Thorax pins · front

Superior: thoracic inlet 15

Superior thoracic aperture and suprapleural membrane **Superior thoracic aperture** sup *Boundaries: T1 vertebra, first ribs and their cartilages, superior border of the manubrium; the suprapleural membrane (Sibson fascia) runs from the C7 transverse process to the internal border of the first rib and roofs the cervical pleura*

First rib: head, neck and tubercle B **First rib** sup ★ V **Subclavian vein** ant M **Suprapleural membrane** sup deep B **Head of the first rib** med B **Neck of the first rib** post B **Tubercle of the first rib** post *First rib: shortest, broadest, most curved; single facet on its head (T1 only); its superior surface carries the scalene tubercle between the two subclavian grooves*

Scalene tubercle and subclavian grooves B **Groove for the subclavian vein** sup ★ N **Accessory phrenic nerve** ant B **Scalene tubercle** sup ★ B **Groove for the subclavian artery** sup ★ *Vein, tubercle, artery from anterior to posterior: subclavian vein anterior to the scalene tubercle (scalenus anterior), subclavian artery and inferior trunk posterior to it*

Venous angle and lymph trunks **Venous angle** sup **Vertebral vein** post *Right lymphatic duct drains the right upper quadrant (right head, neck, upper limb, thorax); the thoracic duct drains everything else into the left venous angle*

↳ **Right lymphatic duct** lat

↳ Right lymphatic duct: **Bronchomediastinal trunk** inf

Superior: superior mediastinum 43

Mediastinum and its divisions Or **Mediastinum** Or **Superior mediastinum** sup A **Aortic arch** sup ★ V **Superior vena cava** lat ★ V **Thoracic duct** post ★ Or **Inferior mediastinum** inf *PVT Left BATTLE (superior mediastinum: phrenic nerves, vagus nerves, thoracic duct, left recurrent laryngeal nerve, brachiocephalic veins, aortic arch, thymus, trachea, lymph nodes, oesophagus); a plane through the sternal angle and T4/T5 separates superior from inferior mediastinum*

↳ **Aortic isthmus** post

↳ **Right brachiocephalic vein** lat ★

↳ **Left brachiocephalic vein** ant ★

↳ Left brachiocephalic: **Inferior thyroid veins** ant **Left superior intercostal vein** lat ★

Thymus and thymic vessels Or **Thymus** ant ★ A **Thymic branches** lat V **Thymic veins** post Or **Right lobe of the thymus** lat Or **Left lobe of the thymus** lat *Thymus comes from the 3rd pharyngeal pouch with the inferior parathyroids; large in children, it involutes after puberty into the thymic fat body*

Brachiocephalic veins and superior vena cava **Brachiocephalic lymph nodes** ant deep *Left brachiocephalic vein is the long one, crossing anterior to the arch branches; SVC forms at the right 1st costal cartilage and enters the right atrium at the right 3rd costal cartilage*

Aortic arch and ligamentum arteriosum **Ligamentum arteriosum** inf ★ *Arch begins and ends at the sternal angle (T4/T5); the left recurrent laryngeal nerve hooks around the arch, posterior to the ligamentum arteriosum (right one hooks the right subclavian)*

Trachea and cervical oesophagus Or **Trachea** ant ★ A **Brachiocephalic trunk** ant ★ N **Right vagus nerve** post ★ V **Paratracheal lymph nodes** lat deep Or **Cervical part of the trachea** sup N **Left recurrent laryngeal nerve** med ★ Or **Thoracic part of the trachea** inf A **Left common carotid artery** med ★ Or **Tracheal cartilages** ant ★ Or **Anular ligaments of the trachea** ant Or **Membranous wall of the trachea** post Or **Trachealis** post Or **Cervical part of the oesophagus** post *C6 rule: at the cricoid (C6) the larynx becomes the trachea and the pharynx becomes the oesophagus*

↳ **Right common carotid artery** med **Right subclavian artery** lat **Thyroid ima artery** ant

↳ **Right recurrent laryngeal nerve** med

Tracheal bifurcation and paratracheal nodes Or **Bifurcation of the trachea** inf V **Inferior tracheobronchial lymph nodes** inf deep N **Cardiac plexus** sup A **Pulmonary trunk** ant ★ Or **Carina of the trachea** inf ★ *Trachea bifurcates at the sternal angle (T4/T5); the carina is the cough-sensitive ridge between the main bronchi*

↳ **Superficial cardiac plexus** ant superf. **Deep cardiac plexus** post deep

↳ **Bifurcation of the pulmonary trunk** sup

Anterior: anterior thoracic wall (sternum, costal cartilages, internal thoracic vessels) 33

Manubrium and sternal angle B **Sternum** M **Transversus thoracis** post deep A **Internal thoracic artery** ant deep ★ B **Manubrium of the sternum** sup ★ B **Jugular notch** sup ★ B **Clavicular notch** lat B **Lateral border of the manubrium** lat B **Synchondrosis of the first rib** lat B **Sternal angle** ant ★ B **Manubriosternal joint** inf *RATPLANT at the sternal angle (T4/T5): Rib 2 articulates, Aortic arch begins and ends, Trachea bifurcates, Pulmonary trunk bifurcates, Ligamentum arteriosum, Azygos enters the SVC, Nerve (left recurrent laryngeal) hooks the arch, Thoracic duct crosses right to left; count ribs from the 2nd costal cartilage here*

↳ **Sternal branches** med **Perforating branches** ant

Body of the sternum and sternocostal joints **Body of the sternum** **Costal notches** lat **Sternocostal joint** lat **Radiate sternocostal ligament** ant **Intra-articular sternocostal ligament** lat **Anterior surface of the sternum** ant **Sternal membrane** ant *1st sternocostal joint is a synchondrosis (primary cartilaginous); 2nd to 7th are synovial*

