Cervical vertebrae

Position of human cervical vertebrae (shown in red). It consists of 7 bones, from top to bottom, C1, C2, C3, C4, C5, C6 and C7.

A human cervical vertebra

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In vertebrates, **cervical vertebrae** (singular: *vertebra*) are those vertebrae immediately inferior to the skull.

Thoracic vertebrae in all mammalian species are defined as those vertebrae that also carry a pair of ribs, and lie caudal to the cervical vertebrae. Further caudally follow the lumbar vertebrae, which also belong to the trunk, but do not carry ribs. In reptiles, all trunk vertebrae carry ribs and are called dorsal vertebrae.

In many species, though not in mammals, the cervical vertebrae bear ribs. In many other groups, such as lizards and saurischian dinosaurs, the cervical ribs are large; in birds, they are small and completely fused to the vertebrae. The transverse processes of mammals are homologous to the cervical ribs of other amniotes.
In humans, cervical vertebrae are the smallest of the true vertebrae, and can be readily distinguished from those of the thoracic or lumbar regions by the presence of a foramen (hole) in each transverse process, through which passes the vertebral artery.

The remainder of this article focuses upon human anatomy.

**Structure**

By convention, the cervical vertebrae are numbered, with the first one (C1) located closest to the skull and higher numbered vertebrae (C2-C7) proceeding away from the skull and down the spine.

**Features**

The general characteristics of the third through sixth cervical vertebrae are described here. The first, second, and seventh vertebrae are extraordinary, and are detailed later.

- The bodies of these four vertebrae are small, and broader from side to side than from front to back.
  - The *anterior* and *posterior surfaces* are flattened and of equal depth; the former is placed on a lower level than the latter, and its inferior border is prolonged downward, so as to overlap the upper and forepart of the vertebra below.
  - The *upper surface* is concave transversely, and presents a projecting lip on either side.
  - the *lower surface* is concave from front to back, convex from side to side, and presents laterally shallow concavities which receive the corresponding projecting lips of the underlying vertebra.
- The pedicles are directed laterally and backward, and are attached to the body midway between its upper and lower borders, so that the superior vertebral notch is as deep as the inferior, but it is, at the same time, narrower.
- The laminae are narrow, and thinner above than below; the vertebral foramen is large, and of a triangular form.
- The spinous process is short and bifid, the two divisions being often of unequal size. Because the spinous processes are so short, certain superficial muscles (the trapezius and splenius capitis) attach to the nuchal ligament rather than directly to the vertebra; the nuchal ligament itself attaching to the spinous processes of C2-C7 and to the posterior tubercle of the atlas.
- The superior and inferior articular processes of cervical vertebrae have fused on either or both sides to form *articular pillars*, columns of bone that project laterally from the junction of the pedicle and lamina.
- The articular facets are flat and of an oval form:
  - the *superior* face backward, upward, and slightly medially.
  - the *inferior* face forward, downward, and slightly laterally.
- The transverse processes are each pierced by the foramen transversarium, which, in the upper six vertebrae, gives passage to the vertebral artery and vein, as well as a plexus of sympathetic nerves. Each process consists of an anterior and a posterior part. These two parts are joined, outside the foramen, by a bar of bone that exhibits a deep sulcus on its upper surface for the passage of the corresponding spinal nerve.
  - The anterior portion is the homologue of the rib in the thoracic region, and is therefore named the *costal process* or *costal element*. It arises from the side of the body, is directed laterally in front of the foramen, and ends in a tubercle, the anterior tubercle.
  - The posterior part, the true transverse process, springs from the vertebral arch behind the foramen, and is directed forward and laterally; it ends in a flattened vertical tubercle, the posterior tubercle.
The cervical spinal nerves emerge from above the cervical vertebrae. For example, the cervical spinal nerve 3 (C3) passes above C3.

