

## 6<sup>th</sup> Lecture

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# CARDIAC CYCLE-2

Notes Dr. Ashraf

Physiology Team - 430

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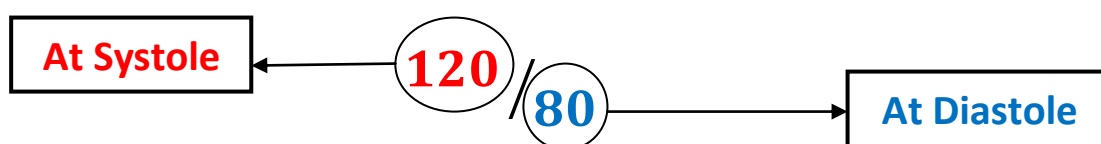
**Reem Al jurayyad** - **Suliman AL-Shammari**

**Cardiac Catheterization** : to measure the pressure and the amount of oxygen in each chamber of the heart

**Catheter** : is a tube that can be inserted into a body cavity, duct, or vessel

- **Right side of heart** : pass the tube through vein  
(SVC → right atrium → right ventricle )
- **Left side of heart** : pass the tube through artery  
(Femoral artery → Aorta → left ventricle → left atrium )

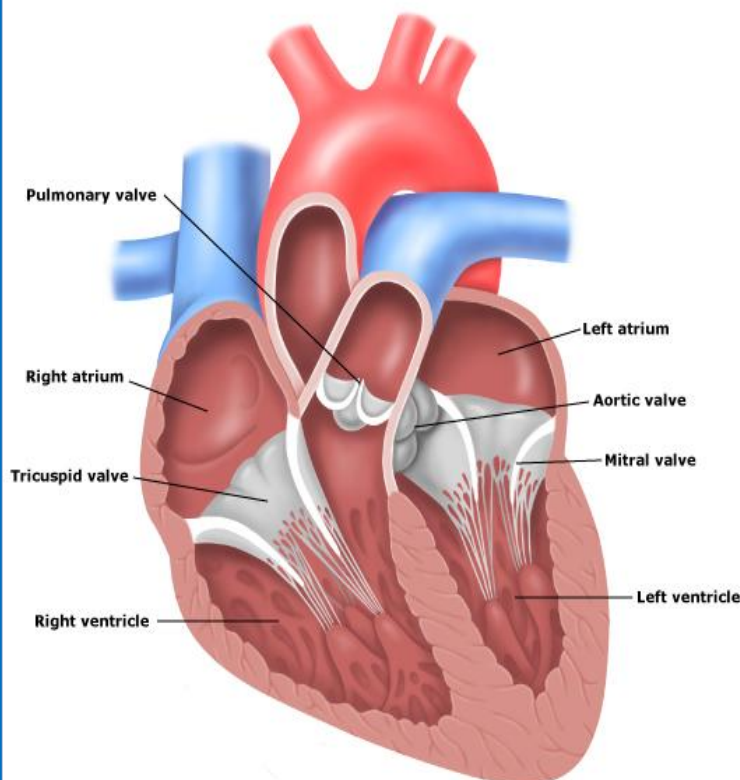
## Pressure in heart chambers

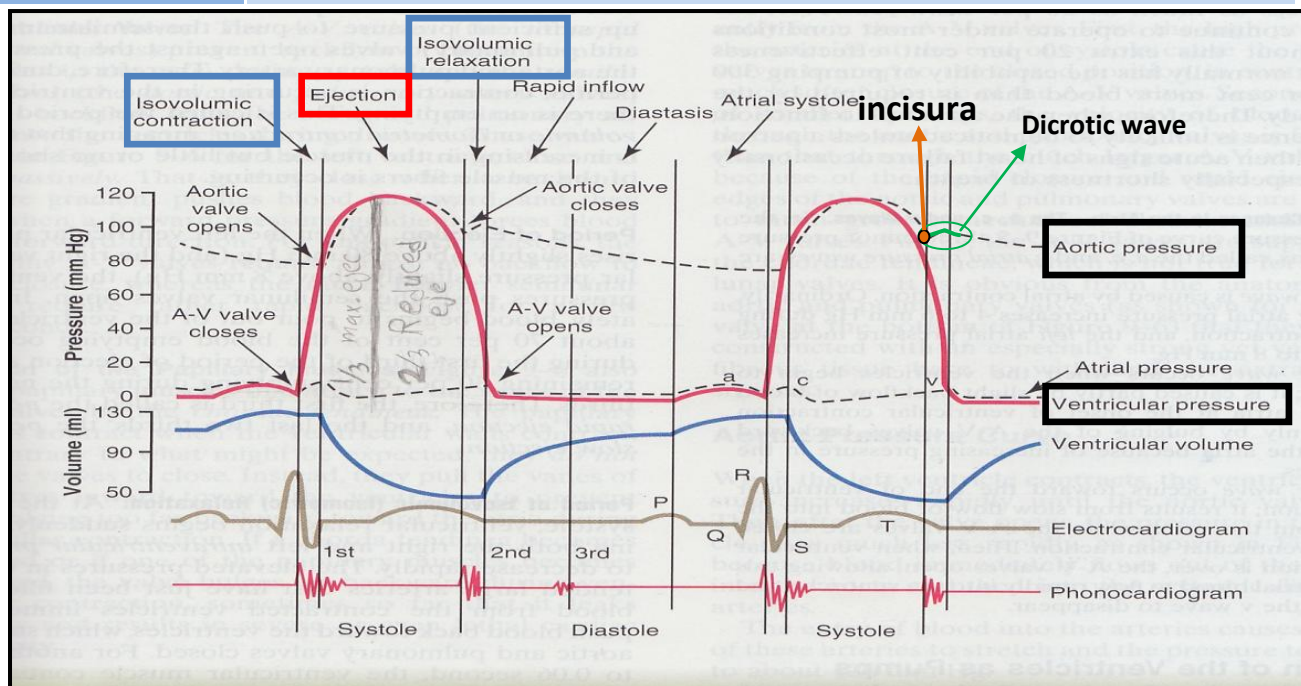


- **Right atrium** : 0 → 4 mm hg  
( some books : -2 → 4 mm hg )
- **Left atrium** : 8 mm hg
- **Aorta** : 120 / 80
- **Left ventricle** : 120 / 10
- **Pulmonary vein** : 25 / 10
- **Right ventricle** : 25 / 10

- Pressure in LV is **higher** than RV ,  
Because LV is thicker than RV ( 5 times )

- LV and Aorta have the same pressure at systole ( 120 ) But they differ at diastole





