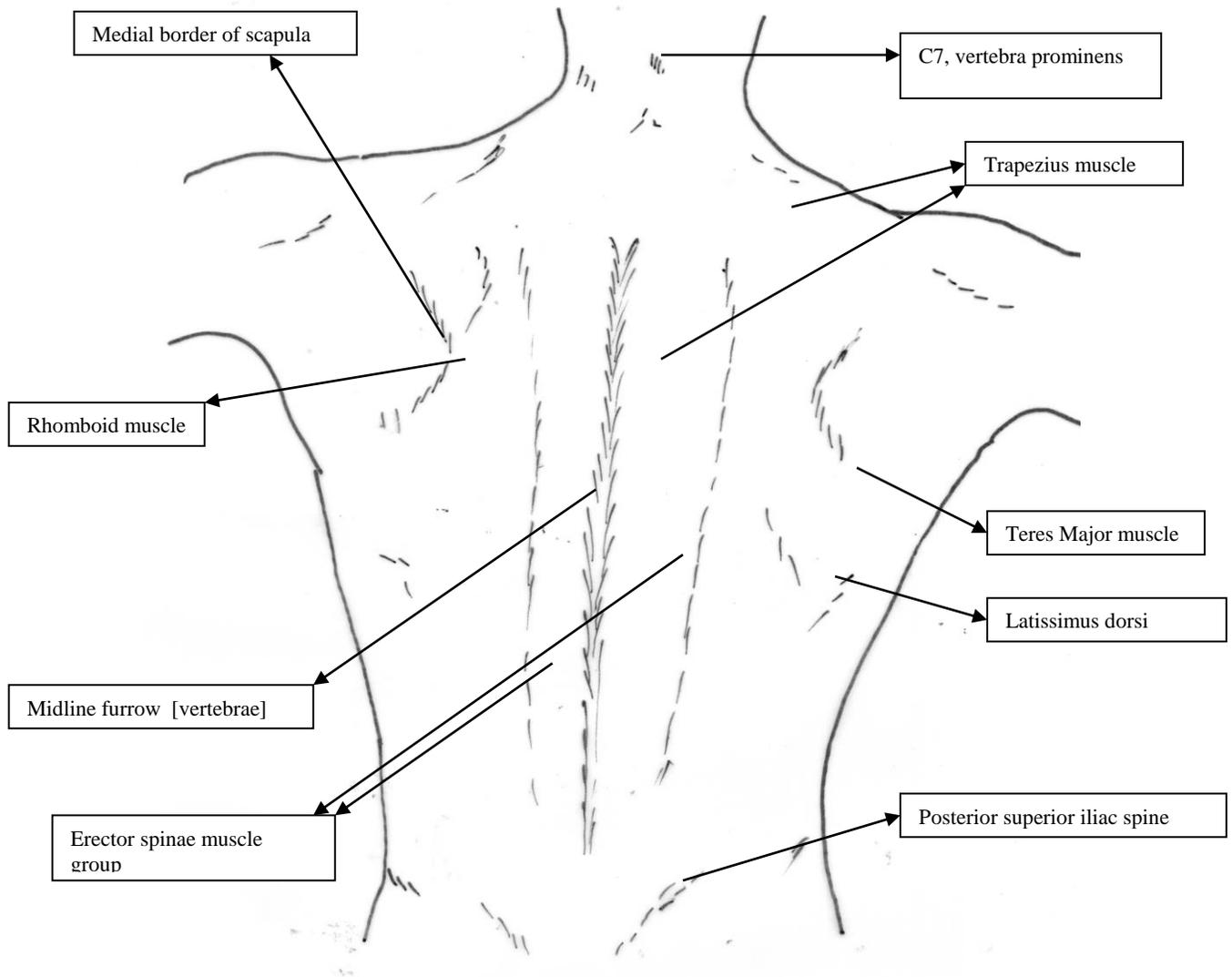


**THE
BACK**

Yiannis P Panayiotopoulos, MD, PhD

SURFACE ANATOMY

- **C7 , vertebra prominens**, is easily palpable as the fingers run down [the first spine to be palpated]
- **Spines of the lower vertebrae**
- **Rhomboid muscle**: is visible **medially to the medial border of scapula** with the arms abducted
- **Trapezius muscle**: forms aquadrangle as it comes down from the neck. Is subdivided in superior, middle and inferior part.
- **Latissimus dorsi & teres major**: they form the posterior fold of the axilla
- **Erector spinae muscle group**: there is a **deep midline furrow** separating its lateral buldges
- **Dimples at the top of buttocks**: they represent the **posterior superior iliac spines** which lie at the **level of the sacroiliac joint**.



