Typical vertebra

Ni Meningeal branches: periosteum, disc, PLL · Zygapophysial joints: medial branches of posterior rami

Aa Spinal branches of vertebral, posterior intercostal, lumbar aa.

Vv Basivertebral vv. to the internal vertebral venous plexus

P Body anterior, arch posterior: vertebral foramen · 1 spinous, 2 transverse, 4 articular processes

Vertebral body F Anterior part; bears and transmits body weight J Adjacent bodies through the intervertebral discs

Vertebral arch P Two pedicles and two laminae No Pars interarticularis: site of spondylolysis

Spinous process P Posterior, at the junction of the laminae F Levers for muscles; ligament attachment

Transverse process P Lateral, at the pedicle-lamina junction F Levers for deep muscles; thoracic: rib tubercle joint

Articular processes J Superior and inferior processes form the zygapophysial joints

Intervertebral foramen B Pedicles, disc and bodies, facet joint C Spinal nerve, spinal ganglion, vessels C Herniated disc or osteophytes compress the root

Atlas and axis

Ni C1 n.: between occiput and atlas posterior arch · C2 n.: between atlas posterior arch and axis lamina

Aa Vertebral a.: C1 foramen transversarium, then posterior-arch groove

Vv Suboccipital venous plexus; vertebral v. forms here

P Atlas: no body, no spinous process; axis: dens

Atlas (C1) P Anterior arch, posterior arch, two lateral masses Fa Superior: occipital condyles; inferior: axis T Anterior: longus colli; posterior: rectus capitis post. minor

Groove for the vertebral artery P Superior surface of the posterior arch of the atlas C Vertebral a. and suboccipital n. (C1)

Axis (C2) Fe Dens; large bifid spinous process No First spinous process palpable inferior to the occiput

Dens of the axis J Median atlanto-axial joint with the anterior arch H Transverse ligament of the atlas C Dens fracture endangers the spinal cord

Cervical, thoracic, lumbar

Ni C1-C7 nn. exit superior to their vertebra; C8 onward inferior

Aa Vertebral a. ascends through the foramina transversaria of C6-C1

Vv Vertebral v. descends with the artery to the brachiocephalic v.

C 7 cervical, 12 thoracic, 5 lumbar, 5 sacral (fused), 4 coccygeal

Cervical vertebra Fe Foramen transversarium, small body, bifid spine No Uncinate processes; carotid tubercle on C6

Vertebra prominens (C7) Fe Longest non-bifid cervical spinous process No Foramen transversarium usually lacks the vertebral a.

Thoracic vertebra Fe Costal facets on the body and transverse process S Heart-shaped body; long spine sloping inferiorly No T1: full facet for rib 1; T11-T12: no transverse costal facet

Lumbar vertebra Fe Large kidney-shaped body; no costal facets or foramen transversarium P Mammillary and accessory processes; hatchet-shaped spine

POST Sacrum and coccyx

Ni Anterior/posterior rami via anterior/posterior sacral foramina · Middle clunial nn.: posterior rami S1-S3

Aa Lateral sacral aa. (internal iliac a.); median sacral a. (aorta)

Vv Lateral, median sacral vv. to internal, common iliac vv.

Sacral promontory P Anterior lip of the S1 body No Posterior landmark of the pelvic inlet

Median sacral crest Fo Fused spinous processes No Intermediate crest: articular, lateral: transverse processes

Auricular surface F Sacro-iliac joint: transfers trunk weight to the pelvis No Sacral tuberosity: interosseous ligament

Sacral hiatus P Inferior end of the sacral canal, between the cornua C Caudal epidural anaesthesia

Coccyx P Usually four fused vertebrae; coccygeal cornua At Gluteus maximus, coccygeus, filum terminale

Disc and intervertebral joints

Ni Outer anulus: meningeal branches; facets: medial branches

Aa Adult disc avascular: diffusion through the end plates

Vv Bodies drain through basivertebral vv. to the internal plexus

Intervertebral disc P Anulus fibrosus, nucleus pulposus, end plates F Absorbs shock; allows movement between bodies C Posterolateral L4-L5 herniation compresses the L5 root

Zygapophysial joint T Synovial plane joint between articular processes F Guide and limit movement; orientation sets regional motion

Uncovertebral joint P Uncinate processes, C3-C7 C Osteophytes narrow the intervertebral foramen

Rib joints H Rib head on two demifacets and the disc T Rib tubercle on the transverse costal facet L Radiate, intra-articular; costotransverse (superior, lateral)

POST Ligaments of the column

Ni Meningeal branches: posterior longitudinal ligament and dura

Aa Spinal branches of the segmental aa.

