Heart pins

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*

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*