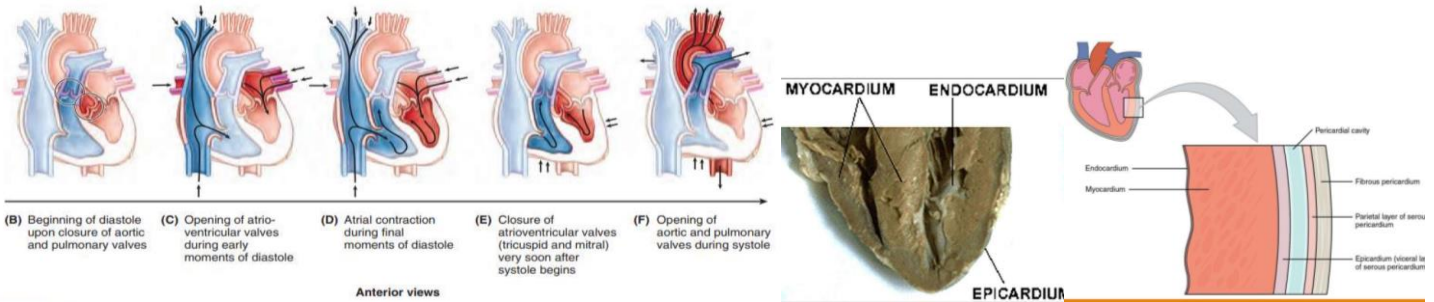


organ	Description	Location	Layers
heart	a muscular pump propels blood to various parts of body	Lies within pericardium in the middle mediastinum . 1/3 of the heart lies to the right & 2/3 to the left of the median plane	walls of heart composed of 3 layers from outside: 1. Epicardium 2. Myocardium (cardiac muscle) 3. Endocardium

Cardiac cycle	Description	Ventricles state	Sound * (heard with a stethoscope)
Diastole	<u>Beginning</u> of cycle: blood is transferred <u>from</u> the atria <u>into</u> ventricles	ventricular (<u>relaxation</u>) elongation + filling	lub (1st) sound
Systole	<u>End</u> of cycle: ventricles expel blood from the heart	ventricular (contraction) shortening + emptying	dub (2nd) sound

* heart sounds are produced by the **snapping shut** of the **one way valves** that normally keep blood from flowing backward during contractions of the heart



Layers (from superficial to deep)	Thickness	Location	Tissue type
Endocardium	Thin layer	internal layer	endothelium
Myocardium	Thick layer	middle layer	cardiac muscle
Epicardium	Thin layer	external layer	visceral layer of serous pericardium

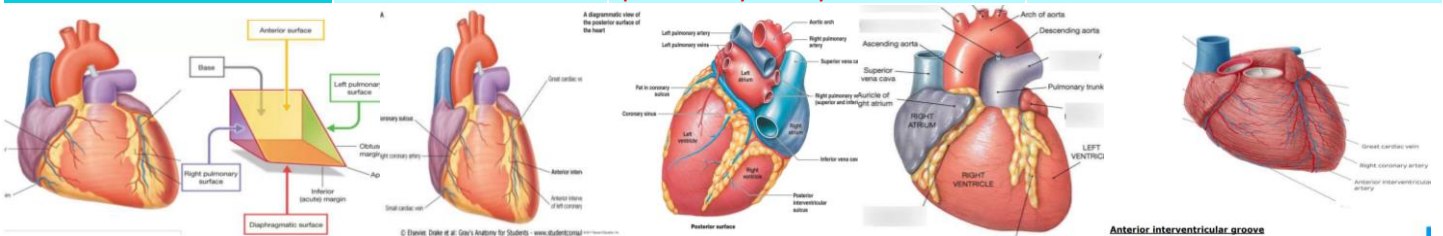
fibrous skeleton of the heart	Description	Number	
cardiac muscle fibers are anchored to fibrous skeleton of the heart formed of dense collagen fibers	1. fibrous rings (L. anuli fibrosi)	surround the orifices of the valves	4
	2. Fibrous trigone	formed by connections between the rings	2 1. right trigone : connective tissue between aortic ring and right atrioventricular ring 2. left trigone : formed by connective tissue between aortic ring and left atrioventricular ring
	3. Membranous parts	of the interatrial and interventricular septa	2


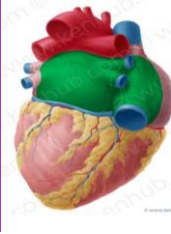



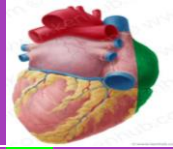
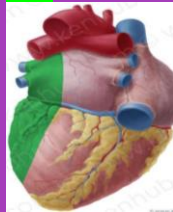
Functions of cardiac skeleton	Separation	Attachment	Maintains	Insulation
	atria from ventricles	1. for myocardium 2. of myocardial fibers (acts as framework) 3. for valve leaflets and cusps	valve orifices open and prevents them from being overly distended	electrical insulator between atria and ventricles

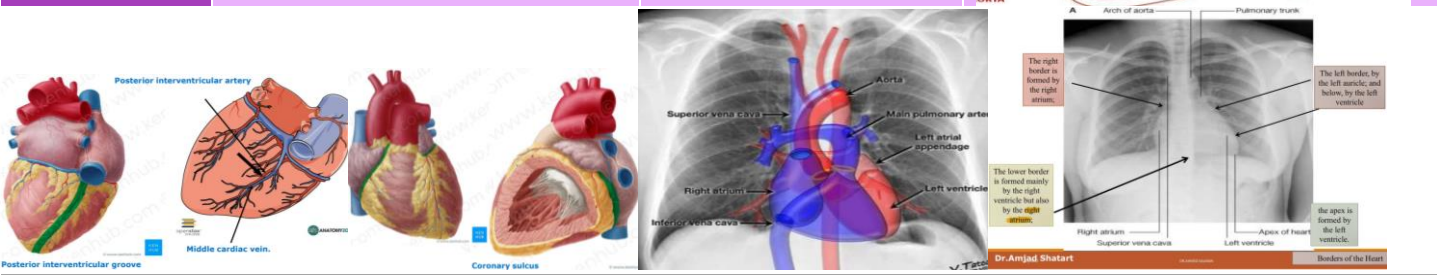
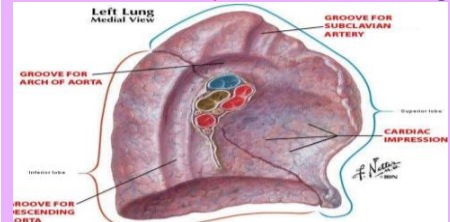
External Morphology of the Heart	Base	Apex	Surfaces	Borders	Grooves
pyramidal in shape	Located posteriorly	Formed by the left ventricle	4 1. anterior/sternocostal 2. inferior / diaphragmatic 3. right 4. left	4 1. right 2. left 3. Superior 4. inferior	4 1. atrioventricular (Coronary sulcus) 2. anterior interventricular 3. inferior (posterior) interventricular 4. interatrial grooves

