# Valvular Heart Disease

Dr . HANAN ALBACKR

# Valvular Heart Disease

- **Format for this lecture**
  - **IMPORTANT CLINICAL INFO**
    ***know for boards, tests and clinical practice***

# Spectrum of VHD

Aortic Valve

Mitral Valve

Tricuspid Valve

Pulmonic Valve

# Spectrum of VHD

| | |
|---|---|
| Aortic Valve | Regurg |
| | Stenosis |
| Mitral Valve | Regurg |
| | Stenosis |
| Tricuspid Valve | Regurg |
| | Stenosis |
| Pulmonic Valve | Regurg |
| | Stenosis |

# Spectrum of VHD

| | | |
|---|---|---|
| Aortic Valve | Regurg | Acute |
| | | Chronic |
| | Stenosis | Acute |
| | | Chronic |
| Mitral Valve | Regurg | Acute |
| | | Chronic |
| | Stenosis | Acute |
| | | Chronic |
| Tricuspid Valve | Regurg | Acute |
| | | Chronic |
| | Stenosis | Acute |
| | | Chronic |
| Pulmonic Valve | Regurg | Acute |
| | | Chronic |
| | Stenosis | Acute |
| | | Chronic |

# Spectrum of VHD

| | | |
|---|---|---|
| Aortic Valve | Regurg | Acute |
| | | Chronic |
| | Stenosis | Acute |
| | | Chronic |
| Mitral Valve | Regurg | Acute |
| | | Chronic |
| | Stenosis | Acute |
| | | Chronic |

# Spectrum of VHD

| | | |
|---|---|---|
| Aortic Valve | Regurg | Acute |
| | | Chronic |
| | Stenosis | |
| | | Chronic |
| Mitral Valve | Regurg | Acute |
| | | Chronic |
| | Stenosis | |
| | | Chronic |

# Spectrum of VHD

| | | |
|---|---|---|
| Aortic Valve | Regurg | Acute |
| | | Chronic |
| | Stenosis | |
| | | Chronic |
| Mitral Valve | Regurg | Acute |
| | | Chronic |
| | Stenosis | |
| | | Chronic |

# Spectrum of VHD – Right Sided VHD

Tricuspid Valve

- Endocarditis
  - – IV drug abusers or inpt with IVs
- Carcinoid HD - classically TS
- TR – common, benign, may be secondary to Pulm HTN

Pulmonic Valve

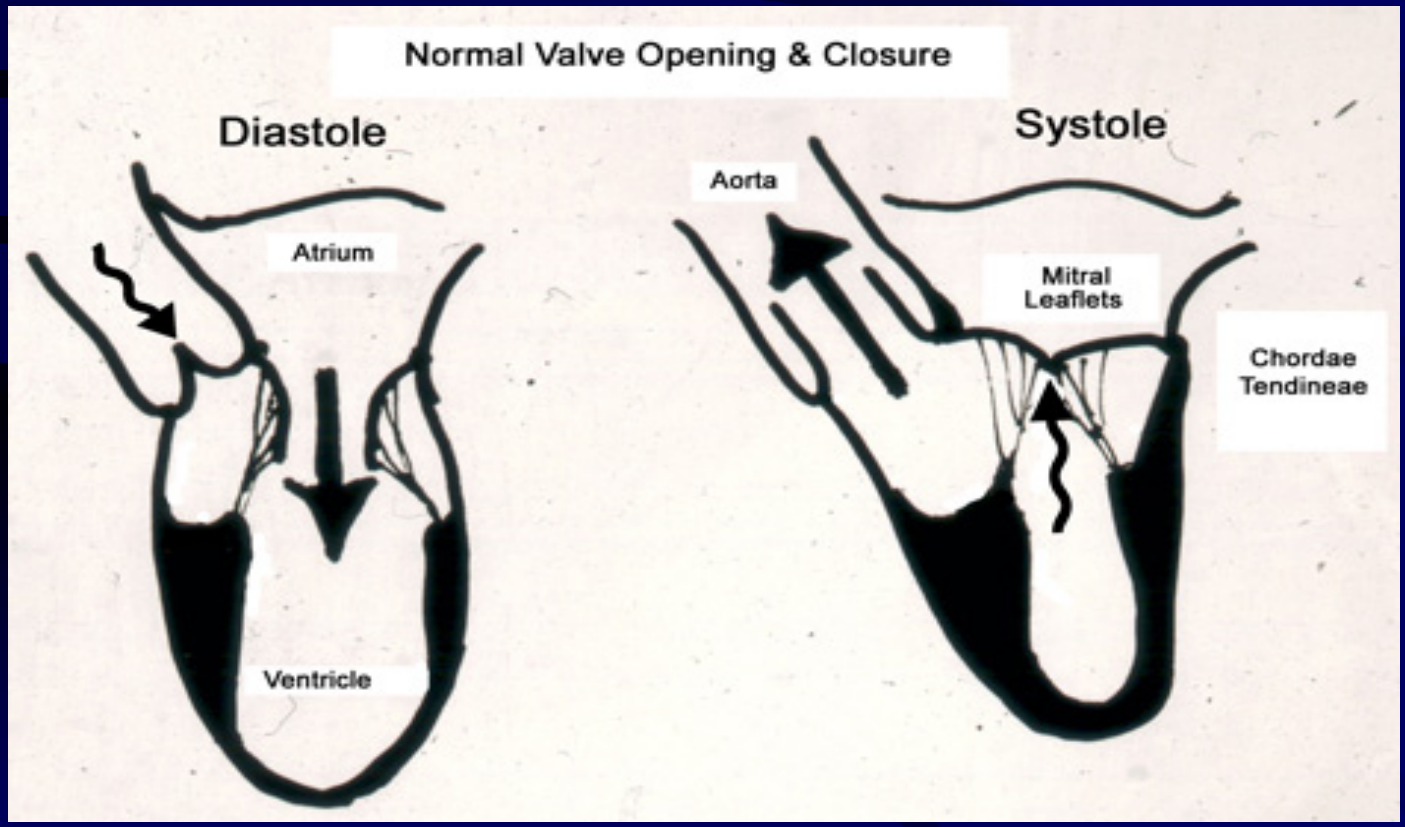
- Pediatrics – Pulm Stenosis
- Rheumatic HD – PI (Graham Steel Murmur)

Right sided valvular lesions change in intensity with inspiration

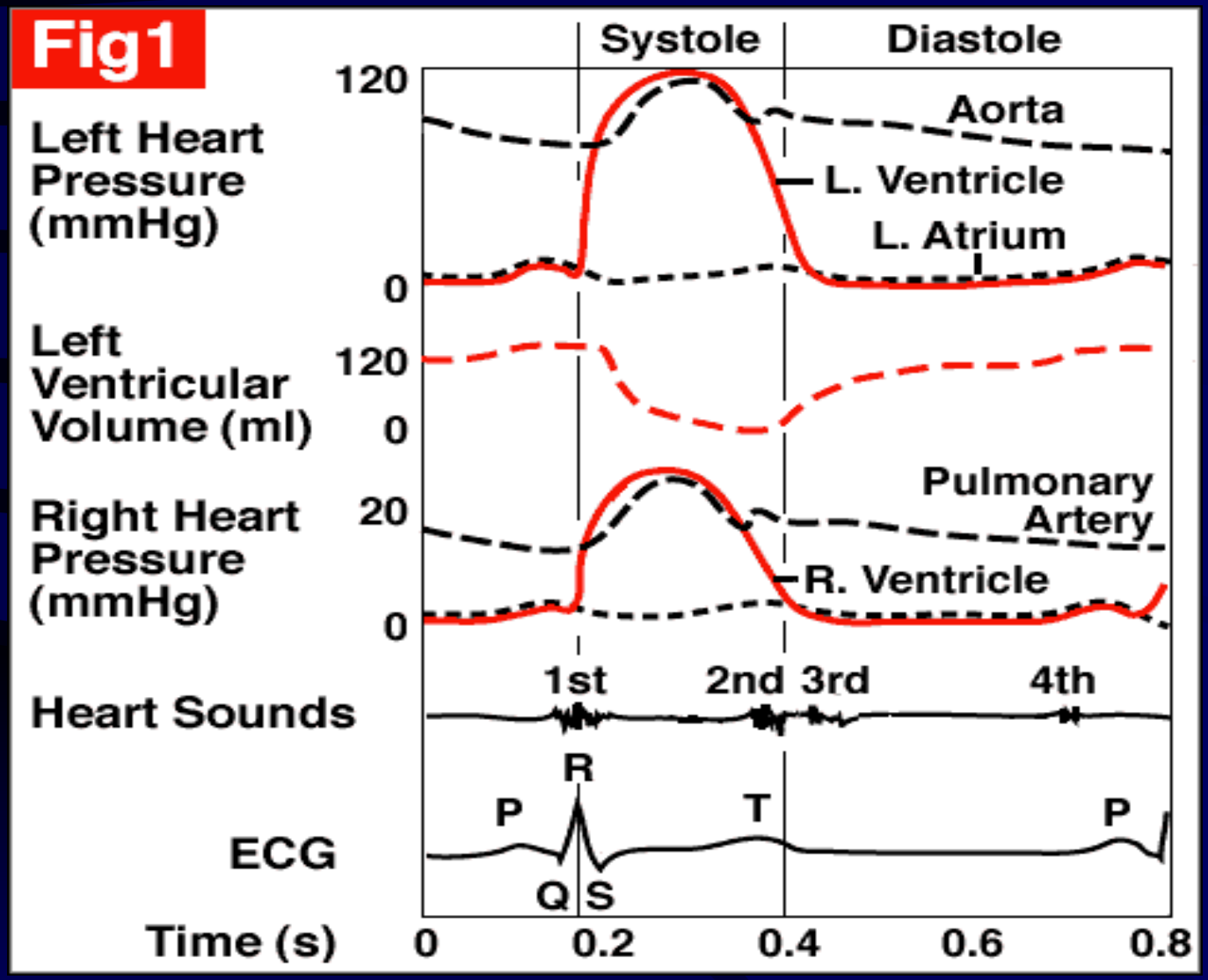
Eric Petersen / The Livingston Enterprise

# *Cardiac Physiology 101*

| | |
|---|---|
| **Systole** | **AV/PV – opens** |
| ***S1-S2*** | **MV/TV – closes** |
| **Diastole** | **AV/PV – closes** |
| ***S2-S1*** | **MV/TV – opens** |



