PASSION ACADEMIC TEAM YU - MEDICINE

Cardiovascular System

Sheet #2 - PHYSIOLOGY

Lec. Title : cardiac cycle

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CARDIAC CYCLE

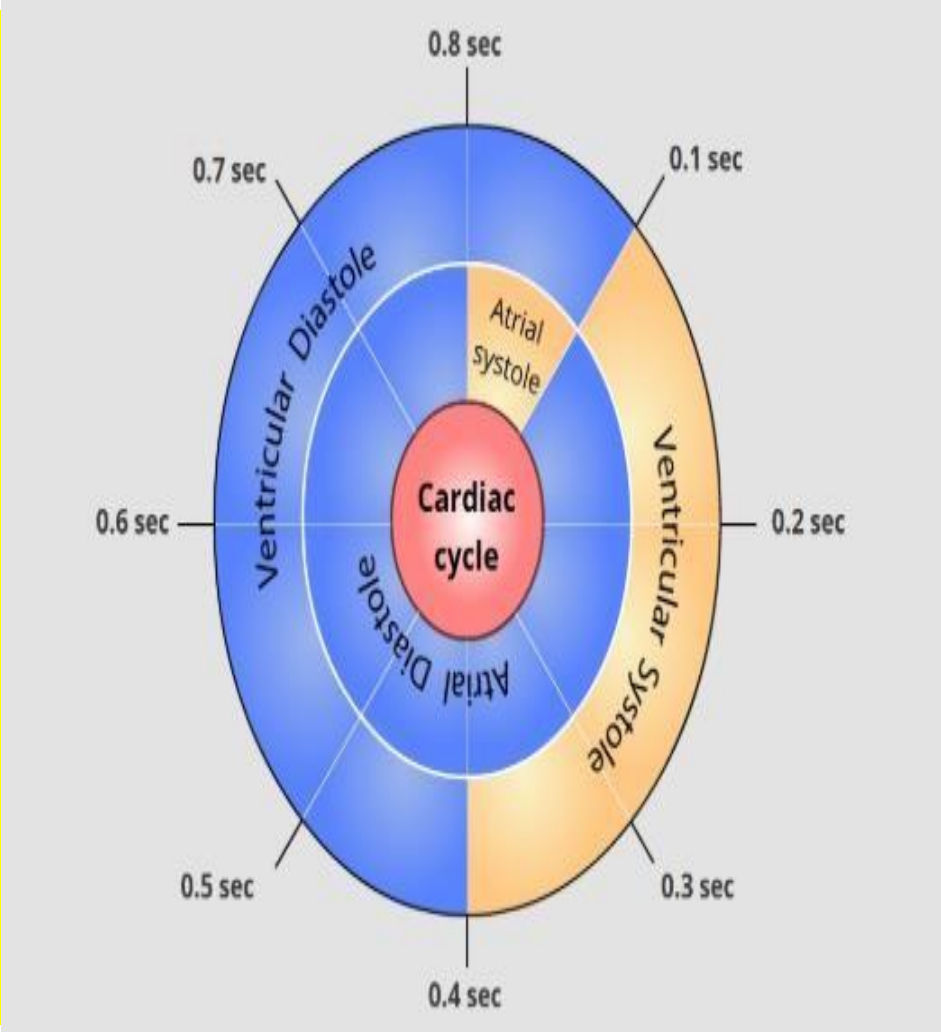
Learning Objectives

On completion of study of this chapter, the student MUST be able to:

- **Define cardiac cycle and list the phases of cardiac cycle.**
- **Describe the various electromechanical events of cardiac cycle.**
- **Understand the pressure-volume relationship of left ventricle.**
- **Give the causes, character and significance of heart sounds.**

Cardiac cycle

- Cardiac cycle is defined as the sequence of electrical and mechanical events occurring in heart during a single beat.
- Similar electromechanical events occur almost simultaneously in both left and right sides of the heart. However, the pressure is significantly high on the left side.
- The duration of the cardiac cycle is the reciprocal of heart rate



The resulting changes in volume , pressure and flow in different chambers of the heart & the electrical activities that are recorded in the form of ACG all are precisely repeated in each beat

NOTE :For better understanding . Discussion of cardiac cycle is usually performed for the activities in the left side of the heart
When we study cardiac cycle and its phases the discussion always about left side of the heart .And the events that occur in the left side are the same that occur in the right side , only names are different and the pressures are higher in the left side of the heart because **left side of the heart** eject blood through systemic circulation (high pressure circulation) while **right side of the heart** eject the blood into pulmonary circulation (low pressure circulation).

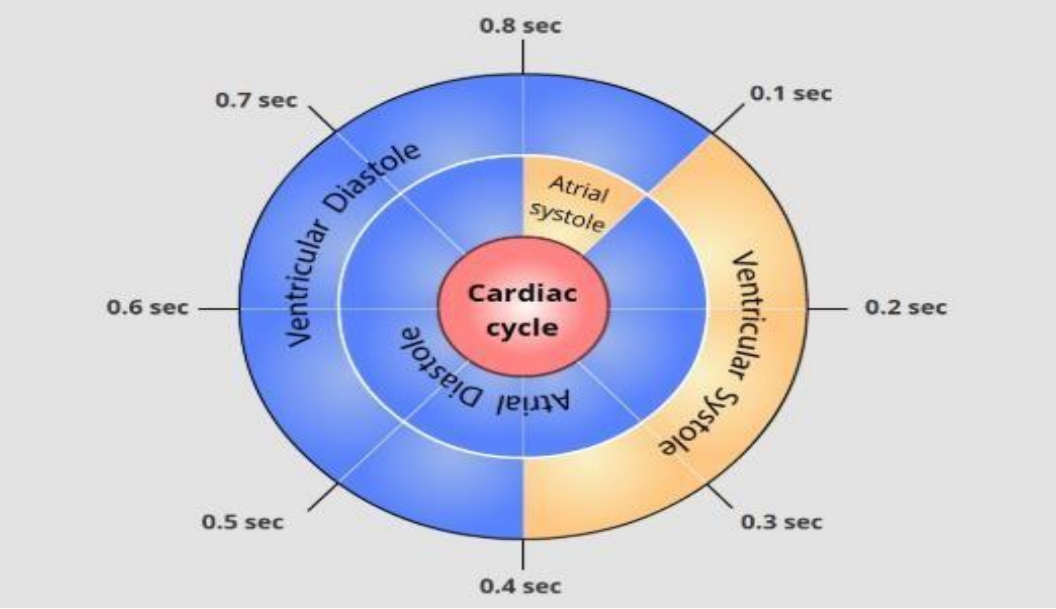
Phases of cardiac cycle are 4 :

1.Atrial systole
2.Atrial diastole
3. Ventricular systole
4. Ventricular diastole

Sheet 2

Duration of cardiac cycle is **reciprocal** of the **heart rate .**
Normally heart rate(HR) is about **75 beats/min** and so on the cardiac cycle duration is 1/75 = .013 min =0.8 sec

Look at the figure ,You can see that :
•ventricular systole = 0.3 sec
• ventricular diastole = 0.5 sec
•Atrial systole = 0.1 sec
• atrial diastole =0.7 sec



We notice on the figure that first 0.3 seconds of **atrial diastole coincides with ventricular systole….**
then **ventricular diastole** start and it last for about 0.5 sec
later part of **atrial diastole coincides with ventricular diastole** about 0.4 sec (which mean there is an overlapping between theses phases)

When the **HR increases** the **total duration of cardiac cycle decreases**
For ex. if the HR was 200 beats/min the total duration of cardiac cycle will become 0.3 sec instead of 0.8 sec

Imp to notice that though the duration of all phases of cardiac cycle decreases at high HR, BUT the **duration of diastole decreases much more than duration of systole
(both of systole & diastole in atria & ventricles decrease due to increase in HR BUT the decrease in duration is higher in DIASTOLE)
In prev. example , HR = 200 beats/min the duration of systole decrease from 0.3 to 0.16 sec (in ventricles)
While the diastole duration decreases from 0.5 to 0.14 sec (this has imp physiologic and clinical implications)

The physiologic and clinical implication of diastole decrement:

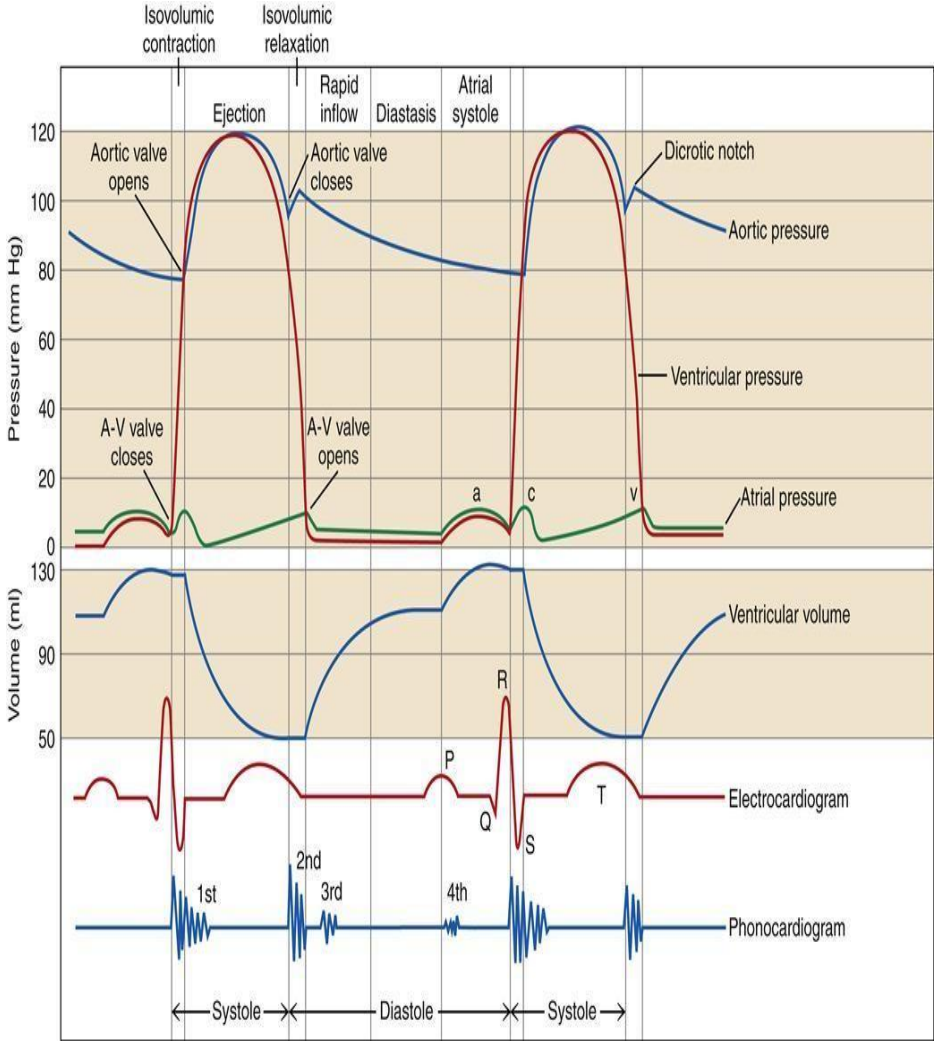
During DIASTOLE the coronary blood flow occurs (blood that supply the wall of cardiac muscle).
More specific ,supply to subendocardial portion of the left ventricle occurs during diastole , therefore at very high HR occurs reduction in cardiac perfusion and reduction in coronary blood flow …
and SO ON There are **chances of myocardial ischemia** due to that reduction , so high rate of beating has an effect on duration of ALL phases of cardiac cycle , but decrement in diastole is much higher and this affect negatively on supplying the wall of heart and specifically left portion of the heart –finally leads to **ischemia**

