Human Anatomy

Lecture 8

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The Vertebral Column

The vertebral column is the central bony pillar of the body. It supports the skull, pectoral girdle, upper limbs, and thoracic cage and, by way of the pelvic girdle, transmits body weight to the lower limbs. Within its cavity lie the spinal cord, the roots of the spinal nerves, and the covering meninges, to which the vertebral column gives great protection.

Composition of the Vertebral Column

The vertebral column is composed of 33 vertebrae—7 cervical, 12 thoracic, 5 lumbar, 5 sacral (fused to form the sacrum), and 4 coccygeal. That is the vertebral column consist of 26 bones (7C+12T+5L+Sacrum+Coccyx).

Because it is segmented and made up of vertebrae, joints, and pads of fibrocartilage called **intervertebral discs,** it is a flexible structure. The intervertebral discs form about one quarter the length of the column.

- ### General Characteristics of a Vertebra

Although vertebrae show regional differences, they all possess a common pattern.

A **typical vertebra** consists of a rounded **body** anteriorly and a **vertebral arch** posteriorly. These enclose a space called the **vertebral foramen,** through which run the spinal cord and its coverings. The vertebral arch consists of a pair of cylindrical **pedicles,** which form the sides of the arch, and a pair of flattened **laminae,** which complete the arch posteriorly.

The vertebral arch gives rise to seven processes: one spinous, two transverse, and four articular.

The **spinous process,** or **spine,** is directed posteriorly from the junction of the two laminae. The **transverse processes** are directed laterally from the junction of the laminae and the pedicles. Both the spinous and transverse processes serve as levers and receive attachments of muscles and ligaments.

The **articular processes** are vertically arranged and consist of two superior and two inferior processes. They arise from the junction of the laminae and the pedicles, and their articular surfaces are covered with hyaline cartilage.

The two superior articular processes of one vertebral arch articulate with the two inferior articular processes of the arch above, forming two synovial joints.

The pedicles are notched on their superior and inferior borders, forming the **superior** and **inferior vertebral notches.** On each side, the superior notch of one vertebra and the inferior notch of an adjacent vertebra together form an **intervertebral foramen.**

These foramina, in an articulated skeleton, serve to transmit the spinal nerves and blood vessels. The anterior and posterior nerve roots of a spinal nerve unite within these foramina with their coverings of dura to form the segmental spinal nerves.

