Physiology Team 434

Practical Physiology Revision

Cardiovascular Block

Color index

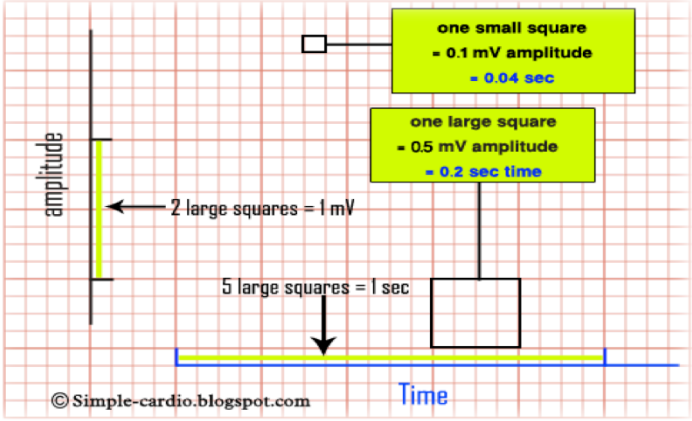
- **Important**
- Further Explanation

In the females' folder (download center) you'll find the real slides of each one of the 4 lectures.

1- Electrocardiograph (ECG)

✧ The ECG Paper:

The horizontal line represent the TIME
And every small square = 0.04 sec



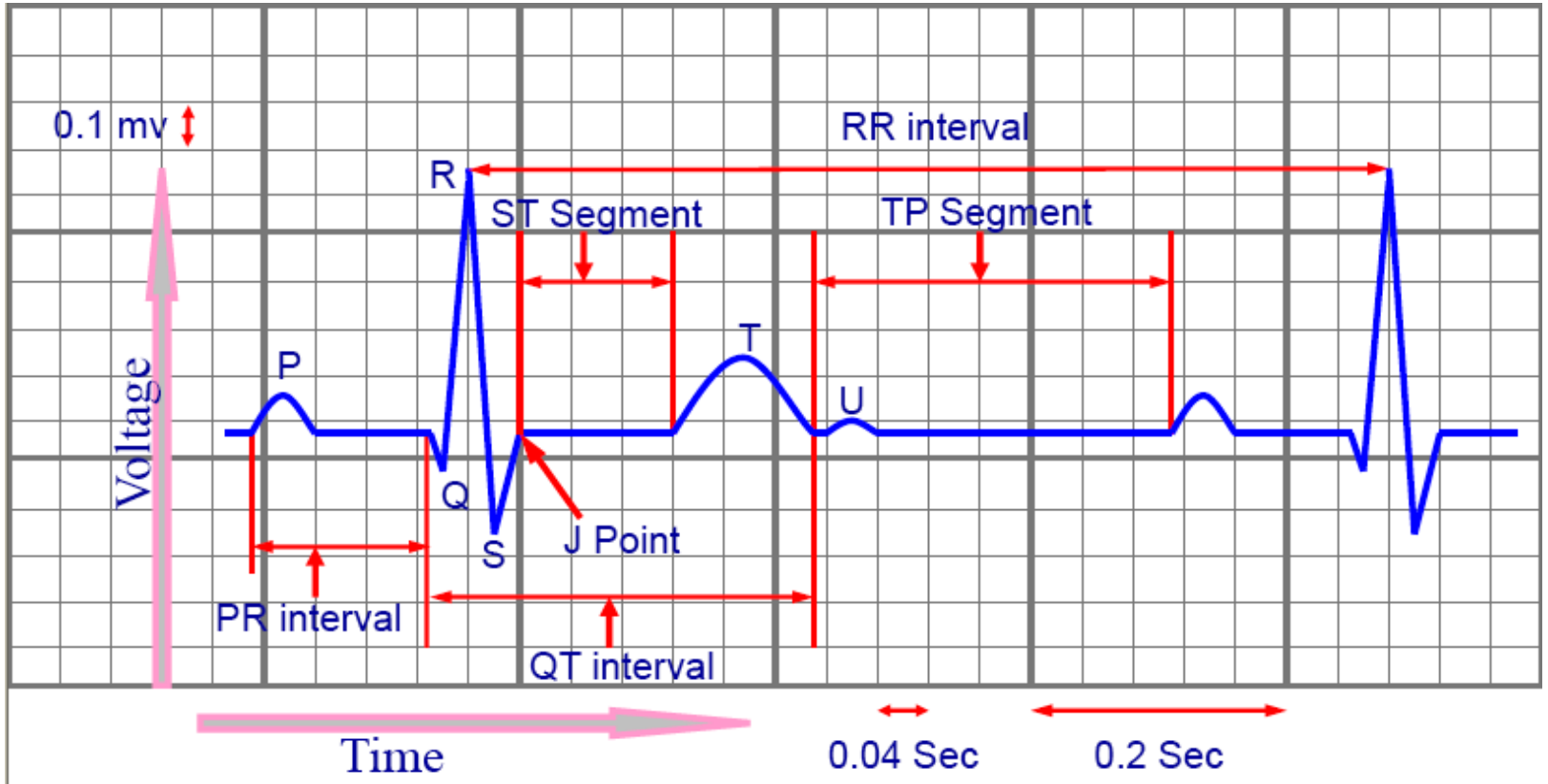
✧ ECG leads:

Definition: a pair of electrodes joined together to record the potential difference between the two electrodes.