PHASES OF THE CARDIAC CYCLE

VENTRICULAR SYSTOLE:

The ventricular systole lasts for 0.3s and has 3-phases:

1. **Phase of isovolumic (isometric) contraction:The events that occur during this phase include the following:**
   - **Ventricular pressure and volume: the ventricular pressure rises sharply while the ventricular volume remains constant.**
   - **Atrial pressure: This increases slightly on closure of the AV valves.**
   - **Aortic pressure: This gradually decreases**
   - **Valves: AV valves are closed, and semilunar valves remain closed.**
   - **Sounds: The first heart sound is produced in this phase as a result or closure of the AV valves.**
   - **ECG : The Q wave starts about 0.02 second before this phase. while the R and S waves are recorded during it.**



Sheet 4

Look at the Figure :

Up

there are 3 curves :

blue → represent aortic pressure

Red→ ventricular pressure

Green →atrial pressure

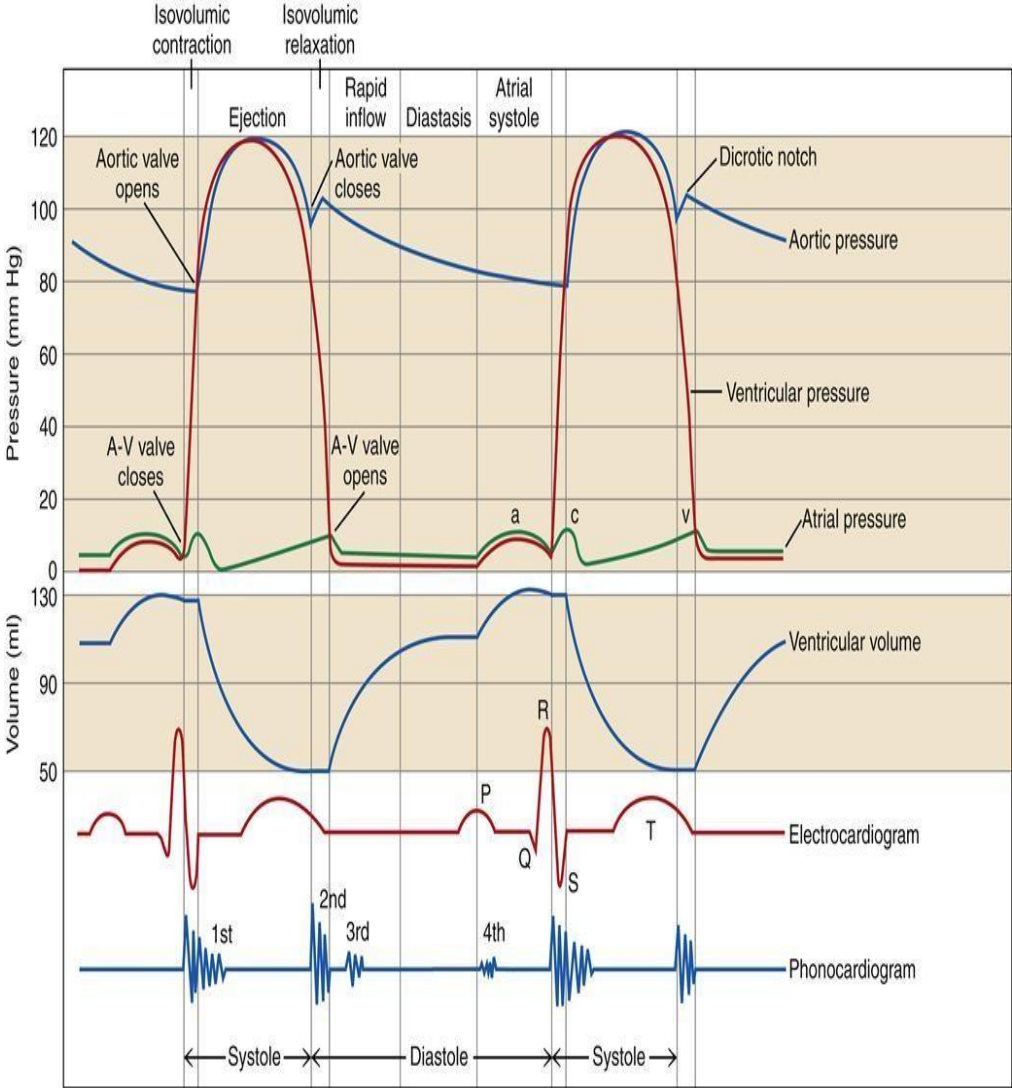
Consist of 2 similar peaks (cycle so it repeat..)

Down

Blue : represent changes in ventricular volume

ECG electrocardiogram

Phonocardiogram which record heart sounds



Ventricular systole – continues for **0.3 sec** , consist of 3 phases :

look at the peak on the figure on the upper left side

phase 1: called isovolumic or isometric contraction

phase2 : rapid ejection

phase 3 : reduced ejection

and repeat …

Sheet 5

Look at the figure in prev. slide while studying

The events that occur during **Ventricular systole** phase include the following:

1. Ventricular pressure (in red color**) rises sharply** during isovolumic contraction , WHILE ventricular volume remains CONSTANT (look at the lower figure on the volume) and this volume = **130 ml** and it represent the end diastolic volume

the increase in ventricular pressure is due to :

beginning of the ventricle to contract , we call this phase isovolumic because there is contraction and tension but without shortening that's why there is no change in ventricular volume (another words , no pump occurred) during this phase all valves are **CLOSED** (AV, mitral valve and **aortic valve** all closed even in right side the tricuspid &pulmonary valves are closed , but we said before that all our discussion will focus on the left side).

2. Atrial pressure increases slightly . Why ?

Due to the increase in ventricular pressure, there will be closing to AV valves and bulging of AV valves into the atrial region , this bulging produces a small but sharp increase in the atrial pressure producing the so called **C wave (c stand for contraction of the ventricle)**

3. the aortic pressure **gradually decreases** simply bc during this phase the blood is flowing from the aorta to the peripheral smaller vessels , so the pressure in aorta start to decrease , this pressure decreases to minimum value at the end of this phase. (min value of aortic p. is at the end of isovolumic contraction nearly equal **80 mmHg** and it represent diastolic BP)

if we talk about **pulmonary artery** in right side it will be 9 mmHg (min value)

we said there is similarity but there is difference in the pressure which is higher in left side rather than right which has high pressure vessels

4. Sounds: The first heart sound is produced in this phase as a result or closure of the AV valves.

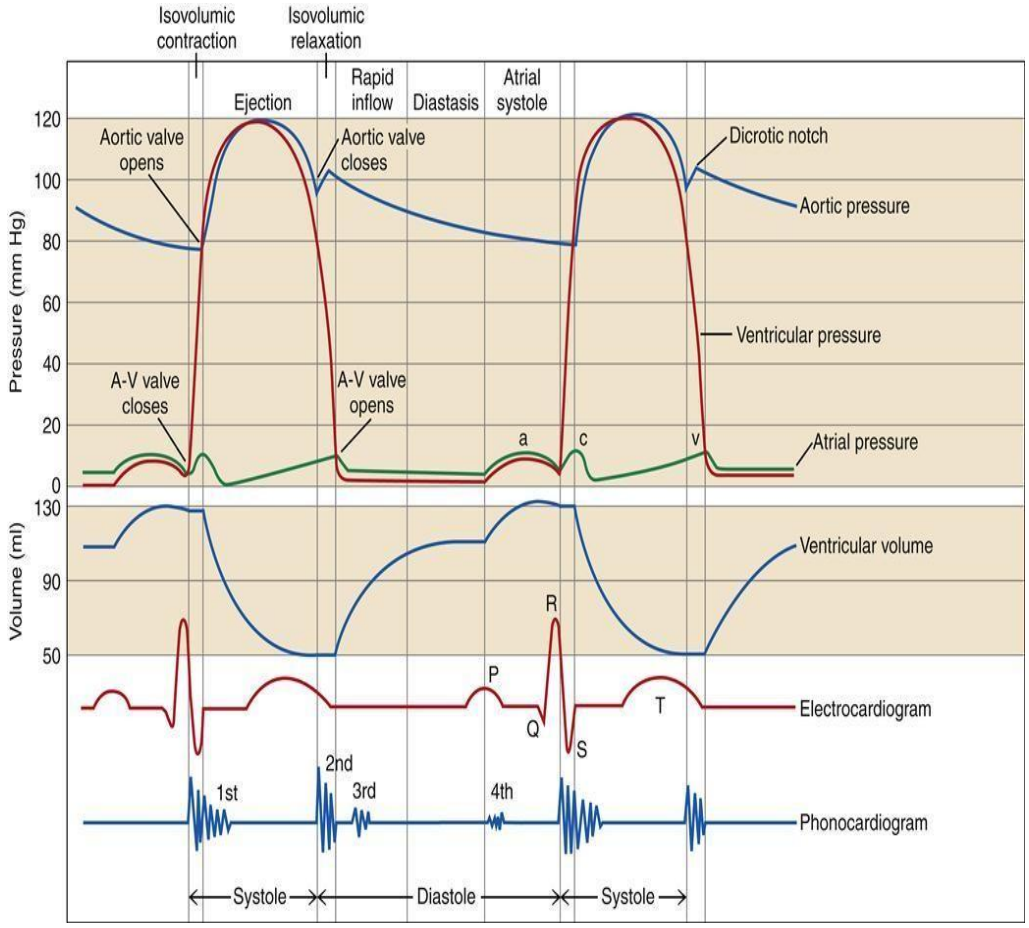
5. ECG : Q WAVES are NOT recorded in this phase because the Q wave starts about 0.02 second before this phase. while the R and S waves are recorded during this isovolumic contraction phase (first phase of ventricular systole)

