

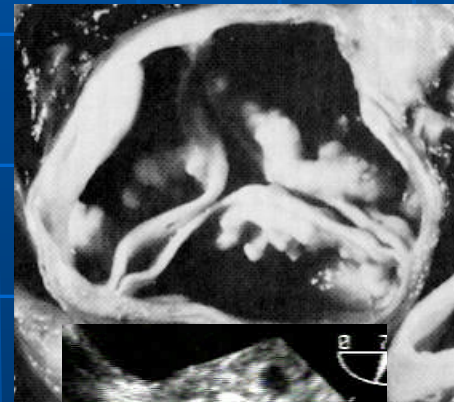
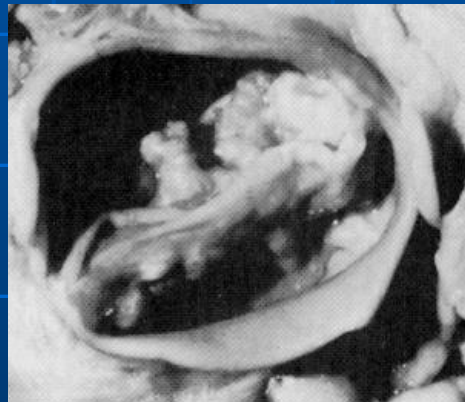
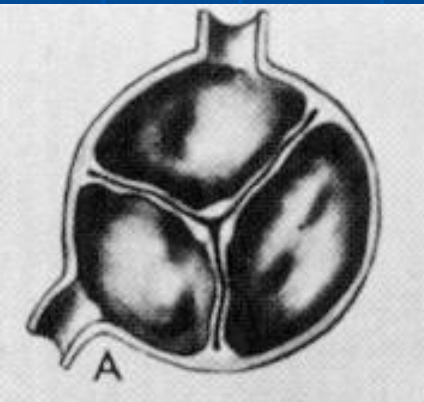
# Aortic Stenosis

# Aortic Stenosis

- Etiology
- Physical Examination
- Assessing Severity
- Natural History
- Prognosis
- Timing of Surgery

# Aortic Stenosis: Etiology

- Congenital bicuspid valve is the most common abnormality
- Rheumatic heart disease and degeneration with calcification are found as well



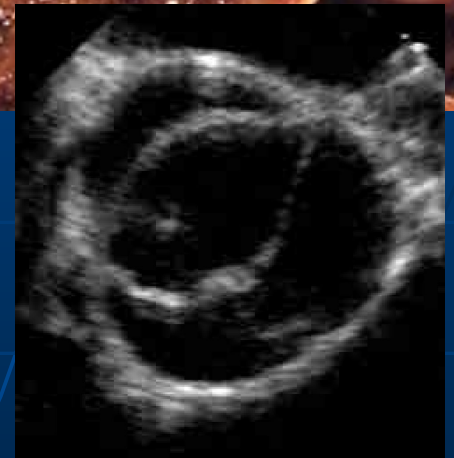
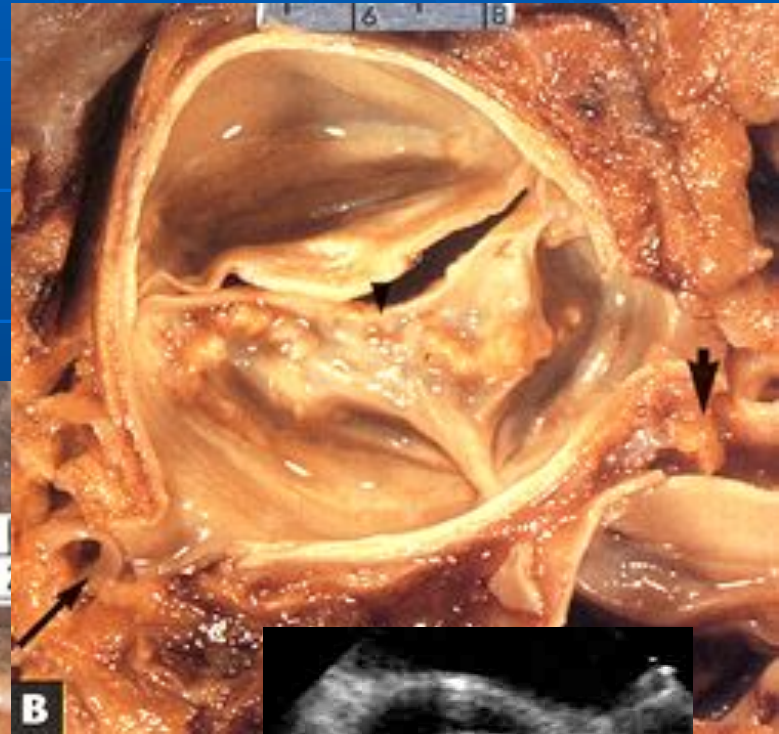
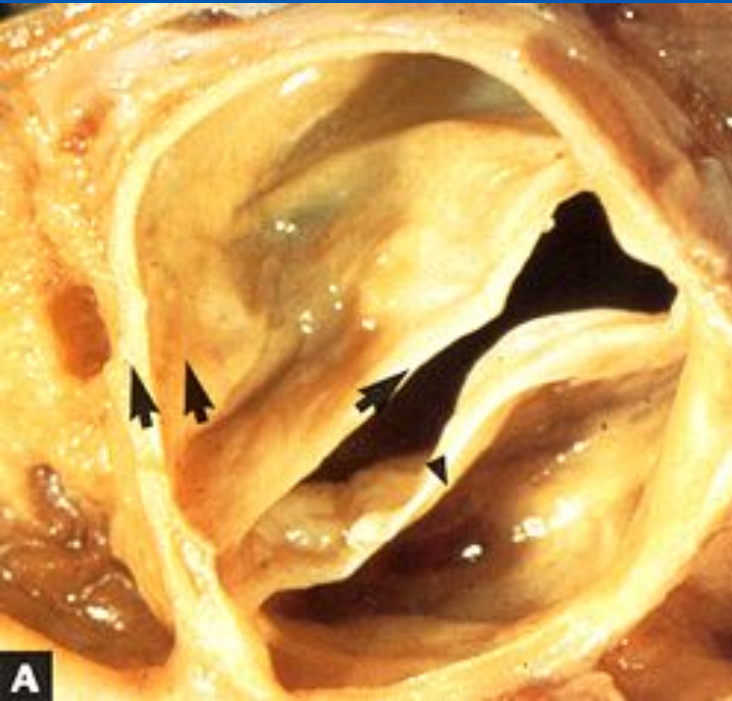
Normal

