

VERTEBRAL COLUMN – Part a

I General Info

A. Vertebral Column Function/Structure

1. Provides support for upright posture (attenuate loads)
2. Protective, flexible casing for the spinal cord
3. Site of many muscle attachments
4. 33 total vertebrae
5. 24 vertebrae comprise the flexible column

B. Four Sections

1. Cervical Spine - 7 bones
2. Thoracic Spine - 12 bones
3. Lumbar Spine - 5 bones
4. Sacrum/Coccyx - 5 bones / 4 bones respectively (fused)

C. Vertebral column curvature

1. Primary curvature is present at birth (**Kyphotic** - 'C' shape)
2. Secondary curvatures develop as a result of erect posture and associated external forces such as gravity. (**Lordotic**)

a. Cervical Region (Secondary Curve)

Lordotic curve ... begins to develop when infants start to hold their head upright

b. Thoracic Region (Primary Curve)

Kyphotic curve ... present at birth

c. Lumbar Region (Secondary Curve)

Lordotic curve ... begins to develop when infants start to sit upright in response to weight bearing. Influenced by pelvic and lower extremity positioning.

d. Sacrococcygeal Curve (Primary Curve)

Kyphotic curve ... present at birth

D. Vertebral Unit (also called 'movement segment')

1. Definition: two adjacent vertebrae and the connective structures (including the disk) in between.
2. Disk -
 - Avascular
 - Aneural
 - a. Shape and thickness of disk depends of location in the vertebral column
 - b. Parts of Disk:
 - i) Nucleus Pulposus - Inner gelatinous center
 - ii) Annulus Fibrosis - Outer fibrous ring consisting of fibrocartilage. Surrounds the nucleus pulposus. Fibers of each alternate layer run perpendicular to the fibers of the previous layer.
 - c. Function
 - i) bears & distributes load within the vertebral column
 - ii) restrains excessive motion occurring in vertebral segment
 - d. Disc Wear
Over time, disks lose their ability to bind with water which causes a loss of elasticity and their ability to adequately store energy and distribute loads.

II. Major Bones

Four sections of the spine

1. Cervical spine
2. Thoracic spine
3. Lumbar spine
4. Sacral spine

III. Bony Landmarks

(Applies to each section of the spine)

Spinous process

Body

Transverse Process

Pedicle

Lamina

Vertebral Foramen
Superior and Inferior Articulating surfaces (facets)
Superior and Inferior vertebral notches
Intervertebral Foramina

Joints

Two Types

A. Central joints

- *From the axis to the sacrum*
- *Fibrocartilaginous disks between the bodies of adjacent vertebrae*
- *Disks are continuous with hyaline cartilage on the inferior and superior surfaces of the vertebral bodies*

1. Classification

Cartilaginous, synarthrotic

2. Description of articulating surfaces

Proximal: Inferior body of superior vertebrae

Distal: Superior body of inferior vertebrae

3. Movements

Negligable – deformation of disks

B. Lateral joints - (facets)

- *Synovial joints between the articular processes of adjacent vertebrae.*
- *The articular capsules are thin and loose.*
- *Flexibility of these joints depends upon their relative orientation to one another.*
- *Prevent forward translation of one vertebrae & help in load bearing*

1. Classification

Synovial – diarthrotic gliding

2. Description of articulating surfaces

Concave superior facet & convex inferior facet of adjacent vertebrae forming 2 joints on either side of the vertebrae

3. Movements

Gliding

IV. Supporting Structures

Ligaments

1. Anterior Longitudinal Ligament :Very dense, powerful ligament

Attachments

from axis down to sacrum attaching along anterior disc and vertiebral bodies of the motion segment

Function

*limits hyperextension of the spine
restrains forward movement of one vertebrae over another*

2. Posterior Longitudinal Ligament

Attachments

from the axis to the sacrum, runs down posterior surface of vertebral bodies, inside the spinal canal, and connects to the rim of the vertebral bodies and the center of the disc

Function

resists flexion of the spine

3. Interspinal Ligament

Attachments

runs the entire length of the vertebral column spinous process to adjacent spinous process

Function

*resists shear & forward bending of the spine
prevents excessive rotation*

4. Intratransverse Ligament

Attachments

runs entire length of the vertebral column connecting transverse process to adjacent transverse process

Function

resists lateral bending of the spine & slight rotation

5. Ligamentum Flavum

Attachments

runs entire length of the spine connecting adjacent vertebral arches longitudinally, attaching laminae to laminae

Function

*Elongates with flexion
Contracts with extension*

In neutral position, it is under constant tension, imposing a continual tension on the disc.

