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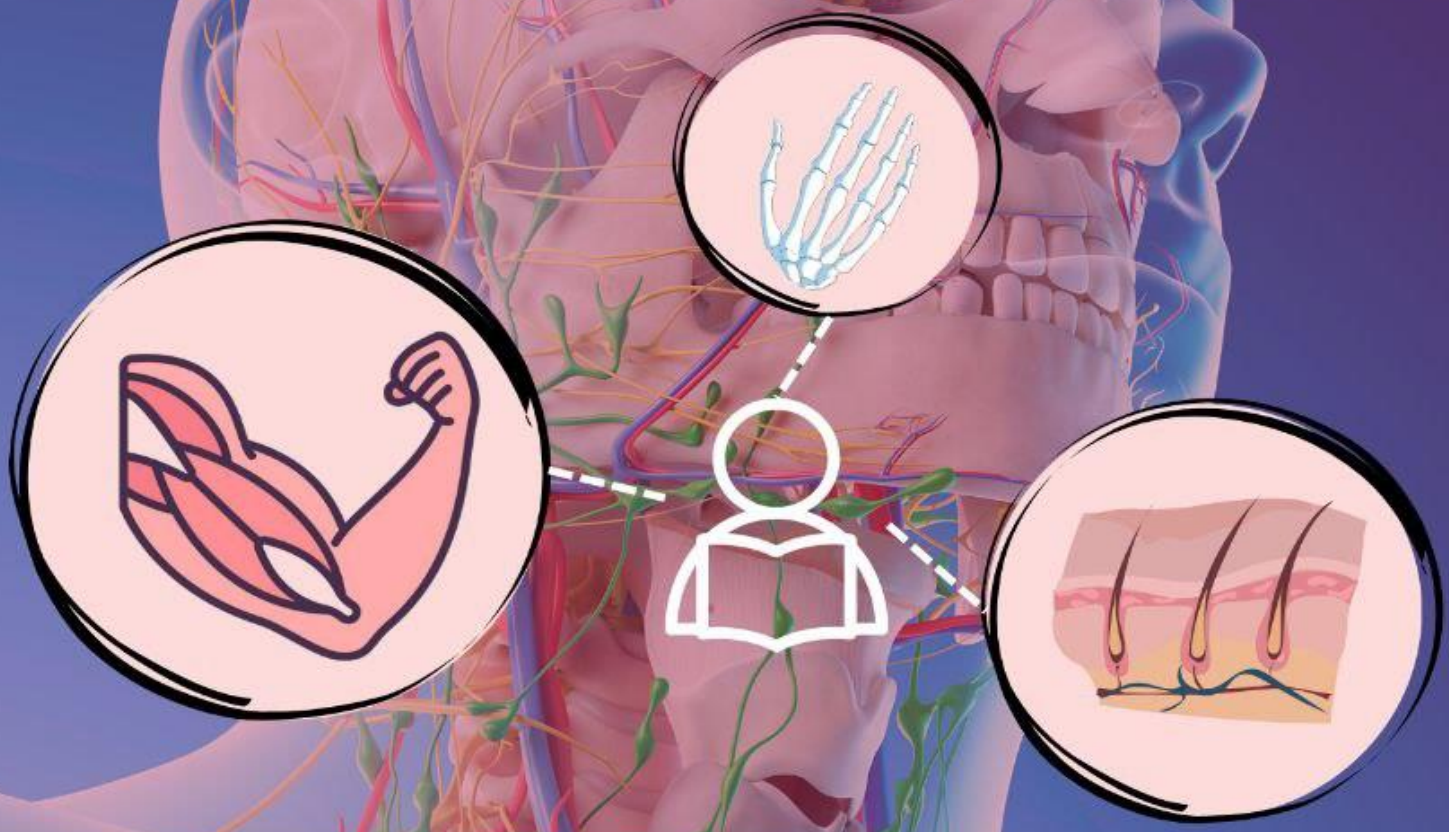