Bicuspid Ao V  
calcific valve

“Normal” geriatric

Rheumatic

# Bicuspid Aortic Valve



# Aortic Stenosis - Etiology

- **Young or middle-aged patient** (4 & 5<sup>th</sup> decades) think congenital or rheumatic
  - Bicuspid
    - 2% population
    - 3:1 male:female distribution
    - Co-existing coarctation 6% of patients
- Rarely
  - Unicuspid valve
  - Sub-aortic stenosis
    - Discrete
    - Diffuse (Tunnel)
- **Old patient** think degenerative (6,7,8<sup>th</sup> decades)

# Aortic Stenosis: Symptoms

- Cardinal Symptoms
  - Chest pain (angina)
    - Reduced coronary flow reserve
    - Increased demand-high afterload
  - Syncope/Dizziness (exertional pre-syncope)
    - Fixed cardiac output
    - Vasodepressor response
  - Dyspnea on exertion & rest
  - Impaired exercise tolerance
- Other signs of LV failure
  - Diastolic & systolic dysfunction



# Aortic Stenosis: Physical Findings

- Intensity **DOES NOT** predict severity
- Presence of thrill **DOES NOT** predict severity
- “**Diamond**” shaped, harsh, systolic crescendo-decrescendo
- Decreased, delay & prolongation of pulse amplitude
- Decreasing intensity of S2
- S4 (with left ventricular hypertrophy)
- S3 (with left ventricular failure)

