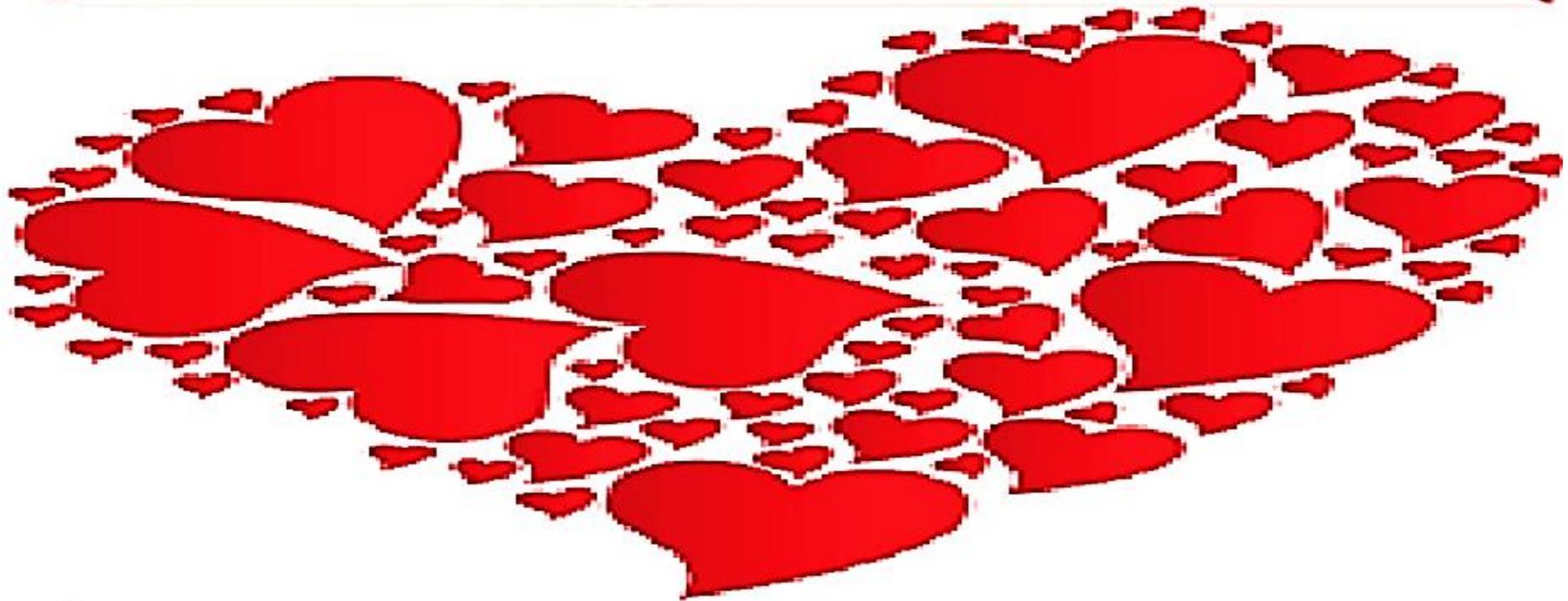


UNDERSTANDING PHYSIOLOGY

L 25: Cardiac Cycle

First year medical students



DR. KHALED AHMED ABDEL-SATER

Anatomy of the Heart

- 4 Cardiac Chambers:

- Right and left atria.
- Right and left ventricles.