PBL

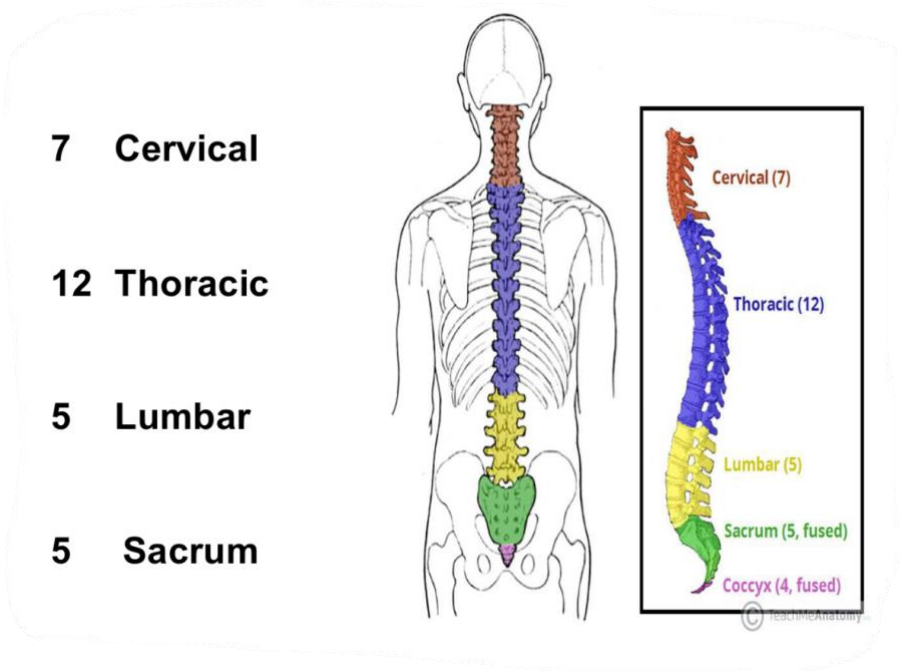
Sheet no. 1

Writer: Leen Abd & Zaina Rawashdeh
corrector: Farah Khazneh
Doctor: Fadi Hadidi

بسم الله الرحمن الرحيم

Anatomy of the back

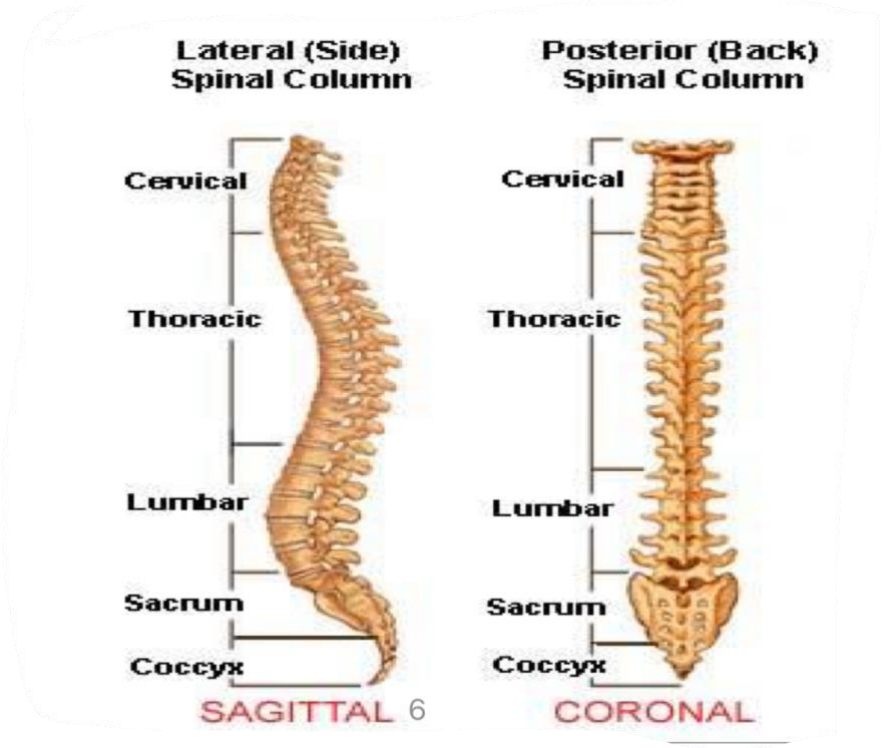
Revision!



As we have learnt before, our spinal cord is segmented through 33 bony structures called vertebrae (plural), and between each vertebra (single) an intervertebral disc, consisting of <u>fibrocartilaginous</u> material called intervertebral disc.

What is the point of the intervertebral disc?
It works as a pillow, absorbing shocks, compressions and tensions.
Vertebrae in neck → cervical vertebrae
Vertebrae in thorax → thoracic vertebrae
Vertebrae in abdomen → lumbar vertebrae
Vertebrae in pelvis → sacral and coccyx vertebrae
🛑 so we named each <u>vertebra according to its region</u> ...

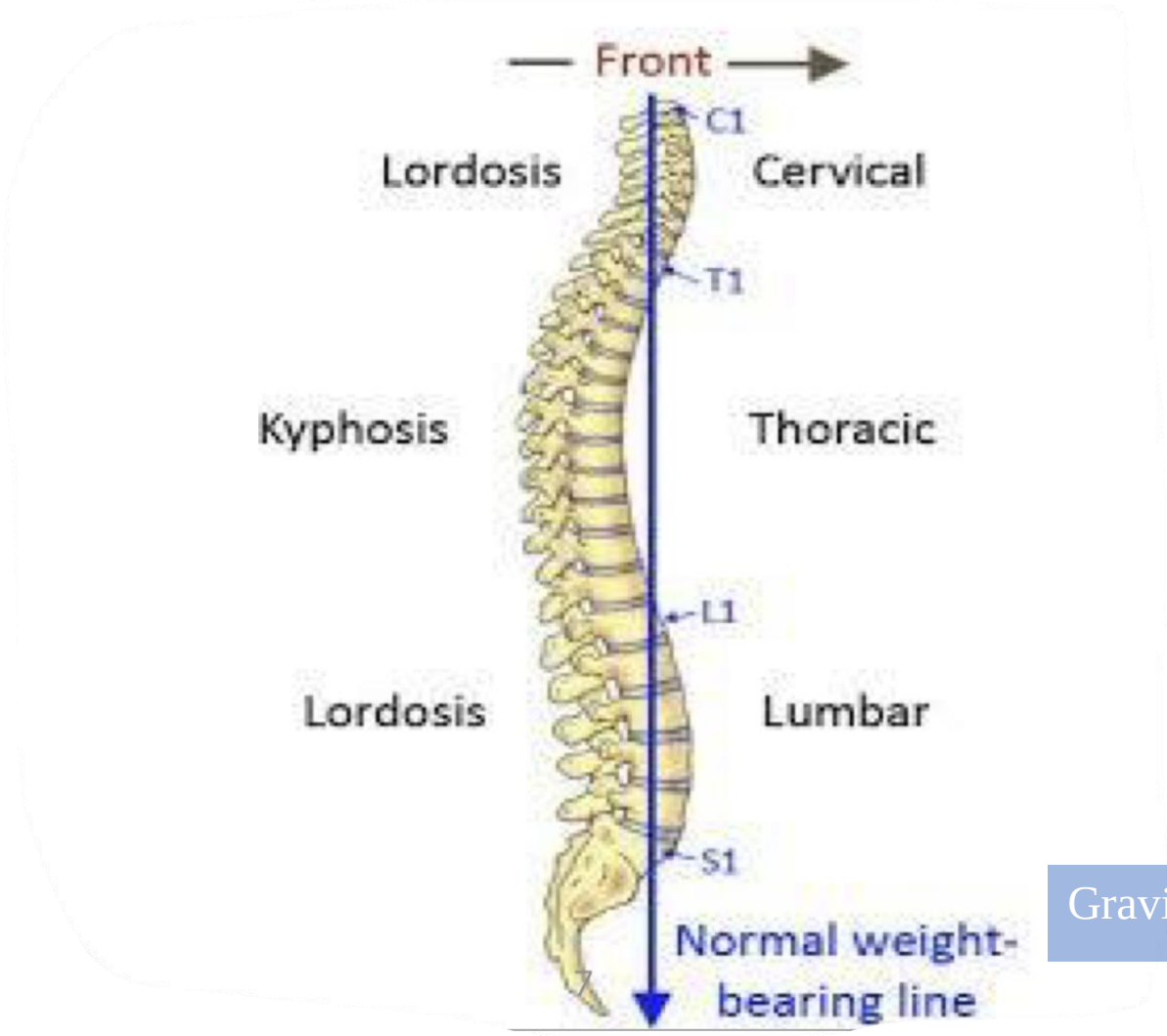
let's take a look at the alignment of the spine, we will see an alignment that couldn't be seen in any other species in mammalian kingdom, from anterior to posterior it's straight, unlike from lateral view it has multiple curves, and this absolutely for a reason… WHY?