**Atlas and axis**

The Atlas (C1) and Axis (C2) are the two topmost vertebrae. The Atlas, C1, is the topmost vertebra, and along with the Axis; forms the joint connecting the skull and spine. Its chief peculiarity is that it has no body, and this is due to the fact that the body of the atlas has fused with that of the Axis.

The Axis, C2, forms the pivot upon which the Atlas rotates. The most distinctive characteristic of this bone is the strong odontoid process (dens) that rises perpendicularly from the upper surface of the body. The body is deeper in front than behind, and prolonged downward anteriorly so as to overlap the upper and front part of the third vertebra.

**Vertebra prominens**

The vertebra prominens, or C7, has a distinctive long and prominent spinous process, hence the name *vertebra prominens*. In some subjects, the seventh cervical vertebra is associated with an abnormal pair of ribs, known as cervical ribs. These ribs are usually small, but may occasionally compress blood vessels (such as the subclavian artery or subclavian vein) or nerves in the brachial plexus, causing pain, numbness, tingling, and weakness in the upper limb, a condition known as thoracic outlet syndrome.

**Function**

The movement of nodding the head takes place predominantly through flexion and extension at the joint between the atlas and the occipital bone, the atlanto-occipital joint. However, the cervical spine is comparatively mobile, and some component of this movement is due to flexion and extension of the vertebral column itself.

The movement of shaking or rotating the head left and right happens almost entirely at the joint between the atlas and the axis, the atlanto-axial joint. A small amount of rotation of the vertebral column itself contributes to the movement.

**Clinical significance**

Injuries to the cervical spine are common at the level of the second cervical vertebrae, but neurological injury is uncommon. C4 and C5 are the areas that see the highest amount of cervical spine trauma.[5]

If it does occur, however, it may cause death or profound disability, including paralysis of the arms, legs, and diaphragm, which leads to respiratory failure.

Common patterns of injury include the odontoid fracture and the hangman's fracture, both of which are often treated with immobilization in a cervical collar or Halo brace.

A common EMS practice is to immobilize a patient's cervical spine to prevent further damage during transport to Medical Aid. This practice has come under review recently as incidence rates of unstable spinal trauma can be as low as 2% in immobilized patients. Canadian studies have developed the Canadian C-Spine Rule (CCR) for physicians to decide who should receive radiological imaging.[6]
Landmarks

The vertebral column is often used as a marker of human anatomy. This includes:

- At C1, base of the nose and the hard palate
- At C2, the teeth of a closed mouth
- At C3, the mandible and hyoid bone
- At C4, the common carotid artery bifurcates.
- From C4-5, the thyroid cartilage
- From C6-7, the cricoid cartilage
- At C6, the oesophagus becomes continuous with the laryngopharynx and also where the larynx becomes continuous with the trachea. It is also the level where the carotid pulse can be palpated against the transverse process of the C6 vertebrae.

Additional images

- Position of cervical vertebrae (shown in red). Animation.
- Illustration of cervical vertebrae.
- Cervical vertebrae, lateral view (shown in blue and yellow).
- Vertebra column.
- X-Ray of cervical vertebrae.
- First cervical vertebra, or Atlas
- Second cervical vertebra, epistropheus, or axis, from above.
- Second cervical vertebra, epistropheus, or axis, from the side.
- Seventh cervical vertebra.
Cervical vertebrae

Posterior atlanto-occipital membrane and atlantoaxial ligament.

Median sagittal section through the occipital bone and first three cervical vertebrae.

Section of the neck at about the level of the sixth cervical vertebra.

References

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1. http://archive.org/stream/anatomyofhumanbo1918gray#page/97/mode/2up
3. http://www.unifr.ch/ffaa/Public/EntryPage/TA98%20Tree/Entity%20TA98%20EN/02.2.02.001%20Entity%20TA98%20EN.htm

External links

- Diagram (http://biology.kenyon.edu/heithausp/cat-tutorial/vertebrae/cervical.htm) at kenyon.edu
- Cervical vertebra quiz (http://anatomyhq.org/quizzes/labelling-exercises/cervical-vertebra/)
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