ANT Sternum and sternal angle

Ni Anterior cutaneous branches of intercostal nn.

Aa Internal thoracic a.: sternal and perforating branches

Vv Internal thoracic vv.; parasternal lymph nodes

C Sternal marrow puncture; median sternotomy

Manubrium L T3–T4 vertebrae Ar Clavicles, 1st costal cartilages, part of the 2nd

Sternal angle M 2nd costal cartilage; T4–T5 disc P Superior/inferior mediastinum; ends of arch; tracheal bifurcation No Azygos v. joins the SVC; pulmonary trunk bifurcates

Xiphoid L Xiphisternal joint at T9 At Sternal part of the diaphragm, linea alba, rectus abdominis

LAT Ribs and costal cartilages

Ni Intercostal n. in the costal groove of each rib

Aa Posterior and anterior intercostal aa.

Vv Intercostal vv. to the azygos system and internal thoracic v.

T True 1–7; false 8–10; floating 11–12; arch: cartilages 7–10

Ff Inspiration: pump handle (ribs 2–6), bucket handle (7–10)

C Fracture just anterior to the angle; flail chest if segmental

Typical rib P Head (2 facets), neck, tubercle, angle, body Ar Head: own and superior vertebra; tubercle: own transverse process

First rib Fe Scalene tubercle; subclavian v. groove anterior, a. groove posterior R Neck: sympathetic trunk, supreme intercostal v. and a., T1 ramus

Costal groove C Intercostal v., a., n. (VAN), superior to inferior No Needles pass at the superior border of the inferior rib

POST Thoracic vertebrae and costovertebral joints

Ni Joints: dorsal rami of thoracic spinal nn.

Aa Posterior intercostal aa.: dorsal and spinal branches

Vv Vertebral venous plexuses to posterior intercostal vv.

C Compression fracture at the thoracolumbar junction

Thoracic vertebra Fe Heart-shaped body; long sloping spine; 3 costal facets At T1: full facet rib 1; T10–T12: single facets; T11–12: no transverse facet

Head joint T Synovial; rib head to two bodies and the disc L Radiate lig.; intra-articular lig. splits the cavity

Costotransverse joint T Rib tubercle to the transverse costal facet No Absent at ribs 11–12; superior and lateral ligg.

DEEP Intercostal muscles

Ni Intercostal nn.; subcostal n. (T12)

Aa Posterior (aorta) and anterior (internal thoracic) aa.

Vv Intercostal vv. with the arteries

L External, internal, innermost; bundle between the last two

Ff Accessory inspiration: SCM, scalenes, pectorals, levatores

External intercostal

O Inferior border of a rib

I Superior border of the next rib

F Elevates ribs: inspiration · Fibres inferoanterior; membrane anteriorly

Internal intercostal

O Costal groove of a rib

I Superior border of the next rib

F Depresses ribs: forced expiration · Fibres inferoposterior; interchondral part elevates

Innermost intercostal P Deepest layer, lateral part of the space No Layer with subcostales and transversus thoracis F As internal intercostals: depresses ribs, expiration

Transversus thoracis

O Posterior surface of the inferior sternum and xiphoid

I Costal cartilages 2–6

F Weakly depresses costal cartilages: expiration

DEEP Intercostal nerves and vessels

Ni Anterior rami T1–T11 = intercostal nn.; T12 = subcostal n.

Aa Posterior 1–2: supreme intercostal a.; 3–11: aorta · Anterior: internal thoracic (1–6), musculophrenic (7–9)

Vv Posterior vv. to azygos/hemiazygos; anterior to internal thoracic v.

Intercostal n. C Costal groove, between internal and innermost layers B Muscular, collateral, lateral and anterior cutaneous F Intercostal mm.; skin and parietal pleura of the space

Intercostobrachial n. Ar Lateral cutaneous br. of T2: skin of axilla, medial arm

Posterior intercostal aa. Ar Thoracic aorta, spaces 3–11 B Dorsal, collateral, lateral cutaneous

ANT Internal thoracic vessels

Ni Phrenic n. crosses the artery near its origin

Aa From the first part of the subclavian a.

Vv Internal thoracic vv. to the brachiocephalic v. · Parasternal nodes along the vessels: medial breast drains here

C Bypass graft: internal thoracic a. to anterior interventricular branch

Internal thoracic a. C 1 cm lateral to the sternum, posterior to cartilages 1–6 E 6th space: musculophrenic and superior epigastric aa.

Musculophrenic a. C Along the costal arch; anterior intercostal aa. 7–9

Superior epigastric a. C Sternocostal triangle to rectus sheath; meets inferior epigastric a.

INF Diaphragm and its openings

Ni Motor: phrenic nn. (C3–C5) · Sensory periphery: inferior intercostal and subcostal nn.