PHASES OF THE CARDIAC CYCLE

2. Rapid ejection phase:

The events that occur during this phase include the following:

- **Ventricular pressure and volume:** the ventricular volumes rapidly decrease (2/3 is ejected) while the ventricular pressures increase
- **Atrial pressure:** This is initially decreased, then gradually increases.
- **Aortic pressure:** This gradually increase to a maximum.
- **Valves:** Both AV valves remain closed while both semilunar valves open
- **Sounds:** The first heart sound continues for a brief period in this phase,
- **ECG :** The S-T segment is recorded and the T wave starts in this phase



Sheet 7

Second phase of Ventricular systole
Rapid ejection phase

1.Ventricular pressure & volume →There will be ventricular contraction due to ejection but **an isotonic contraction** , which means cardiac muscle fiber are shortened (unlike isovolumic which had pressure but no shortening)

Ejection = shortening

So on the ventricular volumes rapidly decreases (sharp decrease) nearly 2 thirds of end-diastolic volume is ejected

But ventricular pressure increases gradually due to isotonic contraction to a **maximum of 120 mmHg**

But in right side of the heart , right ventricle pressure due to isotonic contraction will gradually increase **to max of 25 mmHg**

2.ATRIAL PRESSURE →initially decreases . WHY ?

Because **of widening of the atrial cavities** which occurs as a result of :

1. atrial diastole (relaxation of atria →causes widening →decrease in atrial pressure .

2. Pulling of the atrioventricular fibrous ring downward during ventricular contraction.

Then as you see on the figure the atrial pressure will start to increases , due to continuous venous return , presence of blood that fill the atria which causes increase in its pressure again

3. AORTIC PRESSURE → **gradually increase to a maximum** (blue color on the figure).
WHY?

Because of ejection of blood from the ventricle to aorta (blood enters to aorta) ..

Remember in prev. phase there was reduction in aortic pressure because blood was discharging or moving from the aorta to the peripheral smaller vessels)

this increase continues to a max point , that nearly equal the max pressure in corresponding ventricles (**120 mmHg** in aorta and **25 mmHg** in pulmonary arteries (right ventricles))

4.Valves : AV valves remain closed . Why ?

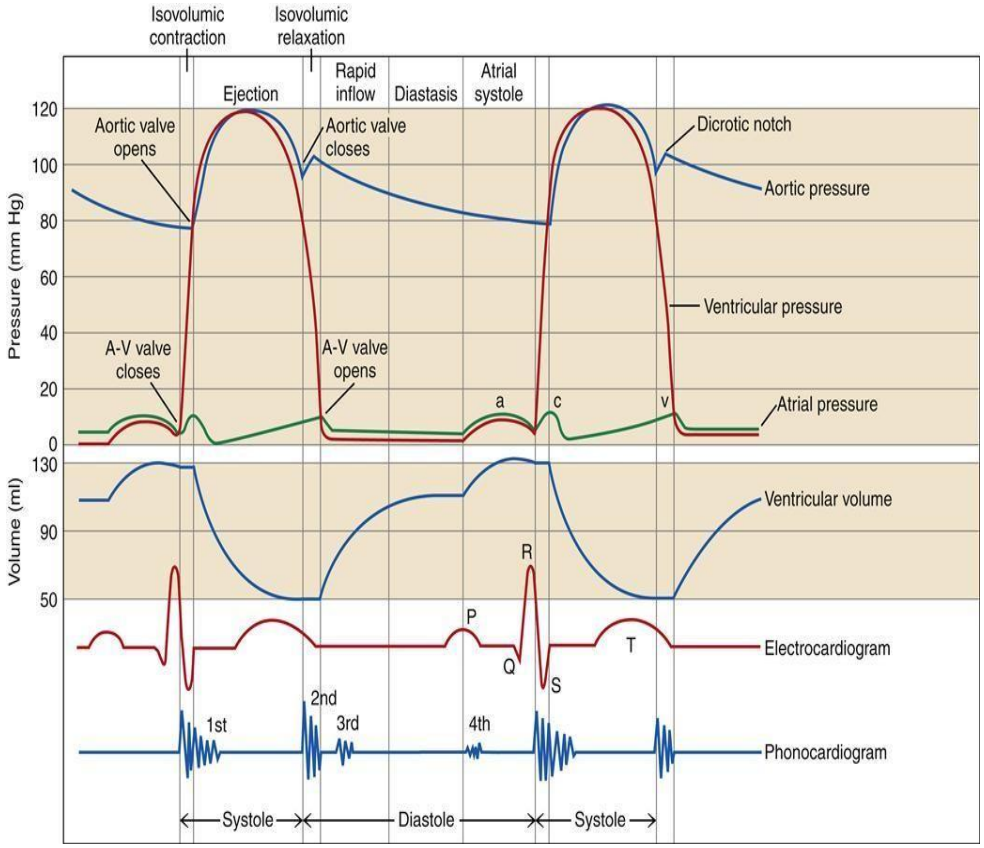
Because ventricular pressure is higher than atrial pressure while both semilunar valves OPEN (because when ventricular pressure exceed the diastolic pressure in great arteries (80mmHg in aorta and 9mmHg in pulmonary arteries) these valves open and blood ejection occur)

5. Sounds : first heart sound continue for a brief period in this phase يستمر لكن يبدأ بالتلاشي

6. ECG : The S-T segment is recorded and **the T wave** starts in this phase

PHASES OF THE CARDIAC CYCLE

3. Reduced ejection phase: The events that occur during this phase include the following:
   - Ventricular pressure and volume: the ventricular volumes further decreased, the ventricular pressures starts to decrease.
   - Atrial pressure: still increasing.
   - Aortic pressure: This decrease
   - Valves: Both AV valves remain closed while both semilunar valves open
   - Sounds: There are no sound in this phase.
   - ECG : The ascending limb & top of the T wave are recorded in this phase.



Sheet 9

Reduced ejection phase

1.Ventricular pressure & volume : begin to **decrease** during this phase(red color in figure)

, due to pumping of most of ventricular blood into the great arteries during max ejection

(LESS blood in ventricles) and further reduction in volume.

2. Atrial pressure: still **increasing** due to continuous venous return

3. Aortic pressure: decreases . Why ?

Bc the ejection amount of blood from the ventricles into the aorta becomes smaller than the amount of blood leaving these vessels to peripheral smaller vessels (amount of blood leaving the ventricles to aorta is LESS than the amount of blood that leaves aorta to smaller vessels) so on the aortic p. decreases.

The aortic p. is slightly MORE than **ventricular p.** ALTHOUGH both are decreasing . Why ? Because blood flow from the ventricles to the aorta continues by **the momentum of the forward blood flow**

4. Valves : Both AV valves remain closed while both semilunar valves still open Sounds: There are 5. **no sound** in this phase.

6. ECG : **The ascending limb** & **top of the T wave** are recorded in this phase.

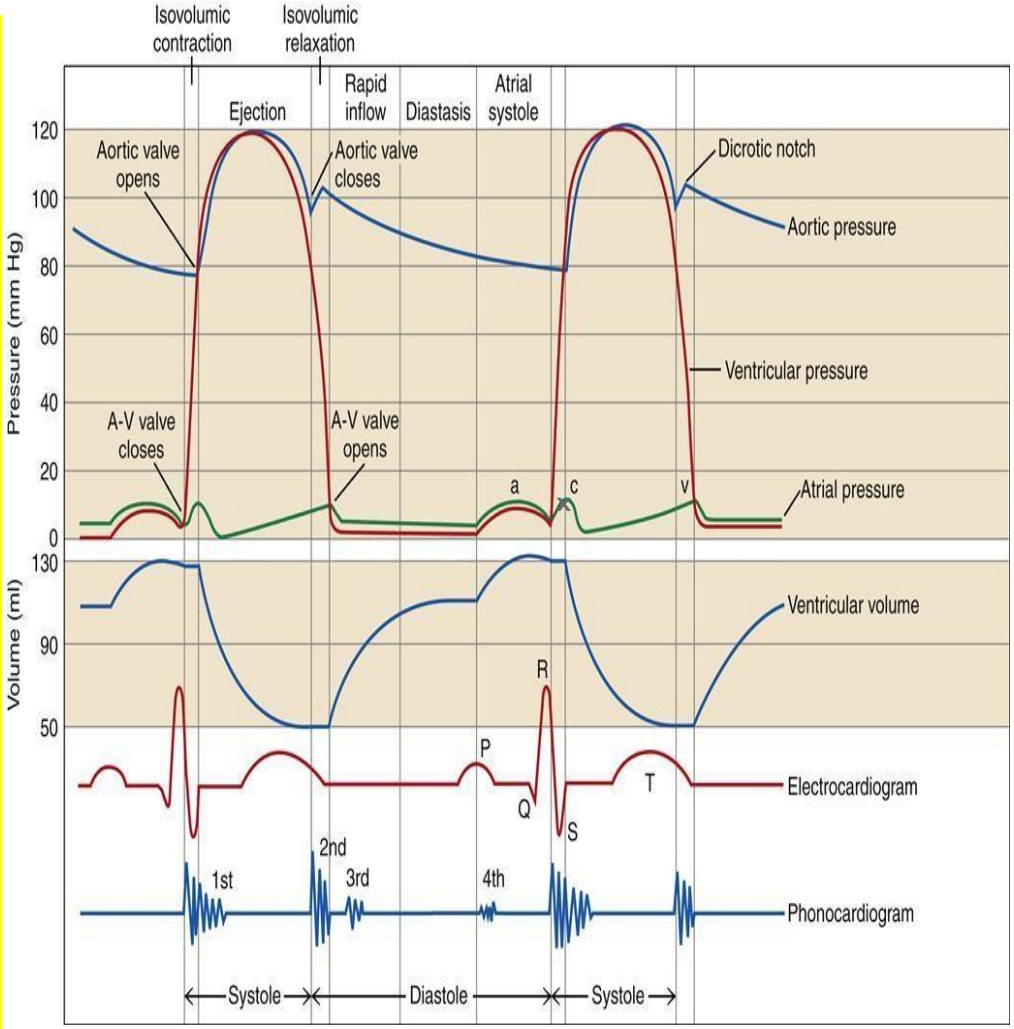
PHASES OF THE CARDIAC CYCLE

VENTRICULAR DIASTOLE:

The ventricular diastole lasts for 0.5 s and has 4-phases:

1- Isovolumic (isometric) relaxation phase: The events that occur during this phase include the following:

- **Ventricular pressure and volume: The ventricles relax isometrically, so the ventricular pressure falls sharply to about 0 mmHg while the ventricular volume remains constant.**
- **Atrial pressure: still increasing.**
- **Aortic pressure: This gradually decrease with appearance of a dicrotic notch (windkessel effect)**
- **Valves: Both AV valves are closed, and both semilunar valves remain closed**
- **Sounds: The second heart sound is produced in this phase.**
- **ECG : The descending limb & top of the T wave are recorded in this phase.**



In slides there is a wrong it was written ascending but the correct is Descending

Ventricular diastole

Ventricular diastole , with duration of 0.5 sec ,consist of 4 parts :

Isovolumic relaxation phase or **isometric** , means there is no change in muscle fiber length (constant), the ventricle relax BUT without change in the length of cardiac fiber →no change in volume →ventricular volume remains constant (notice on prev. figure)

This volume represent **end systolic volume** : volume of blood in ventricle at the end of ejection (blood stay in the ventricle after ejection)

The blood that was in the heart before ejection is called **end diastolic volume**

The difference bw end systolic and end diastolic is the amount of ejected blood which is called **stroke volume .**

Stroke volume : is the volume of blood ejected from each ventricle in one peak

The ventricular pressure falls sharply to about 2 to 3 mmHg (little above zero) because the ventricle ejected the blood inside of it and **start to make relaxation** (isometric relaxation) which led to sharp fall in ventricular p.

Atrial pressure : still increasing due to continuous venous return.

Aortic p. : (notice in the figure at isovolumic relaxation phase) you will see **gradual reduction** with appearance of dicrotic notch

dicrotic notch is a result of an effect called **windkessel effect**

Aortic p. in the beginning of this phase is slightly higher than pressure in left ventricle (higher due to presence of blood in the aorta). This result in 2 things :

1. **Backward flow of blood** →the ventricle is in isometric relaxation → the pressure in aorta higher than in ventricles → causes back ward of blood .
2. **Closure of aortic semilunar valves** . And that's why in this phase the second heart sound is produced

As a result of **sudden closure** of semilunar valves the backflow blood collides against the closed aortic valves

This collision causes a sharp increase in aortic pressure

windkessel effect is a result of elasticity in aorta

Heart contraction →systole → blood ejection through the great vessels (aorta for ex) → stretching because its elastic → during diastole (heart relaxation) → recoiling back of aorta to its original state (elasticity)

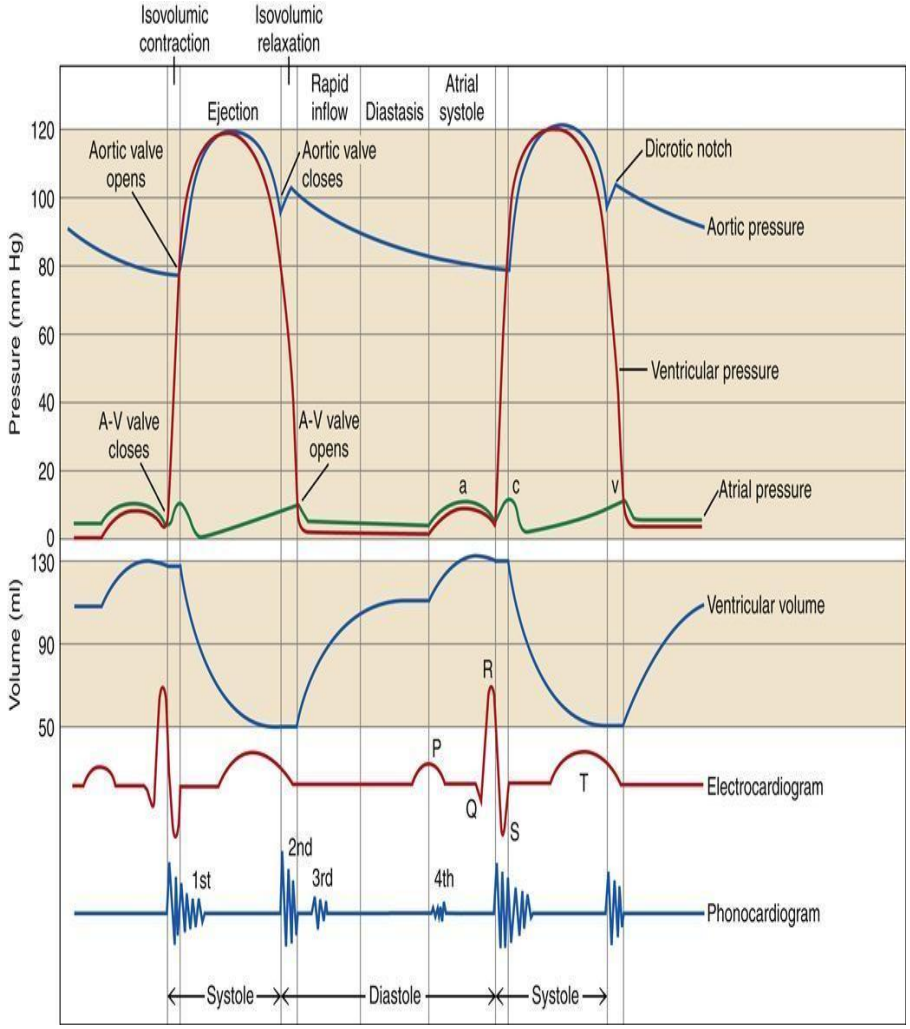
So windkessel effect **maintains forward movement of blood during ventricular diastole** , therefore it makes the blood flow to the tissues in a continuous manner during both systole & diastole and NOT pulsatile movement (not intermittent there is moving only during systole , no movement during diastole)

summary : windkessel effect due to recoiling back ,some blood move back to heart but semilunar valves suddenly close and the heart collides with the closed valves – this collides causes sharp rising in aortic pressure (**dicrotic notch**)

Because the pressure is higher in vessels than heart so **semilunar valves close** and **AV valves remain closed** (although the pressure in ventricle is decreasing but still higher than the atrium so the AV valves will remain closed).

PHASES OF THE CARDIAC CYCLE

2. Rapid passive filling phase: The events that occur during this phase include the following:
   - Ventricular pressure and volume: The ventricular pressure decreases and then it increases gradually. The ventricular volume increases markedly
   - Atrial pressure: exceeds the ventricular pressure.
   - Aortic pressure: This gradually decreases.
   - Valves: The A V valves open while the semilunar valves remain closed
   - Sounds: The third heart sound is produced in this phase.
   - ECG : The early part or the T-P segment and the U wave (if present) are recorded in this phase.



Sheet 13

Rapid passive filling phase

Ventricular pressure : decreases because ventricles are relaxing , but the pressure then increase gradually since the blood is being filled in the ventricles.

Ventricular volume : increases markedly as a result of filling of ventricles by the blood from the atria.

Atrial pressure : it exceed the ventricular pressure (blood moves from atria (high pressure) to ventricles (less pressure))
The atrial pressure initially decreases because the rushing of blood from the atria to the ventricles (unloading of blood) → then it start to increases due to **continuous venous return**

Aortic pressure : decrease gradually due to continuous blood flow from the aorta to small peripheral blood vessels so the pressure decrease.

Valves : **semilunar valves remain closed** because the pressure in vessels still higher than ventricles .
while **AV valves open** because pressure in atria is higher than in ventricles .

Sounds : **third heart sound produced** , which is not normally heard in adult , if heard in adult its associated with **DISEASES** for ex : congestive heart failure , mitral or tricuspid stenosis
BUT it can be heard in children normally . WHY ? (critical question the dr. wants us to look for the answer—see next slide))
ECG : the T-P segment is recorded in this phase

Sheet 14

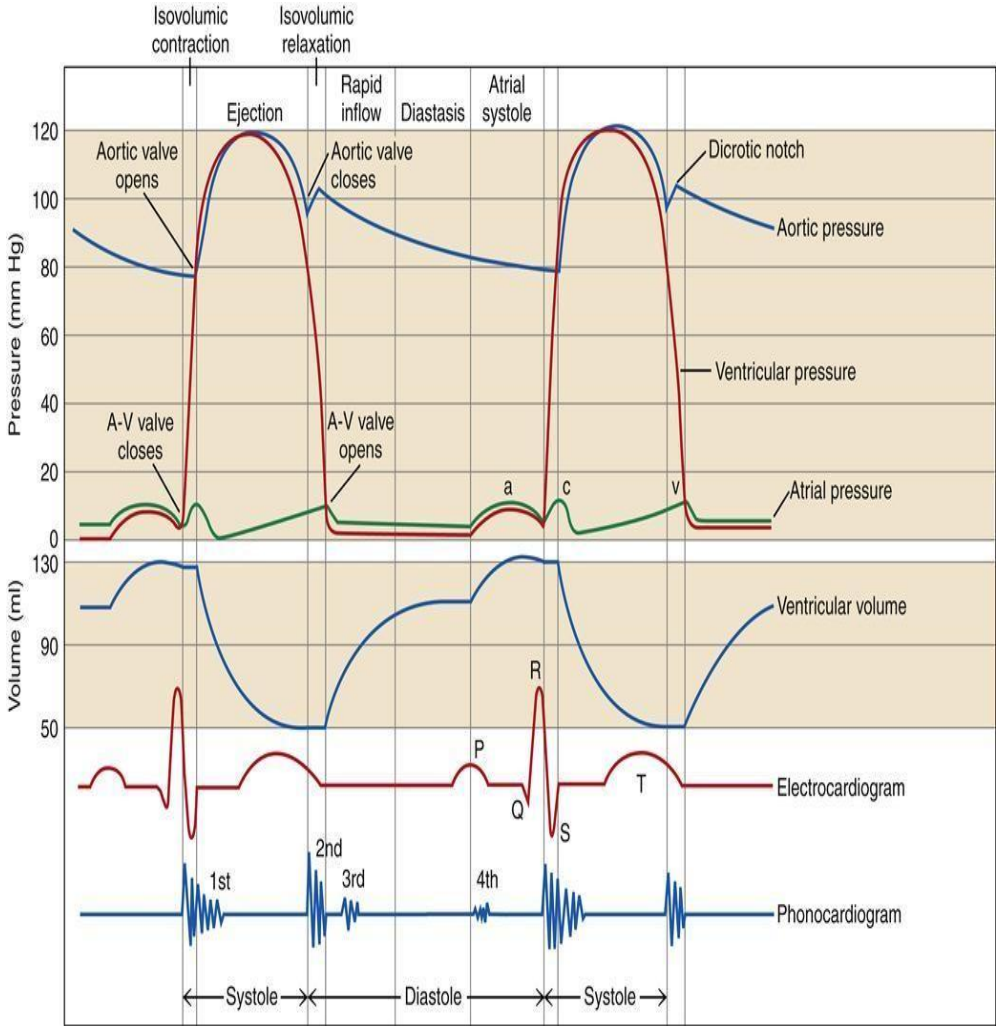
This answer is from glory sheets , the doctor didn't answer it in our record :
The third heart sound S3 can be heard in children at the middle on ventricular diastole , because :

