Spinal column basis sciences

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FACET JOINTS

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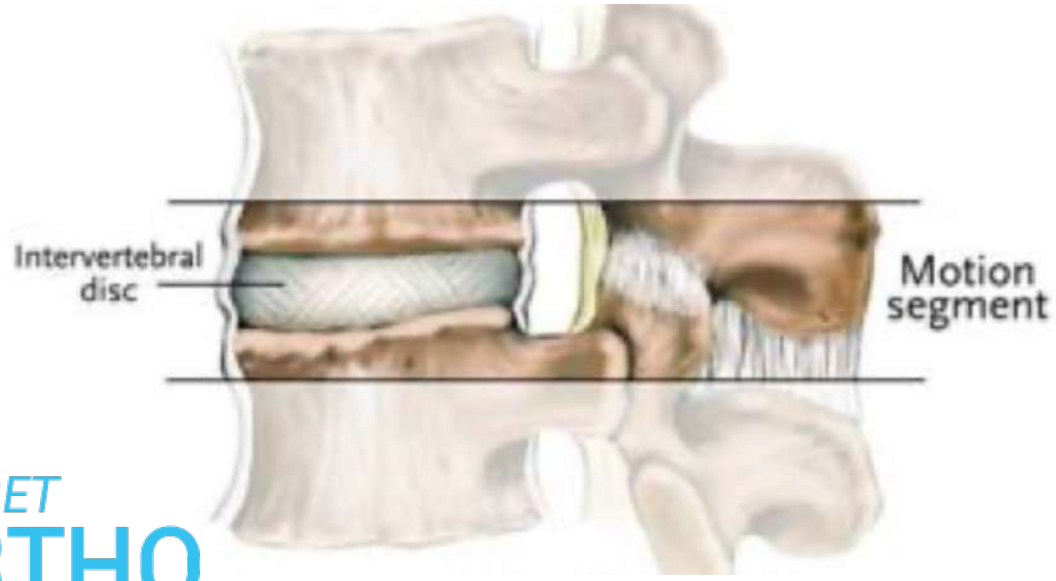
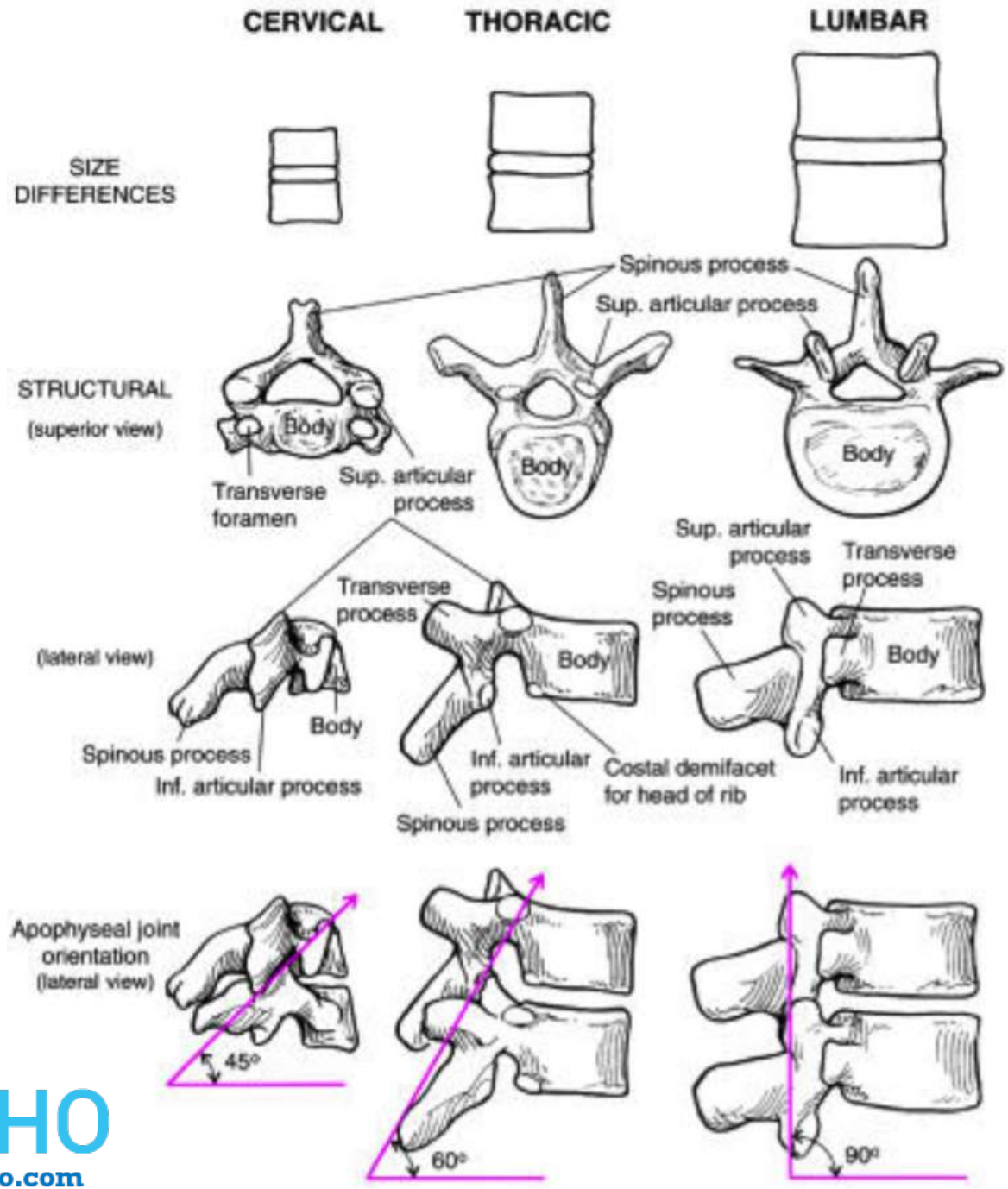
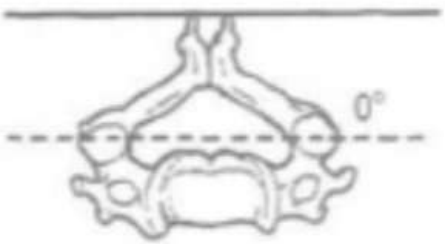
- zygapophysial joint
- Facet joints work in pairs
- Along with the intervertebral disc - constrain the motion of the vertebrae while aiding in the transmission of spinal loads