How many leads? 12 standard leads to record ECG.

What is the different between bipolar and unipolar? A bipolar lead records the potential difference between two active electrodes and a unipolar lead records the potential of one active electrode

Type of leads	Limb Leads	Chest leads
Bipolar	I,II,III (standard limb leads)	-
unipolar	aVR.aVL,aVF (augmented limb leads)	V1-V6



• PR interval	0.12 – 0.20 sec	• QT interval	0.4 – 0.43 sec
• QRS duration	0.08 – 0.10 sec	• RR interval	0.6 – 1.0 sec

https://youtu.be/55vEtwZPtDw

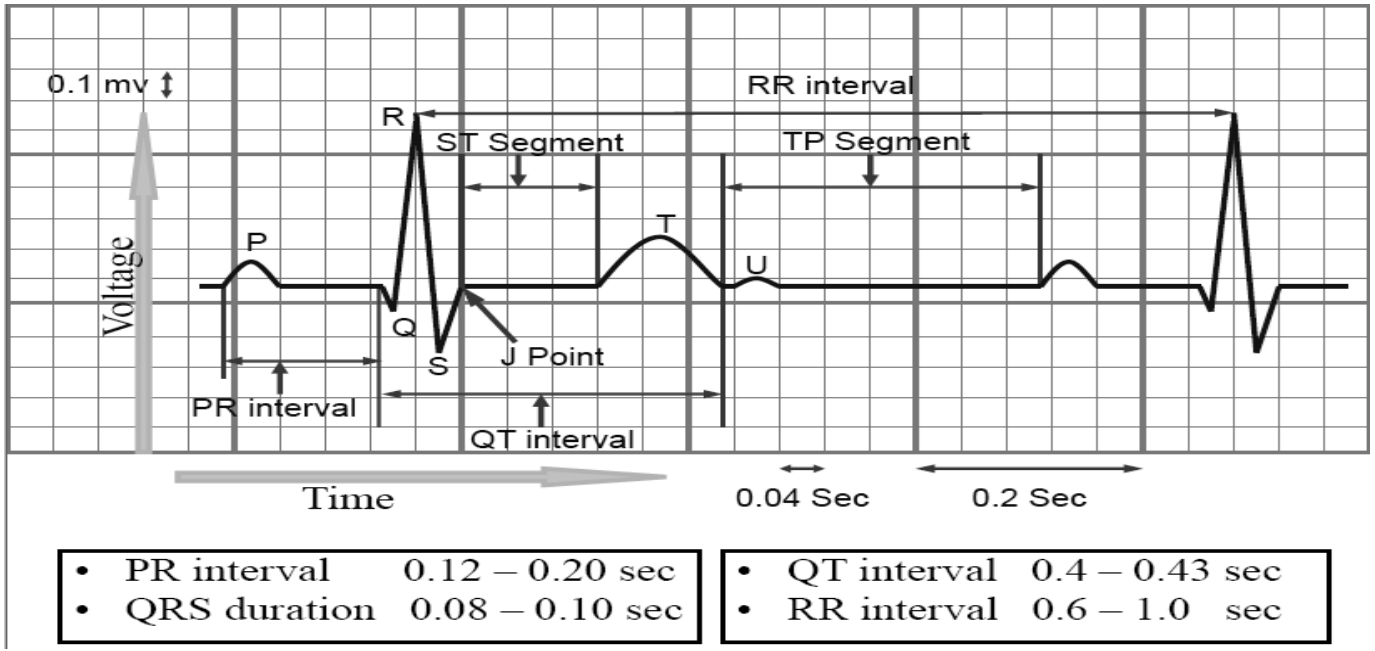
https://youtu.be/VyMcd3Sk3ZU

WAVES	
P wave	Represents atrial depolarization.
QRS complex	Represents ventricular depolarization.
T wave	Represents ventricular repolarization.
U wave	Is sometimes present due to repolarization of hypertrophied papillary muscles.(Physiological) and due to hypokalemia (pathological)

INTERVALS			
Name of interval	**What the interval represent?**	**Normal range**	**Disease related to intervals**
PR interval	From the "beginning of p-wave to the beginning of q-wave" (R-wave in case if Q-wave is absent).	0.12 – 0.20 seconds 3 to 5 small squares	Prolonged PR interval more than 0.2 may be sign of first degree heart block.
QRS duration	From the beginning of q-wave to the end of s-wave	0.08 – 0.1 seconds	-
QT interval	From the beginning of q-wave to the end of t-wave	0.4 – 0.44 seconds	QT interval is short = hypercalcaemia . Prolong the QT interval = hypocalcaemia
ST interval	From the end of s-wave to the end of t-wave.	0.28 – 0.36 seconds	Elevated in myocardial infarction

Calculation of The Intervals

Remember the small squares are 0.04 so what we do is we count the number of small squares between the intervals and we multiply it by 0.04



• PR interval	0.12 – 0.20 sec	• QT interval	0.4 – 0.43 sec
• QRS duration	0.08 – 0.10 sec	• RR interval	0.6 – 1.0 sec