# Aortic Stenosis: Physical Findings



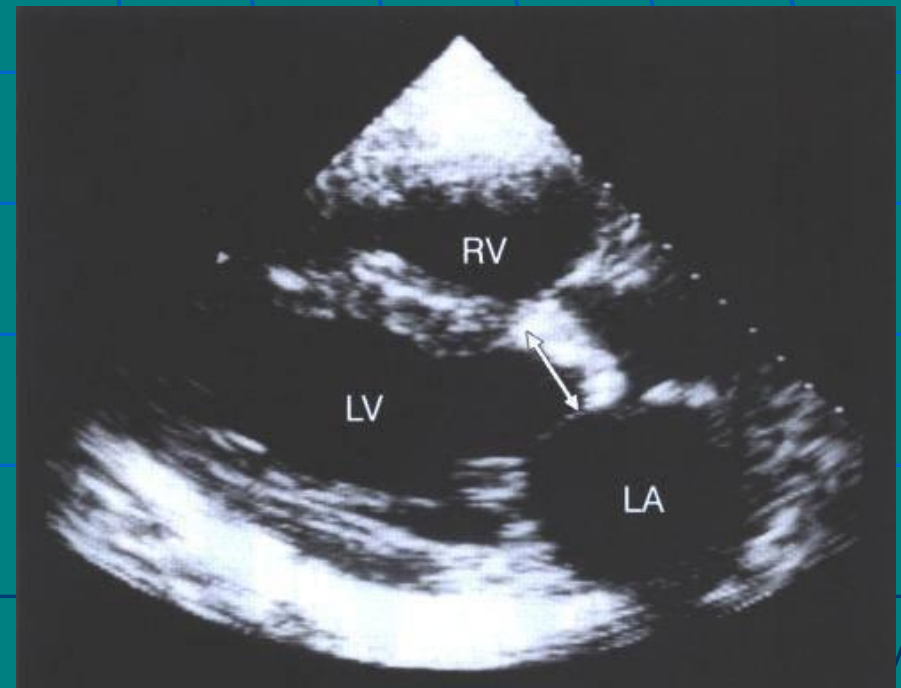


# Severity of Stenosis

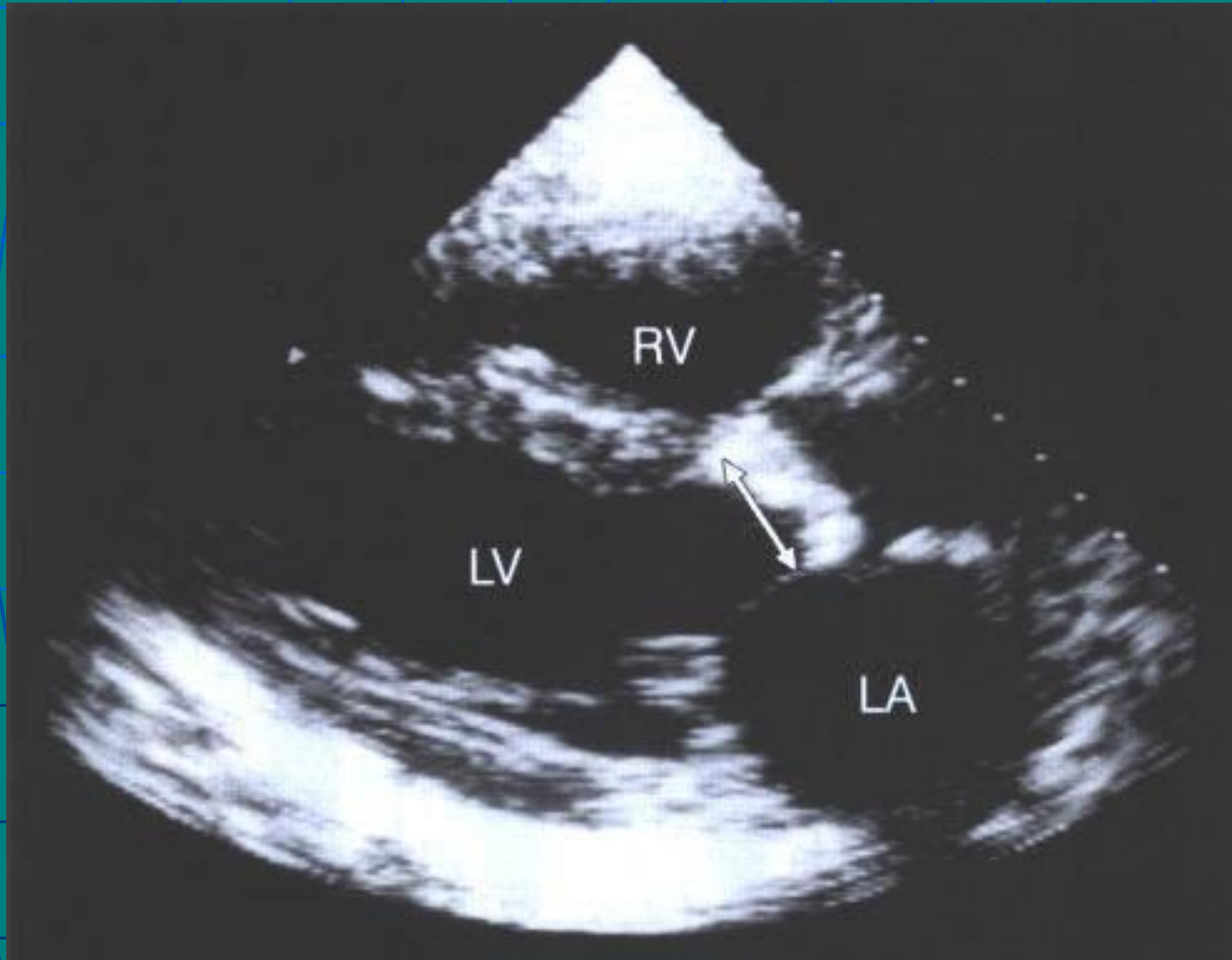
- Normal aortic valve area 2.5-3.5 cm<sup>2</sup>
- Mild stenosis 1.5-2.5 cm<sup>2</sup>
- Moderate stenosis 1.0-1.5 cm<sup>2</sup>
- Severe stenosis < 1.0 cm<sup>2</sup>
- Critical stenosis < 0.7 cm<sup>2</sup>
- Onset of symptoms
  - ~ 0.9 cm<sup>2</sup> with CAD
  - ~ 0.7 cm<sup>2</sup> without CAD