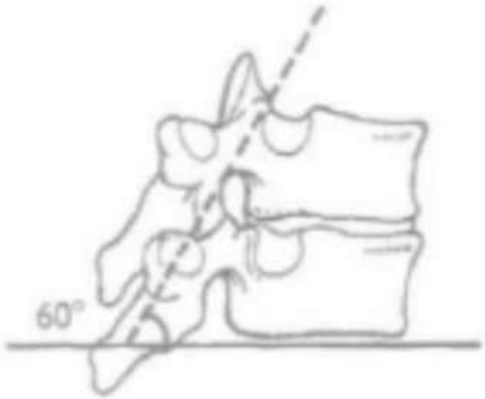




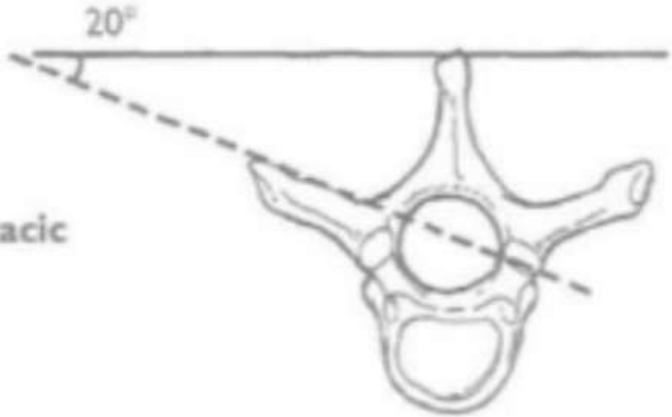
Cervical



A

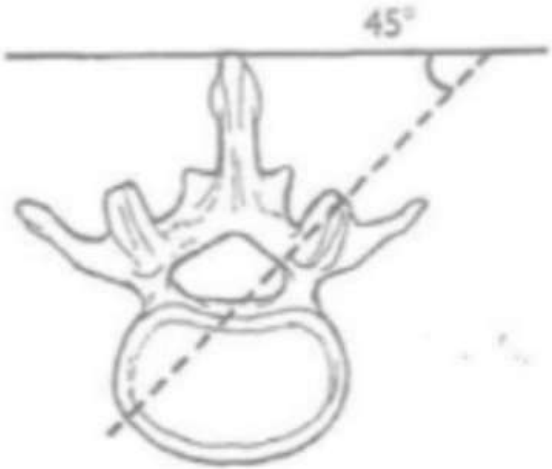


Thoracic



B

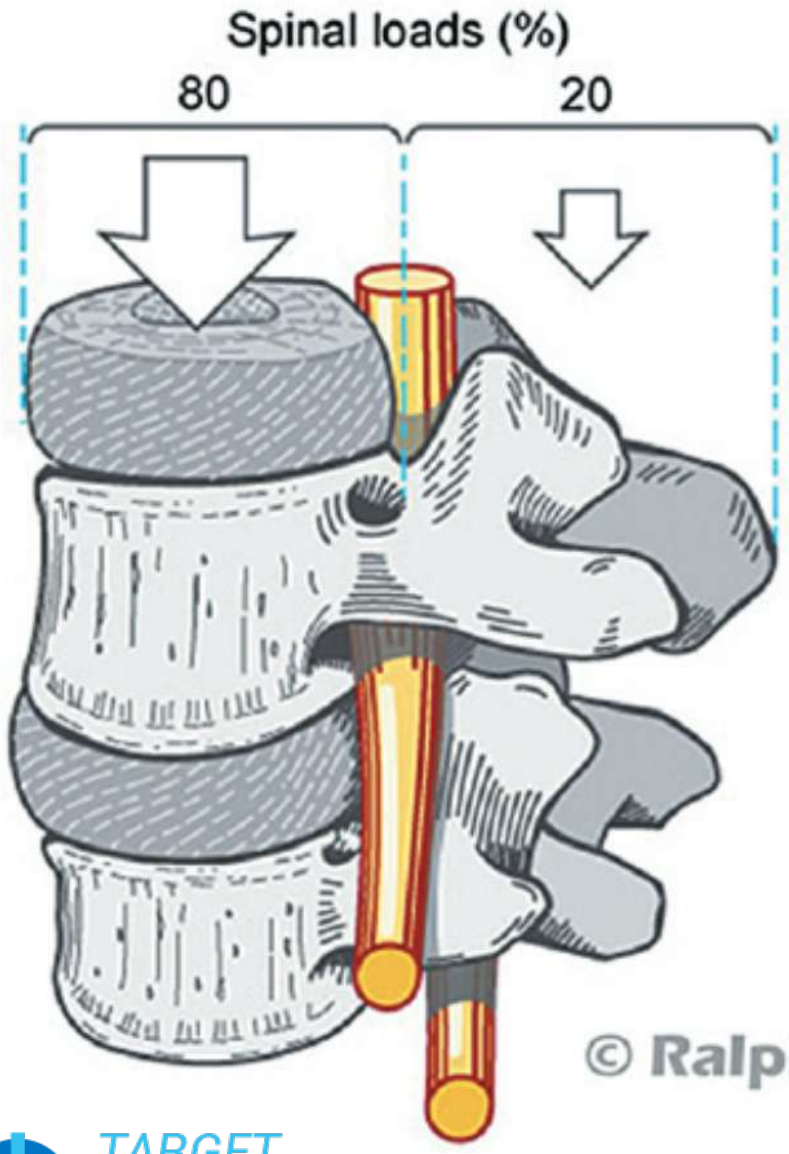
Lumbar

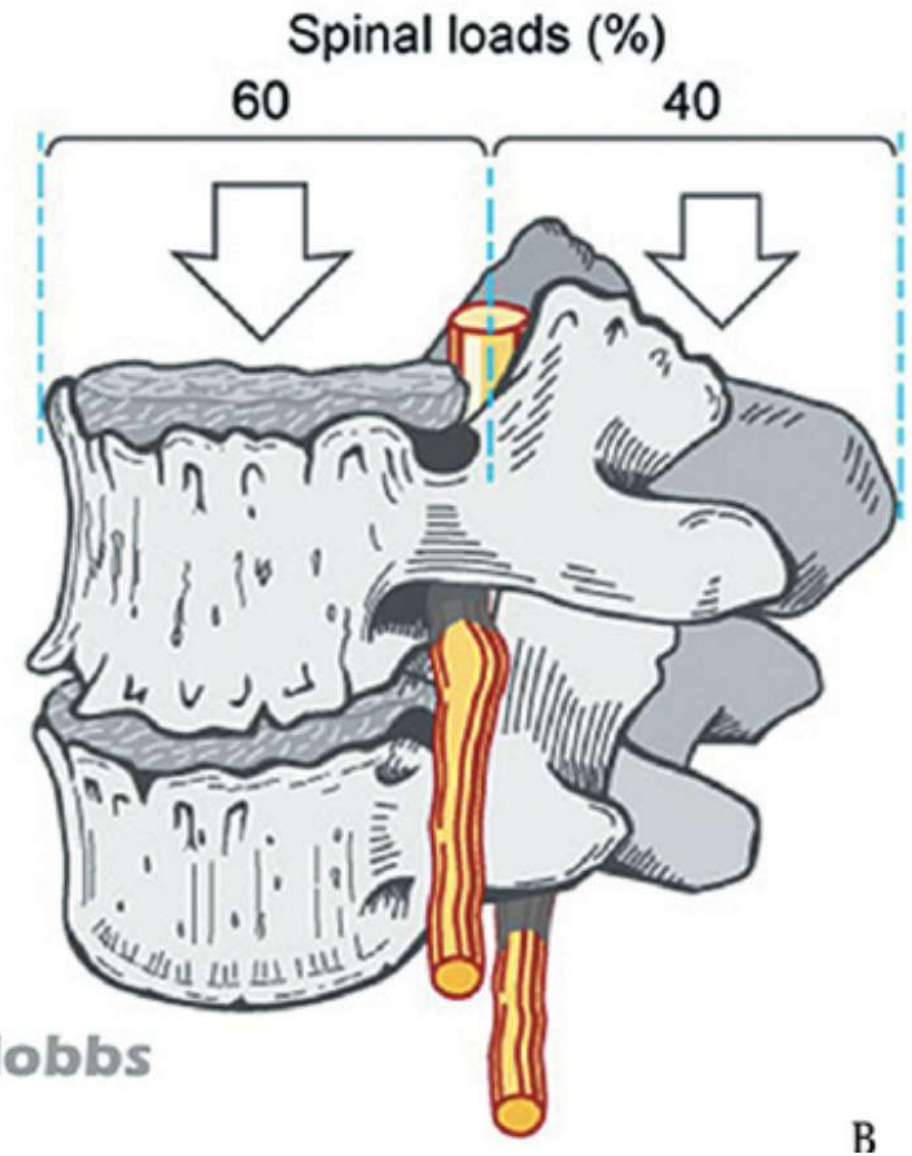


C

- Lumbar facets
- Sagitally oriented
- Mutual convexity and concavity of the opposing joint surfaces
- Greater Flexion & higher resistance to axial rotation
- Smaller inclination angle- increased protection against forward displacement of the spinal segment

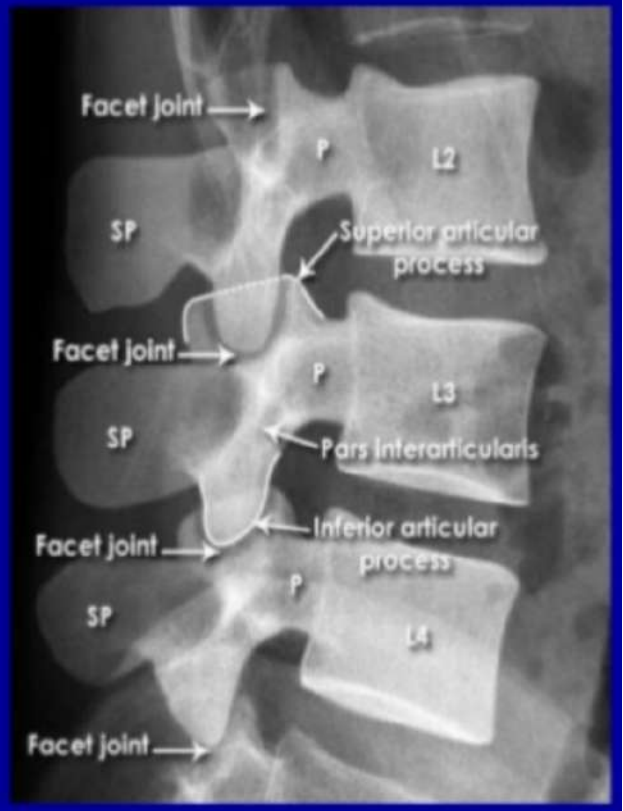
- Thoracic & cervical spine
- Less sagittal orientation of the joint
- Greater inclination angle,
- Planar articular surfaces facilitate a greater range of both axial rotation and lateral bending