Costal cartilages and costal arch B **Costal cartilage** ant ★ B **Costochondral joint** lat B **Interchondral joint** inf B **Costal arch** inf A **Musculophrenic artery** lat V **Musculophrenic vein** lat B **Infrasternal angle** inf *Costal arch = cartilages 7 to 10; true ribs 1 to 7 reach the sternum by their own cartilage*

Xiphoid process **Xiphoid process** inf ★ **Xiphisternal joint** sup **Costoxiphoid ligament** ant *Xiphisternal joint at T9*

Posterior surface of the sternum: internal thoracic vessels B **Posterior surface of the sternum** post V **Internal thoracic vein** med deep ★ *Internal thoracic artery (first part of the subclavian) branches in order: pericardiacophrenic, mediastinal, thymic, sternal, perforating, anterior intercostal, then musculophrenic and superior epigastric*

Terminal branches of the internal thoracic vessels A **Superior epigastric artery** med V **Superior epigastric vein** med *Internal thoracic artery runs about 1 cm lateral to the sternal border and divides in the 6th intercostal space: musculophrenic (lateral) and superior epigastric (medial, into the rectus sheath)*

Anterior: pectoral region and breast 31

Mammary gland and its vessels Or **Mammary gland** ant superf. A **Medial mammary branches** med M **Pectoral fascia** ant superf. V **Parasternal lymph nodes** lat deep Or **Suspensory ligaments of the breast** ant Or **Lobes of the mammary gland** Or **Axillary process of the breast** lat M **Pectoralis major** ant superf. ★ A **Lateral thoracic artery** lat superf. V **Lateral thoracic vein** lat superf. *Breast extends from rib 2 to rib 6, sternal border to midaxillary line, with the axillary tail (of Spence); about 75% of lymph drains to axillary nodes*

↳ **Lateral mammary branches** lat

↳ **Thoracoepigastric vein** lat superf.

Nipple, areola and lactiferous ducts **Nipple** ant superf. **Areola** ant superf. **Areolar glands** ant superf. **Lactiferous sinus** post deep **Lactiferous ducts** deep *Male nipple at the 4th intercostal space in the midclavicular line (T4 dermatome); 15 to 20 lobes, each with its own lactiferous duct and sinus opening on the nipple*

Retromammary space and pectoralis major Or **Retromammary space** post deep M **Clavicular head of pectoralis major** sup superf. M **Sternocostal head of pectoralis major** med superf. M **Abdominal part of pectoralis major** inf superf. N **Supraclavicular nerves** sup superf. *Breast lies two-thirds on pectoralis major and one-third on serratus anterior, separated by the retromammary space*

Pectoralis minor M **Pectoralis minor** post deep ★ N **Medial pectoral nerve** lat deep *Medial pectoral nerve is lateral, lateral pectoral nerve is medial (named for their cords); the medial pectoral nerve pierces pectoralis minor*

Subclavius M **Subclavius** sup deep N **Nerve to subclavius** post A **Superior thoracic artery** sup *Nerve to subclavius (C5, C6) from the superior trunk; it often gives the accessory phrenic nerve*

Clavipectoral fascia and its piercing structures M **Clavipectoral fascia** sup deep A **Thoracoacromial artery** sup N **Lateral pectoral nerve** med *Two in, two out: cephalic vein and lymphatics pass in; thoracoacromial artery and lateral pectoral nerve come out*

↳ **Pectoral branch of the thoracoacromial artery** inf

Medial: anterior and middle mediastinum (outside the heart) 12

Between sternum and pericardium Or **Anterior mediastinum** V **Anterior mediastinal lymph nodes** ant deep A **Mediastinal branches of the internal thoracic artery** lat Or **Thymic fat body** sup Or **Sternopericardial ligaments** ant *4 Ts of anterior mediastinal masses: thymoma, teratoma, thyroid (retrosternal), 'terrible' lymphoma*

Ascending aorta and pulmonary trunk Or **Middle mediastinum** A **Ascending aorta** med ★ N **Phrenic nerve** ant ★ A **Pericardiacophrenic artery** ant ★ *Pulmonary trunk bifurcates at the sternal angle (T4/T5), in the concavity of the aortic arch*

↳ **Aortic bulb** inf

↳ **Left phrenic nerve** lat ★

Cardiac plexus **Thoracic cardiac branches of the vagus nerve** sup *Superficial cardiac plexus in the concavity of the aortic arch, deep cardiac plexus anterior to the tracheal bifurcation; sympathetic nerves speed the heart, the vagus slows it*

Lateral: ribs (typical and atypical) and serratus anterior 27

Thoracic cage, classes of ribs and twelfth rib B **Thoracic cage** B **True ribs** sup B **False ribs** inf B **Floating ribs** inf B **Tenth rib** inf B **Eleventh rib** inf B **Twelfth rib** inf N **Subcostal nerve** inf deep *7 true, 3 false, 2 floating; atypical ribs 1, 2, 10, 11, 12*

Rib: head and neck **Rib** **Head of the rib** med ★ **Articular facet of the head of the rib** med **Crest of the head of the rib** med **Neck of the rib** post ★ **Crest of the neck of the rib** sup *A typical rib head articulates with its own vertebra and the one superior to it (two demifacets)*

Rib: tubercle and angle **Tubercle of the rib** post ★ **Articular facet of the tubercle of the rib** post **Angle of the rib** post ★ *Tubercle of rib N articulates with the transverse process of vertebra N; ribs 11 and 12 have no costotransverse joint*