# *Cardiac Physiology 101*



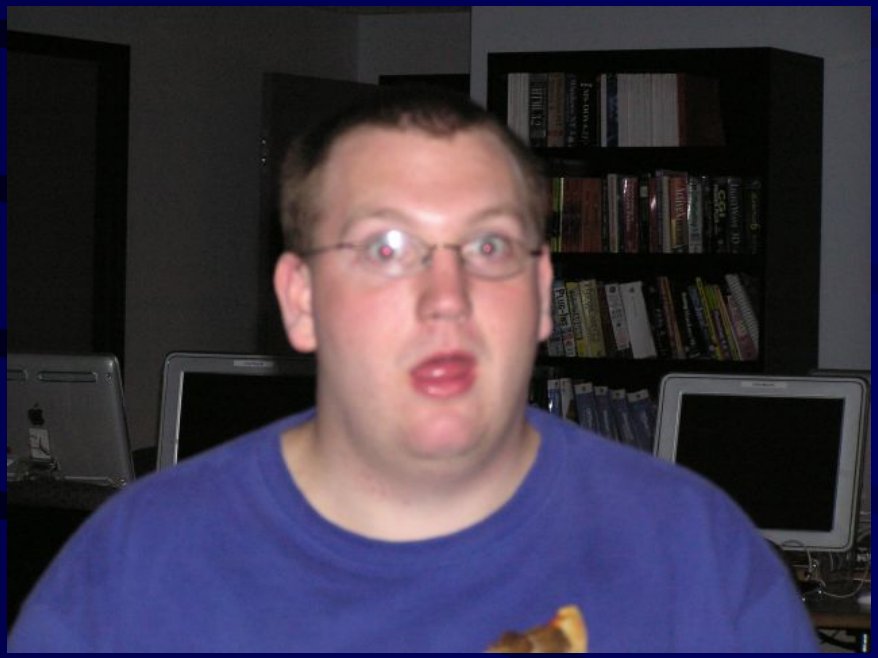
## *Cardiac Physiology 101*

**Regurg/ Insuff –** leaking (***backflow***) of blood across a ***closed*** valve

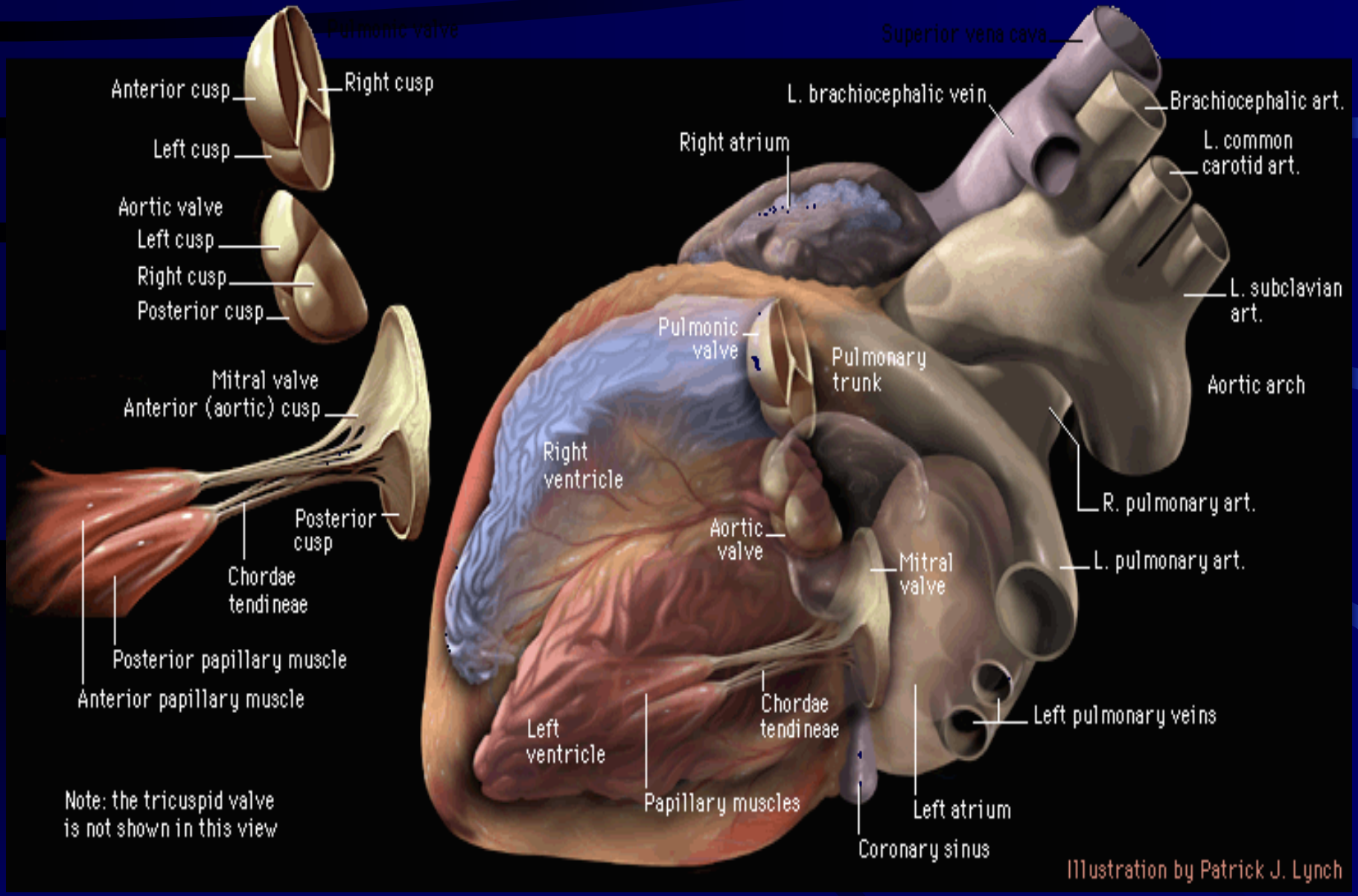
**Stenosis** – Obstruction of (***forward***) flow across an ***opened*** valve

| | |
|---|---|
| **Systole** | **AV/PV – opens-------Aortic Stenosis** |
| ***S1-S2*** | **MV/TV – closes------Mitral Regurg** |
| **Diastole** | **AV/PV – closes------Aortic Regurg** |
| ***S2-S1*** | **MV/TV – opens-------Mitral Stenosis** |

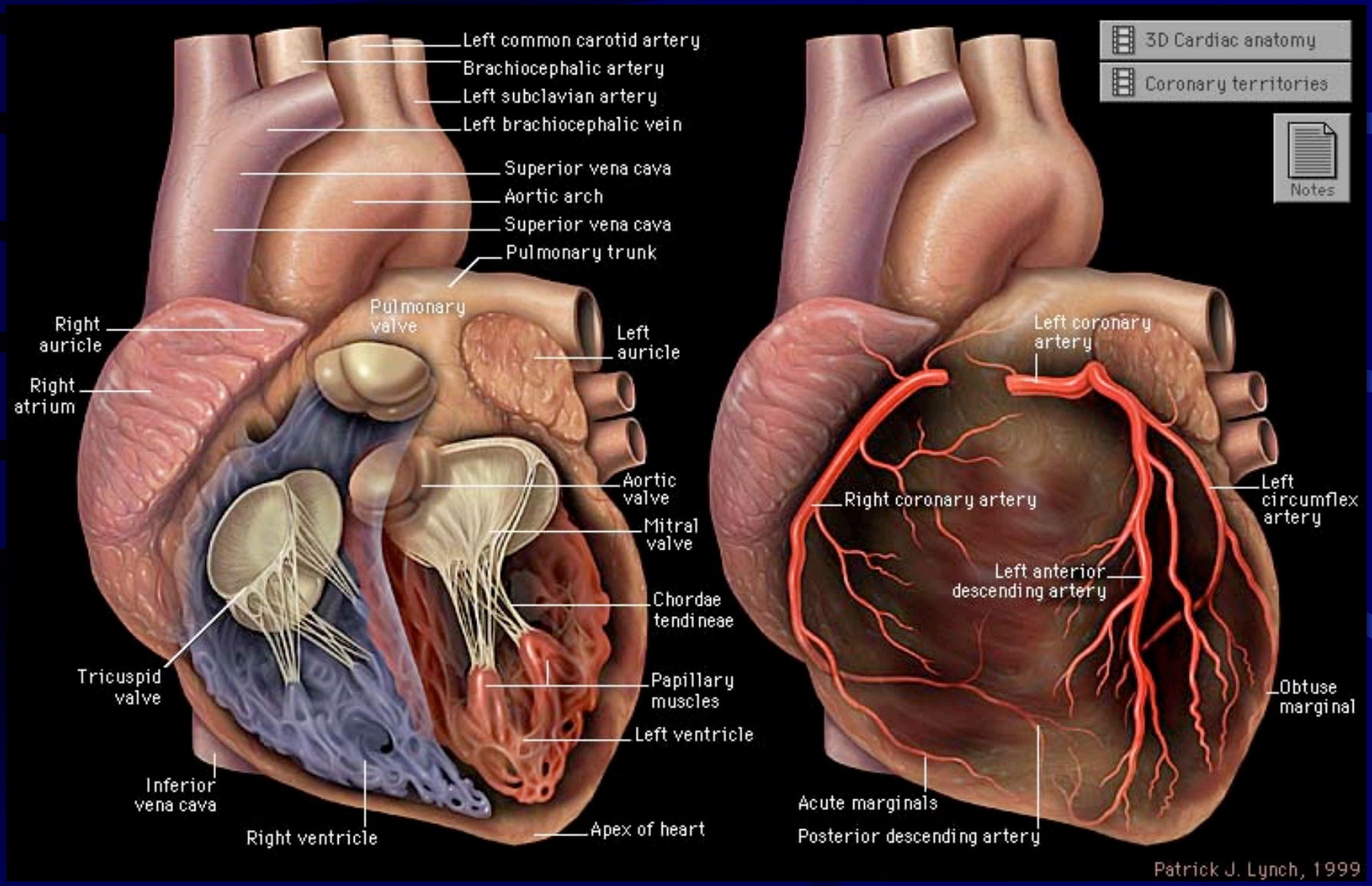
***These concepts are set in stone, it can't occur any other way,***
***It would be anatomically impossible***