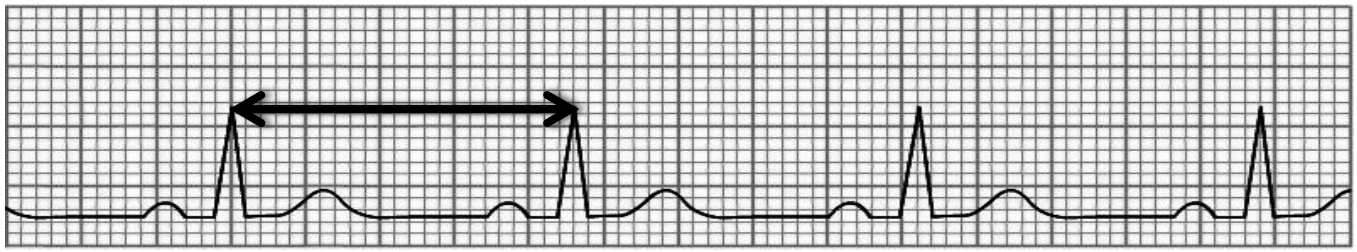
As an example :

Q-T interval = 8 small squares multiply by 0.04 = 0.32 sec

Calculation of Heart Rate

We can calculate the heart rate from the ECG by using the following formula:

$Heart\ Rate$ **= 1500 / Number of small squares between R – R waves**



In above the number of the small squares is 23 so we apply it to the formula:
1500/23 = 65 beats/minutes

1- The normal range of heart rate is between 60 – 100 beats/minute.
2- If the heart rate exceeds from 100 beats/minute, it is called **Tachycardia**.
3- If the heart rate goes below 60 beats/minute, it is termed **Bradycardia**.

Determination of Axis

How we use it and why ?

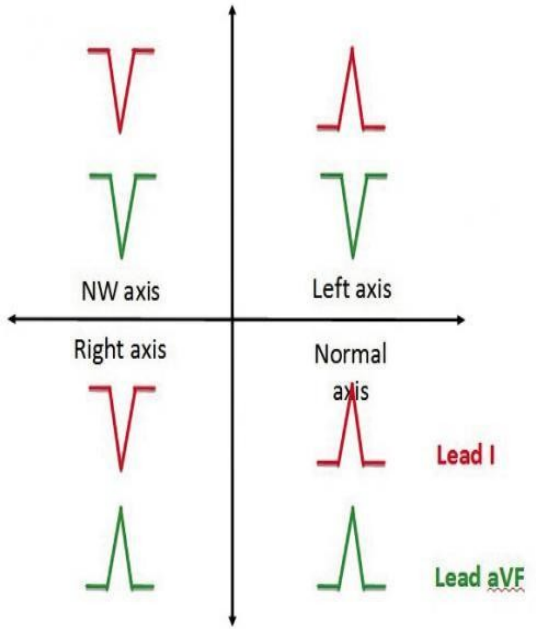
By applying rule of thumb on the direction of R-wave in the Leads I and III/ aVF of the ECG in order to determine the electrical axis of the heart.

What does LAD and RAD mean?

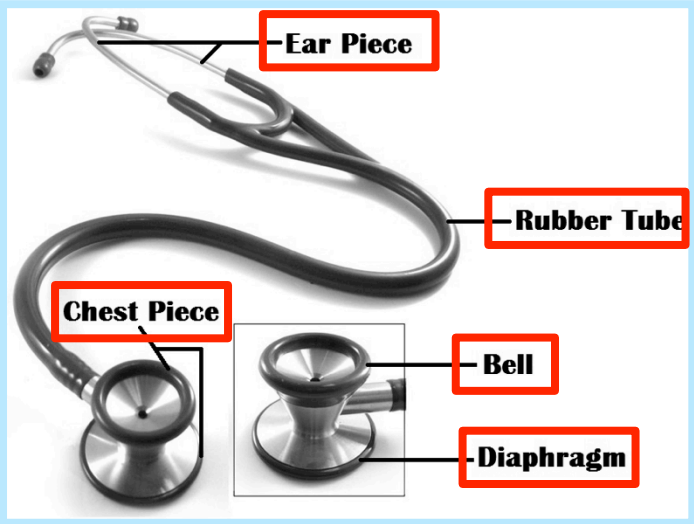
LAD = deviated to the left.

RAD = deviated to the right.

R WAVE		
axis	Lead I	Lead III oraVF
Normal	Positive "upward"	Positive "upward"
LAD	Positive "upward"	Negative "downward"
RAD	Negative "downward"	Positive "upward"
Extreme RAD or Extreme LAD	Negative "downward"	Negative "downward"



2- Heart Sounds



✧ The Stethoscope

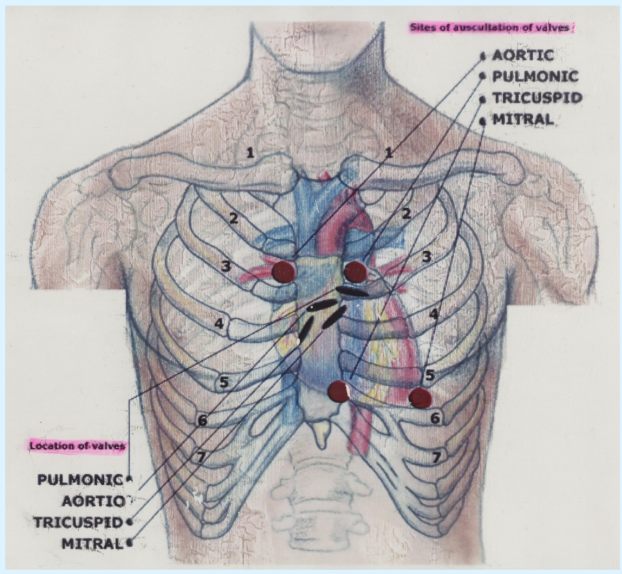
Consists of:

- ✓ Earpiece
- ✓ Rubber tubing
- ✓ Chest piece contains:
  - ✪ Diaphragm for 1st & 2nd heart sounds
  - ✪ Bell for Murmurs

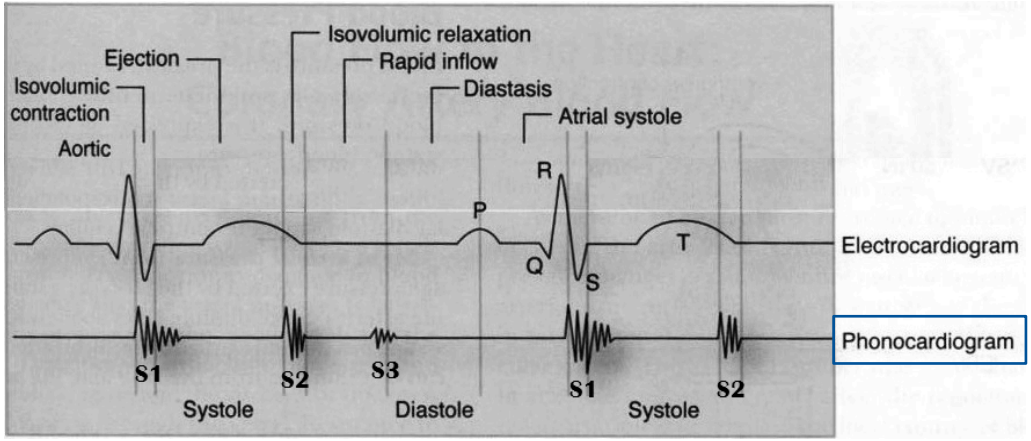
✧ Auscultation

The following area should be auscultated for normal & abnormal heart sounds:

- ✓ **Mitral Area** **"The site of apex beat"**
  Left 5th intercostal space. (1cm medial to the mid-clavicular line
- ✓ **Tricuspid Area**
  Left of the lower border of the sternum.
- ✓ **Pulmonary Area**
  Left 2nd intercostal space at the sternal boarder.
- ✓ **Aortic Area**
  Right 2nd intercostal space at the sternal boarder.



✧ Heart Sounds Using Phonocardiography



1st Heart Sound (S1)

- ✓ Normal. It sounds as "lub".
- ✓ Caused by the closure of AV valves. **"the beginning of systole"**
- ✓ Best heard when auscultated at **mitral and tricuspid areas.**
- ✓ Occurs **just after QRS complex**

2nd Heart Sound (S2)

- ✓ Normal. It sounds as "dub".
- ✓ Caused by the closure of semi-lunar valves. **"the beginning of diastole"**
- ✓ Best heard when auscultated at **aortic and pulmonary areas.**
- ✓ Occurs **just after T wave.**

S2 splitting is **normal** I that may occur **during deep inspiration.**

Physiological Splitting of The Second Heart Sound

3rd Heart Sound (S3)

It may be heard normally in:

- ✓ **Children**
- ✓ **Thin adults**
- ✓ **Pregnant**
- ✓ **After exercise**

4th Heart Sound (S4)

It may be heard normally in:

- ✓ **Older people**

3- Recording of Ceratoid Arterial Pulse & Jugular Venous Pulse

✧ Carotid Arterial Pressure (CAP):

The carotid pulse can be taken on the right side of the neck over the **carotid artery** in order to determine heart rate.

✧ Recorded CAP graph

✓ **Anacrotic limb:**

*Record during maximum ejection phase of ventricular systole.

✓ **Dicrotic notch (Incisura):**

*Due to closure of aortic valve.

