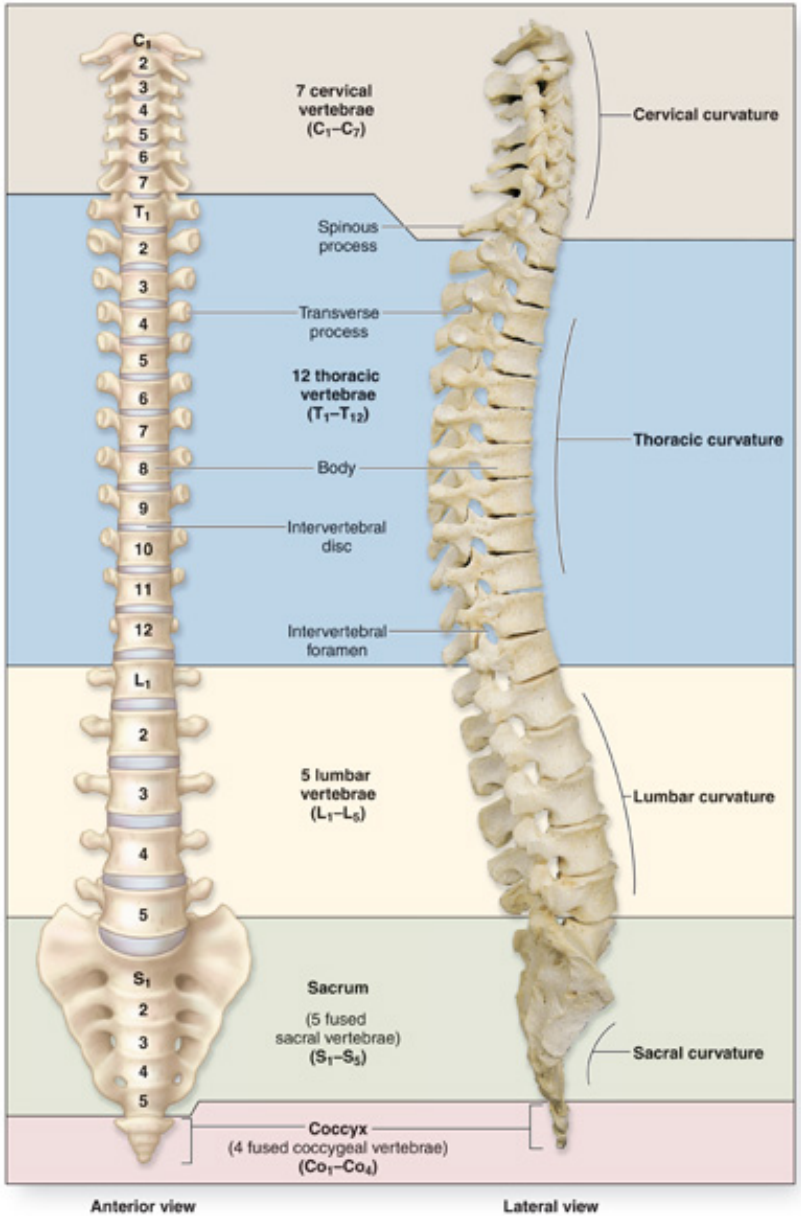
SPINAL DEGENERATIVE DISEASES

Wajd al habashneh
Rahaf abu salm

OVERVIEW

- The Vertebral column consists of 33 vertebrae: 7 cervical, 12 thoracic, 5 lumbar, 5 sacral (fused to form the sacrum), and 4 coccygeal (the lower 3 are fused)
- Spinal cord proper ends at L1 in adult, and the remaining spinal nerves, seeking their intervertebral foramen of exit form the cauda equina.
- Subarachnoid space ends at S2.

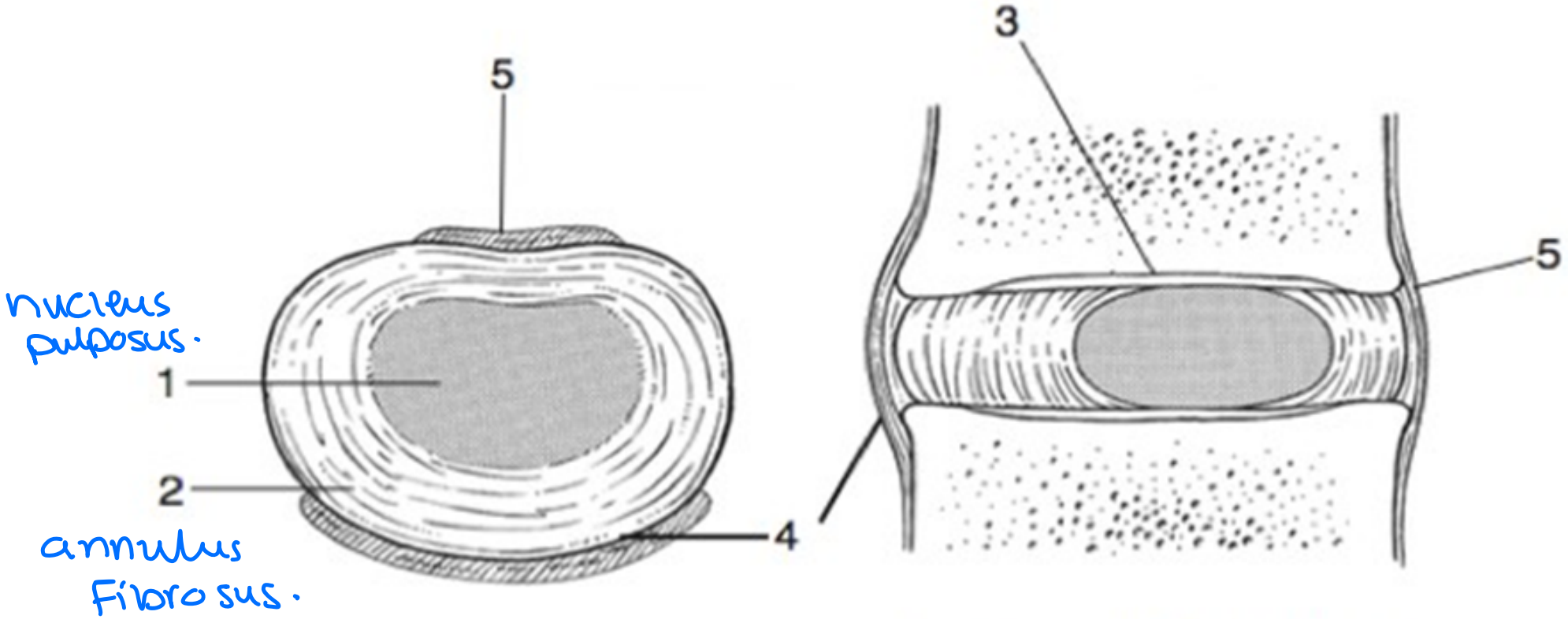
33 vertebrae: 7 C, 12 T, 5 L, 5 S, 4 coccygeal.



Overview

The vertebrae from C2 to S1 articulate with each other by two types of joints:

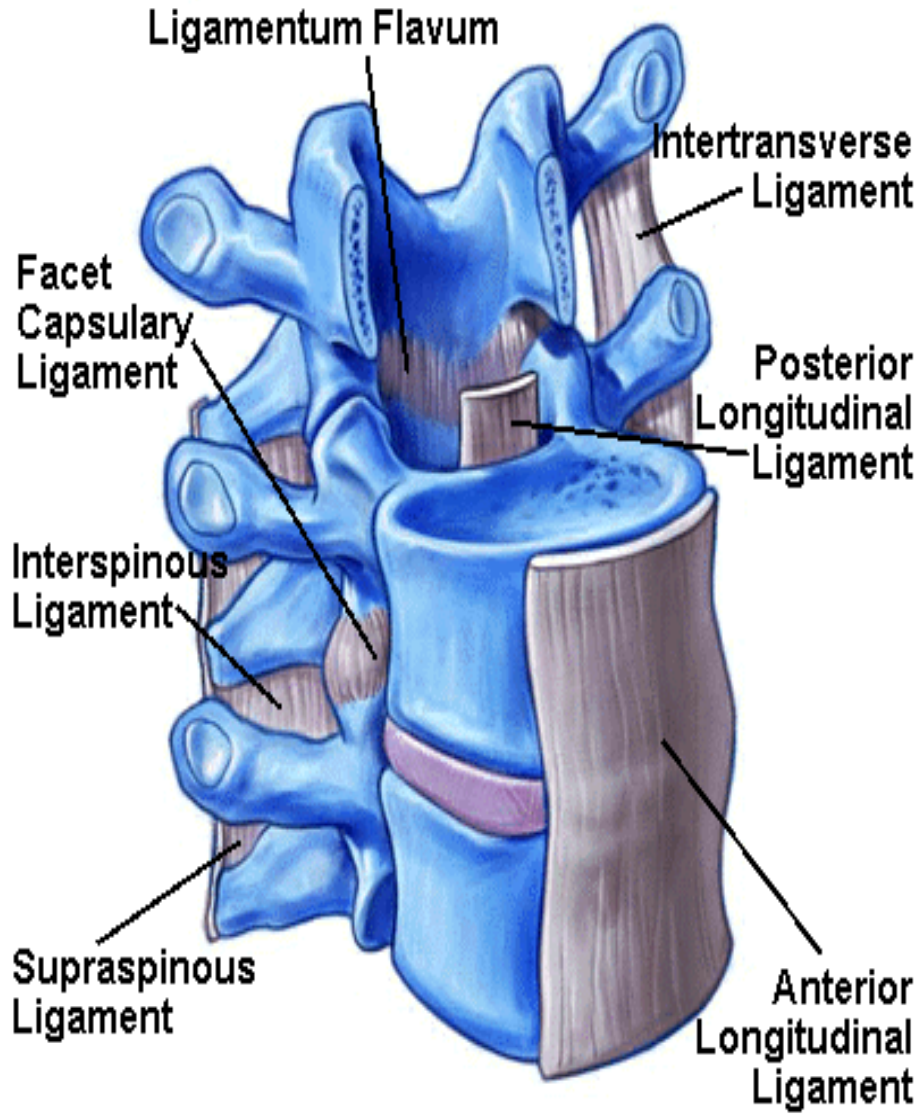
- Facet joint
  - Synovial joint between superior and inferior articular processes.
- Intervertebral disc
  - Cartilaginous joint between the vertebral bodies, it works as a shock absorber. The disc consists of;
    I. Annulus fibrosus: fibrous ,tough, outer layer.
    II. Nucleus pulposus: gelatinous part, with 80% water, which decreases with aging. → shock absorber.



The intervertebral disc: 1, nucleus; 2, annulus; 3, cartilaginous endplate; 4, anterior longitudinal ligament; 5, posterior longitudinal ligament.

OVERVIEW

- Vertebrae are also stabilized by the following ligaments:
  - Anterior longitudinal ligament
  - Posterior longitudinal ligament
  - Ligamentum flavum: between the laminae (The strongest lig.)
  - Interspinus ligament: between the inner surface of the spinous processes.
  - Supraspinous ligament: between the tips of the spinous processes.
  - Intertransverse ligament: between the transverse processes.



Degenerative Diseases of The Spine

- a general term that covers many types of conditions involve the gradual loss of normal structure and function of the spine over time. This kind of spinal problems is usually a part of the normal aging process.

- many people are more prone to spinal problems than others, like those who have: infections, tumors, muscle strains, or arthritis .

DEGENERATIVE DISEASES OF THE SPINE

1. Degeneration of the disc : (process of dehydration)

The intervertebral discs are composed of 90% water , with age the water content decreases thus the elasticity will decrease and this will increase the tendency for disc prolapse .

2. Facet joint prolapsed : they are synovial joints so they dehydrate with age .

3.Ligament degeneration : the ligament become hypertrophied causing pressure on spinal cord and nerve root or thecal sac .

DEGENERATIVE DISEASES OF THE SPINE

4. **Bone degeneration** : osteophyte formation , when they present on the posterior side they cause more symptoms than anterior .