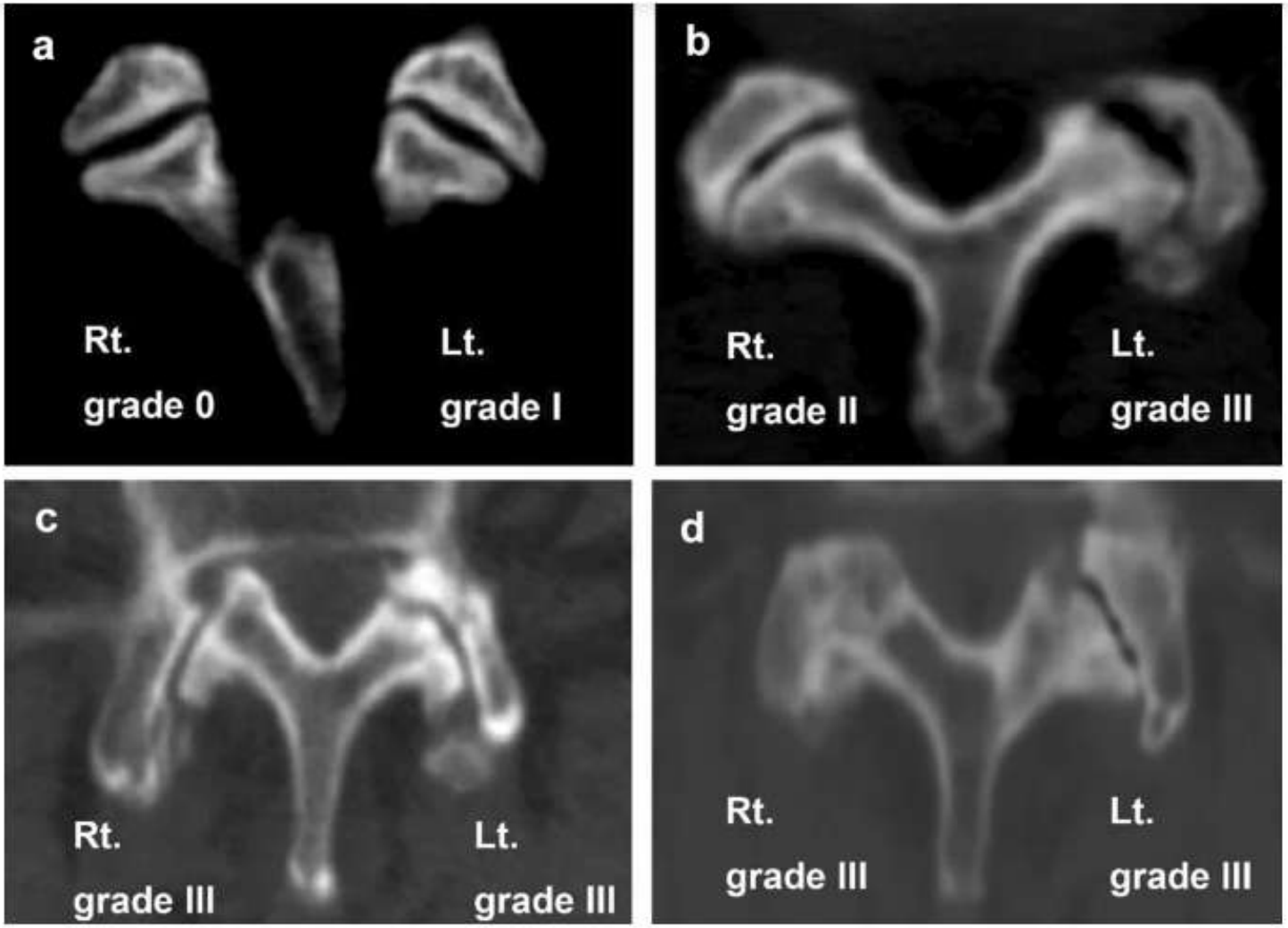




A B

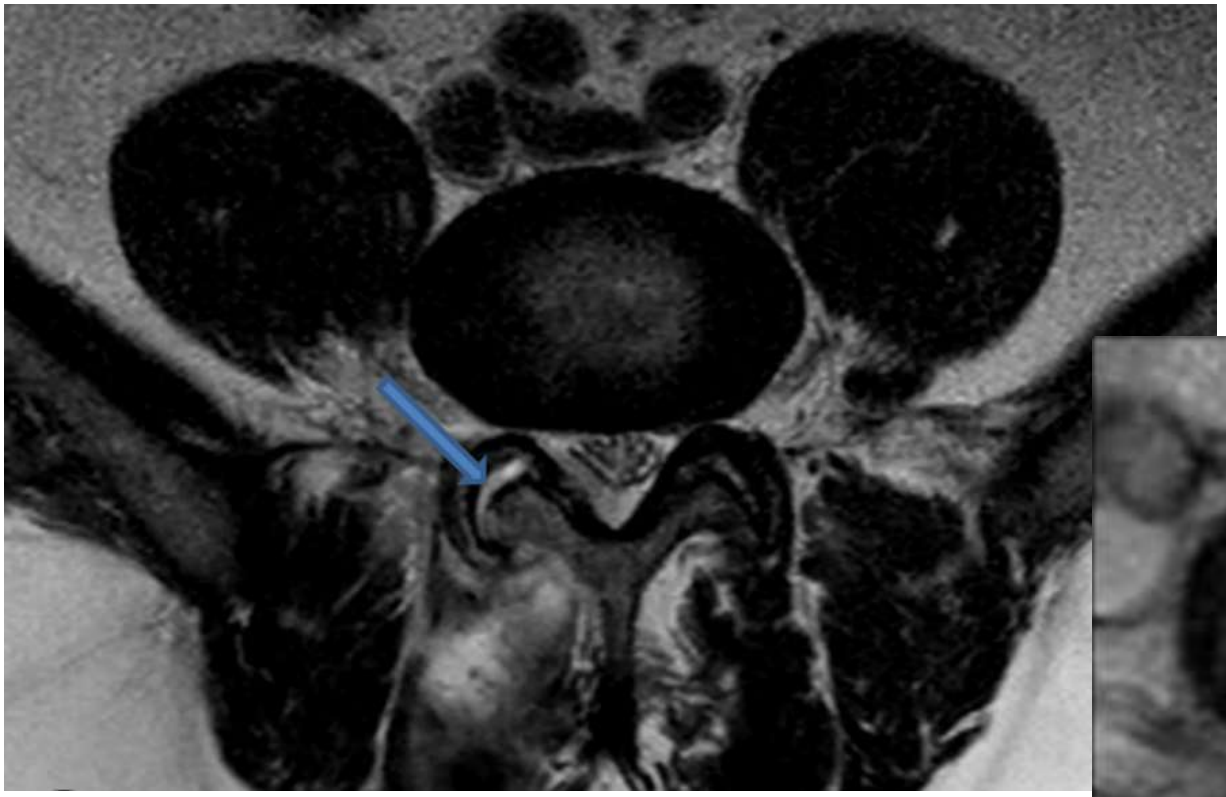
(A) Distribution of spinal loads on the anterior and posterior weight-bearing columns in a normal lumbar spine.
(B) Shifting of spinal loads to the posterior column after degenerative pathology to the lumbar spine.





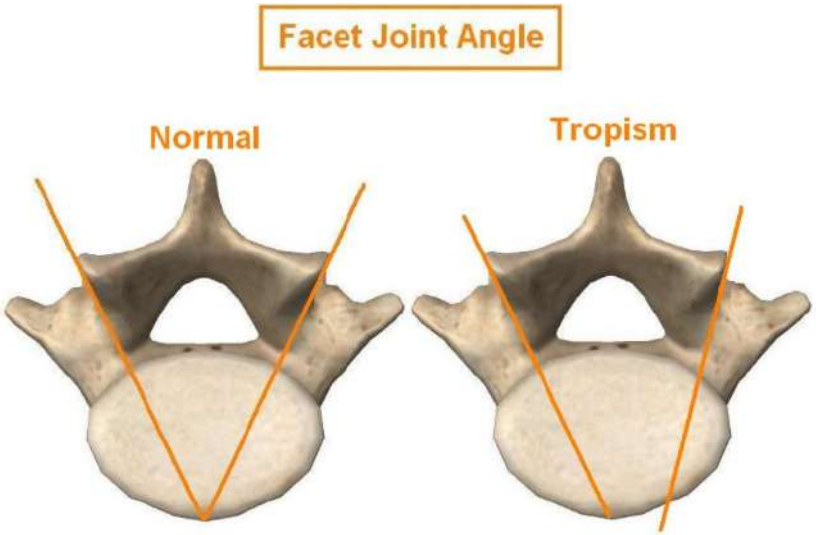
Low back pain – facet joint arthritis
Radiating pain
Radicular pain