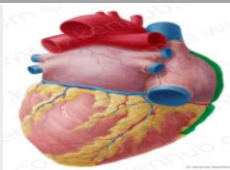
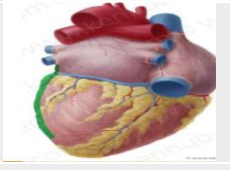
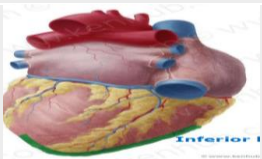
Groove of heart	Separation	Location	Content
atrioventricular (Coronary sulcus)	two atria from two ventricles		1. right coronary artery 2. circumflex branch of left coronary artery 3. coronary sinus 4. small cardiac vein
anterior interventricular	two ventricles	lies on the anterior surface of heart	1. Anterior interventricular artery 2. Great cardiac vein
inferior (posterior) interventricular	two ventricles	lies on the inferior surface of heart	1. Posterior interventricular artery. 2. Middle cardiac vein.
interatrial grooves		marked on posterior surface , while anteriorly it is hidden by pulmonary artery and aorta	

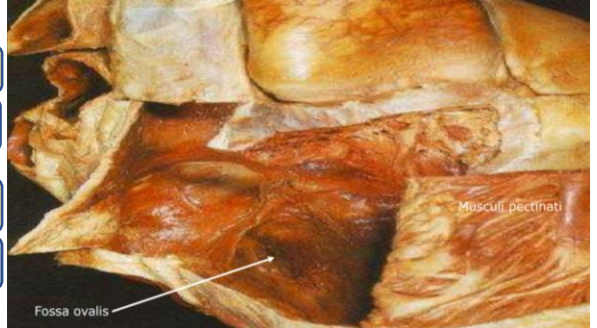
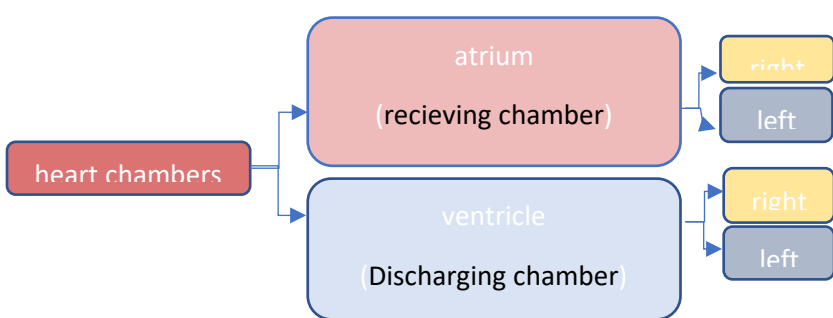


Surface / part	Formation	Location	Notes
Apex 	by infero-lateral part of left ventricle	posterior to left 5th intercostal space 9 cm (a hand's breadth) from the median plane	site mitral valve auscultation
Base 	by left atrium , with lesser contribution by right atrium .	posteriorly (opposite apex)	- related posteriorly to bodies of T6–T9 - <u>separated</u> from vertebrae by: 1. Pericardium 2. oblique pericardial sinus 3. Esophagus 4. descending aorta
sternocostal surface	1. Right atrium (mainly) . 2. Ventricular part: consists of: - Right ventricle (2/3) - Left ventricle (1/3) .	Anterior	ventricles separated by anterior interventricular groove
Diaphragmatic surface	1. Right ventricle (2/3) 2. Left ventricle (1/3)	inferior	- related mainly to central tendon of diaphragm

			<ul style="list-style-type: none"> - ventricles separated by posterior interventricular groove - surface is separated from base of heart by atrioventricular (coronary) sulcus
Right surface 	Right atrium (mainly)	Right	
Left surface 	left ventricle (mainly)		forms cardiac impression in left lung




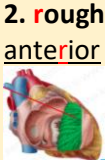
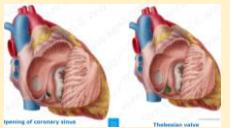
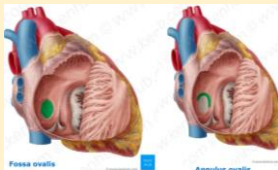
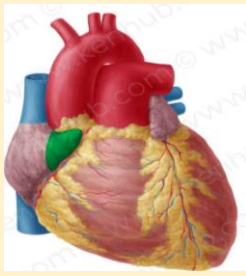



Borders of heart	Formation	Picture
Right border	by right atrium and extending between SVC and IVC	
Left border	<ol style="list-style-type: none"> left ventricle (mainly) left auricle (slightly) 	
Superior border	left atrium completed by right atrium	
Inferior border	<ol style="list-style-type: none"> right ventricle (mainly) left ventricle (slightly) 	



Heart valves	Name	Location
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Atrioventricular valves	Tricuspid valve	Between right atrium and right ventricle
	Mitral/Bicuspid valve:	Between left atrium and left ventricle
Semilunar valves	Pulmonary valve	Between right ventricle and pulmonary artery
	Aortic valve	Between left ventricle and Aortic artery

chamber	Name	walls Description	Separations	Openings	Special structures / notes
Right atrium 	1. Smooth posterior 	(the sinus venarum) receives openings: 1. SVC 2. IVC 3. coronary sinus	smooth and rough parts are <u>separated</u> : 1. Externally by <u>shallow vertical groove</u> : sulcus terminalis / terminal groove	1. SVC Opens at level of right 3rd costal cartilage 2. IVC Opens at level of right 5th costal cartilage - has a valve called Eustachian valve / valve of inferior vena cava , located anterior to orifice 	has a small muscular pouch called right auricle <u>Function</u> : increasing capacity of atrium <u>Shape Description</u> : conical muscular pouch that <u>projects</u> from Rt. atrium <u>Location Description</u> : overlaps ascending aorta
	2. rough anterior 	muscular anterior wall composed of pectinate muscles (L. musculi pectinati)	2. Internally by <u>vertical ridge</u> : crista terminalis / terminal crest	3. Coronary sinus opens between orifice of IVC + fossa ovale + vestibule of atrioventricular opening - has a valve called Thebesian valve 	<u>Clinical use</u> : Cardiac surgeon used it as point of entry
	3. Septal wall	separates right atrium from left atrium has oval depression called fossa ovalis (remnant of oval foramen) (L. foramen ovale) in fetus <u>surrounded</u> by annulus ovalis (limbus fossa ovalis). 			
				4. Anterior cardiac veins. 5. Venae cordis minimi. 6. Right Atrioventricular orifice guarded by Tricuspid valve 	
Right ventricle 	1. Smooth outflow part	called conus arteriosus (infundibulum) leads into pulmonary trunk	parts are separated by A thick muscular ridge called supraventricular crest		- three papillary muscles (named relative to point of origin on ventricular surface):