### ■ Left Ventricular and Aortic Pressure curve :

**1- During isovolumic contraction :** ( after "closure of A-V valve" and before "opening of aortic valve" : )

**Ventricular pressure** increases until **80mm Hg** then Aortic valve opens

**2- During Ejection :** **Both** ventricular and Aortic pressures will be **increased** BUT ventricular pressure is higher than aortic pressure.

**End of "Reduced Ejection" :** **Both** ventricular and Aortic pressures will be **decreased** BUT Aortic pressure will be higher than ventricular pressure.(this will continue until the Aortic valve closes)

**3- During isovolumic relaxation :** (after "closure of Aortic valve" and before "opening of A-V valve")

**Ventricular pressure** still on being decreased until the A-V valve opens then the ventricle should be completely filled with blood to lead to **the isovolumic contraction** again

**Aortic pressure** will be slightly **increased (dicrotic wave)**.  $\Delta$  then **decrease** until Aortic valve opens again

**Dicrotic notch ( incisura ) :** occurs in the closure of Aortic valve

**$\Delta$  : Explained in the end**

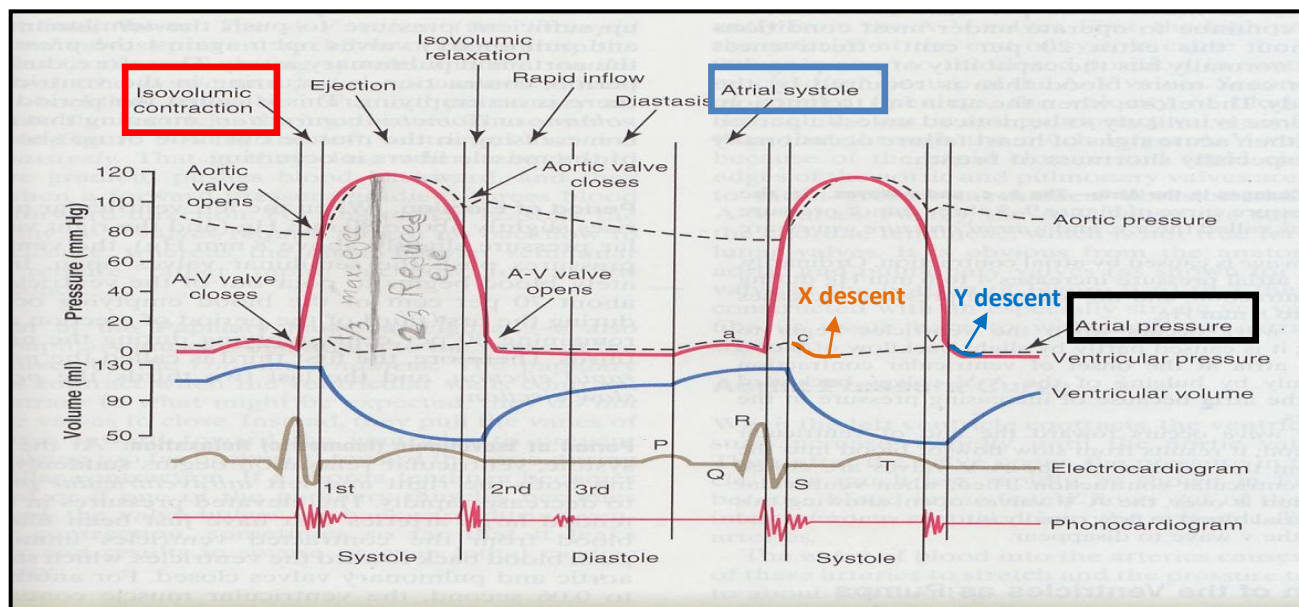
**End of Reduced Ejection :** Aortic pressure will be higher than ventricular pressure Because muscle of ventricle will be relaxed but Blood continues flowing (**Why ?**) Because of the **Inertia**

