Vertebral column

- Cervical (C): Lordosis
- Thoracic (T): Kyphosis (rib)
- Lumbar (L): Lordosis
- Sacral (S) (pelvic bone)
- Coccyx (Cx)
  - Intervertebral joints

Posterior view
Vertebra (Spine)

- Vertebral Body; Vertebral foramen (canal)
- Vertebral Arch: Pedicle, Lamina, Process
- Vertebral notch: superior, inferior (intervertebral foramen)

**Upper view**

- Spinous process (1)
- Transverse process (2)
- Articular processes (4)
- Vertebral arch
- Vertebral body
- Vertebral foramen (canal)

**Anterior**

- Muscle attachment and movement
- Restriction of movement
- Protection of spinal cord
- Support of body weight
Vertebra (Spine)

- Vertebral Body; Vertebral foramen (canal)
- Vertebral Arch: Pedicle, Lamina, Process
- Vertebral notch: superior, inferior (intervertebral foramen)
Vertebral foramen (canal) and spinal cord

Anterior
Intervertebral foramen and spinal nerves
Vertebrae

- Superior articular process
- Transverse process
- Spinous process
- Inferior articular facet
- Pedicle
- Vertebral body
- Superior vertebral notch
- Inferior vertebral notch
- Lamina (interarticular part)
Vertebral foramen (canal)
Vertebral process

- Spinous process, Transverse process
- Articular process (facet): superior, inferior
Intervertebral joints

- Hyaline cartilage
- Intervertebral disc: Annulus fibrosus + Nucleus pulposus
Vertebrae

Cervical vertebrae

- Typical vertebrae (C3-C6)
- C1: atlas, C2: axis
Cervical vertebrae: Typical (C3-C6)

- small body; large, triangular canal; arch
- **Transverse process**: end as post. & ant. tubercle; foramen transversarium
- **Articular process**: sup. & inf.; sup. facet
- Short, bifid **spinous process**; attachment of ligamentum nuchae
Ligamentum nuchae
Vertebral artery in transverse foramen

- Through transverse foramen of C1-6; but no C7 (only for accessory vertebral v.)
- Vascular insufficiency during forceful rotation of vertebral column
Variations: transverse foramen and vertebral artery

- mainly through C1-6; some through C7

<table>
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<th>Sex</th>
<th>Side</th>
<th>C3 %</th>
<th>C4 %</th>
<th>C5 %</th>
<th>C6 %</th>
<th>C7 %</th>
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</tr>
</tbody>
</table>

All values were presented as percentage (%)

J Craniovertebr Junction Spine 2015; 6: 30–35
C1: atlas

- Sup. articular facet; with occipital condyle
- No body; No spinous proc.; Lateral mass: ant., & post. arch
- Long transverse proc.
C2: axis

- Dens (odontoid proc)
- Sup. articular facet; Inf. articular facet
- Body, pedicle; Spinous proc.; Transverse proc.
Assembling of C1 and C2

Anterior

Transverse ligament of atlas

Lateral mass

Superior view

Posterosuperior view

Vertebrae - 19
C7 vertebra

- Large, long spinous process
- Caudal end of lig. nuchae as a landmark
- No vertebral a. through transverse foramen
Thoracic vertebrae: “typical” [T2~T10(9-11)] 1/2

- Body: larger than C-vertebrae; round canal
- Upper and lower surfaces: parallel to each other
- Spinous proc.: directly posteriorly
- Vertical articular facets: sup. facet faces posteriorly
Thoracic vertebrae: “typical” [T2~T10(9-11)] 2/2

- **Articular facets for ribs**
  - With rib head: sup. & inf. costal demifacet at upper & lower border of body
  - With tubercle of rib: costal facet on trans. proc.
Vertebra and rib

Superior costotransverse ligament

Joint with vertebral body

Costotransverse joint

Joint capsule

Rib

Disc

Intra-articular ligament

Vertebra

Joint cavities

Costotransverse ligament

Lateral costotransverse ligament

Anterior
Vertebra T1

- Upper surface of body: saddle-shaped
- Intermediate between C and T
- Triangular canal
- Rib1 contact T1 body only
Vertebra T11-T12

- Single rib articular facet; no rib articular facet on trans. proc.
- T12: intermediate between T and L
- Sup. articular facet: resembles T-vertebrae
- Inf. articular facet: resembles L-vertebrae
Lumbar vertebra: typical L1-L4