📌 the purpose of the vertebral column being straight anteriorly, is to keep the head central over the pelvis. This is the main function of the vertebral column, to have symmetrical left and right sides, otherwise the brain will sense something abnormal and try to compensate for it.

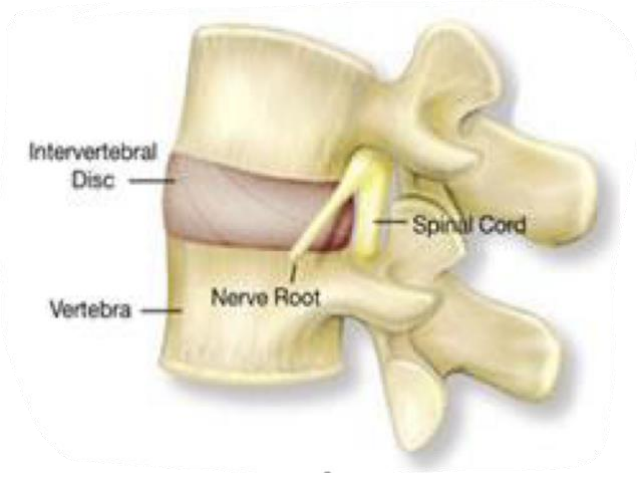
Ok what is the purpose of the curves we see in the lateral view?
Well, don't forget that we are always under the affect of the gravity. (Look at the picture next page). You can notice that some regions have anterior convexity, and we call it lordosis (like cervical and lumbar), in others the convexity is posterior, and it's called kyphosis (like thoracic and sacral).

📌 so our vertebrae are 50% lordosis, 50% kyphosis, the purpose here is to get away from the affect of the gravity, look at the picture below, you see the gravity line is posterior to lordosis regions, and anterior to kyphosis regions. (Most of our vertebral column is away from the gravity line which reduces probability of injury)



But still, we can see that there are some vertebrae touching the gravity line, such as C1, T1, L1, S1... <u>those also are the most likely to be fractured or injured.</u>

- collectively -- LARGE ROM
- flex/ ext
- L-R rotation
- L-R lateral flexion



The picture on the right shows you the <u>functional unit</u> of the vertebral column, two vertebrae and intervertebral disc between them. It also may be considered a joint.
We may say that our vertebral column is made up of multiple joints thus has a very flexible and wide range of movement. As shown in the figure on the left: wide range of mobility, such as: flexion, extension, rotation or even complex motion (two at the same time), like flexion and bending at the same time// extension and rotation at the same time. This unique feature is only found in the spine, because of its multiple joint structure.

<u>>>>always remember that mobility is reversibly related to the stability,</u> if there's more stability, there will be less mobility, and vice versa. Whenever there is more mobility, there will be more likely to have injuries. For example, sacrolumbar joint is immovable joint so there is more stability to carry the weight of our body, and less exposure to injuries.

↑ Stability ↓ Movement ↓ Injuries

Look at this cute baby.. unfortunately, we can notice his face is asymmetrical, and shifted.
>The question is, why? What the problem is here?

The **problem is with a muscle called (<u>sternocleidomastoid</u>),** in the left it's shorter than the right side, and this disease is (<u>torticollis</u>).

Previously we said, the most important role of the vertebral column is to stabilize the head central over the pelvis, any problem affecting this, will lead to asymmetry thus causing the head to shift. If the head deviates to one side, the gravity line shifts to that side.
The gravity line when it is deviated to any side, will make compression and load a weight, then not allowing the organs to naturally grow. As the baby here his left eye is smaller and his left cheek is smaller too, nostril, mouth, etc…

- Can be treated?
  Yes by releasing the torticollis and reveart the head central over the pelvis again, and it's almost a must, or the babywill have asymmetrical face along his life ☹.

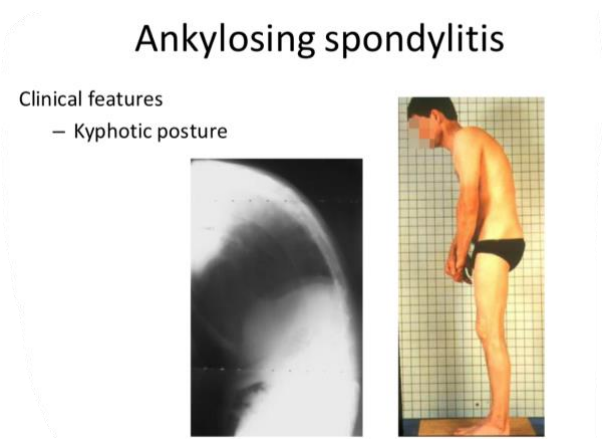
- What can you see in the picture?

A female whose vertebral column is deviated to the right, I can also see her head is shifted to the left side and she has right shoulder elevated more than the left one, the right ribs are well-developed unlike the left ribs which are under-developed. This disease called (scoliosis).

- Can be treated?