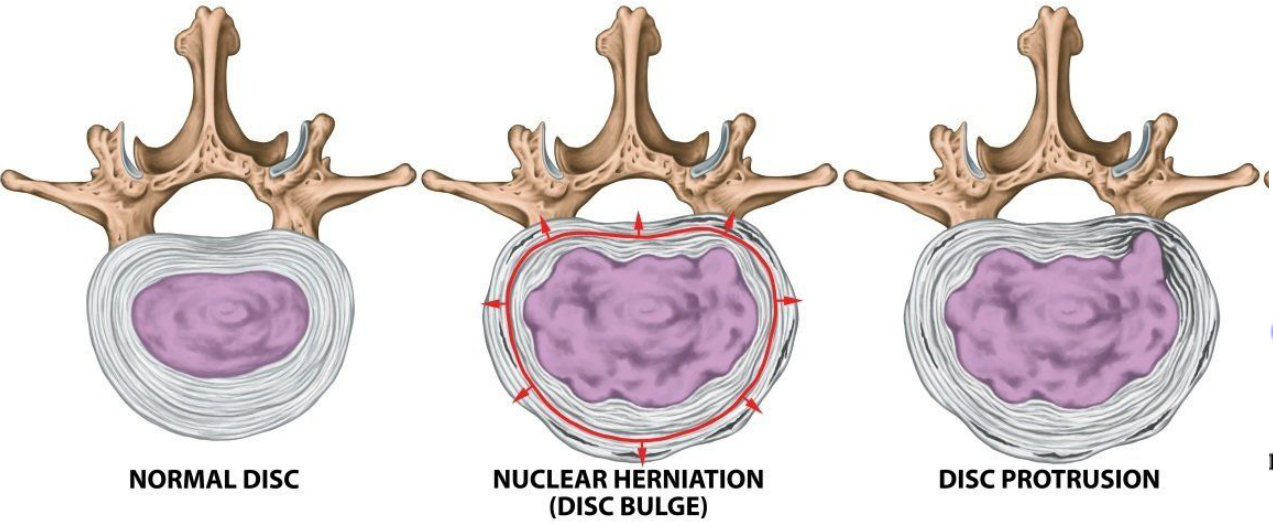
5. **Spondylolysis** : associated with **pars interarticularis** fracture.

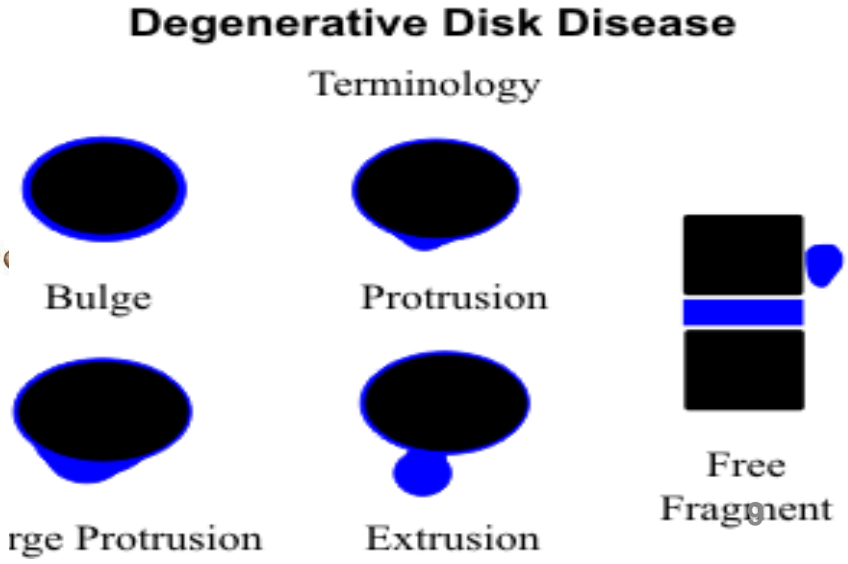
6. **Spondylolithiasis** : appears on oblique view X-ray as (decapitated scoty dog appearance).

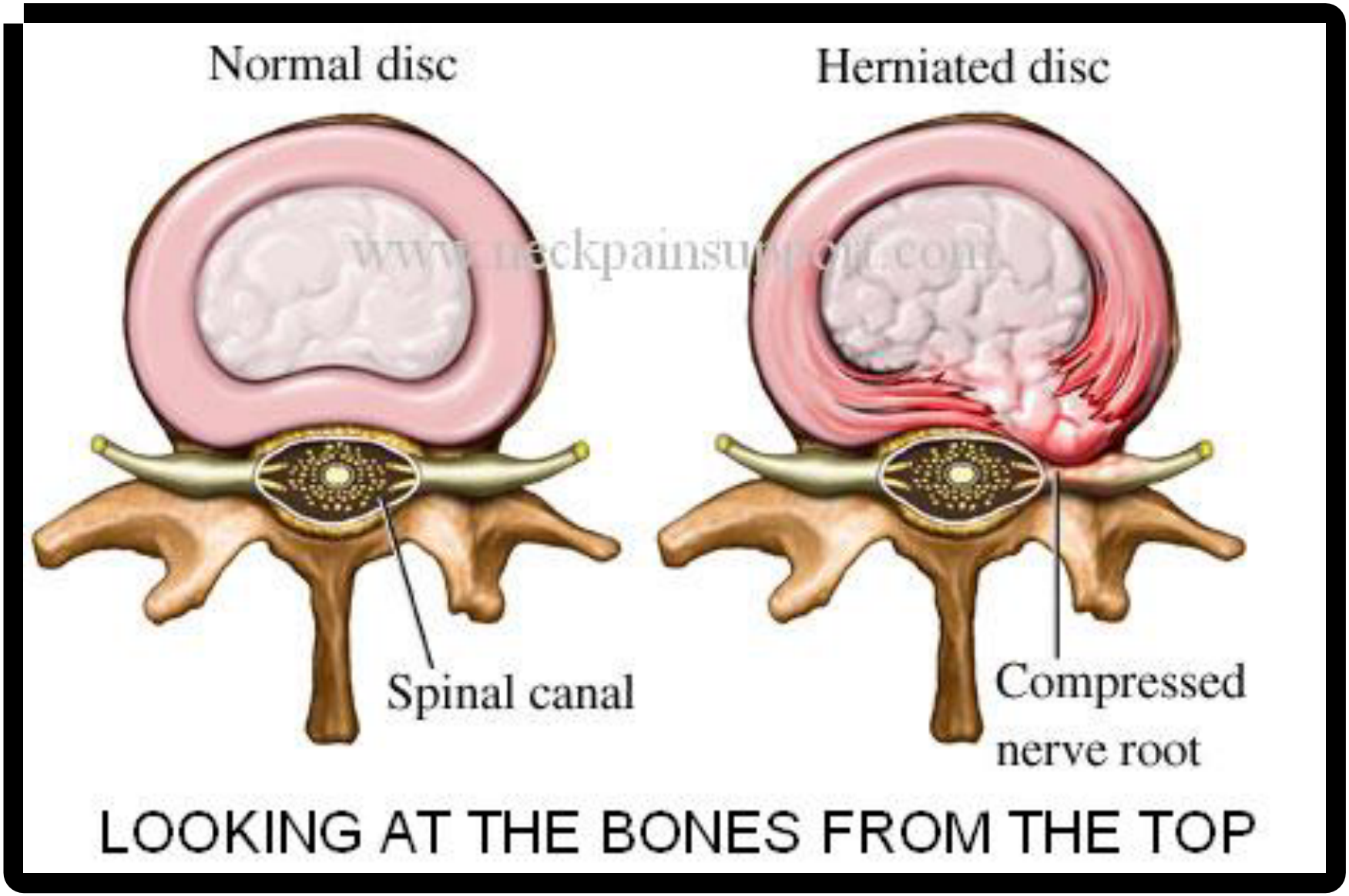
Intervertebral Disc degeneration

- Many factors including aging, induce changes in the biochemical and structural formation of the intervertebral discs, such as decreasing its water-binding capacity. The water content decreases down to 70%.

- Development of annular tears in the annulus fibrosus due to weakness allows nucleus pulposus to prolapse into the defects.

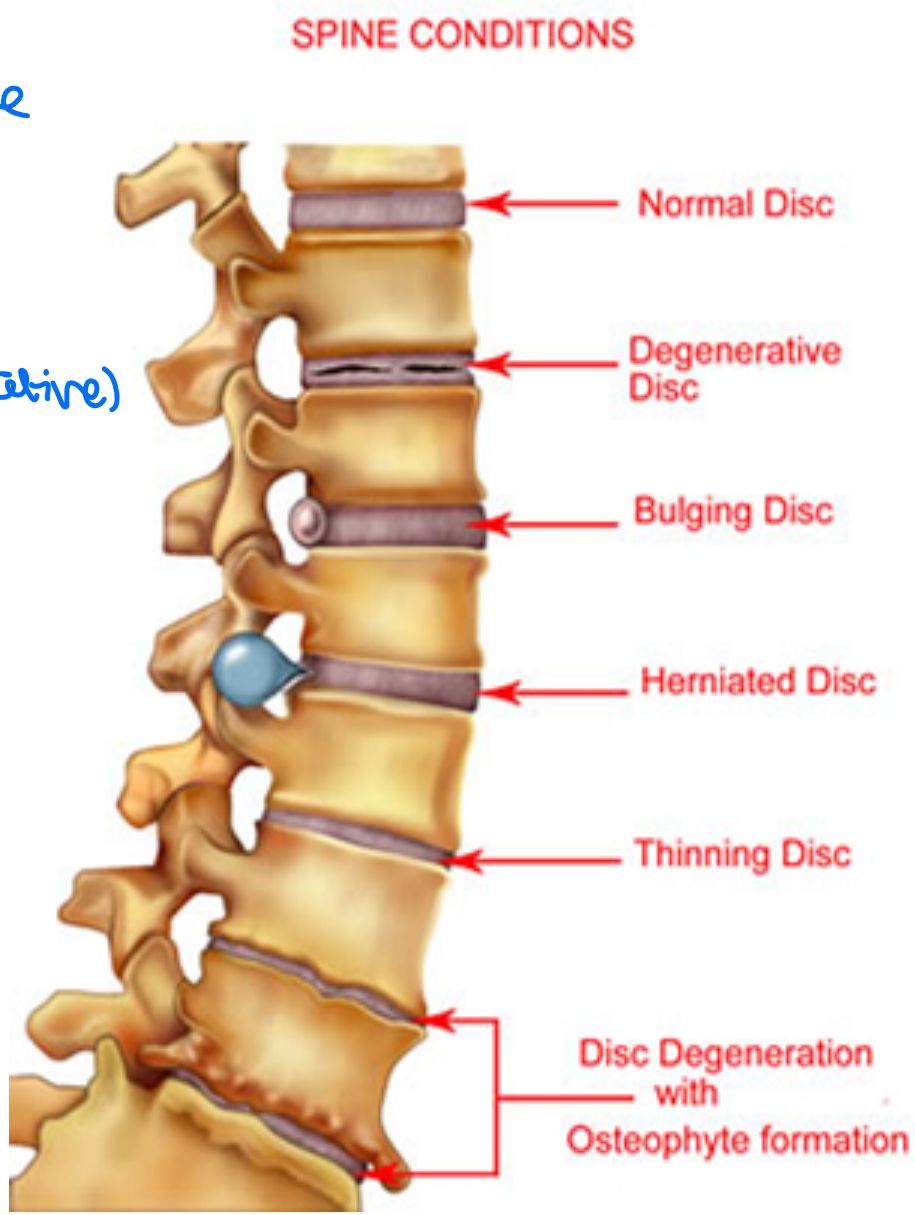





Normal disc
Herniated disc
Spinal canal
Compressed
nerve root
LOOKING AT THE BONES FROM THE TOP

Types: of degenerative disease.

1. Cervical Disc Prolapse
2. Cervical Spondylosis (degenerative)
3. Thoracic Disc Herniation
4. Lumbar Disc Prolapse
   most common
5. 4.Lumbar Stenosis
6. 5.Lumbar Spondylolisthesis

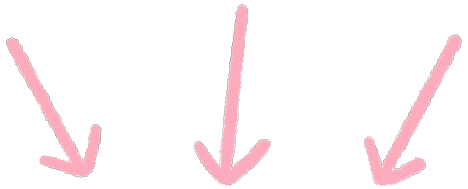


Cervical Disc Prolapse

Cervical disc herniation is a condition in which the inner gelatinous substance of the disc escapes through a tear in the outer, fibrous ring causing a compression of the spinal cord or the surrounding nerves, resulting in neck or arm pain.

