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Common Spinal Disorders

Objectives:

Comprehension of the common spine disorders:

- ★ Disc degeneration/hernia
- ★ Spinal stenosis
- ★ Common spinal deformity (Spondylolisthesis, Scoliosis)
- ★ Osteoporotic fracture
- ★ Destructive spinal lesions

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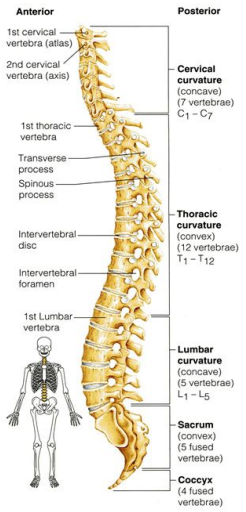
References: 435 Lectures And Notes & Apley's

Anatomy of the spine

A) Vertebral column

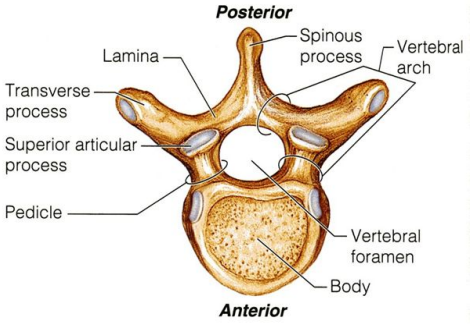
- The vertebral column extends from the skull to the pelvis.
- It surrounds and protects the spinal cord and supports the whole body.
- It is formed from 33 irregular vertebrae.
- 7 Cervical vertebrae,
- 12 Thoracic vertebrae,
- 5 Lumbar vertebrae
- Sacrum, (5 fused vertebrae).
- Coccyx, (4 fused vertebrae).



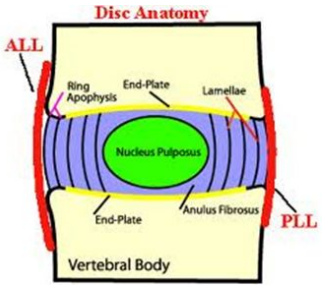
If we're looking at the spine from the sides (sagittal view) → spine is curved
whereas if we're looking at it from the back (coronal view) → it's straight

- **Normal lordosis** is the *forward curve* seen in the <u>cervical spine</u> and <u>lumbar spine</u>.
- **Normal kyphosis** is the two *backward curves* seen in the chest (<u>thoracic spine</u>) and hip areas (<u>sacral spine</u>).
- Each of the naturally occurring and normal soft curves serves to distribute mechanical stress as the body is at rest and during movement.

Any vertebra is formed from **body** and **arch**.

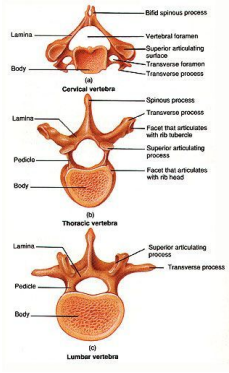


- **Body** or Centrum:
  <u>Weight-bearing part</u> of the vertebra that lies **anteriorly**.
- **Vertebral arch**: formed from fusion of
  <u>2 Pedicles</u>, <u>2 Laminae</u>
  - The vertebral arch carries <u>7 process</u>
    - **2 Transverse processes**: Lateral projections from the vertebral arch.
    - **One spinous process**: single projection arising from the posterior aspect of the vertebral arch.
    - **2 Superior and 2 inferior articular processes:** Paired projections lateral to the vertebral foramen, allowing a vertebra to form joints with adjacent vertebrae. **(four facet joints associated with each vertebra)**
- **Vertebral foramen**:
  Lies between the body and the arch, through which the <u>spinal cord passes.</u>



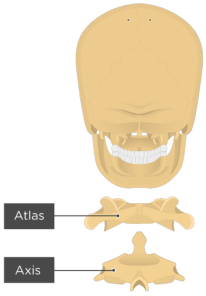
- The single vertebrae are separated by <u>pads of flexible fibrocartilage</u> called the **intervertebral disc.**
  - About one-quarter of the length of the vertebral column is made up of fibrocartilaginous discs.
  - **The intervertebral discs cushion the vertebrae and absorb shocks.**
  - The discs and the S-shaped curvatures of the vertebral column work together to prevent shock to the head when we walk or run.
  - They also make the body trunk flexible. **They are thickest in the cervical and lumbar region**s, where the <u>movements of the vertebral column are greatest</u> unlike the thoracic region which is LESS THICK and has less movement .
  - Each disc consists of :
    - ➢ **Peripheral part :** the **<u>annulus fibrosus</u>**, composed of <u>fibrocartilage</u> .
    - ➢ **Central part :** the **<u>nucleus pulposus,</u>** a mass of <u>gelatinous material</u> containing a **large amount of water** 90% water, a small number of collagen fibers, and a few cartilage cells.
- No discs between the first & second cervical vertebrae or in the sacrum or coccyx.