Aa Sup. and inf. phrenic, pericardiacophrenic, musculophrenic aa.

Vv Phrenic vv. with the arteries

L IVC T8, oesophagus T10, aorta T12

C Referred shoulder-tip pain (C4) from diaphragmatic irritation

Diaphragm

O Xiphoid, cartilages and ribs 7–12, crura, arcuate ligg.

I Central tendon

F Main muscle of inspiration

Right crus

O Bodies L1–L3; left crus L1–L2

I

F Encircles the hiatus: anti-reflux sphincter

Caval opening C T8, central tendon: IVC, right phrenic n. branches

Oesophageal hiatus C T10, right crus: oesophagus, vagal trunks

Aortic hiatus C T12, median arcuate lig.: aorta, thoracic duct, ± azygos v.

Pleura and recesses

Ni Parietal: intercostal and phrenic nn., pain-sensitive · Visceral: autonomic, pain-insensitive

Aa Parietal: intercostal, internal thoracic aa.; visceral: bronchial aa.

Vv Parietal: intercostal, parasternal nodes; visceral: bronchopulmonary

L Rib 8 midclavicular, 10 midaxillary, 12 paravertebral; lung 6, 8, 10

Ff Frictionless gliding; surface tension couples lung to wall

C Pleural tap: 9th space, midaxillary line, superior rib border

Parietal pleura P Costal, mediastinal, diaphragmatic, cervical

Cervical pleura P 2–3 cm superior to medial third of clavicle; suprapleural membrane

Costodiaphragmatic recess P Deepest recess; midaxillary line ribs 8–10; fluid collects here

Pulmonary ligament S Pleural fold hanging from the lung root

Lungs, lobes and fissures

Ni Pulmonary plexus: vagus constricts, sympathetic dilates bronchi

Lungs, lobes and fissures (cont.)

Aa Bronchial aa. nourish lung; pulmonary aa. bring blood to oxygenate

Vv Pulmonary vv. to the left atrium; bronchial vv. to the azygos system · Lymph: bronchopulmonary then tracheobronchial nodes

Ff Gas exchange; elastic recoil drives quiet expiration

C Pancoast tumour at the apex: Horner syndrome, T1 pain

Right lung L 3 lobes, oblique and horizontal fissures; 10 segments No Shorter and wider: right dome more superior

Left lung L 2 lobes, oblique fissure; 8–10 segments Fe Cardiac notch; lingula of the superior lobe

Apex P Into the neck, 2–3 cm superior to the clavicle R Subclavian a. grooves it; cervical pleura covers it

Oblique fissure M T2–T3 spine to the 6th costal cartilage; isolates the inferior lobe

Horizontal fissure M Right only: 4th rib and cartilage, midaxillary line to sternum

MED Root, hilum and mediastinal surfaces

Ni Phrenic n. anterior, vagus posterior to the root; pulmonary plexus

Aa Pulmonary a.: superior on the left, anterior on the right

Vv Pulmonary vv. most anterior and most inferior

Lung root L T5–T7 vertebrae C Bronchus, pulmonary a., 2 pulmonary vv., bronchial vessels, nodes, plexus

Right hilum Or Superior lobar bronchus eparterial; veins anteroinferior

Left hilum Or Pulmonary a. superior; bronchus posterior; veins anteroinferior

Right mediastinal surface G Right atrium, SVC, azygos arch, oesophagus, IVC

Left mediastinal surface G Left ventricle, aortic arch, descending aorta, left subclavian a.

Trachea and main bronchi

Ni Vagus and recurrent laryngeal nn.; sympathetic trunk

Aa Inferior thyroid and bronchial aa.

Vv Inferior thyroid vv.; paratracheal and tracheobronchial nodes

C Inhaled bodies enter the right main bronchus

Trachea E C6 (cricoid) to the sternal angle, T4–T5 F 16–20 C-rings keep airway open; trachealis narrows it

Carina P Internal ridge at the bifurcation C Widened by an enlarged left atrium or nodes

Right main bronchus Fe Shorter, wider, more vertical; azygos arch over it

Left main bronchus Fe Longer, horizontal; inferior to arch, anterior to oesophagus

Mediastinum and its divisions

Ni Phrenic nn. pass anterior, vagi posterior to the lung roots

Aa Aorta: ascending (middle), arch (superior), descending (posterior)

Vv SVC, brachiocephalic vv. (superior); azygos, thoracic duct (posterior)

P Transverse thoracic plane: sternal angle to the T4–T5 disc

Superior mediastinum C Thymus, great vessels, trachea, oesophagus, thoracic duct, nn.

Anterior mediastinum C Sternopericardial ligg., fat, nodes; thymus in children

Middle mediastinum C Pericardium, heart, roots of great vessels, phrenic nn.