# Diagnosis: Echocardiogram

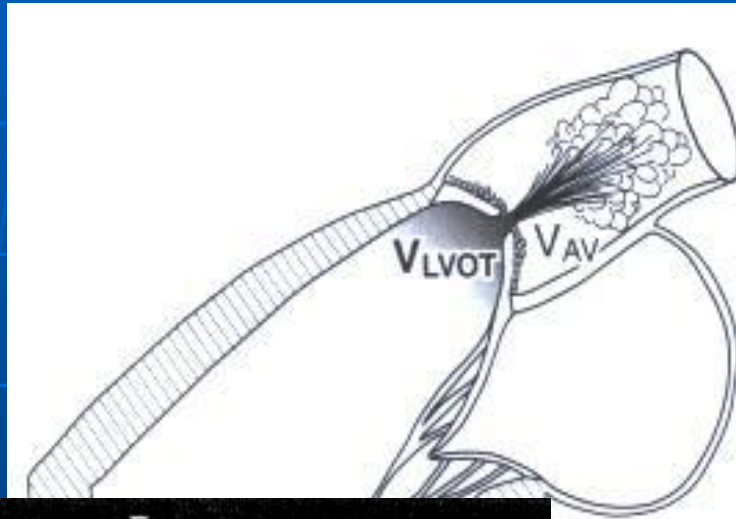
- Etiology
- Valve gradient and area
- LVH
- Systolic LV function
- Diastolic LV function
- LA size
- Concomitant regional wall motion abnormalities
- Coarctation associated with bicuspid AV