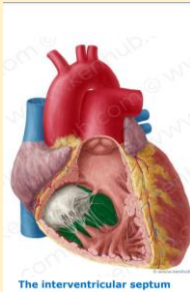
2. Rough inflow part



receives blood from right atrium through the **right atrioventricular orifice** which is guarded by **Tricuspid valve**, It has numerous muscular irregular structures called **trabeculae carneae**



3. interventricular septum (IVS)



composed of **muscular** and **membranous** parts

- **obliquely** placed partition between **right + left ventricles** forming part of walls of each.

- Because of much higher blood pressure in **left ventricle**, **muscular** part of **IVS**, **bulges** into cavity of right ventricle.

- **Superiorly** and **posteriorly**, **membranous part** of **IVS** is formed from **membranous part of fibrous skeleton** of the heart

- On the **right side**, **septal cusp** of **tricuspid valve** is attached to **middle** of this **membranous part of fibrous skeleton**.

- **inferior** to **cusp**, **membrane** is an **interventricular septum**

- **superior** to **cusp** it is an **atrioventricular septum**, separating **right atrium** from the **left ventricle**.

1. anterior papillary muscle
2. posterior papillary muscle
3. septal papillary muscle

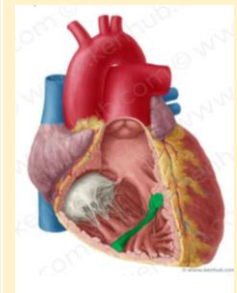
- **septo marginal trabecula (moderator band)**

- Description: a curved muscular bundle that **traverses right ventricular**

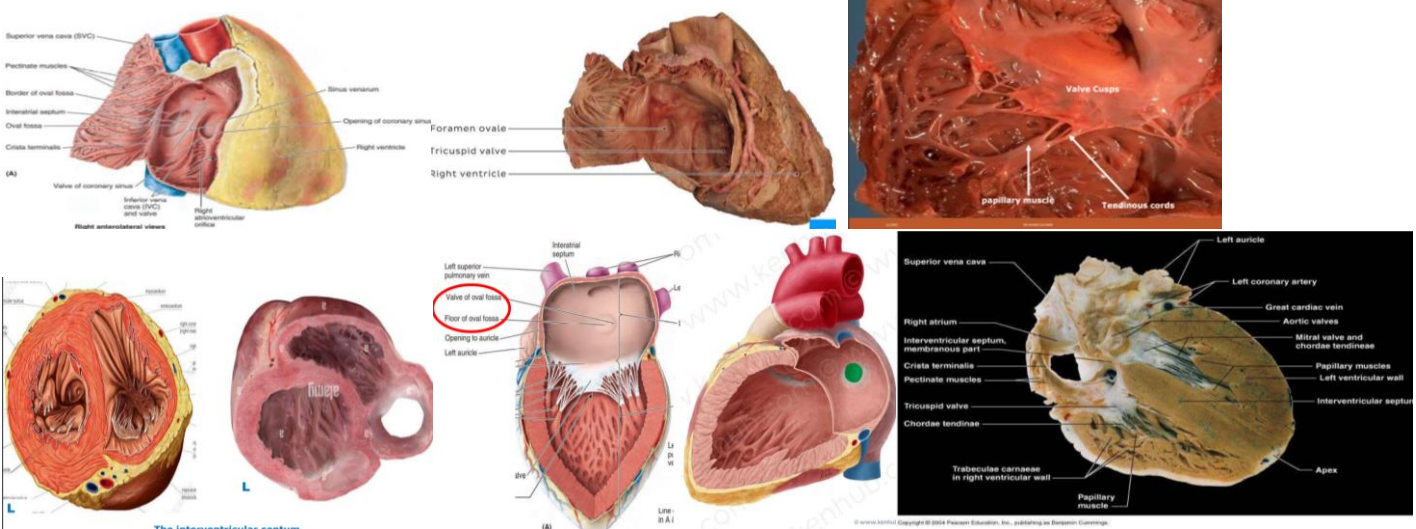
- Location: **traverses** from **inferior** part of **IVS** to **base** of **anterior papillary muscle**

- Function: carries part of **right branch** of **atrioventricular (AV) bundle** (part of the conducting system of the heart) to **anterior papillary muscle**

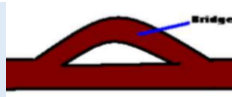
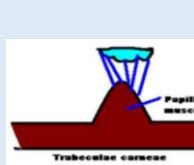
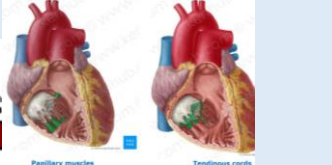



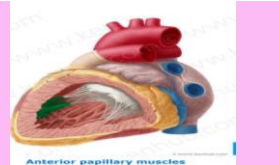

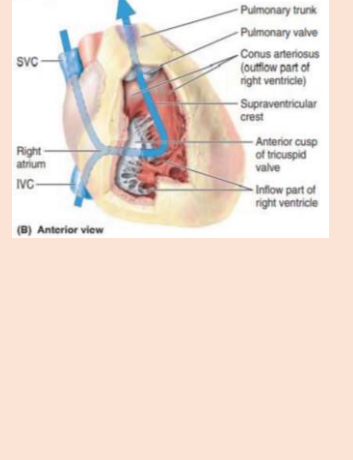
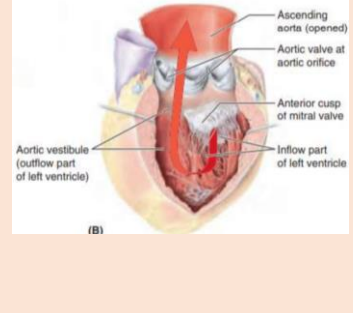
This **shortcut** across chamber seems to facilitate conduction time, allowing coordinated contraction of **anterior papillary muscle**