Yes, we can do a correction surgery to make this scoliosis straight as much as we can without damaging the spinal cord.

📌 very important to emphasize that this disease seen from AP View
AP = anteroposterior



📌this disease can be seen from lateral view

- As we studied before, each region of the vertebral column is either lordosis or kyphosis, in this disease there is only kyphosis and it's developing gradually over time. (dr. used the expression "hyperkyphosis"). Hyperkyphosis is due to arthritis.

- What are the expected complications?

The patient will not be allowed to extend his back, he will also have a problem in vision, eating and drinking and even respiratory problems.

- Can be treated?

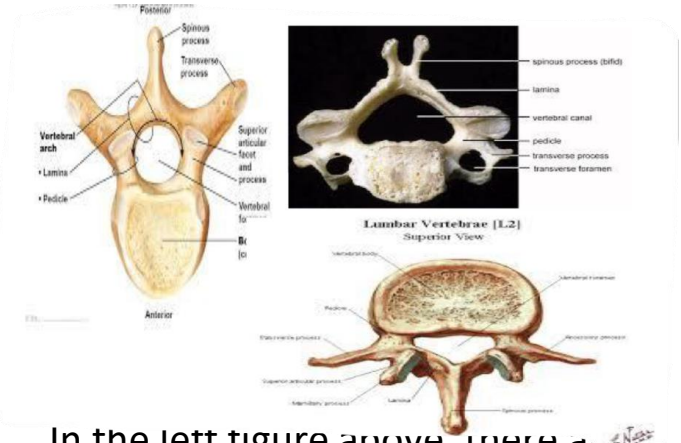
Yes, also by correction surgery, by removing this hyper-kyphosis and return it to normal kyphosis as shown in the right picture.

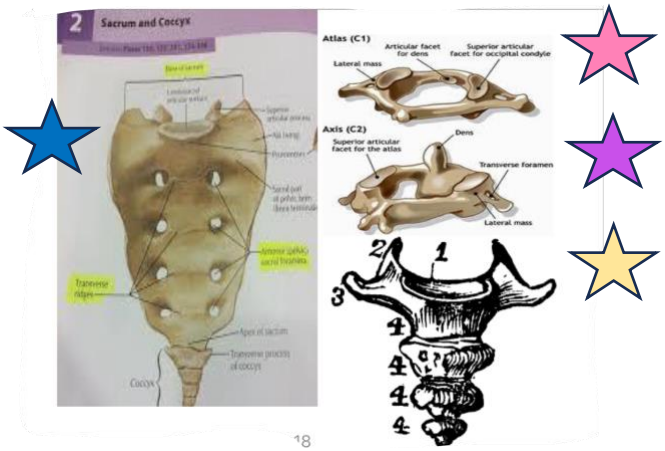
Types of vertebrae

We can classify the vertebrae in many ways, one of them according to its region as we took before, the other is due to its structure. So, its classified as typical and a typical as explained below:

1- Typical has:
•body
•arch

2- Atypical has: •additional structure
- (and/or) is fused

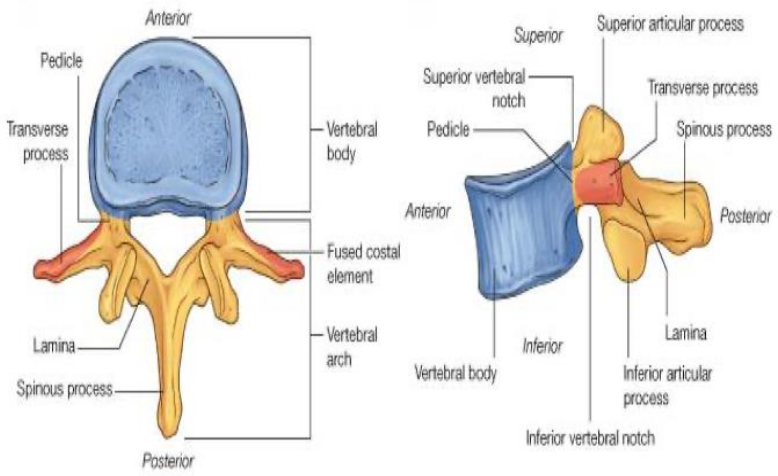




In the left figure above, there are 3 different vertebrae (different in the region) but have similar structures (body and arch). Although they have some variations, they are all typical vertebrae.

In the right figure above, the picture noted with pink star, consists of two arches, in picture marked with purple star there is a vertebra consisting of body and arch but with additional accessory structure (nipple like) called dens. The latest picture with yellow star is coccygeal bone consisting of body of the vertebrae without arch, so atypical vertebrae. Next to blue star are sacral bones, although they have arches and bodies, they are fused so they are atypical ones.