Rib: body, surfaces and borders B **Body of the rib** M **Serratus anterior** lat superf. ★ B **External surface of the rib** lat B **Internal surface of the rib** med B **Superior border of the rib** sup B **Inferior border of the rib** inf B **Sternal end of the rib** ant *Costal groove on the internal surface at the inferior border holds the intercostal bundle: VAN (vein, artery, nerve, superior to inferior) in the costal groove; pass a needle along the superior border of the rib inferior to the space*

Second rib and serratus anterior B **Second rib** sup B **Tuberosity for serratus anterior** lat N **Long thoracic nerve** lat superf. ★ *C5, 6, 7 - wings of heaven (long thoracic nerve; injury gives a winged scapula); the 2nd rib is found at the sternal angle*

Lateral: intercostal spaces 19

External and internal intercostal layers B **Intercostal space** lat N **Anterior ramus of a thoracic spinal nerve** post deep M **External intercostal muscle** lat superf. ★ M **Internal intercostal muscle** med deep ★ M **Innermost intercostal muscle** med deep ★ M **External intercostal membrane** ant superf. M **Internal intercostal membrane** post deep *Hands in pockets: external intercostal fibres run inferomedially (anteroinferiorly), internal intercostals at right angles to them; external membrane anteriorly, internal membrane posteriorly*

↳ **Intercostal nerve** inf deep ★

↳ Intercostal: **Collateral branch of the intercostal nerve** inf deep **Muscular branches of the intercostal nerve** inf deep

Intercostal space (from superior to inferior: VAN) B **Costal groove** inf ★ V **Anterior intercostal veins** ant deep A **Anterior intercostal branches** ant deep *VAN (vein, artery, nerve, superior to inferior) in the costal groove; pass a needle along the superior border of the rib inferior to the space*

Cutaneous branches of the intercostal nerves **Lateral cutaneous branch of the intercostal nerve** lat superf. **Anterior cutaneous branch of the intercostal nerve** ant superf. **Thoracoabdominal nerves** inf deep *Dermatome landmarks: T4 at the nipple, T10 at the umbilicus*

First and second intercostal nerves **First intercostal nerve** sup **Second intercostal nerve** sup *Intercostobrachial nerve (T2) supplies the medial arm: why cardiac pain refers to the medial left arm*

↳ **Intercostobrachial nerve** lat superf.

Lateral: pleura and pleural recesses 27

Cervical and costal pleura with recesses Or **Parietal pleura** M **Endothoracic fascia** med deep Or **Cervical pleura** sup ★ A **Left subclavian artery** lat ★ A **Costocervical trunk** sup N **Sympathetic trunk** lat ★ Or **Costal pleura** lat Or **Costodiaphragmatic recess** inf ★ M **Costal part of the diaphragm** lat Or **Costomediastinal recess** ant Or **Vertebromediastinal recess** post *2-4-6-8-10-12 rule for the parietal pleura: meets in the midline at rib 2, left diverges at 4 (cardiac notch), right continues to 6, 8 in the midclavicular line, 10 in the midaxillary line, 12 paravertebrally; the lung stops two ribs short (6-8-10)*

↳ **Supreme intercostal artery** ant

↳ **Cervicothoracic ganglion** sup ★

↳ **Thoracic ganglia** lat

↳ Thoracic ganglia: **Grey rami communicantes** med

Diaphragmatic and mediastinal pleura Or **Diaphragmatic pleura** inf M **Diaphragm** A **Superior phrenic arteries** post Or **Phrenicomediastinal recess** inf Or **Mediastinal pleura** med V **Pericardiacophrenic vein** ant Or **Pulmonary ligament** inf ★ V **Right inferior pulmonary vein** inf V **Left inferior pulmonary vein** inf ★ *Parietal pleura, four parts: cervical, costal, diaphragmatic, mediastinal; it is pain-sensitive (intercostal and phrenic nerves)*

Visceral pleura and pleural cavity Or **Visceral pleura** N **Pulmonary plexus** post Or **Pleural cavity** *Visceral pleura has autonomic supply only and is insensitive to pain; parietal pleura is somatic and painful*

Thorax pins · back

Lateral: right lung 52

Apex of the right lung · Or · Right lung · A · **Right pulmonary artery** · ant · ★ · V · **Right superior pulmonary vein** · ant · ★ · V · **Azygos vein** · lat · ★ · Or · **Apex of the lung** · sup · ★ · Or · Groove for the right subclavian artery · sup · Or · Groove for the right brachiocephalic vein · med · *Apex and cervical pleura rise 2 to 3 cm superior to the medial third of the clavicle: a Pancoast tumour at the apex can involve the inferior trunk of the brachial plexus and the sympathetic trunk (Horner syndrome)*

↳ **Arch of the azygos vein** · sup · ★ · **Right superior intercostal vein** · sup · ★

Costal surface and borders of the right lung · Or · Costal surface of the lung · lat · Or · Diaphragmatic surface of the lung · inf · M · **Right dome of the diaphragm** · sup · M · **Left dome of the diaphragm** · inf · Or · Vertebral part of the mediastinal surface · post · A · **Posterior intercostal arteries** · post · deep · ★ · V · **Posterior intercostal veins** · post · deep · N · **Greater splanchnic nerve** · med · ★ · Or · Anterior border of the lung · ant · Or · Posterior border of the lung · post · Or · Inferior border of the lung · inf · *Lung borders two ribs short of the pleura: 6 midclavicular, 8 midaxillary, 10 paravertebral*

↳ **Right posterior intercostal arteries** · post · deep · **Dorsal branch of the posterior intercostal artery** · post · **Collateral branch of the posterior intercostal artery** · inf · deep · **Lateral cutaneous branch of the posterior intercostal artery** · lat · superf.

