

# **CARDIAC CYCLE**

**By: Sathish Rajamani  
Associate Professor**

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# DEFINITION

- Cardiac cycle is defined as the succession of coordinated events taking place in the heart during each beat.
- Each heart beat consists of two major periods called **systole** and **diastole**.
- **During systole heart contracts and pumps the blood through arteries.**
- **During diastole heart relaxes and blood is filled in the heart.**
- All these events are repeated in a cyclic manner.

# **EVENTS OF CARDIAC CYCLE**

- **Atrial Events**
- **Ventricular Events**

# DIVISION & DURATION

- When the heart beats at a normal rate of 72/ minute duration of each cardiac cycle is about 0.8 seconds.
- **Atrial Events**
  - Atrial Systole = 0.11 (0.1) sec
  - Atrial Diastole = 0.69 (0.7) sec

- **Ventricular Events**

- **Ventricular Systole = 0.27 (0.3) sec**

- **Ventricular diastole = 0.53 (0.5) sec**

- **In Clinical terms**

- **Systole – Ventricular Systole**

- **Diastole – Ventricular Diastole**

# SUB DIVISIONS

## Ventricular Systole

- **Isometric Contraction**  
= 0.05 sec
- **Ejection Period** = 0.22  
Sec
- **Total** = 0.27 Sec

## Ventricular Diastole

- Protodiastole = 0.04
- Isometric relaxation =  
0.08
- Rapid filling = 0.11
- Slow filling = 0.19
- Last rapid filling = 0.11
- Total = 0.53



# **ATRIAL SYSTOLE**

- **Atrial systole is also known as last rapid filling phase or presystole.**
- **It is usually considered as the last phase of ventricular diastole.**
- **The duration is 0.11 sec.**
- **During this period, only a small amount, i.e. 10% of blood is forced from atria into ventricles.**

- **Pressure and Volume Changes** – Intra atrial pressure increases, intra ventricular pressure and ventricular volume also increases but slightly.
- **Fourth Heart Sound** – Contraction of the atrial musculature causes the production of Fourth Heart Sound.



# **ATRIAL DIASTOLE**

- **Atrial diastole starts after atrial systole.**
- **Simultaneously ventricular systole also starts.**
- **Atrial diastole last for about 0.7 sec.**
- **The long atrial diastole is necessary because, this is the period during which atrial filling takes place.**

# VENTRICULAR EVENTS

- **Isometric Contraction Period**
- **Ejection Period**
- **Proto Diastole**
- **Isometric Relaxation Period**
- **Rapid Filling Phase**
- **Slow Filling Phase**
- **Last Rapid Filling Phase**

# **ISOMETRIC CONTRACTION PERIOD**

- **It is the first phase of ventricular systole.**
- **It lasts for 0.05 sec.**
- **This is a type of muscular contraction characterized by increase in tension, without any change in the length of muscle fibers.**

# ISOMETRIC CONTRACTION PERIOD

- Immediately after atrial systole, the atrioventricular valves are closed due to increase in ventricular pressure.
- Semilunar valves are already closed.
- Now ventricles contract as closed cavities.

- In such a way there is no change in the volume of ventricular chambers or in the length of muscle fibers.
- Only the tension increases in ventricular musculature.
- **First Heart Sound** – closure of atrioventricular valves at the beginning of this phases produces first heart sound.

# EJECTION PERIOD

- Due to the opening of the semilunar valves and isotonic contraction of ventricles, blood is ejected out of both the ventricles.
- Hence this period is called as ejection period.
- Duration = 0.22 sec
- Ejection period is of two stages



# **1<sup>st</sup> Stage: Rapid Ejection Period**

- **1<sup>st</sup> stage starts immediately after the opening of semilunar valves.**
- **During this stage, a large amount of blood is rapidly ejected from both the ventricles. It last for 0.13 sec.**

## **2<sup>nd</sup> Stage: Slow Ejection Period**

- **During this stage, the blood is ejected slowly with much less force.**
- **Duration of this period is 0.09 sec.**

# PROTODIASTOLE

- It is the first stage of ventricular diastole, hence the name protodiastole.
- Duration of this period is 0.04 sec.
- Due to the ejection of blood, the pressure in aorta and pulmonary artery increases and pressure in ventricle drops.

## **PROTODIASTOLE (Cont)**

- When intraventricular pressure becomes less than the pressure in aorta and pulmonary artery, the semilunar valves close.
- **Second Heart Sound:** Closure of Semilunar valves during this phase produces second heart sound.

# ISOMETRIC RELAXATION PERIOD

- It is a type of muscular relaxation characterized by decrease in tension without any change in the length of the muscle fibers.
- During this period, once again all the valves of the heart are closed once again.
- Intraventricular pressure decreases.
- Duration is 0.08 sec.

## RAPID FILLING PHASE

- When AV – Valves are opened, there is a sudden rush of blood from atria into ventricles.
- So, this period is called the first rapid filling period.
- Ventricles also relax isotonic ally about 70 % of filling takes place during this phase, which last for 0.11 sec.
- **Third Heart Sound** – Rushing of blood into ventricles during this phase causes production of third heart sound.



# **SLOW FILLING PHASE**

- **After the sudden rush of blood, the ventricular filling becomes slow. Now it is called slow filling,**
- **It is also called as diastasis.**
- **About 20 % of filling occurs in this phase.**
- **Duration = 0.19 sec.**

# LAST RAPID FILLING PHASE

- Last rapid filling phase occurs because of atrial systole,
- After slow filling period, the atria contract and push a small amount of blood into ventricles.
- About 10% of ventricular filling takes place during this period,
- Flow of additional amount of blood into ventricles due to the atrial systole is **atrial kick**.

# SUMMARY

- **Definition**
- **Events**
- **Division and Duration**
- **Sub Divisions**
- **Heart Sounds**



**THANK YOU**