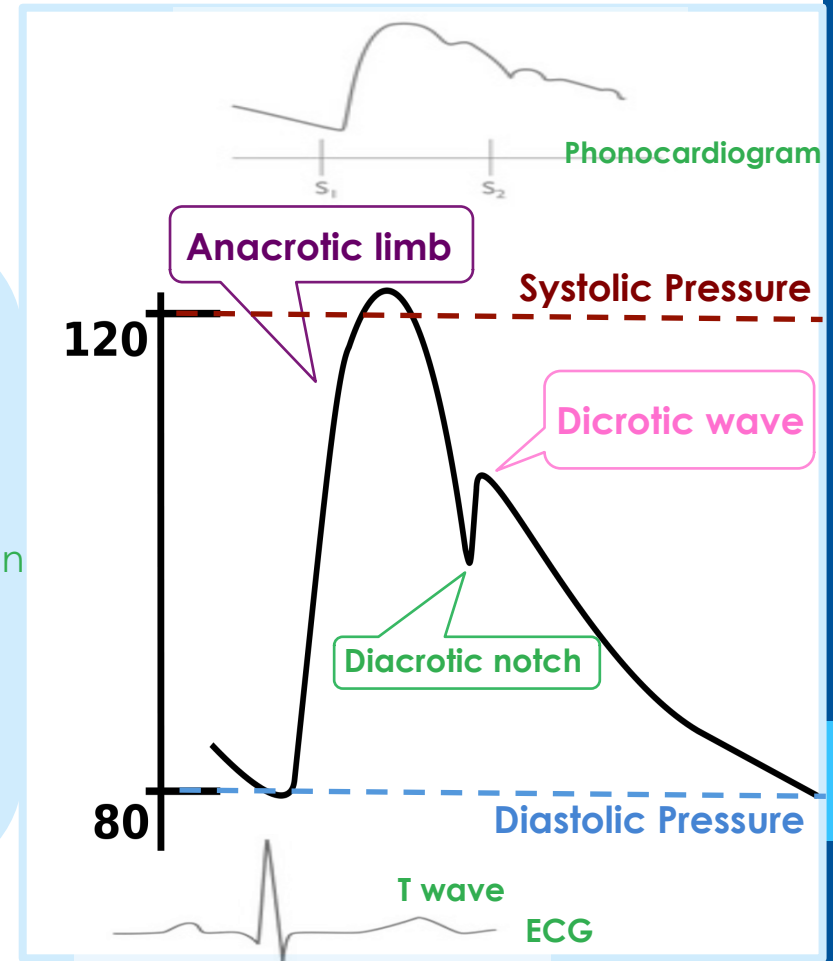
*Occurs just after the T-wave when we relate it to an ECG.

*Coincides with the second heart sound when we relate it to a phonocardiogram

✓ **Dicrotic wave:**

Due to elastic recoil of arterial wall.

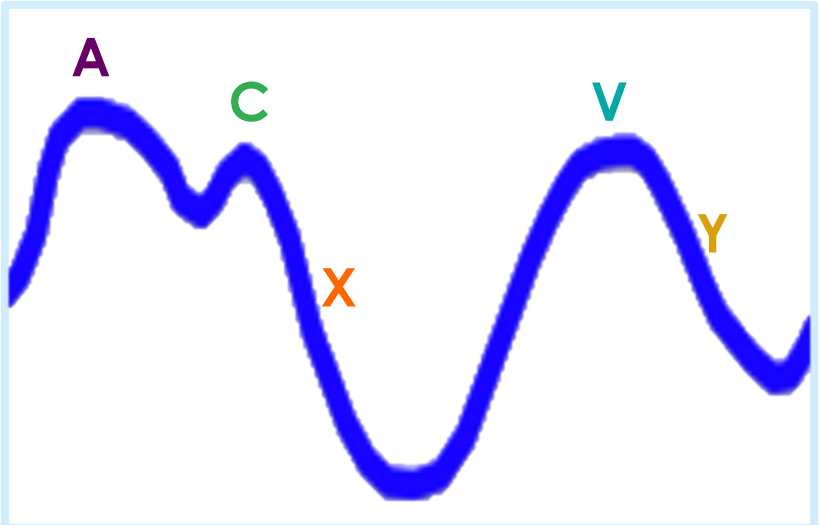
✓ **Dicrotic limb: (descending)**



✧ Jugular Venous Pressure (JVP)

Pressure changes in the right atrium are transmitted directly to the **internal jugular vein** as there are no valves between this vein and the right atrium

✧ Recorded JVP graph:



Causes of the waves:

- ✓ **A wave:** RA contraction.
- ✓ **C wave:** Bulging of TV into RA during isovolumetric contraction phase.
- ✓ **V wave:** ↑ RA press due to filling of atrium with blood, (venous return.)
- ✓ **X descent:** Downward displacement of TV during rapid ejection phase.
- ✓ **Y descent:** Rapid blood flow from RA to RV.

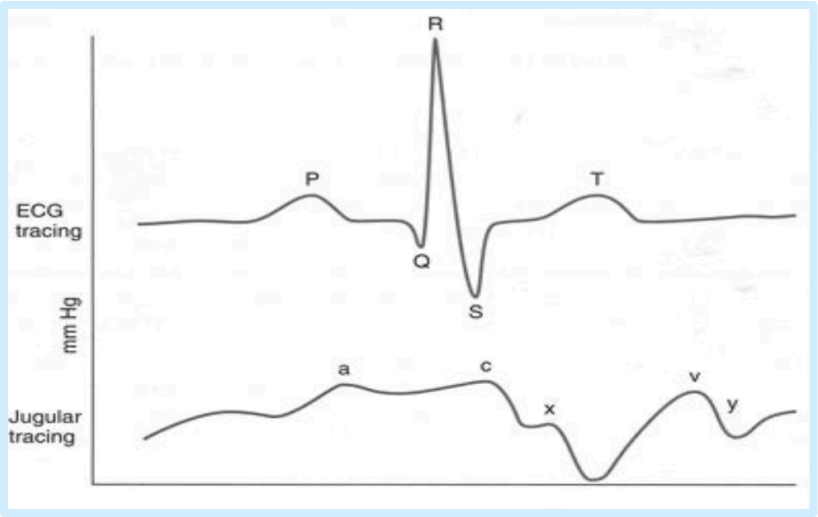
✧ JVP and ECG:

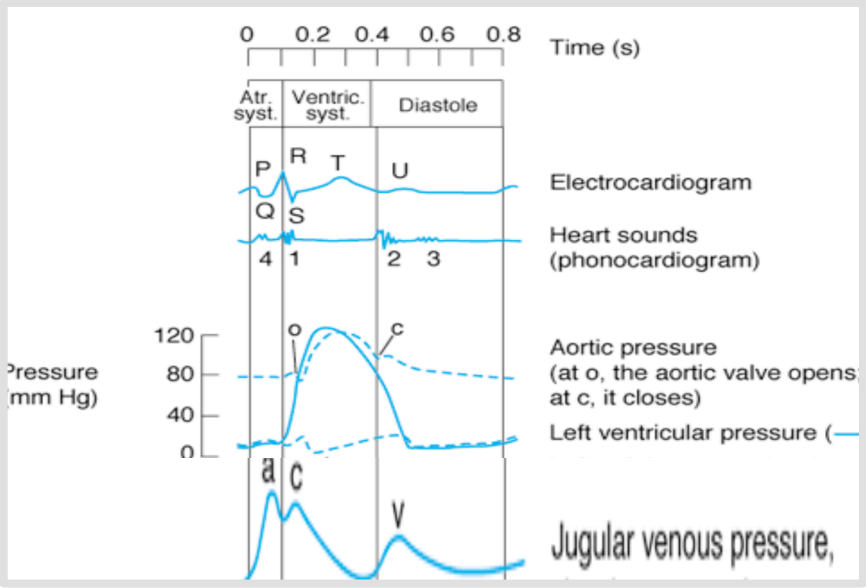
- a wave follows p wave

*Precedes upstroke of carotid pulse.

*Synchronises with S1.

- c wave follows QRS
- v wave peaks after S2 which is synchronous with dicrotic notch·





Recall

Abnormalities

✧ Abnormal CAP

✓ Aortic stenosis : pressure drops
✓ Aortic regurgitation: pulse strong

✧ Clinical abnormalities of JVP

✓ A wave:

- Prominent:

1. RV hypertrophy (↑ resist of filling)
2. Pulmonary stenosis.
3. Pulmonary hypertension.
4. Tricuspid stenosis.

- Absent:

1. Atrial fibrillation.
2. Tricuspid regurgitation .

- Cannon wave:

1. Complete AV block.
2. Atrial flutter.
3. Ventricular extrasystole.

✓ C wave:

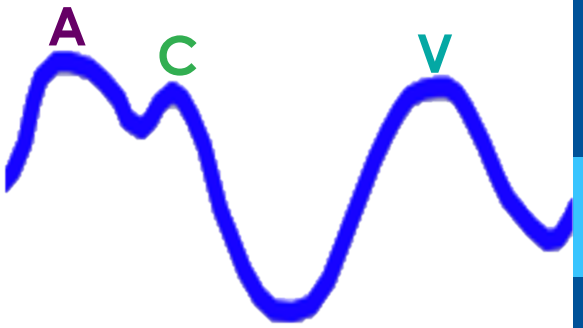
- Prominent

1. Tricuspid regurgitation ; absent in const.peric.

✓ V wave:

- Prominent

1. Tricuspid regurgitation.



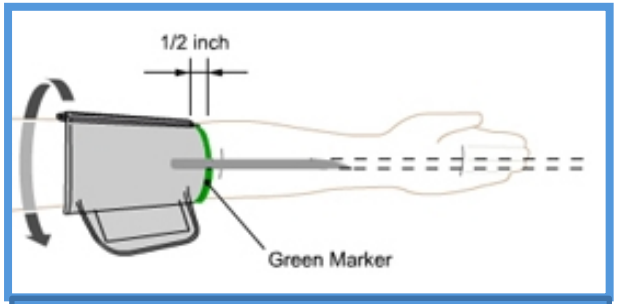
Recall the curve!

4- Blood Pressure

First: Methods For Measuring Arterial Blood Pressure		
Method	1-Palpatory Method	2-Auscultatory Method
Measures	only gives an estimate of the systolic blood pressure	measures both systolic and diastolic blood pressures

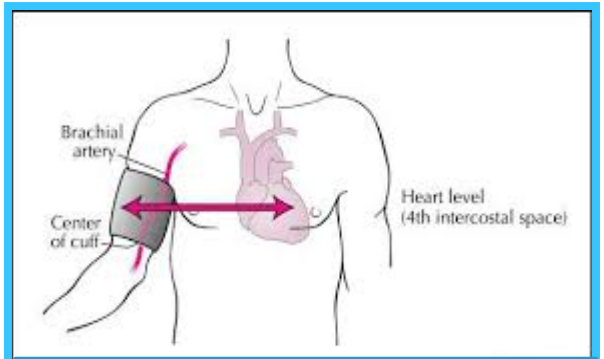
Second: Precautions For Measuring Arterial Blood Pressure

The cuff size should be appropriate for patients cuff and his age



The cuff should be applied over the arm and it's lower end must be at least 1 inch above the cubital fossa

Rubber bag within the cuff is on the medial side to occlude the brachial artery



The cuff should at the same level as the heart

The subject must be physically and mentally relaxed and in comfortable environment

Condition	Blood Pressure reading	Observation
Before Exercise	120/80 mmHg	Normal adult BP
After Mild To Moderate Exercise	140/80 mmHg	systolic blood pressure increases and the diastolic blood pressure remains more or less the same
After Heavy (Severe) Exercise	160/60 mmHg	the systolic pressure increases tremendously and the diastolic pressure drops.