# Cardiac Anatomy 101



# *Cardiac Anatomy 101*



# Valvular Heart Disease

## Aortic Valve

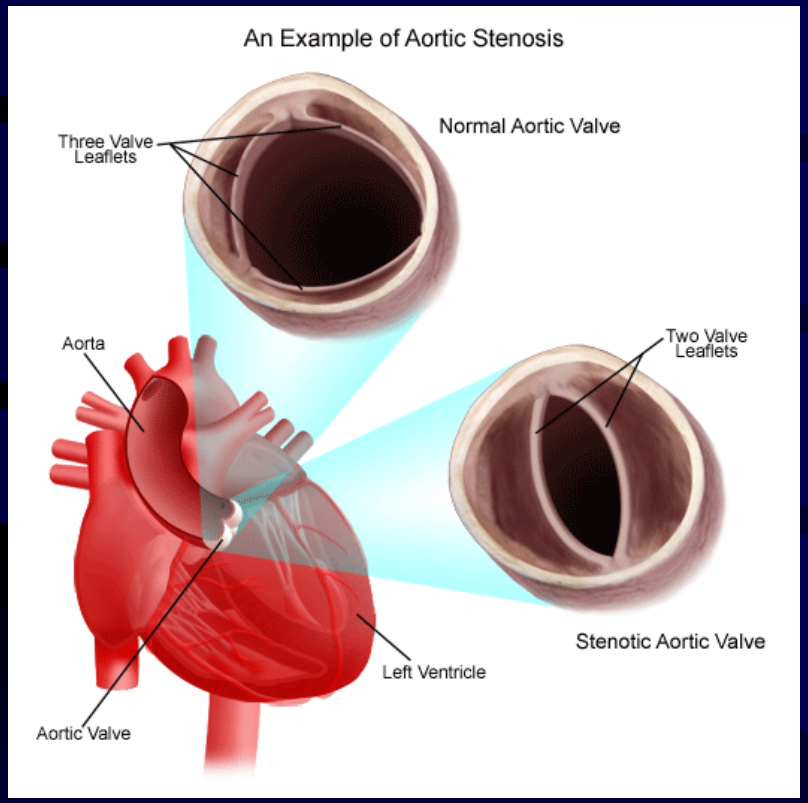
- Aortic Stenosis
- Aortic Regurgitation

# Aortic Stenosis

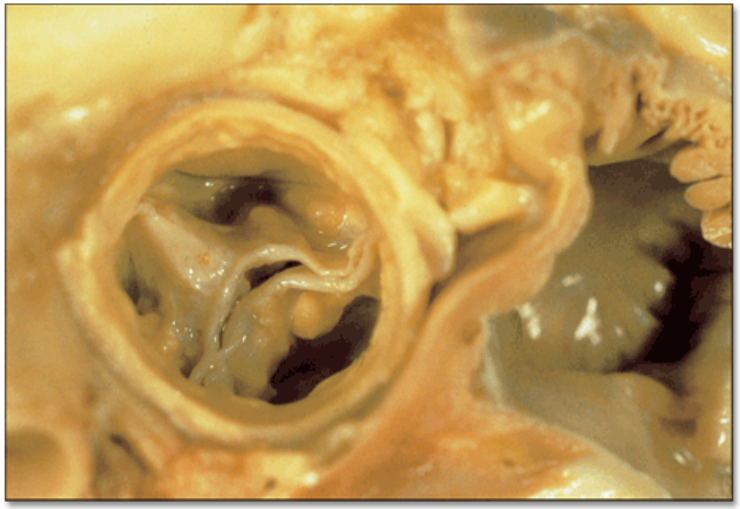
## Etiologies

| | | |
|---|---|---|
| *Congenital* | *0-30 yrs* | • |
| *Bicuspid* | *30-50 yrs* | • |
| *Rheumatic* | *30-60 yrs* | • |
| *Degenerative* | *>60 yrs* | • |

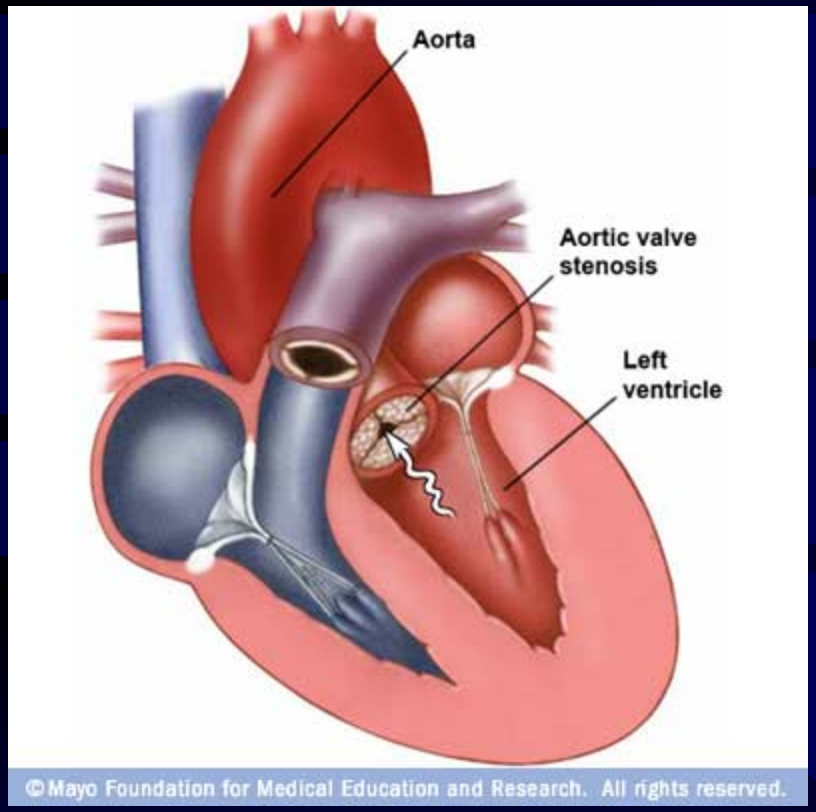
# Aortic Stenosis

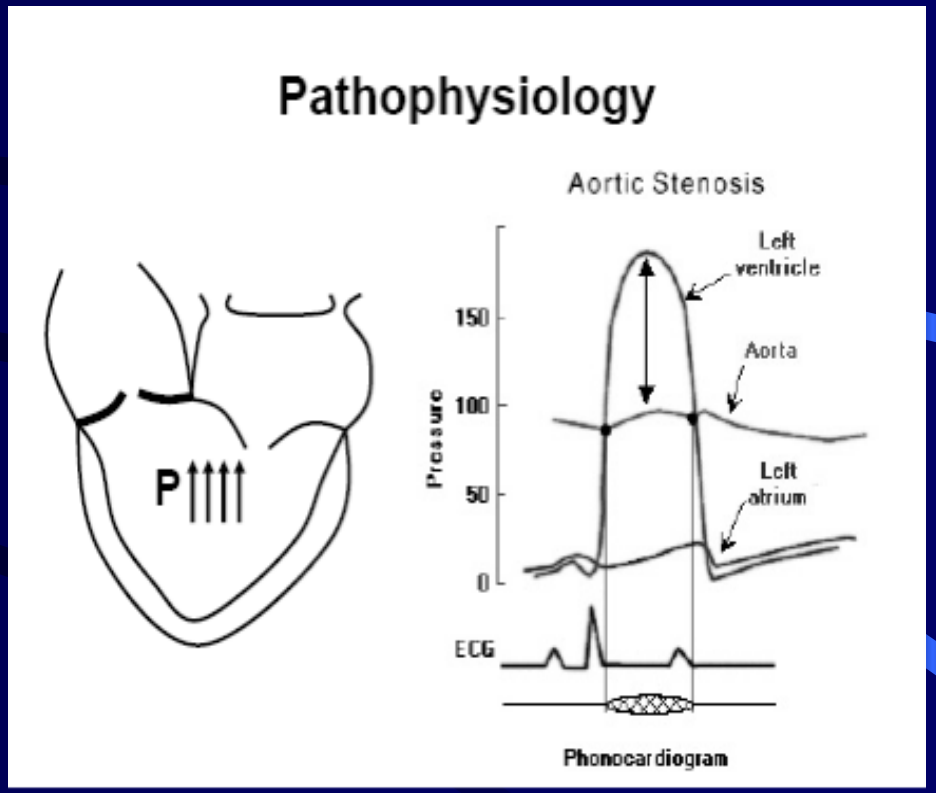



## Bicuspid Aortic Valve Stenosis



# Aortic Stenosis – pathophysiology

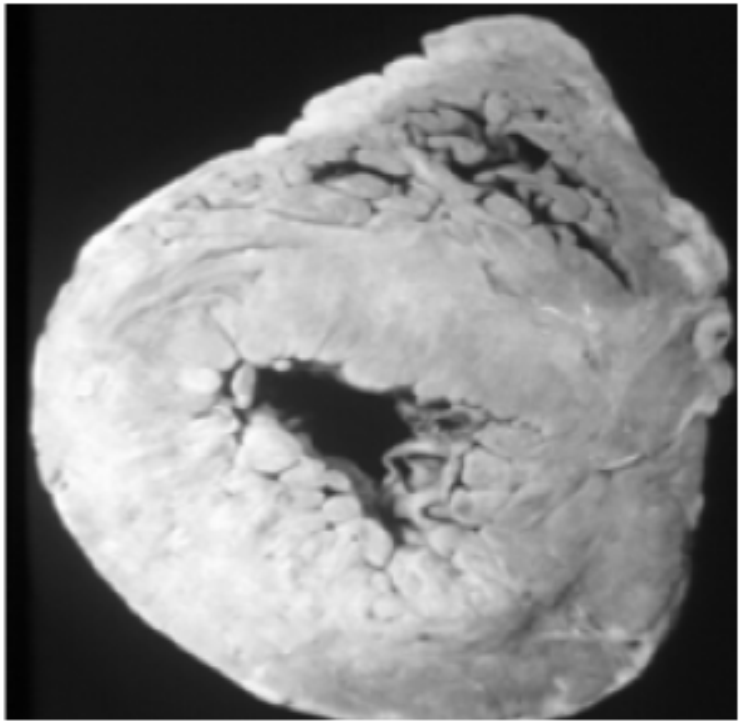


# Aortic Stenosis – pathophysiology

## Ventricular Compensation

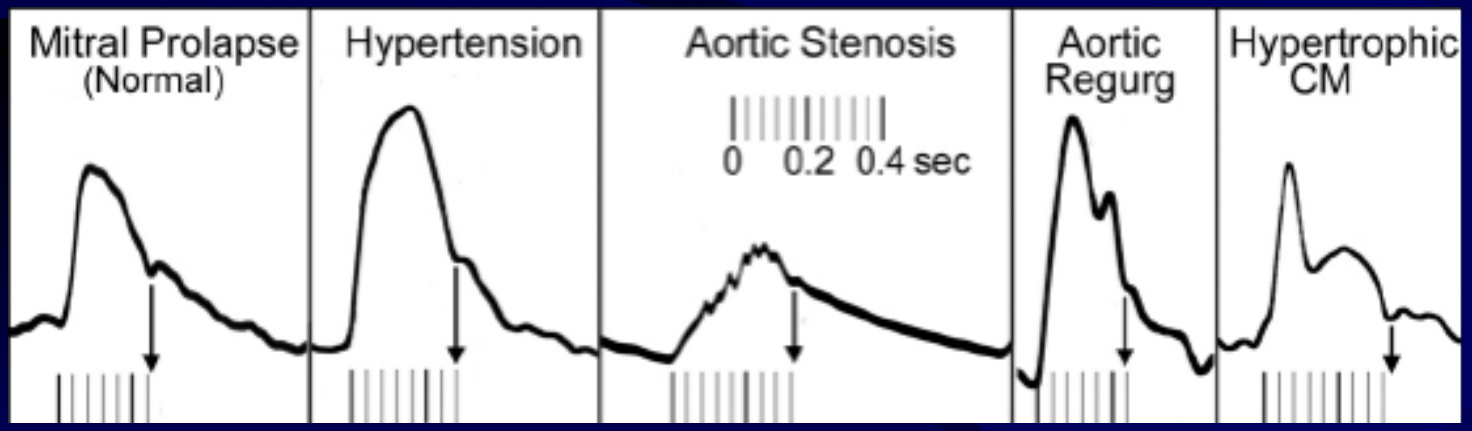
- Concentric hypertrophy
  - Reduces wall stress
  - Reduces ventricular compliance
  - LVEDp increases
  - LAp increases