Normally disc appears **WHITE** in T2 weighted image (because it contains mostly water)



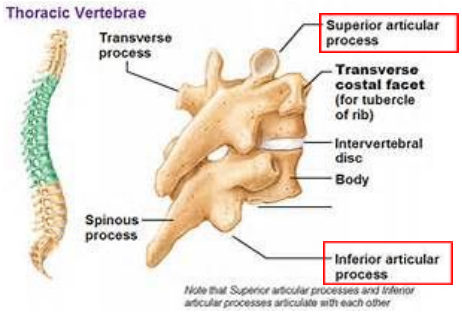
Cervical anatomy:

- 7 Cervical vertebrae; 8 cervical nerve roots.
- Nerve root exits above vertebra (i.e. C4 nerve root exits above C4 vertebrae), C8 nerve root exits below C7 vertebra.
- 80% of the weight goes to the front of the spine (the body) and 20% to the back of the spine
- C1&C2:
  - C1 (atlas)⟶ **No vertebral body** (ring like), **no spinous process and attached to the occipital condyles (hemisphere) above** ⟶ 50% of cervical **flexion and extension** happens between occiput and C1. Then 5% for every subsequent level. This joint allows you to nod "**YES"**.
  - C2 (axis)⟶ Has **Odontoid process** (or Dens.) ⟶ 50% of **rotation** in cervical spine occurs between C1 and C2. Then 5% for every subsequent level. This joint allows you to nod "**NO"**.
- C3-C7 :
  - Have Transverse foramen (specific to cervical vertebrae) which is important for Vertebral Artery ⟶ forms the circle of willis in the brain.So any fracture or disc herniation affect this area may affect the brain (not common).
  - 5% range of motion at each level.



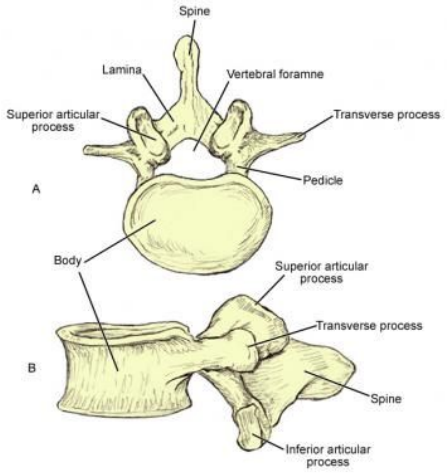
Thoracic anatomy:

- Most thoracic vertebrae are typical, have bodies, vertebral arches and seven processes for muscular and articular connection.
- It articulates with the **ribs**, acts as a splint to stabilize the thoracic spine.
- **Most rigid part** of the mobile spine (due to rib attachment)⟶ rarely injured (usually in high energy trauma.) ⟶ usually osteoporotic fractures.
- there are more motion in the thoracocervical junction and the thoracolumbar junction **(thoracic spine ⟶ less motion)**
- ROM: Mainly **rotation**, very limited extension and flexion. **Why?** due to the way the thoracic articular facets are oriented (superior facet is posterolateral, inferior facet is anteromedial)
- Characteristics of thoracic vertebra:
  - Costal facets are present on the transverse processes for articulation with the tubercles of the ribs (T11 and 12 have no facets on the transverse process).
  - The spines are long and inclined downwards.
  - The vertebral foramen is small and circular.
  - The body is medium sized and heart shaped.

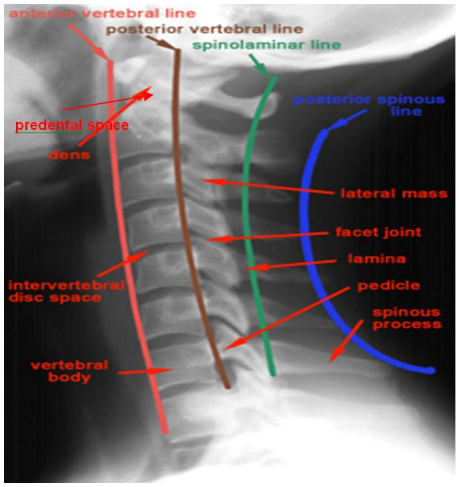


Lumbar anatomy:

- The **most common** region for fractures and disc herniation. Most of the lumbar disc herniation happen **posterolateral**.
- ROM: **Flexion and Extension**. (again due to facet orientation that goes in the sagittal plane)
- Defect in **Pars interarticularis** (connection between pedicle & lamina) ⟶ **Spondylolisthesis**.
- Characteristics of Lumbar vertebra:
  - The Spinous process are short, flat, and quadrangular and project backwards.
  - The vertebral foramina are triangular and the body is large and kidney shaped .
  - The laminae are thick and the transverse process are long and slender
  - The Pedicles are strong and directed backwards.



Some notes on radiological anatomy:



When looking to a spine x-ray always notice the alignment of each of, the **anterior vertebral line**, the **posterior vertebral line** and the **spinolaminar line**. These lines need to be congruent otherwise this might indicate, fractures, displacement or any other spinal column pathology.

The soft tissue shadow should measure :

- in front of C1 = 7 mm
- in front of C2 = 2-3 mm
- in front of C6-C7 = 22 mm

- generally speaking, if it was significantly displaced ⟶ indicates trauma

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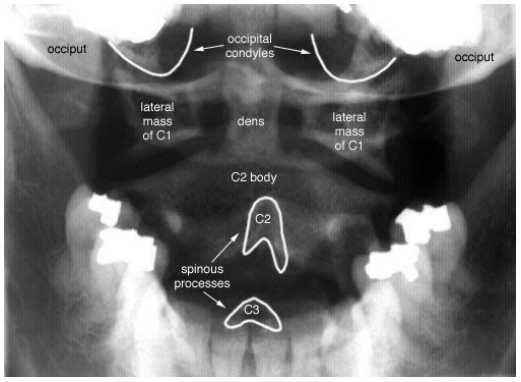
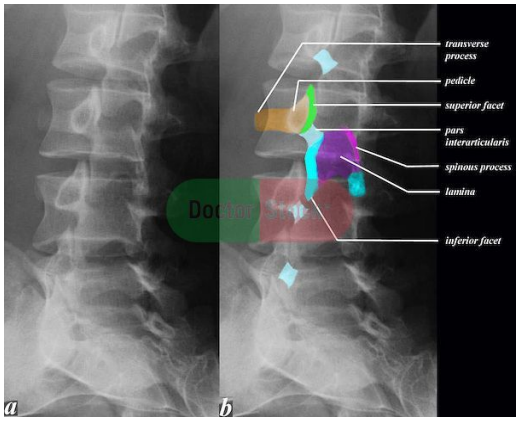