When the Pressure changed in **right Atrium** will reflect on **internal jugular vein** ( Right side of neck ) because there is no valve between them . So, we can **record waves** from it, called the jugular venous pulse .

We have :

■ **3 upward waves ( a , c and v )**

■ **2 downward waves ( x and y )**



### ■ Atrial Pressure curve :

**1- During Atrial systole** : blood will go down to ventricles and up to jugular vein . also , Pressure goes up to the jugular vein . So, we will see **a wave** ( Atrial contraction cause **a wave** )

**2- During Atrial diastole** : ( A-V valves closed ) blood fills the atrium and the pressure will be increased . So, we will see **v wave** ( Atrial relaxation cause **v wave** )

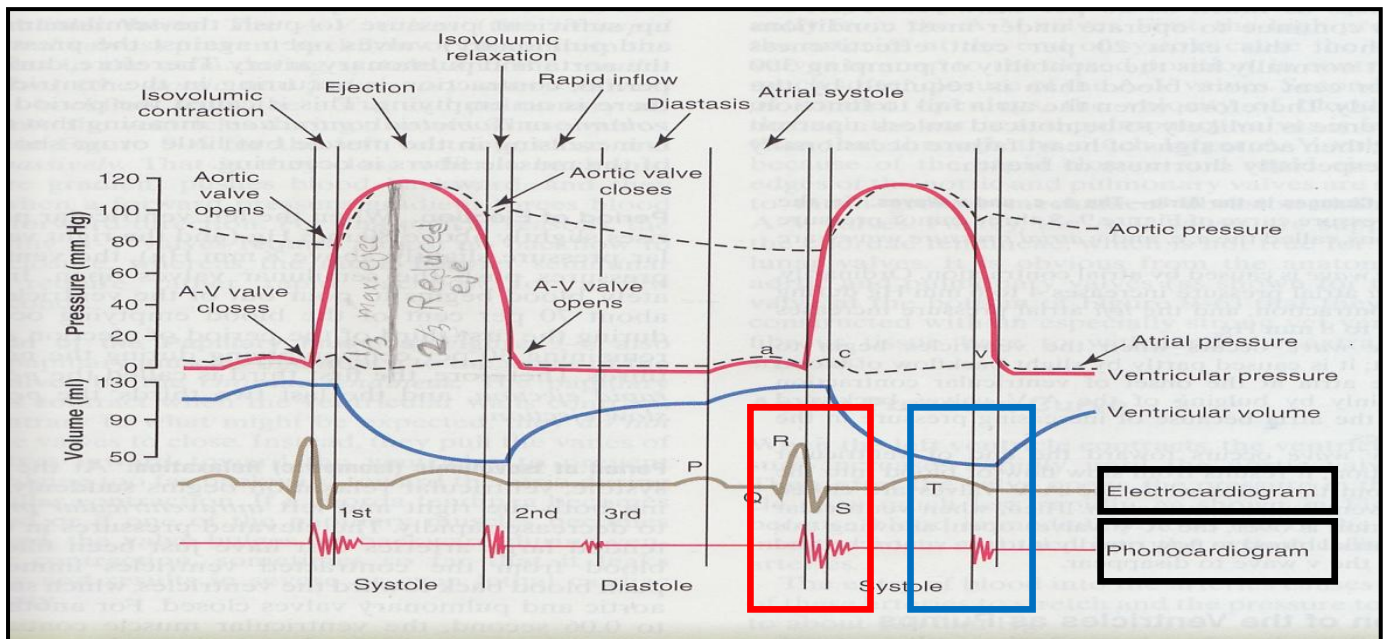
■ **After the peak of v wave** the rapid filling happens. we will see **y descent** ( or wave ) (Rapid filling cause **y wave** )

**3- During isovolumic contraction** : All valve closed and pressure in ventricles will go up that causes **bulging** of A-V valves in atrial cavity. This will increase the pressure in the atrium , causing **c wave**.