Mediastinal surface of the right lung · Or · Mediastinal surface of the lung · med · Or · Cardiac impression of the right lung · med · N · **Right phrenic nerve** · lat · ★ · Or · Groove for the superior vena cava · med · Or · Groove for the inferior vena cava · med · V · **Inferior vena cava** · inf · Or · **Groove for the azygos vein** · med · ★ · Or · Azygos lobe · sup · Or · Tracheal impression · med · Or · Groove for the oesophagus · med · *Right lung is the venous side: grooves for the SVC, IVC, azygos arch and right brachiocephalic vein (left lung is the arterial side)*

Fissures and lobes of the right lung · Interlobar surface of the lung · **Oblique fissure of the right lung** · post · ★ · **Horizontal fissure of the right lung** · ant · ★ · **Superior lobe of the right lung** · sup · ★ · **Middle lobe of the right lung** · ant · ★ · Inferior lobe of the right lung · inf · *Right: 3 lobes, 2 fissures; left: 2 lobes, 1 fissure. Oblique fissure from the T2/T3 spine to the 6th costochondral junction; horizontal fissure along the 4th costal cartilage*

Segments of the right superior and middle lobes · Or · Apical segment of the right lung · sup · A · **Lobar arteries** · post · Or · Posterior segment of the right lung · post · Or · Anterior segment of the right lung · ant · Or · Lateral segment of the right lung · lat · Or · Medial segment of the right lung · med · *A PALM Seed Makes Another Little Palm (right lung: apical, posterior, anterior; lateral, medial; superior, medial basal, anterior basal, lateral basal, posterior basal)*

↳ **Segmental arteries**

Segments of the right inferior lobe · Superior segment of the right lung · sup · Medial basal segment of the right lung · med · Anterior basal segment of the right lung · ant · Lateral basal segment of the right lung · lat · Posterior basal segment of the right lung · post · *A PALM Seed Makes Another Little Palm: the last five (superior, medial basal, anterior basal, lateral basal, posterior basal) are the right inferior lobe*

Lateral: left lung 28

Apex of the left lung · Or · Left lung · A · **Left pulmonary artery** · sup · ★ · V · **Left superior pulmonary vein** · ant · ★ · A · **Thoracic aorta** · lat · ★ · Or · Groove for the first rib · sup · Or · Groove for the left subclavian artery · sup · Or · Groove for the left common carotid artery · med · Or · Groove for the left brachiocephalic vein · med · *Apex and cervical pleura rise 2 to 3 cm superior to the medial third of the clavicle: a Pancoast tumour at the apex can involve the inferior trunk of the brachial plexus and the sympathetic trunk (Horner syndrome)*

↳ **Pericardial branches of the thoracic aorta** · ant · **Mediastinal branches of the thoracic aorta** · ant

Mediastinal surface of the left lung · Or · Cardiac impression of the left lung · med · ★ · Or · Groove for the aortic arch · med · ★ · N · **Left vagus nerve** · post · ★ · Or · **Groove for the descending aorta** · med · ★ · Or · Oesophageal impression of the left lung · med · *Left lung is the arterial side: grooves for the aortic arch, descending aorta, left subclavian and left common carotid (right lung is the venous side)*

Fissure and lobes of the left lung · **Oblique fissure of the left lung** · post · ★ · **Superior lobe of the left lung** · sup · ★ · Inferior lobe of the left lung · inf · *Left: 2 lobes, 1 fissure (oblique); no horizontal fissure*

Cardiac notch and lingula · **Cardiac notch of the left lung** · ant · ★ · **Lingula of the left lung** · ant · ★ · *Lingula is the left counterpart of the right middle lobe; the cardiac notch lies at the 4th to 6th left costal cartilages (pleura diverges at 4)*

Segments of the left superior lobe · Apicoposterior segment of the left lung · sup · Anterior segment of the left lung · ant · Superior lingular segment · sup · Inferior lingular segment · inf · *Left lung has 8 segments: apical + posterior fuse (apicoposterior); the lingula takes superior and inferior lingular segments in place of a middle lobe*

Segments of the left inferior lobe · Superior segment of the left lung · sup · Anteromedial basal segment of the left lung · ant · Lateral basal segment of the left lung · lat · Posterior basal segment of the left lung · post · *Left inferior lobe: anterior and medial basal fuse (anteromedial basal), so 4 segments: superior, anteromedial basal, lateral basal, posterior basal*

Medial: lung roots, hila and bronchi 22

Root and hilum of the lung · Or · Root of the lung · med · A · **Bronchial arteries** · post · V · **Bronchial veins** · post · Or · **Hilum of the lung** · med · ★ · V · **Pulmonary veins** · inf · V · **Bronchopulmonary lymph nodes** · lat · deep · N · Bronchial branches of the vagus nerve · post · *Anterior to posterior: vein, artery, bronchus (VAB) on both sides; pulmonary veins are the most anterior and most inferior; phrenic nerve anterior to the root, vagus posterior*

Right hilum · Or · Right main bronchus · post · ★ · A · **Right bronchial artery** · post · V · **Superior tracheobronchial lymph nodes** · sup · deep · Or · **Right superior lobar bronchus** · sup · ★ · *RALS (Right Anterior, Left Superior: the pulmonary artery is anterior to the main bronchus on the right, superior to it on the left); the eparterial bronchus (right superior lobar) arises superior to the artery. Right main bronchus is wider, shorter, more vertical: inhaled bodies go right*

Right intermediate and lobar bronchi · Intermediate bronchus · inf · Right middle lobar bronchus · ant · Right inferior lobar bronchus · inf · *Right main bronchus gives the superior lobar (eparterial) bronchus, then continues as the intermediate bronchus, which splits into middle and inferior lobar bronchi*