Cervical Disc Prolapse

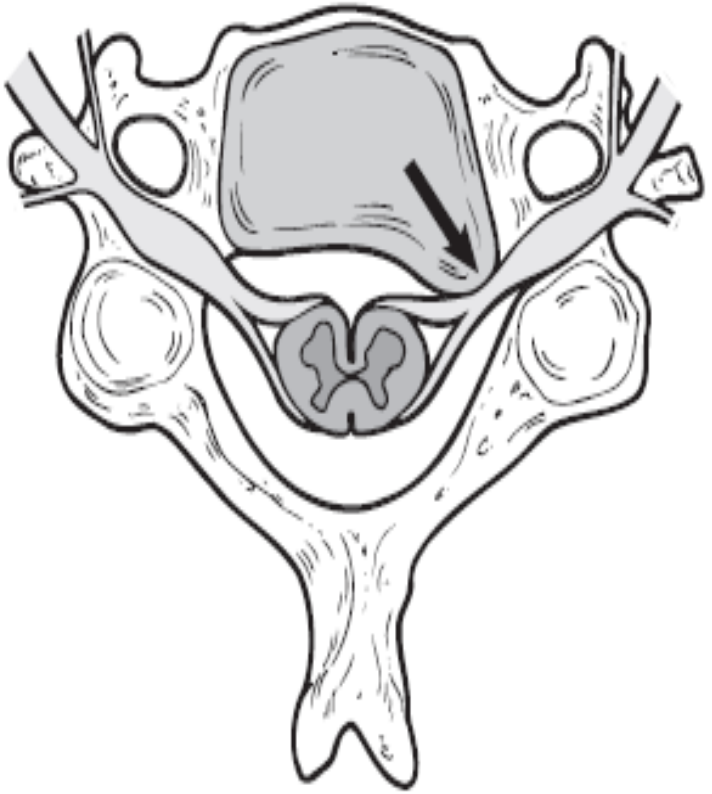
- **Less common than disc prolapse in the lumbar area.**
- **The disc prolapse occurs most frequently at the C6/7 (70%) level** because they are most mobile **and at the C5/6 level (20%).**
- **Disc prolapse above these levels and at the C7/T1 level is much less common.**



- **Physical exam leads you to the level of the disc .**

Cervical Disc Prolapse

- The cervical disc prolapse is usually in the posterolateral direction, because the strong posterior longitudinal ligament prevents direct posterior herniation.



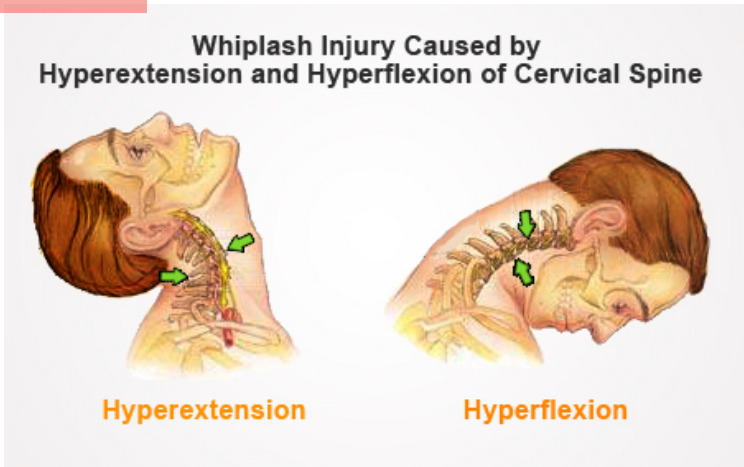
- The posterolateral disc herniation will cause compression of the adjacent nerve root as it enters and passes through the intervertebral neural foramen causing "Radiculopathy" .

- If the cervical disc herniates posteriorly, causing compression on the adjacent cervical spinal cord, It's a neurosurgical emergency.

CERVICAL DISC PROLAPSE CAUSES

- Repetitive cervical stress .
- Trauma.
- Heavy lifting.
- Prolonged sedentary position.
- Whiplash accidents (Neck strain). Hyperextension + Hyperflexion of cervical spine.
- Frequent acceleration/deceleration.

حتشبه الـ whiplash لكن اوك.

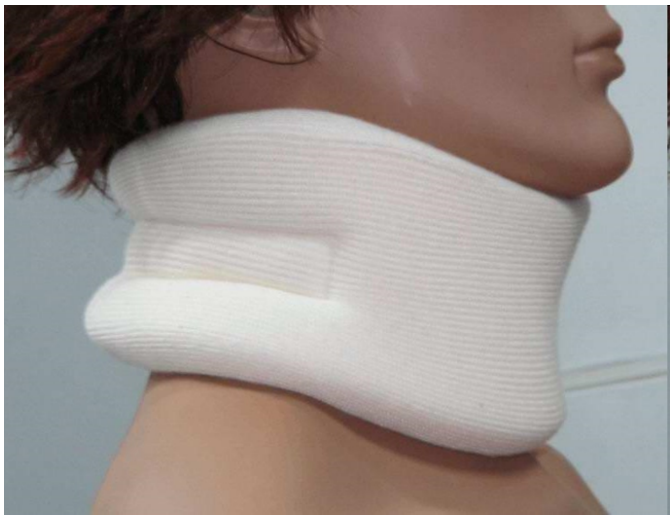


Management

Conservative treatment

Patients may find relief by:

- Applying ice or heat.
- Using medications to control pain and inflammation (NSAIDs).
- Exercising the neck and shoulder areas (alone or with the help of a professional familiar with neck conditions) to relieve stiffness and maintain flexibility.
- Use of a cervical collar, cervical pillows or neck traction may also be recommended to stabilize the neck and improve neck alignment.



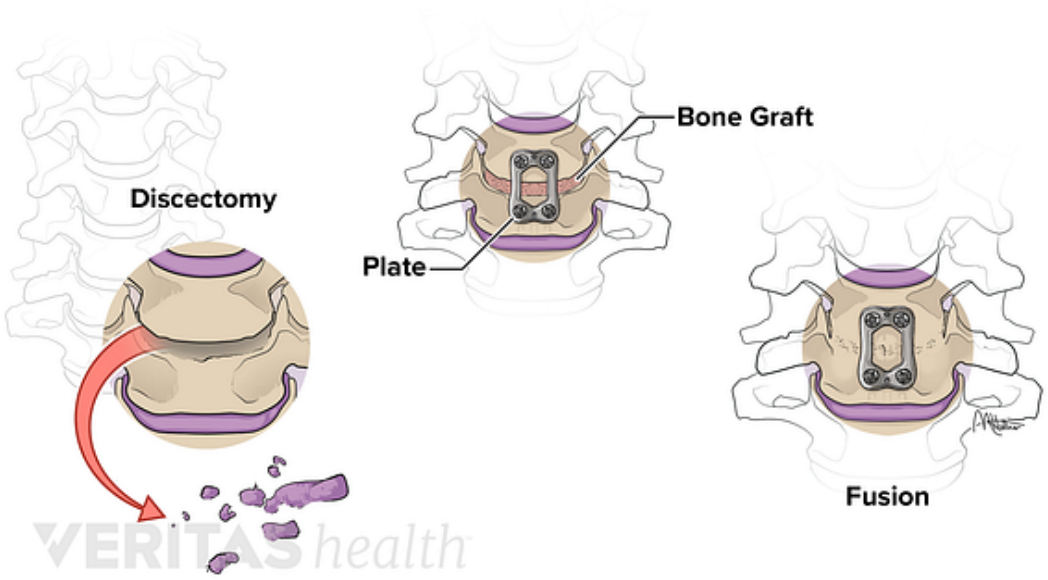
Conservative treatment is the 1st choice, except in two cases we do surgery :

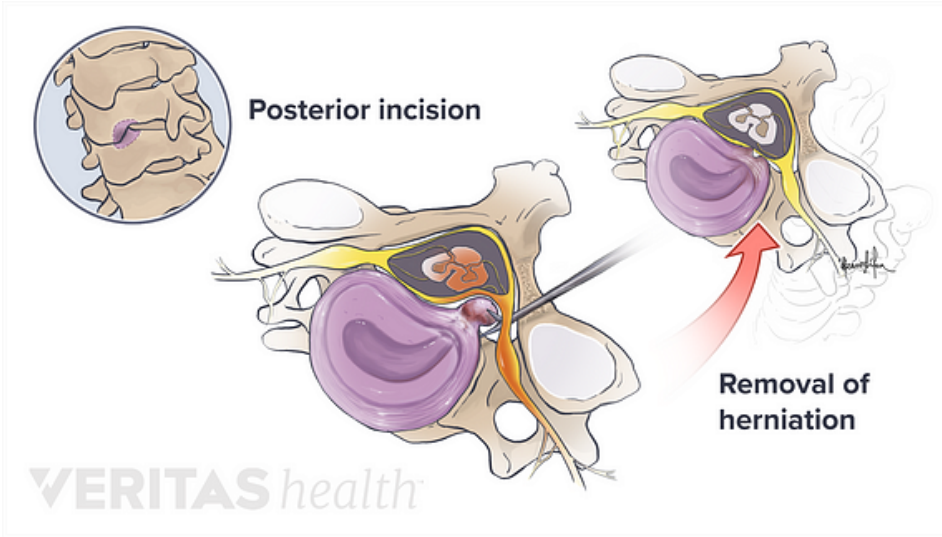
1. Myelopathy direct injury of spinal cord.
2. If red flags are present

If conservative treatment fails we go for surgery

OPERATIVE PROCEDURES

- The two most commonly performed operations for cervical disc prolapse are:
  1) Cervical foraminotomy with excision of the disc prolapse.
  2) Anterior cervical discectomy, with subsequent fusion.





CERVICAL SPONDYLOSIS

Cervical spondylosis is a degenerative arthritic process involving the cervical spine and affecting the intervertebral disc, facet joints and vertebral bodies.

PATHOLOGIC CHANGES

- The degenerative process occurs in most cases largely as a result of the inevitable stresses and traumas that occur to the cervical spine as a result of the normal activities of daily living.
- The spondylitic process may cause narrowing of the spinal canal as a result of osteophyte formation, particularly the formation of hypertrophic bony ridges at the anterior intervertebral spaces of the spinal canal and hypertrophy of the ligamentam flavum. This may result in compression of the spinal cord. Such compression is maximal during hyperextension of the neck and may cause "cervical myelopathy", here it can affect not only the arms, but the legs as well.

RISK FACTORS

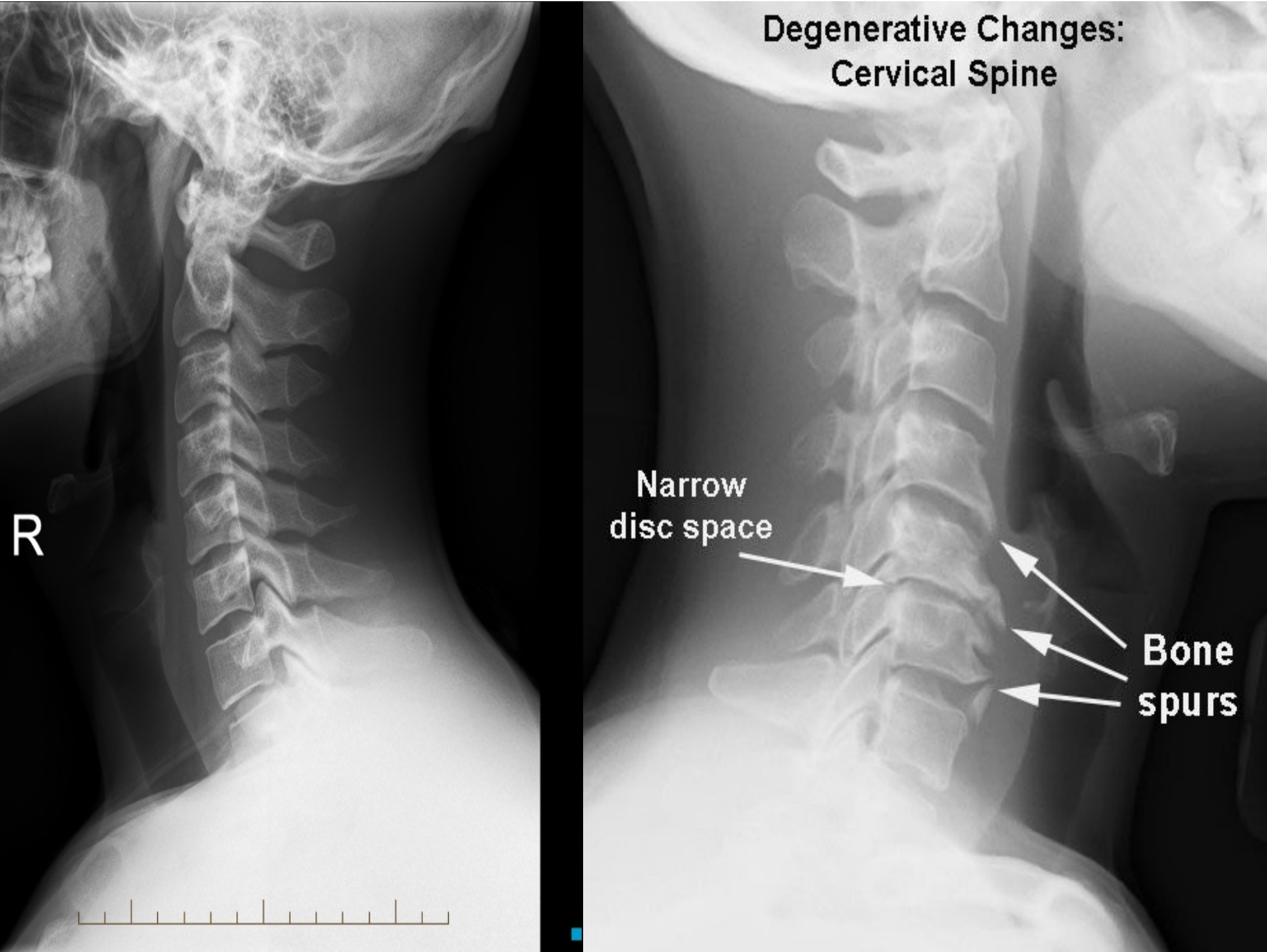
Major: Aging, By age 60, most women and men show signs of cervical spondylosis on x-ray without symptoms.