Routine anteroposterior cervical spine view shows the spine from **C3** (You can't see C1 and C2 because of the jaw), so if you want to see C1 AND C2 you have to ask for **open mouth** x-ray. Notice how each occipital condyle is sphere like. Also notice how the lateral masses of C1 are **aligned on the same level and placed on the same distance** from the midline, if they're at different distance ومتباعدين = complete (anterior posterior) **ring fracture.**

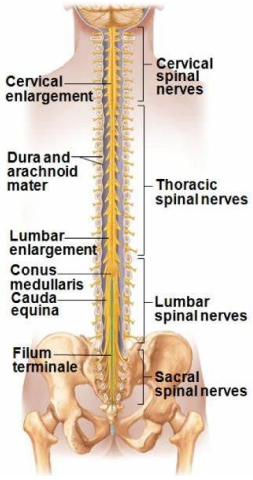
- useless for u , we won't ask u about it



We must see pedicles at each level (very important), also pay attention to the alignment of the spines and the space between each vertebral body = **intervertebral disc.**

B) Spinal cord

- It is an elongated, almost cylindrical structure, about the thickness of the little finger.
- It is suspended in the vertebral canal & surrounded by the meninges and cerebrospinal fluid (CSF).
- In adults, its Length is approximately **45 cm**
- Extends from **foramen magnum** to **L1- L2** (In children it extends to L3)
- Continuous above with the medulla oblongata.
- The spinal cord gives rise to **31 pairs** of spinal nerves.



Conus medullaris

Is termination of spinal cord

Filum terminale

Is residual fragment of spinal cord that extends from conus medullaris to sacrum.

Cauda equina

Nerve roots and filum terminale surrounded by dura that extend from the spinal cord

Spinal tracts

A) Ascending Tracts (**Sensory**)
   - **P**osterior columns (P carry Ps)
     Deep touch (**p**ressure), **p**roprioception (joint position), 2 **p**oint discrimination, vibrations.

→ When the posterior column is affected, how do you expect the patient to present?

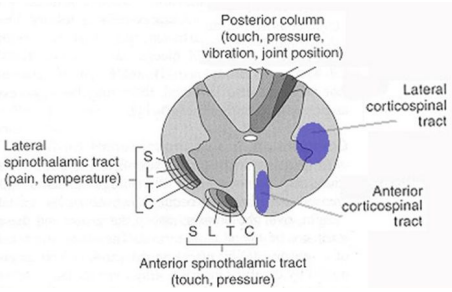
1. **Gait disturbance** → elicited by Romberg's test (closing eyes will eliminate visual compensation of losing proprioception → sensory ataxia)
2. **Loss of dexterity** → cannot button his shirt (because he cannot feel the buttons appropriately)
   - Lateral spinothalamic tract: Pain and temperature
   - Anterior spinothalamic tract: Light touch

B) Descending Tracts (Motor)
   - Corticospinal tract (anterior and lateral): Main voluntary motor

- The corticospinal tracts are particularly concerned with the control of **voluntary**, **discrete**, **skilled movements**, especially those of the distal parts of the limbs.
- Every tract decussate تتصالب, for example **corticospinal decussate at brain stem**, also posterior column does the same. The only tract that doesn't decussate at the brain stem and instead decussate at the **spinal level** (one or 2 levels above) is the **spinothalamic tract.** Just to make it easy and not confuse you.
  - Upper extremity motor pathways are more **medial (central)** which explains why a central cord injury affects the upper extremities more than the lower extremities.

Another fact, the representation of the fibers in the spinal cord differs; that being said the fibers with the most **C**entral representation are **C**ervical fibers after that comes thoracic, lumbar then sacral (i.e. **sacral fibers are the last fibers to be affected** when the source of pathology is central, a phenomenon known as sacral sparing).

- Now cervical injury due to a central cause has occurred (spinal cord is compressed at the level of the neck), **how do you expect the patient to present? upper limbs are affected** → weakness, wasting of extrinsic muscles of the hand, as it gets more affected → lower limbs get involved.

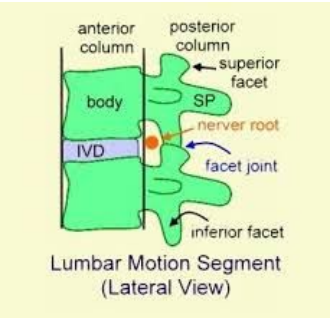


Degenerative spinal disorders

Overview

Spinal motion segment is composed of:

- ★ **Two adjacent vertebrae.**
- ★ **Three-joint complex. (intervertebral disc & 2 facet joints)**
- ★ **Ligaments.**



Lumbar Motion Segment
(Lateral View)

Note that each level of your spine functions as a **three-joint complex**. There are two facet joints in the back and a large disc in front that comprise each intervertebral segment. This tripod creates great stability, supports all your weight above each level and provides support for you to move in all directions. The posterior **facet joints** are synovial joints whereas the **intervertebral disc** is a fibrocartilaginous joint.