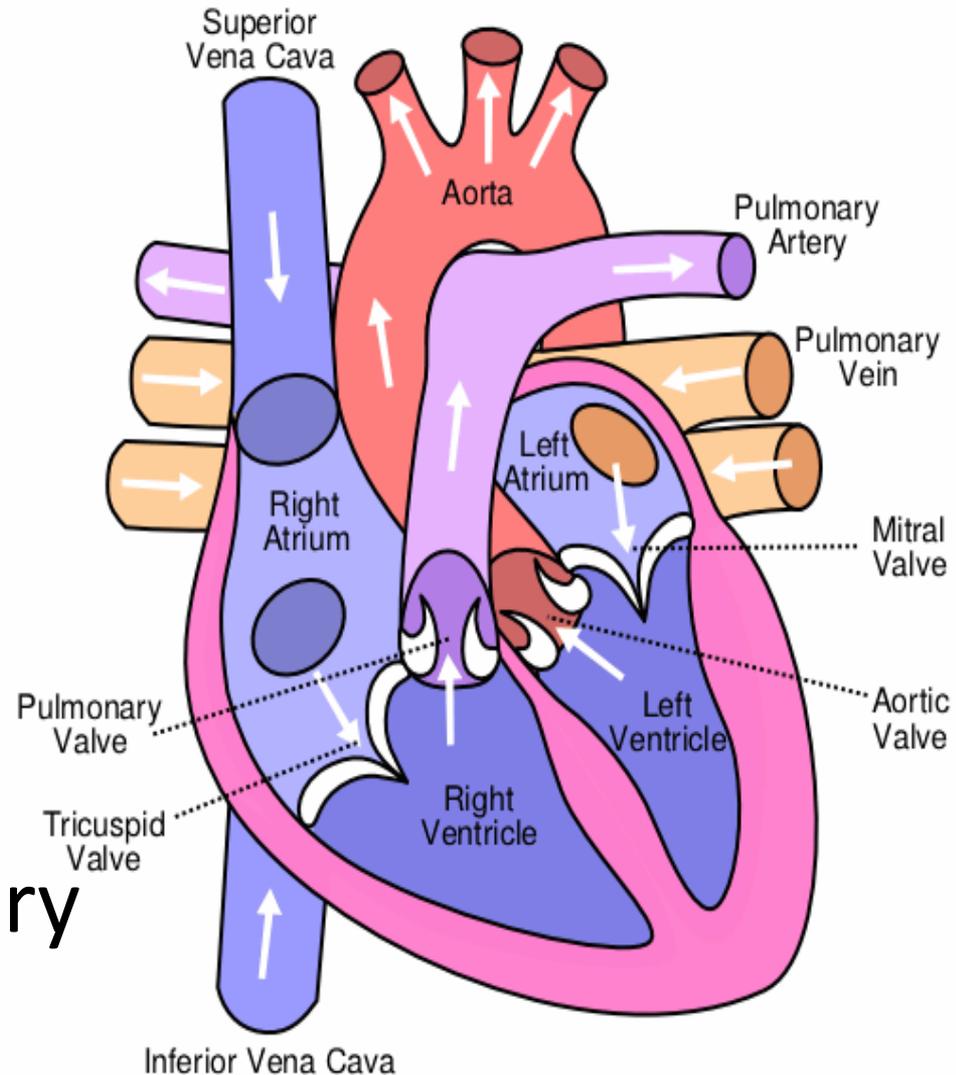
- 4 Cardiac Valves:

I-Atrioventricular (AV) Valves

A- Mitral B- Tricuspid

II-Semilunar Valves

A- Aortic B- Pulmonary



Physiology of the Heart

- The two atria contract at the same time, then they relax while the two ventricles simultaneously contract.
- During ventricular contraction (ventricular systole), the atria relax (atrial diastole). Then, in ventricular diastole, the atria in systole.
- **Systole** = blood flows out = ejection
- **Diastole** = blood flows in = filling

It is cardiac events that occur from the beginning of one beat to the beginning of the next beat.

=

**Cardiac
cycle**

It takes 0.8 seconds!

Period of contraction

during which the heart eject the blood

Systole

Diastole

Period of relaxation

during which the heart fills with blood

Phases of the Cardiac Cycle

I- Ventricular systole phase. It includes:

- 1- Isometric contraction phase
- 2- Rapid ejection phase
- 3- Slow ejection phase

II- Ventricular diastole phase. It includes:

- 4- Isometric relaxation phase
- 5- Rapid filling phase
- 6- Slow filling phase
- 7- Atrial systole phase.