- *The back: surface markings*

THE VERTEBRAL COLUMN

Consists of **33 vertebrae**, **24 separate** [**8 cervical**, **12 thoracic**, **5 lumbar**] and **9 fused** in **sacrum** [5] and **coccyx** [4].

In the foetus the spine is **C-shaped**, forming an **anteriorly concave curve**. At birth, the concave curvatures persist in the thoracic and sacrococcygeal vertebrae, called thus **primary curvatures**. The **secondary curvatures** [**convex anteriorly**] are formed when the child starts holding its head up [cervical curvature, C1-T1] and walking [lumbar curvature, T12-L5].

THE VERTEBRAE

At birth, each vertebra consists of 3 bony parts: the **centrum** [body] and **two vertebral arches** [formed by pedicles and lamina] connected by **hyaline cartilage**. The two arches fuse at the age of two and at the age of 7 they fuse with the centrum, forming the typical vertebra.

- **VERTEBRAL BODY**

Is a columnar pessary with a little waist. Its upper and lower plateaus are articular surfaces.

- **VERTEBRAL ARCH** [NEURAL ARCH]

2 pedicles with a **notch** above and below which, when the vertebrae are joined, form the **intervertebral foramen**. Through the intervertebral foramina pass the segmental spinal nerves. C1-C7 pass above their own numbered vertebra. C8 passes below C7. The rest pass below their corresponding vertebrae.

2 laminae, which start from the pedicles and meet posteriorly at the point where the **spinous process** is formed.

2 transverse processes, bearing at their end a facet [articular surface] for articulation with the rib tubercle.

4 articular processes, 2 superior [upper] with posteriorly facing facets and 2 inferior [lower] with facets facing anteriorly.

- **SPINAL CANAL** [VERTEBRAL]

Between the pedicles and the lamina an empty space is left, rather triangular-ovoid in shape, which, when the vertebrae are joined, forms the spinal canal.

- **THE CERVICAL VERTEBRAE** [8]