# Aortic Stenosis

## Physical Exam

- *Harsh Systolic Ejection Murmur – late peaking*
- *S4 gallop (from LVH)*
- *Sustained Bifid LV impulse (from LVH)*
- *Pulsus Parvus et Tardus (Carotid Impulse)*



# Aortic Stenosis

## Symptoms

- *Angina*
- *Syncope*
- *Congestive Heart Failure (CHF)*

# Aortic Stenosis

## Symptoms of Aortic Stenosis

- Angina
  - Imbalance between supply and demand
    - Elevated LVEDp decreases perfusion pressure
    - Myocardial hypertrophy increases demand
- Syncope with exertion
  - Inability to increase cardiac output and meet reduced SVR demands
- Congestive heart failure
  - Elevated LVEDp = elevated LAp = pulmonary venous congestion

# Aortic Stenosis

| Prognosis with Symptomatic Aortic Stenosis | |
|---|---|
| **Clinical Symptoms** | **Median Survival** |
| Angina | 5 years |
| Syncope | 3 years |
| CHF | 2 years |

# Aortic Stenosis

***Diagnosis***

- ***Ecg – LAE, LVH***
- ***Echo 2D/color doppler –test of choice***
- ***Cardiac Cath – helpful, confirmatory, needed if the pt is older – look at the coronaries***