Isometric Contraction Phase

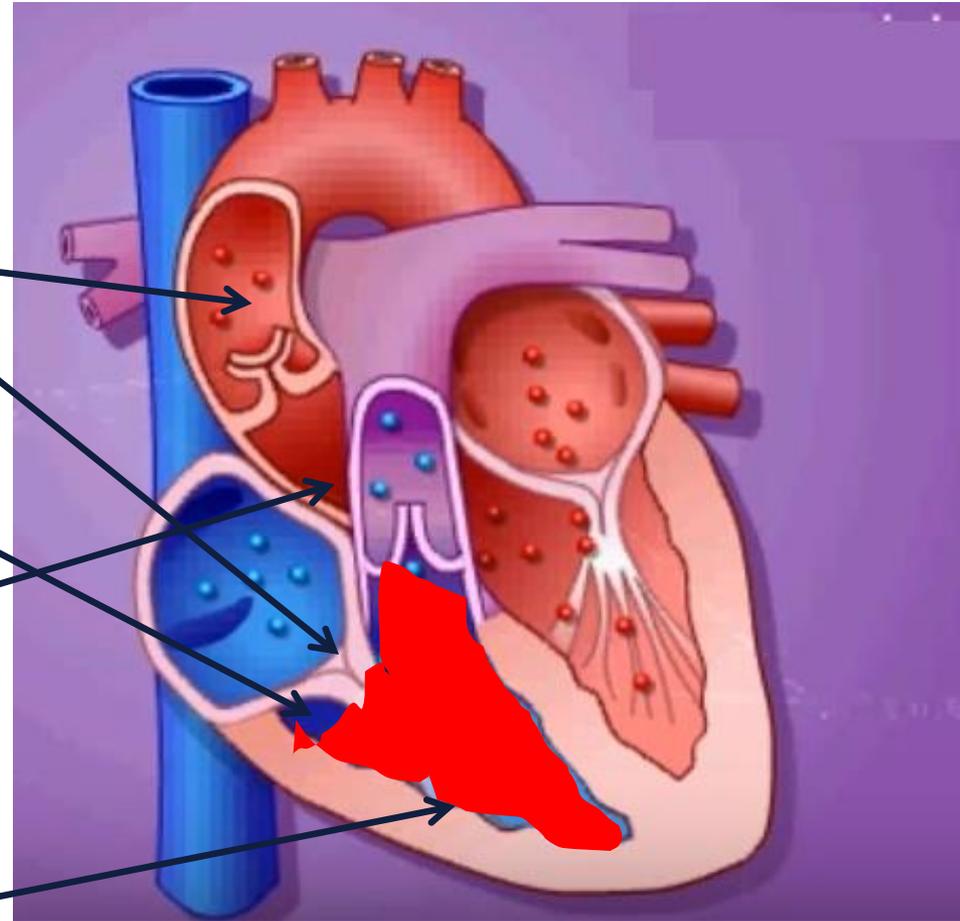
The ventricles contract isometrically while the 4 valves are closed