Question & Problems	Answers
How can we calculate the mean arterial blood pressure? Give an example.	Because the diastole phase of a cardiac cycle is longer than its systole phase, ➔ we cannot apply mathematical average to determine the mean arterial blood pressure; instead we can calculate the mean arterial blood pressure (M.A.B.P.) by applying the following formula: M.A.B.P. =Diastolic Blood Pressure+1/3 Pulse pressure Example : subject's blood pressure is measured to be 120/90 mmHg, then we can calculate the mean arterial blood pressure in the following 3 steps: 1. Determine the pulse pressure: 120 – 90 = 30 mmHg Divide the pulse pressure by 3: 30/3 = 10 mmHg Add the above answer to the diastolic blood pressure: 10 + 90 = 100 mmHg So 100 mmHg will be the mean arterial blood pressure in this example.

Question & Problems	Answers	
	Mild To Moderate Exercise	**Severe Or Heavy Exercise**
What are the effects of exercise on the systolic & diastolic blood pressures? What happens to the pulse pressure? Explain why these changes occur.	Systolic BP increases, while Diastolic BP remains the same.	Systolic BP increases further and Diastolic BP decreases
	Because of sympathetic stimulation, the cardiac output increases, which in turn increases the systolic BP, but no effect on diastolic BP.	More sympathetic stimulation will increase the Systolic BP further and the Diastolic BP drops because of a net decrease in the total peripheral resistance due to the more vasodilatation effect on the arterioles supplying the exercising skeletal muscles than the vasoconstriction effect on the arterioles supplying the other tissues.

1-What is the causes of P wave, QRS-complex, T wave?

-P wave is due to **atrial depolarization**

-QRS-complex is due to **ventricular depolarization**

-T wave is due to **ventricular repolarization**

-U wave is sometimes present due to **repolarization of hypertrophied papillary muscles**.

2-What will happen if PR interval is prolonged?

First degree heart block

3-What will happen if QT interval is prolonged or become short?

Prolonged = Hypocalcaemia Short = Hypercalcaemia

4-What is the range of normal heart? and what is the abnormal?

-Normal is (60-100)

- > 100 is tachycardia

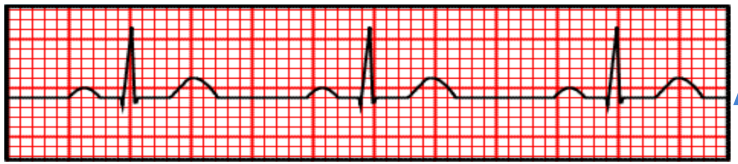
- < 60 is bradycardia

5-Calculate the heart rate form the following figures:

A) Heart Rate = $\frac{1500}{20}$ = 75 beats/minute.

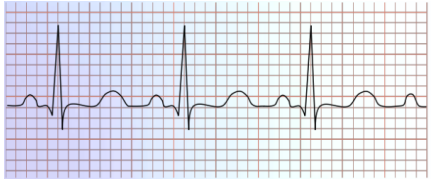
B) Heart Rate = $\frac{1500}{\sim 28}$ = 54 beats/minute. (Bradycardia)

C) Heart Rate = $\frac{1500}{\sim 12}$ = 125 beats/minute. (Tachycardia)



A

B



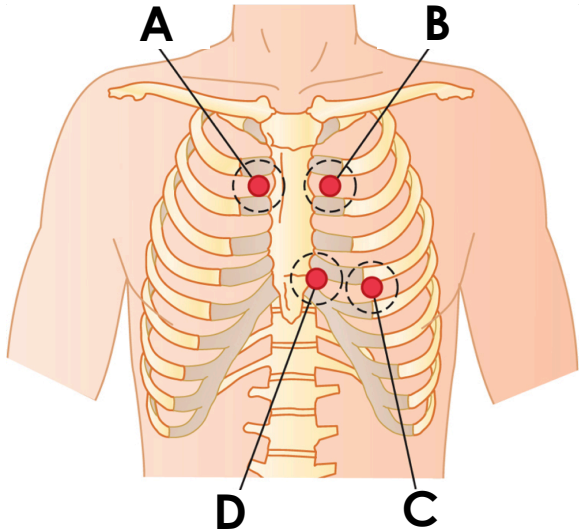
C

Questions

Electrocardiogram

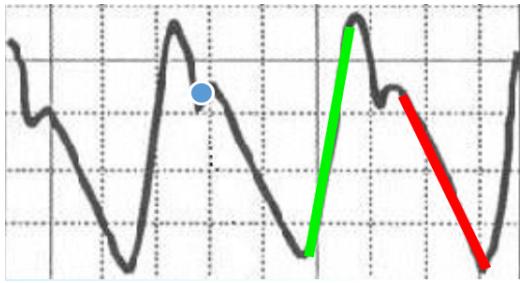
1-What is the conditions that present the 3rd sound normally?
Children, Thin people, Athletes and Pregnancy.
2-What is the conditions that present the 4th sound normally?
Old ages usually more than 60 years.
3-How can you hear the heart sounds?
By stethoscope.
4-What is the surface of the stethoscope you can hear the murmur?
Bell.
5-What is physiological heart sound can be auscultated in deep inspiration?
Physiological splitting of the second heart sound.
6-How the First heart sound is related to the ECG?
After QRS-complex.
7-How the Second heart sound is related to the ECG?
After the T-wave.
8-What is the apex beat?
it is the lowermost and outermost cardiac palpation.
9-What is the cause of the 1st heart sound?
Closure of the Atrioventricular valves.
10-What is the cause of the 2nd heart sound?
Closure of semilunar valves.