■ **After Bulging** : ventricles will be in rapid ejection phase that cause downward displacement of A-V valves . So, we will see **x descent** ( or wave ) ( Rapid Ejection cause **x wave** )



- Electrical phenomenon occurs before mechanical event (Ex : depolarization then contraction )



- Compared between ECG and Phonocardiogram :

**1st heart sound :** ( At the beginning of systolic ventricles when A-V valves are closed )

**In ECG :** at the **end of QRS complex** ( Depolarization )

**Why ?** because Electrical event happens before mechanical ( contraction )

**2nd heart sound :** (At the beginning of diastolic ventricles when Semilunar valves are closed )

**In ECG :** **after T wave** (Repolarization )

**Why** because Electrical event happens before mechanical ( relaxation )

- Right ventricle's pressure curve like Left ventricle's
- Left Atrial's pressure curve like Right Atrial's
- Pulmonary vein's pressure curve like Aortic's

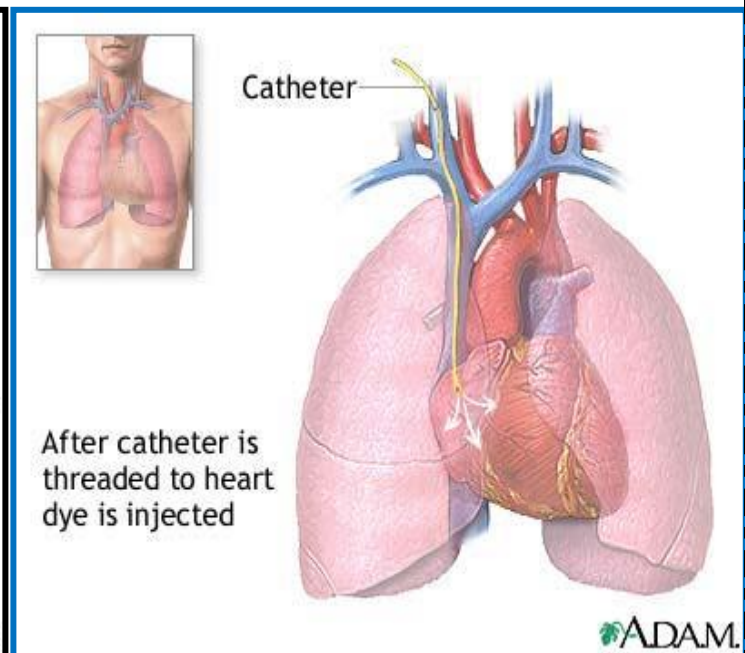
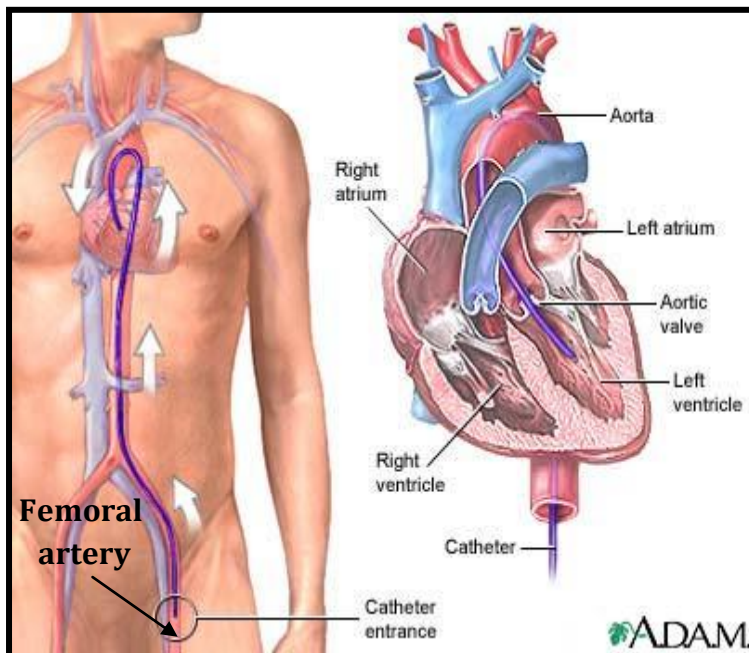


■ More explanation on How **dicrotic wave** occurred ::

**1<sup>st</sup> phase** : ventricles pressure will be higher than Aortic pressure . So, blood will go to Aorta

**2<sup>nd</sup> Phase** : Aortic pressure will be higher . So, Blood goes back to ventricle But Aortic valve closed . therefore blood reflects back . This will be cause dicrotic wave

**For You ^\_^ ( Cardiac Catheterization )**



1- Femoral artery

**Then** 2- Aorta

**Then** 3- left ventricular

**Then** 4- left atrium

1- SVC

**Then** 2- Right atrium

**Then** 3- Right ventricles