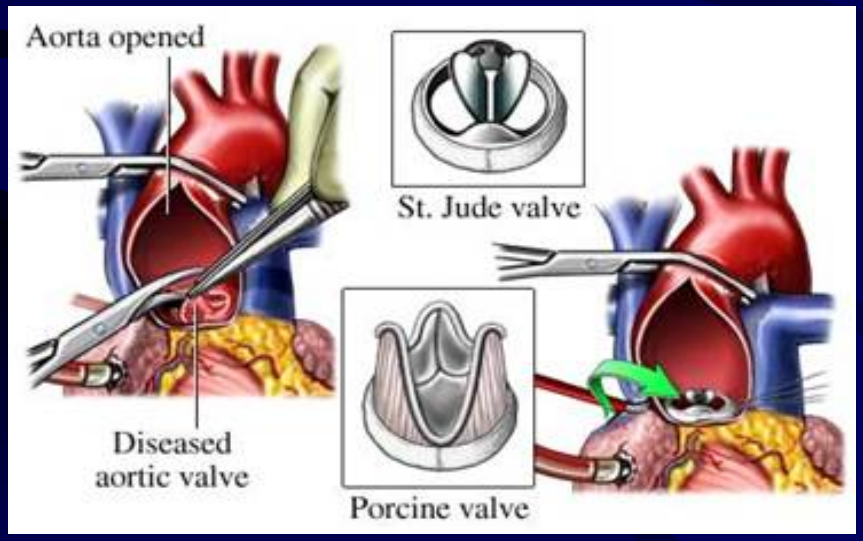
# Aortic Stenosis

***Treatment of Symptomatic Aortic Stenosis or Decreased LV Function***

***Medical Therapy – treats the symptoms not the cause***

***Aortic Valve Replacement***

***Bioprosthetic vs Mechanical AVR***

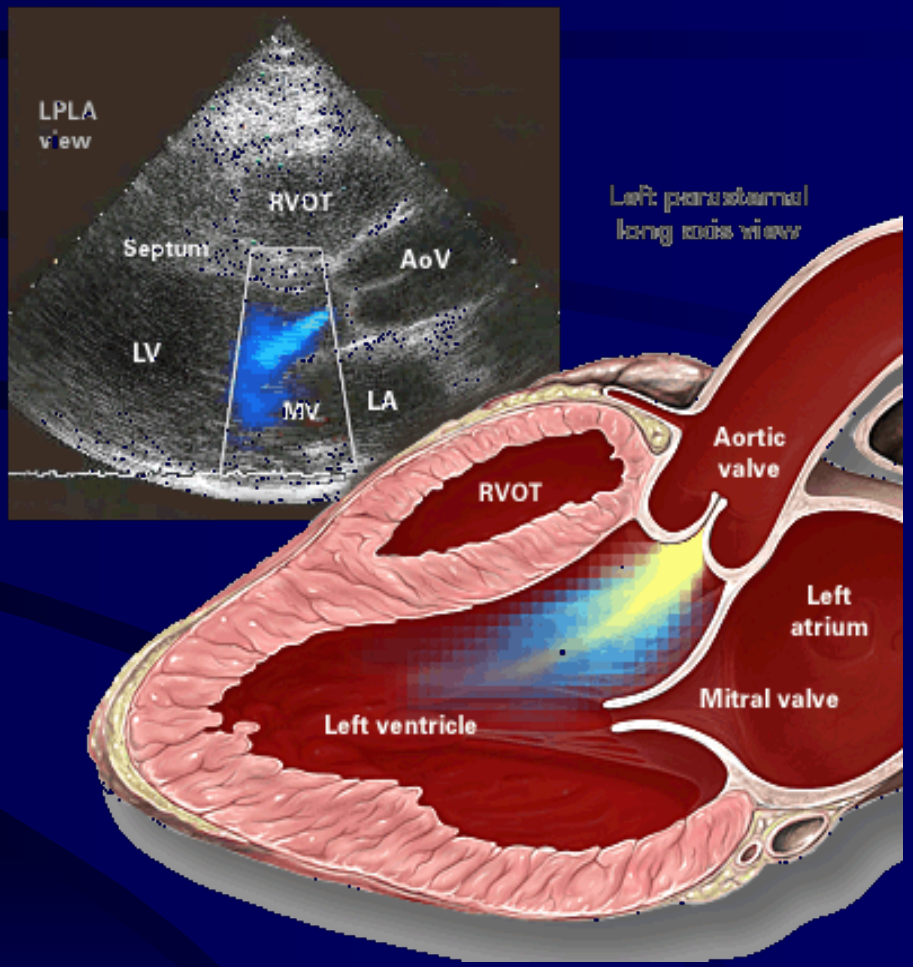


# Valvular Heart Disease

## Aortic Valve

- Aortic Stenosis
- Aortic Regurgitation

# Aortic Regurgitation

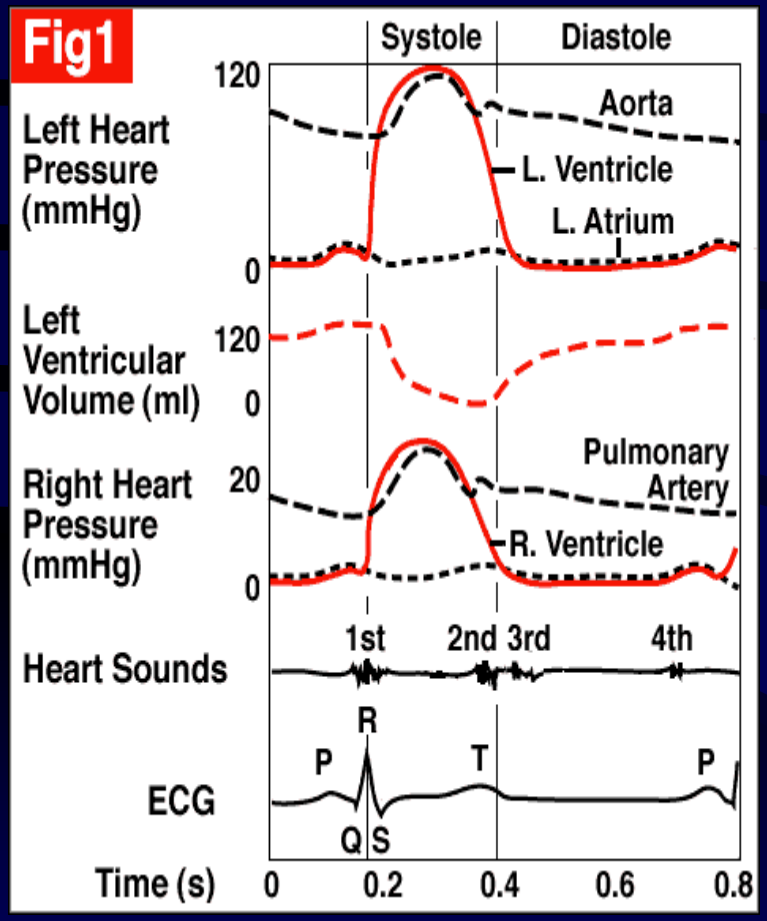


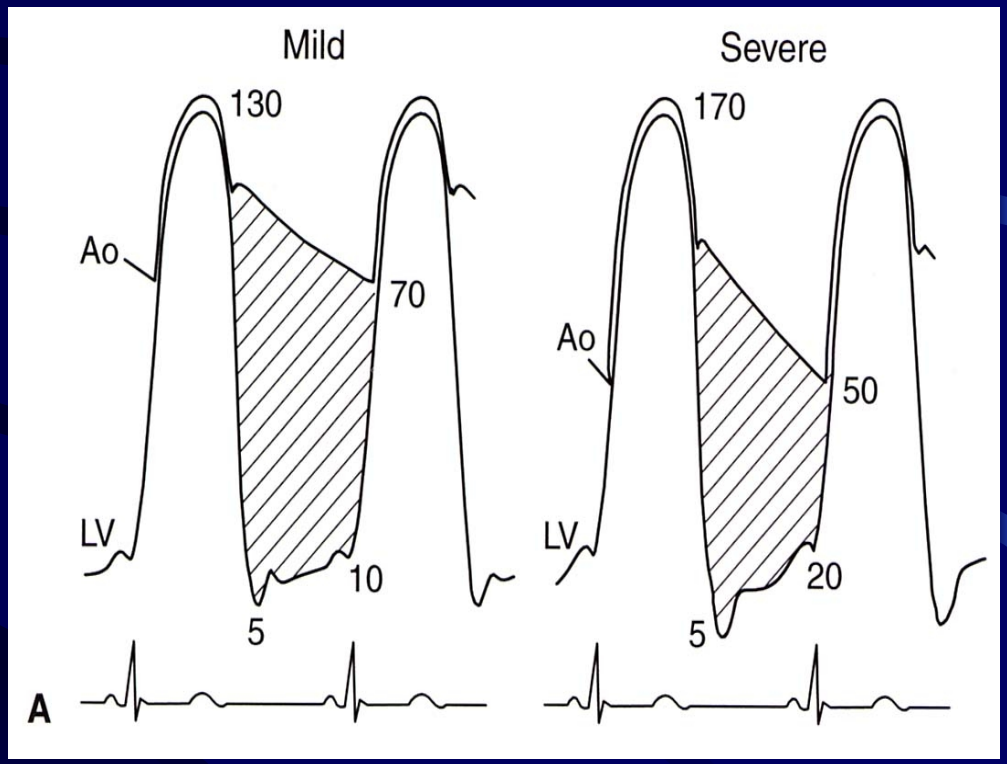
# Aortic Regurgitation

## Etiologies

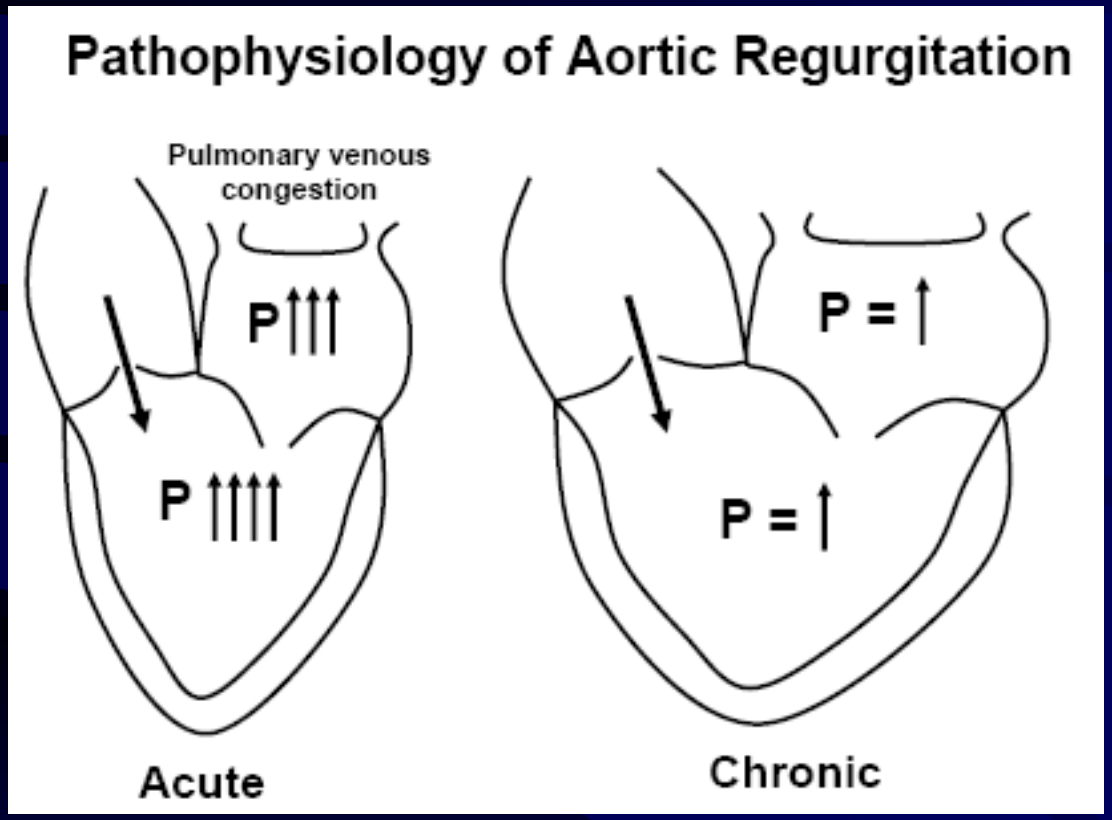
- ***Abnormalities of the Leaflets***
  - ***Rheumatic, Bicuspid, Degenerative***
  - ***Endocarditis***
- ***Dilation of the Aortic Annulus***
  - *Aortic Aneurysm / Dissection*
  - *Inflammatory (Syphyllis, Giant Cell Arteritis. Coll Vasc Dis-Ankylosis Spondylitis, Reiters)*
  - *Inheritable (Marfans, Osteogensis Imperfecta)*

# Aortic Regurg – pathophysiology

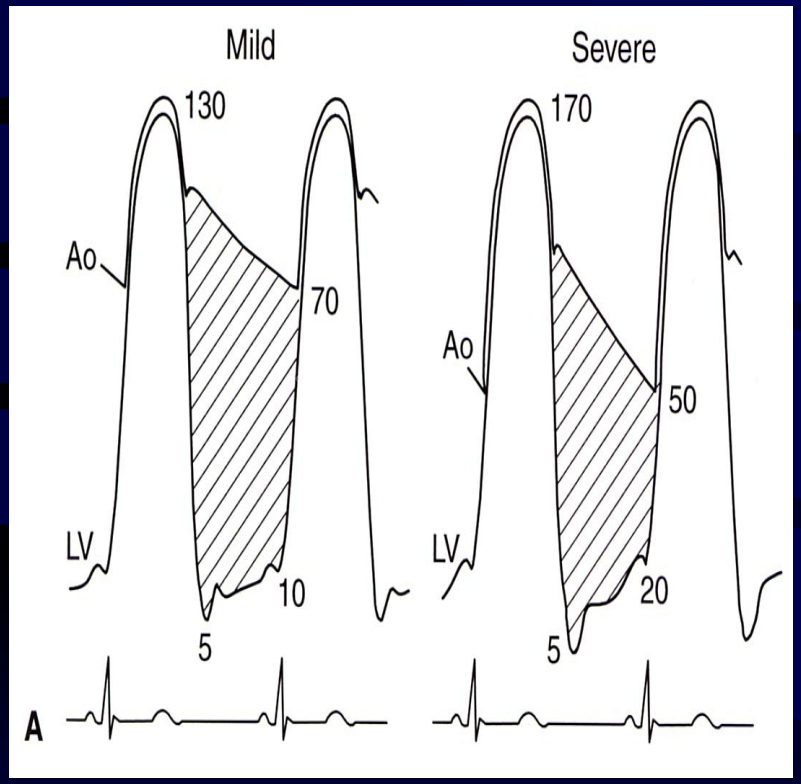


# Aortic Regurg – pathophysiology



# Aortic Regurg – pathophysiology




## Pathophysiology of Aortic Regurgitation

- Widened pulse pressure
  - Stroke volume increased (high SBP)
  - Regurgitant volume increased (low DBP)
- Imbalance between myocardial supply and demand
  - Decreased DBP = decreased perfusion pressure = decreased supply
  - Increased LV size (and thus wall stress) = increased demand

# Aortic Regurgitation

## Symptoms of Aortic Regurgitation

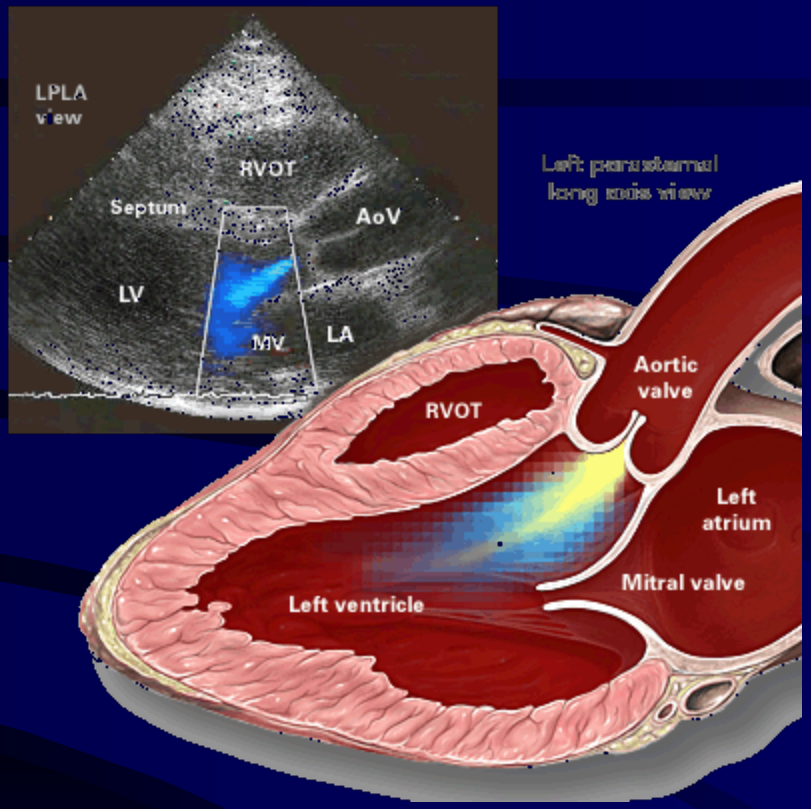
- Pulmonary venous congestion
  - Dyspnea on exertion
- Inadequate cardiac output
  - Fatigue
  - Diminished exercise tolerance

# Aortic Regurgitation

## Physical Exam

- *Diastolic Decrescendo Blowing Murmur*
- *Hyperdynamic LV apical impulse*
- *Bounding Pulses*
- *S4, S3 Gallop-advanced AI*
- *Apical Rumble – "Austin Flint Murmur"*

# Aortic Regurg – Austin Flint Murmur




Due to the vibration of the anterior leaflet of the mitral valve as it is buffetted simultaneously by the blood jets from the left atrium and the aorta.

# Aortic Regurgitation

***Diagnosis***

- ***Ecg – LAE, LVH***
- ***Echo 2D/color doppler –test of choice***
- ***Cardiac Cath – helpful, confirmatory, needed if the pt is older – look at the coronaries***

# Aortic Regurgitation

## *Treatment of Asymptomatic Aortic Regurg*

***Medical Therapy – treats the symptoms not the cause***

- ***Serial Check ups with Echos*** (eval EF, Severity AR)
- **SBE Prophylaxis**
- **Vasodialators** (Nifedipine, ACE-I)
- **Diuretics**

## *Treatment of Symptomatic Aortic Regurg*

***Aortic Valve Replacement***

***Bioprosthetic vs Mechanical AVR***

If you're not confused,
you're not paying attention.