All Valves are closed

Ventricular pressure:
increased

Aortic pressure:
decreased

Ventricular volume:
constant



Rapid Ejection Phase

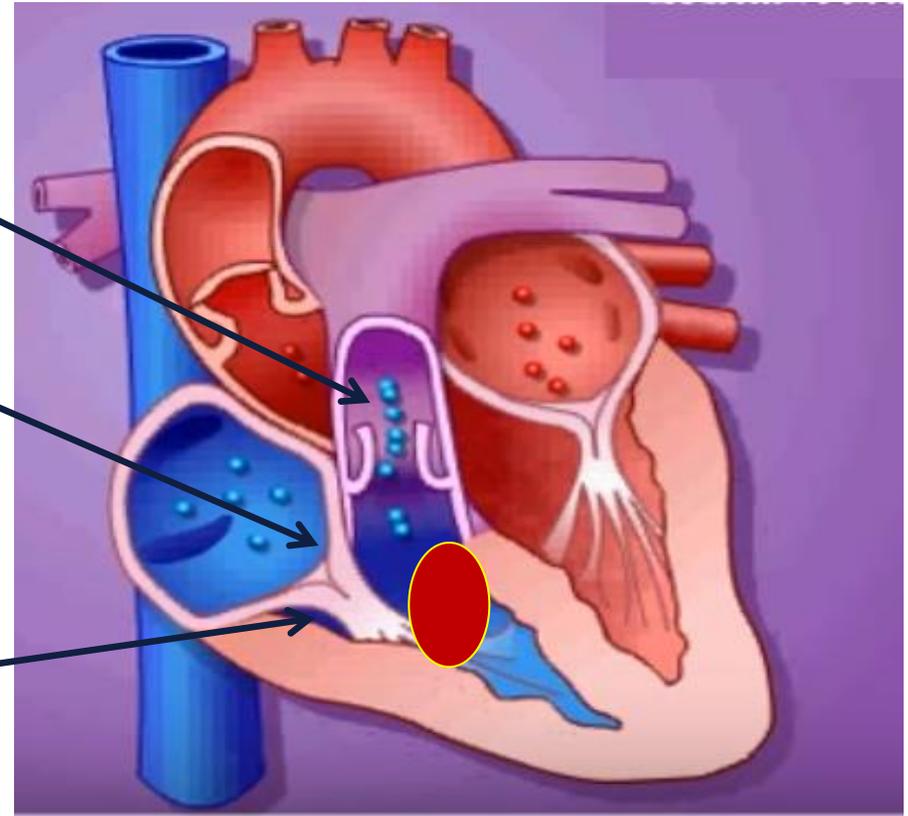
the ventricles contract maximally leading to sudden opening of the semilunar valves and ejection of the blood into the aorta and the pulmonary artery (=70%)

**Semilunar valves
are opened**

AV Valves are closed

**Ventricular pressure:
a greater increase**

**Ventricular volume:
a greater decrease**



Slow Ejection Phase

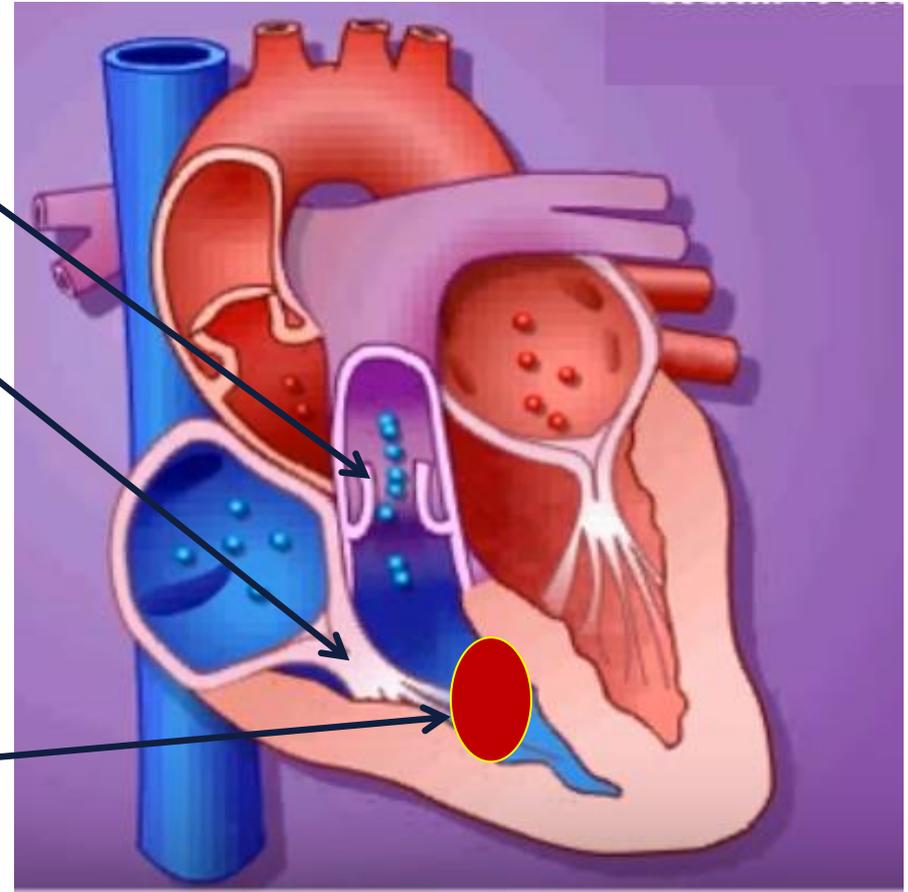
the blood flow from ventricles to arteries but with force less than the previous phase (=30%)