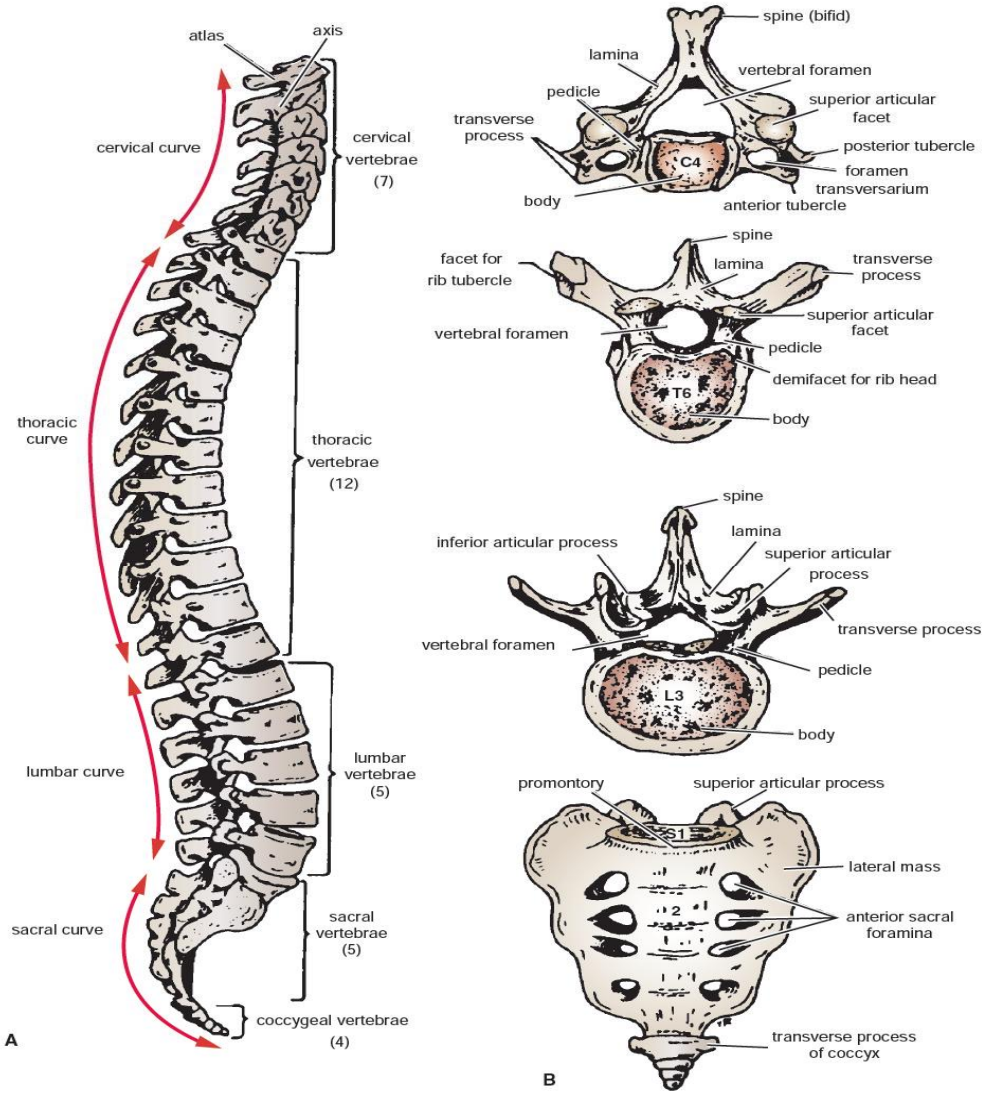


FIGURE 12.2 **A.** Lateral view of the vertebral column. **B.** General features of different kinds of vertebrae.

Cervical Vertebra

▪ Characteristics of a Typical Cervical Vertebra

A typical cervical vertebra has the following characteristics:

■■ The transverse processes possess a **foramen transversarium** for the passage of the vertebral artery and veins (note that the vertebral artery passes through the transverse processes C1 to 6 and not through C7).

■■ The spines are small and bifid.

- The body is small and broad from side to side.
- The vertebral foramen is large and triangular.

The superior articular processes have facets that face posteriorly and superiorly; the inferior processes have facets that face inferiorly and anteriorly.

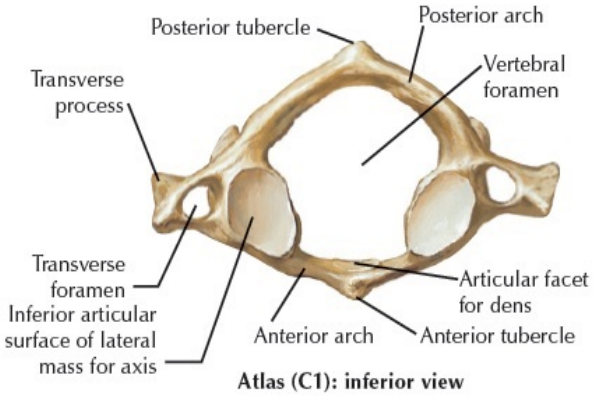
Characteristics of the Atypical Cervical Vertebrae

The 1st, 2nd, and 7th cervical vertebrae are atypical.

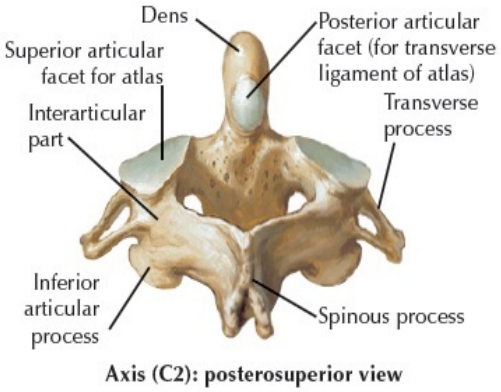
The **1st cervical vertebra,** or **atlas,** does not possess a body or a spinous process. It has an anterior and posterior arch. It has a lateral mass on each side with articular surfaces on its upper surface for articulation with the occipital condyles **(atlanto-occipital joints)** and articular surfaces on its inferior surface for articulation with the axis **(atlantoaxial joints).**

The **2nd cervical vertebra,** or **axis,** has a peglike **odontoid process (dens)** that projects from the superior surface of the body (representing the body of the atlas that has fused with the body of the axis).

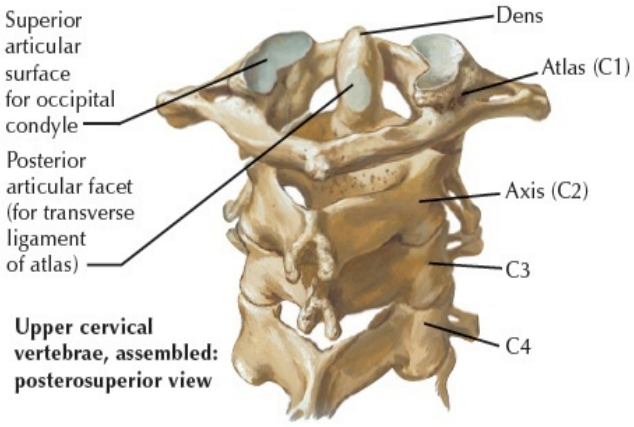
The **7th cervical vertebra,** or **vertebra prominens**, is so named because it has the longest spinous process, and the process is not bifid. The transverse process is large, but the foramen transversarium is small and transmits the vertebral vein or veins.