- **Other factors:**
- **Past neck injury (often several years ago).**
- **Severe arthritis.**
- **Past spine surgery.**

CLINICAL MANIFESTATIONS

- **Symptoms** often develop slowly over time, but may start **suddenly**.
- **Common symptoms are:**
  1. **Neck pain** (may **radiate to the arms or shoulder**).
  2. **Neck stiffness** that gets **worse over time**.
  3. **Loss of sensation** or abnormal sensations in the shoulders, arms, or (rarely) legs.
  4. **Weakness** of the arms or (rarely) legs.
  5. **Headaches**, particularly in the **back** of the head.
- **Less common symptoms are:**
  6. **Loss of balance**
  7. **Loss of control over the bladder or bowels** (if spinal cord is compressed).

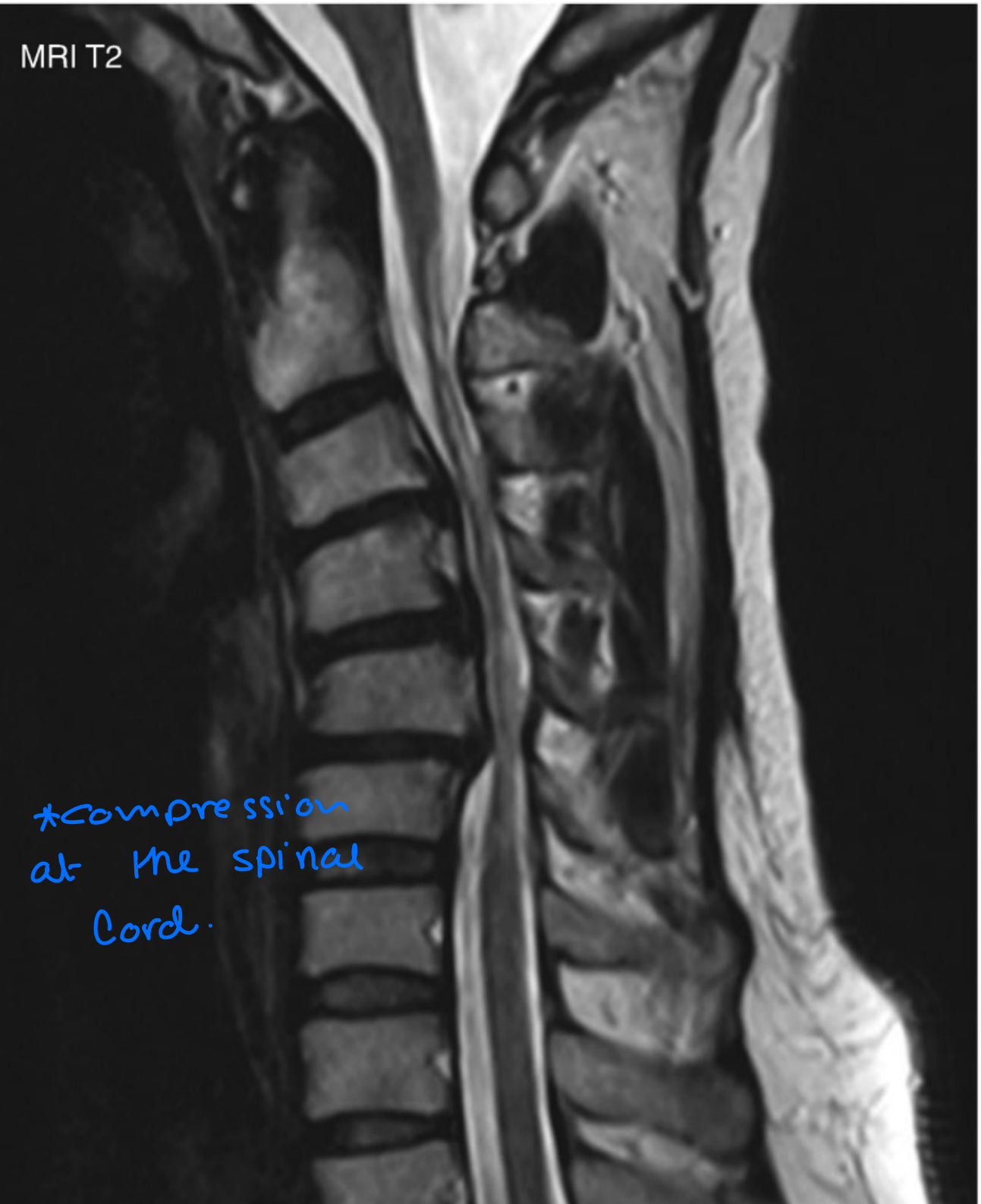
- The clinical features are similar to the neuralgia caused by an acute soft disc prolapse, in that the pain radiates diffusely into the periscapular area and shoulder, numbness and tingling in the appropriate dermatome distribution, and weakness of the arm are present also.
- Although the clinical features may be almost indistinguishable from those due to an acute soft disc prolapse, the process is usually not as acute and the patient often has a history of intermittent or chronic pain.
- Wasting of a muscle group in the appropriate nerve root distribution is more common because of the longer history, but the examination findings will otherwise be similar to those seen with an acute soft disc protrusion.

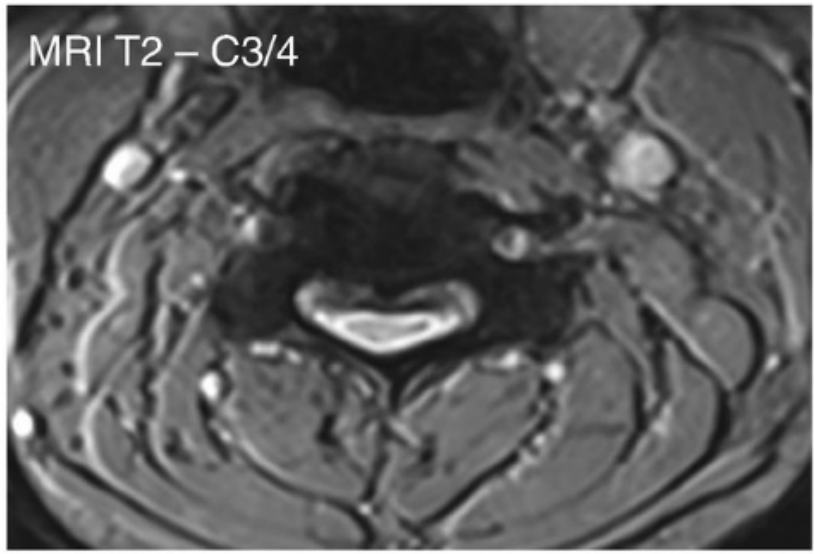

Degenerative Changes:
Cervical Spine
R
Narrow
disc space
Bone
spurs

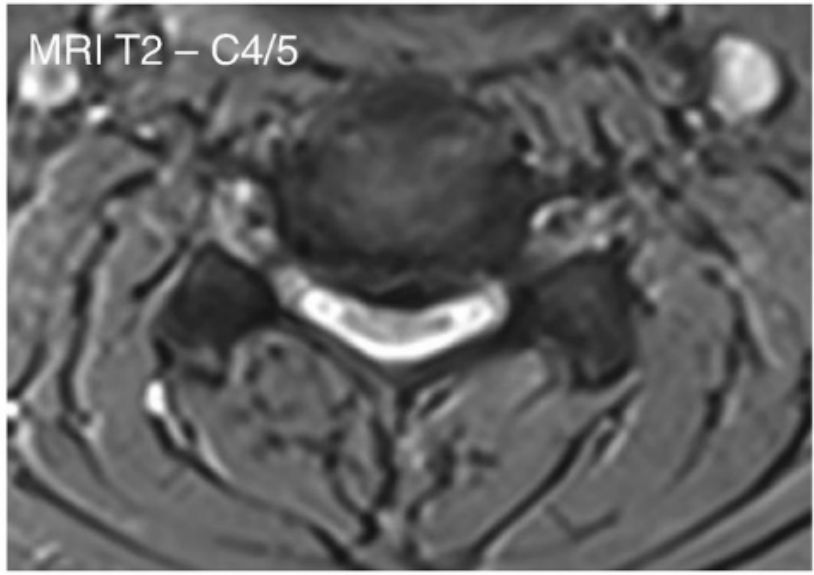
CERVICAL SPONDYLOTIC MYELOPATHY (CSM)

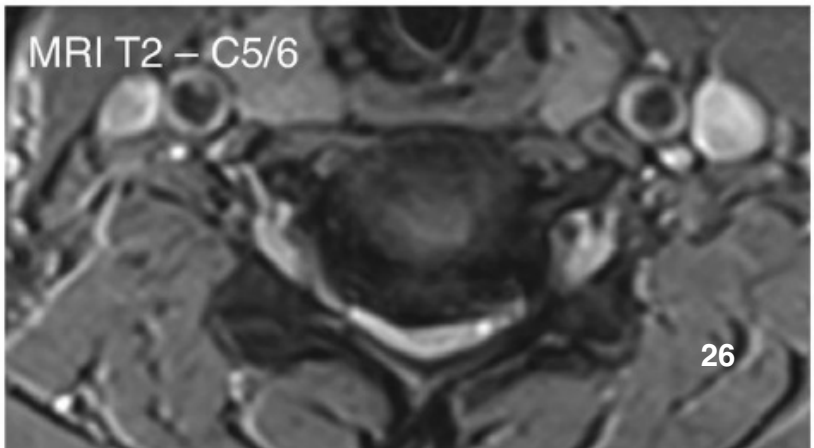
- Cervical spondylosis is the most common cause of myelopathy in patients > 55 yrs of age.

- Cervical spondylotic myelopathy (CSM) develops in almost all patients with < 30% narrowing of the cross-sectional area of the cervical spinal canal (although some patients with severe cord compression do not have myelopathy).


MRI T2
*compression at the spinal Cord.


MRI T2 – C3/4


MRI T2 – C4/5


MRI T2 – C5/6

TREATMENT

- Several medications may be used together during the first phase of treatment to address both pain and inflammation.
- Acetaminophen : Mild pain.
- Non-steroidal anti-inflammatory drugs (NSAIDs).
- Muscle relaxants: Medications such as cyclobenzaprine or carisoprodol can also be used in the case of painful muscle spasms.
- Cortisone injections to specific areas of the spine.

* شو الفرق بين Myelopathy and spinal cord injury?

* spinal cord injury → acute

? myelopathy → chronic.

Treatment Collars

Soft Collars

Firm Collars

TREATMENT
PHYSICAL THERAPY

Heat

Superficial heat modalities:

1)Infrared :

The patient should be positioned 20 inches from the source.