Vv External and internal vertebral venous plexuses

L Needle: supraspinous, interspinous, flavum, dura, arachnoid

Anterior longitudinal ligament C Anterior bodies, occiput to sacrum F Limits extension; supports the disc anteriorly

Posterior longitudinal ligament C Posterior bodies, in the vertebral canal F Limits flexion; narrow lumbar: posterolateral herniation

Ligamentum flavum B Laminae of adjacent vertebrae F Elastic: limits flexion, helps restore erect posture

Supraspinous and interspinous ligaments C Spine tips C7-sacrum; between adjacent spines F Limit flexion

Nuchal ligament At External occipital protuberance to C7 spine; trapezius, splenius, rhomboid minor F Muscle attachment; supports the head

Atlanto-occipital and atlanto-axial

Ni C1 and C2 spinal nn.

Aa Branches of the vertebral and ascending pharyngeal aa.

Vv Suboccipital and internal vertebral venous plexuses

M Atlanto-occipital: flexion and extension; atlanto-axial: rotation

Atlanto-occipital joint T Synovial condylar: occipital condyles on the atlas M Anterior and posterior atlanto-occipital

Transverse ligament of the atlas F Holds the dens against the anterior arch No With the longitudinal bands: cruciate ligament

Alar ligaments At Sides of the dens to the occipital condyles F Limit rotation of the head

Tectorial membrane P Superior continuation of the posterior longitudinal ligament F Covers the cruciate ligament, reinforcing it posteriorly

SUP Superficial back muscles

Ni Trapezius: CN XI; latissimus: thoracodorsal n. · Levator, rhomboids: dorsal scapular n. (C5); levator also C3-C4

Aa Transverse cervical, dorsal scapular aa.; latissimus: thoracodorsal a.

Vv Transverse cervical v. to EJV; thoracodorsal to subscapular v.

Trapezius

O Superior nuchal line, nuchal ligament, spines C7-T12

I Lateral clavicle, acromion, scapular spine

F Descending: elevates; transverse: retracts; ascending: depresses scapula · With serratus anterior: rotates glenoid superiorly

Latissimus dorsi

O Spines T7-T12, thoracolumbar fascia, iliac crest, ribs 9-12

I Floor of the intertubercular groove

F Extends, adducts, medially rotates arm · Climbing; forced expiration (cough)

Levator scapulae

O Transverse processes C1-C4

I Medial border, superior angle to spine

F Elevates scapula · Rotates glenoid inferiorly

SUP Superficial back muscles (cont.)

Rhomboid major and minor
- O Minor: C7-T1 spines; major: T2-T5 spines
- I Medial border of the scapula
- F Retract and elevate scapula · Rotate glenoid inferiorly; fix scapula to the thoracic wall

POST Serratus posterior, thoracolumbar fascia

- Ni Serratus posterior: intercostal nn. (superior T2-T5, inferior T9-T12)
- Aa Posterior intercostal and subcostal aa.
- Vv Posterior intercostal vv. to the azygos system

Serratus posterior superior
- O Nuchal ligament, spines C7-T3
- I Ribs 2-5, lateral to the angles
- F Elevates ribs 2-5; mainly proprioceptive

Serratus posterior inferior
- O Spines T11-L2
- I Ribs 9-12
- F Depresses ribs 9-12; mainly proprioceptive

Thoracolumbar fascia
L Posterior, middle, anterior; erector spinae, quadratus lumborum between
F Encloses deep muscles; origin of latissimus, internal oblique, transversus

DEEP Splenius and erector spinae

- Ni All intrinsic back muscles: posterior (dorsal) rami · Erector spinae mainly lateral branches
- Aa Dorsal branches of posterior intercostal, subcostal, lumbar aa. · Neck: occipital, deep cervical, vertebral aa.
- Vv Accompanying vv. to the vertebral venous plexuses
- C Lateral to medial: iliocostalis, longissimus, spinalis
- Ff Both sides: extend the column; one: lateral flexion

Splenius capitis and cervicis
- O Nuchal ligament, spines C7-T6
- I Mastoid, superior nuchal line; C1-C3 transverse processes
- F Both: extend head and neck · One: laterally flexes, rotates head to the same side

Iliocostalis
- O Common tendon: iliac crest, sacrum, lumbar spines
- I Rib angles, cervical transverse processes
- F Extends column; one side: laterally flexes it

Longissimus
- O Common tendon; transverse processes
- I Transverse processes, ribs, mastoid process
- F Extends column; capitis: extends, turns head same side

Spinalis
- O Spinous processes
- I Spinous processes more superior
- F Extends the column

DEEP Transversospinales

- Ni Medial branches of the posterior rami
- Aa Dorsal branches of segmental aa.; occipital and deep cervical aa.
- Vv External vertebral venous plexus; deep cervical v.
- R Transverse process to spinous process superior to it
- S Semispinalis 4-6 segments, multifidus 2-4, rotatores 1-2

Semispinalis capitis
- O Transverse processes T1-T6, articular C4-C7
- I Occiput between the nuchal lines
- F Extends head; rotates it to the opposite side

Note: Pierced by the greater occipital n.