Atlas (C1): inferior view



Axis (C2): posterosuperior view



Upper cervical vertebrae, assembled: posterosuperior view

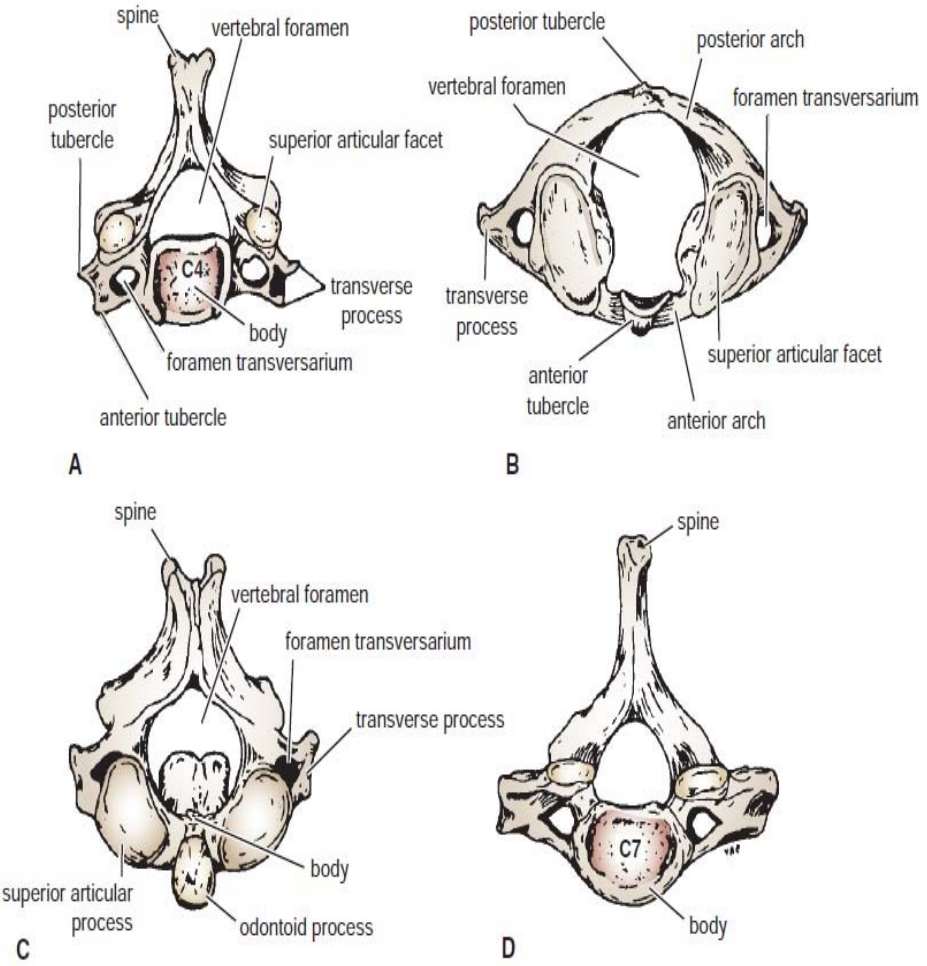


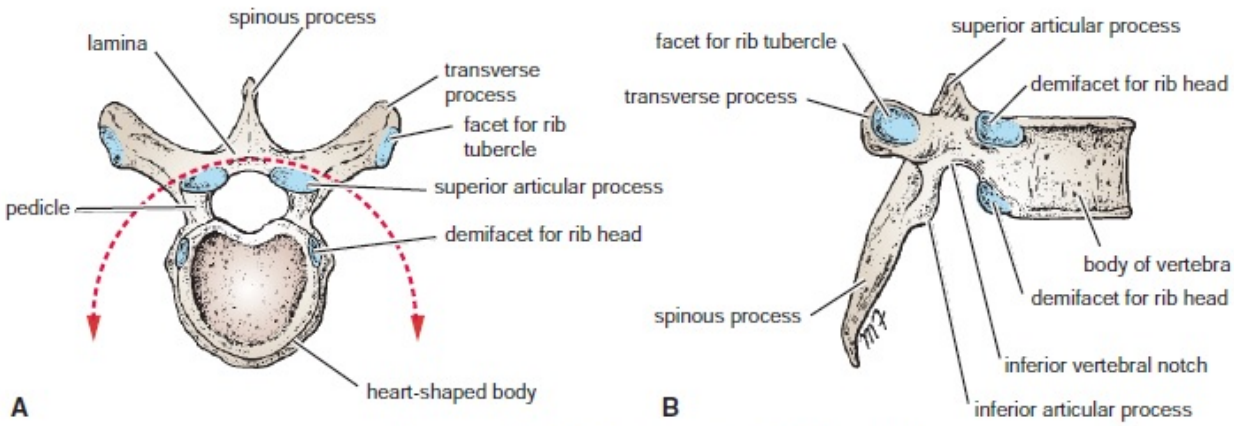
FIGURE 12.3 **A.** Typical cervical vertebra, superior aspect. **B.** Atlas, or 1st cervical vertebra, superior aspect. **C.** Axis, or 2nd cervical vertebra, from above and behind. **D.** 7th cervical vertebra, superior aspect; the foramen transversarium forms a passage for the vertebral vein but not for the vertebral artery.