Tom Peters

# Valvular Heart Disease

## Mitral Valve

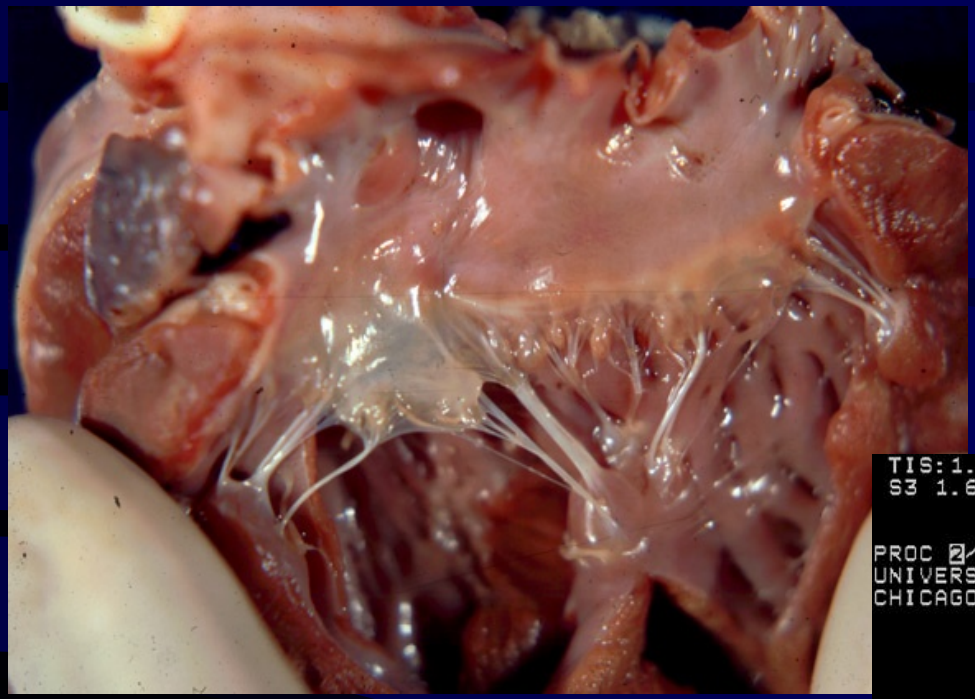
- Mitral Regurgitation
- Mitral Stenosis

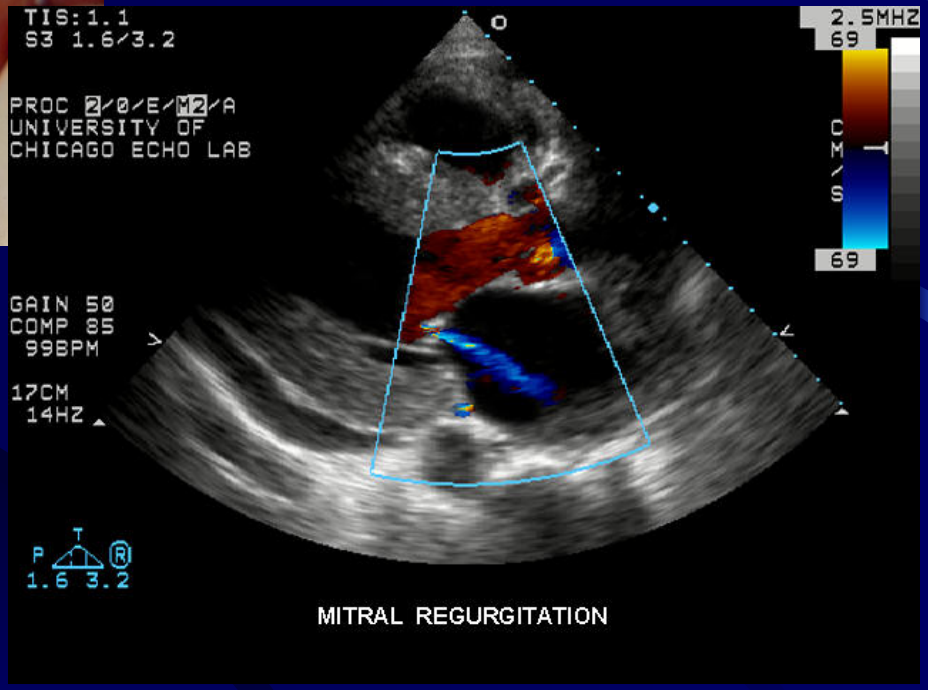
# Mitral Regurgitation

## Etiologies

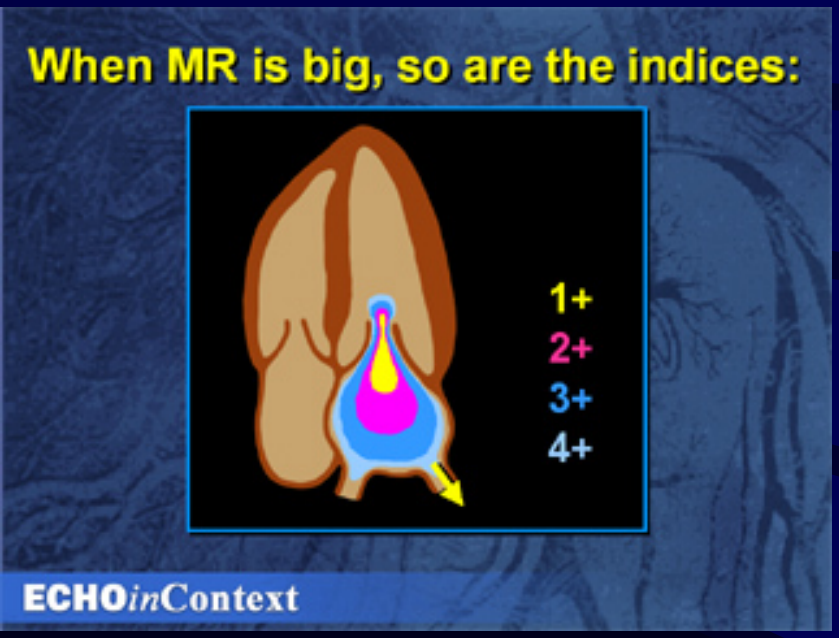
- ***Alterations of the Leaflets, Commissures, Annulus***
  - ***Rheumatic***
  - ***MVP***
  - ***Endocarditis***
- ***Alterations of LV or LA size and Function***
  - ***Papillary Muscle (Ischemic, MI, Myocarditis, DCM)***
  - **HOCM**
  - ***LV Enlargement – Cardiomyopathies -***
  - ***LA Enlargement from MR –***
    - *MR begets MR*

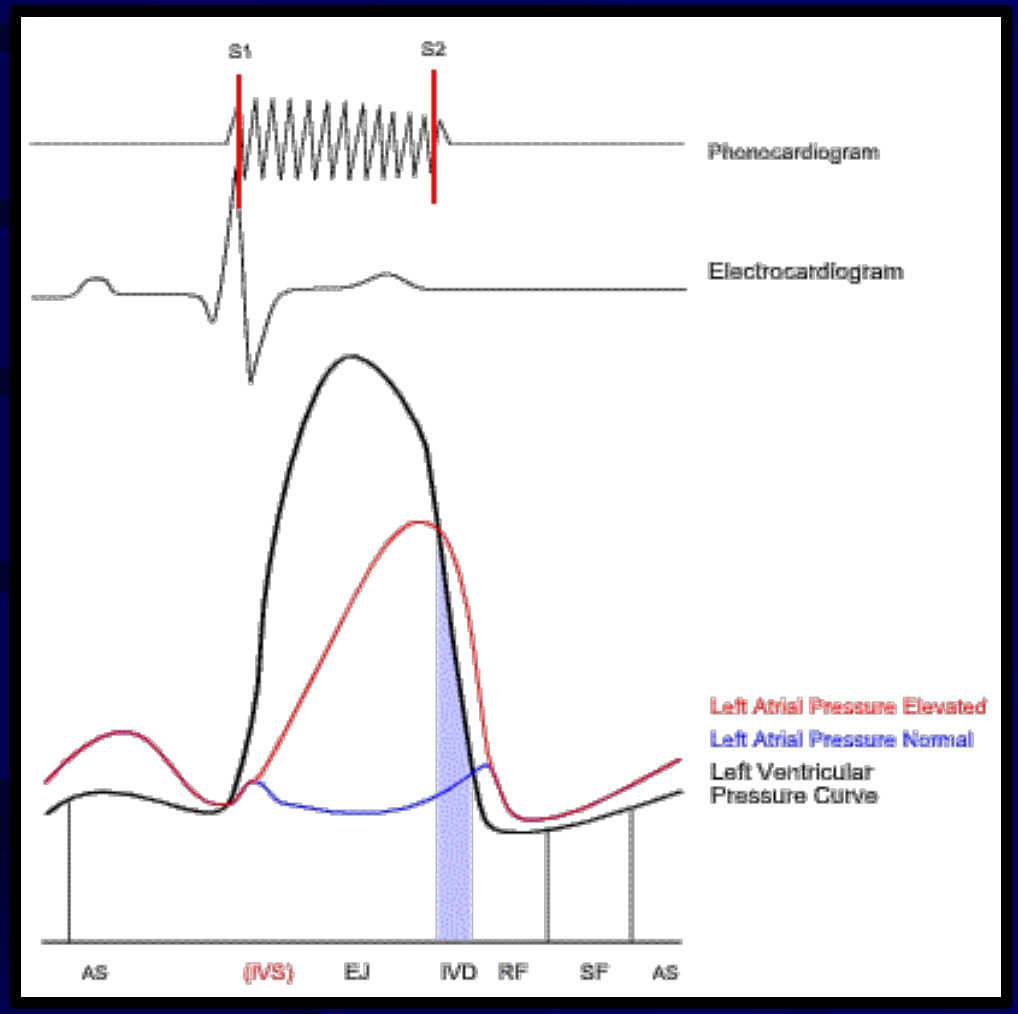
# Mitral Regurgitation





# Mitral Regurg – pathophysiology

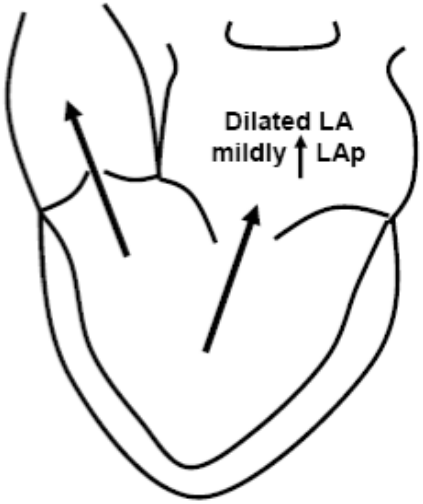


# Mitral Regurg – pathophysiology

## Pathophysiology

- Eccentric hypertrophy
  - Increased preload
  - Increased afterload
  - Increased total stroke volume AND forward stroke volume AND LVESV returns to normal
- Increased LA size
  - Increased LA compliance
  - Larger volume at lower pressure