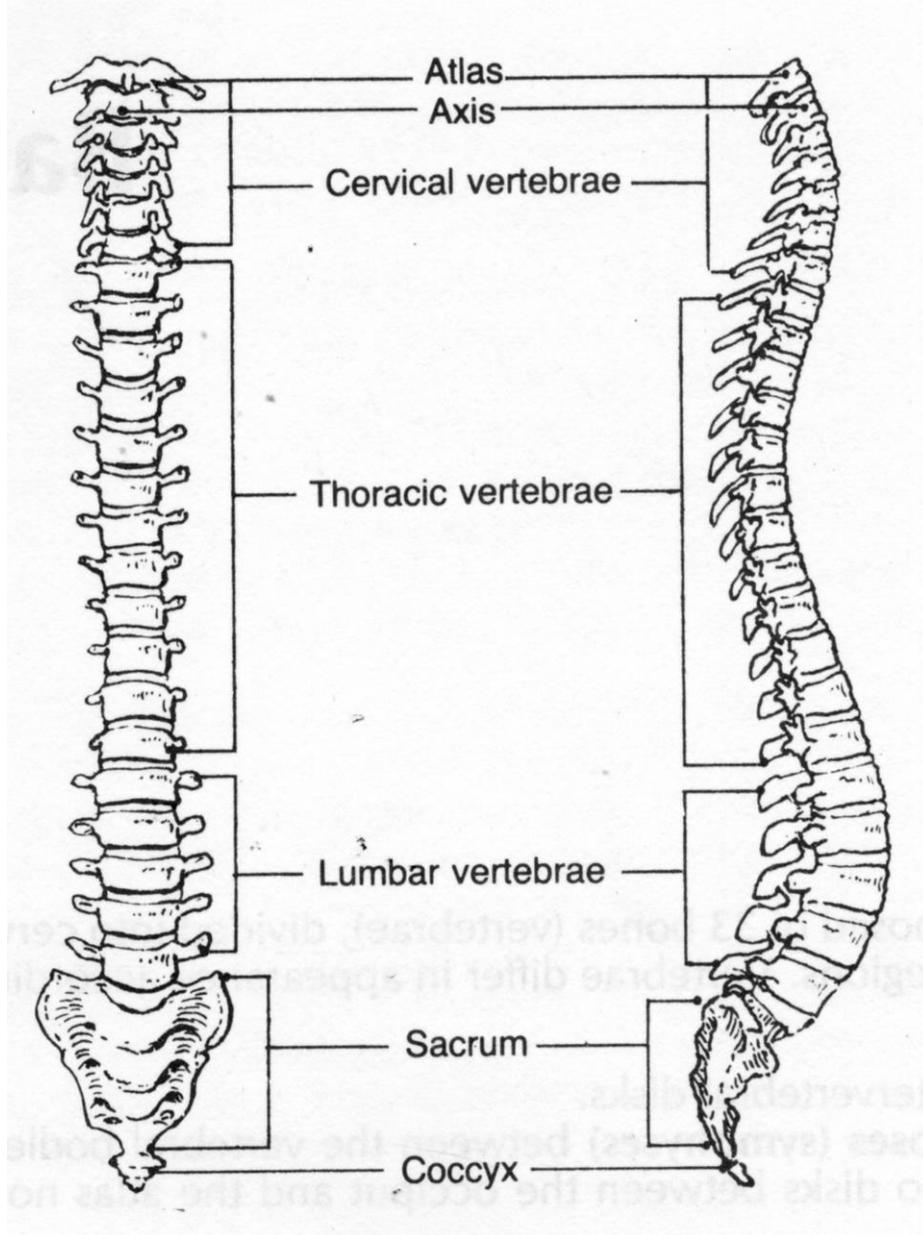
CHARACTERISTICS

1. **Transverse process**

- **Transverse foramen** [pass vertebral artery and vein]

- Have an **anterior and posterior tubercle**

2. **Bifid spinous process** [not in atlas and C7]



- *The spinal column*

3. **Transversely elongated body**

4. The **anterior lip of the superior body surface** articulates with the vertebra above [**Luschka's joint**]

5. **Triangular vertebral foramen**

6. The **superior and inferior facets** of the articular processes face almost **horizontally** [they gradually move to a more vertical position as we go downwards]

ATLAS [C1]

- Has **no body**. It has been detached from atlas to form the odontoid process of C2.
- The superior articular surface is located on a **lateral mass** and faces horizontally
- There is a **groove for the vertebral artery**, posterior to the lateral mass
- Its vertebral canal bears the **transverse ligament** which divides it in two parts: an anteriorly placed **foramen for the odontoid process [dens]** and a posterior loose spinal canal.
- There is a facet for the dens on the posterior aspect of the anterior arch

AXIS [C2]

- **Odontoid process** [on its anterior aspect there is a facet]
- The atlanto-axial joint is seen on the plain anteroposterior radiograph only when the mouth is open.

VERTEBRA PROMINENS [C7]

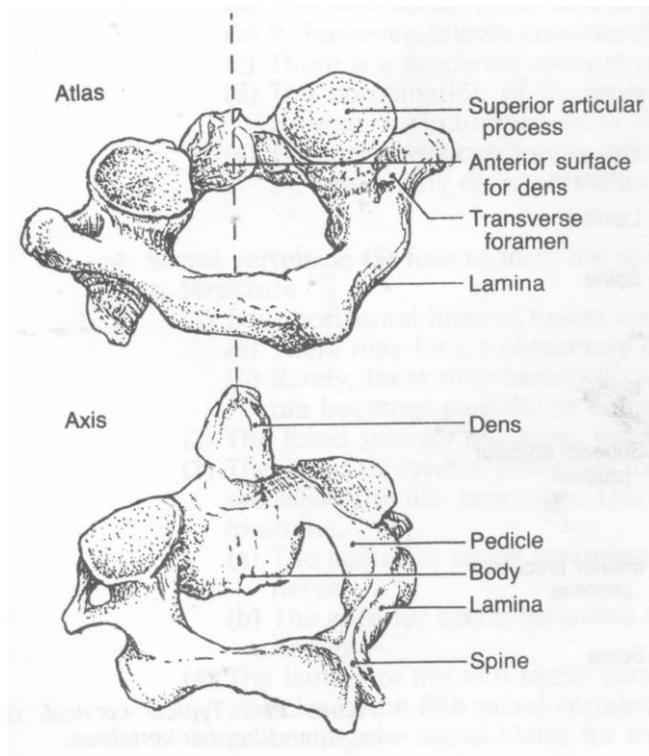
- **Does not have a bifid spinous process**
- The **transverse foramen** is small because it **transmits only the vertebral vein**; the artery passes through the C6-C2 foramina.