11: Identify the labeled auscultators areas?
A: Aortic area.
B: Pulmonic area.
C: Mitral area.
D: Tricuspid area.



Questions
Heart Sounds

1-From what artery can we take the arterial pulse?
The carotid artery.
2-From what vein can we take the venous pulse?
Internal Jugular veins.

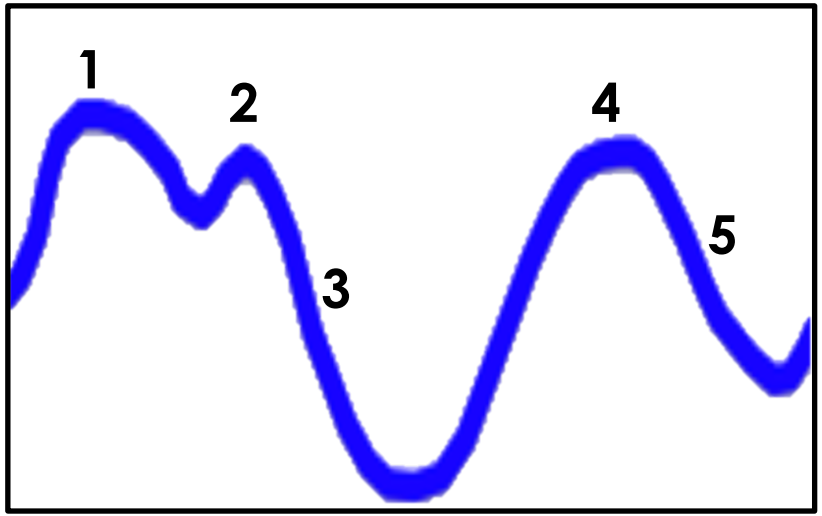


3-In the figure above: what is the colors refer to?
-Blue: Dicrotic Notch(incisura) is due to closure of the aortic valves and Causes 2nd heart sound
-Green : Anacrotic limb is due increase of carotid blood pressure during maximum ejection. phase of ventricular systole (at the beginning is 80 mmHg and the peak is 120 mmHg).
-Red: Dicrotic limb is due decrease of carotid blood pressure.

4-What is the phase of the cardiac cycle that make the anacrotic limb increase up to 120 mmHg?
During maximum ejection phase.
5: What is the phase of the cardiac cycle that make the dicrotic limb decrease to 80 mmHg?
During ventricular diastole.
6-why Dicrotic limb is falling into 80 mmHg only?
Because is due to the elastic recoil of the arterial wall.

Questions
CAP & JVP

7- Identify the waves of the JVP and their causes?



1: A wave: It is due to the right **atrial contraction** at the end of the ventricular diastole, which in turn will lead to increased right atrial pressure.

2: C wave: It is due to the increased right atrial pressure by the **bulging of tricuspid valve into right atrium during isovolumetric contraction** phase of ventricular systole because of a continually increasing right ventricular pressure in the early systole when all the valves are closed. OR another explanation is that it is just a Carotid Artifact.

3: X descent: It is due to the **downward displacement of the tricuspid valve during rapid ejection** by the contraction of papillary muscles during ventricular systole, thus decreasing the right atrial pressure.

4: V wave: It is due to **the increase in right atrial pressure, when right atrium continues to fill with the blood (Venous return)** returning from great veins against the closed tricuspid valve.

5: Y descent: It is due to the fall in right atrial pressure, when **the blood flows out of the right atrium into the right ventricle** as soon as the tricuspid valve opens.

1-What is the methods to measure the Blood Pressure?

-Palpatory method.

-Auscultatory method.

2-Which method we use the stethoscope?

Auscultatory method (we don't use it palpatory method).

3-Which method we can measure the systolic and diastolic pressure?

Auscultatory method, (we can measure only systolic in palpatory).

4-What is the name of device that used to measure the blood pressure?

Sphygmomanometer.

5-If the patient has 130/70 mmHg, what is the mean blood pressure?

Diastolic = 70 mmHg

Pulse pressure = Systolic Pressure – Diastolic Pressure = 130 – 70 = 60 mmHg

Mean Blood Pressure = Diastolic + 1/3 Pulse pressure = 70 + (1/3 × 60) = 70 + 20 **= 90 mmHg**

6-What is the effect of the exercise on blood pressure?

Effects of the exercise	Before the exercise	After the exercise
Person (1)	120 / 90 mmHg	160 / 60 mmHg
Person (2)	130/ 70 mmHg	150/ 70 mmHg

-Person (1) : it severe or heavy exercise because Systolic BP increases and Diastolic BP decreases

-Person (2) : it mild to moderate exercise because Systolic BP increases and Diastolic BP remain the same.

Done by:

✧ Nouf Almasoud ✧ Abdullah Alfaleh

BEST OF LUCK!