Facet cyst

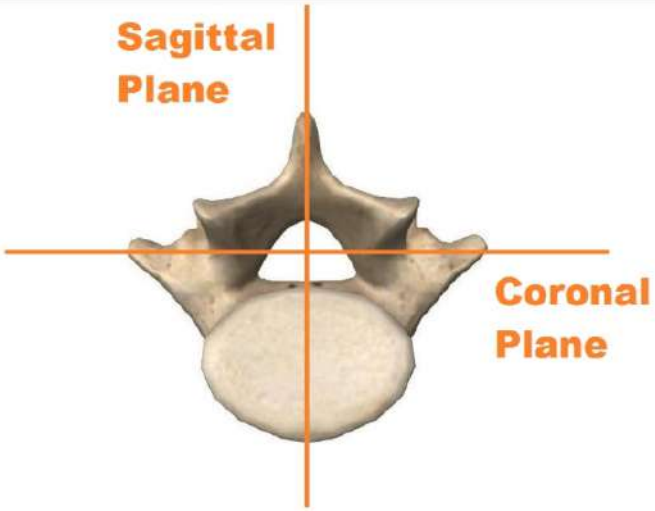


FACET TROPISM

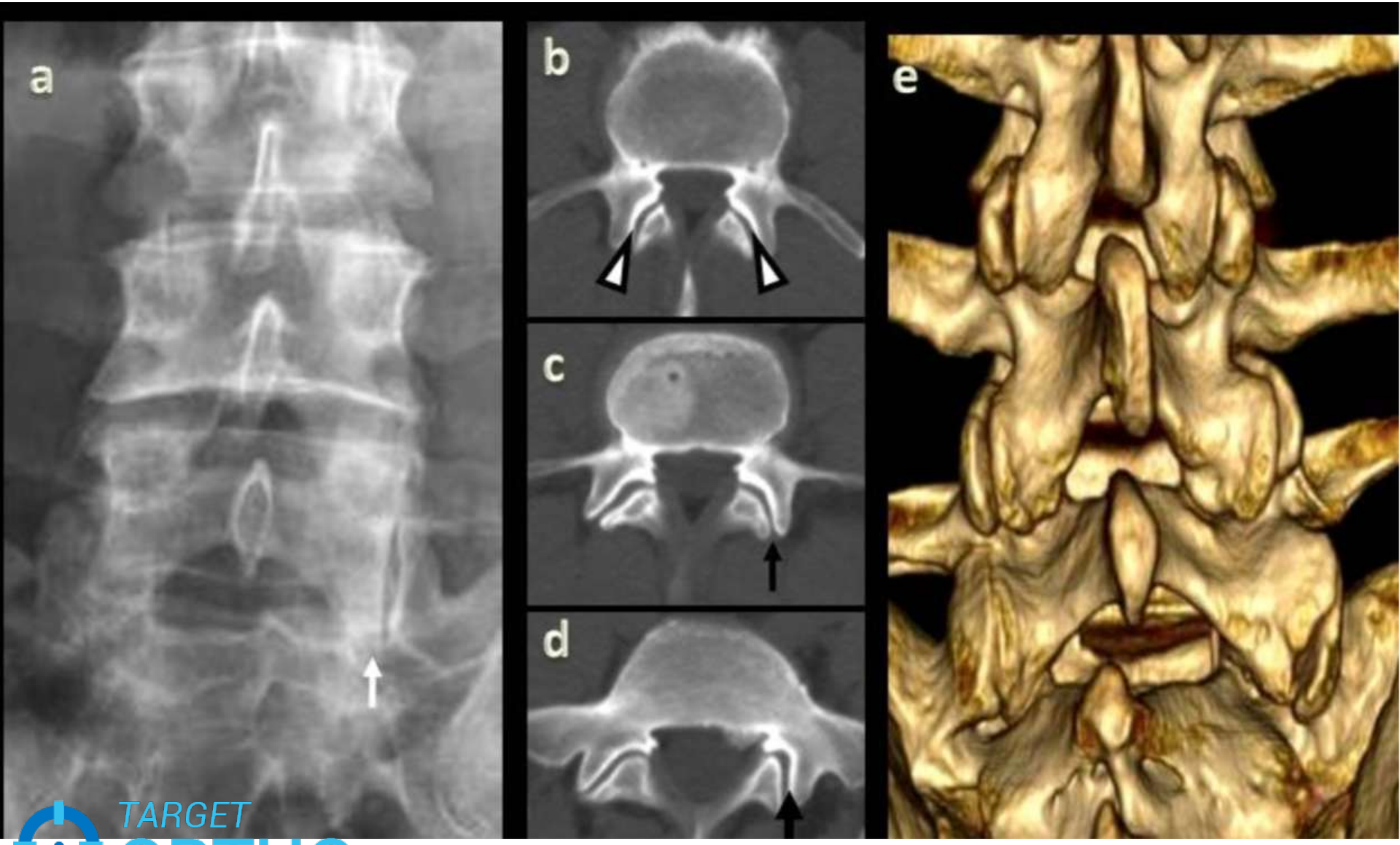
- Tropism - asymmetry of a paired organ system
- Facet Tropism- facet joints show unequal rotation in axial plane- asymmetry



Asymmetry of the facet joint is called tropism. This is an example of sagittal tropism.



The facet normally splits the coronal and sagittal planes.



Thank you

Blood supply of spinal cord

- Three longitudinal arterial trunks -anterior and posterior spinal artery longitudinally runs along the whole spinal cord -anastomose - forming plexuses.

- They receive supply via the vertebral arteries only up to the cervical segments of the spinal cord.
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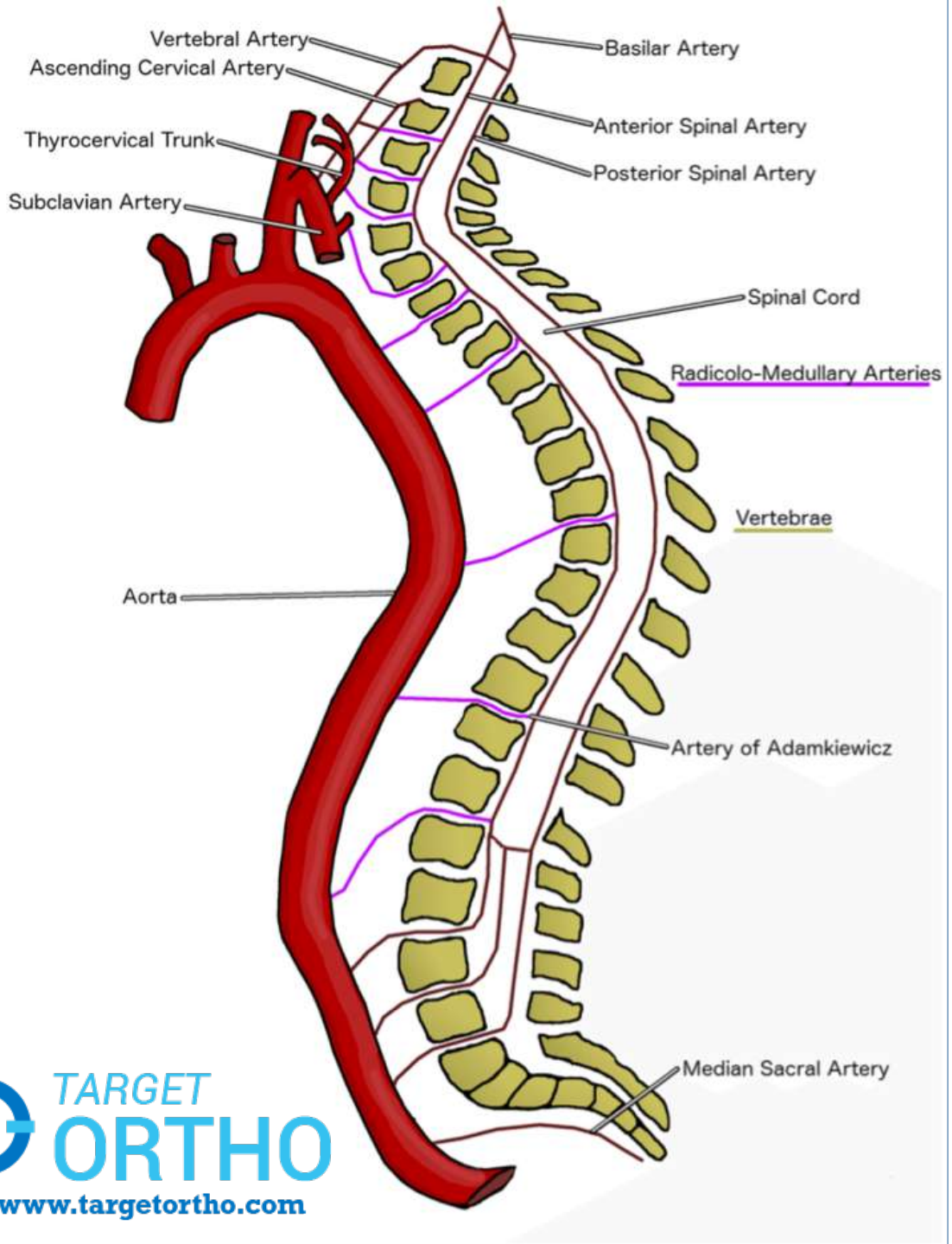
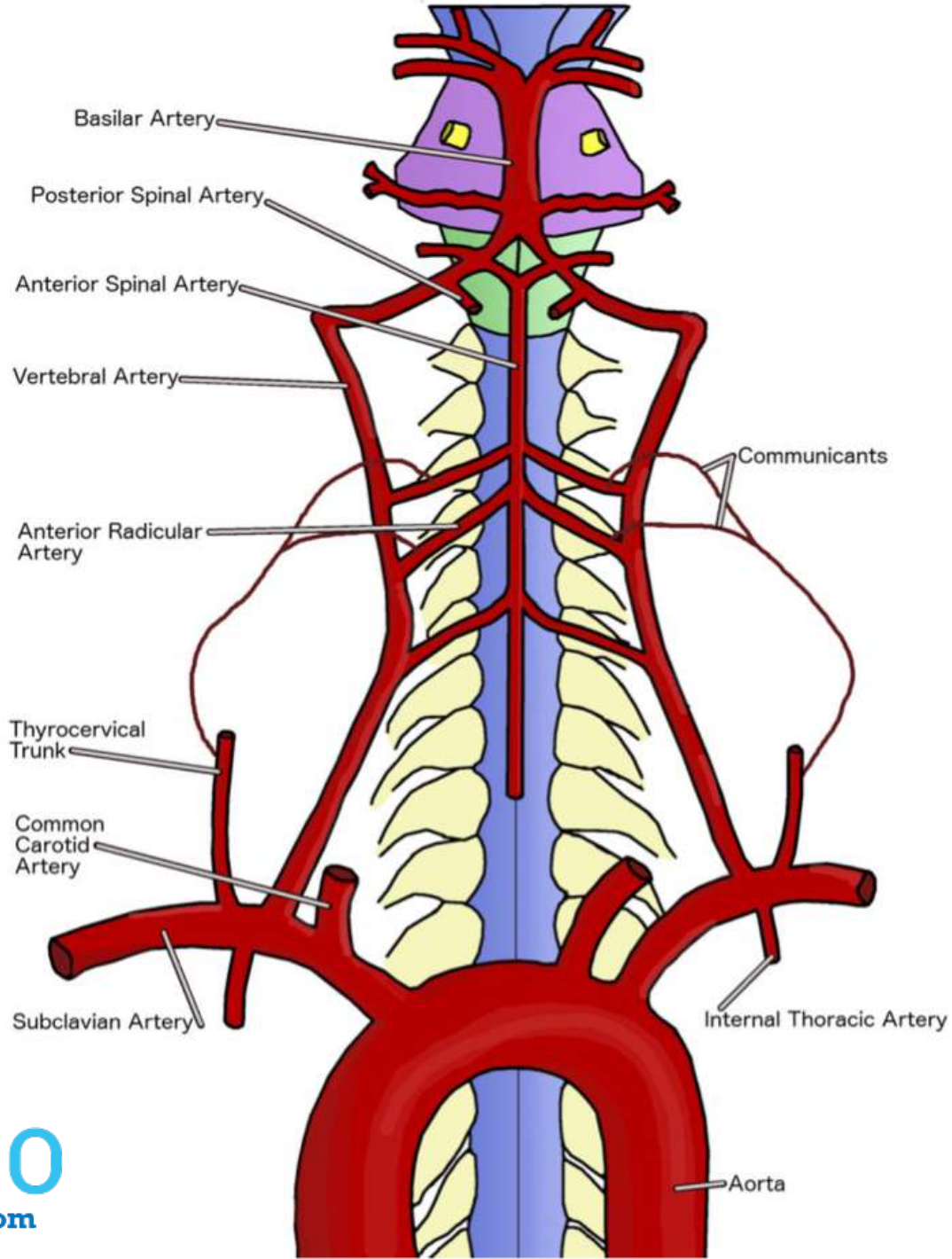
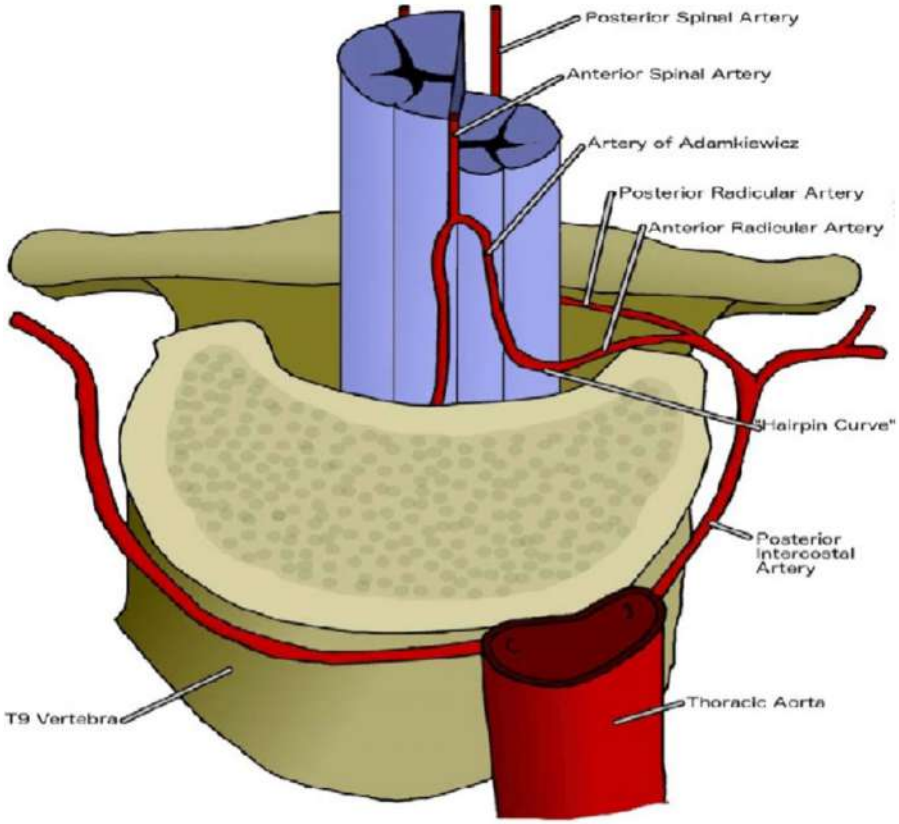
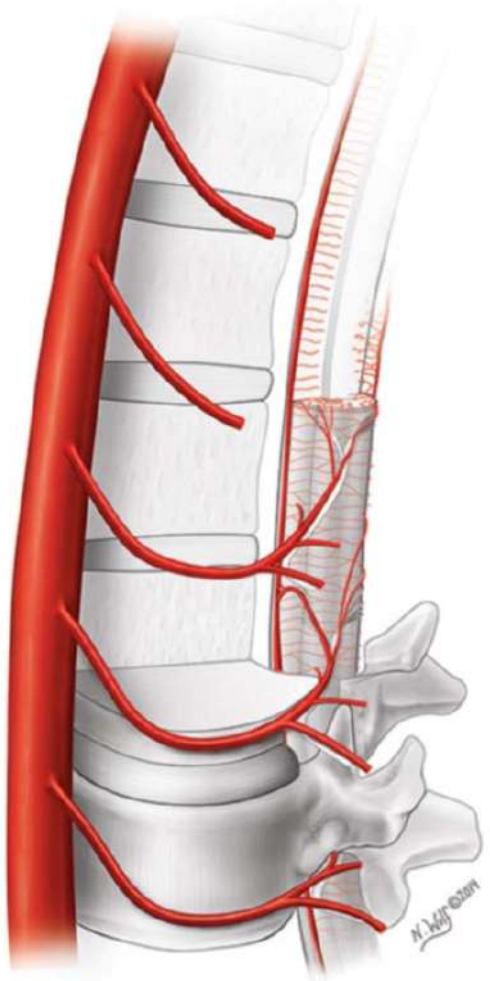
- Inferiorly the spinal arteries receive blood through the lumbar and radicular arteries.