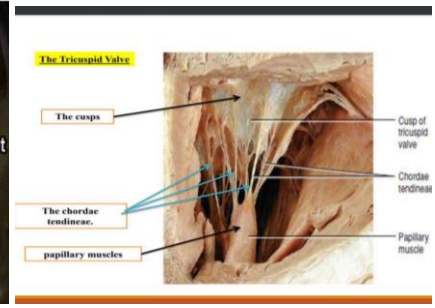
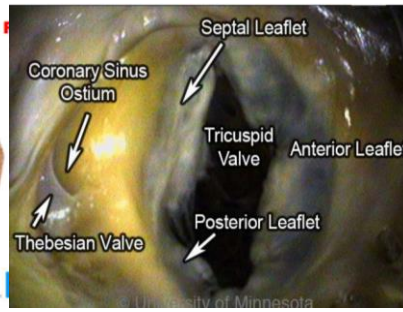
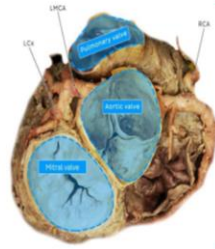
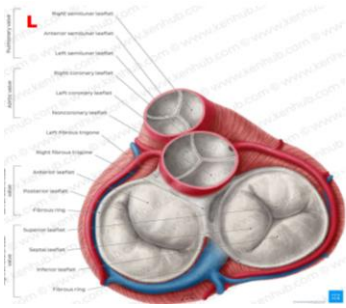



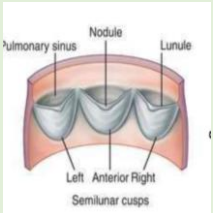
Left atrium 	1. Rough part 	left auricle , its wall lined with pectinate muscles. It represents the remains of the left part of the primordial atrium.		1. four pulmonary veins - forms most of the base of heart	- Behind it lies fibrous pericardium separates it from esophagus . It is smaller in size but has thicker wall than right atrium . - extends behind right atrium , thus right atrium is anterolateral to right part of left atrium .
	2. Smooth part 	represent the <u>absorption</u> of the future 4 pulmonary veins .		2. left atrioventricular orifice which is <u>guarded</u> by mitral valve	
	3. interatrial septum 	shows a semilunar edge indicates the oval fossa <u>surrounding</u> ridge is valve of oval fossa			
Left ventricle	1. Inflow rough part 	contains trabeculae carneae which are more numerous than right ventricle called aortic vestibule . - It is a smooth-walled, non muscular . - located supero-anterior . - <u>leads</u> to the aortic orifice and aortic valve .	parts are separated by subaortic curtain and anterior leaflet of mitral valve .	1. Left atrioventricular orifice which is <u>guarded</u> by mitral valve (ostium venosum) . 2. An outlet region, guarded by the aortic valve (ostium arteriosum) .	thickness of its wall is three times that of right ventricle . - It is a conical cavity -> longer than that of right ventricle . It contains two papillary muscles:
	2. Smooth outflow part 				1. Anterior papillary muscles 2. Posterior papillary muscles



Patterns Ridges	Attachment Attached throughout their length	Picture 
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Bridges	Attached by both ends				
papillary muscles	Attached by one end and the other end is free (margins) attached to tendinous cords called chordae tendineae which also attach to ventricular surfaces of tricuspid/mitral valve cusps				
papillary muscles	Description	Location	Attachment	Picture	
Right Ventricle	Anterior	largest and most prominent one	arises from anterior wall of right ventricle	To adjacent parts of anterior and posterior cusps of tricuspid valve	
	Posterior	Smaller than anterior muscle	arises from inferior wall of right ventricle	to posterior and septal cusps of tricuspid valve	
	Septal		Arises from interventricular septum	to septal and anterior cusps of tricuspid valve	
Left Ventricle	Anterior		arise from sternocostal surface		
	Posterior		arises from diaphragmatic surface		
Blood flow	Pathway		Degree	Picture	
right ventricle	<ol style="list-style-type: none"> right atrium contracts when right ventricle is relaxed blood is forced into right ventricle, pushing the cusps of tricuspid valve aside like curtains inflow of blood into right ventricle (inflow tract) enters posteriorly When ventricle contracts, the outflow of blood into pulmonary trunk (outflow tract) superiorly and to the left Consequently, blood takes a U-shaped path through right ventricle, changing direction about 140° This change in direction is accommodated by supraventricular crest, which deflects incoming flow into main cavity of ventricle, and the outgoing flow into conus arteriosus toward pulmonary orifice. 		140°		
Left ventricle	<ol style="list-style-type: none"> left atrioventricular orifice admits atrial blood during diastole, flow being towards cardiac apex After closure of mitral cusps, and throughout ejection phase of systole, blood is expelled from apex through aortic orifice bloodstream undergoes two right angle turns, which together result in a 180° change in direction. This reversal of flow takes place around the anterior cusp of the mitral valve 		180°		

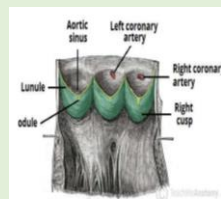


Valve	papillary muscles	Leaflets/cusps	attachments	Orifice	Blood supply	notes
Tricuspid 	Each papillary muscle sends its chordae tendineae to two adjacent leaflets 1. Anterior 2. posterior 3. septal	1. Anterior (largest) 2. posterior 3. septal (smallest) Each cusp / leaflet is formed of a double layer of endocardium enclosing a collagenous fibrous lamina	- base of cusps attached to tricuspid fibrous annulus of heart skeleton - margins of cusps are fused together forming valve commissures	right Atrioventricular (Surrounded by tricuspid valve annulus - a collagenous fibrous ring)	- Valve cusps normally avascular - Small blood vessels and smooth muscle found only in base of cusp . - surfaces of valve are exposed to blood , and cusps are thin enough to allow nutrients and oxygen to diffuse from blood - Rheumatic fever causes inflammation of heart valves (valvulitis): - induces angiogenesis in valve and vascularization in the normally avascular layers of valve - can lead to progressive replacement of elastic tissue by irregular masses of	<u>Composition of valve:</u> 1. Tricuspid valve orifice and annulus 2. Tricuspid valve cusps (leaflets) 3. Chordae tendineae <u>Annulus function:</u> keeps caliber of orifice constant , large enough to admit tips of 3 fingers <u>Chordae tendineae:</u> strong collagenous fibrous threads which spring from apical parts of papillary muscles or directly from septal wall
Mitral	Each papillary muscle sends its chordae tendineae to two adjacent leaflets 1. Anterior 2. posterior	1. Anterior (larger + directed anterior and right) 2. posterior (smaller + directed posterior and left)		left atrioventricular orifice between left atrium and left ventricle		mitral orifice is narrower than tricuspid orifice
Pulmonary		1. Anterior 2. Right 3. Left 		guards the orifice between right ventricle and pulmonary artery		<u>Semilunar valves:</u> - Each consists of 3 pocket like cusps of approximately equal size - arterial wall has 3 dilated pouches called sinuses / Valsalva (aortic sinuses pulmonary sinuses)