Left hilum · Or · Left main bronchus · post · ★ · A · **Left superior bronchial artery** · sup · A · **Left inferior bronchial artery** · inf · Or · **Left superior lobar bronchus** · inf · ★ · *RALS (Right Anterior, Left Superior: the pulmonary artery is anterior to the main bronchus on the right, superior to it on the left); the left pulmonary artery arches over the superior aspect of the left main bronchus (no eparterial bronchus on the left)*

Left lingular and inferior lobar bronchi · Lingular bronchus · ant · Left inferior lobar bronchus · inf · *Left main bronchus is longer, narrower and more horizontal than the right (inhaled objects go right); the lingular bronchus comes from the left superior lobar bronchus*

Lobar and segmental branching · Or · Segmental bronchi · V · **Intrapulmonary lymph nodes** · lat · deep · *Bronchopulmonary segment: segmental bronchus and artery central, veins intersegmental (at the periphery)*

Posterior: posterior thoracic wall (vertebrae, costovertebral joints, posterior intercostal vessels) 42

Vertebral body and joint of the head of the rib · Thoracic vertebra · Vertebral body · ant · **Superior costal facet** · lat · ★ · **Inferior costal facet** · lat · ★ · Joint of the head of the rib · lat · Radiate ligament of the head of the rib · ant · Intra-articular ligament of the head of the rib · med · *Ribs 2 to 9 meet two demifacets (own vertebra + the one superior); ribs 1, 10, 11, 12 have a single full facet*

Pedicles and intervertebral foramen · B · Vertebral foramen · med · B · Pedicle of the vertebral arch · lat · B · Superior vertebral notch · sup · B · Inferior vertebral notch · inf · B · Intervertebral foramen · lat · A · **Spinal branch of the posterior intercostal artery** · med · *Thoracic spinal nerve T(n) leaves through the intervertebral foramen inferior to the pedicle of vertebra T(n); C1 to C7 exit superior to their pedicles, C8 inferior to C7*

Laminae, articular and spinous processes · B · Lamina of the vertebral arch · post · B · Ligamentum flavum · post · B · Superior articular process · sup · B · Inferior articular process · inf · B · Zygapophysial joint · lat · B · Spinous process · post · M · Serratus posterior superior · sup · deep · M · Serratus posterior inferior · inf · deep · *Rule of threes (thoracic spines): T1 to T3 spines are level with their own transverse processes, T4 to T6 half a vertebra inferior, T7 to T9 a whole vertebra inferior, T10 to T12 return towards level*

Transverse process and costotransverse joint · B · Transverse process · lat · M · Levatores costarum · post · deep · B · **Transverse costal facet** · lat · ★ · B · Costotransverse joint · lat · B · Costotransverse ligament · med · B · Superior costotransverse ligament · sup · B · Lateral costotransverse ligament · lat · *Tubercle of rib N to transverse process of vertebra N; no costotransverse joints for ribs 11 and 12*

Intervertebral disc and longitudinal ligaments · Intervertebral disc · med · Anterior longitudinal ligament · ant · Posterior longitudinal ligament · post · *Anterior longitudinal ligament is broad and limits extension; the posterior longitudinal ligament is narrow and limits flexion, so discs herniate posterolaterally*

Levatores costarum · Levatores costarum breves · post · deep · Levatores costarum longi · post · deep

First thoracic vertebra and costocervical trunk · B · First thoracic vertebra · sup · V · **Supreme intercostal vein** · ant · *Costocervical trunk gives the deep cervical artery and the supreme intercostal artery (posterior intercostals 1 and 2)*

Posterior intercostal space (from superior to inferior: VAN) · M · **Subcostales** · post · deep · V · **Intercostal lymph nodes** · post · deep · *VAN (vein, artery, nerve, superior to inferior) in the costal groove; pass a needle along the superior border of the rib inferior to the space; posterior intercostal arteries 3 to 11 come from the thoracic aorta, 1 and 2 from the supreme intercostal*

Tenth to twelfth thoracic vertebrae and subcostal vessels · B · Tenth thoracic vertebra · inf · B · Eleventh thoracic vertebra · inf · B · Twelfth thoracic vertebra · inf · A · **Subcostal artery** · inf · deep · V · **Subcostal vein** · inf · deep · *T10, T11, T12 carry single full costal facets for ribs 10 to 12; oesophageal hiatus at T10, aortic hiatus at T12*

Posterior: posterior mediastinum 25

Thoracic oesophagus · Or · Posterior mediastinum · V · **Hemiazygos vein** · inf · ★ · V · Posterior mediastinal lymph nodes · post · deep · Or · **Oesophagus** · post · ★ · N · **Oesophageal plexus** · inf · ★ · Or · Thoracic part of the oesophagus · post · A · **Oesophageal branches of the thoracic aorta** · ant · V · **Oesophageal veins** · post · V · **Juxta-oesophageal lymph nodes** · lat · deep · Or · Aortic constriction of the oesophagus · lat · Or · Bronchial constriction of the oesophagus · ant · *Oesophageal constrictions at 15, 25, 40 cm from the incisors: cricopharyngeal (C6), aortic arch and left main bronchus (T4/T5), diaphragmatic (T10); DATES (posterior mediastinum: descending aorta, azygos and hemiazygos veins, thoracic duct, oesophagus, sympathetic trunk and splanchnic nerves)*

↳ **Ascending lumbar vein** · inf

Vagus nerves and oesophageal plexus · Oesophageal branches of the vagus nerve · med · *Vagus passes posterior to the lung root, phrenic anterior; the two vagi form the oesophageal plexus on the oesophagus*