Typical Vertebra

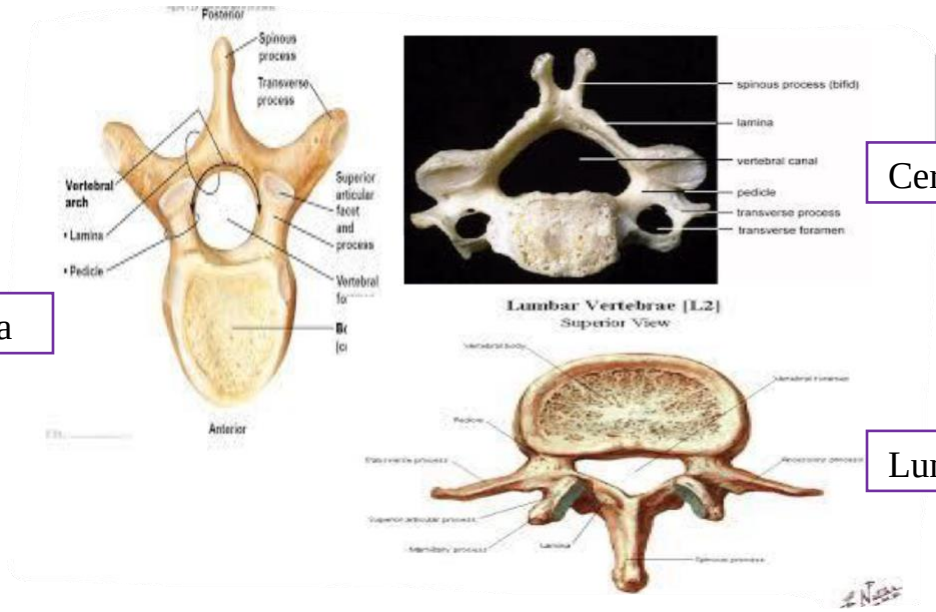


As we said that typical vertebra consists of the body and the arch, **The body (Anterior)** and the body is bigger in size than the arch because the body of vertebra carry 70% of load of your body's load and 30% of the load is carried on the arch.
The size of vertebra increases downward: when we go down (cervical<thoracic<lumber).

The Arch (Posterior) consists of two bones called **lamina**, when these two lamina fused together gives ---> **spinous process**, also the arch has transverse process. These processes **(spinous and transverse)** function for the attachment of ligaments and attachment of muscles, gives origin for the muscle & ligament.

How to connect the body and arch? By **Pedicles** on each side.
It should be strong because it holds both the body and the arch. So, the pedicle and the arch together form the **spinal canal** to pass the spinal cord & nerves through this canal to make protection for the spinal cord and from injuries.

"Pedicles are the strongest part of vertebra"
"Body, pedicles and arch form spinal canal"



Cervical vertebra

Thoracic vertebra

Lumbar vertebra

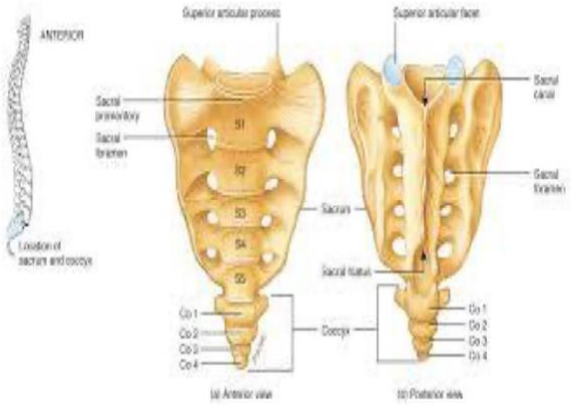
How to distinguish between the cervical vertebra & for example the lumber vertebra? There must be a specification for each vertebra. As we said before that the size of vertebra <u>increases downward</u>: when we go down (cervical<thoracic<lumber) --> typical vertebra.

→**The cervical vertebra** (the smallest size) the body has an **oval** shape, the arch and spinous process posteriorly; it has two branches like V (bifid).

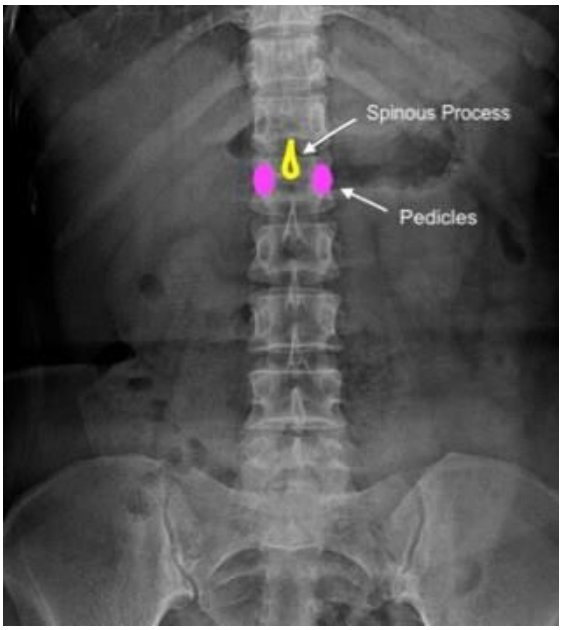
→**The thoracic vertebra** (medium size), it has **heart** shape, the spinous process long and thin.

→**The lumbar vertebra** (large size) , **kidney** shape, and the spinous process will be short and thick.

The Sacrum consists from body & arch and fused together so it's <u>Atypical Vertebra.</u>



The Coccygeal bone it's the body of vertebra attached to each other and it's Atypical Vertebra.



In X-Ray we suppose to notice **these important things:**

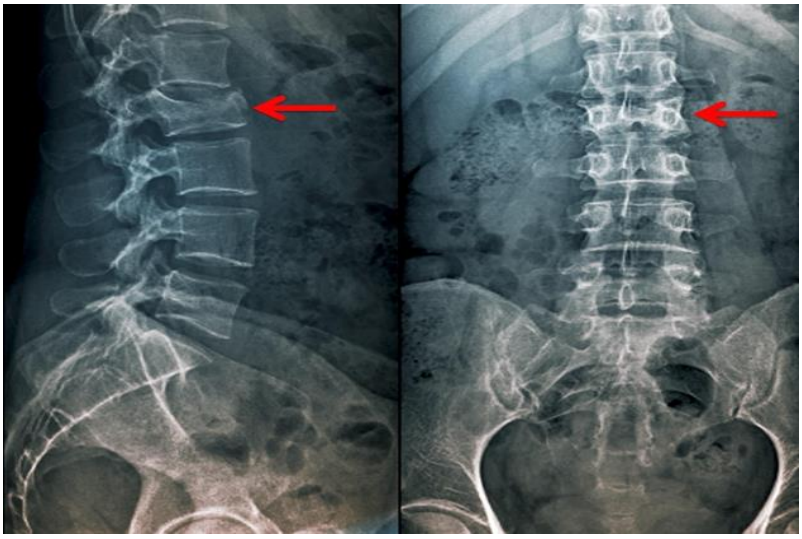
1. The size of vertebra increases downward: when we go down (cervical<thoracic<lumber).

2. On the posterior view of the vertebra I should see the spinous process located in the midline, also I must see the arch.