Degeneration of IVD (intervertebral disc):

- ★ **Loss of cellular material and hydration** "proteoglycans"
- ★ **Loss of disc height.**
- ★ **Abnormal loading to the facet.**
- ★ **Facet joints degeneration (Loss of height + facet OA).**
- ★ **Spinal stenosis +/- instability.**

السالفة وما فيها أن الدسك هذا الجزء اللطيف من عامودنا الفقري حصل له ما يسمى بـ"عوامل التعريه" اللي أدت إلى أنه يصير جاف ومفعوص, هذا الشيء سيء جداً بالنسبة للمفاصل facet joints اللي موجودة بعامودنا الفقري لأن المسافة بينهم قلّت (لأن الدسك أنفعص!) وبالتالي هذا يؤدي إلى احتكاك = osteoathiritis = تكوين الـosteophytes وبما أننا جنب النيرفز هذي مصيبة عظمى لأن هالـosteophytes راح تسبب انحشار للـ spinal cord - nerve roots (النتيجة radiculopathy & pain ← ادفانسد ارثرايتس راح يسبب instability اللي هي spondylolisthesis)

With ageing there is a gradual loss of **proteoglycans** and the disc becomes somewhat dehydrated and degenerate.

- This is thought to be the underlying cause of two important disorders that occur particularly in the **lumbar** and **cervical** regions and to a lesser extent in the thoracic spine: **intervertebral disc herniation** and **chronic intervertebral disc degeneration**. لاحظوا معاي أن الهيرنيا و الديجينيريشن شيئين مختلفين, لكن الهيرنيا غالباً يسبقه ديجينيريشن.
    - **Acute intervertebral disc herniation:**
      Intervertebral disc herniation or protrusion is a bulging of the disc with the outer part of the annulus intact, either directly posteriorly or to one or other side of the posterior longitudinal ligament towards the intervertebral foramen. Acute disc herniation is usually initiated by pre-existing degeneration + mechanical stress (combination of flexion and compression).

- Other terms that are used interchangeably with "degenerative spinal disorders" are: Spondylosis* - Degenerative disc disease - Facet osteoarthros
  *Term used to describe reactive new bone formation (osteophytes) and adjacent vertebral end-plates ossification.

Etiology

They are multifactorial disorders, the identified etiologies are:

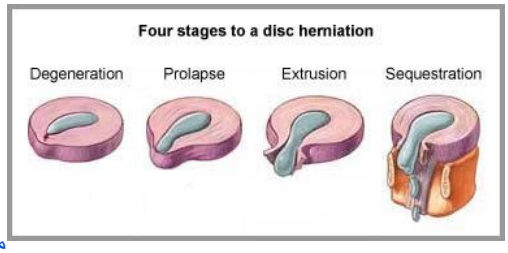
★ Genetic predisposition
★ Ageing
★ Some environmental factors:
- Smoking
- Obesity
- Previous injury, fracture or subluxation
- Deformity
- Operating heavy machinery, such as a tractor.

Pathology

What are the segments involved in the pathology?

- **Both mechanical & neurological segments**

A) Mechanical segment	
Anteriorly	**Intervertebral disc** → **degeneration occurs here** **What is the intervertebral disc?** ★ The first component of the 3 joint complex (motion segment) ★ **It is primarily loaded in FLEXION** ★ Composed of "annulus fibrosus" and "nucleus pulposus" فيجي سؤال بيشنت عنده ألم مع الflexion ووو...إلخ. ما هي الستركتشر انفولفد؟ الدسك **What will disc degeneration cause?** ★ **Bulging of the disc →"Spinal" stenosis** ★ **Loss of disc height →"Foraminal" stenosis** ★ **Herniation of the nucleus →"Radiculopathy" (e.g. sciatica in the lumbar spine)** - **Annular tear** is extremely painful and leads to sciatica. will improve anyway, but it gives chronic kind of pain

	- **Sequestered disc** → it's water, the body will eventually absorb it. Almost all will improve within three months - So basically, most patients with disc pathology & herniated disc who are in severe pain & cannot leave bed WILL also IMPROVE, **almost 90% will improve within 3 months** هذا الشيء معناته أنه طريقة سهلة لكسب المال من خلال الإدعاء بأن ممكن معالجته بالكي و الربط و الحجامة ويعلقوا رجولهم بالسقف ومدري ايش, و المريض بعد ما يطيب يعتقد أنه فعلاً طاب بسبب المعالج الشعبي لكن أحنا نعرف أن هذا ما هو إلا **الناتشورال هستوري أوف ذا دزيز**  Remember when we said normally disc appears WHITE in T2 weighted image (because it contains mostly water) Now i'll ask you what is the **first sign of disc degeneration** (before loss of height) that is evident via MRI? → **BLACK disc** → what does that mean? → loss of water content of the disc → shrink → loss of hight ...etc
Posteriorly	**Facet joints (2 in each level)** → **Subsequent degeneration (osteoarthritis) occurs at the facet joints** **What are the "facet joints"?** ★ Scientific name is "zygapophysial joints" ★ They are **synovial joints** (2 in each motion segment) ★ **Are primarily loaded in EXTENSION (along with pars interarticularis posterior muscles and ligaments)** العكس, بيشنت عنده ألم مع الextension ماهي الستركتشر انفولفد؟ facet joints يجيك ألم مع الflexion و الextension (كلهم) ماهي الستركتشرز انفولفد؟ Spinal motion segment **What will facet joints degeneration cause?** ★ **Hypertrophy, osteophyte formation → Contributing to spinal stenosis or foraminal stenosis** ★ **Laxity in the joint capsule → Leading to instability (degenerative spondylolisthesis)**

B) Neurological segment

★ **Spinal cord**
★ **Nerve roots**
★ **Cauda equina**

Clinical presentation

Relates to the pathology → also falls into 2 categories (mechanical & neurological)

A) Mechanical pain	**Due to joint degeneration or instability.** ★ **"Axial pain" in the neck or back** ★ **Activity related-not present as rest pain, associated with movement, at:** - **Sitting**, bending forward **(flexion)** → originating from the disc → "discogenic pain" - **Standing**, bending backward **(extension)** → originating from the facet joints → "Facet syndrome"
B) Neurologic symptoms	**Due to neurologic impingement** ★ **Spinal cord – Presents as myelopathy, spinal stenosis (neurogenic claudication) and spinal cord injury** **Myelopathy** الضغط على السباينل كورد نفسه - Loss of motor power and balance (gait disturbance) - Loss of dexterity → Objects slipping from hands - UMN deficit (rigidity, hyperreflexia, positive Babinski..) - Slowly progressive "stepwise" deterioration.