Aortic

1. Posterior
2. Right
3. left

superior to right and left cusps in the aortic sinus there are the openings of the right and left coronary arteries, respectively



guards the orifice between left ventricle and aorta

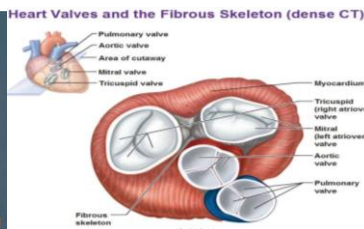
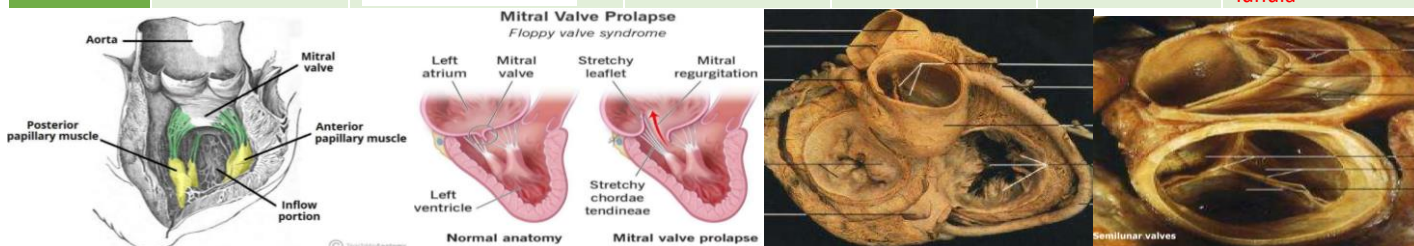
collagen fibers, causing valve to thicken

- valves become rigid and inflexible, which affects their ability to open and close

- blood in sinuses and dilation of wall prevent the cusps from sticking to wall of vessel, which might prevent closure

- At center of free margin of each cusp is a small fibrous nodule called nodulus Arantii

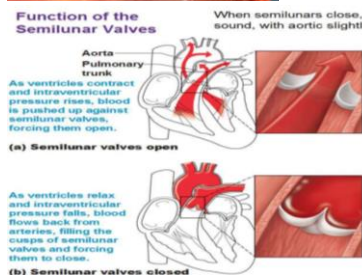
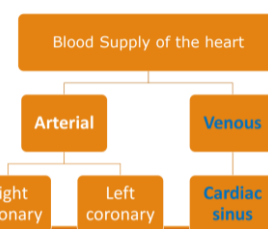
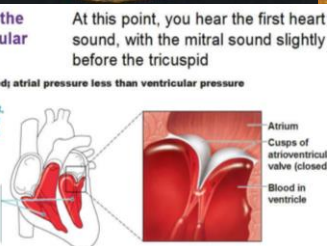
- Along entire free edge of cusp, on each side of nodules of Arantius there is a thin, halfmoon-shaped area called the lunula



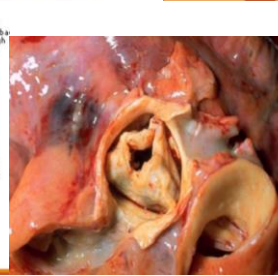
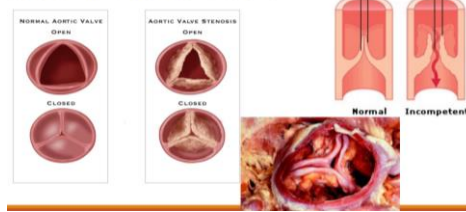
Function of the Atrioventricular Valves

(b) AV valves closed; atrial pressure less than ventricular pressure

1. Ventricles contract, forcing blood against atrioventricular valve cusps.
2. Atrioventricular valves close.
3. Papillary muscles contract and chordae tendineae tighten, preventing valve flaps from everting into atria.



Clinical Anatomy
Incompetent valve leads to regurgitation of blood
Stenosis of the valve leads to heart overload



Aortic stenosis, secondary to rheumatic heart disease. The aorta has been removed to show thickened, fused aortic valve leaflets and opened coronary arteries from above.


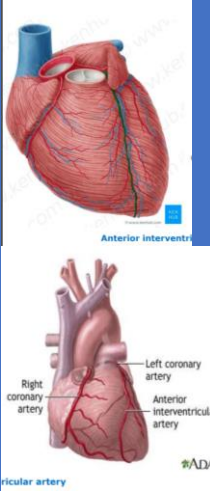
Valves




Mechanism of action

Atrioventricular (Tricuspid + Mitral)

1. ventricle contracts -> forcing blood against atrioventricular valve cusps
 2. papillary muscles contract and prevent cusps / valve flaps from being forced / everting into atrium and turning inside out as intraventricular pressure rises
- (To assist this process, chordae tendineae of one papillary muscle are connected to adjacent parts of two cusps -> prevent separation of cusps and prolapsing (being driven into right atrium (inversion)) as ventricular pressure rises (tension is applied to tendinous cords) -> regurgitation of blood (backward flow of blood) from right ventricle back into right atrium is blocked during ventricular systole by valve cusp)
3. On closure of an AV valve, narrow border between free edge of each cusp presses against that of the next, resulting in a secure, watertight closure (Papillary muscles begin to contract before right ventricle, tightening tendinous cords and drawing cusps together.)