Posterior mediastinum C Descending aorta, oesophagus, thoracic duct, azygos, vagi, splanchnic nn.

SUP Aorta and arch branches

Ni Left vagus and phrenic nn. cross the left side of the arch · Left recurrent laryngeal n. loops posterior to the ligamentum

Aa Arch: brachiocephalic trunk, left common carotid, left subclavian

Vv Left brachiocephalic v. crosses anterior to the branches

C Coarctation at isthmus: rib notching (intercostal collaterals)

Ascending aorta C Left ventricle to the sternal angle, in the pericardium B Right and left coronary aa. only

Aortic arch C Begins and ends at the sternal angle plane R Arches over the left main bronchus and pulmonary a.

Brachiocephalic trunk E Divides posterior to the right sternoclavicular joint

Ligamentum arteriosum J Arch to the left pulmonary a.: ductus arteriosus remnant

Thoracic aorta C T4–T12, left of the bodies, then midline at the hiatus B Posterior intercostal, subcostal, bronchial, oesophageal, sup. phrenic

POST SVC, brachiocephalic and azygos veins

Ni Right phrenic n. descends on the SVC

Aa Right posterior intercostal aa. cross posterior to the azygos v.

Vv Azygos: from right ascending lumbar and subcostal vv.

C SVC obstruction: azygos and thoracoepigastric collaterals

SVC C Formed at the right 1st cartilage; enters right atrium at the 3rd

Left brachiocephalic v. C Posterior to the manubrium, anterior to the arch branches

Azygos v. C Right of bodies; arches over right root to SVC at T4

Hemiazygos v. C Left side; crosses to the azygos v. at T9

R superior intercostal v. D Spaces 2–4 to the azygos arch

L superior intercostal v. C Crosses the aortic arch to the left brachiocephalic v.

Nerves of the mediastinum

Ni Phrenic C3–C5 somatic; vagus slows heart; trunk (T1–L2) speeds it

Aa Pericardiacophrenic a. runs with the phrenic n.

Vv Pericardiacophrenic vv. with the artery

C Left recurrent n. compressed by aneurysm or nodes: hoarseness

Phrenic n. C Anterior to the lung root, on the pericardium S Diaphragm (motor); pericardium, mediastinal, diaphragmatic pleura

Vagus n. C Posterior to the lung root; forms the oesophageal plexus S Right on the trachea; left crosses the aortic arch

Left recurrent laryngeal n. C Loops inferior to the arch at the ligamentum arteriosum F Motor: intrinsic laryngeal mm. except cricothyroid

Sympathetic trunk P On rib heads; white and grey rami to spinal nn.

Greater splanchnic n. C Ganglia T5–T9; pierces the crus to the coeliac ganglion F Preganglionic sympathetic to foregut viscera

POST Oesophagus, thoracic duct and thymus

Ni Oesophageal plexus (vagi) and sympathetic trunks

Aa Oesophageal brr. of thoracic aorta; left gastric a. inferiorly

Vv Azygos and left gastric vv.: portosystemic anastomosis

C Oesophageal varices in portal hypertension

Oesophagus C C6 to the cardia; posterior to the trachea and left atrium F Peristalsis carries the bolus to the stomach C Pharyngo-oesophageal junction, aortic arch, left bronchus, diaphragm

Thoracic duct C Aortic hiatus; between aorta and azygos v., posterior to oesophagus F Lymph and chyle of all but right upper quadrant E Crosses left at T4–T6; enters the left venous angle

Thymus P Superior and anterior mediastinum, posterior to the manubrium F T-lymphocyte maturation; involutes after puberty

Pericardium · sinuses

Ni Fibrous, parietal layers: phrenic nn. (C3–C5); visceral: pain-insensitive

Aa Pericardiacophrenic aa. (internal thoracic a.)

Vv Pericardiacophrenic vv. to brachiocephalic or internal thoracic vv.

C Tamponade: cavity fluid compresses the heart · Pericardial pain refers to the shoulder (C4)

Fibrous pericardium At Central tendon; sternopericardial ligg. F Anchors the heart; prevents sudden overdilation

Serous pericardium L Parietal lines the fibrous sac; visceral = epicardium F Serous fluid: frictionless gliding

Transverse pericardial sinus P Posterior to aorta and pulmonary trunk, anterior to SVC and atria No Clamp route in bypass surgery

Oblique pericardial sinus P Posterior to the left atrium, among pulmonary vv. and IVC

ANT External heart · surfaces, borders

Ni Cardiac plexus (sympathetic T1–T4, vagus)

Aa Right and left coronary aa. from the ascending aorta

Vv Cardiac vv. to coronary sinus, then right atrium

B Right: right atrium; left: left ventricle, left auricle · Inferior: right ventricle; superior: atria, great vessels

Apex of the heart Fo Left ventricle; left 5th intercostal space, midclavicular line

Base of the heart Fo Mainly left atrium; faces posteriorly, toward the oesophagus

Sternocostal surface Fo Mainly right ventricle

Diaphragmatic surface Fo Both ventricles, mainly left; on the central tendon

Surface sulci

Ni Coronary plexuses run with the arteries

Aa Coronary aa. and main branches lie in the sulci

Vv Coronary sinus: posterior coronary sulcus

Coronary sulcus C Right coronary a., circumflex branch, coronary sinus, small cardiac v.