- **Cervical** level → cervical spondylotic myelopathy → objects falling from the hand, changed dexterity, change of signature, loss of ulnar function, UMN signs in the upper limbs or non-dermatomal-sensory-distribution deficit, gait disturbance (posterior column), when severe can include lower limb motor function (motor & sensory).
- **Thoracic** level → same as CSM symptoms except everything lower limb (no involvement of upper limb)
- **Sacral** level → **cauda equina** presentation which includes:
  - Urinary retention
  - Bowel incontinence
  - paresthesia

  If not treated within 48h = permanent loss of bowel and bladder functions.

Neurogenic claudication (discussed below)

- Pain in both legs caused by walking
- Must be differentiated from vascular claudication

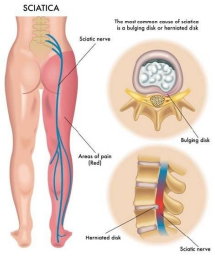
Spinal cord injury

- Spinal stenosis associated with a higher risk of spinal cord injury
- ★ **Nerve roots & cauda equina – Presents as radiculopathy (e.g. sciatica) or cauda equina syndrome**
  - ➢ **Nerve roots**

    Cervical level → radiculopathy → upper limb

    lumbar level → radiculopathy → sciatica
    - **Radiculopathy** الضغط على النيرف روتس
- LMN deficit
- Commonest is **sciatica**, but cervical root impingement causes similar complaints in the upper limb
  - ➢ **What is Sciatica?**

  Sciatica refers to the symptoms of **pain**, **numbness**, **tingling**, **burning** sensation or weakness that originate in the **lower back, radiate through the buttock, and continue down the back of the thigh, leg and foot.** Sciatica occurs when there is compression, inflammation or injury to the sciatic nerve or to its (spinal nerve) roots L4-S2 .



- **Cauda equina** (discussed above)
  - Prevalence 0.0004/lower back pain yet very serious

Neurogenic claudication:

(very important table) →

★ Flexion = **widening** of the spinal foramen (walking uphill requires flexion to bring the center of gravity anteriorly)

★ Extension = **compression** of the spinal foramen (walking downhill requires extension to bring the center of gravity posterior)

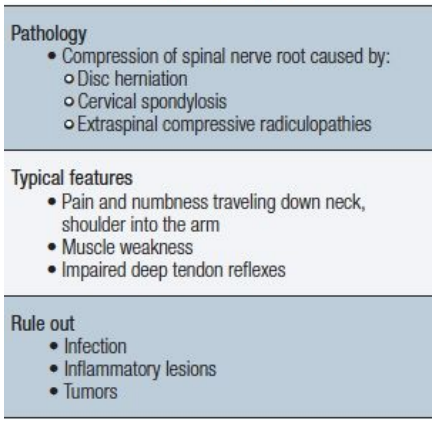
★ Neurogenic claudication:
- pain as soon as he walk from **proximal to distal** (he didn't use muscles → not vascular claudication)
- pain **relieved by sitting** (sitting = flexion = **widening**)

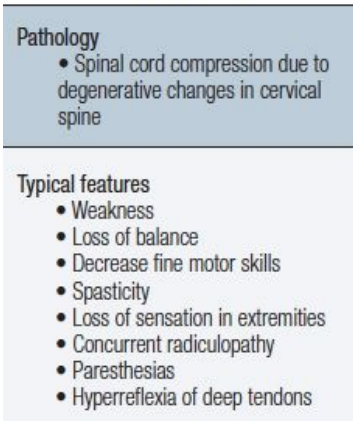
★ Vascular claudication:
- pain **relieved by stopping & standing** (benefits from gravitational force on blood supply).
- Why **distal to proximal** in vascular claudication? Because blood supply is less as you go distally

Table III.[22,32] Differences between neurogenic and vascular claudication

Symptom/sign	Neurogenic Claudication	Vascular Claudication
Pain	Proximal to distal	Distal to proximal
Relief of symptoms	Relieved by sitting/forward bending	Relieved by standing
Walking up hill	Better	Worse
Walking down hill	Worse	Better
Cycling	No symptoms	Symptoms present
Walking distance	Variable	Fixed
Neurological symptoms	Commonly present	Not present
Neurological signs	May be positive especially after walking	Negative
Pulse	Present	Absent
Skin	No changes	Atrophic changes

Extra just to know how to differentiate between cervical radiculopathy (pic at left) & cervical myelopathy (pic at right):





Imaging

- **X-ray examination** typically shows *flattening* of the 'disc spaces' and *spur formation* at the borders of the vertebral bodies, often accompanied by characteristic features of *osteoarthritis* in the small facet joints.
- **MRI scans** may show *bulging* of one or more discs in both sagittal and axial projections

Now we'll discuss the disorder based on the level of spine affected, this division is the one clinically relevant:

	Cervical Spine	Lumbar Spine
Site	Degenerative changes typically occur in **C3-C7**	Degenerative changes typically occur in **L3-S1**
Presentation	Presents with ★ Axial neck pain ★ Myelopathy ★ Radiculopathy	Presents with (could be combined) ★ Axial lower back pain ★ Spinal stenosis ★ Disc hernia
Physical examination	★ Stiffness (loss of ROM) ★ Neurologic exam: (along upper limbs) - Weakness - Loss of sensation - Hyper-reflexia, hypertonia (in myelopathy) - Special tests: Spurling's sign	★ Stiffness (loss of ROM) ★ Neurologic exam: (along lower limbs) - Weakness - Loss of sensation - Hypo-reflexia, hypotonia - Special tests: straight leg raise test
Treatment	★ **Conservative treatment** **First line of treatment for axial neck pain and mild neurologic symptoms** (e.g. mild radiculopathy **without** any motor deficit) - **Rest** & short periods of immobilization - **Physiotherapy**: – Focus on ROM and muscle strengthening - Non-steroidal anti-inflammatory medications (**NSAID**) – E.g. Diclofenac, ibuprofen, naproxen - Neuropathic medication: for radiculopathy pain – E.g. Gabapentin or pregabalin	➢ **Axial low back pain** ★ Conservative treatment is **first-line** and mainstay of treatment - **Physiotherapy**: core muscle strengthening, posture training - NSAID ★ Surgical treatment Indicated for: - Instability or deformity e.g. **high-grade spondylolisthesis** - Failure of conservative treatment ➢ **Spinal stenosis** (neurogenic claudication) ★ Conservative treatment is first line of treatment - Activity modification, analgesics, epidural corticosteroid injections.

★ **Surgical management**

Indicated for,

- **Cervical stenosis** causing **cervical myelopathy** هنا أنتِ تتعاملين مع السباينل كورد > جزء من السنترل نرفس سستم الموضوع سيريس يحتاج تدخل جراحي
- Disc herniation causing **severe radiculopathy associated with weakness**
- **Failure of conservative treatment** of axial neck pain or mild radiculopathy

Procedures, **(decompress and fuse almost all the time)**

- **Anterior discectomy and fusion**
- **Posterior laminectomy +/- fusion**
- Laminoplasty
- Cervical disc arthroplasty

★ Surgical treatment

Indicated for:

- Acute Motor weakness e.g. drop foot
- Severe neurogenic claudication → needs to sit every 5 mins (severe functional disturbance)
- Failure of –minimum- 6 months of conservative treatment
- Procedure: Spinal decompression (**laminectomy**) is the commonest procedure

➢ **Acute disc herniation**

★ Conservative treatment is **first line** of treatment for mild sciatica **without** motor deficit

- Short (2-3 day) period of rest, NSAID, physiotherapy, epidural cortico-steroid injection
- **90% of sciatica resolves within the first 3 months without surgery**

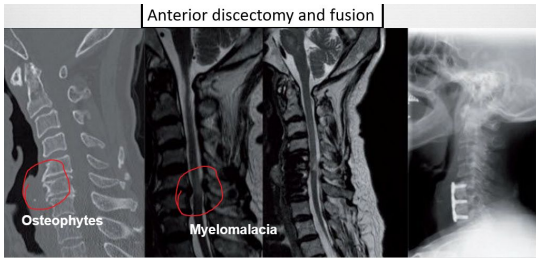
★ Surgical treatment

Indicated for,

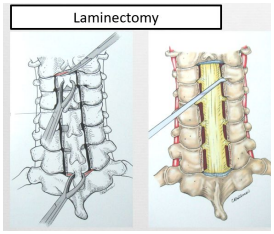
- cauda-equina syndrome
- **Motor deficit** Muscle power 3 or less
- **Failure of 3 months of conservative treatment**
- Procedure: Discectomy (only the herniated part) (+ laminectomy if accompanied with **cauda equina**)

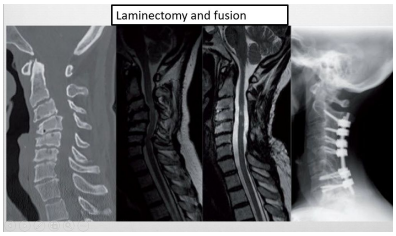
Myelomalacia is a pathological term referring to the softening of the spinal cord. Hemorrhagic infarction (bleeding) of the spinal cord can occur as a sequela to acute injury, such as that caused by intervertebral disc extrusion (being forced or pressed out).

Removal of the disk anteriorly and decompression of the spine. Myelomalacia will persist bc the cord is affected. Main indications for surgery: to stop worsening and to improve one functional grade



Multiple cervical degeneration, loss of cervical lordosis (cervical kyphosis) → treated with decompression laminectomy & fusion (cutting the lamina to remove pressure)

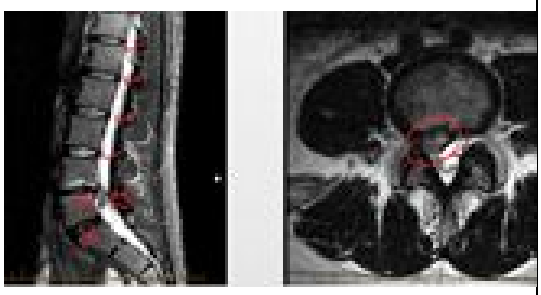




T2 weighted image showing lumbar disc hernia. Notice how upper discs are white (good disc, good water content) whereas lower discs are black.