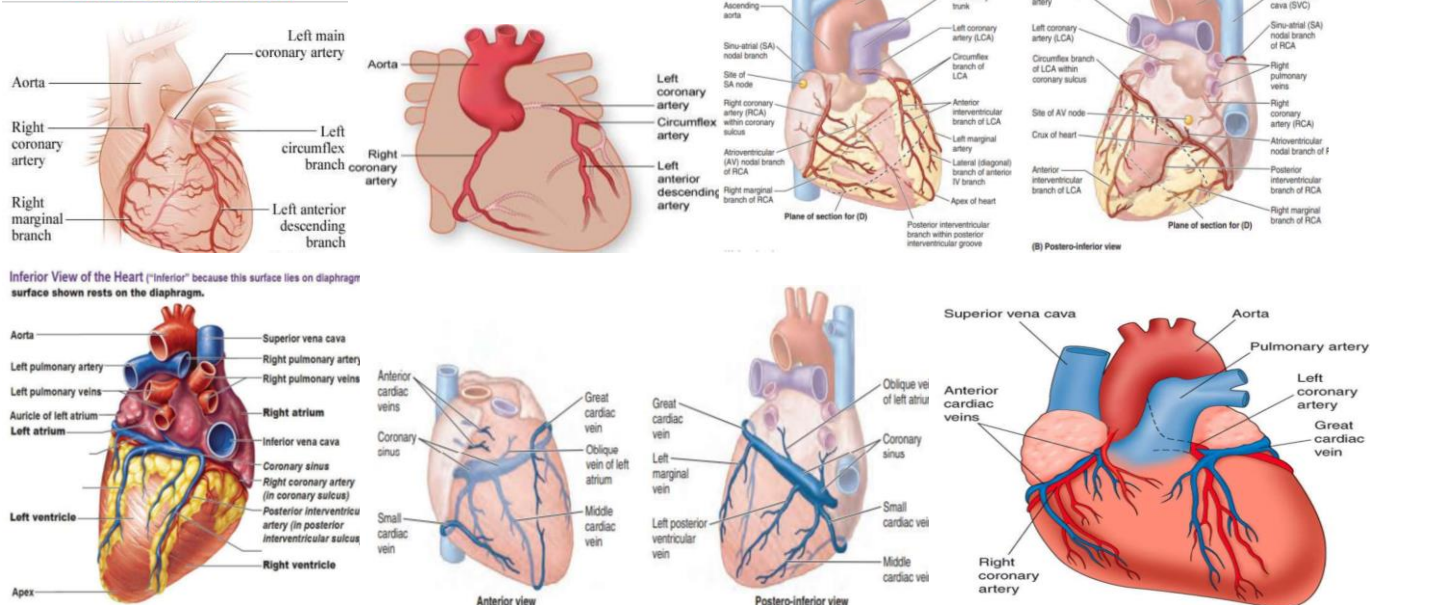
Semilunar (pulmonary + Aortic)	<ol style="list-style-type: none"> 1. As ventricles contract and intra ventricular pressure rises, <u>blood</u> is pushed up against semilunar valves, forcing them open. 2. After relaxation of ventricle (diastole), elastic recoil of wall of pulmonary trunk / aorta forces blood back toward heart. 3. blood filling cusps of semilunar valves and forcing them to close 4. They come together to completely close orifice and preventing any blood from returning to ventricle
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Vessel	Origin / beginning	Pathway	Branches / divisions / tributaries	Supply / drainage	Notes
left coronary artery (LCA) 	originates from left aortic sinus of ascending aorta	passes between left auricle and left side of the pulmonary trunk	has short stem divided into: <ol style="list-style-type: none"> 1. anterior interventricular (Clinician name: left anterior descending (LAD)) 2. circumflex artery 	<ol style="list-style-type: none"> 1. left atrium 2. Most of left ventricle. 3. Part of right ventricle. 4. Most of IVS (usually anterior two thirds), including AV bundle of conducting system of heart, through its perforating IV septal branches. 5. SA node (in 40% of people) 	- branches of coronary arteries considered functional end arteries (arteries that <u>supply</u> regions of myocardium lacking sufficient anastomoses from other large branches to maintain viability of tissue when occlusion occur) - endocardium and some subendocardial tissue located immediately external to endocardium receive oxygen and nutrients by diffusion / microvasculature directly from chambers of heart
Anterior interventricular artery (IV) / (LAD) 		<ol style="list-style-type: none"> 1. runs downward in anterior interventricular groove to apex of the heart 2. passes around apex of heart to enter posterior interventricular groove and anastomoses with terminal branches of right coronary artery. 3. In one third of individuals it ends at apex of heart 	In many people, gives rise to a lateral branch (diagonal artery) , which descends on anterior surface of heart	<ol style="list-style-type: none"> 1. adjacent parts of both ventricles 2. anterior two thirds of IVS via IV septal branches 	

<p>circumflex artery</p> 		<p>same size as the anterior interventricular artery</p> <p>it winds around the left margin of the heart in the atrioventricular groove</p>	<p>1. Left marginal artery (large branch)</p> <p>2. Anterior ventricular</p> <p>3. posterior ventricular</p> <p>4. Atrial</p>	<p>supplies left margin of left ventricle <u>down</u> to apex</p> <p>supply left ventricle</p> <p>supply left atrium</p>	
<p>right coronary artery (RCA)</p> 	<p>Arises from right aortic sinus of ascending aorta</p>	<p>runs along right AV sulcus, embedded in fat</p>	<p>1. Sinoatrial (SA) nodal artery</p> <p>2. Atrioventricular (AV) nodal artery</p> <p>3. Inferior (Posterior) interventricular branch</p>	<p>1. right atrium.</p> <p>2. Most of right ventricle</p> <p>3. Part of left ventricle (diaphragmatic surface)</p> <p>4. Part of IV septum, usually posterior third</p> <p>5. SA node (in 60% of people)</p> <p>6. AV node (in 80% of people).</p> <p>7. LBB also receives small branches</p>	
<p>Sinoatrial (SA) nodal artery</p>		<p>encircles base of SVC</p>		<p>SA node</p>	
<p>Atrioventricular (AV) nodal artery</p>				<p>AV node</p>	
<p>Inferior (Posterior) interventricular</p>		<p>descends in posterior IV groove toward apex of heart</p>		<p>1. adjacent areas of both ventricles</p> <p>2. posterior third of IV septum</p>	
<p>coronary sinus</p>		<p>(main vein of heart) is a wide venous channel runs from left to right in posterior</p>	<p>receives :</p> <p>1. Great cardiac vein</p>		<p>The heart is drained mainly by veins that empty into coronary sinus</p>

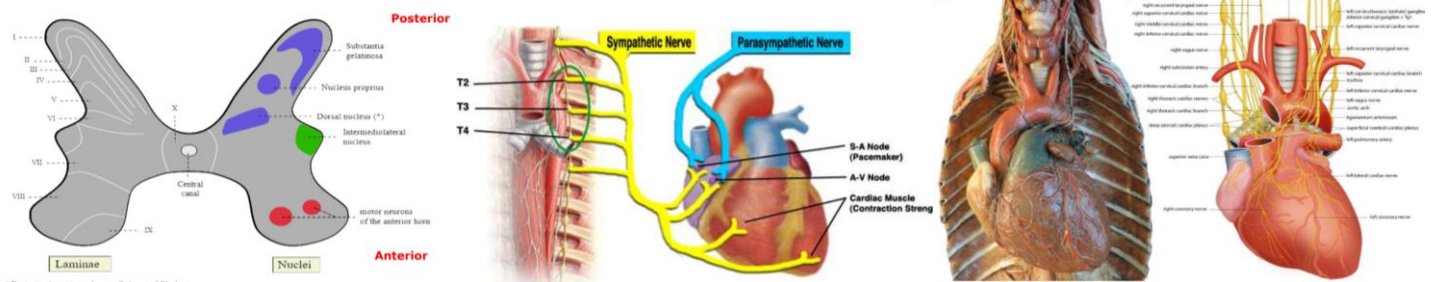
 <p>Coronary sinus</p>		<p>part of coronary sulcus runs between left atrium and ventricle</p>	<p>2. Middle cardiac vein (begins at apex of heart and runs in posterior (inferior) interventricular groove)</p> <p>3. Small cardiac vein</p> <p>4. Posterior vein left ventricle</p> <p>5. Oblique vein of left atrium</p>		<p>and partly by small veins that empty directly into right atrium</p> <p>Veins of the heart are:</p> <ol style="list-style-type: none"> 1. coronary sinus 2. Anterior cardiac vein 3. Vena cordis minimi
<p>Great cardiac vein</p>  <p>Great cardiac vein</p>	<p>begins at apex of heart</p>	<p>ascends in anterior interventricular groove</p>	<p>Receives: left marginal vein (ascends on left border of heart)</p>		
<p>Middle cardiac vein</p>  <p>Middle cardiac vein</p>	<p>begins at apex of heart</p>	<p>runs in posterior (inferior) interventricular groove</p>			