MOVEMENT

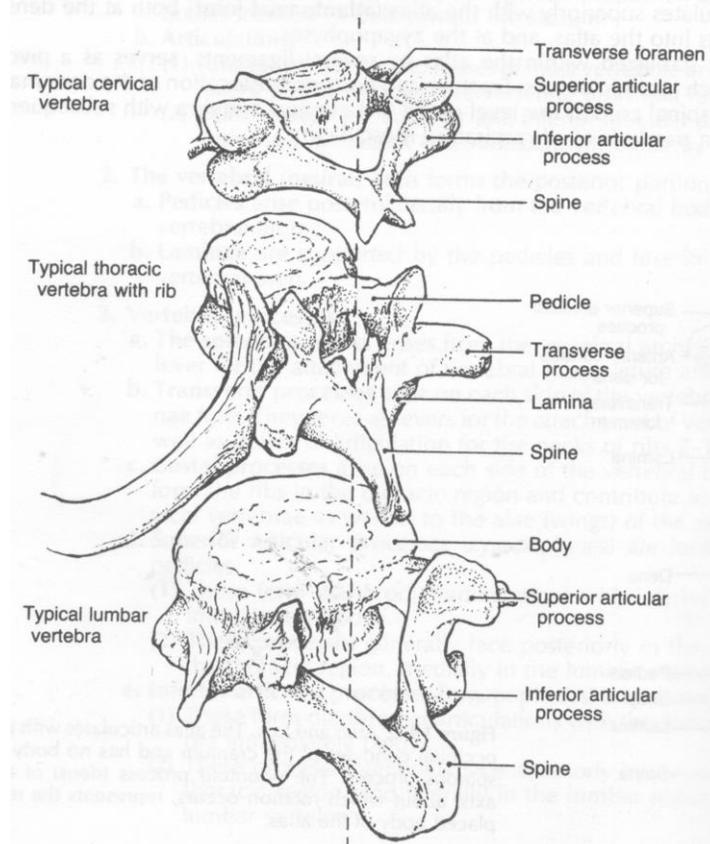
In all regions the articular processes allow **flexion / extension** and **side-to-side movement**. Lateral flexion occurs at the **atlanto-occipital joint**, while rotation of the skull occurs at the **atlanto-odontoid joint**.

• **THORACIC VERTEBRAE [12]**

1. **Facets on the posterolateral angle** of their body to articulate with the head of the rib
2. **Facets on the transverse processes** to articulate with the rib tubercle
3. The **articular facets** are in an almost **vertical plane**
4. **Long and downward sloping spinous process**
5. **T5-T8 are typically thoracic** and come into contact with the descending aorta [In case of aneurysm their body may be eroded by its pressure but the intervertebral disks, which are avascular, remain intact]. T1-T4 vertebrae have some cervical while T9-T12 have some lumbar characteristics.



- *Superiorly: Atlas & axis Inferiorly: cervical, thoracic & lumbar vertebrae*



- **LUMBAR VERTEBRAE [5]**

They are great in size with strong, transversely elongated body, square, oblong and horizontal spines, big transverse processes [especially L5], and small triangular vertebral foramen. The articular facets are almost in the sagittal plane.

- **ANOMALIES OF THE VERTEBRAE**

- **Hemivertebra**

One of the centres of the body fail to develop. Only half the vertebral body is present and the condition is associated with scoliosis.

- **Spina bifida**

Failure of the two arch centres to fuse posteriorly. Is more common in the lumbar region and is associated with an overlying dipple, lipoma or presence of tuft of hair.

- **Synostosis of vertebrae C2 & C3**

• **Ossifying ligamenta flava**, with bony spurs growing from the ligament

- **Sacralisation of L5**

The last lumbar vertebra fuses with sacrum

- **Lumbarised S1**

Behaves as a transitional, separate or semiseparate vertebra.

- **Spondylolysis**

There is a defect in the articular process mass. The two parts are held in place with fibrous tissue. On the oblique X-ray there is a **lucent cleft across the “neck of the dog”**, where neck of the dog → inferior articular process, head → transverse process, eye → pedicle, ear → superior articular process.