Diaphragmatic constriction and vagal trunks · Or · Diaphragmatic constriction of the oesophagus · inf · M · **Oesophageal hiatus** · med · ★ · M · **Right crus of the diaphragm** · post · ★ · N · Anterior vagal trunk · ant · N · Posterior vagal trunk · post · Or · Abdominal part of the oesophagus · inf · *LARP (Left vagus becomes Anterior trunk, Right becomes Posterior trunk); oesophagus and vagal trunks pass the diaphragm at T10*

Thoracic aorta · Thoracic aortic plexus · lat · *Descends from the left side of T4 to the aortic hiatus at T12 (At 12), moving towards the midline anterior to the vertebral bodies*

Hemiazygos veins · Accessory hemiazygos vein · sup · *Hemiazygos crosses to the azygos at T9, accessory hemiazygos at T8*

Sympathetic trunk on the rib heads · White rami communicantes · lat · *White rami only T1 to L2 (thoracolumbar outflow); grey rami to every spinal nerve*

Splanchnic nerves · Thoracic cardiopulmonary splanchnic nerves · sup · Lesser splanchnic nerve · lat · Least splanchnic nerve · inf · *Greater T5 to T9, lesser T10 to T11, least T12*

Inferior: diaphragm and thoracic outlet 14

Domes and central tendon of the diaphragm · B · Inferior thoracic aperture · inf · M · **Central tendon of the diaphragm** · med · M · **Caval opening** · sup · ★ · *I 8 10 Eggs At 12 (IVC T8, oesophagus T10, aortic hiatus T12); letter count also works: 'vena cava' 8, 'oesophagus' 10, 'aortic hiatus' 12; right dome higher (liver), reaching the 5th rib*

Sternal and costal parts of the diaphragm · Sternal part of the diaphragm · ant · Sternocostal triangle · ant · Lumbocostal triangle · post · *Morgagni anterior (sternocostal triangle, superior epigastric vessels); Bochdalek is Back and Left (lumbocostal triangle, posterolateral hernia)*

Crura, arcuate ligaments and hiatuses · Lumbar part of the diaphragm · post · Left crus of the diaphragm · post · Median arcuate ligament · ant · Medial arcuate ligament · med · Lateral arcuate ligament · lat · **Aortic hiatus** · post · ★ · *I 8 10 Eggs At 12 (IVC T8, oesophagus T10, aortic hiatus T12); letter count also works: 'vena cava' 8, 'oesophagus' 10, 'aortic hiatus' 12; median arcuate over the aorta, medial over psoas, lateral over quadratus lumborum; right crus L1 to L3, left L1 to L2*

Thoracic surface of the diaphragm · V · **Superior diaphragmatic lymph nodes** · sup · deep · N · Phrenicoabdominal branches · inf · *C3, 4, 5 keeps the diaphragm alive: central diaphragmatic pain refers to the shoulder tip (C4); the periphery is supplied by intercostal nerves*

Heart pins · front

General: pericardium and heart wall 19

Fibrous pericardium and phrenic nerve
Or Fibrous pericardium superf. N Phrenic nerve ant ⭐ A Pericardiacophrenic artery ant V Pericardiacophrenic vein ant A Pericardial branches of the thoracic aorta post Or Sternopericardial ligaments ant Or Pericardiacophrenic ligament inf *C3, 4, 5 keeps the diaphragm alive; phrenic also carries pericardial pain, referred to the shoulder tip*

Parietal serous pericardium and pericardial cavity
Parietal layer of serous pericardium deep Pericardial cavity *Superficial to deep: fibrous pericardium, parietal serous layer, pericardial cavity, visceral serous layer (epicardium)*

Reflections and pericardial sinuses
Reflection of serous pericardium around the arteries sup Transverse pericardial sinus post ⭐ Superior aortic recess sup Reflection of serous pericardium around the veins post Oblique pericardial sinus post ⭐ Fold of the left vena cava lat *Transverse sinus separates the arteries (aorta, pulmonary trunk, anterior) from the veins (SVC, pulmonary veins, posterior); oblique sinus is the cul-de-sac posterior to the left atrium between the pulmonary veins and IVC*

Layers of the heart wall and coronary sulcus
Visceral layer of serous pericardium (epicardium) superf. Myocardium Endocardium deep Coronary sulcus ⭐ *Inner to outer: endocardium, myocardium, epicardium; the coronary sulcus divides atria from ventricles*

Superior: base and great vessels 24

Base, superior border and ascending aorta
Or Base of the heart (posterior surface) post V Right superior pulmonary vein sup V Right inferior pulmonary vein inf V Left superior pulmonary vein sup V Left inferior pulmonary vein inf ⭐ Or Superior border sup V Superior vena cava lat ⭐ A Ascending aorta med ⭐ A Pulmonary trunk ant ⭐ *Base faces posteriorly (mostly left atrium); apex points anteriorly, inferiorly and to the left*

↳ Aortic bulb inf

↳ Bifurcation of the pulmonary trunk
sup Right pulmonary artery post Left pulmonary artery lat

Pulmonary trunk and its bifurcation
Ligamentum arteriosum sup ⭐ *Pulmonary trunk bifurcates at T4/T5 in the concavity of the arch; ligamentum arteriosum (ductus remnant) joins the left pulmonary artery to the arch, with the left recurrent laryngeal nerve hooking posterior to it*

Cardiac plexus
Superficial part of cardiac plexus ant superf. Deep part of cardiac plexus post deep *Superficial cardiac plexus in the concavity of the aortic arch, deep cardiac plexus anterior to the tracheal bifurcation; sympathetic nerves speed the heart, the vagus slows it*

↳ Coronary plexuses inf

Sympathetic cardiac nerves
Superior cervical cardiac nerve sup Middle cervical cardiac nerve sup Inferior cervical cardiac nerve sup Thoracic cardiac nerves inf *Cardiac sympathetics: 3 cervical ganglia + T1 to T4; cardiac pain travels back to T1 to T4 and refers to the left chest and medial arm*