Blood Supply of heart



Heart Innervation	Type	Divisions	Location	Formation (fibers)
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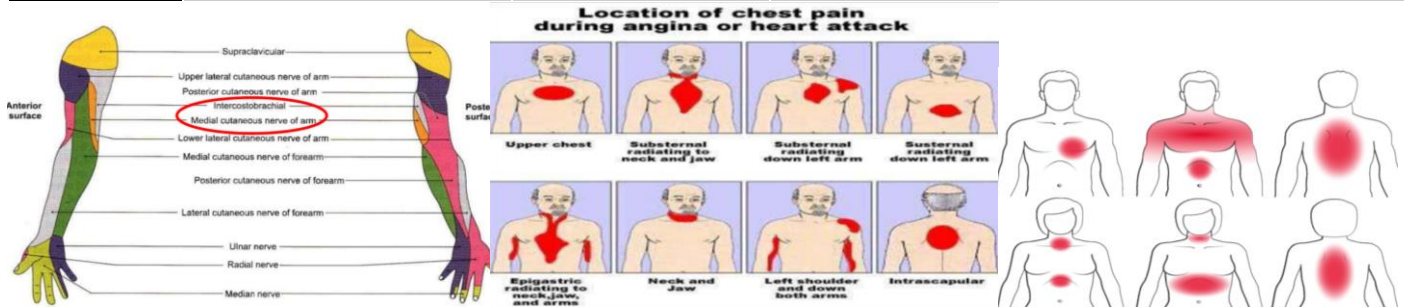
cardiac plexus	autonomic nervous system	1. superficial 2. deep	anterior surface of bifurcation of trachea	1. sympathetic 2. parasympathetic 3. visceral afferent
Supply	Preganglionic fibers location / origin	Preganglionic fibers relay	Postganglionic fibers pathway	Function
Sympathetic	from cell bodies in intermediolateral cell columns (IMLs) of superior 5 / 6 thoracic segments of spinal cord	at cervical and superior thoracic ganglia of sympathetic trunks	traverse cardio pulmonary splanchnic nerves and cardiac plexus to end in SA and AV nodes	Stimulation causes increased: 1. heart rate 2. impulse conduction force of contraction 3. blood flow through coronary vessels to support increased activity
Parasympathetic	from vagus nerves	relay in cardiac plexus and nerve cells in atrial wall and interatrial septum near SA and AV nodes and along coronary arteries		Stimulation: 1. slows heart rate 2. reduces force of contraction 3. constricts coronary arteries saving energy between periods of increased demand

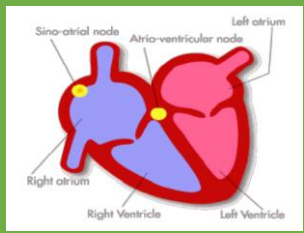
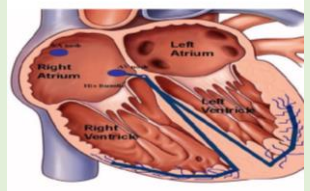


Receptors	Location	Type	Mechanism of action	Result / function
Adrenergic	coronary blood vessels	b2-receptors	when activated : cause relaxation (or perhaps inhibition) of vascular smooth muscle , therefore, dilation of arteries (Wilson-Pauwels et al., 1997)	supplies more oxygen and nutrients to myocardium during periods of increased activity

Condition	Description	Nerve fibers pathway	Relayed area
Cardiac Pain	nature of pain varies from a severe crushing pain to a mild discomfort heart is insensitive to: 1. touch 2. cutting 3. cold 4. Heat However: 1. ischemia 2. accumulation of metabolic products stimulate pain endings in myocardium	afferent pain fibers run with thoracic cardiac branches of sympathetic trunk . These sensory fibers enter <u>spinal cord</u> through posterior roots of upper four thoracic nerves	pain is not felt in heart , but is referred to skin areas supplied by upper four thoracic nerves skin areas supplied by upper four intercostal nerves and by intercostobrachial nerve (lateral cutaneous branch of second intercostal nerve / T2) are affected intercostobrachial nerve communicates with medial cutaneous nerve of arm and is distributed to skin on medial side of upper part of arm - can heart pain be felt in: right side, both sides, or back? Synaptic contacts may also be made with connector neurons , which conduct impulses to neurons on right side of comparable areas of spinal cord .

Myocardial infarction	involving inferior wall or diaphragmatic surface of heart often gives rise to discomfort in epigastric	afferent pain fibers run with sympathetic nerves and enter spinal cord in posterior roots of T7, T8, and T9	gives a referred pain to epigastric region
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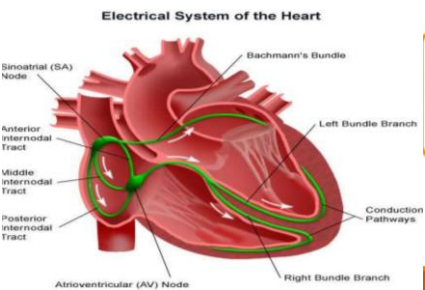
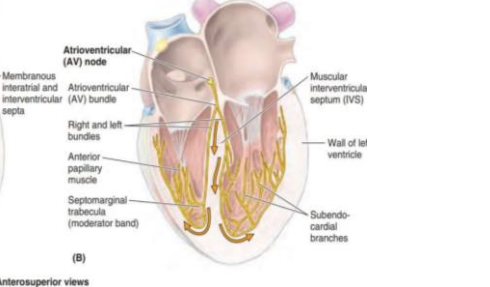
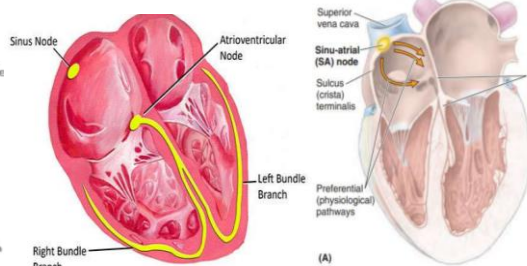
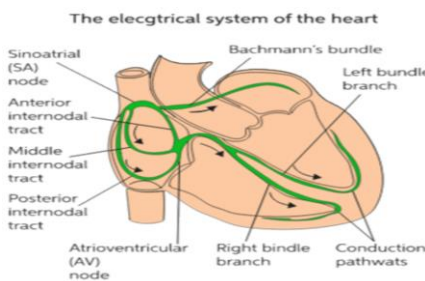