3.The pedicle on the right and left sides on the same line, as we mentioned previously, it's the connection between the body & the arch.

The arch can be defected called : spina bifida --> absence of arch or insufficient one or more vertebral arches.

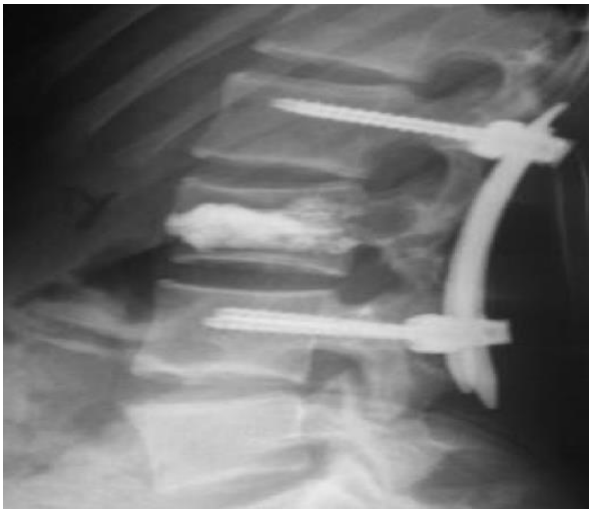
In the figure above: From the **lateral view**, the body of vertebra is rectangular in shape and all the vertebra must are on the same line, **The size of vertebra** is increasing downward. (normal)



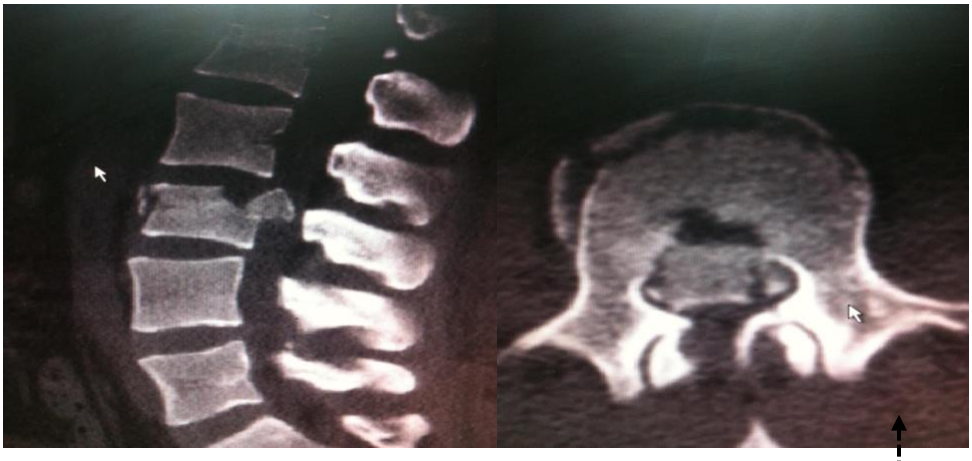
In this patient case, the shape is not rectangular, supposed this (pointed at in red) vertebra to be bigger than the vertebra above but it's smaller so there is a defect which is **fracture**. As we talked previously that 70% of the load is carried by the body of vertebra but here it's fractured, so this patient lost around at least 50%-60% from 70% of the load anteriorly.

The Treatment--->

I have to restore this load by **increasing the load on the arch** to carry more.



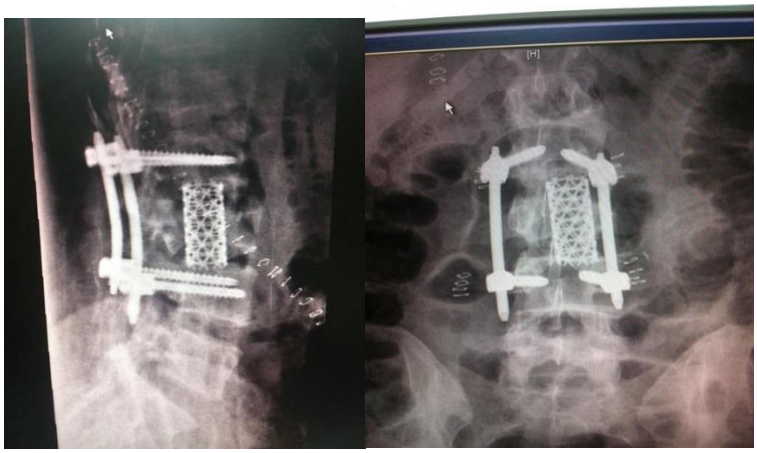
In the picture above, in this patient we put **screws posteriorly** to increase the load on the arch posteriorly & at the same time we add **artificial bone** beside the vertebra to restore the whole strength.



In other cases, like in the picture above, the vertebra is completely destroyed. Here we lost the whole 70%, ---------- the CT scan shows marked **compromise of vertebral canal which means it compresses the spinal cord.**

The Treatment is :

At the figure below, I should remove this defected piece, and sometimes I should remove the whole vertebra and replace it by an artificial vertebra to restore the 70% load carried by the body.
At the same time I will put posterior screws to increase the load that the arch carries; instead of 30% → increase it to 40%-60% .



