

- **Vertebral foramen** formed from posterior wall of body and the vertebral arch
- **Vertebral canal** - succession of vertebral foramina, contains the spinal cord, roots of spinal nerves, meninges, fat and vessels

Vertebral notches

- **Indentations** in the vertebrae, superior and inferior to each pedicle, posterior to the body and anterior to the superior and inferior articular processes
- **Intervertebral foramen** is the gap formed between superior and inferior vertebral notches of adjacent vertebrae
 - **Spinal nerves** emerge from here, and **spinal ganglia** located here

Processes

- **1 spinous** – projects posteriorly (and usually inferiorly, overlapping the vertebrae below) from the vertebral arch, where the laminae join
- **2 transverse** – project posterolaterally from junction of pedicles and laminae
- **4 articular** – 2 superior, 2 inferior, arise from junction of pedicles and laminae; each have an articular facet
- Spinous and transverse processes provide attachment for deep back muscles; serve as levers for vertebral movement
- Articular processes connect to articular processes of adjacent vertebrae, forming **facet joints**
 - Determine **type of movement** between each vertebrae
 - Also keep vertebrae **aligned**
 - Generally **not weight bearing** (except inferior articular processes of L5)

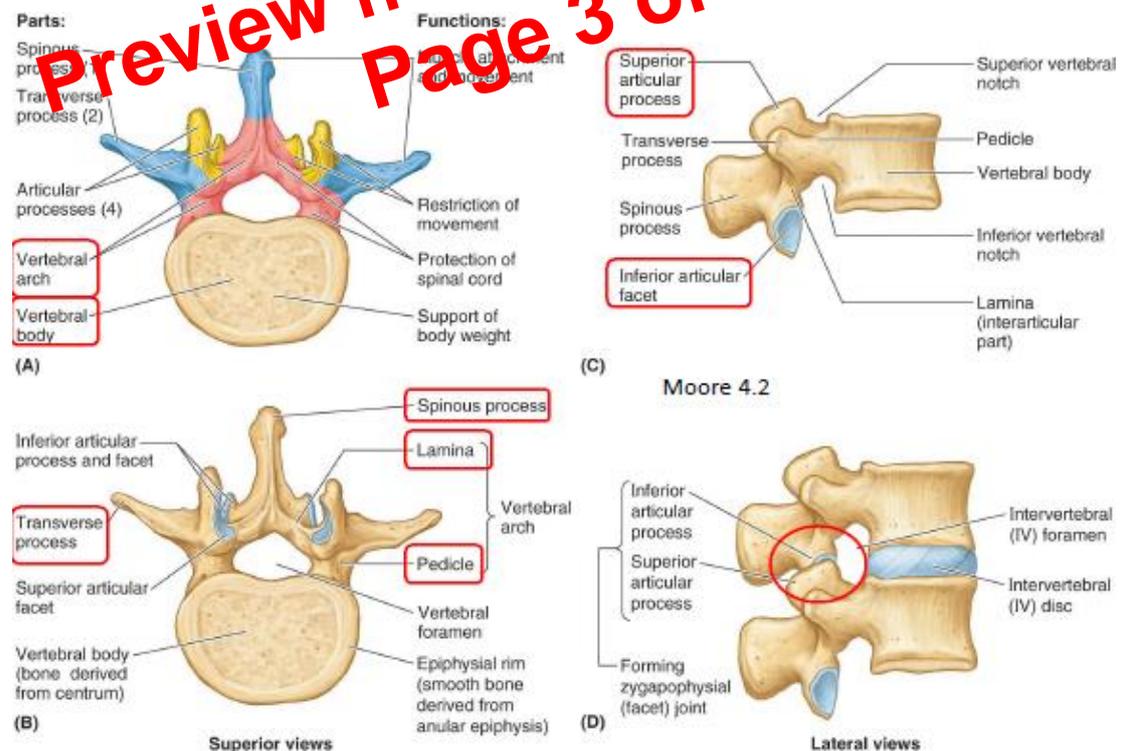


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Lumbar vertebrae

- Large spinous process of lumbar vertebrae are easily observed when trunk is flexed, and can be palpated in the **posterior median furrow**
- **L2 spinous process** gives indication of the end of the **spinal cord**
- Horizontal line joining the highest points of the two iliac crests will pass through the tip of the **L4 spinous process**, a useful marker for **lumbar puncture**

Sacrum

- The middle of a line drawn between the posterior iliac spines indicates the S2 spinous process, indicated by skin dimples formed by attachment and deep fascia to these spines; L2 indicates inferior extent of the subarachnoid space
- Median sacral crest can be felt inferior to L5
- Sacral triangle is formed from joining the superior iliac spines to the intergluteal (natal) cleft) – outlines the sacrum
- Sacral hiatus can be palpated at the superior part of the natal cleft