V. MUSCLES

(Know origins, insertions, function, and one example of an activity it performs)

A. Abdominals

1. Rectus Abdominis

Proximal: *Pubic crest and symphysis*

Distal: *Costal cartilages of fifth, sixth, and seventh ribs, and xiphoid process of sternum*

2. External Obliques

Proximal: *External surfaces of ribs five through eight interdigitating with Serratus anterior*

Distal: *Into a broad, flat aponeurosis, terminating in the linea alba, a tendinous raphe which extends from the xiphoid*

3. Internal Obliques

a. Lower Anterior Fibers

Proximal: *Lateral 2/3 of inguinal ligament, and short attachment on iliac crest near anterior superior spine*

Distal: *With Transversus abdominis into crest of pubis, medial part of pectineal line, and into linea alba by means of an aponeurosis*

b. Upper Anterior Fibers

Proximal: *Anterior 1/3 of intermediate line of iliac crest*

Distal: *Linea alba by means of aponeurosis*

c. Lateral Fibers

Proximal: *middle 1/3 of intermediate line of iliac crest, and thoracolumbar fascia*

Distal: *Inferior borders of 10th, 11th, and 12th ribs and linea alba by means of aponeurosis*

4. Transversus Abdominis

Proximal: *Inner surfaces of cartilages of lower six ribs, interdigitating with the diaphragm; thoracolumbar fascia; anterior $\frac{3}{4}$ of internal lip of iliac crest; and lateral 1/3 of inguinal ligament.*

Distal: *Linea alba by means of a broad aponeurosis, pubic crest and pecten pubis*

B. Erector Spinae

1. Iliocostalis

a. Lumborum

Proximal: *Common origin from anterior surface of broad tendon attached to medial crest of sacrum, spinous processes of lumbar and 11th and 12th thoracic vertebrae, posterior part of medial lip of iliac crest, supraspinous ligament, and lateral crests of sacrum.*

Distal: *by tendons into inferior borders of angles of lower six or seven ribs*

b. Thoracis

Proximal: *by tendons from upper borders of angles of lower six ribs*

Distal: *cranial borders of angles of upper six ribs, and dorsum of transverse process of 7th cervical vertebrae*

c. Cervicis

Proximal: *angles of 3rd, 4th, 5th, and 6th ribs*

Distal: *posterior tubercles of transverse processes of 4th, 5th, and 6th cervical vertebrae*

2. Longissimus

a. Thoracis

Proximal: *in lumbar region it is blended with iliocostalis lumborum, posterior surfaces of transverse and accessory processes of lumbar vertebrae, and anterior layer of thoracolumbar fascia.*

Distal: *by tendons into tips of transverse processes of all thoracic vertebrae, and by fleshy digitations into lower nine or ten ribs*

b. Cervicis

Proximal: *by tendons from transverse processes of upper four or five thoracic vertebrae*

Distal: *by tendons into posterior tubercles of transverse processes of 2nd through 6th cervical vertebrae.*

c. Capitis

Proximal: *by tendons from transverse processes of upper four to five thoracic vertebrae, and articular processes of lower three or four cervical vertebrae*

Distal: *posterior margin of mastoid process*

3. Spinalis

a. Thoracis

Proximal: *by tendons from spinous processes of 1st two lumbar and last two thoracic vertebrae*

Distal: *Spinous processes of upper four to eight thoracic vertebrae*

b. Cervicis

Proximal: *ligamentum nuchae, lower part; spinous process of 7th cervical*

Distal: *spinous process of axis and, occasionally, into spinous processes of C3 and C4*

c. Capitis

Proximal: *inseparably connected with Semispinalis capitis*

Distal: *between superior and inferior nuchal lines of occipital bone*

C. Quadratus Lumborum

Proximal: *Iliolumbar ligament, iliac crest. Occasionally from upper borders of transverse processes of lower three or four lumbar vertebrae.*

Distal: *Inferior border of last rib and transverse processes of upper four lumbar vertebrae.*