1.The children ventricles are highly **compliant**

2. They have **HYPERDYNAMIC circulation** (very fast blood flow)

PHASES OF THE CARDIAC CYCLE

3. Reduced filling phase (diastasis)(20%): This phase (the longest phase of the cardiac cycle) is a continuation of the rapid filling phase and is associated with the following events:
   - Ventricular pressure and volume: These gradually increase but at a slower rate
   - Atrial pressure: This is still increasing .
   - Aortic pressure: This gradually decreases.
   - Valves: The AV valves are open while the semilunar valves are closed
   - Sounds: There are no sounds in this phase.
   - ECG : The late part of the T-P segment and the start of the P wave are recorded in this phase.



Sheet 15

Reduced filling phase

Diastasis is **the longest phase** of cardiac cycle and it's a continuation of rapid filling phase (continuation of filling)

The events :

- **Ventricualr p. and volume** : gradually increase but at slower rate , why?

Because of reduction of the amount of blood coming from the atria & this slow filling called DIASTASIS

- **Atrial p**. still increasing.
- **Aortic p.** gradually decreases due to ejection of blood from the aorta to other vessels .

- **AV valves** are **open** because there still have filling BUT a slow filling of blood.

Pressure in atria is higher than in ventricles

- **Semilunar valves** are closed although there is filling of the ventricle with blood but the pressure still didn't rise to a point that in can open the AV valves and causes ejection (it should reach to **80mmHg** to open the valves then ejection occur and rising in the pressure to **120 mmHg**)

- **NO sounds** in this phase

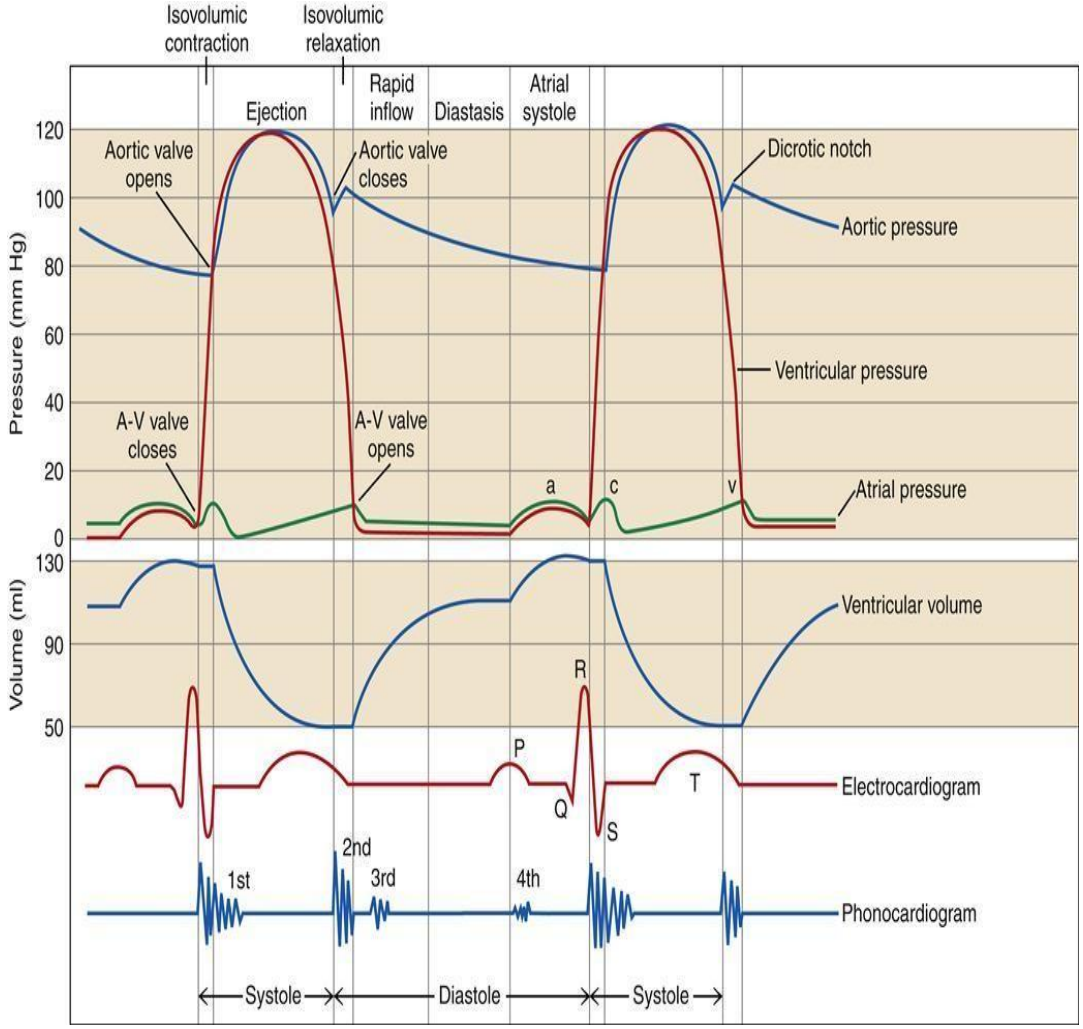
- **ECG:** The late part of the T-P segment and the start of the P wave are recorded in this phase.

NOTE : its imp to note that **75% of blood** passes from the atria to the ventricle during rapid and reduced filling phases , remain 25% or less occur during atrial systole

PHASES OF THE CARDIAC CYCLE

4. Last rapid filling phase:

- **The last rapid filling phase of ventricular diastole coincides with the atrial systole.**
- **Flow of additional amount of blood into ventricle due to atrial systole is called atrial kick.**

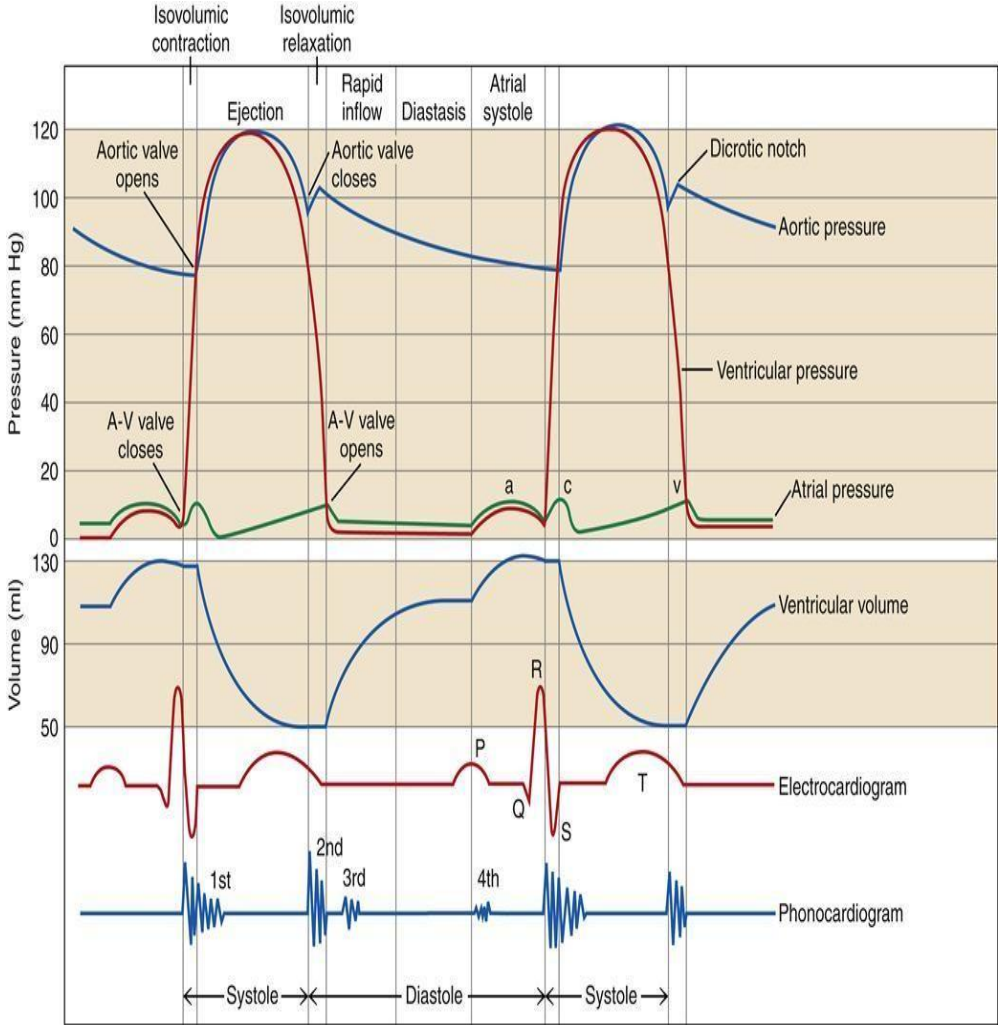


PHASES OF THE CARDIAC CYCLE

ATRIAL SYSTOLE

The events that occur during atrial systole include the following:

- **Ventricular pressure and volume: These slightly increase.**
- **Atrial pressure: This initially increases , then it decreases .**
- **Aortic pressure: This gradually decreases.**
- **Valves: The AV valves are open while the semilunar valves are closed**
- **Sounds: The fourth heart sound is produced.**
- **ECG : The P wave starts about 0.02 second before this phase, while the main part or the P wave. the P-R segment and the Q wave occur during it.**