Coccyx

- Can be palpated in the natal cleft
- Apex can be palpated 2.5cm superior to the anus

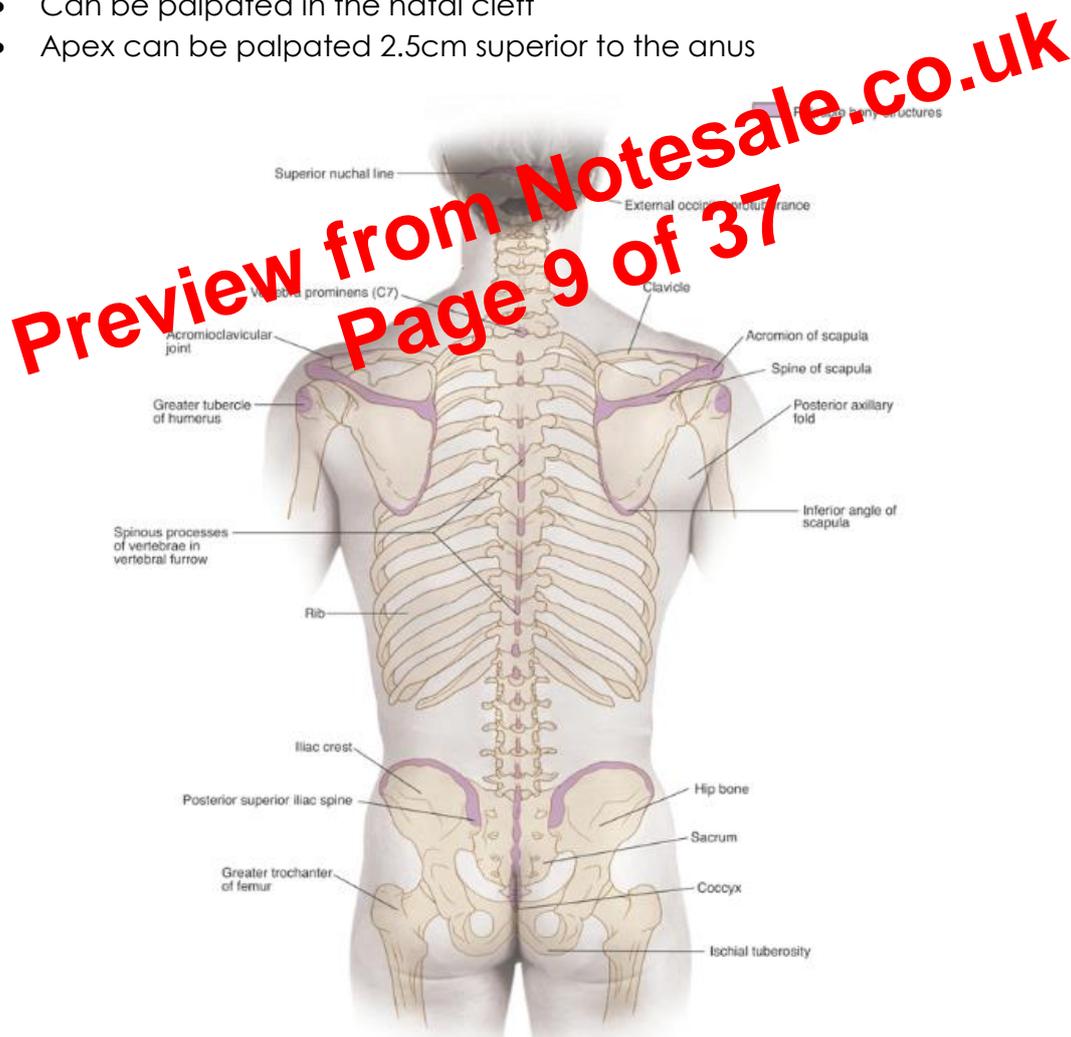


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Ossification of vertebrae

- Vertebrae begin to develop during the embryonic period as mesenchymal condensations around the notochord
 - Later chondrify and cartilaginous vertebrae form
- Ossification begins at 8th week; 3 primary ossification centres in each vertebra
 - Endochondral centrum – will eventually constitute most of the body
 - 2 perichondral centres – one each half of neural arch
- At birth, typical vertebra and the superior sacral vertebra consist of three bony parts united by hyaline cartilage
 - Inferior sacral and coccygeal are cartilaginous, and ossify in infancy
- The neural arches articulate at neurocentral joints (primarily cartilaginous) and start to fuse during first year, beginning in lumbar and moving to thoracic area
- Arches begin to fuse with the centrum in the 3rd year of life, and is complete in the lumbar region after age 6 years
- During puberty, 5 secondary ossification centres develop; all ossify by mid 20s
 - Tip of spinous process
 - Tip of transverse processes
 - Annular epiphyses on inferior and superior edges of the body
- Hyaline annular epiphyses (IV discs attach) are called growth plates as they form the zone where the vertebral body grows in height
 - Unites with body in early adulthood when growth stops, resulting in characteristic epiphyseal rim
- Costal elements (primary ribs) occur at all levels in association with the transverse elements (secondary ossification centre of transverse process)
 - Develop into ribs in thoracic region
 - Become part of the transverse process at other levels
- In cervical region
 - Foramina transversarii develop between the two ossification centres; costotransverse bar links the centres, forming the lateral boundary
 - Anterior tubercle formed from costal element and posterior tubercle from the transverse element
- Atypical ossification at C1, C2, and C7 and the sacrum
- C1 centrum fuses to C2
 - C1 loses peripheral connection to the rest of C1 – forms the dens
 - As centrum are fused, no IV disc between them
 - Part of body remaining with C1 forms the anterior arch and tubercle
- In the thoracic region, the costal elements separate from the developing vertebrae and elongate into ribs
- In the lumbar region, the majority of the transverse process originates from the costal element, so is called the costal process; the transverse element forms the mammillary processes
- Ala and auricular processes of the sacrum formed from fusion of transverse and costal elements