- **Spondylolisthesis**

Anterior displacement of L5 while the posterior elements may remain aligned.

INTERVERTEBRAL DISKS & LIGAMENTS

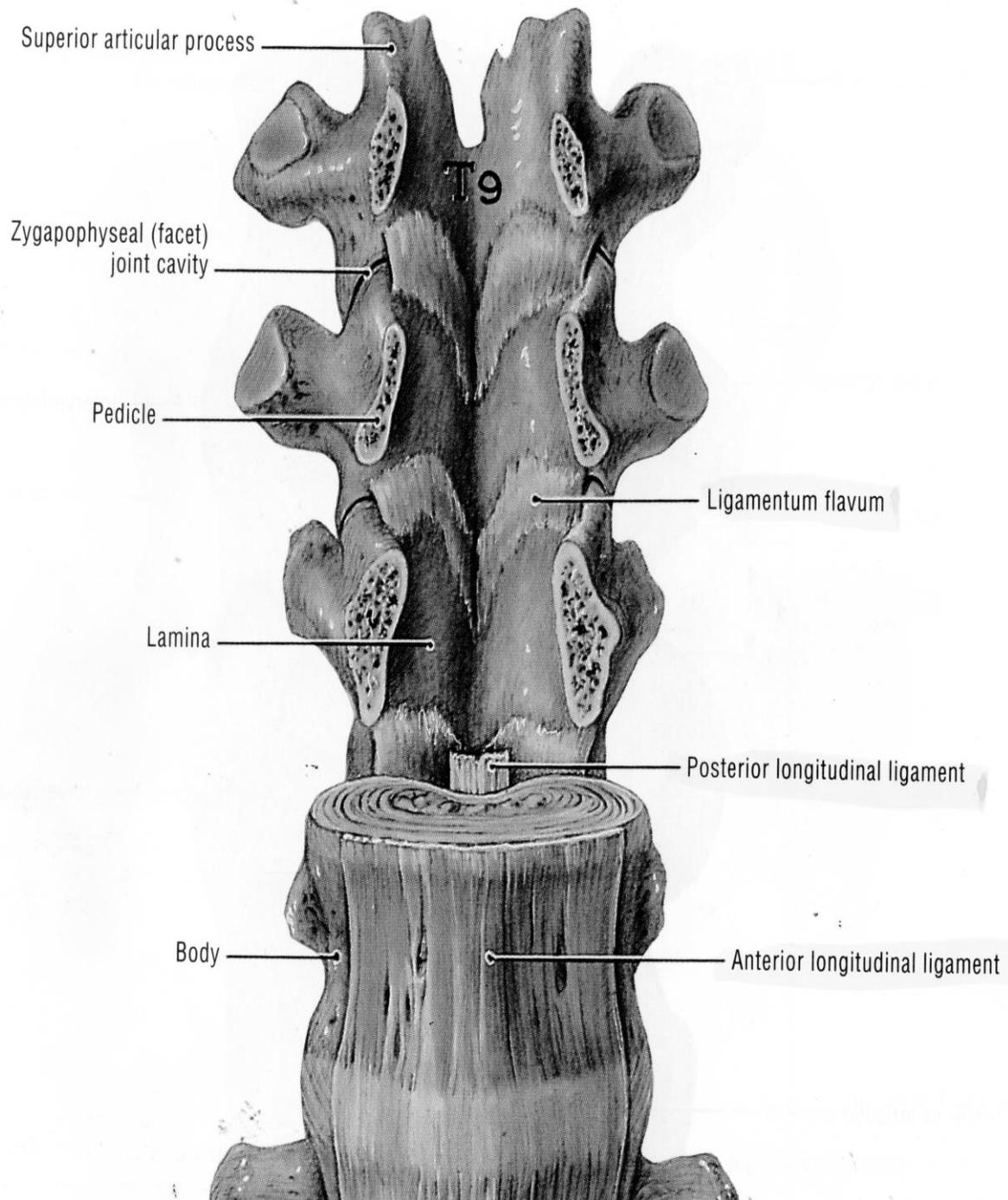
The vertebrae articulate by body-to-body [cartilaginous plates] and by their articular facets. The additive effect of movement is considerable [particularly in the cervical and lumbosacral regions which are thus more prone to injury]

- **LIGAMENTS**

1. **Ligamentum flavum**

Yellow elastic fibres connecting the ventral surface of the two adjacent lamina, extending to the articular ligament.