Artery of Adamkiewic:

- Largest anterior radiculomedullary artery.
- Arises from the left posterior intercostal artery
- Only significant arterial supply feeding the anterior spinal artery along the lower thoracic, lumbar, and sacral spinal cord.
- Atypical nature-the artery of Adamkiewicz typically arises from the left side of the aorta between T8 and L2 in 75% of people.

Cord ischemia

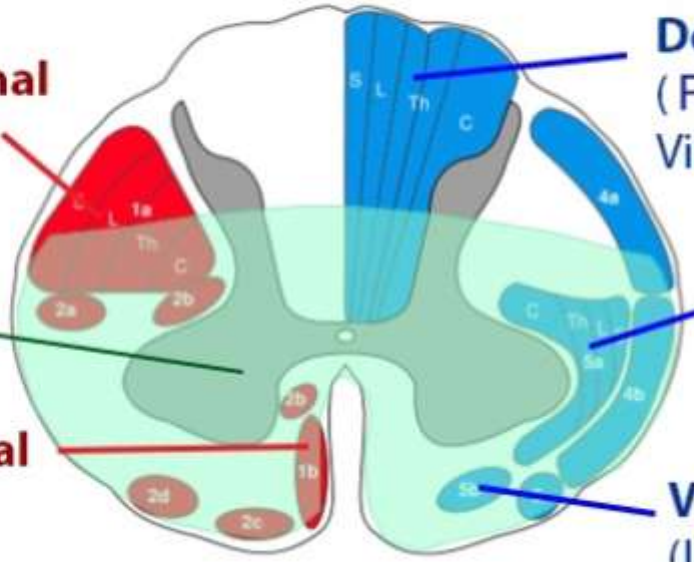
- Common in mid-thoracic region
- diameter of the spinal cord and its resulting arteries undergo significant narrowing
- Damage to the anterior spinal artery- significant motor symptoms, as it supplies the anterior two-thirds of the spinal cord(Cortico spinal tract)
- Extensive dissection and periosteal stripping should be avoided around the mid-thoracic region - vascular insults - cord ischemia

Descending Tracts (Motor)

Lateral Corticospinal Tract (Motor)

Region of Anterior Cord Syndrome

Ventral Corticospinal Tract (Motor)



Ascending Tracts (Sensory)

Doral Columns
(Fine touch, Propioception, Vibration)

Lateral Spinothalamic Tract
(Pain, Temperture)

Ventral Spinothalamic Tract
(Light touch)

Descending Tracts (Motor)

Lateral Corticospinal Tract (Motor)

Posterior Cord Syndrome

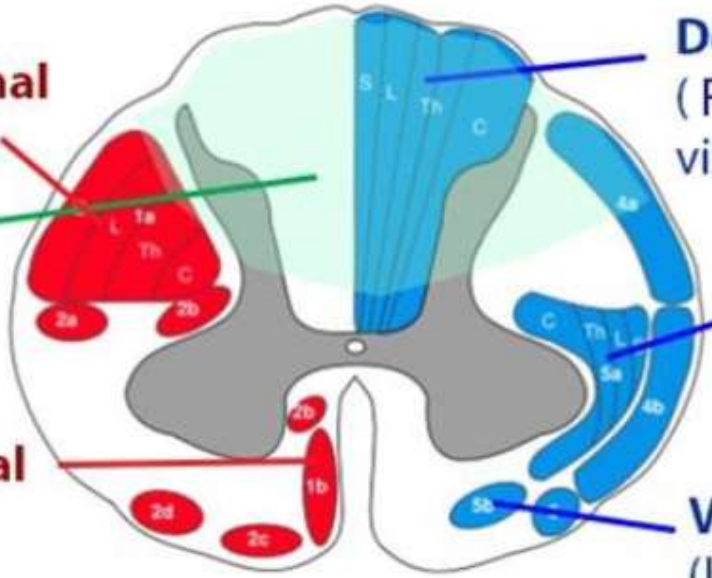
Lateral Corticospinal Tract (Motor)