- Massive body; Small, triangular canal
- Short, square spinous proc.; sup. facet: faces medially
Lumbar vertebra: L5

- body: deeper anteriorly than posteriorly; lordosis
- Short massive transverse proc.; attached by ilio-lumbar lig
Sacrum and Coccyx: Sacrum

- Sacrum (5)
- Transfer body weight from vertebrae to pelvis
Sacrum: ant. surface

- Ala of sacrum
- Promontory
- Sacro-iliac joint: articular surface
- 4 ant. sacral foramina: S1-4 ant. primary rami
Sacrum: post. surface

- Sacral hiatus
- Median sacral crest
- Intermediate sacral crest
- Lateral sacral crest
- Post. sacral foramina
**Coccyx**

- Formed by 3-5 fused vertebrae

![Coccygeal cornu](image)
Comparison of vertebrae

CERVICAL VERTEBRAE

THORACIC VERTEBRAE

LUMBAR VERTEBRAE

Vertebrae- 32
Joints between adjacent vertebrae

- Intervertebral disc: body
- Zygapophyseal joint: facet
Intervertebral disc

- between bodies, cartilaginous joint
- Annulus fibrous (fibrocartilage) + nucleus pulposus
Herniation of intervertebral disc (HIVD)
Lig. between adjacent vertebrae

- body
  - Ant. Longitudinal lig.
  - Post. Longitudinal lig.
- lamina
  - Ligamentum flavum
- Spinous proc
  - Interspinous lig.
  - Supraspinous lig.: ligamentum nuchae of cervical region
Ligamentum flavum

- Between laminae, elastic fibers
- Posterior wall of vertebral canal; vs. post. long. lig.
Interspinous lig.

- Between adjacent spinous processes; membranous
Supraspinous lig.

- cord-like; C7-S
- nuchal ligament
Ligamentum nuchae: surface anatomy
Interspinous ligament

Left lateral view (partially sectioned)

- Anterior longitudinal ligament
- Lumbar vertebral body
- Intervertebral disc
- Anterior longitudinal ligament
- Posterior longitudinal ligament
- Inferior articular process
- Capsule of zygapophyseal joint (partially opened)
- Superior articular process
- Transverse process
- Spinous process
- Ligamentum flavum
- Interspinous ligament
- Supraspinous ligament
- Intervertebral foramen
Joints and ligaments: right lateral view

- Nuchal ligament
- Ligamenta flava
- Interspinous ligaments
- Spinous process of C7 vertebra
- Supraspinous ligament
- Articular capsule of zygapophysial joints
- Transverse process
- Anterior longitudinal ligament

External occipital protuberance
Posterior atlanto-occipital membrane
Atlas
Axis
Joints between Axis, Atlas, and Skull

- No intervertebral disc; wider range of movements than other vertebrae; dens as the center of rotation (“axis”)
- Large facet joint anteriorly: to bear weight
Atlanto-occipital joints

- Anterior atlanto-occipital membrane ~ ant. long. lig.
- Posterior atlanto-occipital membrane ~ lig. flavum
Functions of craniovertebral joints

- Nodding: atlanto-occipital joint
- Shaking head: atlanto-axial joint
Ant. atlanto-occipital lig.

- continuation of ant. longitudinal lig.
Post. atlanto-occipital lig.: ligamentum flavum
Atlantoaxial joints: cruciate (cruciform) ligaments

● = transverse lig. + sup. & inf. fibers to connect dens to foramen magnum
Tectorial membrane (ligament): posterior view

- extension of post. longitudinal lig.

Basilar part of occipital bone (clivus)

Upper part of vertebral canal with spinous processes and parts of vertebral arches removed to expose ligaments on posterior vertebral bodies: post.

- Tectorial membrane
- Deeper (accessory) part of tectorial membrane
- Posterior longitudinal ligament
- Alar ligaments

Capsule of atlantooccipital joint

Atlas (C1)

Capsule of atlantoaxial joint

Axis (C2)

Capsule of zygapophyseal joint (C2–3)
Tectorial membrane (ligament): sagittal view
Review on Vertebrae

- Common features of vertebrae
  - Characters of C, T, L, S vertebrae
  - Typical vs. Atypical vertebrae for different levels
- Joints
  - Body, Lamina, Spinous proc.
  - Equivalent structures: between vertebrae, vertebrocranial junctions