# Echocardiogram



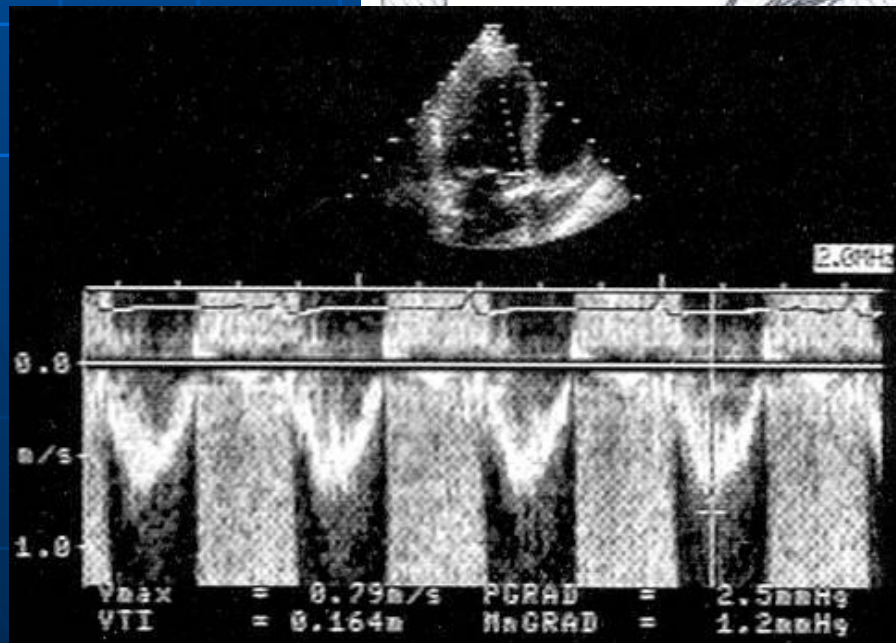
# Doppler estimation of AVA



$$A_{LVOT} \times TVI_{LVOT} = A_{VA} \times TVI_{AV}$$

$$A_{VA} = A_{LVOT} \times \frac{TVI_{LVOT}}{TVI_{AV}}$$

$$A_{VA} = A_{LVOT} \times \frac{V_{LVOT}}{V_{AV}}$$

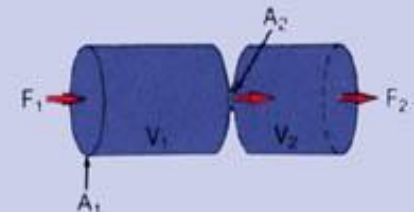


## Continuity Equation

$$Flow_2 = Flow_1$$

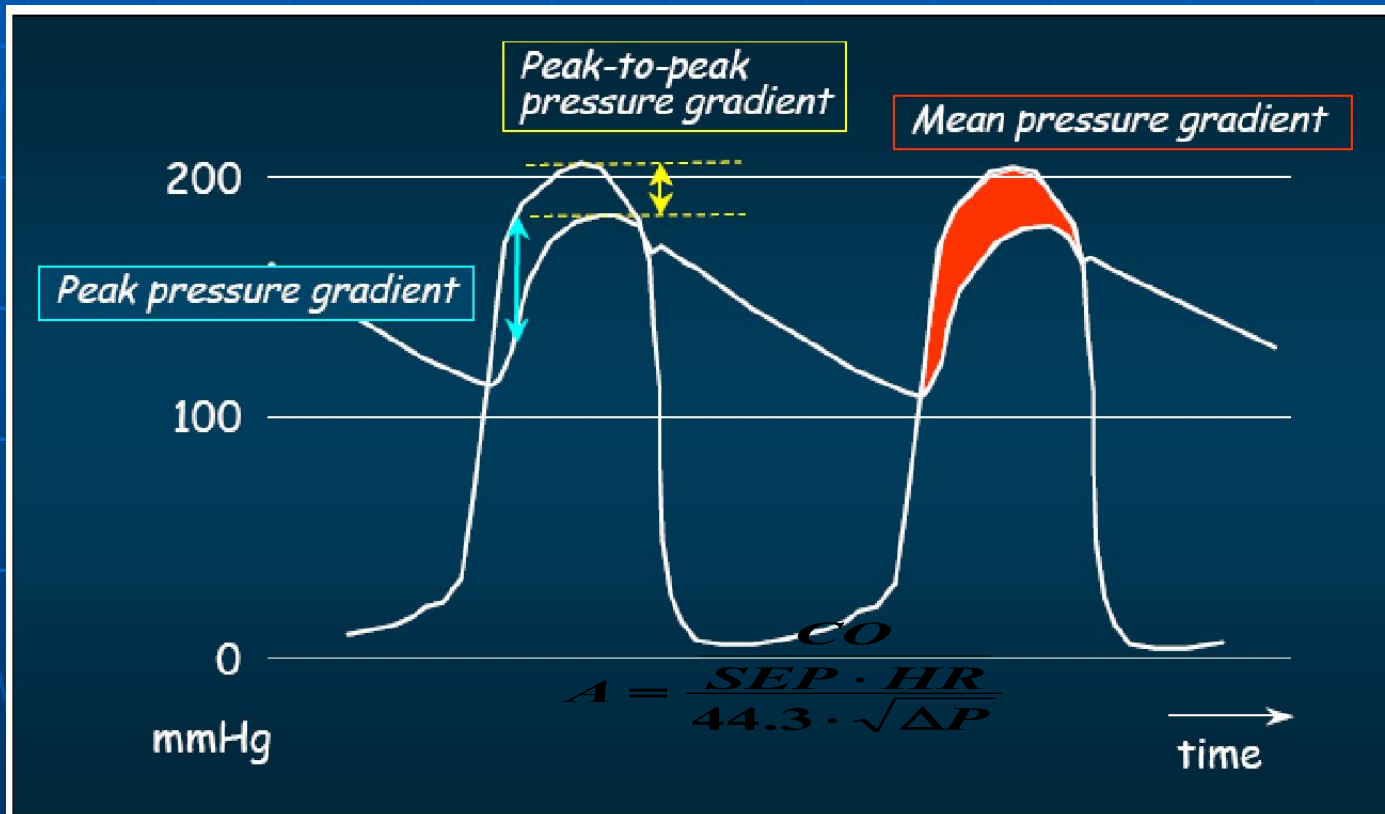
$$Area_2 \times V_2 = Area_1 \times V_1$$