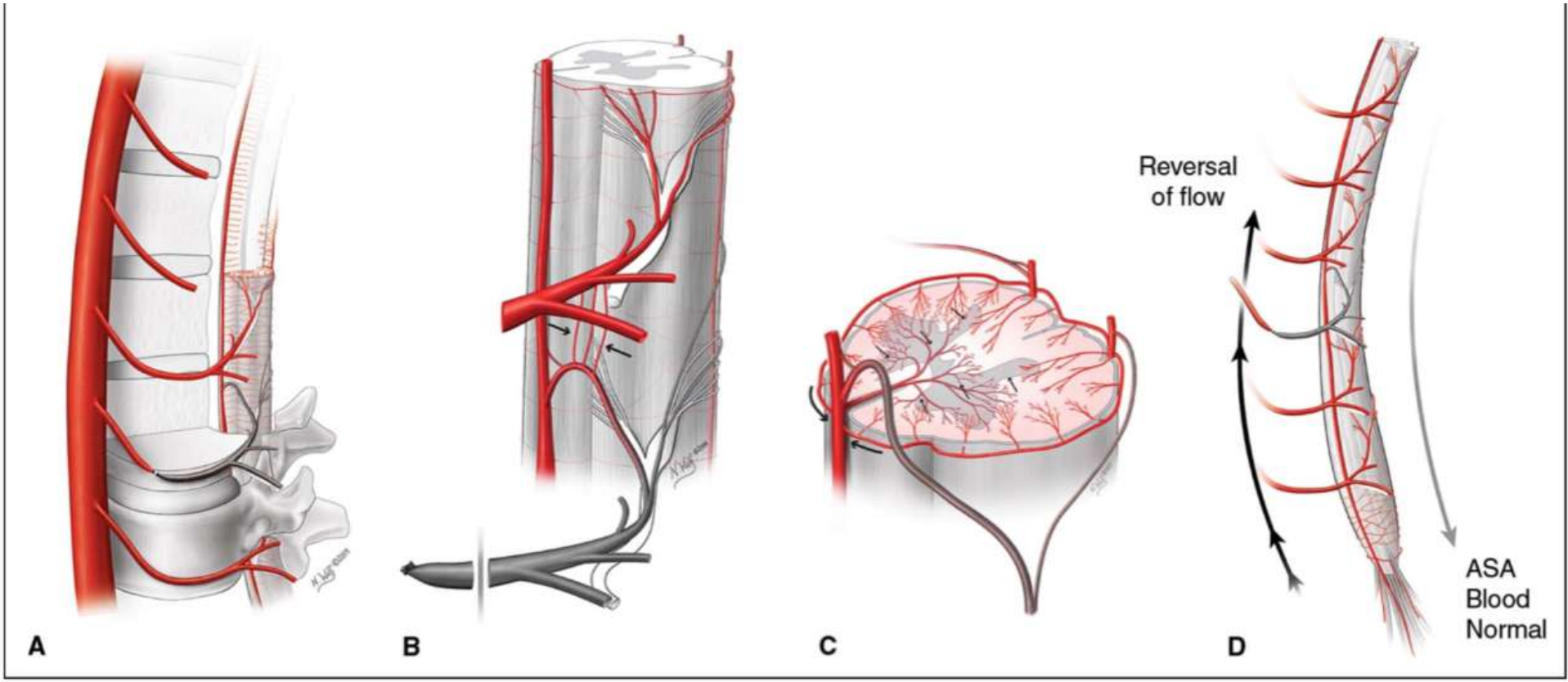
Ascending Tracts (Sensory)

Doral Columns
(Fine touch, propioception, vibration)

Lateral Spinothalamic Tract
(pain and temperture)

Ventral Spinothalamic Tract
(light touch)



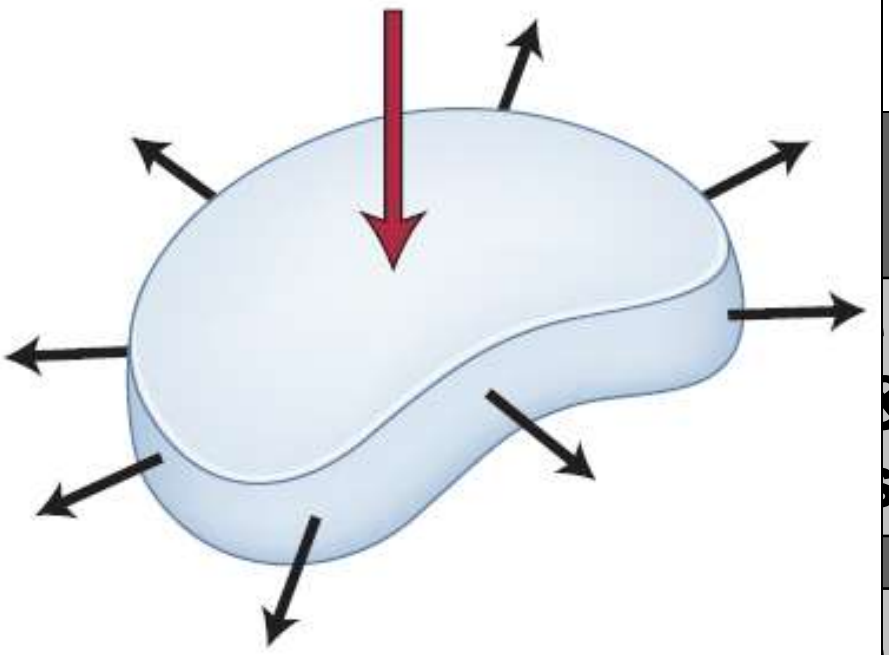


A through **D**, Illustration of disrupted spinal cord supply following ligation of a key segmental artery (shown in gray) (**A**) with three possible compensatory mechanisms for reconstitution of the anterior spinal artery (ASA). Without direct supply to the ASA via the typical flow from the segmental artery to the radiculomedullary artery (RMA), the ASA may be reconstituted by collaterals emanating from an adjacent segment radicular artery (**B**), communication between the posterior spinal arterial system and the ASA system via the pial plexus and areas of spinal cord parenchymal overlap (**C**), or compensatory dynamic reversal of flow in the ASA itself using supply from distant RMAs or the anastomotic loop of the conus (**D**).

Protective maneuvers

- Mean arterial pressure above 80mmHg
- Oxygenation
- Neuro monitoring
- CSF drainage