Anterior interventricular sulcus C Anterior interventricular branch, great cardiac v.

Posterior interventricular sulcus C Posterior interventricular branch, middle cardiac v.

Crux of the heart P Meeting of coronary, interatrial, posterior interventricular sulci

SUP Great vessels · roots

Ni Left recurrent laryngeal n. hooks the arch at the ligamentum arteriosum

Aa Arch: brachiocephalic trunk, left common carotid, left subclavian aa.

Vv SVC, IVC to right atrium; four pulmonary vv. to left atrium

Ascending aorta C From the left ventricle, right of the pulmonary trunk B Right and left coronary aa. only

Pulmonary trunk C From the conus arteriosus; divides in the arch concavity

Ligamentum arteriosum At Left pulmonary a. origin to arch concavity; ductus remnant

Superior vena cava C Into the superior right atrium; azygos v. joins it

Pulmonary veins C Two each side, valveless, into the left atrium

LAT Right atrium

Ni Sinuatrial node in its wall (cardiac plexus input)

Aa Right coronary a. (atrial, sinuatrial nodal branches)

Vv Receives SVC, IVC, coronary sinus, anterior cardiac vv.

T Smooth sinus of venae cavae, rough pectinate part; crista between

Crista terminalis P Ridge from SVC to IVC; matches terminal sulcus F Atrial contraction; fast conduction from sinuatrial node

Pectinate muscles P Anterior wall and right auricle F Atrial contraction; strengthen the thin auricular wall

Fossa ovalis P Interatrial septum; limbus is its margin C Patent foramen ovale: interatrial shunt

Opening of the coronary sinus P Between IVC opening and right atrioventricular orifice

Triangle of Koch B Coronary sinus opening, tendon of Todaro, septal cusp; AV node

ANT Right ventricle

Ni Right bundle branch in the septomarginal trabecula

Aa Right coronary a.; anterior part from the left coronary

Vv Anterior cardiac vv. to right atrium; small cardiac v.

Conus arteriosus P Smooth outflow funnel to the pulmonary valve

Supraventricular crest P Separates rough inflow from the smooth conus F Deflects inflow into the cavity, outflow into the conus

Septomarginal trabecula At Septum to anterior papillary muscle F Right bundle branch shortcut to anterior papillary muscle

Papillary muscles of right ventricle P Anterior (largest), posterior, septal F Tense chordae in systole: no tricuspid eversion

POST Left atrium · left ventricle

Ni Left bundle branch, subendocardial, left side of the septum

Aa Left coronary a. (circumflex, anterior interventricular)

Vv Great cardiac v., posterior v. of left ventricle, oblique v.

C Enlarged left atrium indents the oesophagus (barium swallow)

Left atrium P Most posterior chamber; four pulmonary v. openings R Oesophagus posterior, across the oblique sinus

Left auricle P Left of the pulmonary trunk; its only pectinate muscles

Left ventricle W 2–3 times as thick as the right P Anterior, posterior papillary muscles F Pumps blood into the aorta · Papillary muscles tense chordae: no mitral eversion

POST Left atrium · left ventricle (cont.)

Aortic vestibule — P Smooth outflow part to the aortic valve

Interventricular septum — P Thick muscular; thin membranous near the aortic valve — C Ventricular septal defect: mostly membranous

Atrioventricular valves

Ni Cardiac plexus only

Aa Papillary muscles: coronary a. of their ventricle · Left posterior papillary muscle: often single supply, ruptures more

Vv Cusps nearly avascular; papillary muscles to cardiac vv.

Au Tricuspid: left sternal border; mitral: apex (both 5th intercostal space)

Tricuspid valve — P Anterior, posterior and septal cusps — F Stops backflow from right ventricle to right atrium (systole)

Mitral valve — P Anterior (next to aortic orifice), posterior cusps — F Stops backflow from left ventricle to left atrium (systole)

Chordae tendineae — At Papillary muscle tips to the cusp edges — F Hold cusps closed: no eversion into the atrium

SUP Semilunar valves · aortic sinuses

Ni Cardiac plexus only

Aa Coronary aa. open in right and left aortic sinuses

Vv Cusps nearly avascular; aortic root to cardiac vv.