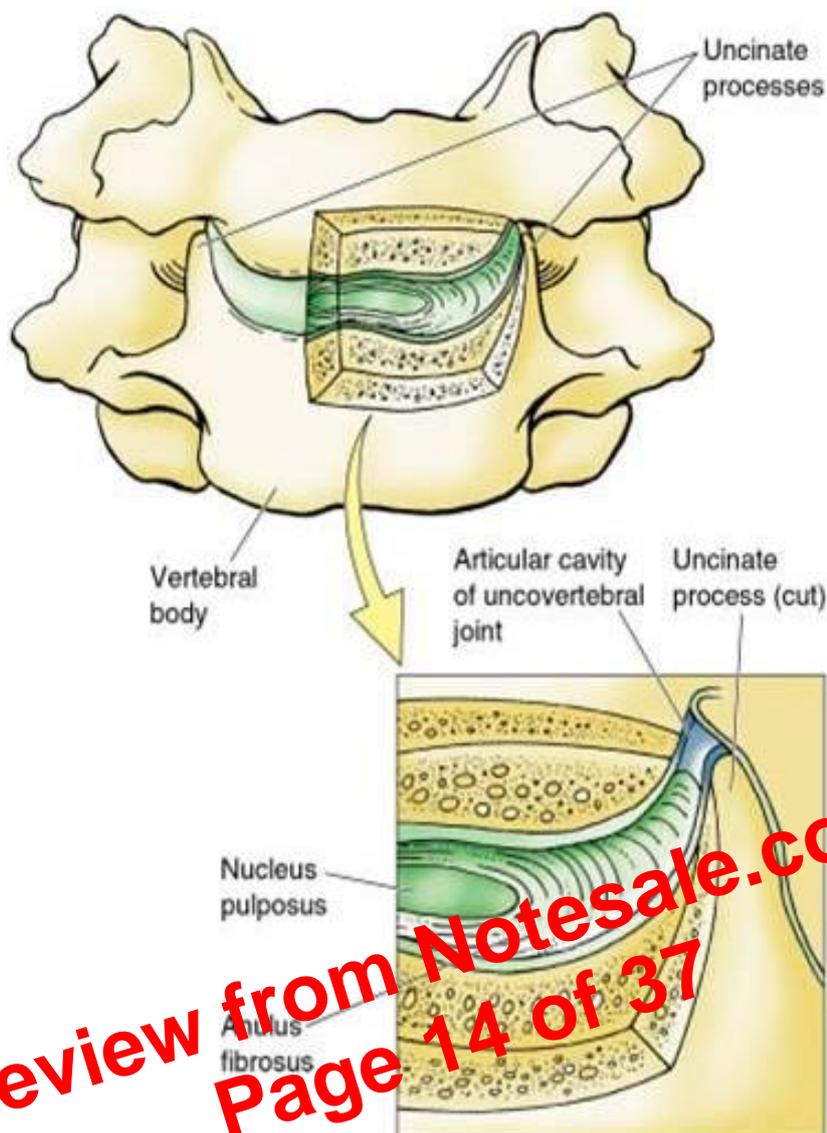


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- Anterior longitudinal ligament
 - Strong, broad fibrous band covering and connecting the anterolateral aspect of the vertebral bodies and IV discs
 - Extends from pelvic surface of sacrum to anterior tubercle of C1 and occipital bone; extends laterally to the IV foramen
 - Thickest on the anterior aspect
 - Prevents hyperextension – only ligament that limits extension; all others limit flexion
- Posterior longitudinal ligament
 - Narrower, weaker band, runs within vertebral canal along posterior aspect of vertebral bodies
 - Attaches mainly to the IV discs
 - Extends from C2 to the sacrum
 - Weakly resists hyperflexion, prevents herniation of nucleus pulposus
 - Innervated with nociceptive nerve endings

- Distance between origin and exit increases as you go down; thus length of nerves also increase
- Lumbar and sacral roots extend beyond L2, forming loose bundle of free nerves (cauda equine) within lumbar cistern
- From the tip of the conus medullaris, the filum terminale descends among the spinal roots in the cauda equine
 - Remnant of caudal part of the spinal cord
 - Proximal end is filum terminale internum – vestiges of neural tissue, connective tissue and neuroglia covered by pia mater
 - Perforates inferior end of dural sac, gains layer of dura and continues through sacral hiatus as filum terminale externum