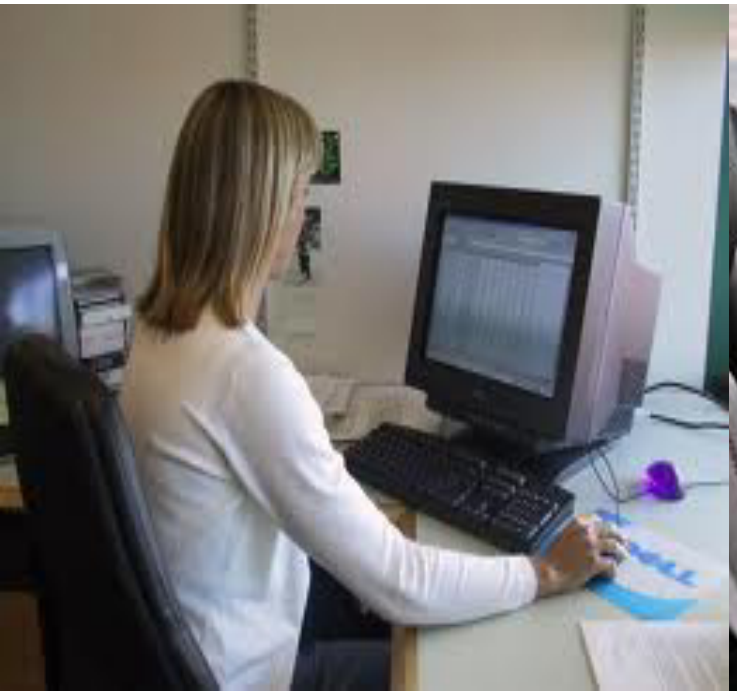
Treatment time should be 15-20 minutes.

2)Hot packs:

Treatment time should be 20-30 min.

LIFE STYLE

- Don’t maintain the position of the neck for long periods so TAKE BREAKS when driving, watching TV or working on a computer .
- Avoid watching TV from one side.
- Exercise regularly.



INDICATIONS FOR SURGERY

1. Severe pain that does not settle with conservative treatment over 2–3 weeks.
2. Chronic or recurrent pain.
3. Progressive weakness in the arm which causes functional disability.

red Flag!

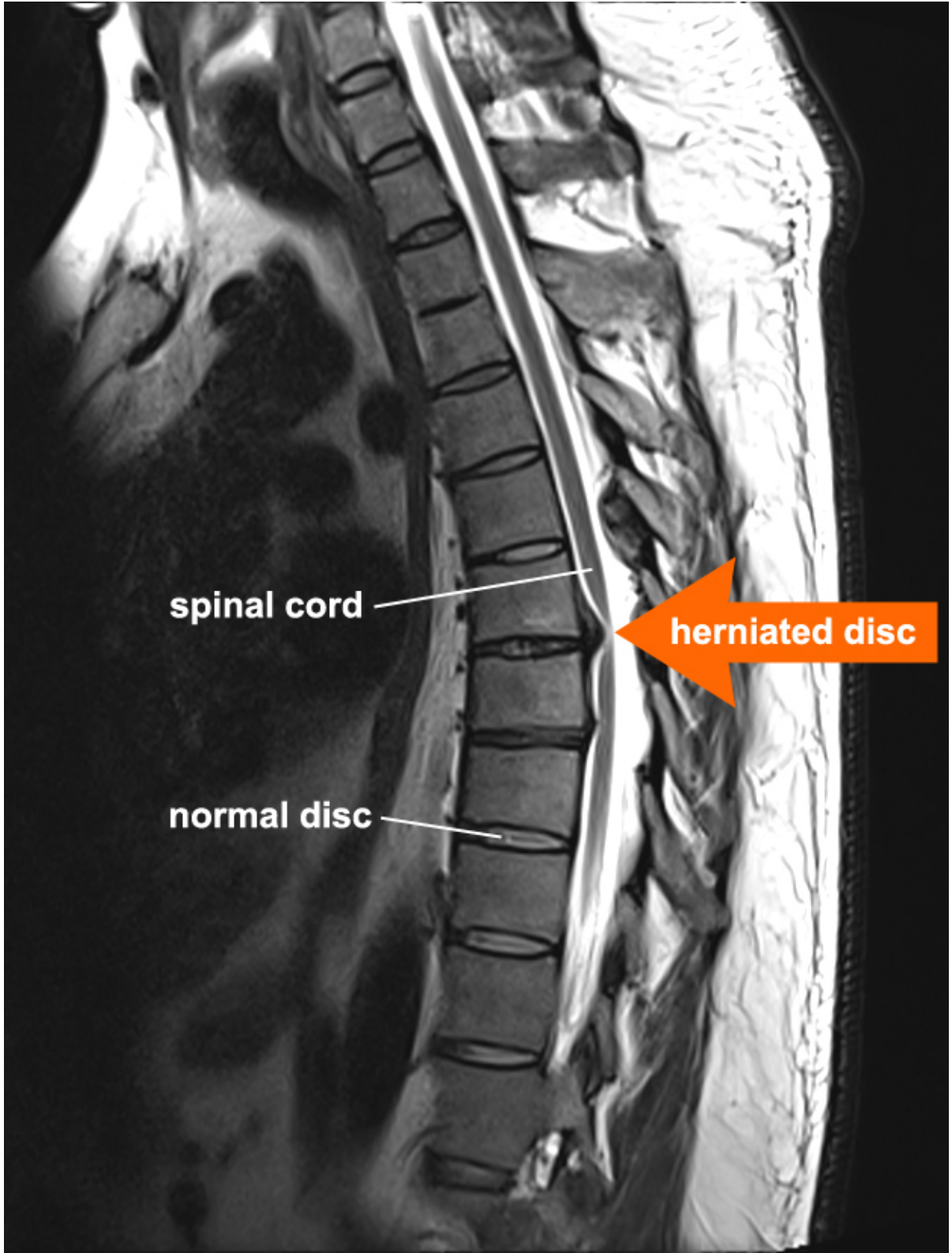
THORACIC DISC HERNIATION

The majority of the thoracic disc herniation is asymptomatic, or the patient presents with nonspecific symptoms like chest wall pain, epigastric pain, upper extremity pain, and sometimes, a pain in the groin or the lower extremity.

THORACIC DISC HERNIATION

- Usually occur at or below T8 (the more mobile portion of the thoracic spine)
- Frequently calcified .·. get CT through disc (may affect choice of surgical approach)
- Primary indications for surgery: refractory pain, progressive myelopathy.
- 80% occur between the 3rd and 5th decades.
- A history of trauma may be elicited in 25% of cases.
- Most common symptoms: pain (60%), sensory changes (23%), motor changes (18%).
- With thoracic radiculopathy, pain and sensory disturbance is in a band-like distribution radiating anteriorly and inferiorly along the involved root's dermatome.
- Motor involvement is difficult to document.

* في بعض الـ abdominal reflexes بنكتشف انه صفر ، T10 او تحتها.


spinal cord
herniated disc
normal disc


Lumbar
Disc
Prolapse
NO Myelopathy
here
spinal cord
حبل شوكي

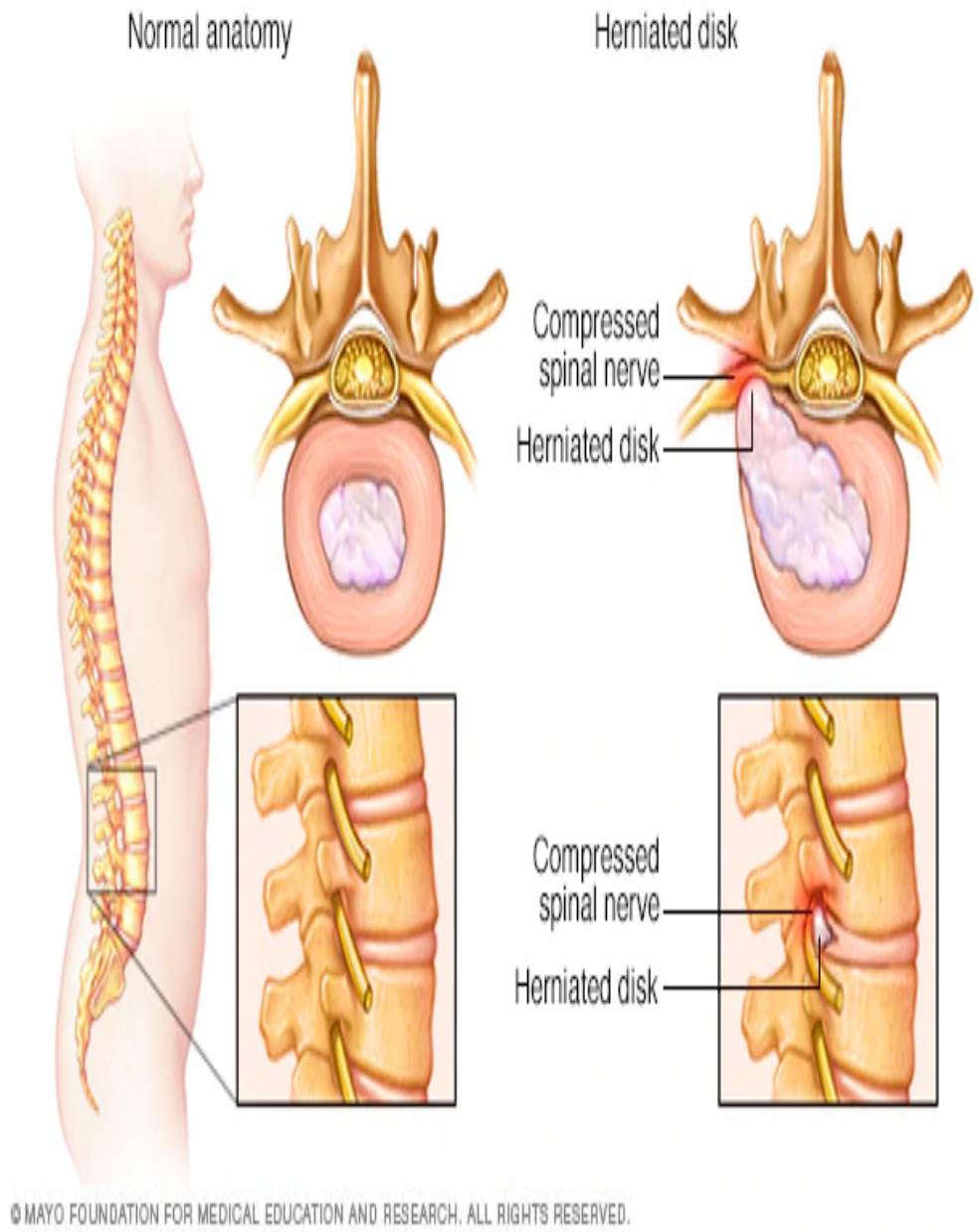
About 75% of total spinal movement & of lumbar flexion–extension occurs at the lumbosacral junction (L5/S1), 20% at (L4/L5) level and 5% at upper lumbar levels.

Consequently, about 90% of lumbar disc prolapses occur at the lower two lumbar levels;

-The most frequently affected disc is at L5/S1 level. *most common cause: sciatica

-Most common cause of

vertebrae على ال اللي تحته .



Disc prolapse is usually in a posterolateral direction, as the posterior longitudinal ligament prevents direct posterior herniation.

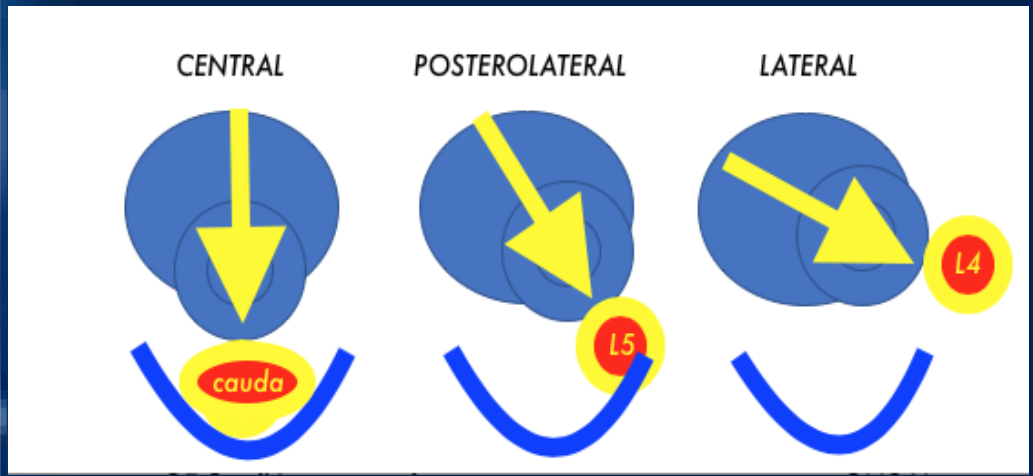
Less frequently the disc herniates laterally.

- **Posterolateral prolapsed disc**

causes compression of the nerve which runs along the posterior aspect of the disc and down in the neural foramen under the

- **Lateral disc prolapse** will cause compression of the nerve root passing below the pedicle of the vertebra above the disc prolapse.