2. **Articular [capsular] ligaments**



- *The spinal ligaments and disks*

Fibres around the small synovial facet joints.

3. **Anterior longitudinal ligament**

Broad, strong, attached to the ventral surface of the bodies and intervertebral disks.

4. **Posterior longitudinal ligament**

On the posterior [dorsal] surface of bodies and disks, rendering the anterior wall of the vertebral canal smooth. Has a diamond shape at each disk level.

5. **Supraspinous ligament**

6. **Interspinous ligament**

• **INTERVERTEBRAL DISKS**

Strong plates which connect the bodies and act as **shock absorbers**. Their outer part is the **annulus fibrosus** while the inner part is gelatinous, forming the **nucleus pulposus**. The disks account for 1/4th of the length of the spine [atrophy of the disk in elder people is accompanied by shrinkage in height and C-shape of the vertebral column].

If the relatively thin posterior part of the annulus fibrosus ruptures the pulp protrudes posterolaterally, laterally or posteriorly [**prolapsed herniated intervertebral disk**] impinging the spinal nerves or cauda equina or even the spinal cord. The most common sides are the L4-L5, L5-S1 and then C5-C6 and C6-C7.

L5-S1 hernia: symptoms from the 1st sacral root

L4-L5 herniation: impinges the root of L5 spinal nerve. Pain along the back of the leg and foot [sciatic nerve distribution]. Painful test of raising the straight leg. Weakness in ankle dorsiflexion. Numbness over the lateral part of the leg and medial site of foot [L5] or lateral foot [S1]. Diminished ankle jerk [S1].

VERTEBRAL VENOUS PLEXUSES

There are two plexuses inside and outside the spinal canal, the internal and external venous plexus, which communicate via the **intervertebral vein** [on the side of pedicles] and the **basilvertebral vein** [in the midline]. Via those veins they communicate with the lumbar, intercostal and pelvic or azygos system veins.

Extradural, around the cord are the valveless **anterior and posterior longitudinal sinuses**.