Au Aortic: right 2nd intercostal space; pulmonary: left 2nd

Aortic valve — P Right, left, posterior (non-coronary) cusps; nodules, lunules — F Stops backflow from aorta to left ventricle (diastole)

Aortic sinuses — C Right and left coronary aa. open in their sinuses — F Diastolic backflow closes cusps and fills coronary aa.

Pulmonary valve — P Anterior, right, left cusps; top of conus — F Stops backflow from pulmonary trunk to right ventricle (diastole)

LAT Right coronary artery

Ni Coronary plexus

Aa From the right aortic sinus, into the right coronary sulcus · Right dominance (about 2/3): gives posterior interventricular branch

Vv Small cardiac v. with it; middle cardiac v. with posterior branch

S Right atrium, right ventricle, both nodes (usually)

Right coronary artery — C Between right auricle and pulmonary trunk; coronary sulcus to crux

Sinuatrial nodal branch — C Early branch to SVC opening and sinuatrial node (about 60%)

Right marginal branch — C Along the inferior border toward the apex

Posterior interventricular branch — C In posterior interventricular sulcus; septal branches

MED Left coronary artery

Ni Coronary plexus

Aa From the left aortic sinus, between pulmonary trunk and left auricle

Vv Great cardiac v. with anterior interventricular, circumflex branches

C Anterior interventricular branch: most often occluded

Left coronary artery — B Anterior interventricular and circumflex branches

Anterior interventricular branch — C In the anterior interventricular sulcus to the apex — B Diagonal and anterior septal branches

Circumflex branch — C In the left coronary sulcus around the left border — B Left marginal branch

POST Cardiac veins · coronary sinus

Ni No named nerves

Aa Veins follow the coronary branches

Vv Most to coronary sinus; anterior, smallest cardiac vv. open directly · Lymph: tracheobronchial and brachiocephalic nodes

Coronary sinus — P Posterior coronary sulcus; opens into the right atrium

Great cardiac vein — C Anterior interventricular sulcus, then left coronary sulcus

Middle cardiac vein — C Posterior interventricular sulcus to the sinus

Small cardiac vein — C With right marginal branch, then right coronary sulcus

Anterior cardiac veins — C Cross the coronary sulcus into the right atrium

Conducting system

Ni Sympathetic and vagal fibres reach both nodes

Aa Nodes: usually right coronary a.; bundle branches: septal branches

Vv Drains to the coronary sinus

Or SA node (pacemaker), AV node (delay), bundle, branches, Purkinje (spread)

Sinuatrial node — P Superior crista terminalis at the SVC opening — F Pacemaker: sets the heart rate (about 70/min)

Atrioventricular node — P Interatrial septum, apex of triangle of Koch — F Delays impulse: atria empty before ventricles contract

Atrioventricular bundle — C Right fibrous trigone to membranous septum; divides — F Only conduction route across the fibrous skeleton

Right bundle branch — C Septomarginal trabecula to the anterior papillary muscle

DEEP Cardiac plexus

Ni Sympathetic: cervical, T1–T4 cardiac nn.; vagal cardiac branches

Aa Lies on the arch and pulmonary arteries

Vv No veins of note

Ff Sympathetic: faster rate, stronger beat, more coronary flow · Vagus: slower rate, weaker beat

C Pain afferents run with sympathetic fibres to T1–T4: left arm

Superficial part of cardiac plexus — P Inferior to the arch, anterior to right pulmonary a.

Deep part of cardiac plexus — P Between the arch and the tracheal bifurcation

Triangles of the neck

Ni Posterior triangle: CN XI, cervical plexus skin brs., plexus trunks

Aa Carotid triangle: bifurcation; superior thyroid, lingual, facial aa.

Vv IJV deep to SCM; EJV crosses the posterior triangle to the subclavian v.

Anterior triangle B Midline, anterior border of SCM, inferior border of the mandible P Submental, submandibular, carotid, muscular triangles

Posterior triangle B Posterior border of SCM, trapezius, middle third of the clavicle Fl Prevertebral fascia on splenius, levator scapulae, scalenes P Omohyoid splits it: occipital, omoclavicular triangles

Carotid triangle B SCM, posterior belly of digastric, superior belly of omohyoid C Carotid bifurcation, IJV, vagus n., hypoglossal n., ansa cervicalis

Submandibular triangle B Inferior border of the mandible and both bellies of the digastric C Submandibular gland and nodes, facial a. and v., hypoglossal n.

Submental triangle B Both anterior bellies of the digastric and the body of the hyoid Fl Mylohyoid muscles; submental lymph nodes

SUP Superficial layer · cervical fascia

Ni Platysma: cervical br. of the facial n.; SCM and trapezius: accessory n. (CN XI)

Aa SCM: brs. of the occipital and superior thyroid aa.