Basic spine biomechanics



Nucleus

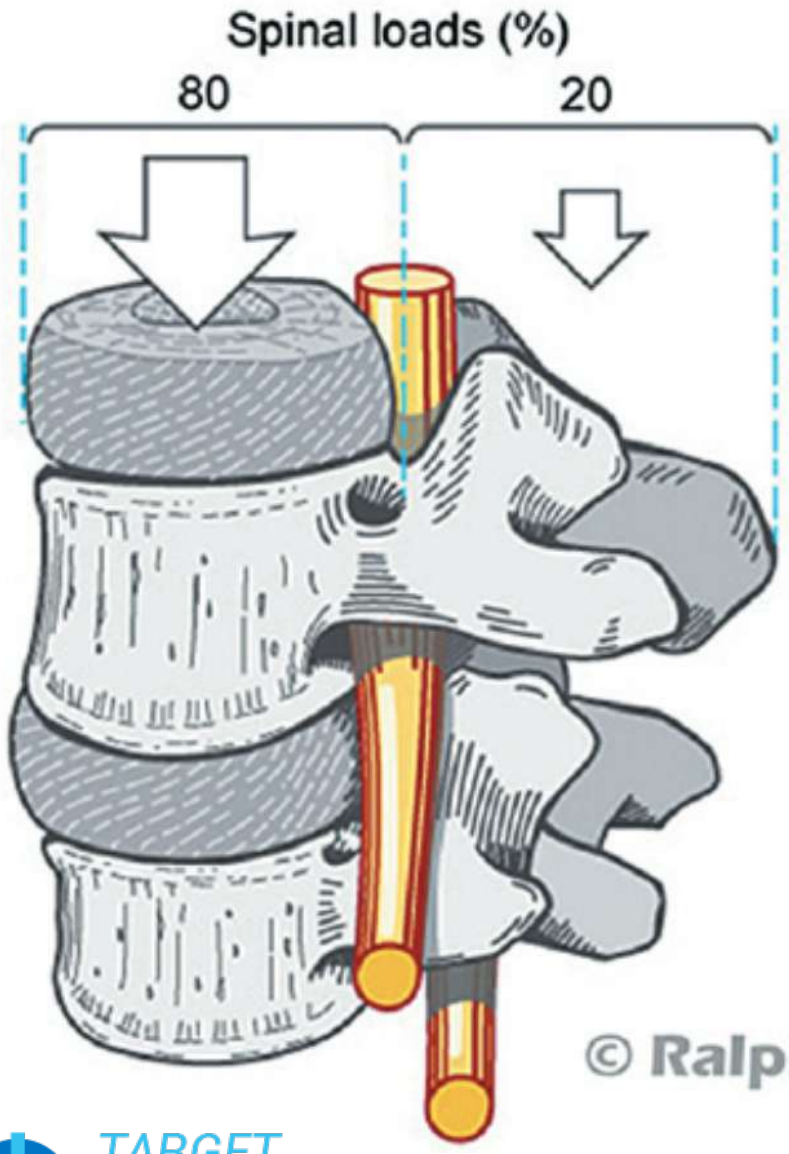
n
&
sts

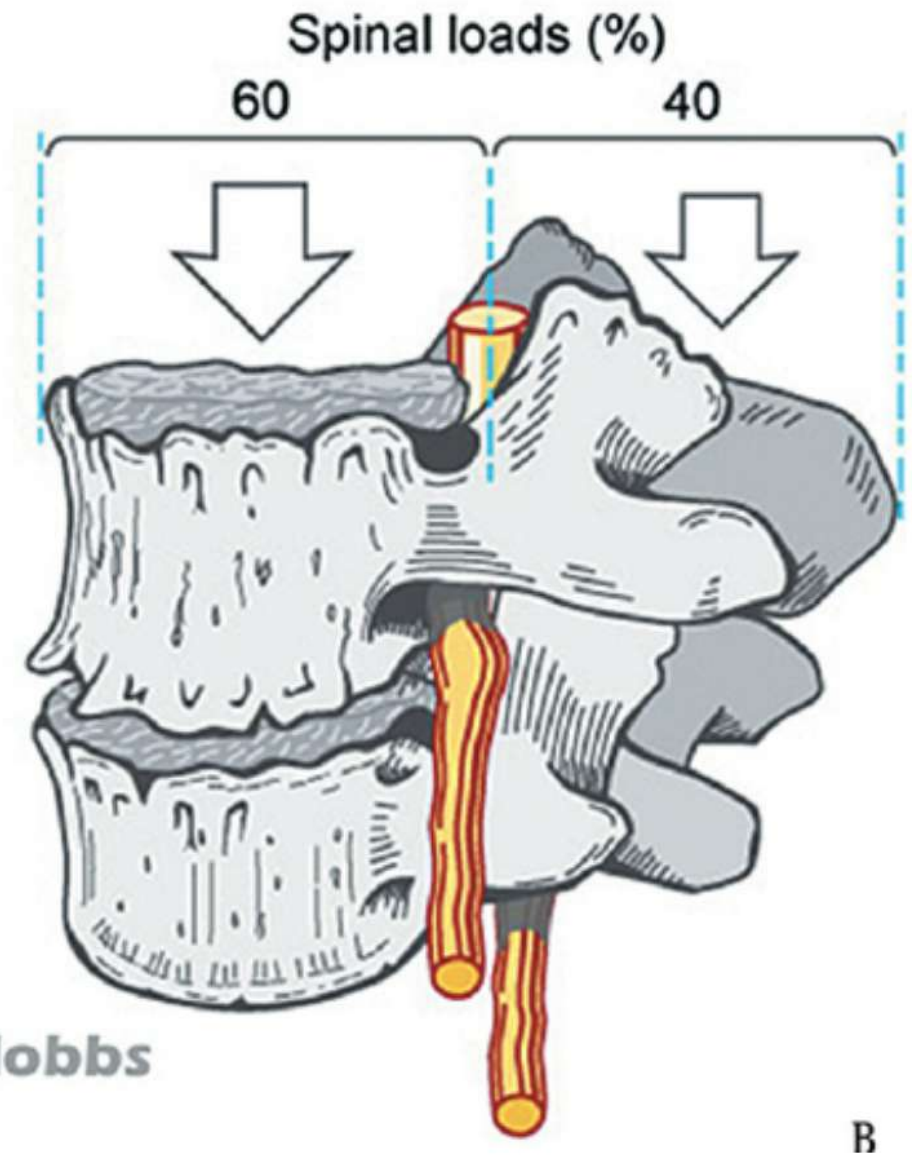
Proteoglycans (glycosaminoglycans) & chondrocytes

nsion & expands circumferentially

Glycosaminoglycans-hydrophilic .

Receives the axial load & converts into radial force





A B

(A) Distribution of spinal loads on the anterior and posterior weight-bearing columns in a normal lumbar spine.
(B) Shifting of spinal loads to the posterior column after degenerative pathology to the lumbar spine.

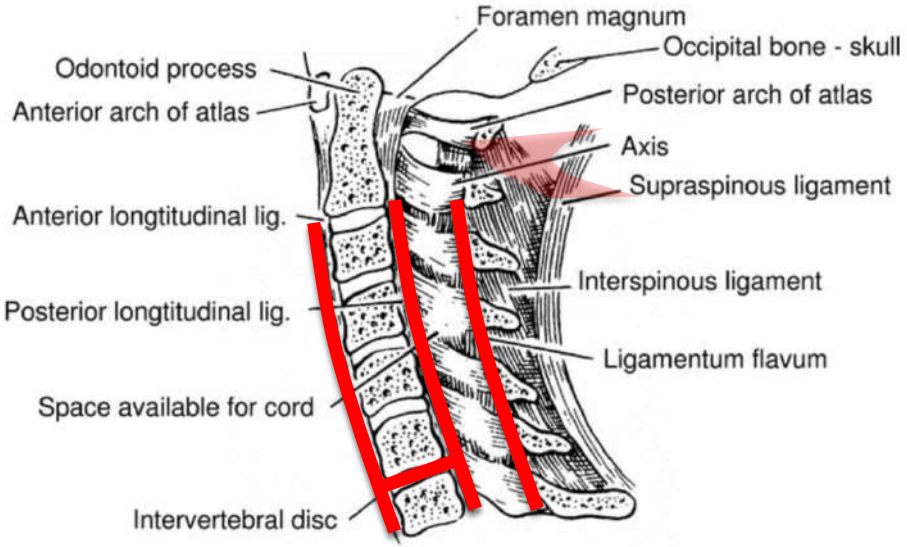
1A

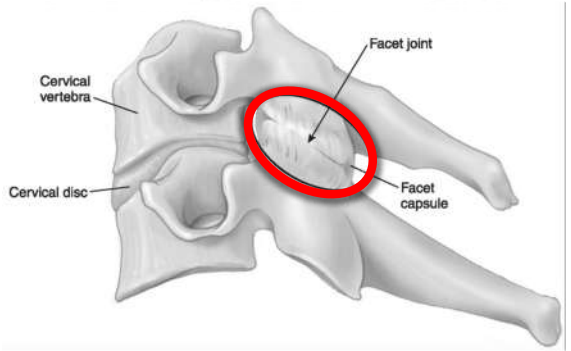
1B

Discoligamentous Integrity

- The discoligamentous complex (DLC) provides significant restraint against motion, making its integrity key to spinal stability
- Anatomically, the DLC consists of the:
  - Intervertebral disc
  - Anterior longitudinal ligament
  - Posterior longitudinal ligament
  - Ligamentum flavum
  - Interspinous and supraspinous ligaments
  - Facet capsules

*(**strongest component of posterior tension band**)*





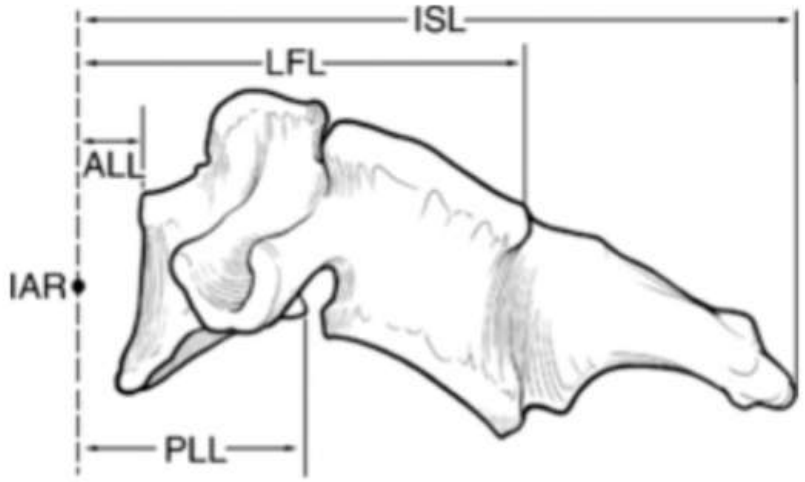


FIGURE 66-7 The lever arm of the ligaments to the instantaneous axis of rotation (IAR) greatly influences the stability of the spine. The weaker interspinous ligaments (ISL) work at the greatest distance from the IAR and therefore provide significant resistance to gravitational influences. ALL, anterior longitudinal ligament; LFL, ligamentum flavum; PLL, posterior longitudinal ligament.

Gravitational force & spine

- Gravitational forces -axial load on the vertebral column in the standing adult human.

- The center of gravity - 4 cm anterior to the first sacral vertebra.

- Ventral bending (angular) vector acting on the spinal column.

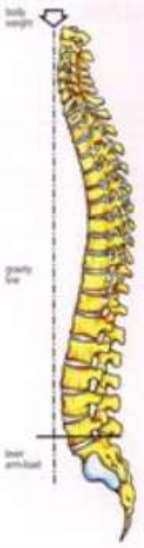
Gravitational force & Spine

- Bending force attracts the ventral spinal column to the center of gravity such that a lower energy state may be achieved by the paraspinous musculature.

- The dorsal ligamentous complex and dorsal paraspinal musculature, acting as a tension band, counteracts these forces.

- Net sum of the vectors acting on the spine equals zero

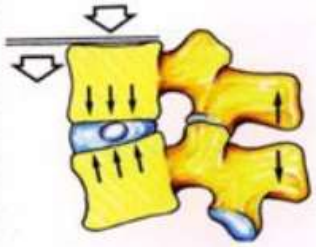
- Spinal Collumn & FSU = analog with **crane**
  = Gravity of body/ centre line of gravity
  → anterior to the tower of the crane
  → anterior to the vertebral body or disk
  Odontoid → S1

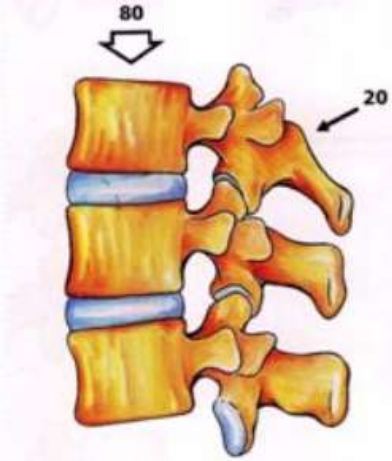


- Axial load is distribute as an axial compression load & bending moment
  = Anterior Collumn = 80% (absorbed 80%)
  = Posterior Collumn = 20%