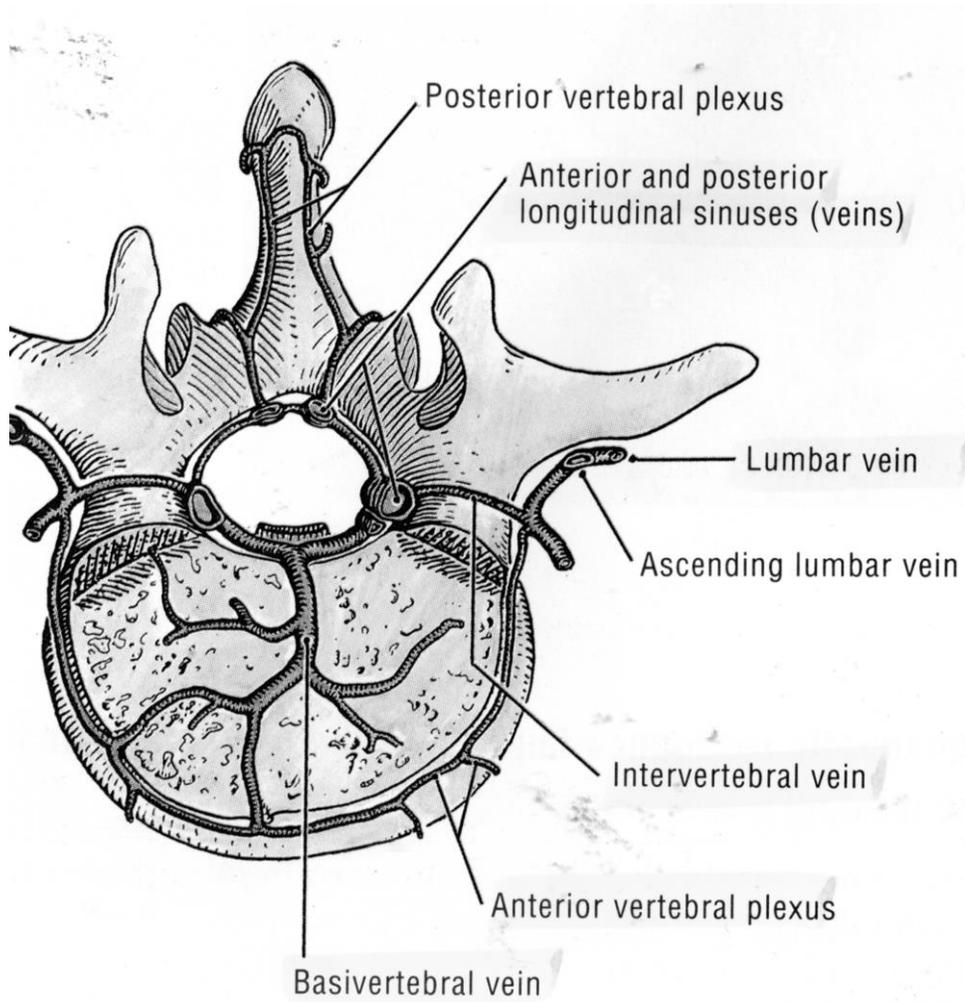
FRACTURES

Most commonly at **T12, L1 & L2 vertebrae**

A **flexion / compression type** of injury will cause wedging of the body

Compression and forward movement will cause dislocation or fracture of the articular facets and **rupture of the interspinous ligaments**.

Dislocation of the cervical facets in the horizontal plane may occur without fracture; this never happens in the lumbar region.



- *The venous plexus of the vertebrae*

MUSCLES OF THE BACK

- **SUPERFICIAL**

1. **Trapezius**

From the occipital bone and spinous processes to the scapular spine

Accessory nerve [XI]

2. **Latissimus dorsi**

From iliac crest and thoracolumbar fascia to bicipital groove

Thoracodorsal nerve [C5-T1]

- **INTERMEDIATE**

1. **Lavator scapula**

From cervical spine to upper angle of scapula

2. **Rhomboid minor**

From spinous processes to medial border of scapula

3. **Rhomboid major**

From spinous processes to medial border of scapula

4. **Serratus posterior** [superior and inferior parts]

From vertebral spines to ribs

5. **Thoracolumbar fascia**

- **DEEP MUSCLES**

1. **Splenius capitis**

2. **Splenius cervicis**

3. **Erector spinae muscles**

- **Spinalis** [medial site]

- semispinalis capitis

- semispinalis cervicis

- **Logissimus** [middle]

- longissimus cervicis

- thoracic

- iliolumbar

- **Iliocostalis** [lateral site]