- **Central prolapse** compresses the **Cauda equina.**
  (remember the spinal cord ends at L1/L2)



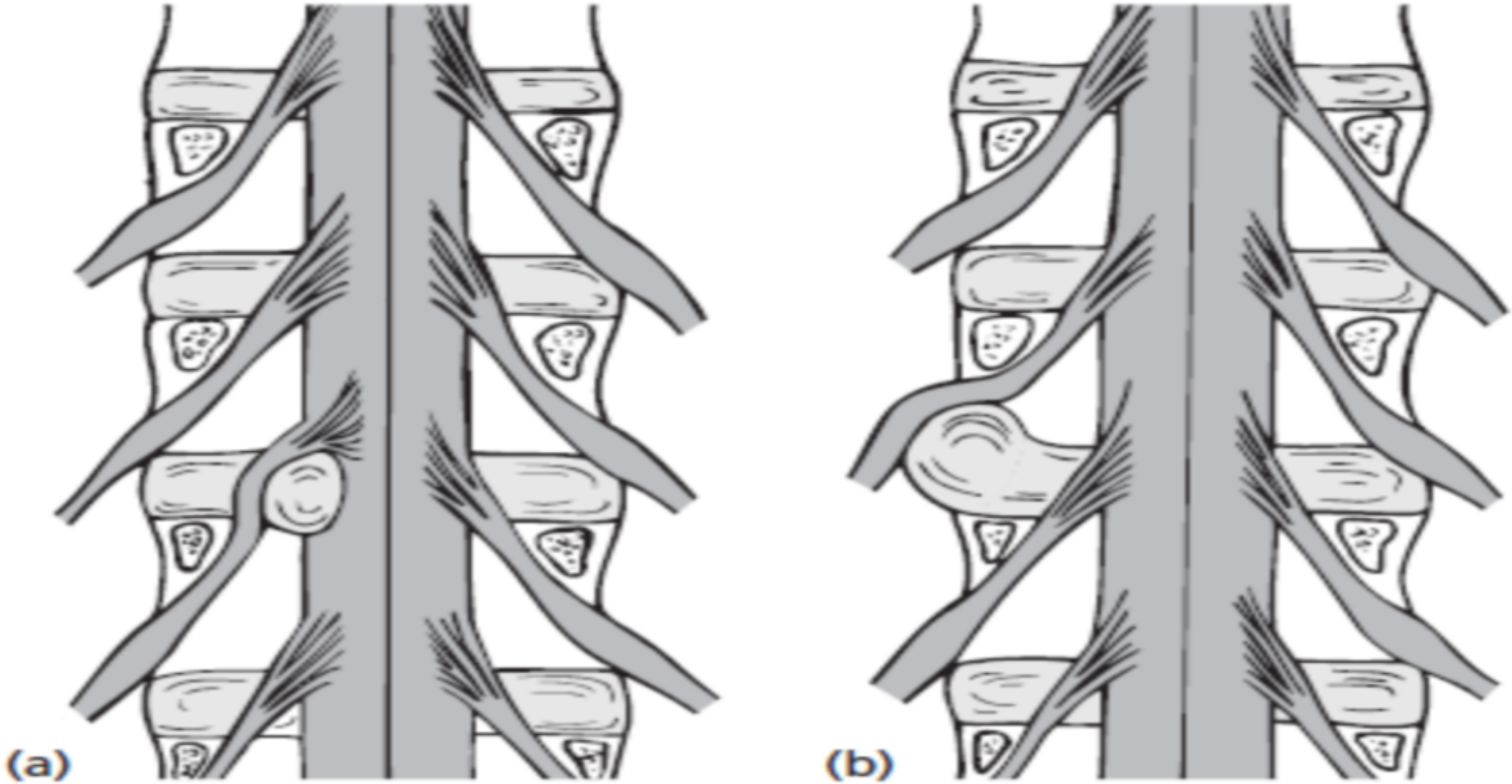


Fig. 13.1 The diagram shows (a) a posterolateral lumbar disc proplapse causing compression of lumbar nerve root passing across the disc to enter the neural canal below the pedicle and (b) a lateral disc prolapse causing compression of the nerve root passing beneath the pedicle above the disc prolapse.

CLINICAL FEATURES OF DISC PROLAPSE

- This type of pain is called sciatica, which is the clinical description of pain in the leg due to lumbosacral nerve root compression which is usually in the distribution of the sciatic nerve.

Table 13.1 Causes of sciatica.

Prolapsed lumbar disc
Lumbar spondylosis (osteophyte)
Lumbar canal stenosis (lateral recess)
Lumbar spondylolisthesis
Cauda equina tumours (e.g. ependymoma)
Pelvic tumours (e.g. rectal carcinoma)
Spinal arteriovenous malformation (rare)

The patient suffering from sciatica will be in obvious discomfort, which will be reflected by movements and posture when lying
supine.

The patient lies tilted, usually to the side opposite to the sciatica, with the affected hip and knee slightly flexed taking pressure off the stretched nerve.

The pain is worse on movement, coughing, sneezing or straining. Although back pain may be present,

the important feature is the pain which radiates down the leg in the distribution of the affected nerve.

PHYSICAL EXAMINATION

sciatica.

- Inspection:

a.Scoliosis with the concavity to the side of the herniation.

b.Loss of lumbar lordosis

c.Muscle spasm

d. Dystrophic skin changes.

- Palpation :

Local tenderness

- Lumbar movement restriction

Special Tests:

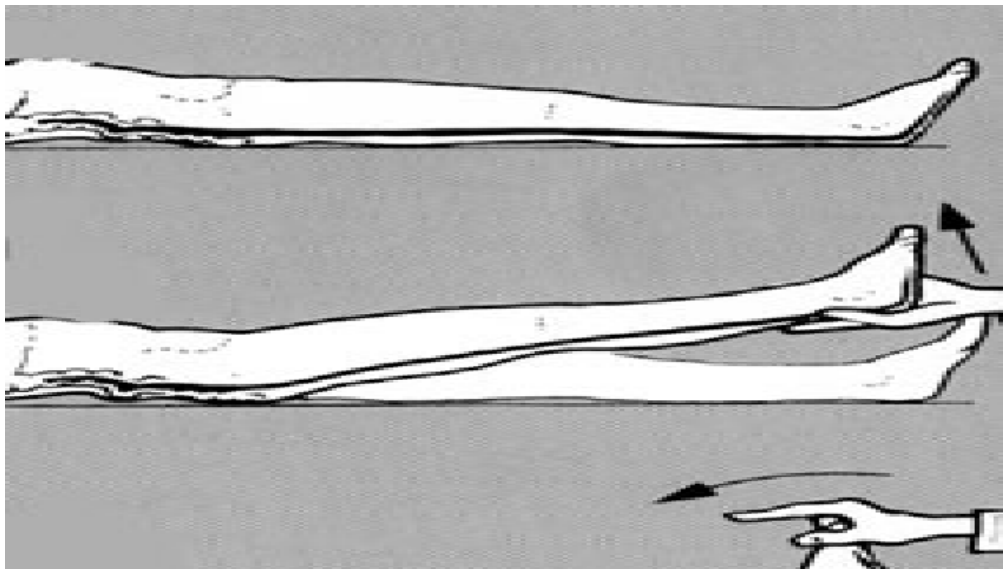
1) Straight leg raising (Lasegue's test) :Raising the leg (30-70degrees) will cause pain.

2) Then ▪ Bowstring sign (perform SLR) then flex knee and sequezee Popliteal fossa

2) Valex Test: Pain increases on pressing the buttocks or the sciatic nerve

4) Femoral Nerve Stretch Test: (Disc at L1-L2)

The knee is passively flexed to the thigh and the hip is passively extended; the test is positive if the patient experiences anterior thigh pain.



CENTRAL DISK PROLAPSE (CAUDA EQUINA SYNDROME)

supply the lower limb and bladder

*myelopathy First present with urine incontinence → hyperactive of the parasympathetic.

It's a compression of the thecal sac below L1/L2, causing a sort of lower motor neuron lesion bilaterally (one side is often more affected).

*early cauda equina symptom → urine retention before urine incontinance.

↳ Lower motor neurone. / parasympathetic

Symptoms:

overflow incontinance

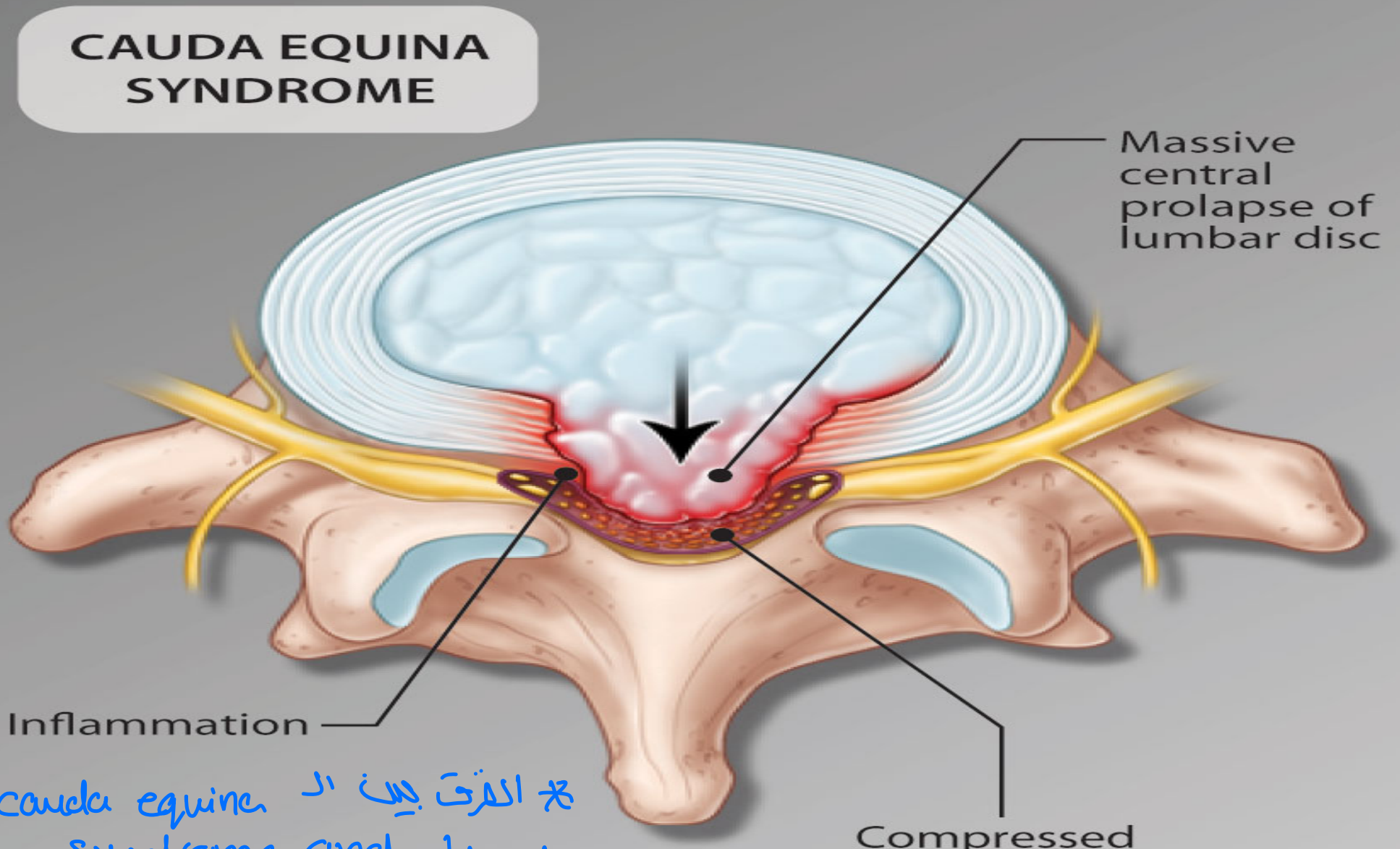
urine retention then incontinance

1. Low back pain
2. Acute or chronic pain radiating to the leg (Bilateral down the back of the thigh, may disappear with the onset of paralysis).
3. Unilateral or bilateral lower extremity motor and/or sensory abnormality
4. Bowel and/or bladder dysfunction

-Bladder dysfunction may present as incontinence, but often presents earlier as difficulty starting or stopping a stream of urine.

+ sexual disturbances in men

Cauda Equina Syndrome (CES)



* الفرق بين ال cauda equina syndrome and lumbar canal stenosis ؟

* cauda equina → acute
* stenosis → chronic.

} both are central.