Multifidus
- O
- I Spinous processes 2-4 segments superior
- F Stabilises lumbar segments; extends, rotates to opposite side

Position:
On the laminae; thickest in the lumbar region

Rotatores
P Deepest layer; best developed in the thoracic region
F Rotate to the opposite side; stabilise; proprioception

Interspinales and intertransversarii
P Between adjacent spines; between adjacent transverse processes F Interspinales extend; intertransversarii laterally flex

DEEP Suboccipital muscles and triangle

- Ni Suboccipital n. (C1 posterior ramus): all four · Greater occipital n. (C2) emerges inferior to obliquus inferior
- Aa Vertebral a. (atlantic part) and occipital a.
- Vv Suboccipital plexus to vertebral, deep cervical vv.
- Ff Mainly postural; proprioception of head position

Rectus capitis posterior major
- O Spinous process of the axis
- I Lateral inferior nuchal line
- F Extends head; rotates it to the same side

Rectus capitis posterior minor
- O Posterior tubercle of the atlas
- I Medial inferior nuchal line
- F Extends head

Obliquus capitis superior
- O Transverse process of the atlas
- I Occiput between the nuchal lines
- F Extends and laterally flexes head

Obliquus capitis inferior
- O Spinous process of the axis
- I Transverse process of the atlas
- F Rotates atlas and head to the same side

Suboccipital triangle
B Rectus capitis posterior major, both obliques Fl Atlas posterior arch, posterior atlanto-occipital membrane C Vertebral a., suboccipital n. R Semispinalis capitis

POST Triangles of the back

- Ni Subcostal n., vessels cross the superior lumbar triangle floor
- Aa Lumbar and subcostal aa. deep to the lumbar triangles
- Vv Lumbar vv. deep to the lumbar triangles

Triangle of auscultation
B Trapezius, latissimus dorsi, medial border of scapula Fl Rhomboid major, sixth intercostal space F Lung sounds clearest; widens with arms folded, trunk flexed

Inferior lumbar triangle
B Latissimus dorsi, external oblique, iliac crest Fl Internal oblique C Lumbar hernia (Petit)

Superior lumbar triangle
B 12th rib, erector spinae, internal oblique Fl Transversus abdominis aponeurosis

Posterior (dorsal) rami and nerves of the back

- Ni Posterior rami: intrinsic muscles, facet joints, skin of back · Superficial back muscles: anterior rami and CN XI
- Aa Occipital a. runs with the greater occipital n.
- Vv Occipital v. to the suboccipital venous plexus

Posterior ramus of a spinal nerve
C Posteriorly, lateral to the articular process B Medial and lateral branches

Suboccipital nerve (C1)
C Between the vertebral a. and the posterior arch of atlas S Suboccipital muscles; motor

Greater occipital nerve (C2)
C Pierces semispinalis capitis and trapezius S Skin of the posterior scalp

Clunial nerves
S Posterior rami L1-L3, across the iliac crest M Posterior rami S1-S3

DEEP Spinal cord and meninges

- Ni Meningeal branches supply the dura
- Aa 1 anterior, 2 posterior spinal aa.; segmental medullary aa. · Great anterior segmental medullary a.: usually left, T9-L2
- Vv Spinal vv. to the valveless internal vertebral plexus · Valveless: route of metastatic spread
- L Adult cord ends L1-L2; dural sac ends S2

Spinal cord
E Foramen magnum to L1-L2 E Cervical, lumbosacral (limb plexuses) F Conducts ascending, descending tracts; segmental reflexes

Conus medullaris and cauda equina
C Tapered end of the cord, L1-L2 C Lumbosacral roots in the lumbar cistern

Spinal nerve roots
R Posterior sensory, anterior motor; join in the foramen G Spinal ganglion (posterior root): sensory cell bodies

Spinal meninges
L Dura, arachnoid, pia, superficial to deep S Epidural: fat, veins; subarachnoid: CSF F Protect the cord; CSF cushions it

Denticulate ligament
F Anchors the cord laterally to the dura, between roots

Filum terminale
F Anchors the conus to the coccyx; dura-covered from S2

Lumbar cistern
E Subarachnoid space, L2 to S2 C Lumbar puncture at L3-L4 or L4-L5