- **DEEPEST LAYER**

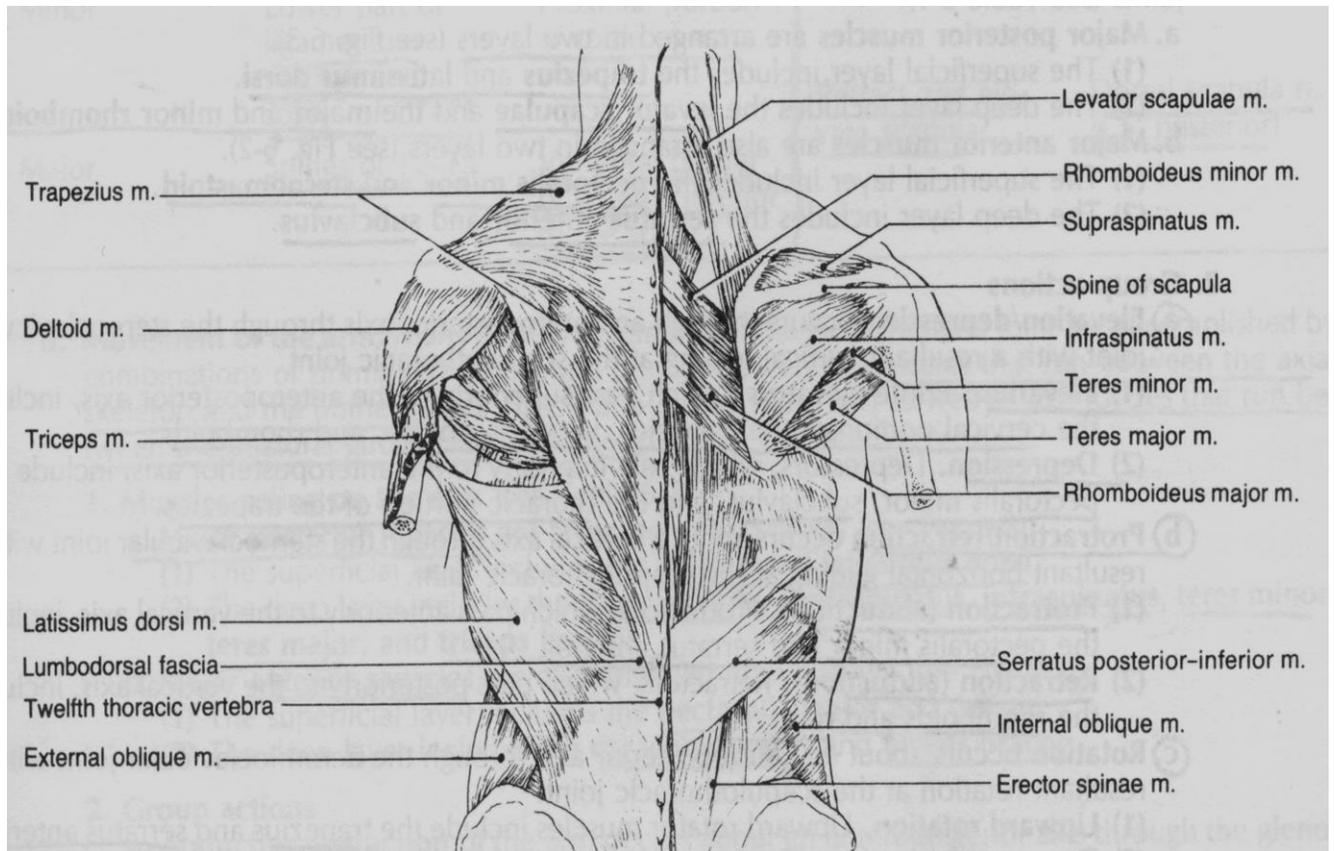
1. **Transversospinalis group**

- **Semispinalis**

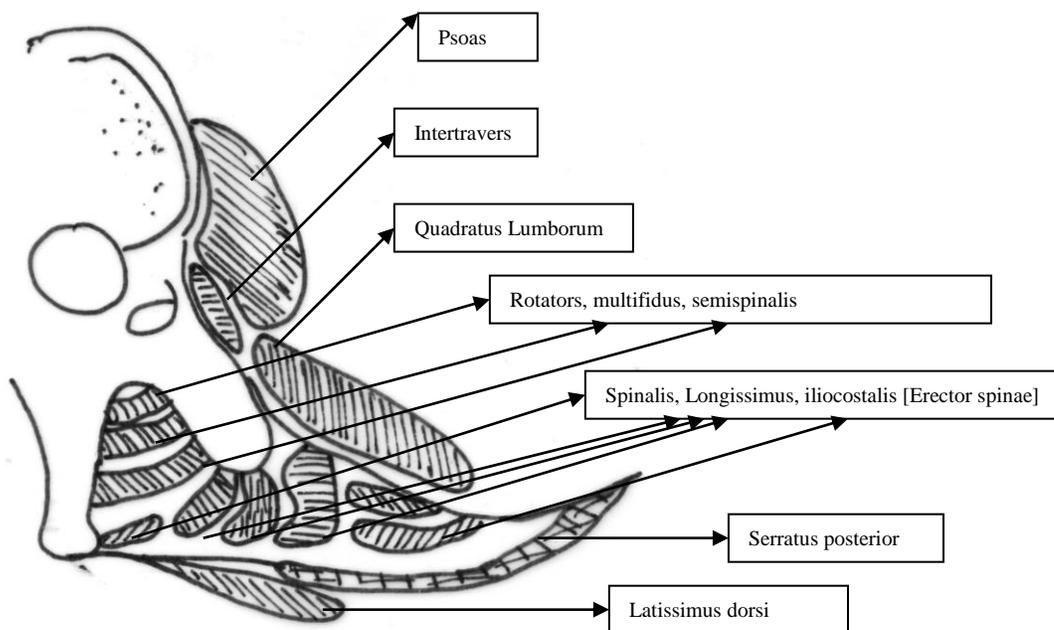
- **Multifidus**

2. **Rotators** [the deepest and shortest muscles]

3. **Levator costae**



• *The back muscles*



• *Transverse section of back muscles*

