Lesson 2 – Circulation

Learning Outcomes:

Demonstrate an understanding of:

- Cardiovascular system
- Cardiac assessment
- Pain assessment
- Electrocardiogram.

Develop understanding of the following:

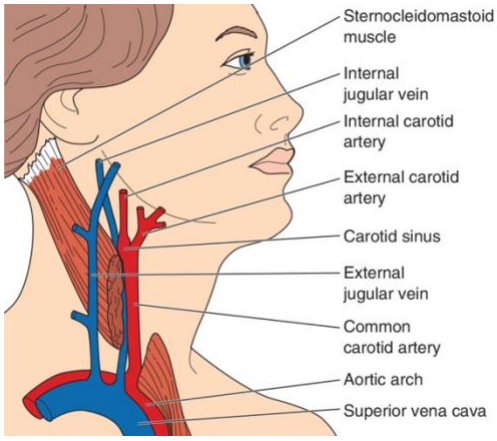
- RISK Factors
- Ischaemia
- Myocardial Infarction STEMI/ NSTEMI

Application to practice:

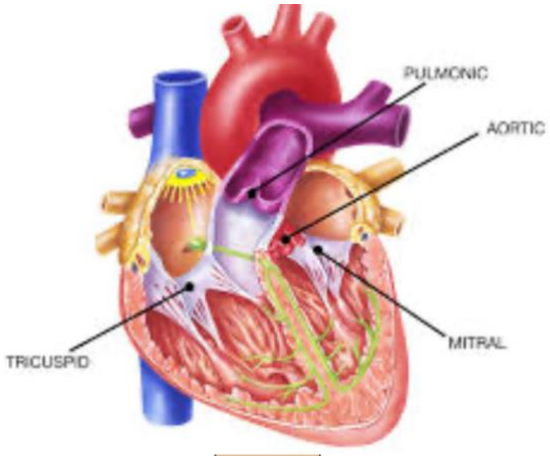
- Diagnosis
- Treatment
- Assessment

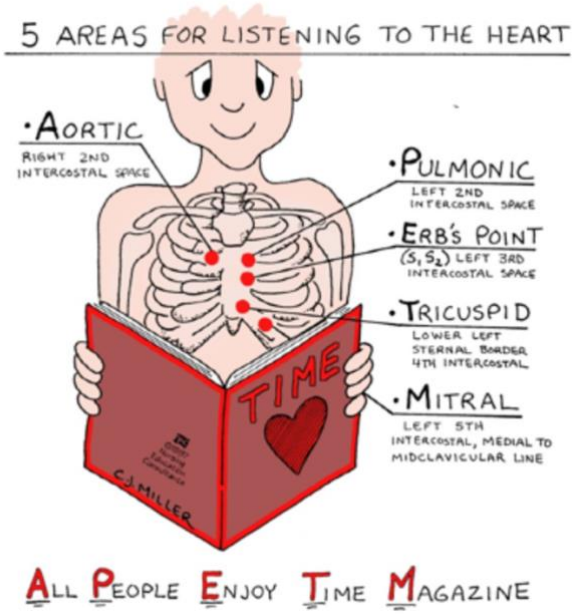
Circulation Anatomy

Arteries & Veins of the right side of neck

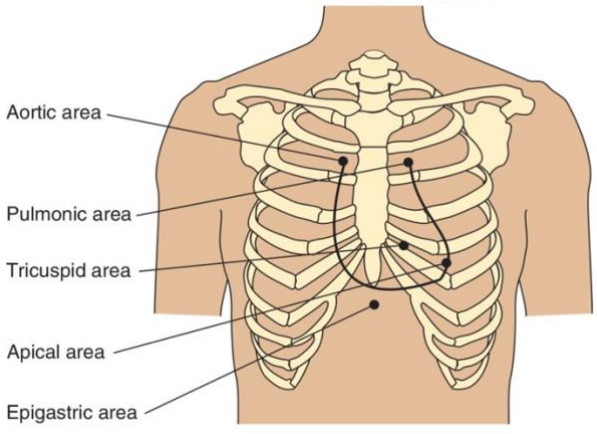


Anatomic sites of heart valves





Anatomic sites of the precordium



Heart Valves

The heart has four valves:

1. Tricuspid
2. Pulmonary
3. Mitral
4. Aortic

Most heart valve problems involve the aortic and mitral valves. Heart valve disease can disrupt the way blood flows through the heart and into your body.