Vagal cardiac branches
Superior cervical cardiac branches of vagus nerve sup Inferior cervical cardiac branches of vagus nerve sup Thoracic cardiac branches of vagus nerve inf *Vagus slows the heart: right vagus mainly to the SA node, left vagus mainly to the AV node*

Anterior: sternocostal surface, right ventricle, anterior interventricular branch 26

Sternocostal surface and left coronary artery
Or Sternocostal surface ant A Right coronary artery ant ⭐ A Left coronary artery lat ⭐ *Borders: right border = right atrium, inferior border = right ventricle, left border = left ventricle (and left auricle); the right ventricle forms most of the sternocostal surface*

↳ Opening of right coronary artery
ant ⭐ Right conus branch ant
Sinuatrial nodal branch sup ⭐
↳ Anterior interventricular branch
ant ⭐

↳ Anterior interventricular branch:
Diagonal branches lat Anterior septal branches med deep

↳ Opening of left coronary artery
lat ⭐

Anterior interventricular sulcus
Or Anterior interventricular sulcus ant ⭐ V Great cardiac vein ant ⭐ *Veins pair with arteries: great cardiac vein with the anterior interventricular branch, middle cardiac vein with the posterior interventricular branch, small cardiac vein with the right marginal branch*

Right ventricle: wall and inflow part
Or Right ventricle ant ⭐ A Right marginal branch inf ⭐ Or Inflow part of the right ventricle inf M Trabeculae carneae of right ventricle inf M Anterior papillary muscle of right ventricle ant ⭐ Or Interventricular septum (right surface) med M Septomarginal trabecula med ⭐ M Septal papillary muscle of right ventricle med *Septomarginal trabecula (moderator band) carries the right bundle branch to the anterior papillary muscle*

Papillary muscles and chordae of the right ventricle
Or Chordae tendineae of tricuspid valve sup M Posterior papillary muscle of right ventricle inf *Right ventricle: 3 papillary muscles (anterior, posterior, septal) for 3 tricuspid cusps; left ventricle: 2 for 2 mitral cusps*

Supraventricular crest and conus arteriosus
Or Conus arteriosus (infundibulum) sup ⭐ M Supraventricular crest med A Left conus branch lat Or Pulmonary orifice sup *Supraventricular crest separates inflow (rough, trabeculated) from outflow (smooth conus arteriosus)*

Right: exterior (right atrium surface, right coronary artery, small cardiac vein) 7

Right border and terminal sulcus
Or Right pulmonary surface lat Or Right border lat V Inferior vena cava inf Or Terminal sulcus lat M Crista terminalis lat ⭐ *Right border = right atrium from SVC to IVC; the terminal sulcus outside matches the crista terminalis inside, with the SA node at its superior end*

Right auricle and origin of the right coronary artery
Or Right auricle ant ⭐ M Pectinate muscles ant *Right aortic sinus gives the right coronary artery; the SA nodal branch comes from the right coronary artery in about 60%*

Right: interior of the right atrium (sinus venarum, crista terminalis, fossa ovalis, triangle of Koch, openings) 21

Right atrium: venous sinus and pectinate part
Or Right atrium lat ⭐ V Coronary sinus post ⭐ A Atrial branches of right coronary artery sup V Anterior cardiac veins ant Or Sinus of venae cavae post Or Opening of superior vena cava sup Or Intervenous tubercle post Or Opening of inferior vena cava inf Or Valve of inferior vena cava ant *Crista terminalis divides the smooth sinus of the venae cavae (posterior) from the rough pectinate part (anterior, auricle)*

↳ Oblique vein of left atrium post

Interatrial septum, right surface
Interatrial septum (right surface) med Fossa ovalis med ⭐ Limbus of fossa ovalis med Torus aorticus ant *Fossa ovalis = foramen ovale remnant; limbus = septum secundum edge*

Triangle of Koch and coronary sinus opening
Triangle of Koch med Opening of coronary sinus inf ⭐ Valve of coronary sinus inf Tendon of Todaro sup Right atrioventricular orifice ant *Koch's triangle: tendon of Todaro, septal cusp of the tricuspid valve, opening of the coronary sinus; the AV node sits at its apex*

Smallest cardiac veins
Or Openings of smallest cardiac veins V Smallest cardiac veins *Smallest cardiac veins (Thebesian veins) open directly into the chambers, mostly the right atrium*

Heart pins · back

Left (lateral): left ventricle, left border, circumflex branch 17

Apex of the heart — **Apex of the heart** lat ★ **Notch of the cardiac apex** inf *Apex beat in the 5th left intercostal space, midclavicular line (about 9 cm from the midline)*

Left border and left marginal vessels — Or **Left border** lat A **Circumflex branch** lat ★ V **Left marginal vein** lat Or **Left pulmonary surface** lat *Left border = left ventricle (with the left auricle superiorly); circumflex runs in the coronary sulcus and gives the left marginal branch*

↳ **Left marginal branch** lat

Branches of the circumflex and intermediate arteries — **Intermediate branch of left coronary artery** ant **Posterior left ventricular branch** inf *Circumflex gives the SA nodal branch in about 40% (the right coronary in about 60%); an intermediate branch (ramus intermedius) makes the left coronary artery trifurcate*

Left ventricle: inflow and papillary muscles — Or **Left ventricle** lat ★ Or **Inflow part of the left ventricle** inf M **Trabeculae carneae of left ventricle** inf M **Anterior papillary muscle of left ventricle** ant M **Posterior papillary muscle of left ventricle** inf Or **Chordae tendineae of mitral valve** sup *Left ventricle: 2 papillary muscles (anterior, posterior) for 2 mitral cusps; wall about 3 times thicker than the right*