*مرات ال symptoms تبعت ال
chronic بتختلف عن ال symptoms لل acute ؟
ال chronic بتعطي فرصة لل ↳
nerve تعملي شوي adaptation .

Lumbar Canal Stenosis

↳ intermittent claudication.
(neurogenic).

The stenosis of the lumbar canal may involve:
a) reduction of the sagittal diameter of the canal
b) narrowing of the 'lateral recess'
c) stenosis of the neural foramen.

The pathology is frequently due to a combination of:
- **Congenital canal stenosis**
- **Degenerative pathology, such as lumbar spondylosis with osteophyte formation & degenerative Spondylolisthesis (L4/L5).**

The most frequently affected levels are L4/5 and L3/4.
The lumbosacral level may be involved, but this is less common

AP diameter	Normal	Mild	Moderate	Severe
	12-16 mm	< 12 mm	< 10 mm	< 8 mm

* Claudication

Neurogenic

* with standing and walking
* at the nerve root.
* relived by posture (بحني ظهره المريض). + rest (لما يقعد).
* shopping cart sign.

بحس بتوسع للقناة ، نوع من الـ adaptation.

* على الطلعة أسوأ (more energy need)

* numbness, parasthesia, hotness.

Vascular

* only with walking
  - ↳ caused by energy consumption.
* releived by rest [لتشو هو واقف)

[peripheral vascular disease].

مسافة ثابتة.

* على النزلة اسوأ. (extension).

* by physical examination:
  - ✓ loss of hair
  - ✓ pulses, capillary refill.

* associated symptoms: muscle cramping

Clinical Features

- Back pain radiating diffusely into the legs, particularly when standing or walking. it is usually relieved by sitting and patients often adopt a posture of bending the body forward when walking to help relieve the discomfort.

- The pain may be similar to that of vascular occlusive disease, but a key feature is the presence of pain when standing only.

- The patient often complains of weakness and diffuse 'numbness' radiating down the legs. Called Neurogenic Claudication

- Patient present with nuerological claudication (which is pain on walking) , and its releaved by changing posture unlike vascular claudication that is releaved by rest ,

نادر نعملها ، نتعلمها للمرحلة
Contraindication اللي عندهم

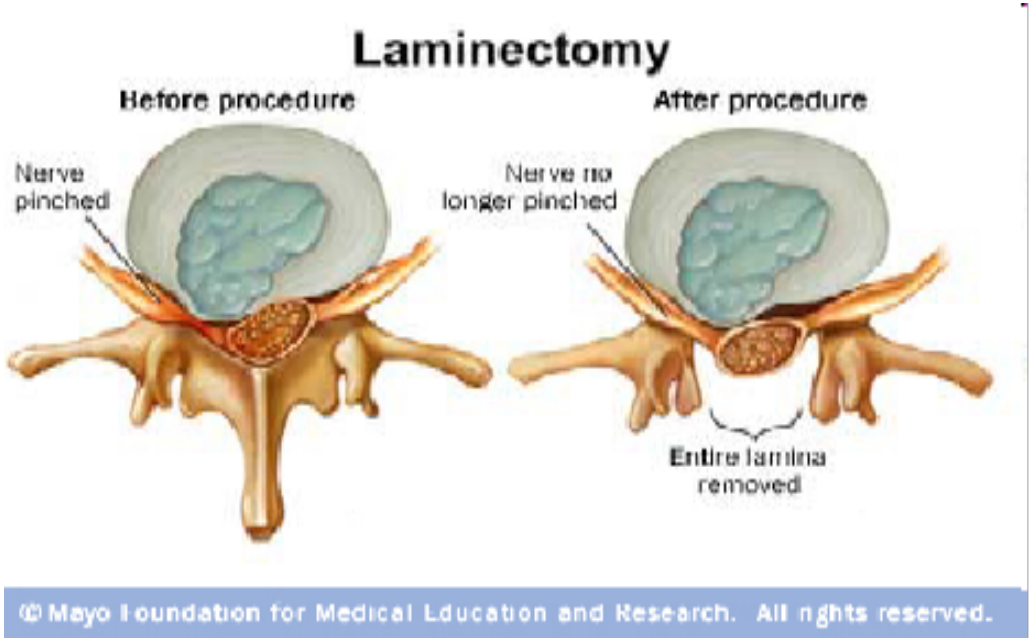
Investigations

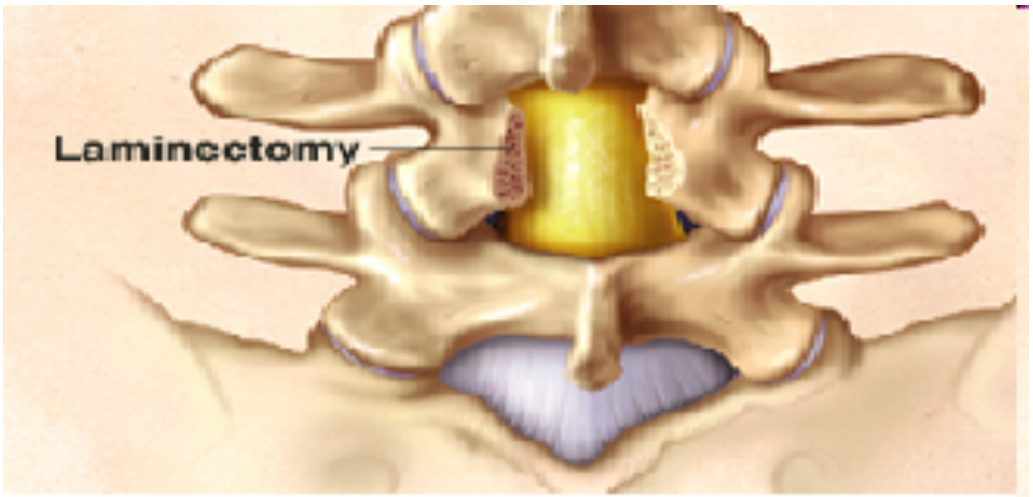
- **Myelography**: show marked indentation of the contrast column and, if the stenosis is severe, there may be a complete block.

gold standard.

- High-quality CT scan and MRI

- Interpediculate distance (IPD): The transverse diameter of the spinal canal. On plain AP x-ray of lumbar spine, an IPD < 25 mm suggests stenosis.





The entire lamina is removed from the affected vertebra.

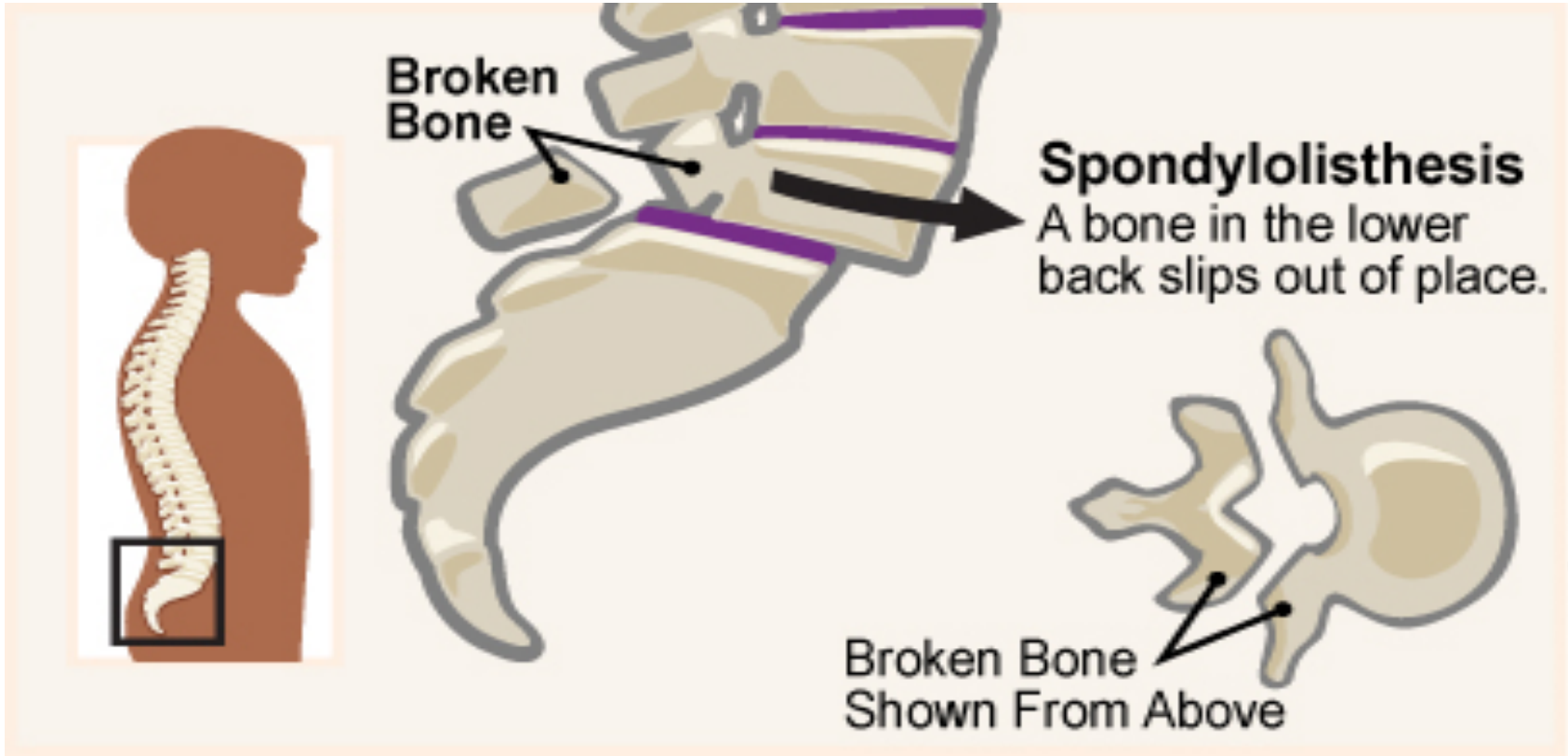
Management

- Lumbar canal stenosis does not respond to conservative treatment, and surgery is almost invariably successful in relieving the symptoms.

- The operation consists of a decompressive lumbar laminectomy extending over the whole region of the stenosis with decompression of the lumbar nerve roots.


Spondylolisthesis

- It is slippage of one vertebral body over another.
- More commonly between L4/L5 , L5/S1.
- It is the most common cause of back pain in adolescents but most cases are asymptomatic.