Last rapid filling phase is the Same as atrial phase in the next phase
The most imp in prev. 2 slides that filling of ventricles by atrial systole causes **the fourth heart sound** (which can't be heard in healthy adults)

Atrial systole contribute to ventricular filling but its not essential for ventricular filling

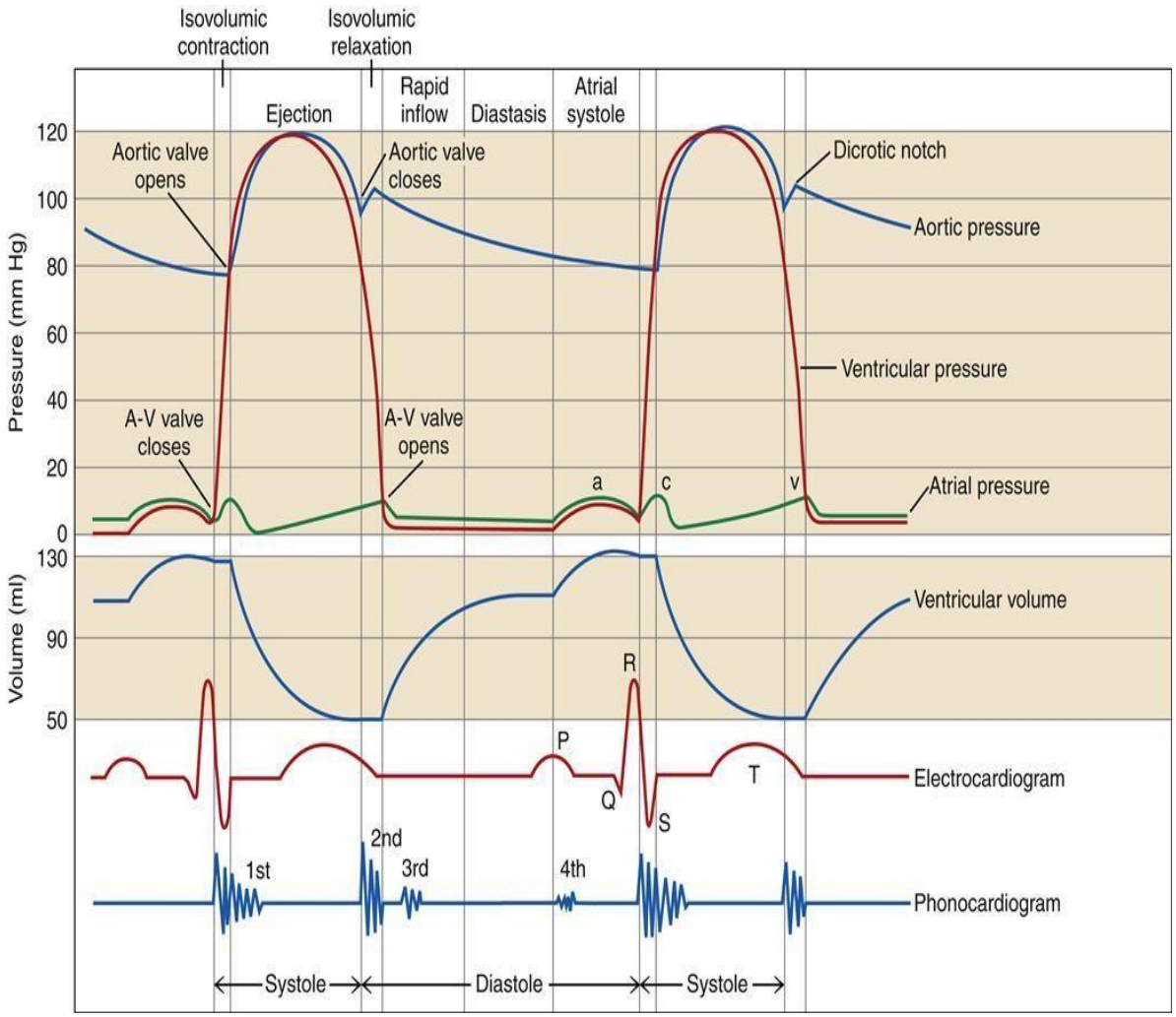
•Many persons with atrial fibrillation survive for years without suffering from circulatory insuffecincy ,but it may affect during physical stress like exercise, these persons feel difficult to cope up with some conditions like physical stress but no problems with normal quite life.

•Summary : atrial systole is not essential for circulation maintenance , it contributes to ventricular filling but not ESSENTIAL to it

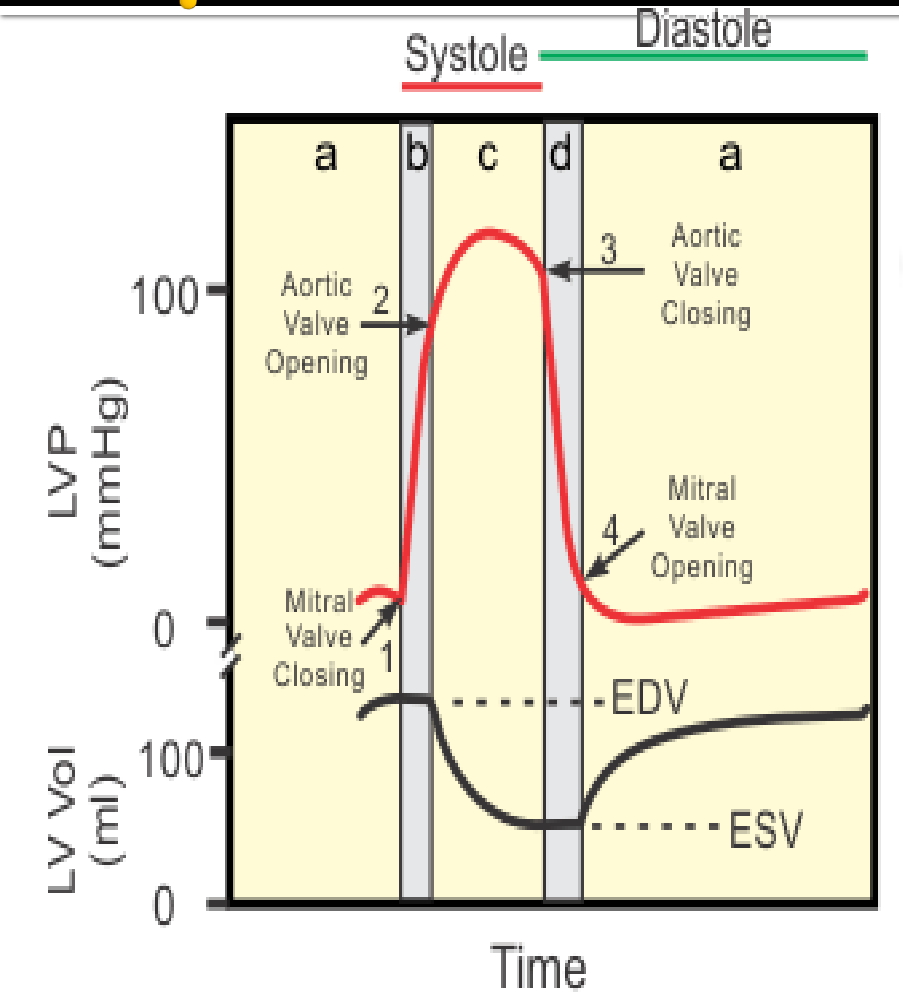
PHASES OF THE CARDIAC CYCLE

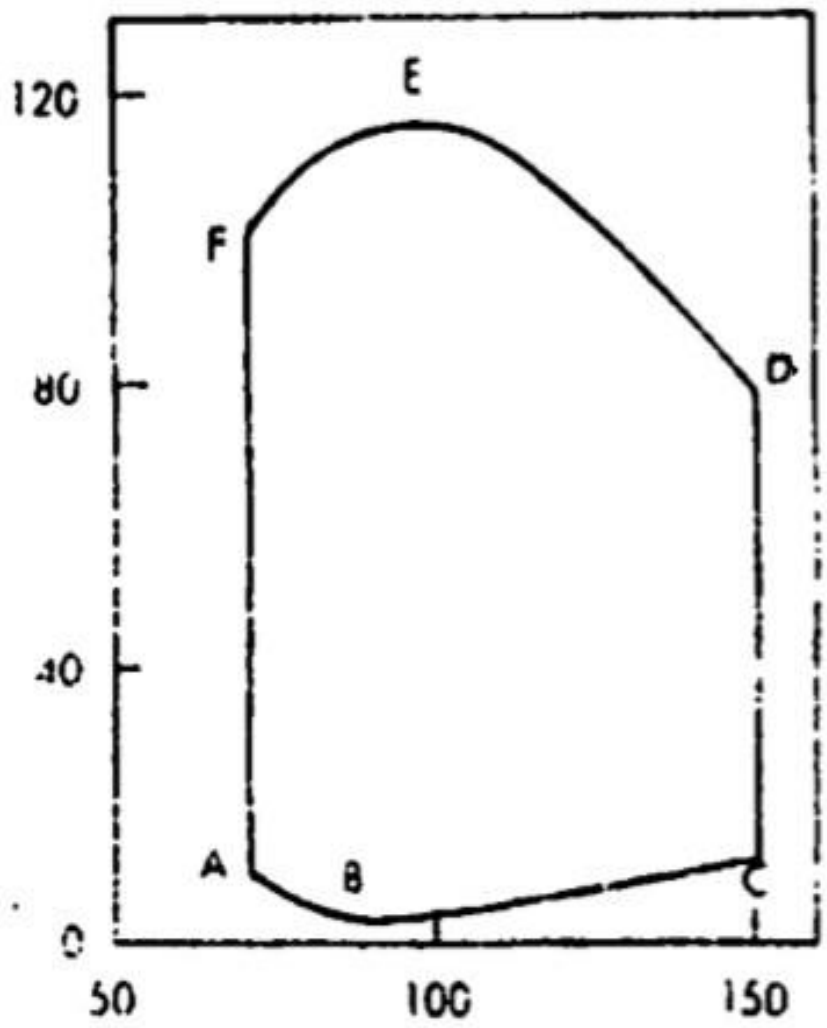
ATRIAL DIASTOLE

- This period coincides with the ventricular systole and most of the ventricular diastole.
- During the atrial diastole, the atrial muscles relax and there occurs gradual filling of the atria due to continuous venous return.
- Then the pressure again rises and follows the ventricular pressure during the rest of atrial diastole.