Aortic vestibule — **Aortic vestibule** sup **Aortic orifice** sup *Anterior cusp of the mitral valve separates the inflow from the smooth outflow (aortic vestibule), as the supraventricular crest does in the right ventricle*

Posterior: left atrium, pulmonary veins, coronary sinus 10

Left atrium and pulmonary veins — Or **Left atrium** post ★ A **Left atrial branches** sup Or **Openings of pulmonary veins** post Or **Interatrial sulcus** post *Four pulmonary veins enter the left atrium, the most posterior chamber; it lies directly anterior to the oesophagus (an enlarged left atrium indents it)*

Left auricle — Or **Left auricle** lat M **Pectinate muscles of left auricle** lat *Left auricle is the commonest site of thrombus in atrial fibrillation*

Interior of the left atrium — **Interatrial septum (left surface)** med **Valve of foramen ovale** med **Left atrioventricular orifice** ant *Valve of the foramen ovale = septum primum; the foramen stays probe-patent in about 25% of adults*

Coronary sinus — **Valve of the great cardiac vein** lat *Coronary sinus lies in the posterior coronary sulcus and drains into the right atrium: great, middle, small cardiac veins, posterior vein of the left ventricle, oblique vein of the left atrium*

Inferior: diaphragmatic surface, posterior interventricular branch, middle cardiac vein 12

Diaphragmatic surface and inferior vena cava — Or **Diaphragmatic surface** inf A **Posterior interventricular branch** inf ★ V **Middle cardiac vein** inf ★ Or **Inferior border** inf V **Small cardiac vein** lat *Diaphragmatic surface: left ventricle two-thirds, right ventricle one-third*

↳ **Posterior septal branches** med deep

↳ **Right marginal vein** inf

Posterior interventricular sulcus and crux — Or **Posterior interventricular sulcus** inf Or **Crux of the heart** post A **Atrioventricular nodal branch** post A **Right posterolateral branch** lat V **Posterior vein of left ventricle** inf *Dominance = the artery that gives the posterior interventricular branch: right dominant about 70%, left about 10%, codominant about 20%; the AV nodal branch arises near the crux from the dominant artery*

Inside: valves 28

Tricuspid valve — **Tricuspid valve** inf ★ **Anterior cusp of tricuspid valve** ant **Posterior cusp of tricuspid valve** post **Septal cusp of tricuspid valve** med **Right fibrous ring** *LAB RAT (Left Atrium Bicuspid, Right Atrium Tricuspid); All Physicians Take Money (aortic 2nd right ICS, pulmonary 2nd left ICS, tricuspid 4th left ICS at the sternal border, mitral 5th left ICS midclavicular line); Try Pulling My Aorta (tricuspid, pulmonary, mitral, aortic: the order blood meets them)*

Pulmonary valve — **Pulmonary valve** ant ★ **Anterior semilunar cusp of pulmonary valve** ant **Right semilunar cusp of pulmonary valve** med **Left semilunar cusp of pulmonary valve** lat **Nodule of semilunar cusp of pulmonary valve** med **Lunule of semilunar cusp of pulmonary valve** lat **Pulmonary sinuses** sup *Pulmonary valve cusps: anterior, right, left; All Physicians Take Money (aortic 2nd right ICS, pulmonary 2nd left ICS, tricuspid 4th left ICS at the sternal border, mitral 5th left ICS midclavicular line)*

Mitral valve — **Mitral valve** post ★ **Anterior cusp of mitral valve** ant **Posterior cusp of mitral valve** post **Commissures of mitral valve** **Left fibrous ring** *LAB RAT (Left Atrium Bicuspid = mitral, like a bishop's mitre); All Physicians Take Money (aortic 2nd right ICS, pulmonary 2nd left ICS, tricuspid 4th left ICS at the sternal border, mitral 5th left ICS midclavicular line)*

Aortic valve cusps — **Aortic valve** med ★ **Right semilunar cusp of aortic valve** ant **Left semilunar cusp of aortic valve** lat **Posterior semilunar cusp of aortic valve** post **Nodule of semilunar cusp of aortic valve** med **Lunule of semilunar cusp of aortic valve** lat *Aortic valve cusps: right, left, posterior (non-coronary); All Physicians Take Money (aortic 2nd right ICS, pulmonary 2nd left ICS, tricuspid 4th left ICS at the sternal border, mitral 5th left ICS midclavicular line)*

Aortic sinuses — **Aortic sinuses** sup **Right aortic sinus** ant **Left aortic sinus** lat **Posterior aortic sinus** post **Sinotubular junction** sup *Right aortic sinus gives the right coronary artery, left sinus the left coronary artery, posterior sinus none (non-coronary)*

Inside: septa, fibrous skeleton and conducting system 15

Sinuatrial node and interatrial septum — **Sinuatrial node** sup ★ **Interatrial septum** **Atrioventricular node** inf ★ *Conduction order: SA node, AV node, AV bundle (of His), right and left bundle branches, Purkinje fibres*

Fibrous trigones and atrioventricular bundle — **Fibrous rings** **Right fibrous trigone** med **Left fibrous trigone** lat **Tendon of the infundibulum** ant **Atrioventricular bundle** med *AV bundle pierces the right fibrous trigone (central fibrous body): the only electrical path from atria to ventricles*

Interventricular septum and bundle branches — **Interventricular septum** ★ **Membranous part of interventricular septum** sup **Atrioventricular septum** sup **Muscular part of interventricular septum** inf **Right bundle branch** med deep **Left bundle branch** med deep **Subendocardial branches (Purkinje fibres)** deep *SA, AV, His, bundle branches, Purkinje; the membranous septum is the commonest VSD site*