

# Spinal Anatomy

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The bony spinal column is composed of 7 cervical, 12 thoracic, 5 lumbar, 5 sacral, a 4-5 coccygeal vertebral bodies. From the front the spine tends to be straight, although in some it may have a tendency to curve to the right possibly as a result of the position of the aorta, and right-hand dominance. From the side (sagittal plane) the mean cervical lordosis from the base of the occiput to the top of C3 is 44 degrees. Normal thoracic kyphosis measures 35 degrees with a range from 20 to 50 degrees. Patients older than 70 years tend to have increased thoracic kyphosis from 29 – 79 degrees. Normal lumbar lordosis measures 60 degrees with a range from 20 to 80 degrees. Lumbar lordosis varies widely but evidence suggests that women and patients with higher body mass index have increased lumbar lordosis.

The sagittal diameters of the cervical canal are 17 to 18 mm at C3 –C6 and 15 mm at C7. Males and females have similar canal diameters and based on the relative larger sizes of the vertebral bodies tend to have a smaller ratio of canal to vertebral body diameter (Torg ratio). The canal diameter has a direct effect on the propensity toward spinal cord compression under certain conditions.

The vertebral bodies are interconnected via the intervertebral disc in the front of the spinal canal and the two facet joints posterior to the canal. This unit composes a vertebral segment otherwise known as a functional spinal unit. The disc is composed of the nucleus pulposus centrally and is surrounded by the anulus circumferentially. The disc carries substantial loads because of gravitational and muscle forces. It is the major anterior load bearing element in axial compression and flexion. As load is applied to the healthy disc it occurs through the nucleus placing the anular fibers in tension which are well suited to resist because of the orientation of the collagen fibers. The disc carries 80 -90% of the compressive load and the facets carry approximately 10 -20% of the load.

The spinal ligaments contribute to the static stability of the spine. In the cervical spine these ligaments consist of the ligamentum nuchae, atlantoaxial, atlantooccipital, and posterior longitudinal ligament. Continuing to the thoracic and lumbar spine the interspinous and supraspinous ligaments are formed by the confluence of muscle tendon and aponeuroses. The anterior longitudinal ligament is a broad thick ligament intricately interwoven with the fibers of the anulus fibrosis whereas the posterior longitudinal ligament is much thinner and narrower in the midline. The posterior longitudinal ligament offers only weak reinforcement to the anulus fibrosus.

There are 31 pairs of spinal nerves: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal. The spinal nerves are mixed and consist of the dorsal sensory fibers and ventral fibers. The anterior primary division ( ventral ramus) and posterior primary division ( dorsal ramus) of the mixed spinal nerve, the recurrent meningeal (sinu-vertebral) nerve, and the sensory fibers that course through the sympathetic nervous system provide sensation to the spinal elements. The spinal nerves supply sensation and motor function to specific dermatomes and myotomes determined by the location of the nerve root. Nerve roots are numbered according to the vertebral level from which they exit i.e. L2 exits from below the L2 pedicle with the cervical spine being the exception.

Here the nerve is numbered by the pedicle below the nerve root i.e. C5 exits on top of the C6 pedicle.

The blood supply of the spinal cord is received via the posterior and anterior spinal arteries. These arteries are small in the cervical spine and the cord will receive additional blood supply from branches of the vertebral, deep cervical, ascending cervical, and the highest intercostals arteries. The anterior spinal cord runs uninterrupted along the cord between the vertebral arteries, the arterial radicularis magna ( artery of Adamkiewicz), and the posterior intercostals and lumbar arteries. In the inferior thoracic and upper lumbar cord the majority is supplied via the artery of Adamkiewicz. In 80% of patients this artery arises from the left side off an inferior intercostal artery and enters the intervertebral foramen near the costovertebral joints from T9 – T12.

Knowledge of the anatomic elements of the spine is essential for proper diagnosis and treatment of pathologic and nonpathologic spinal conditions alike.