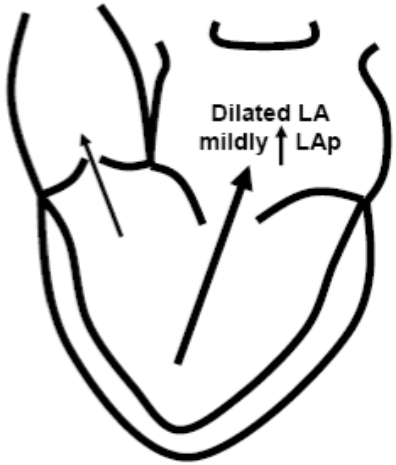



Chronic Compensated

## Pathophysiology

- Depressed contractility
  - Decreased SV
  - Increased LVEDV

NOTE: further dilatation leads to progressive MR




Chronic Decompensted

# Mitral Regurgitation

## Symptoms

- *Fatigue and weakness*
- *Dyspnea and orthopnea*
- *Right sided HF*
- *MVP Syndrome (if present)*

# Mitral Regurgitation

## Physical Exam

- *Holosystolic Apical Blowing Murmur*
- *Laterally displaced apical impulse*
- *Split S2 (but is obscured by the murmur)*
- *S3 Gallop (increased volume during diastole)*
- *Radiation depends on the etiology*

# Mitral Regurgitation

***Diagnosis***

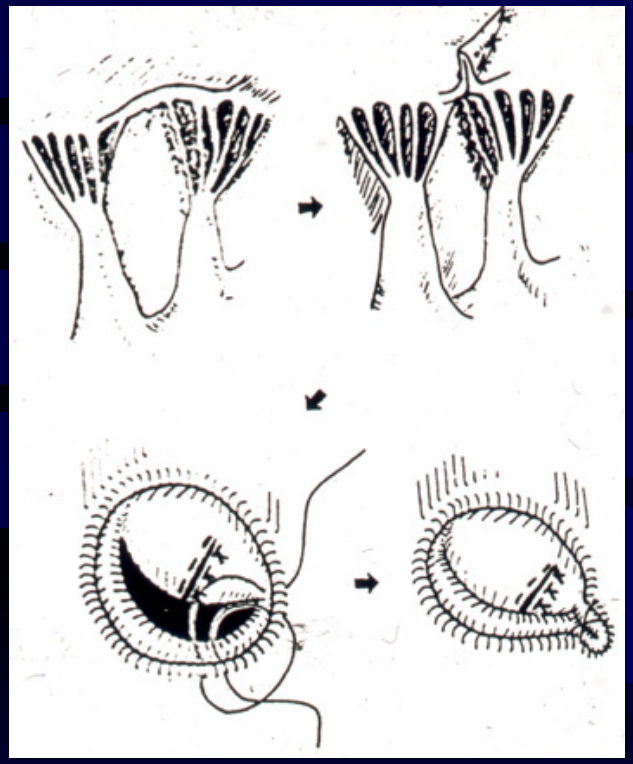
- ***Ecg – LAE, LVH***
- ***Echo 2D/color doppler –test of choice***
- ***Cardiac Cath – helpful, confirmatory, needed if the pt is older – look at the coronaries***

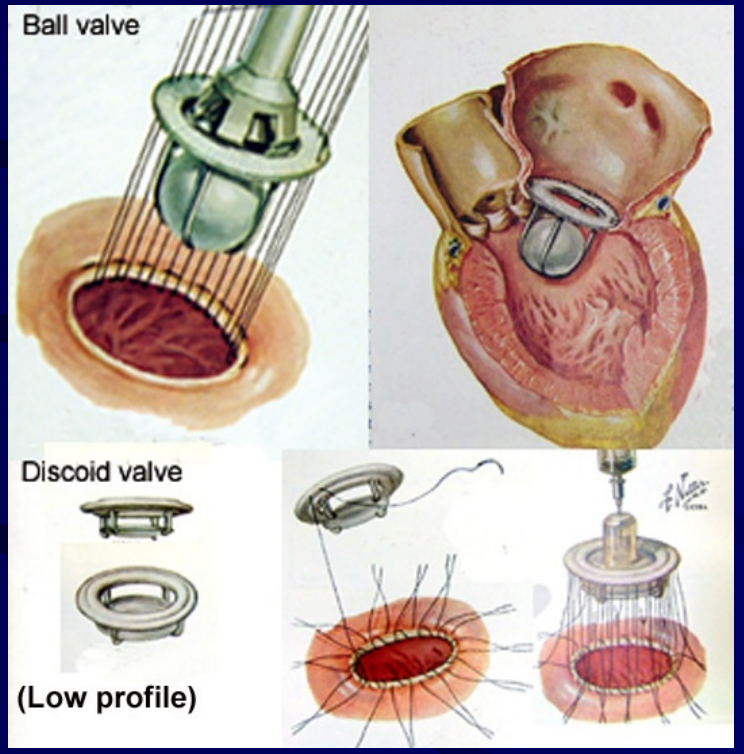
# Mitral Regurgitation

## Treatment of Symptomatic Mitral Regurgitation

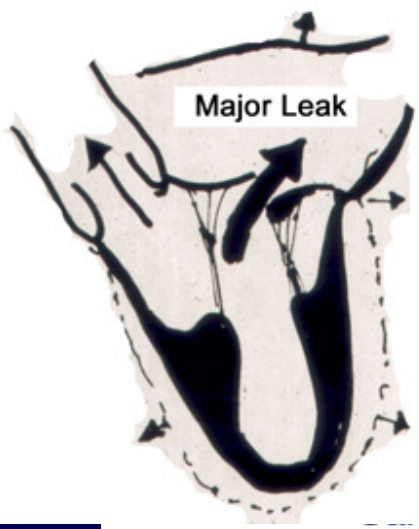
- **Medical therapy**
  - **Diuretics** - SBE Prophylaxis
  - **Vasodilators**
    - ACE inhibitors
- **Surgical therapy**
  - **MV replacement**
    - relief of symptoms
    - MVR survival similar to natural history
    - Operative mortality 8-10%
    - 10 year survival 50%
  - **Mitral valve repair**
    - Operative mortality 2-4%
    - 10 year survival 80%
    - Preservation of mitral apparatus!!!!!!!!!!!!!!!
    - No risk of thrombotic complications

# Mitral Regurgitation





# Mitral Regurgitation -MVP


## ral Valve Prolapse

Long Axis View of the
e Valve Illustrated in Figure 13

# Mitral Regurgitation –MVP Pathophysiology

Abnormal Mitral Apparatus

↓

Mitral Leaflet Prolapse

↓

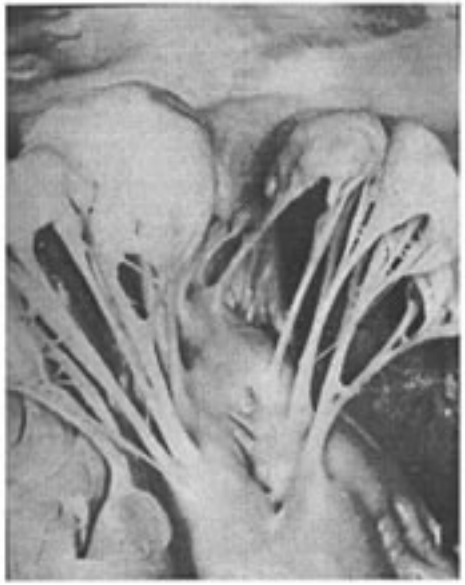
Papillary Muscle Traction
Activation of Stretch
Receptors

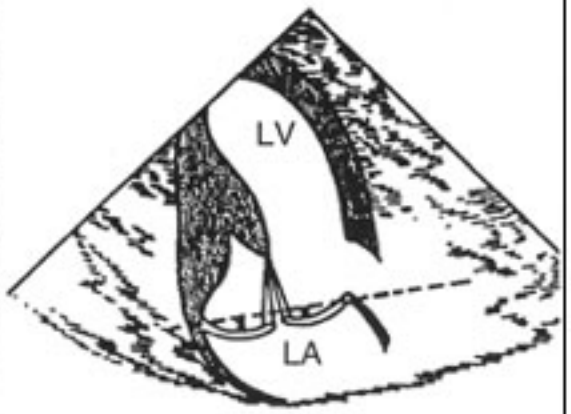
↓

Papillary Muscle and
Subendocardial
Ischemia

↓

Pain
Ventricular Arrhythmias



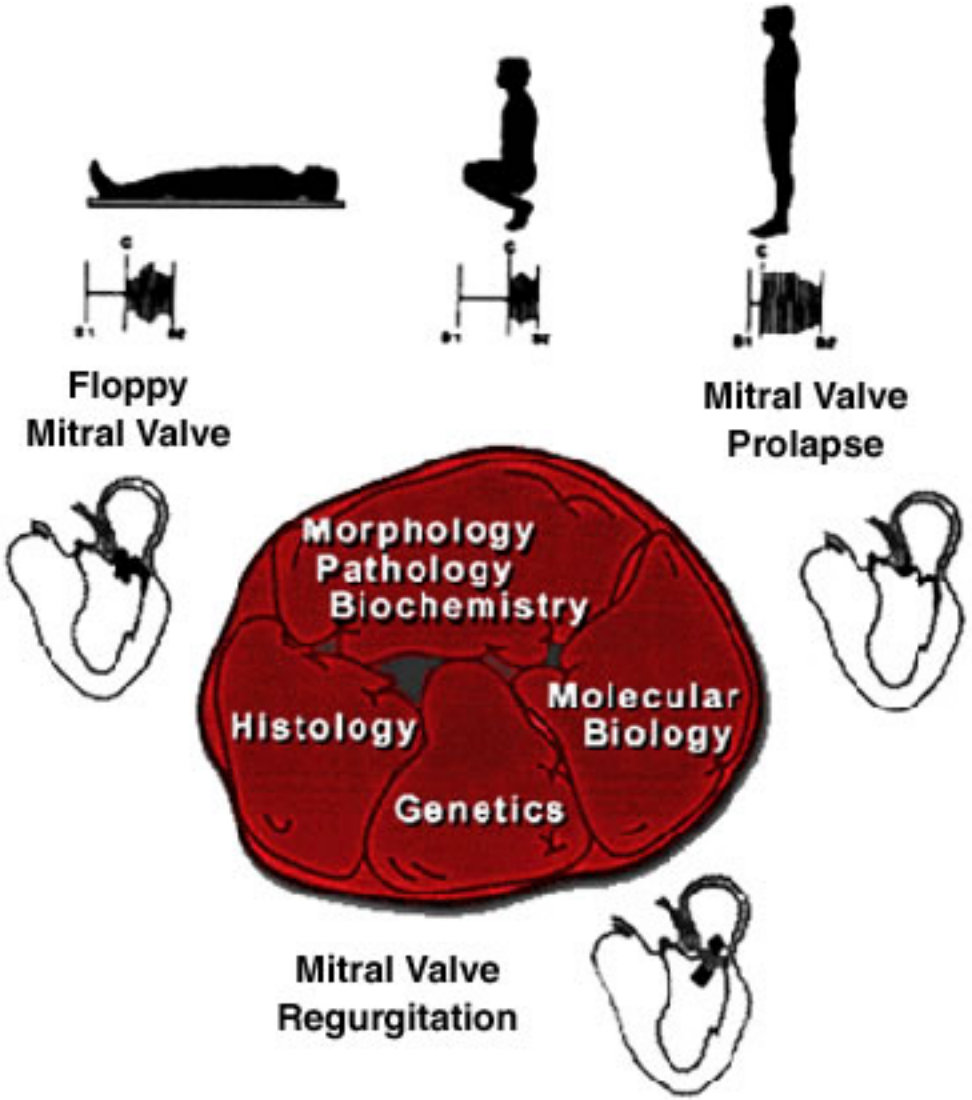


# Mitral Regurgitation -MVP

## Findings in Mitral Valve Prolapse

- Symptoms
  - Chest pain
  - Palpitations
- Physical Exam
  - mid-systolic click
  - late systolic murmur (if associated MR)