**Semilunar valves
are opened**

AV Valves are closed

**Ventricular pressure:
starts to decrease**

**Ventricular volume:
decreased**



Isometric Relaxation Phase

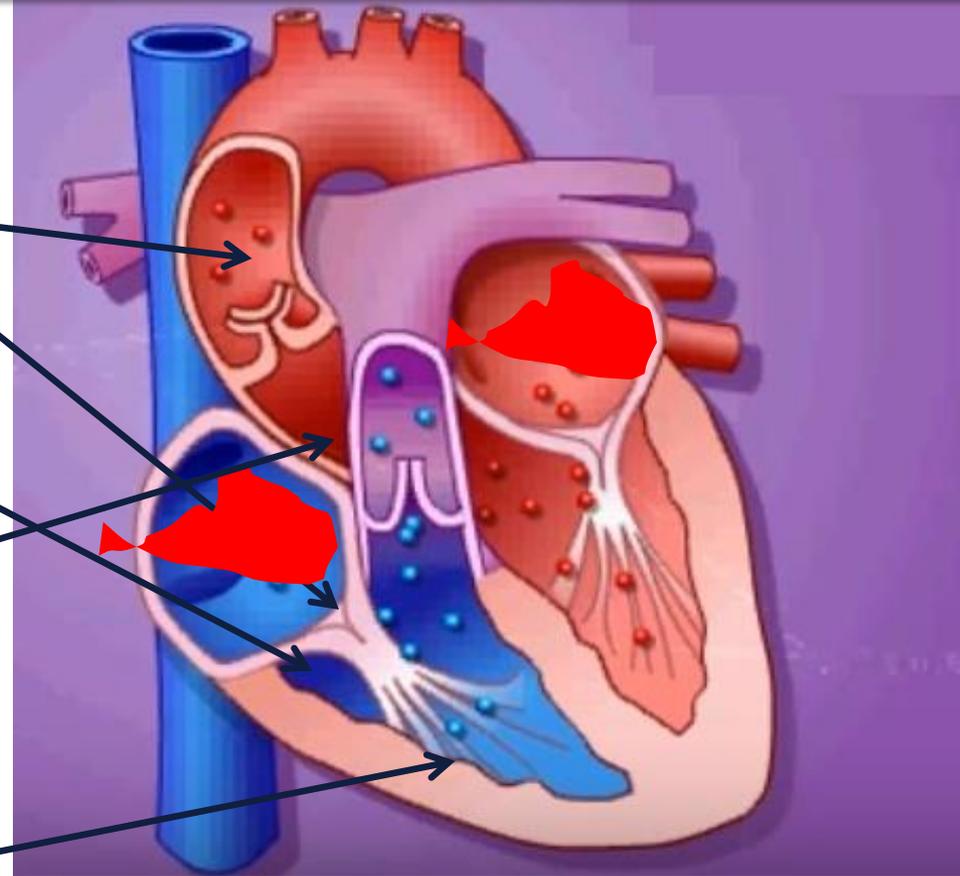
the ventricles relax without change in the length of its fibers. The following changes occur during this phase.