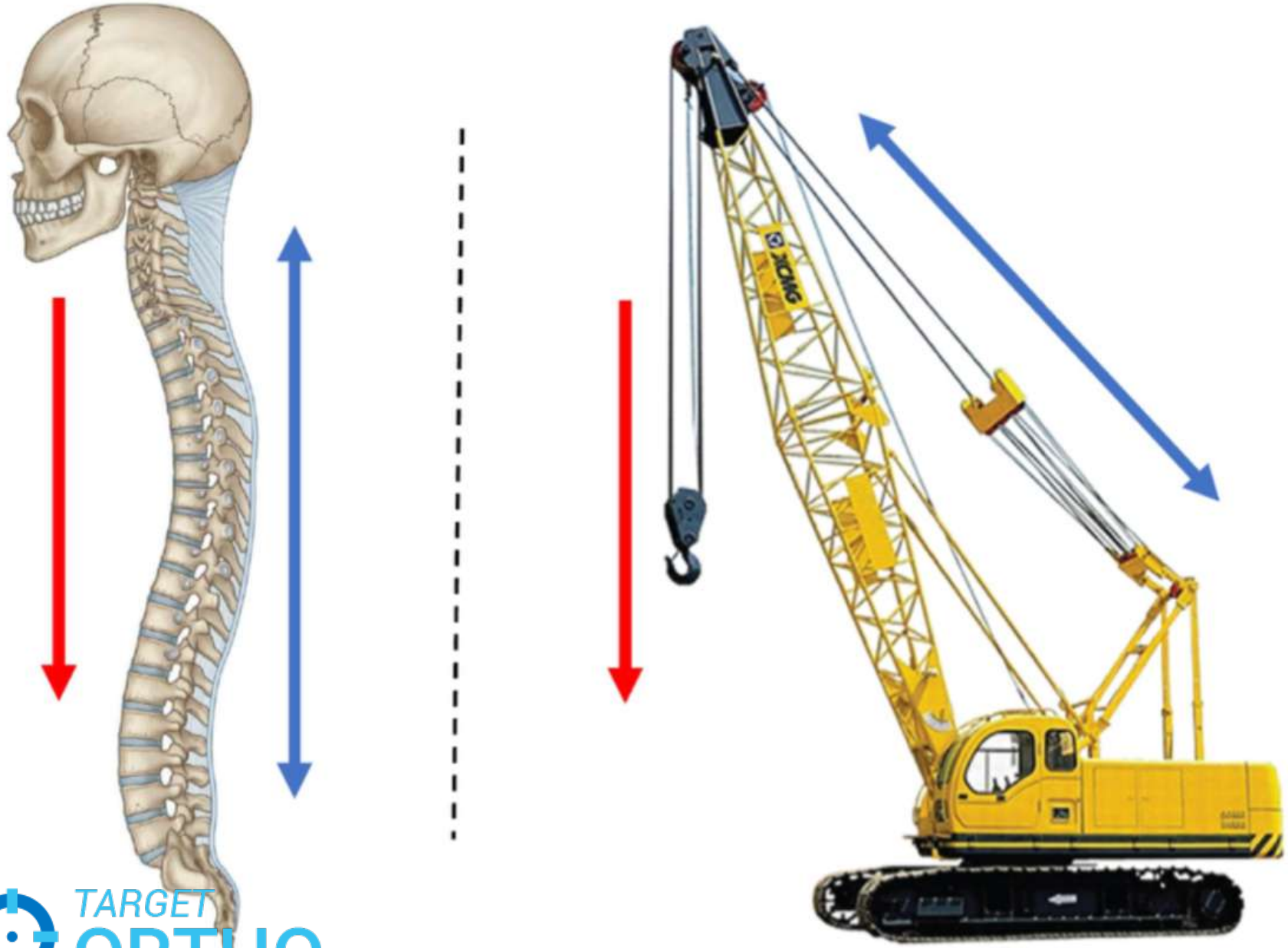
  } Load sharing capacity principle

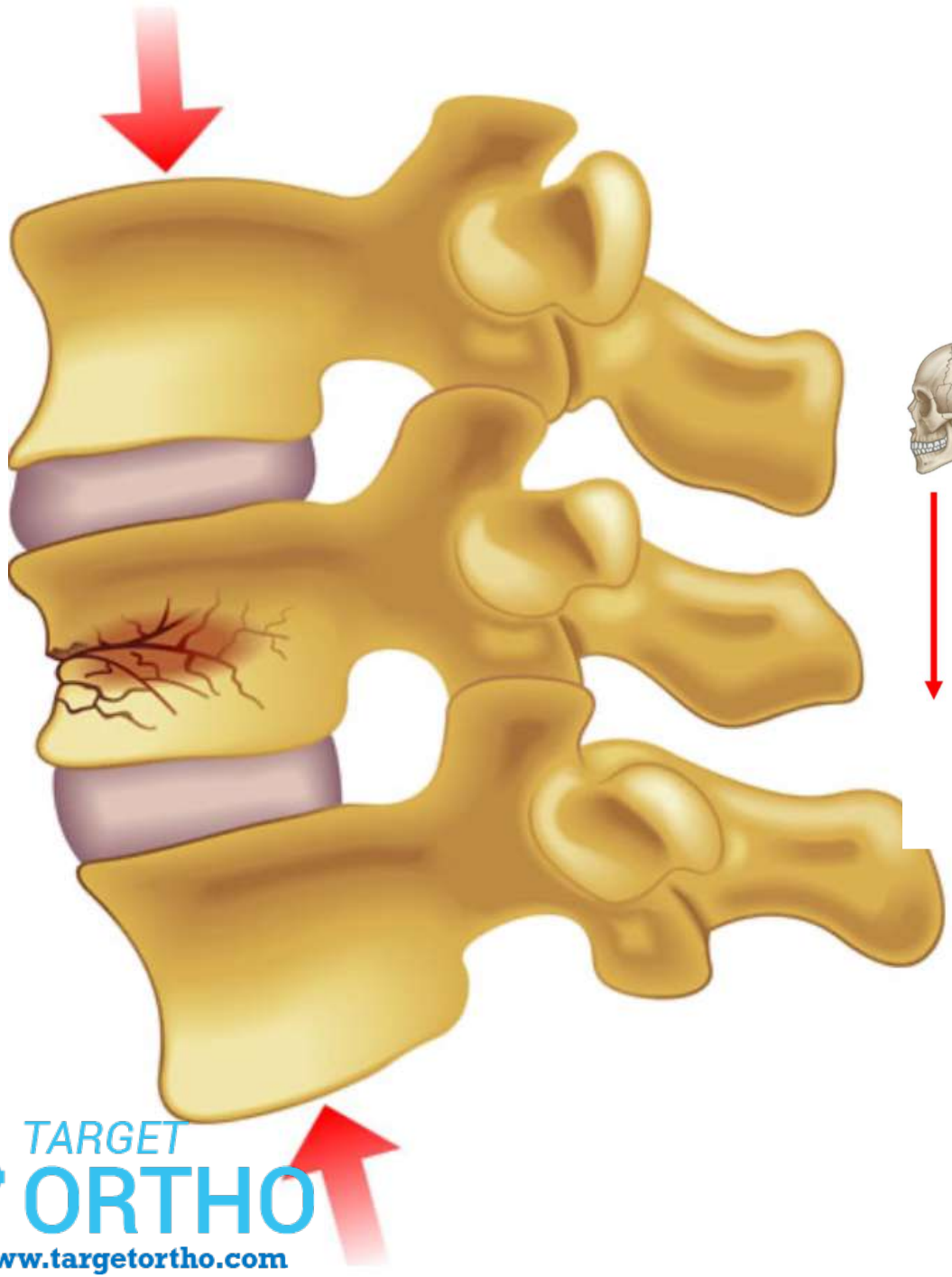
- Compressiom force = 80% which resorbed/absorbed by :
  - Disk - material & structural of Disk (AF & NP)
  - ALL
  - PLL
  - VB

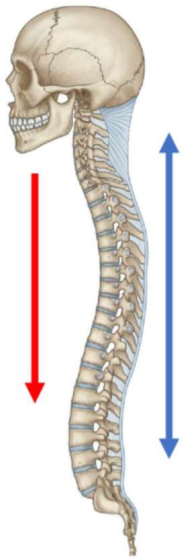


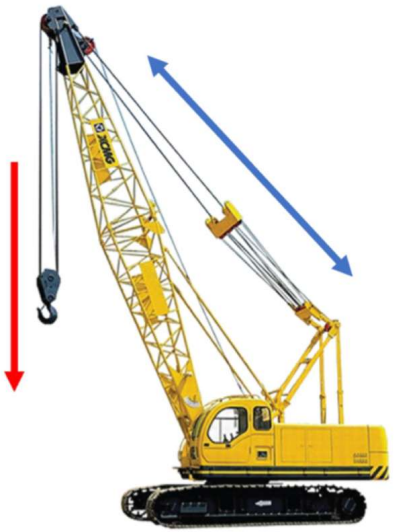


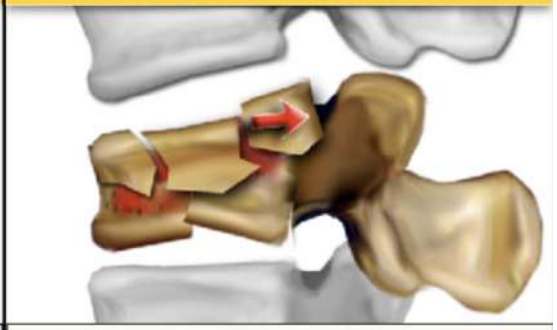
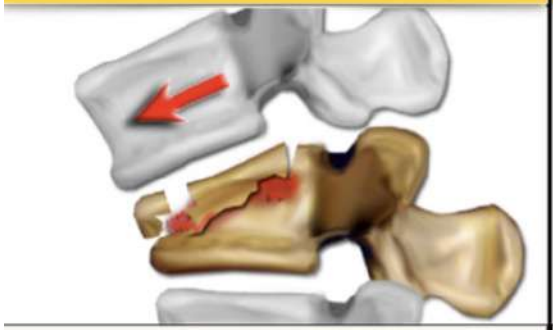
- Tensile force = 20% which hold by :
  - Muscle action
  - Facet joint/fulcrum of muscle action (Impedance)









Compression 1 pnt	Burst 2 pnts
	
- Simple compression - Wedge deformity	- Compression with retro-pulsion of superoposterior body fragment
Translation/rotation 3 pnts	**Distraction 4 pnts**
	
- Rotatory / shearing - Anterior or lat displacement - Facet joint displacement	- Horizontal fracture of posterior elements - Separation of posterior elements