Ventricular pressure – volume loop





Sheet 17

Look at the figure in prev. slide while studying

This figure represent ventricular pressure and volume changes during the cardiac cycle
When changes are mixed together it give us a loop –figure on the right
P represent pressure ,LV represent volume in left ventricle the figure on the right :
Y axis – pressure / x axis –volume changes

t **point A** the mitral valves open and so on ventricular filling occur (from **A-C** is ventricular filling phase)
From **A-B** there is initial reduction in pressure
•ventricular filling means there is blood entering to it which causes pressure to increase which **happened from A-C but not from A-B** , WHY ?
A-C is diastolic filling and increase in volume from 60 or 70 to 150 and increase in pressure..
Then at **point C** the mitral valves closes , filling of the ventricle causes increase in pressure to higher than atrial pressure which causes **closure of mitral valves.**

However ,the pressure in ventricle is still less than pressure in aorta , that's why opening of semilunar valves didn't occur
Then ventricles start to contract but an **isometric contraction** (no change in muscle fiber length)
From **C-D** sharp increase in pressure without change in volume

At **point D** the aortic valves open because the pressure of ventricles = 80 mmHg and pressure in aorta = nearly 80 so aortic valves open at D
From **D-E** rapid ejection occurs
From **E-F** also ejection but reduced ejection

Look at the figure in prev. slide while studying

At **point F** the aortic valves closes bc the aortic pressure is higher than ventricular pressure → no more ejection and the ventricle start to relax , although is relaxes but the pressure in it still higher than atrial pressure and so on the mitral valves still closed

From **F-A** the pressure start to decrease due to relaxation of ventricles , but the mitral valves still closed and semilunar valves closes → NO blood filling nor ejection → constant volume although of pressure decrement → called **isometric ventricular relaxation** (relaxation without any change in muscle fiber length)

At **point A** the mitral valves again open due to pressure increaseing in atria due to venous return →leads to open the valves and start a **new cardiac cycle**

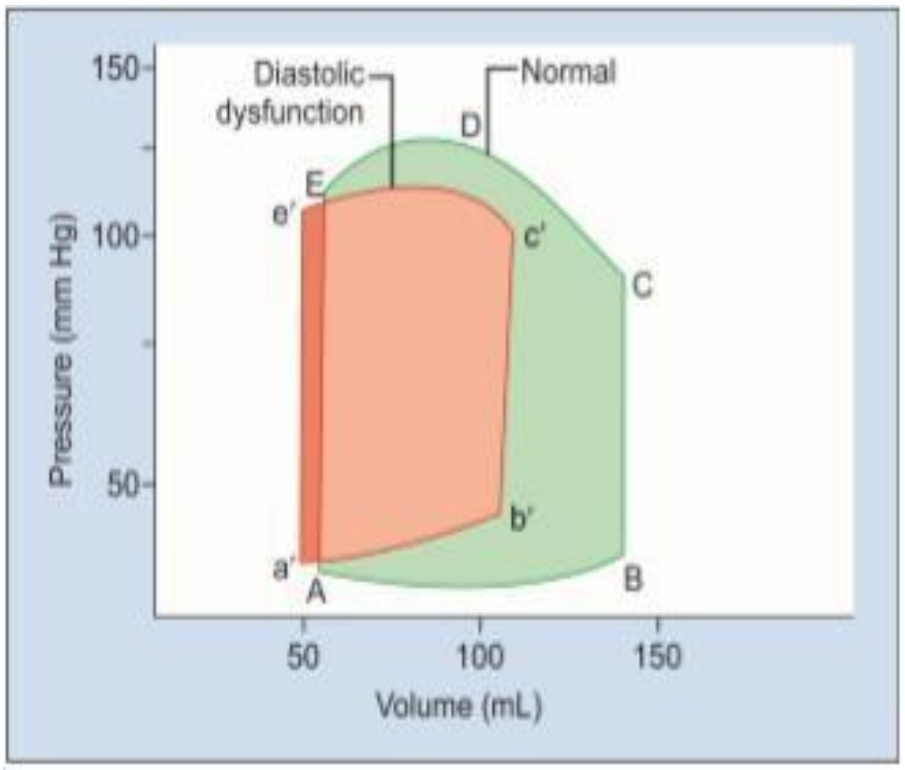
NOTE:

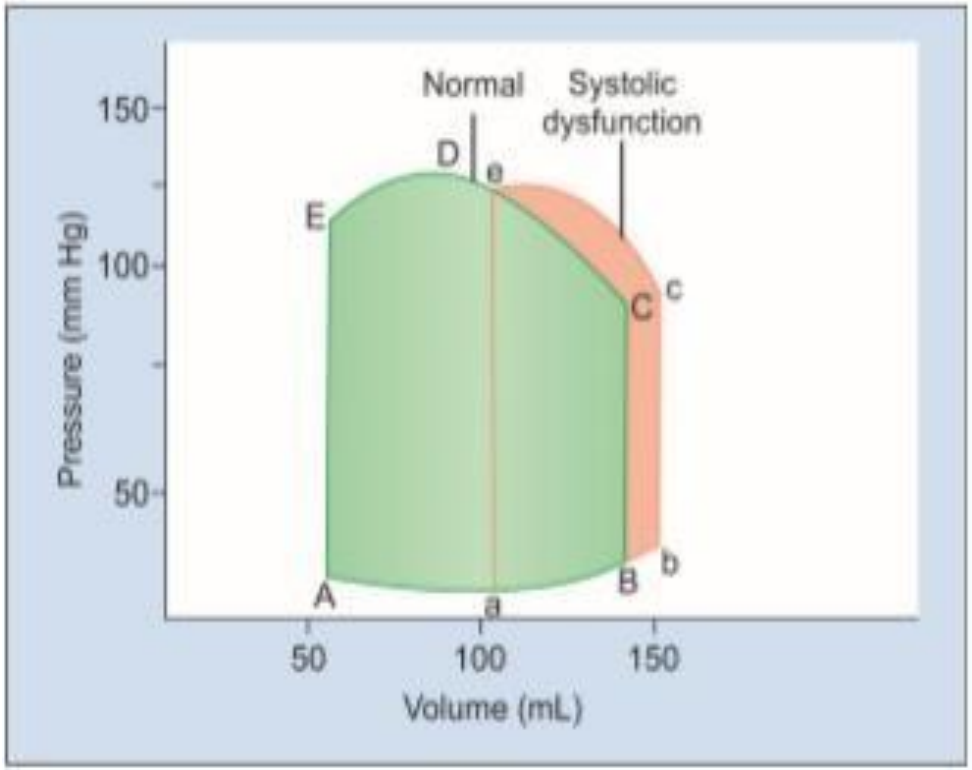
- point A is the **end systolic volume**
- Point C represent **end diastolic volume**

And SO ON the width of the loop is the difference between end diastolic volume and end systolic volume.

Suppose C= 150 ,A=70 , 150-70=80 and this difference represent **stroke volume** (volume of blood ejected in each beat).

Effects of Ventricular Dysfunctions on Pressure-Volume Loop





Sheet 19

Dysfunctions :

•**systolic dysfunction** : abnormality **in contraction** (impaired myocardial contraction) inability of ventricles to contract with high force , pressure-volume curve shifts to the right →due to imperfect contractility it causes reduction in stroke volume (volume ejected in each beat)
Look At the prev. figure:
Changed From **E-C** which the normal state to become **e-c** which is abnormal (reduction in width of the loop which means reduction in stroke volume)

•**Diastolic dysfunction** : the problem **in relaxation** (filling) unlike systolic the problem was in contraction
Inability of the ventricles to relax ..

In this condition the ventricular output is decreased due to impaired in filling and relaxation → led to impaired end diastolic volume (decrease) → problem in stroke volume →problem in output
Look At the figure on the right :
SHIFT In daistolic pressure loop **upward and to the left** from A-B to become a-b

BOTH states has reduction in output and reduction in stroke volume but different MECHANISMS

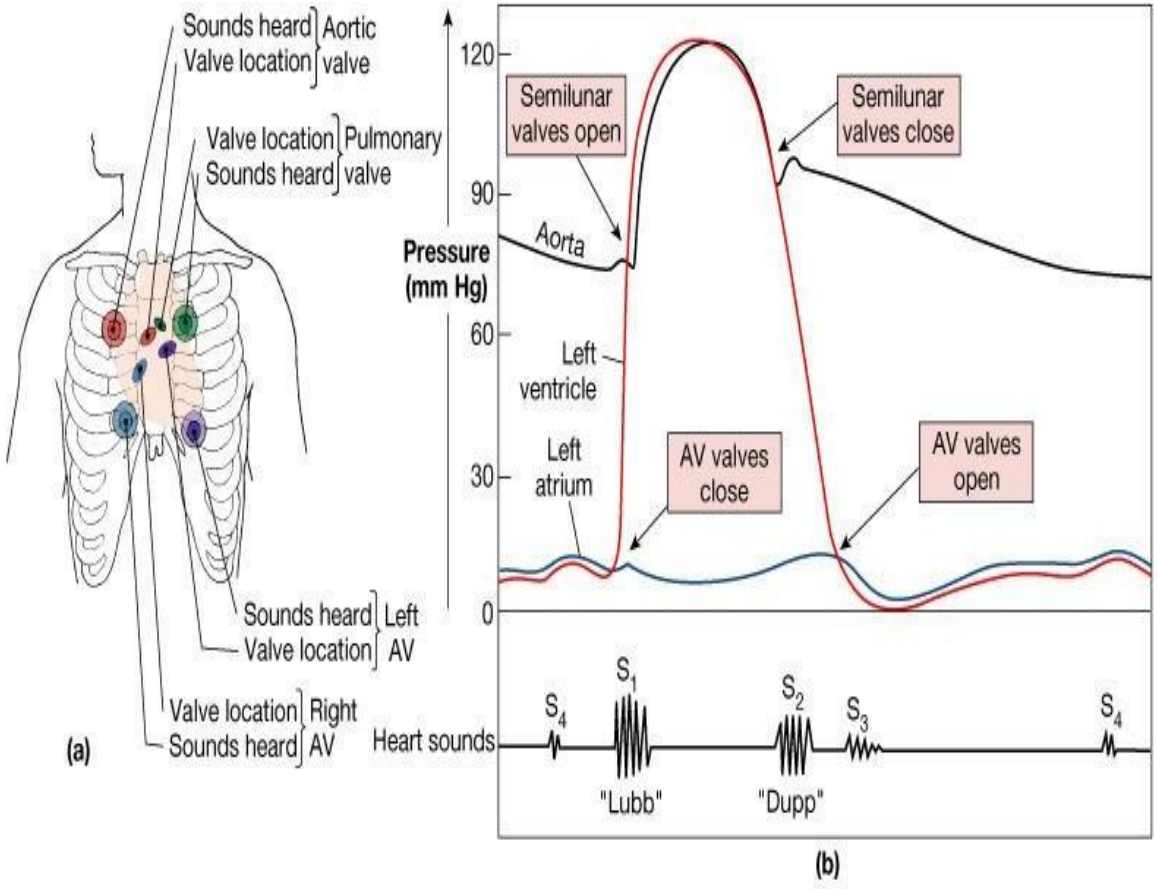
Heart Sounds

The first heart sound:

- **is produced by the vibrations set up by the sudden closure of AV valves.**
- **Its duration is about 0.15s and frequency is 25–45 Hz.**

The second heart sound:

- **is produced by the vibrations set up by the sudden closure of the semilunar valves**
- **is short and loud.**
- **Its duration is about 0.12 s and frequency is 50 Hz.**



Sheet 20

First sound

as a result of closure of AV valves (mitral & tricuspid) during isovolumic contraction phase.