Healthy functioning heart valves should:

- Be properly formed and flexible
- Be open all the way so blood can flow through properly
- Close tightly so that no blood leaks back into the chamber

Roles of the valves:

- Aortic Valve – Closes off the lower left chamber that holds the oxygen rich blood before it is pumped out to the body. Opens to allow the blood to leave the heart.

- Pulmonary/Pulmonic Valve – Closes off the lower right chamber (right ventricle). Opens to allow blood to be pumped from the heart to the lungs.

- Tricuspid Valve – Closes off the upper right chamber (atrium) that holds blood coming from the body. Opens to allow blood to flow from the top right chamber to the lower right chamber (right atrium to right ventricle). It also prevents the back flow of blood between the ventricle to the atrium.

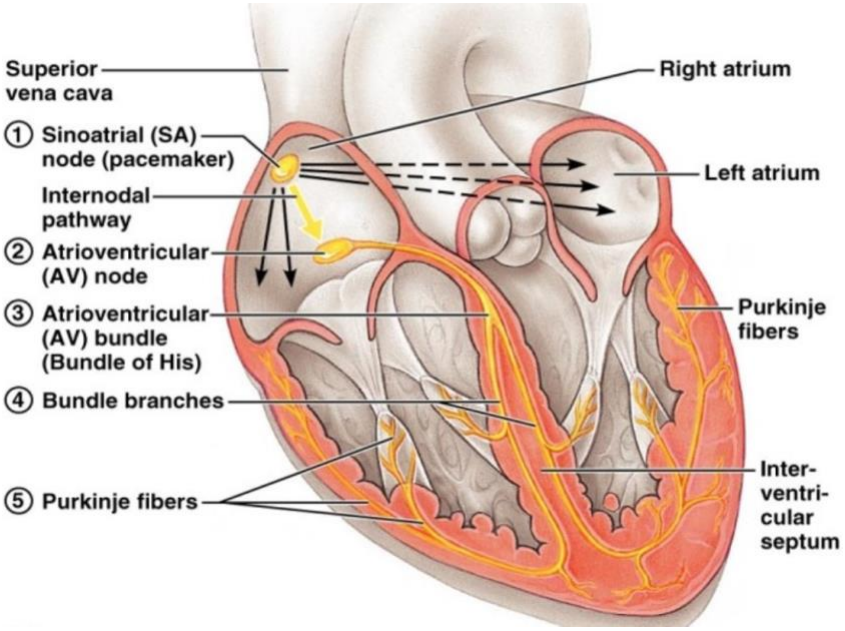
- Mitral Valve – Closes off the upper left chamber (left atrium) collecting the oxygenated blood coming from the lungs. Opens to allow blood to pass from the upper left side to the lower left side (left atrium to left ventricle).