Vertebral Articulation

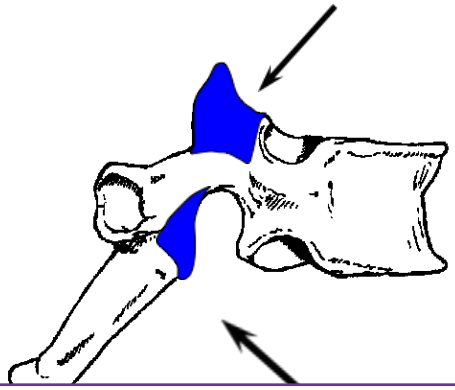
on the lateral side:

- each articulation is a fully

  encapsulated synovial joint

- these are often called apophyseal joints

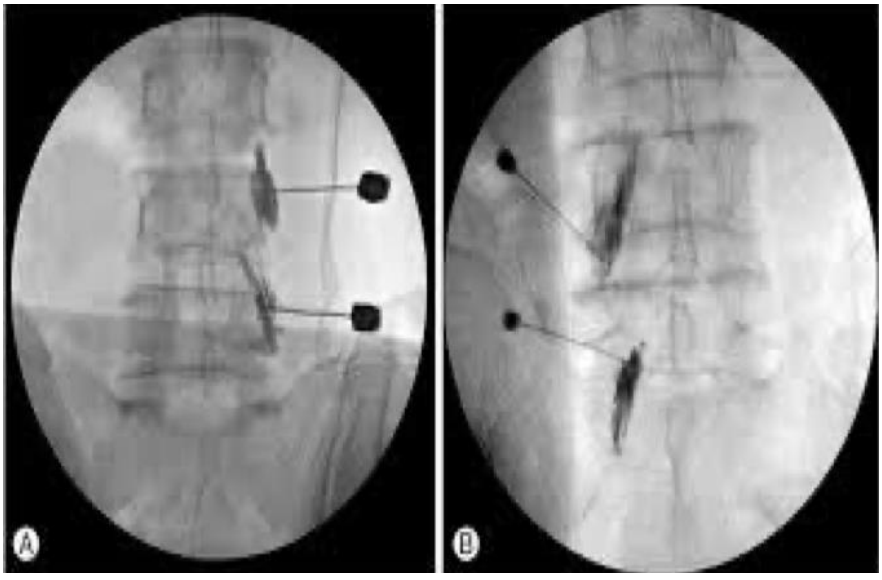
Superior articular process: articulates with the inferior with that vertebra above and so on



Inferior articular process: articulates with the superior with that vertebra below and so on

Note: the processes are bony outcroppings.

This joint (like any other joint) has a synovial membrane and capsule, so it is liable to develop **arthritis**. Many patients come with facet joint pain. The **treatment is by medications or physiotherapy**. These medications are sometimes delivered inside the joint: steroid injection. (anti-inflammatory medication)
It is very important to localize the facet joint carefully. We use dyes to make sure needle is inside the joint.



Muscles of back

(usually they classify the muscles according to there origin and insertion, we won't here)

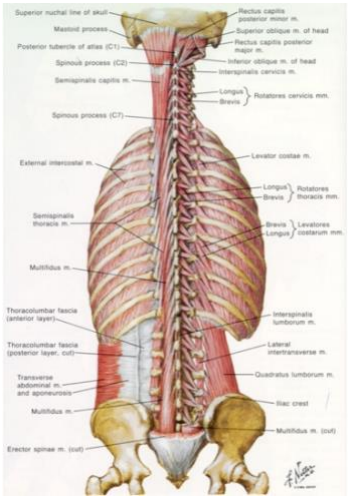
1- superficial muscles

- ass with shoulder girdle
- Ttrapezius, latissimus dorsi, levator scapulae

2- intermediate muscles

- ass with respiration
- serratus post sup, serratus post inf

3- deep muscles (most important because they work solely on the spine, the ones above have dual function) called: main stabilizers of spine



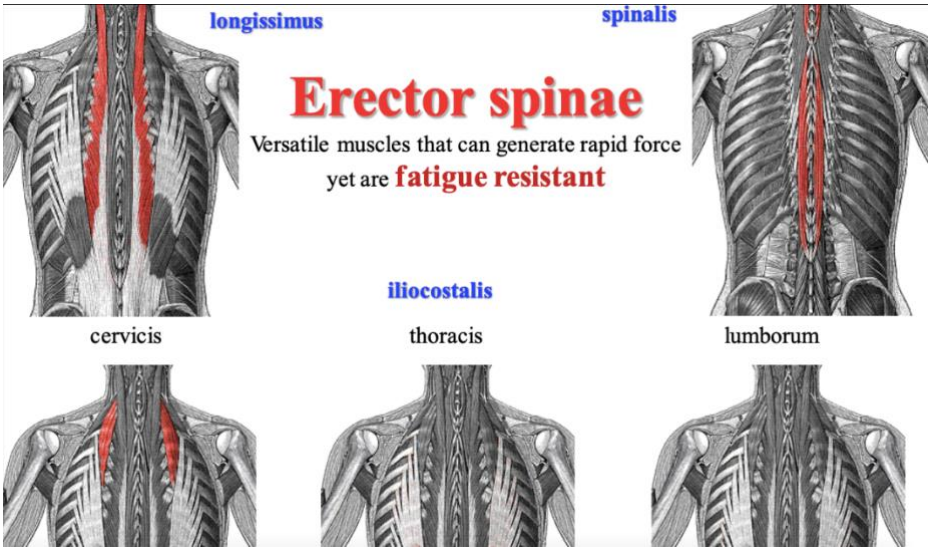
Posterior muscular support

Primarily produce extension and medial/ lateral flexion

- 3 groups: Superficial to Deep
  - Erector spinae
  - Semispinalis
  - Deep posterior

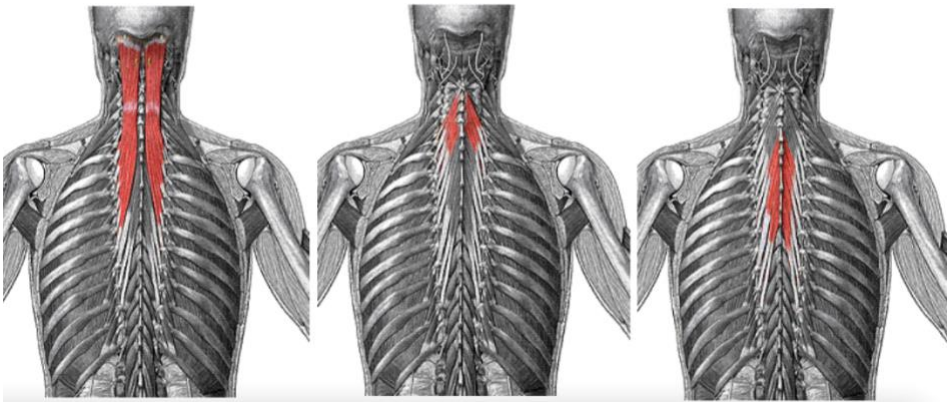
**- erector spinae:

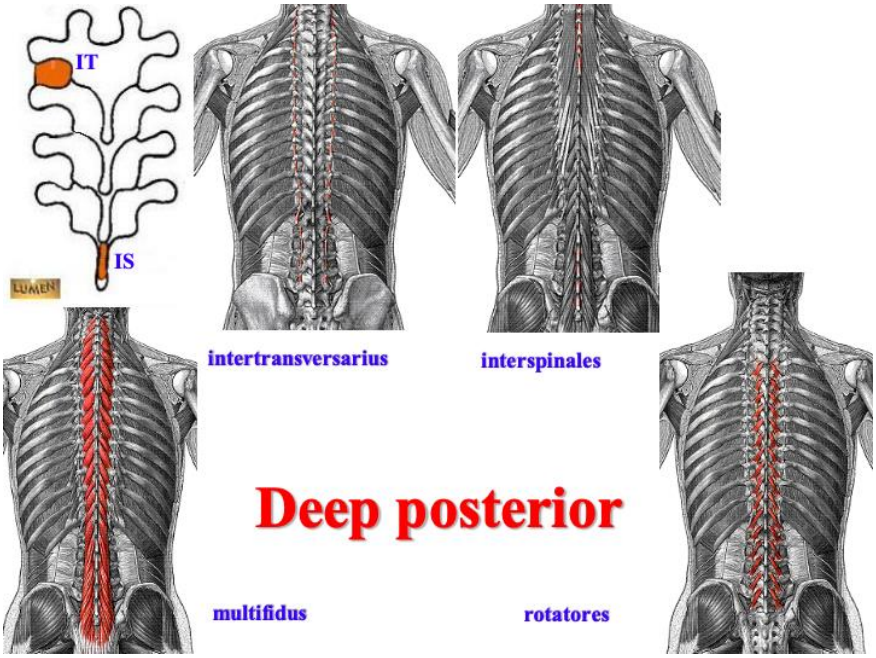
1. iliocostalis
2. Longissumus thoracis
3. spinalis

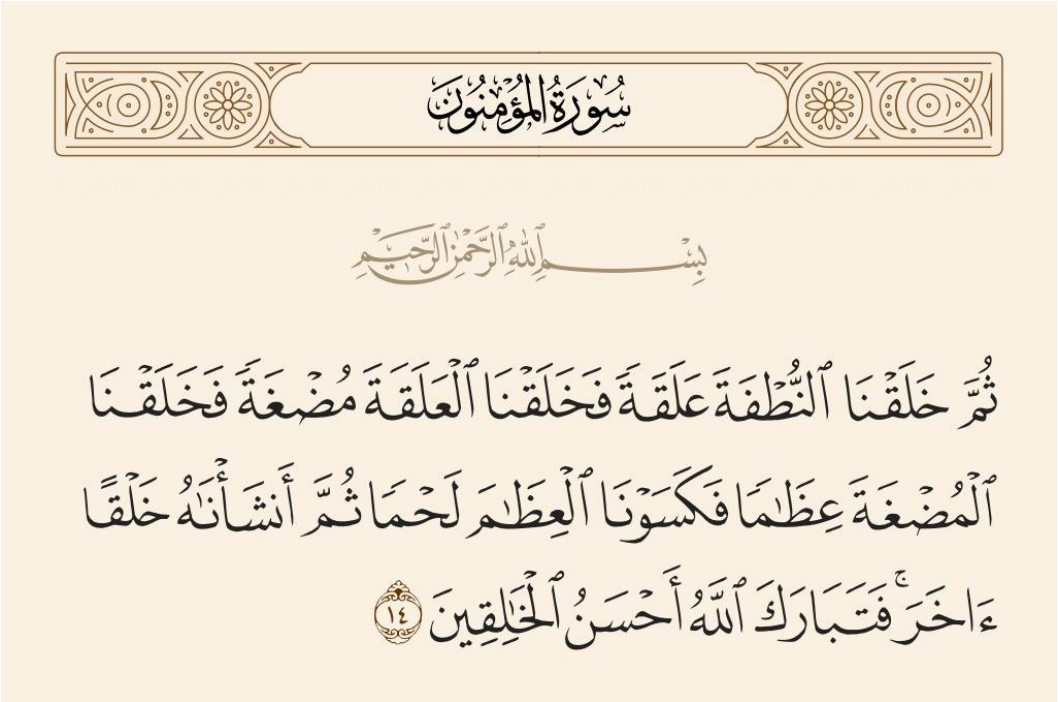


The **Erector spinae** generate rapid force and they're fatigue-resistant (because they have a high amount of ATP). So, because these strong muscles exist we are able to stand for a long time without back pain.

Semispinalis







سبحانه خلقنا شحما ولحما وعظما من قطرة ماء..!!

لا مستحيل مع الله،

ادعُ وأخلص دعاءك وتيقن أنه كريم قادر.

"إذا أراد الله لك شيئا تعطلت قوانين الحياة حينئذ..

البحر لا يُغرِق.. والنار لا تحرِق.. والجبل لا يعصم.. والحوت لا يهضم.. والعذراء تلد..

لا تقل مستحيل! عن الله سبحانه وتعالى أحدثك .

إذا أحبك الله، أحبك أهل السماوات والأرض، وسكَنَتْكَ الجنة قبل أن تسكنها أنت"

V2; Page 8

تم توضيح الشرح تابع لأي صورة فقط

V3:

Page 3 1st line: Alignment (of)

Page 8 penultimate line :There's no blue star

Page 9

line 3:Body's loa(d)

blue box was added "Pedicles are the strongest part of vertebra"

"Body, pedicles and arch form spinal canal"