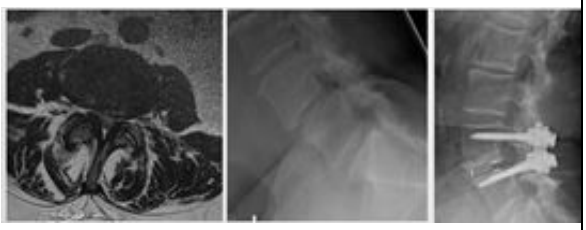
في الإختبار ممكن أجيب لكم صورة زي هذي وألعب في الهستوري بسناريوهات مختلفة, مثلاً:

1. Patient has 10 days acute severe pain, can't get out of the bed معدوم العافية
   Management? **CONSERVATIVE**, because still 10 days & no red flags!
2. Patient with 4 Months history of pain & failed physiotherapy
   Management? **SURGERY**
3. Patient with 2 days history of pain with (....) "features of cauda equina"
   Management? **SURGERY**



Why most herniated discs are posterolateral not central? Central part is stronger due to the **support of the posterior longitudinal ligament.**

Spinal stenosis with spinal instability (spondylolisthesis), evident by forward displacement of L4 (middle image, notice how posterior vertebral line is disturbed) زي المطب أو الدرجة which will compress the spinal cord → procedure is called interbody cage & fusion + laminectomy



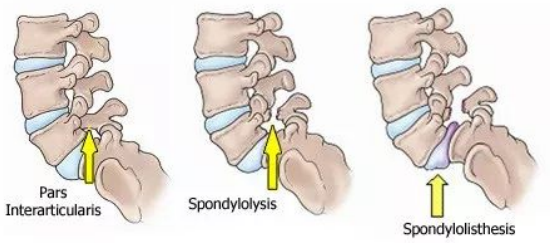
Other spinal disorders

A) Spinal deformities

Kyphosis

★ Deformity of the spine in the Sagittal plane

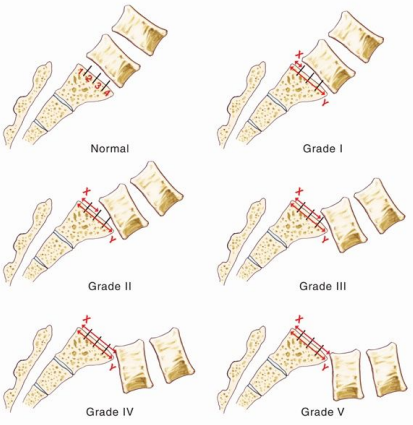
Spondylolisthesis



★ Preceded by spondylolysis of the pars interarticularis (before it becomes spondylolisthesis)
★ Displacement of one vertebra over another
★ It's a defect in the pars interarticularis
★ Most people are asymptomatic
★ Types:
- "Degenerative" Spondylolisthesis
- "Isthmic" spondylolisthesis → Caused by interarticularis defect (spondylolysis)

★ Severity is according to the degree of displacement
★ Management
- Conservative treatment **first**
- Surgery if **Grade 3 or more or failed conservative management** or significant pain and weakness

Grade I 25% displacement
Grade II 50% displacement
Grade III 75% displacement
Grade IV full displacement
Grade V = لمّا تقع قدام مرة يصير اسمه = spondyloptosis



○ Surgical procedure: Instrumented PSF (posterior spinal fusion) with decompression +/- interbody fusion is the commonest

There is significant pars defect, loss of disk height with forward displacement around 50% so we did posterior instrumentation and interbody cage → return of almost normal height with fixation

Scoliosis

★ Deformity of the spine in the Coronal plane (more common than kyphosis)
★ Types:
- Congenital – Associated with anomalies of the bony vertebral column, e.g hemivertebra
- Acquired (=secondary) – Secondary to other pathology, e.g tumor , infection
- Syndromic – Secondary to other syndromes e.g. Ehler danlos', marfan's syndrome
- Neuromuscular – Secondary to poor muscle control or nerve problems e.g. muscular dystrophy, cerebral palsy
- Idiopathic – Most common is adolescent type

→ Adolescent idiopathic scoliosis
★ Between **10 and 14 years old**
★ Three dimensional deformity of the spine – Vertebral **Rotation** is the hallmark (meaning it's not just curving in different directions NO it's a **3D deformity** كأني أمسك السباين وألفه)
★ Painless deformity: Usually noticed by parents/others
★ Examination: neurologically normal, positive Adams test
★ Management: instrumented PSF (posterior spinal fusion) → depends on age & degree of deformity **(45 degrees or more)** لأن بعد كذا ممكن تزيد درجة أو درجتين كل سنة

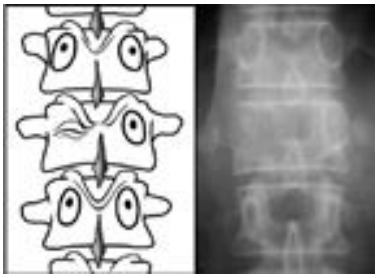
What are the positive clinical signs in this patient shown in the x-ray?
1. **Shoulder asymmetry** (which side is elevated? Left, evident by the clavicle another hint shoulder is usually elevated at the convex side of spine)
2. **Waist is asymmetric** right side is bulging, left side is pushed
3. **Positive Adam forward test** + **rip hump**
4. Lateral image will show either exaggerated kyphosis or hypokyphosis of thoracic spine

B) Osteoporotic vertebral fractures

★ Pathologic, low energy fractures commonest pathological fracture
★ Anterior column (±middle column) only compromised (Wedge/Burst Fracture)
★ Common injury in **postmenopausal women**, often missed
★ Repetitive fractures result in **kyphotic deformity** (hunchback)
★ Treat the underlying cause AKA osteoporosis.
★ Possible surgical management is kyphoplasty/ vertebroplasty if severe pain is present