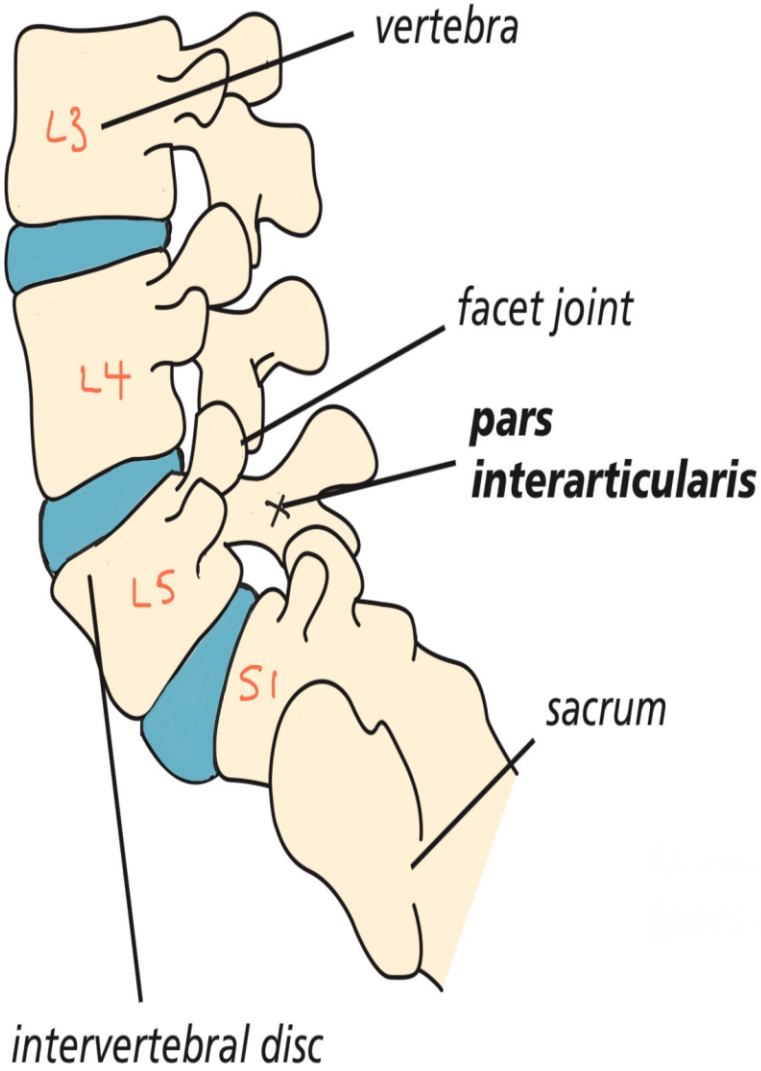


Spondylolisthesis Vs spondylosis

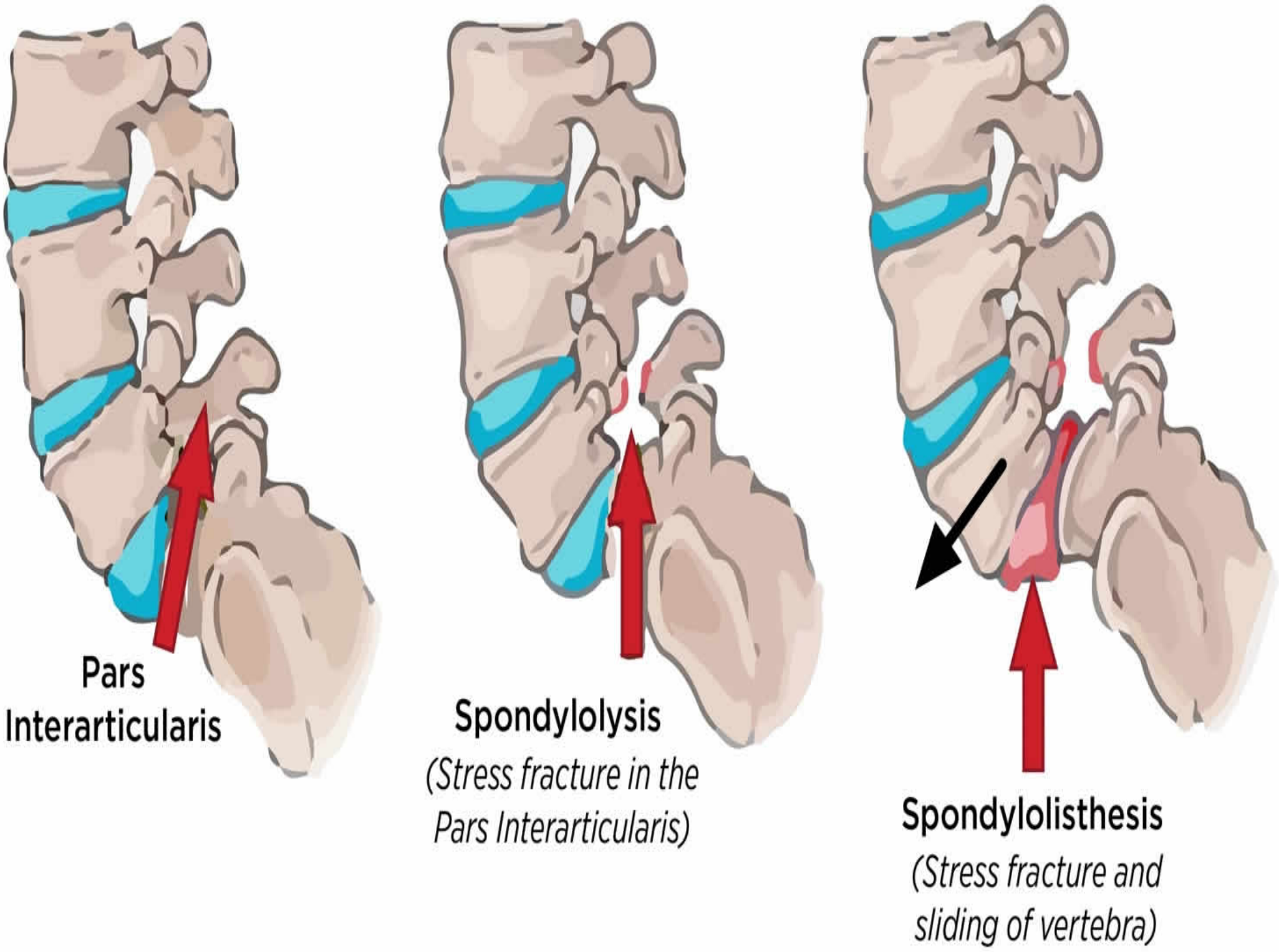
*most common types- isthmic

isthmic
degenerative
congenital
pathological
iatrogenic
traumatic

SPONDYLOLYSIS



- 'pars interarticularis', is a small length of bone that joins the facet joints of one vertebra to the facet joints of the vertebra below it. There is a pars interarticularis on each side of the vertebrae at the back of the spine.
- fracture in the bone that connects the facet joints and they become separated is called "Spondylolysis".
- About 80% of pars defects occur on both sides of the vertebra (bilateral)
- More than 85% of pars defects are found in the L5 vertebrae


Pars
Interarticularis
Spondylolysis
(Stress fracture in the
Pars Interarticularis)
Spondylolisthesis
(Stress fracture and
sliding of vertebra)

PRESENTATION OF SPONDYLOLITHESIS

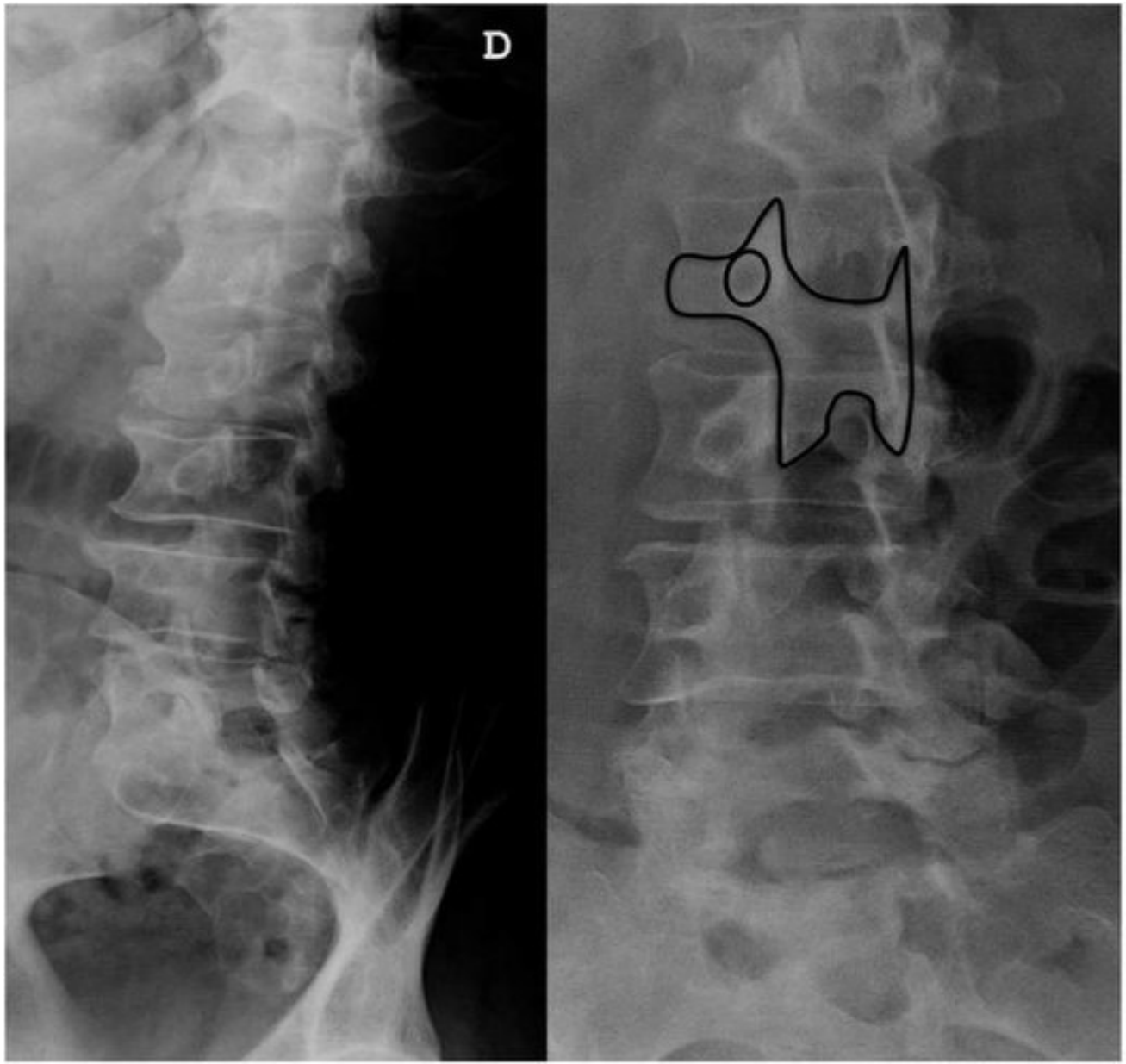
- **Low back pain**:
  - Begins with the growth spurt of adolescence.
- **Sciatic pain with radiation to the buttock, back of the thigh and calf.**
- **Spinal claudication**:
  - The pain is related to activity, walking, or prolonged standing.
  - It improves with rest, either setting or lying down.
- **Sensory loss**.
- **Leg weakness**.

Diagnosis:

- **Plain lumbar spine X -ray:**
  - On the lateral view the slip is clearly seen.
- **MRI:**
  Helpful in demonstrating the degree of nerve compression.
- **Lumbar myelogram.**
- **Post-myelographic CT:**
  Helpful in planning surgical treatment.

Scotty dog (in spondylolisthesis, it seems there is a fracture across the neck of the scotty dog).

oblique view.



Treatment

Conservative

- Rest.
- Physical therapy
- Analgesia
- Anti-Inflammatory drugs
- Epidural Steroid Injection (cortisone) is used for patients who suffer from numbness, tingling and even on pain in the lower extremities

If failed :

•Surgery involves : a laminectomy to decompress the neural structures and a spinal fusion to prevent instability. (Laminectomy should be done if there is lumbar canal stenosis or nerve root compression)

* اذا كان في disc ← Central ، رح يضغط على ال

spinal cord (اذا كان cervical or thoracic) ⇐ cause: myelopathy

↳ signs + symptoms of myelopathy:- [UMN].

⊛ sensory level: [decrease sensation or parasthesia] من المنطقة - وتحت.

⊛ motor: * weakness → spastic weakness
* hyper reflexia.
* spastic gait [بمشي مثل الروبوت]

⊛ imbalance caused by sensory ataxia.
(لانه رح يأثر على posterior column of spinal cord اللي بنقل ال proprioception)

*في sensory ataxia لما تغمض عيونه بزيد. [romberg sign]

*cerebellum the center of the balance and need 3 types of sensory input:-

① vision
② vestibular
③ proprioception. → هذا اتأثر فبالتالي لما يسكر عيونه رح يفقد ال balance.

*على الاقل بدنا ٢ منهم لنحافظ على ال balance

⊛ أو ال vestibular nerve فيه مشكلة.

⊛ اذا كان ال center موجود في ال lumbar area :

بيضغط على ال cauda equina فاذا كان acute

cauda equina syndrome، اما اذا كان chronic بعمل

.stenosis [LMN]

⊛ اذا كان paracentral → بيضغط على ال nerve root)

.called: radeculopathy

⊛ Signs and symptoms of radiculopathy :

① sensory → * pain (neuropathic pain)

with numbness + parasthesia.

* بتكون مكانه على dermatome 1 → [dermatomal distribution]

② motor → ⊛ weakness

⊛ loss of reflex.

* من اشهرها ال sciateca . S1 / L5 .

* red flags of spinal pain? 4DDx:

① progressive / acute neurological defecit (weakness). / acute urine retention

② suspicion of fracture. [high energy trauma / low energy in OP]

③ infection [fever, night sweats]

④ neoplasm [metastatic] → night pain (periosteum : pain مصدر ال)

↳ bone metastasis

* في بينهم تداخل كالعظام .

⊛ Degree of urgency differ between them:

⊛ بسرع وحدة ← نقطة 1 ← ممكن تأدي ل necrosis .

(golden h ← 6 hours اول)

بدها ← infection ← ممكن يعمل venous thrombosis [absecss]

بدها ← fracture without defecit. ← ممكن يعمل immobilization ✓ (without neurological defecit)

بدها ← neoplasim ← نمو الخلايا بشكل عادي .

⊛ اذا المريض عنده red Flag كيف بتعامل معاه ؟

لازم يتحول على طول (urgent) : admittion .