# Spectrum of Mitral Valve Disease (1 of 2)



# Mitral Regurgitation -MVP

## Prognosis in Mitral Valve Prolapse

- Often benign
- Rare complications
  - Endocarditis
  - Progressive MR
    - Acute
    - Chronic
  - Thromboembolism
  - Atrial and ventricular arrhythmias

# Mitral Regurgitation -MVP

## Diagnosis and Treatment

- **Echo 2D/Color**
- **B-Blockers (hyperadrenergic symptoms, Palpitations)**
- **Aspirin (TIAs without etiology)**
- **SBE Prophylaxis (only if associated with MR)**
- **Severe Symptomatic MR – same as chronic MR**

# Valvular Heart Disease

## Mitral Valve

- Mitral Regurgitation
- Mitral Stenosis

# Mitral Stenosis

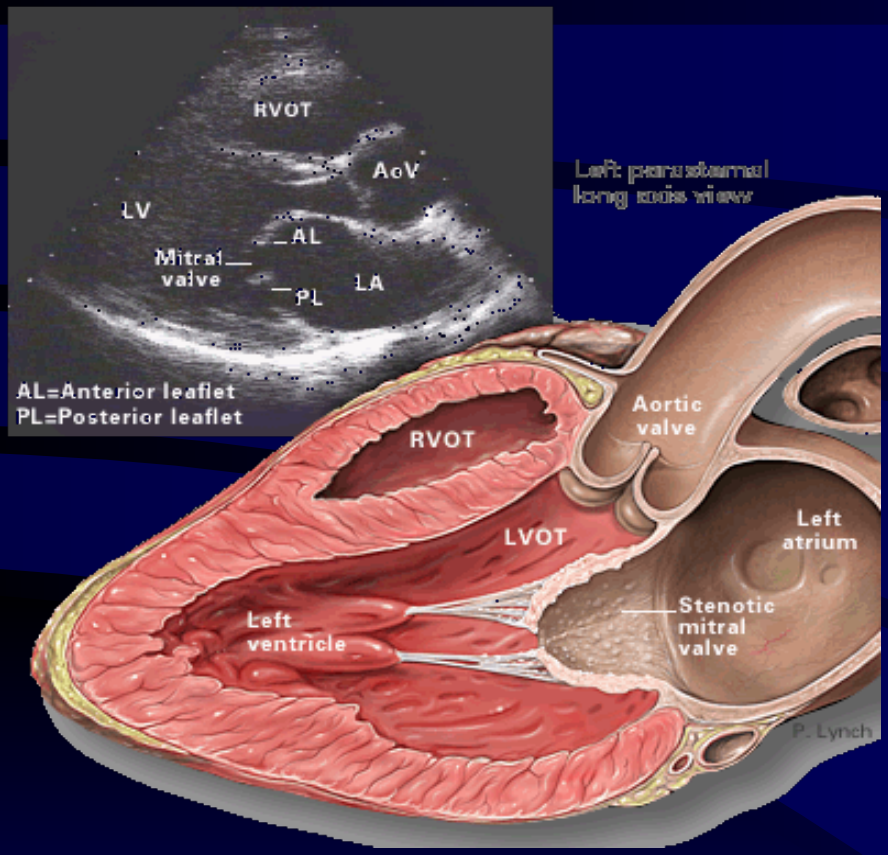
## Etiologies

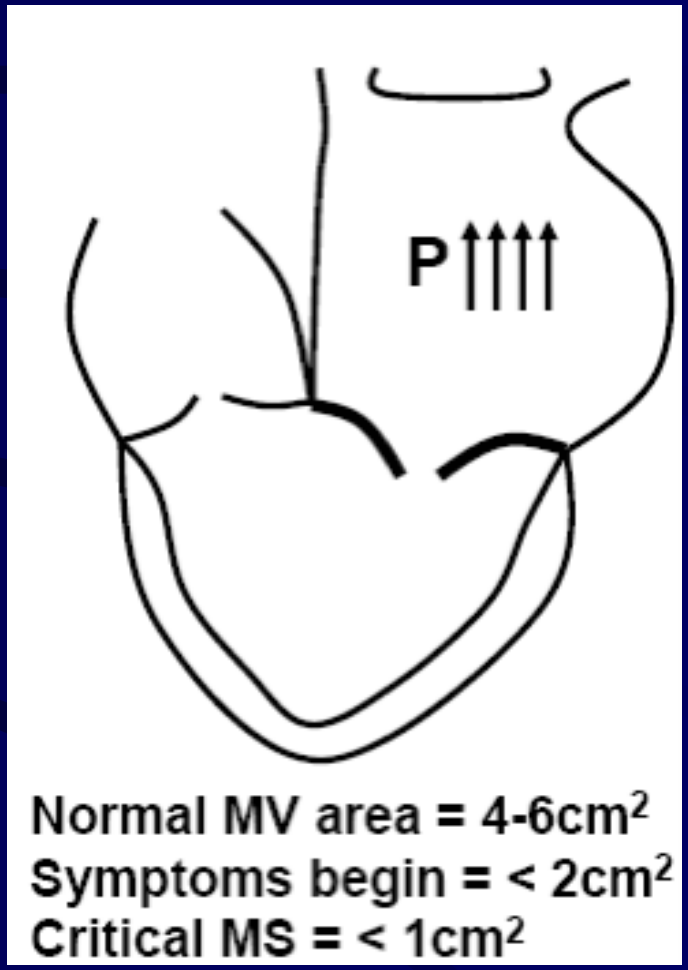
- **Rheumatic – almost all cases in adults**
- **Mitral Annular Ca+ - massive (rare)**
- **Congenital – rare**

***60% of pts don't have a history of ARC***

***50% of pts who have ARC don't develop VHD***

# Mitral Stenosis

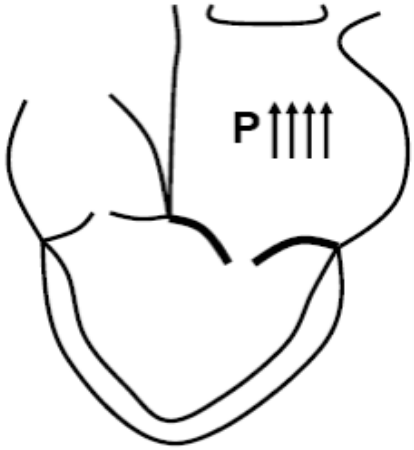


# Mitral Stenosis

## Pathophysiology

- LA hypertension
  - Pulmonary interstitial edema
  - Pulmonary hypertension
    - Passive = obligatory to preserve forward flow
    - Reactive = vascular changes in 40%
      - Protects interstitium from edema
      - Leads to right heart failure
  - LA stretch and atrial fibrillation
    - Increased heart rate thus decreased LV filling
    - Decreased atrial "kick" thus decreased LV filling
    - Atrial thrombus formation and embolus
- Limited LV filling and cardiac output




Normal MV area = 4-6cm$^2$
Symptoms begin = < 2cm$^2$
Critical MS = < 1cm$^2$

# Mitral Stenosis

## Symptoms of Mitral Stenosis

- Dyspnea
  - Pulmonary venous congestion
- Fatigue
  - Diminished cardiac output
- Inability to tolerate increased volume
- Inability to tolerate increased HR
  - Decreased filling
  - Increased LA pressure/PV congestion
- Hemoptysis

# Mitral Stenosis

***Physical Exam***

- *Loud S1*
- *Opening Snap*
- *Diastolic Apical Rumble (murmur)*
- ***May be associated with:***
  - *MR or AS*
  - *Right Sided Murmurs*
    - *PI – Graham Steel Murmur*
    - *TR*

# Mitral Stenosis

***Diagnosis***

- ***Ecg – A Fib, LAE, RAE, RVH***
- ***Echo 2D/color doppler –test of choice***
- ***Cardiac Cath – helpful, confirmatory, needed if the pt is older – look at the coronaries***

# Mitral Stenosis

***Treatment of Symptomatic Mitral Stenosis***

***Medical Therapy – treats the symptoms not the cause***

- ***Diuretics – for congestion***
- ***Digoxin, Beta and Ca Channel Blockers for Afib rate control***
- ***Anticoagulation – for AFib and LA clots***
- ***SBE Prophylaxix – prevent endocarditis***

# Mitral Stenosis

## *Treatment of Symptomatic Mitral Stenosis*

***Surgical Therapy – treats the cause***

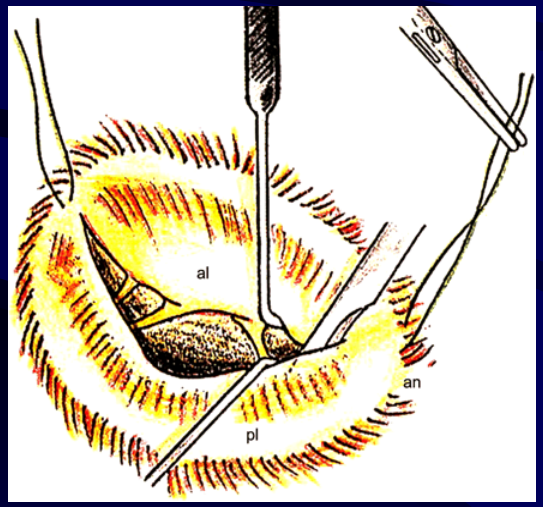
- ***Percutaneous Ballon Valvulaoplasty** – Non-calcified, pliable valve*

# Mitral Stenosis

## *Treatment of Symptomatic Mitral Stenosis*

***Surgical Therapy – treats the cause***

- ***Open Commisurotomy – valve repair***
- ***Mitral Valve Replacement***



# Spectrum of VHD for Boards

**Classic Areas boards will focus on – Physical Exams**

- **Aotric Stenosis -severe**
- **Aortic Regurg – Acute and Chronic**
- **Mitral Stenosis**
- **MVP – changes in MR with manuvers**
- **IHSS/HOCM – changes in MR with manuvers**
- **Mitral Regurg – Acute or chronic typically associated with CAD or Ischemic HD**