Other pathological vertebral fractures are also low energy fractures and are caused most commonly by either **infection or tumors (red flags).** With these pathological fractures, spinal X-ray shows **"winking owl sign"** AKA "absent pedicle sign" which indicates erosion of spinal pedicle **(most commonly suggests osteolytic spinal metastasis)**

what is the anatomical structure involved in this radiological sign ? pedicle



C) Destructive spinal lesions

★ **Present with pain at rest or pain at night → this spinal lesion weakens bone → more pain (axial pain with movements) → further fracture with minor trauma → severe pain with loss of function**

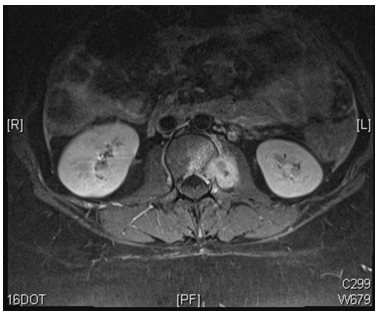
★ Associated with **constitutional symptoms**

★ Most common causes are **infection & tumors (infection is always a differential for tumor and vice versa)**

★ **Vertebral body and pedicles are the commonest sites of pathology** because very vascular

a. Tumors can compress, spinal cord presentation is according to the site of compression (thoracic vs cervical, anterior vs posterior, hemi brown sequard syndrome or combined feature...etc)
   - Primary Spinal tumors:
     - Rare
     - Either benign (e.g. osteoid osteoma) or malignant (e.g. chordoma)
     - Management depends on pathology
   - Spinal metastasis
     - **Very common**
     - Biopsy required if primary unknown whenever see a lesion, your main management is to reach a diagnosis → is it an infection? a tumor? primary or secondary? → do a biopsy!

b. Infection (abscess can act just like tumor and compresses structures in the spine)
   - ★ Most common is **TB** and **Brucellosis**
   - ★ History of contact with TB patient, raw milk ingestion
   - ★ Potentially treatable diseases management is usually medical once diagnosis is established and antimicrobials administered unless there is severe compression or instability
   - ★ Vertebral body and pedicle are the commonest sites of pathology



Psoas abscess + constitutional symptoms → next step in management is? → **Biopsy & evaluation** (is this abscess or tumor)

Last but not least,

Spinal pathology red flags

Beware of:

1. **Cauda Equina/severe neurologic injury (perianal numbness, decreased rectal tone, loss of movement in the extremities)**
2. **Tumour weakening the vertebrae (causing cord compression or vertebral fracture)**
3. **Infection weakening bone (causing disc/vertebral destruction or cord compression)**
4. **Traumatic Spine Fracture (causing vertebral angulation, pain, or neuro compromise).**

Remember that spine fracture can occur without trauma patient can have severe osteoporosis, coughs or sneezes (or any minor load) → fracture!

MCQs

68 years old diabetic and Chronic RF male, come with severe back pain that decrease with going uphill.What is the investigation to confirm the diagnosis?
A- Pelvic US.
B- Lumbar spine MRI.
C- CT hip.
The Answer: B

Patient presented with cervical pain that radiates to the arm, weakness, numbness and loss of function but no gait disturbance which one of the following is the diagnosis?
A- Myelopathy.
B- Radiculopathy.
The Answer: B

Scoliosis case with an X-ray image marked with 92 degrees. What's the best management option?
A- Spinal fusion.
The Answer: A (surprise!)

32 years old female presented to the ED because of sudden lower back pain with positive symptoms of cauda equina syndrome, x ray done and it was normal, what is the best investigation to confirm the diagnosis?
A- bone scan.
B- MRI.
C- US.
D- DEXA.
The Answer: B

48-year-old male presented with history of low back pain. Patient's standing tolerance is only 10 minutes limited by pain but sitting relieves the pain. Which of the following is the cause for his symptoms?
A- Herniated disc
B- Facet OA.
C- Spinal stenosis.
D- Cauda equina.
The Answer: C

35-year-old male presented with back pain, urinary retention, loss of anal tone, anesthesia in the perineal space. X-ray was done and shown below. Which of the following is the best management?

A- L5/S1 discectomy
B- Emergent decompression and ORIF
C- T10 Laminectomy
D- T12/L1 discectomy
The Answer: A

A 21 years old gentleman orthopedic (OPD) C/O low back pain for 5 months. the pain is progress, aggravated by activity and relieved by rest. There is no H/O trauma. Has occasional night sweats. His younger sister is on treatment for tuberculosis for the past 6 Months. Images are shown. How would you obtain a definitive diagnosis for him?
A- Chest X ray
B- ESR and CRP
C- Tissue biopsy
D- Tuberculin test
The Answer: C

An 82-year-old woman presented with back pain. There was no history of trauma, fever or weight loss. Physical examination showed mild thoraco-lumbar kyphosis but no tenderness. Neurologic examination is normal. X-rays are shown below.
A- Start anti-osteoporotic medications
B-Admission and bed-rest.
C- Open reduction and internal fixation.
D- 6 weeks of halo-femoral traction
The Answer: A

14 years old female brought by her parents. They are concerned about the abnormality seen in her back. On examination, the only positive thing was a unilateral hump on the right side of her back when she bends forward. What is the most likely diagnosis?
A- Degenerative disc disease
B- Spinal TB
C- Scoliosis
D- Spondylolisthesis
The Answer: C

41 year old female presented with neck pain which radiate to the arm and thumb. On examination there was a positive spurling's test. Which of the following is the best management?
A. Discectomy and fusion
B. Conservative management
C. Decompression
D. Bracing
The Answer: A

A 45-year-old male with back pain for four months denied any history of trauma or constitutional symptoms. Physical examination showed neurovascular was normal and mildly painful ROM for lumbar spine. What is the best management?
a. Steroid injection
b. Spinal fusion
c. Spinal brace
d. Rest and analgesia
Answer: D