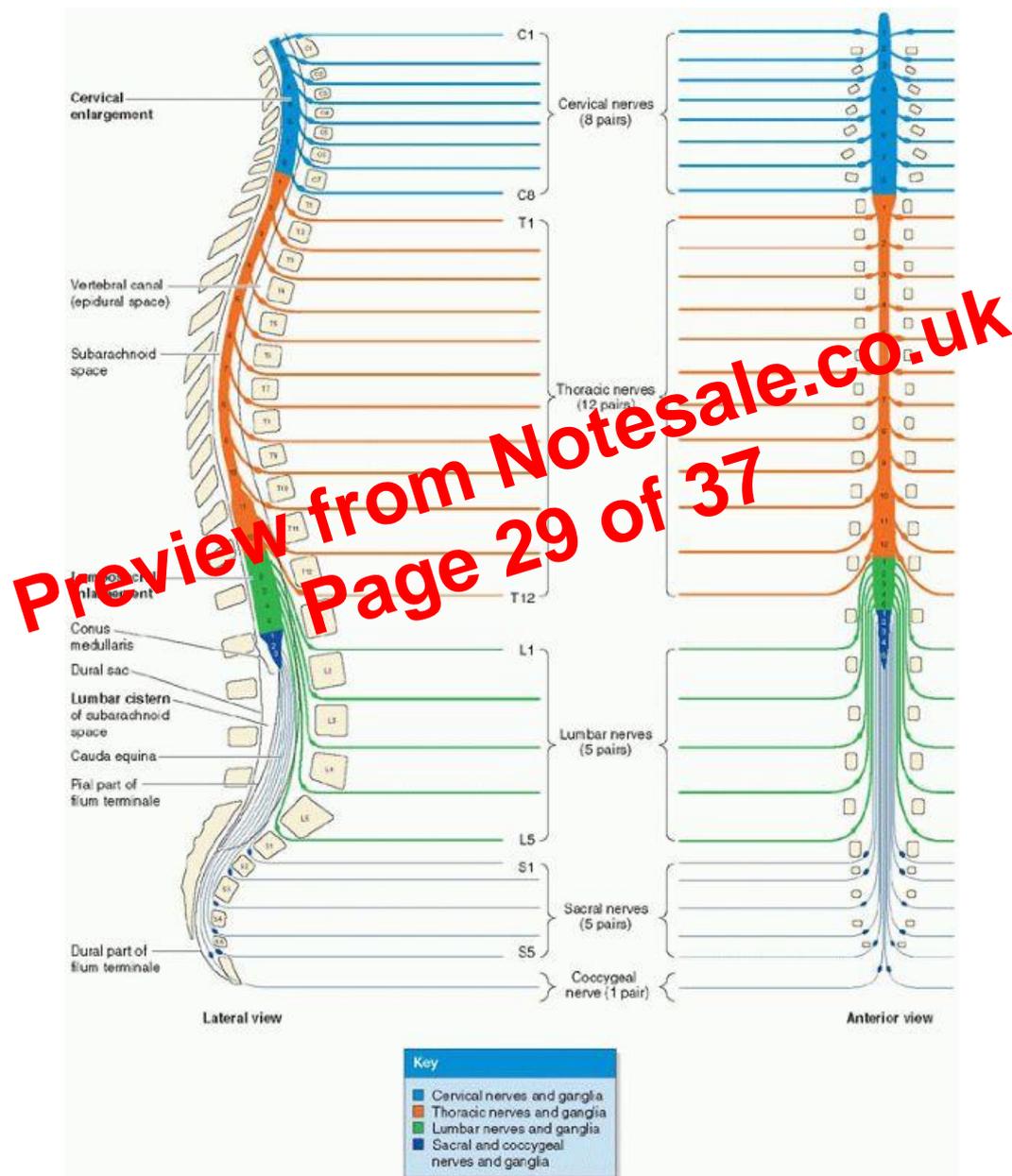


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