All Valves are closed

**Ventricular pressure:
decreased**

**Atrial pressure:
increased**

**Ventricular volume:
constant**



Rapid Filling Phase

The atrial pressure is greater than the ventricular pressure so the A-V valves are opened and the blood flows rapidly from the atria into the ventricles

(=60%)

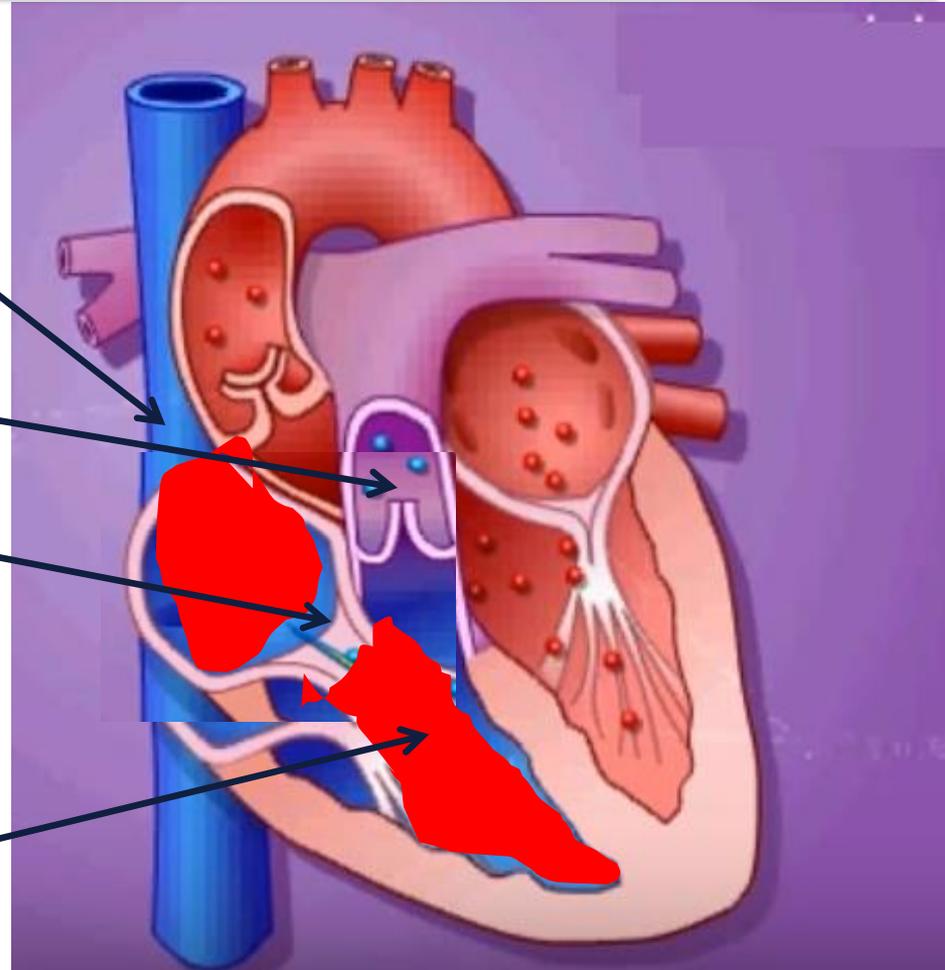
Atria are relaxed

**Semilunar valves
are closed**

AV Valves are open

**Ventricular pressure:
decreased**

**Ventricular volume:
gradually increased**



Slow Filling Phase

The A-V valves are still opened and only a small amount of blood flows into the ventricles (=10%)