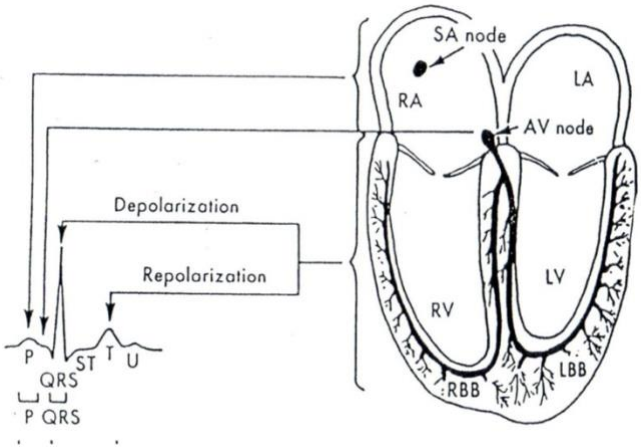
Heart Sounds

TABLE 11–1 Normal Heart Sounds

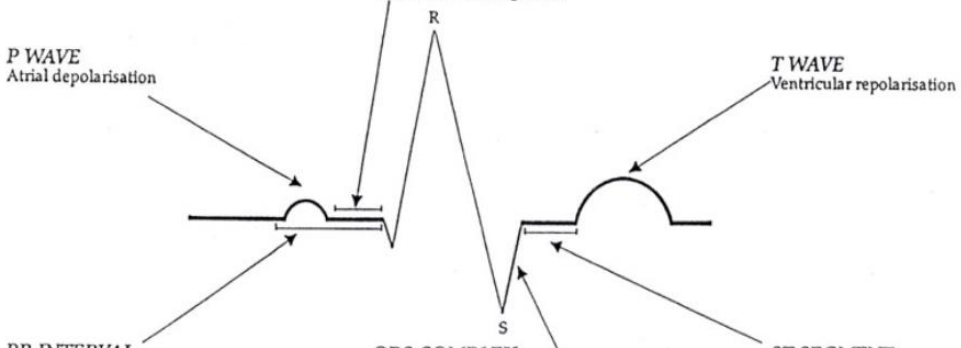
SOUND OR PHASE	DESCRIPTION	AREA			
		AORTIC	PULMONIC	TRICUSPID	APICAL
S_1	Dull, low-pitched and longer than S_2; sounds like 'lub'	Less intensity than S_2	Less intensity than S_2	Louder than or equal to S_2	Louder than or equal to S_2
Systole	Normally silent interval between S_1 and S_2				
S_2	Higher pitch than S_1; sounds like 'dub'	Louder than S_1	Louder than S_1; abnormal if louder than the aortic S_2 in adults over 40 years of age	Less intense than or equal to S_1	Less intense than or equal to S_1
Diastole	Normally silent interval between S_2 and next S_1				

Electrical Conduction of the Heart





PR SEGMENT
Impulse from atrium delayed at AV node. Allows atrium to contract fully forcing as much blood as possible into the ventricles before they contract. 70% of ventricular filling occurs as the ventricles relax but before the atrium contract. (Passive filling due to pressure difference.) Atrium then contract which forces another 30% of blood into the ventricles, increasing the stretch on the walls of the ventricles resulting in increased force of contraction (*Starlings Law*).



P WAVE
Atrial depolarisation

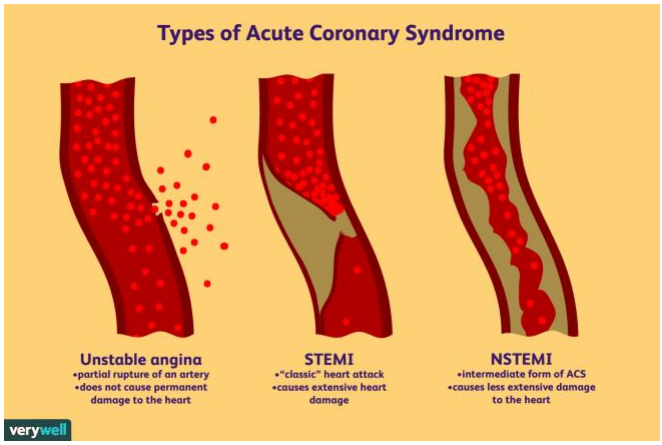
T WAVE
Ventricular repolarisation

PR INTERVAL
Time it takes for impulse to travel from SA node to the ventricles. Normal time: 0.12 to 0.20 seconds (3 to 5 small squares).
**If PR interval greater than 0.20 consider atrioventricular blocks.*

QRS COMPLEX
Ventricular depolarisation. Normal width in time 0.04 to 0.10 seconds. (1 to 2½ small squares.)
**If QRS complex wider than 0.12 consider bundle branch blocks.*

ST SEGMENT
Delay between ventricles depolarising and repolarising. Allows ventricles to contract fully, ensuring good cardiac output.
**If ST segment depressed consider myocardial ischaemia. If elevated consider myocardial infarction.*

Chest pain + Acute Coronary Syndrome (ACS)
ACS is a life-threatening manifestation of a raptured plaque causing a sudden, complete or critical reduction in blood flow.
ACS is an umbrella term for several presentations:

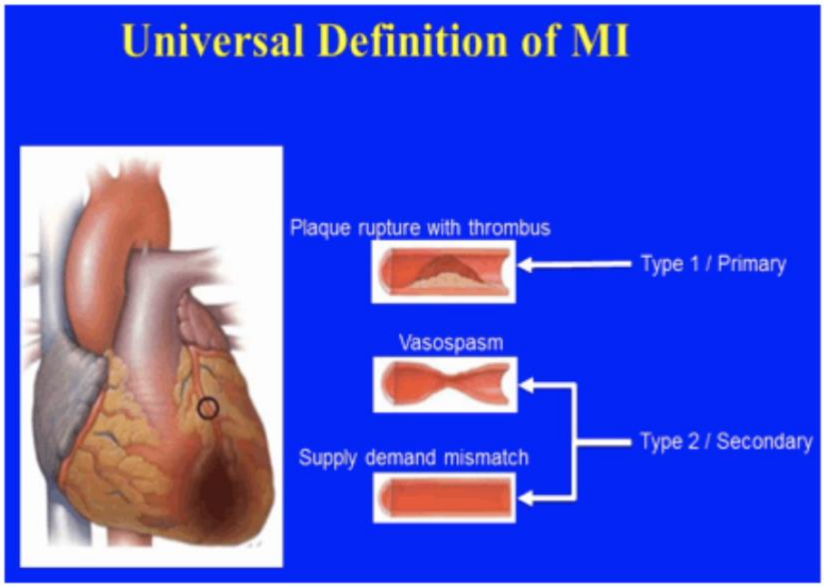


- NSTEMI / NSTE-ACS
- STEMI / ST-ACS
- Unstable Angina

<u>ACS Risk Factors:</u>

- Smoking
- Diabetics
- High BP
- Stress
- Type A personality
- Sedentary lifestyle
- Diet high in saturated fats
- Unhealthy diet
- High cholesterol
- Family history/ certain ethnic groups
- High BMI
- Overweight
- Depression
- Age
- Males

Myocardial Infarction
Myocardial infarction also known as a heart attack occurs when the blood flow decreases or stops to a part of the heart, causing damage to the heart muscle. The usual cause of the sudden blockage is the formation of a blood clot (thrombus) in the coronary artery.



Acute Myocardial Infarction

Acute Myocardial Infarction (MI) is defined as a myocardial cell death caused by prolonged ischemia leading to necrosis of myocardial tissue.

Causes include:

- Coronary Artery Disease
- Trauma
- Hypovolemia
- Risk factors previously mentioned

Stages include:

After an occlusion of the artery the myocardium evolves through various stages which can be seen on an ECG.

- Ischemia (reversable)
- Injury (reversable)
- Infarction (tissue necrosis) irreversible

Stemi and Non-stemi

- Transmural infarcts (STEMI) = Zone of infarction involves almost the entire thickness of the ventricular wall.

Class Work

1. How many large boxes equal 1 second

- 5 large boxes = 1 second

2. How do you calculate rate from a 12 lead ECG?

- A standard 12 lead ECG represents 10 seconds (50 large squares). Multiply all the complexes by 6.

3. What are bipolar limb leads?

Lead I – measures current between R & L arms
Lead II – Between R arm & L foot
Lead III – Between the L arm & L foot

6 steps to ECG interpretation:

1. Is there a P wave? Is the P wave followed by a QRS complex and is it after every P wave?
2. Measure the PR interval – remember this should be by 0.12-0.2 secs or 3-5 small squares
3. Is the QRS interval narrow or wide - Narrow <0.12 seconds or <3 small squares
   -Wide >0.12 seconds > 3 small squares
4. Is it regular/irregular?
5. What is the rate
6. Put it all together to interpret the strip

Additional questions:

- ST changes
- Cardiac axis

Identification of Arrhythmias

- <u>Premature Beat (premature ventricular contraction/PVC's):</u>
  - Extra ventricular heartbeat resulting from abnormal electrical activation originating in the ventricles before a normal heartbeat would occur. The main symptom is a precipitation of a skipped heartbeat. To diagnose the palpitation a standard ECG or a 24 or 48-hour Holter monitor may be used to quantify the PVC's over a set time span to assess the patients risk for developing cardiomyopathy. Caused by environmental factors such as smoking or excessive caffeine.
- Premature atrial contraction
- AV nodal