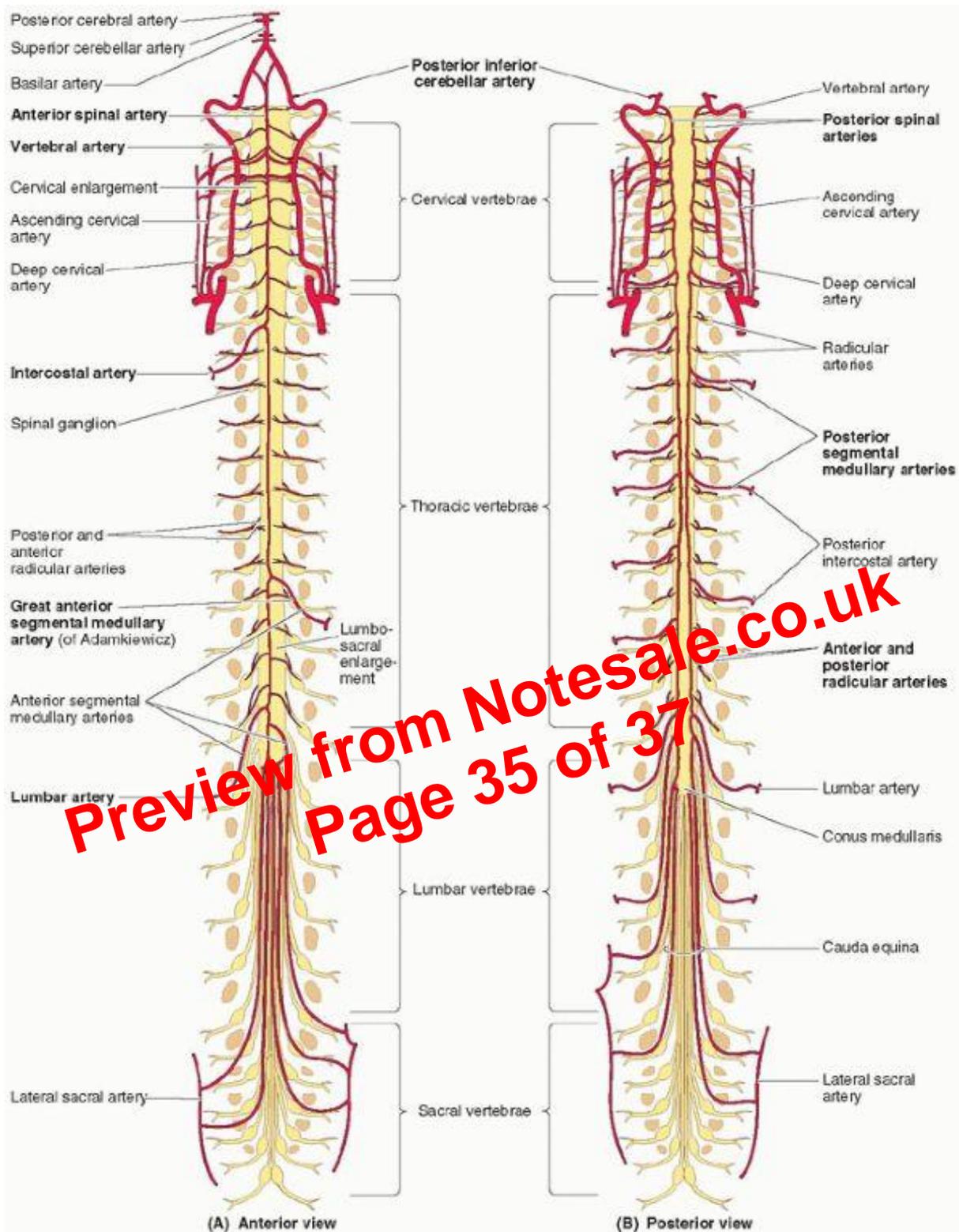


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