Vv EJV runs on the SCM, deep to the platysma

Platysma At Pectoral and deltoid fascia to mandible, skin of mouth F Tenses neck skin; depresses mandible and mouth corners Ne Cervical branch of the facial n.

Sternocleidomastoid At Manubrium and medial third of clavicle to mastoid process F One side: tilts head to same side, turns face to opposite · Both: flex neck, protrude head; accessory inspiration C Congenital torticollis: one SCM fibrosed

Deep cervical fascia L Investing (SCM, trapezius), pretracheal (thyroid, trachea), prevertebral F Planes let structures glide in swallowing; channel infection C Retropharyngeal infection can spread to the mediastinum

Carotid sheath C Carotid a. medial, IJV lateral, vagus n. posterior between them R Ansa cervicalis on it; sympathetic trunk posterior

ANT Suprahyoid and infrahyoid muscles

Ni Anterior digastric, mylohyoid: V3; posterior digastric, stylohyoid: VII

Ni Geniohyoid: C1 fibres via the hypoglossal n.

Ni Infrahyoid: ansa cervicalis (C1–C3); thyrohyoid: C1 via CN XII

Aa Lingual, facial, superior thyroid aa.; vv. to the IJV

Ff Suprahyoid mm. raise hyoid and larynx in swallowing · Thyrohyoid: depresses hyoid; raises larynx if hyoid fixed

Digastric At Anterior belly: digastric fossa; posterior belly: mastoid notch F Depresses mandible; elevates and steadies the hyoid No Tendon slung to the hyoid by a fibrous loop

Stylohyoid At Styloid process to hyoid; split by the digastric tendon F Elevates and retracts the hyoid

Mylohyoid At Mylohyoid line to median raphe and hyoid body F Elevates hyoid, mouth floor and tongue in swallowing No Floor of the mouth; submandibular gland wraps its posterior border

Geniohyoid At Inferior mental spine to hyoid body, deep to mylohyoid F Pulls hyoid anterosuperiorly; depresses mandible if hyoid fixed

Sternohyoid and sternothyroid At Manubrium to hyoid; sternothyroid deeper, to the oblique line F Depress the hyoid (sternohyoid) and larynx (sternothyroid)

Omohyoid At Superior border of scapula to hyoid; intermediate tendon on the IJV F Depresses and steadies the hyoid No Inferior belly divides the posterior triangle

DEEP Scalenes · prevertebral · brachial plexus

Ni Scalenes and longus colli: ventral rami of cervical nn.

Ni Phrenic n. descends on scalenus anterior, lateral to medial

Aa Subclavian a. and plexus pass between scalenus anterior and medius

Vv Subclavian v. crosses the first rib anterior to scalenus anterior

Scalenus anterior At Anterior tubercles C3–C6 to scalene tubercle of first rib F Elevates first rib; flexes neck laterally R Anterior: phrenic n., subclavian v.; posterior: subclavian a., plexus

Scalenus medius and posterior At Medius: posterior tubercles to first rib; posterior: to second rib F Elevate first and second ribs; flex neck laterally R Dorsal scapular n., long thoracic n. (C5–C6) pierce scalenus medius

Longus colli and longus capitis P On anterior vertebral bodies, deep to prevertebral fascia F Flex the neck (colli) and the head (capitis) R Sympathetic trunk lies on them

Brachial plexus in the neck R Ventral rami C5–T1 in the scalene interval T Superior (C5–C6), middle (C7), inferior (C8–T1) C Erb: superior trunk; Klumpke: inferior trunk

Carotid arteries

Ni Carotid sinus br. of CN IX; vagus n. posterior in the sheath

Aa Right CCA from brachiocephalic trunk; left CCA from aortic arch

Vv IJV lateral to the carotid arteries in the sheath

Common carotid artery C Ascends in the carotid sheath; no branches E Divides at superior border of thyroid cartilage (C3–C4) No Compressible on the carotid tubercle (C6)

Internal carotid artery C Posterolateral to ECA at origin; enters the carotid canal B None in the neck

Carotid sinus and carotid body P Sinus: dilated ICA origin; body: in the bifurcation F Sinus: baroreceptor (BP); body: chemoreceptor (O2, CO2, pH)

ANT External carotid artery · branches

Ni Hypoglossal n. crosses ICA and ECA, loops round the occipital a.

Ni External laryngeal n. runs with the superior thyroid a.

Aa Anterior: superior thyroid, lingual, facial; medial: ascending pharyngeal

Aa Posterior: occipital, posterior auricular

Aa Terminal: maxillary, superficial temporal aa. in the parotid

Vv Matching vv. drain to the IJV

External carotid artery C Anteromedial at the bifurcation; ascends into the parotid E Maxillary and superficial temporal aa., at mandibular neck

Superior thyroid artery Ar First anterior branch, near the greater horn of the hyoid B Superior laryngeal a. (pierces thyrohyoid membrane), glandular C Ligate close to the gland: spares the external laryngeal n.