The characteristics of this sound is :

1. Long
2. Soft when HR is low and loud when HR is high
3. Sounds like the spoken word **lub**

Second sound

As a result of closure of semilunar valves at the beginning of ventricular diastole (that's why its sound is short)

The characteristics of this sound is :

1. Short
2. Always loud
3. Sounds like the spoken word **dub**

Site or areas of auscultation on the chest by the stethoscope

heard clearly over the mitral and the tricuspid areas

The mitral valve is located **on 5th intercostal space**

internal to midclavicular line

best heard over the aortic and pulmonary areas

Aortic area : lies in the **right 2nd intercostal space** near the sternum

Pulmonary area: in the left 2nd intercostal space near sternum

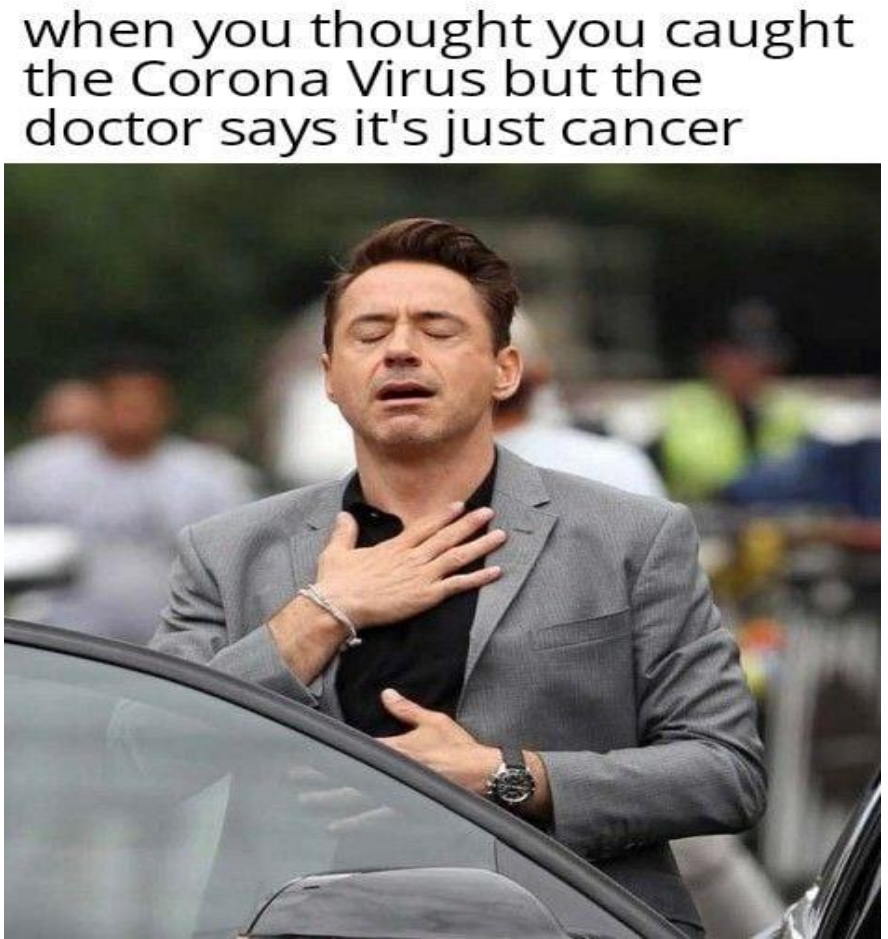
Sound 1 correlated with which wave of ECG ?

QRS complex within the ECG

Look at the figure in prev. slide while studying

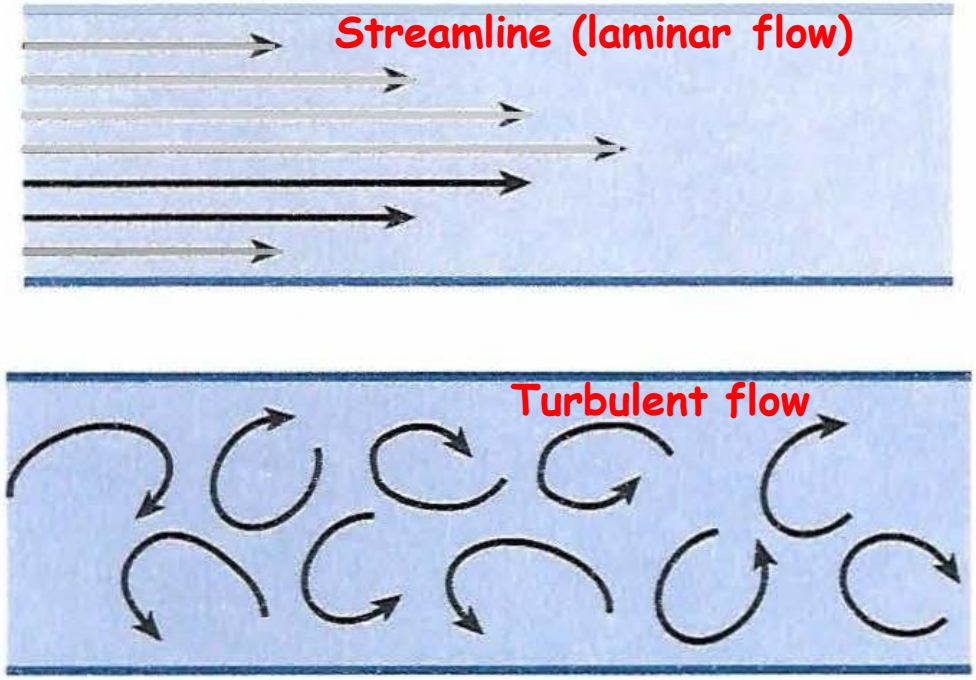
Sound 3: which is non heard in normal conditions , hearing it is a result of abnormality , its produced during rushing of blood during rapid filling phase of ventricular diastole as mentioned before.

Sound 4 : heard during **atrial systole** (late or last rapid filling phase of the ventricles



Cardiac Murmur

- Cardiac murmur is the abnormal or unusual heart sound.
  - Mechanism: change in the direction or the pattern of blood flow.
  - Causes:
    - Valvular stenosis
    - Valvular insufficiency (incompetence),
    - Ventricular septal defect.
    - Atrial septal defect.
    - Coarctation of aorta
    - Patent ductus arteriosus



Cardiac murmur is the abnormal or unusual heart sound.

Mechanism : due to change in normal blood flow (from laminar to turbulent)
→Change in direction OR change in pattern of blood flow .

Blood flow is 2 types :

1. **Laminar flow** : normal flow of blood (stream lines as layers and silent)
2. **Turbulent flow** : abnormal blood flow , due to anemia , branching in vessels , vasoconstriction and others

causes :

- **Valvular stenosis :** means **narrowing** of the valves
- **Valvular insufficiency:** means **leakage , not** Tightly closed

Cardiac Murmur

CLASSIFICATION or type OF MURMUR: Depending upon the timing of appearance these have been classified as

- **Systolic murmur, which is produced during systole,**
- **Diastolic murmur, which is produced during diastole**
- **Continuous murmur, which is produced continuously.**

Either during systole or diastole

Table 4.3-1 Types of murmurs depending on site and type of abnormality

Site of abnormality	Type of abnormality	Type of murmur
Aortic or pulmonary valve	Stenosis Insufficiency	Systolic Diastolic
Mitral or tricuspid valve	Stenosis Insufficiency	Diastolic Systolic
Interventricular septum	Cogenital hole	Systolic
Aorta	Coarctation	Systolic
Ductus arteriosus	Patent	Continuous
Blood	Anaemia	Systolic

Sheet 23

Depending on site and type of abnormality We classify the murmurs Systolic ,Diastolic and continuous murmur

Table 4.3-1 Types of murmurs depending on site and type of abnormality

Site of abnormality	Type of abnormality	Type of murmur
Aortic or pulmonary valve	Stenosis	Systolic
	Insufficiency	Diastolic

Aortic or pulmonary : in semilunar valves , we hear **the stenosis** when there in pumping of blood via the semilunar valves during the systole , the pressure in ventricles higher than aorta so blood pump to it , and through the systole there will be passing of blood through the semilunar valves , so if there **is narrowing** in them (abnormal stenosis) we will hear the abnormal sound during the systole.

If these semilunar valves has **insufficiency** (not closed tightly)→ relaxation of ventricles so pressure in vessels will be higher than ventricles and so on the blood return backward –called **Regurgitation** so blood return and pass through these valves that are not tightly closed , and in this case (insufficiency) we hear it during diastole.

MITRAL or tricuspid (AV valves) :

1.stenosis : if pressure in atria higher than ventricles the blood pass through these valves (during relaxation) so if there is stenosis in these valves we will hear it in diastolic → **diastolic murmur**

2.Insuffecency : the valves aren't closed tightly so during contraction of the ventricle the blood will return through them(Regurgitation) , we hear this abnormal sound during **SYSTOLIC**

Finally
the END

-هي طلعت التعلم عن بعد مش البعد عن التعلم !!

-اه

-يقطعني

دعواتكم