Thoracic Vertebra

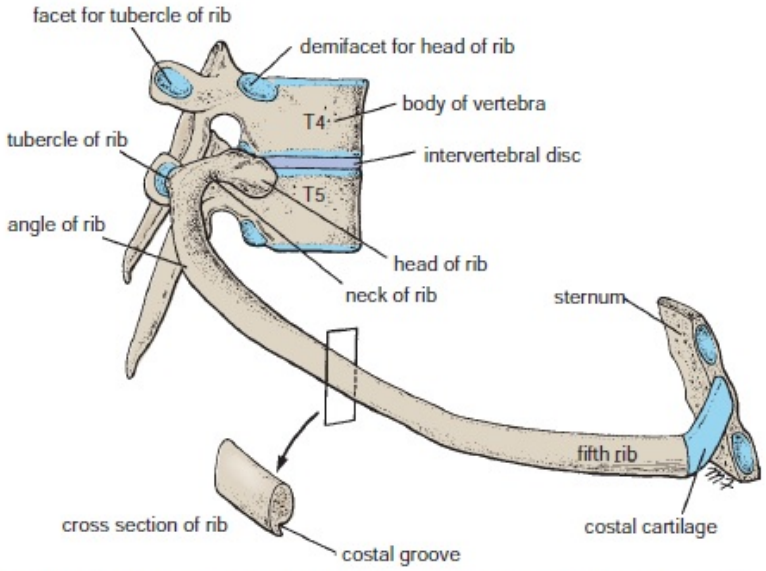
▪ Characteristics of a Typical Thoracic Vertebra

A typical thoracic vertebra has the following characteristics:

- The body is medium size and heart shaped.
- The vertebral foramen is small and circular.
- The spines are long and inclined downward.
- Costal facets are present on the sides of the bodies for articulation with the heads of the ribs.
- 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 processes).
- The superior articular processes bear facets that face posteriorly and laterally, whereas the facets on the inferior articular processes face anteriorly and medially.



Thoracic vertebra. **A.** Superior surface. **B.** Lateral surface.



Fifth right rib as it articulates with the vertebral column posteriorly and the sternum anteriorly. Note that the rib head articulates with the vertebral body of its own number and that of the vertebra immediately above. Note also the presence of the costal groove along the inferior border of the rib.

Lumbar Vertebra

- ## Characteristics of a Typical Lumbar Vertebra

A typical lumbar vertebra has the following characteristics:

- The body is large and kidney shaped.
- The pedicles are strong and directed backward.
- The laminae are short in a vertical dimension.
- The vertebral foramina are triangular.
- The transverse processes are long and slender.

- The spinous processes are short, flat, and quadrangular and project posteriorly.
- The articular surfaces of the superior articular processes face medially, and those of the inferior articular processes face laterally.

Note that the lumbar vertebrae have no facets for articulation with ribs and no foramina in the transverse processes.

Sacrum

The sacrum consists of five rudimentary vertebrae fused together to form a wedge-shaped bone, which is concave anteriorly. The upper border, or base, of the bone articulates with the 5th lumbar vertebra. The narrow inferior border articulates with the coccyx. Laterally, the sacrum articulates with the two iliac bones to form the **sacroiliac joints**.

The vertebral foramina are present and form the **sacral canal.** The laminae of the 5th sacral vertebra, and sometimes those of the 4th also, fail to meet in the midline, forming the **sacral hiatus**. The sacral canal contains the anterior and posterior roots of the sacral and coccygeal spinal nerves.

The anterior and posterior surfaces of the sacrum each have four foramina on each side for the passage of the anterior and posterior rami of the upper four sacral nerves.

Coccyx

The coccyx consists of four vertebrae fused together to form a single, small triangular bone that articulates at its base with the lower end of the sacrum. The first coccygeal vertebra is usually not fused or is incompletely fused with the second vertebra.