Formation	Sequence	Constituents
conducting system of heart 	formed of modified myocardial fibers called purkinje fibers that are responsible for initiation + conduction + maintenance of cardiac muscle slight delay in passage of impulse from atria to ventricles allows time for atria to empty their blood into ventricles before ventricles contract .	consists of: <ol style="list-style-type: none"> sinoatrial node (S.A) atrioventricular node (A.V) antioventricular bundle Right and left terminal branch 

conducting system of heart	Description	Function	Pathway / connections	Location	Notes
sinoatrial node (S.A) pacemaker of the heart	ellipsoid band of modified myocardial fibers and associated fibroelastic connective tissue	initiates and regulates impulses for contractions of heart	Internodal conduction tracts arranged as follows: 1. Anterior internodal tract 2. Posterior internodal tract 3. Middle internodal tract	extends from anterolateral aspect of opening of superior vena cava into upper part of crista terminalis	Internodal conduction tracts: These are fine bundles of modified myocardial fibers connecting sinoatrial (S.A.) node with atrioventricular (A.V.) node
Atrio ventricular (A.V.) node	a collection of nodal tissue but smaller than SA node	receives impulse from SA node through internodal tract and distributes signal to ventricles through AV bundle (of His)		lies on: 1. Right side of interatrial septum 2. just above septal leaflet of tricuspid valve 3. close to opening of coronary sinus	anatomical landmarks are the boundaries of triangle of Koch

Antioventricular (AV) bundle	short bundle of modified myocardial fibers	A. right bundle stimulate: 1. muscle of IVS 2. anterior papillary muscle (through septomarginal trabecula (moderator band)) 3. wall of right ventricle B. subendocardial branches (of left bundle) that stimulate: 1. IVS 2. anterior and posterior papillary muscles 3. wall of left ventricle	divides into right and left bundles at junction of membranous and muscular parts of IVS These branches proceed on each side of muscular IVS deep to endocardium and then ramify into subendocardial branches (Purkinje fibers) which extend into walls of respective ventricles.	begins from A.V. node and passes through fibrous skeleton of heart along membranous part of interventricular septum	left bundle divides near its origin into approximately six smaller tracts , which give rise to subendocardial branches
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Internodal conduction tracts	Origin	Pathway
Anterior	arises from upper end of S.A. node	passes in front of superior vena caval opening and it divides into two bundles: 1. A bundle penetrating interatrial septum to reach wall of left atrium and is called Bachman's bundle. 2. other bundle descends on right side of interatrial septum to reach A.V. node
Middle	arises from postero superior aspect of S.A. node	curves posteriorly behind orifice of Superior vena cava to reach A.V. node
Posterior	arises from postero inferior aspect of S.A	descends through crista terminalis and valve of inferior vena cava to reach A.V. node



Hey Dude!
Be Careful!
Don't Hit
My Power
Button!!

Source of Blow: Tennis racket, Lacrosse ball, Baseball, Fist or elbow.

Primary determinants and triggers: Percussive impact site, Time/duration of impact of T wave.

Contributing variables: Greater hardness of projectile, Smaller sphere, Direct orientation, Thinner, more compliant chest wall.

Effect: Rapid increase in myocardial pressure.

20-msec window.

Left lung, Rib, Chest wall, Heart wall.

Side view.

11/2012. © AHMED SALMAN.

Condition	Description
ventricular septal defect (VSD)	AV bundle usually lies in margin of VSD. (this vital part of conducting system must be preserved during surgical repair of defect)

Destruction of AV bundle would cut the **only physiological link** between **atrial** and **ventricular musculature**, also producing a **heart block**

Comotio Cordis

This condition results in **ventricular fibrillation** and **sudden death**.

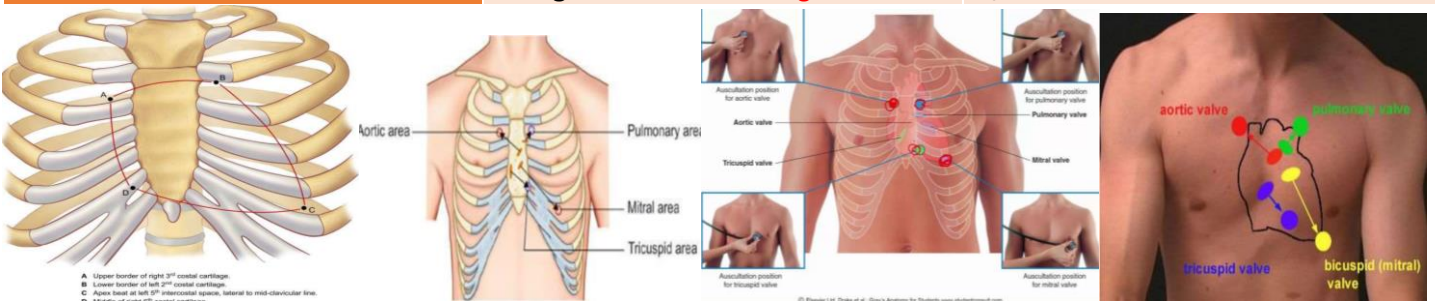
Cause:

blunt non penetrating blow to **anterior chest wall** over heart

Most susceptible group:

most commonly in young and adolescents and is often **sports-related**.

Surface anatomy of the heart	Location	Distance from midline
Point A	Upper border of right 3rd costal cartilage	1 inch
Point B	Lower border of left 2nd costal cartilage	1.5 inch
Point C (Apex)	in left 5th intercostal space	3.5 inches (1 + 1.5 + 0.5 = 3 + 0.5 = 3.5)
Point D	on right 6th costal cartilage	1/2 inch



Heart Auscultation	Location
Pulmonary valve	left 2nd sternocostal junction
Aortic valve	right 2nd sternocostal junction
Mitral valve	apex of heart
Tricuspid valve	xiphisternal joint