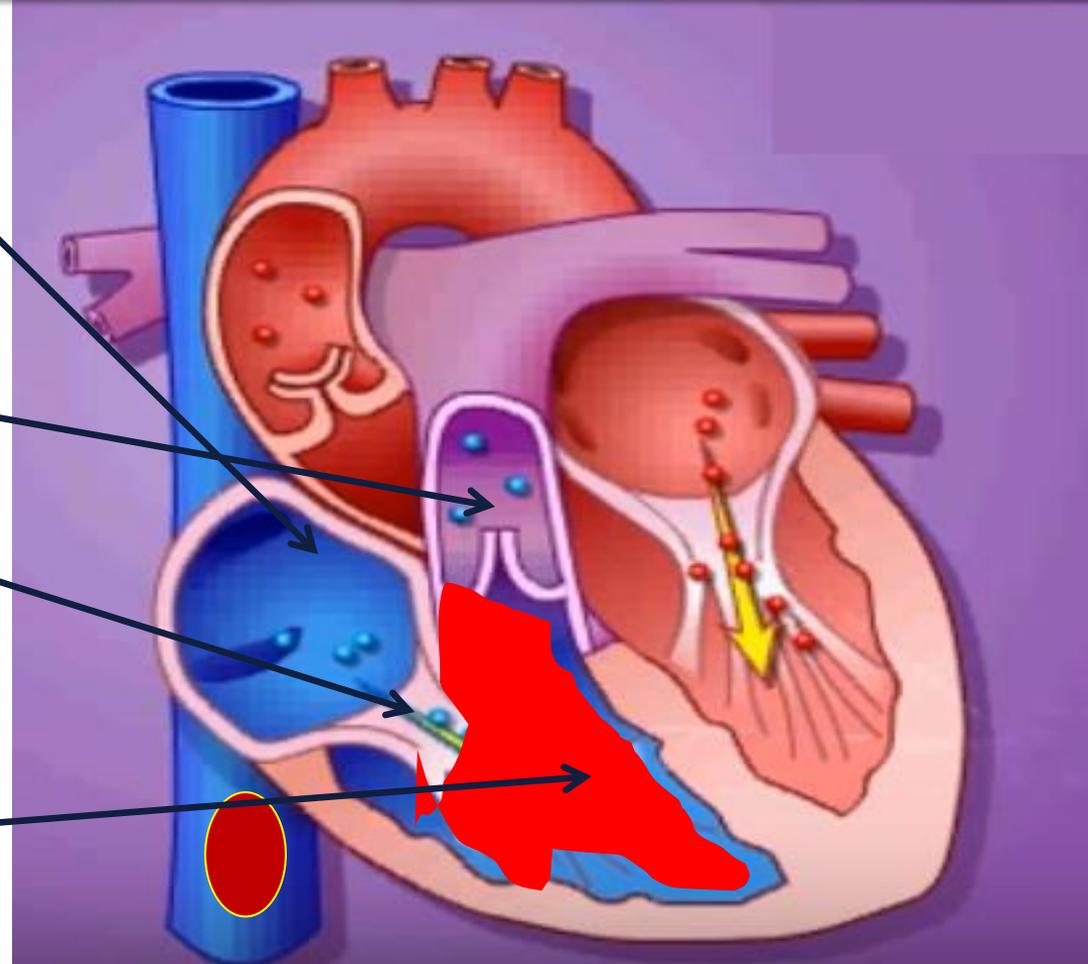
Atria are relaxed

Semilunar valves are closed

AV Valves are open

**Ventricular pressure:
a greater decrease**

**Ventricular volume:
a greater increase**



Atrial Systole Phase

During this phase, atria contract and push 30 % of the filling of the ventricles

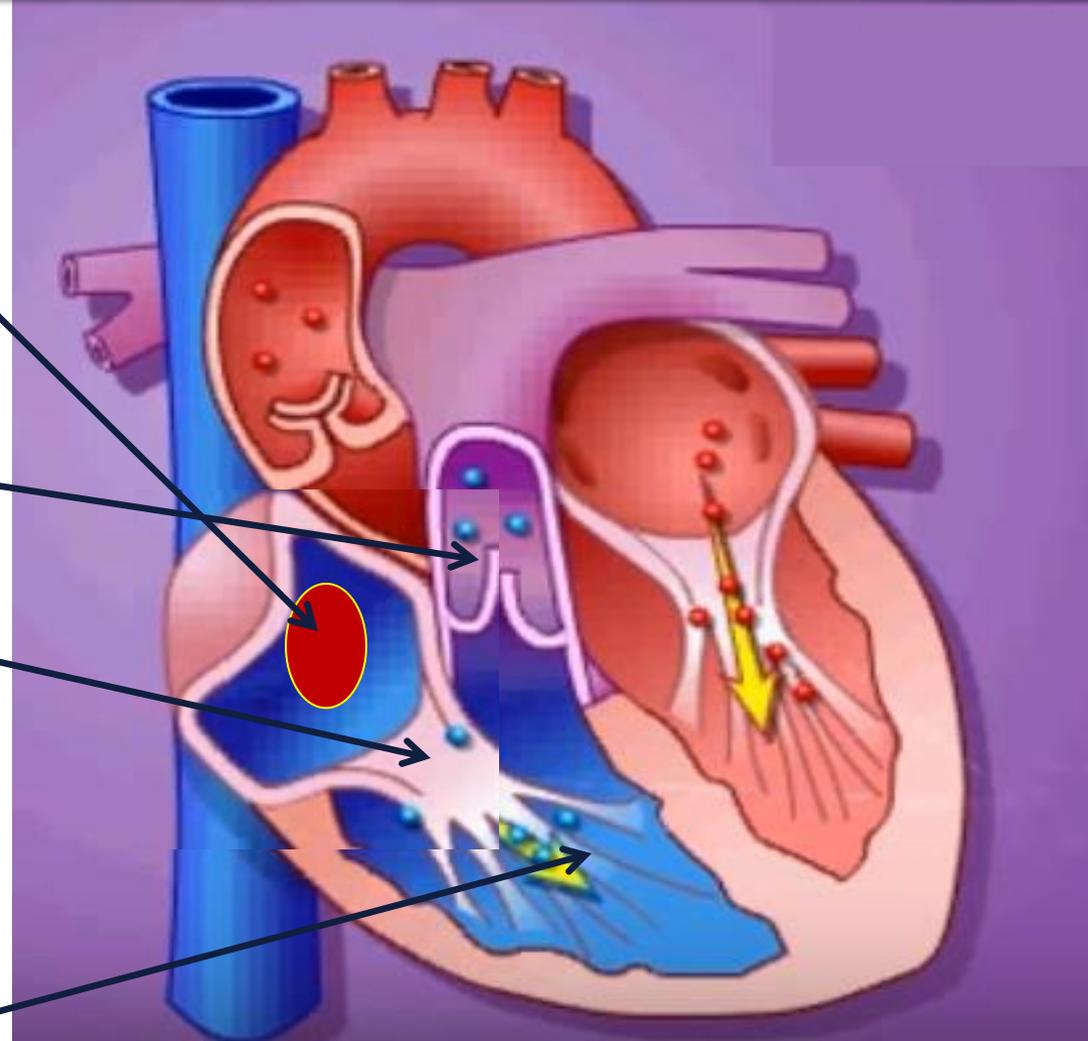
**Contraction of Atria
and atrial pressure
increased**

**Semilunar valves
are closed**

AV Valves are open

**Ventricular pressure:
slightly increases**

**Ventricular volume:
increased more**



N.B.

1- Isometric means:

a-All valves are closed. b-Ventricular volume is constant. c-Ventricular pressure increases in isometric contraction & decreases in isometric relaxation.

2- Pressure increases by contraction & decreases by relaxation.

3- Volume increases by filling & decreases by ejection.

4- Valves are closed in isometric phases. AV valves open in filling & semilunar in ejection.