Lingual artery C Loop at the greater horn; passes deep to hyoglossus R Hypoglossal n. superficial to hyoglossus, artery deep

Facial artery C Grooves submandibular gland; crosses mandible at masseter B Ascending palatine, tonsillar, submental, glandular

Occipital and posterior auricular arteries C Posterior branches along the posterior belly of digastric

LAT Subclavian artery · branches

Ni Right recurrent laryngeal n. hooks round the right subclavian a.

Ni Ansa subclavia loops round the first part

Aa Right from brachiocephalic trunk; left from the aortic arch

Vv Subclavian v. anterior to scalenus anterior; vertebral v. to brachiocephalic

Subclavian artery P Three: medial, posterior, lateral to scalenus anterior E Axillary a. at the lateral border of the first rib

Vertebral artery Ar First part: first branch C Enters C6 foramen transversarium; ascends through C6–C1

Thyrocervical trunk Ar First part, at medial border of scalenus anterior B Inferior thyroid, suprascapular, transverse cervical aa. No Inferior thyroid a. closely related to recurrent laryngeal n.

Costocervical trunk and internal thoracic artery Ar Costocervical: second part (left: often first); internal thoracic: first B Costocervical: deep cervical and supreme intercostal aa.

Jugular veins · lymphatics

Ni Great auricular, transverse cervical nn. cross SCM near the EJV

Aa IJV runs with the common and internal carotid aa.

Vv IJV + subclavian v. = brachiocephalic v., posterior to SC joint

Vv Lymph: all nodes drain to deep cervical nodes, jugular trunk

Jugular veins · lymphatics (cont.)

Internal jugular vein C Jugular foramen to sternoclavicular joint, lateral in the sheath T Facial, lingual, pharyngeal, superior and middle thyroid vv. C Central line between the two heads of SCM

External jugular vein Fo Posterior auricular v. + posterior division of retromandibular v. C Crosses SCM obliquely, deep to platysma, to the subclavian v.

Anterior jugular vein C Near the midline; jugular venous arch in the suprasternal space E EJV or subclavian v.

Thoracic duct in the neck C Arches laterally at C7, posterior to the carotid sheath E Left venous angle (IJV + subclavian v.) F Returns chyle and lymph of all but the right upper body No Right lymphatic duct ends at the right venous angle

Deep cervical lymph nodes P Along the IJV, deep to SCM F Final filter for all head and neck lymph K Jugulodigastric (tonsil), jugulo-omohyoid (tongue) C Left supraclavicular (Virchow) node: abdominal cancer

Cervical plexus

Ni Ventral rami C1–C4, deep to SCM, on scalenus medius and levator scapulae
Aa Ascending cervical a. runs medial to the phrenic n.
Vv EJV crosses the cutaneous branches on the SCM

Cutaneous branches E Nerve point: midpoint of the posterior border of SCM B Lesser occipital, great auricular, transverse cervical, supraclavicular

Ansa cervicalis Fo Superior root (C1, via CN XII) + inferior root (C2–C3) S Infrahyoid muscles except thyrohyoid

Phrenic nerve Fo C3–C5, mainly C4 C On scalenus anterior, deep to prevertebral fascia F Sole motor to diaphragm; sensory to pericardium, pleura C Referred shoulder-tip pain; hemidiaphragm paralysis

Cranial nerves IX–XII in the neck

Ni IX, X, XI leave the jugular foramen; XII the hypoglossal canal
Aa Laryngeal aa. accompany the internal and recurrent laryngeal nn.
Vv IJV at the jugular foramen, lateral to IX–XI

Glossopharyngeal nerve C Curves round stylopharyngeus, between ICA and ECA B Stylopharyngeus, carotid sinus, pharyngeal plexus, posterior tongue

Vagus nerve C In the carotid sheath, posterior, between IJV and carotid a. B Pharyngeal, superior laryngeal, cardiac, recurrent laryngeal

Superior laryngeal nerve In Pierces thyrohyoid membrane, sensory superior to vocal folds E With superior thyroid a., motor to cricothyroid C External br. injury in thyroidectomy: weak, monotone voice

Recurrent laryngeal nerve C Right: round subclavian a.; left: round aortic arch P Tracheo-oesophageal groove; enters deep to inferior constrictor S All intrinsic laryngeal mm. except cricothyroid C Hoarseness; bilateral injury: stridor

Accessory nerve C Through SCM, across posterior triangle to trapezius C Node biopsy injury: weak shoulder shrug

Hypoglossal nerve C Crosses ICA and ECA, round occipital a., onto hyoglossus S All tongue muscles except palatoglossus C Tongue deviates to the injured side on protrusion

POST Cervical sympathetic trunk

Ni Preganglionic fibres from T1–T4 ascend; only grey rami in the neck
Aa Inferior thyroid a. near the middle ganglion; vertebral a. near the stellate
Vv Carotid sheath with the IJV lies anterior to the trunk

Cervical sympathetic trunk P On longus colli and capitis, posterior to the carotid sheath F Head, neck, upper limb: vasomotor, sweat, dilator pupillae B Grey rami to C1–C8; cardiac nn. (heart rate up)

Superior cervical ganglion P Near C2 (C1–C3), the largest; posterior to the ICA B Internal carotid n., external carotid nn., cardiac n.

Middle and cervicothoracic ganglia P Middle: C6; stellate: on the neck of the first rib No Ansa subclavia loops round the subclavian a. C Horner syndrome: ptosis, miosis, anhidrosis

ANT Thyroid and parathyroid glands

Ni Recurrent and external laryngeal nn. at risk in thyroid surgery
Aa Superior thyroid (ECA), inferior thyroid (thyrocervical), ± thyroid ima aa.
Vv Superior, middle thyroid vv. to IJV; inferior to brachiocephalic vv.
Vv Lymph: prelaryngeal, pretracheal, paratracheal, deep cervical nodes

Thyroid gland P C5–T1: lobes lateral to larynx and trachea, deep to strap muscles R In pretracheal fascia: moves with swallowing F T3/T4 set metabolic rate; C cells: calcitonin

Isthmus and pyramidal lobe P Isthmus on tracheal rings 2–4; pyramidal lobe toward the hyoid No Pyramidal lobe: remnant of the thyroglossal duct

Parathyroid glands P Two pairs on the posterior surface of the thyroid lobes F Parathyroid hormone raises blood calcium No Superior: near cricothyroid joint; inferior: near inferior pole S Mainly the inferior thyroid a.

ANT Larynx

Ni Sensory: internal laryngeal (superior to vocal folds), recurrent (inferior)
Ni Motor: recurrent laryngeal n., except cricothyroid (external laryngeal n.)
Aa Superior and inferior laryngeal aa. (superior, inferior thyroid aa.)
Vv Laryngeal vv. join the superior and inferior thyroid vv.
Ff Phonation; airway protection (inlet closes in swallowing) · Effort closure (Valsalva); cough reflex

Thyroid cartilage S Two laminae fused at the laryngeal prominence; superior, inferior horns L Oblique line: sternothyroid, thyrohyoid, inferior constrictor

Cricoid cartilage S Complete ring: narrow anterior arch, broad posterior lamina P C6: larynx and pharynx end; trachea and oesophagus begin

Arytenoid cartilages and epiglottis Ar Apex, vocal process (anterior), muscular process (lateral) E Elastic cartilage, stalk on the thyroid angle

Laryngeal cavity P Vestibule, ventricle (between the folds), infraglottic cavity Fo Vestibular (false): protective; vocal (true): phonation No Rima glottidis: narrowest part of the adult larynx

Median cricothyroid ligament P Midline between thyroid and cricoid cartilages C Emergency cricothyrotomy site

Intrinsic laryngeal muscles F Abduct: posterior cricoarytenoid only · Adduct: lateral cricoarytenoid, transverse and oblique arytenoids · Tense: cricothyroid; relax: thyroarytenoid; vocalis fine-tunes

POST Pharynx · trachea · oesophagus

Ni Pharyngeal plexus: motor X (stylopharyngeus: IX); sensory mainly IX and X
Aa Ascending pharyngeal, ascending palatine, tonsillar, inferior thyroid brs.
Vv Pharyngeal venous plexus to the IJV; lymph to deep cervical nodes
Ff Shared air and food passage; swallowing; speech resonance · Tonsils (Waldeyer ring) guard the entry

Nasopharynx P Posterior to the choanae, superior to the soft palate Fe Auditory tube opening, torus tubarius, pharyngeal recess, tonsil

Oropharynx P Soft palate to the tip of the epiglottis Fe Palatoglossal, palatopharyngeal arches; palatine tonsil; valleculae

Laryngopharynx P Epiglottis tip to inferior border of cricoid (C6) Fe Piriform recesses lateral to the laryngeal inlet C Fish bones lodge in the piriform recess

Pharyngeal muscles C Superior, middle, inferior: overlap on the pharyngeal raphe L Stylopharyngeus, salpingopharyngeus, palatopharyngeus F Constrictors propel the bolus; longitudinal raise pharynx, larynx · Cricopharyngeus: upper oesophageal sphincter C Pharyngeal pouch: between thyro- and cricopharyngeal parts

Cervical trachea and oesophagus P Both begin at C6; oesophagus posterior to the trachea R Recurrent laryngeal nn. in the grooves; thyroid lobes lateral F Trachea: airway held open by C-rings; oesophagus: bolus transport

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