$$Area_2 = \frac{Area_1 \times V_1}{V_2}$$



# Cardiac catheterization

## Gorlin Method



Simplified: Hakke's formula  $AVA = CO / \sqrt{(p-p \text{ gradient})}$

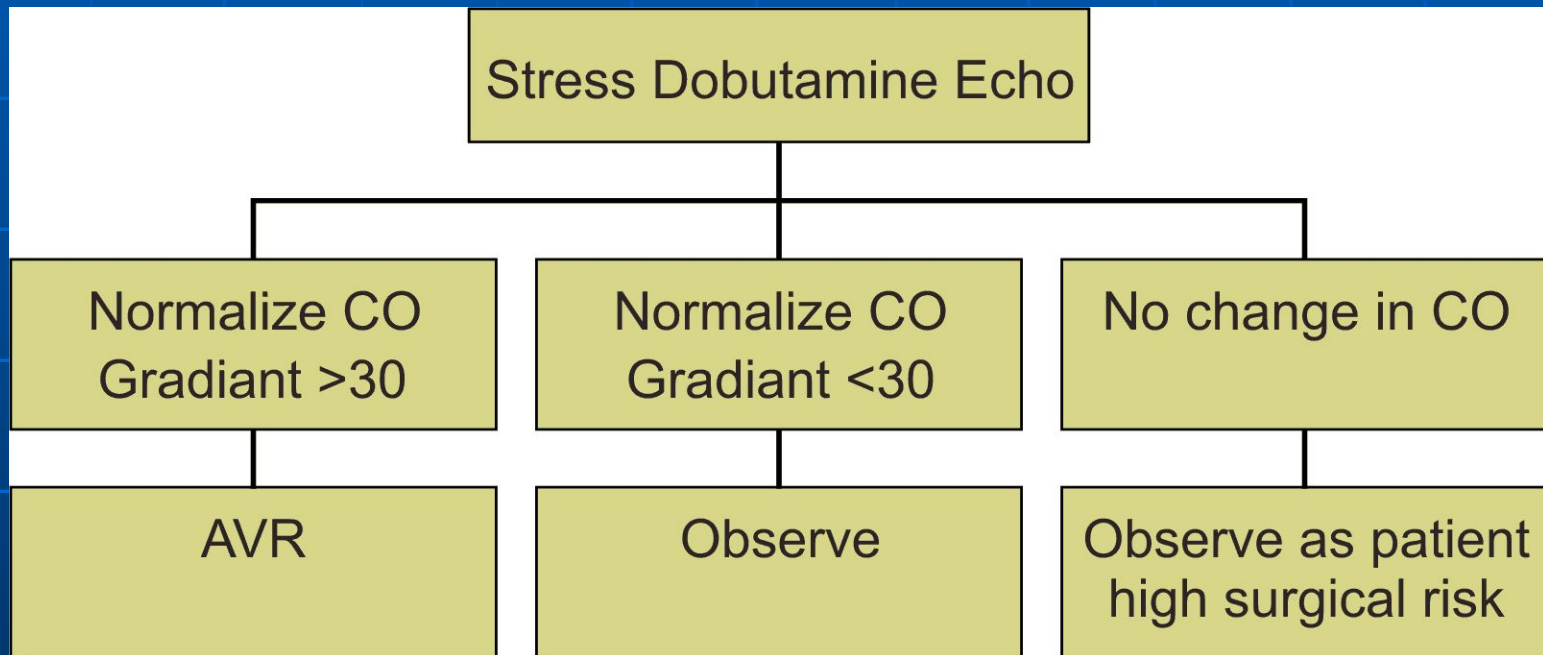
# Low gradient AS

Calculated AVA is  $< 1.0 \text{ cm}^2$  , But...

AV gradient is  $< 30 \text{ mmHg}$ .

Stenotic or not Stenotic?

# Low gradient AS





# Aortic Stenosis: Prognosis

<b>Symptom/Sign</b>	<b>Live expectancy</b>
Angina	5 years
Syncope	2-3 years
Congestive Heart Failure	1-2 years

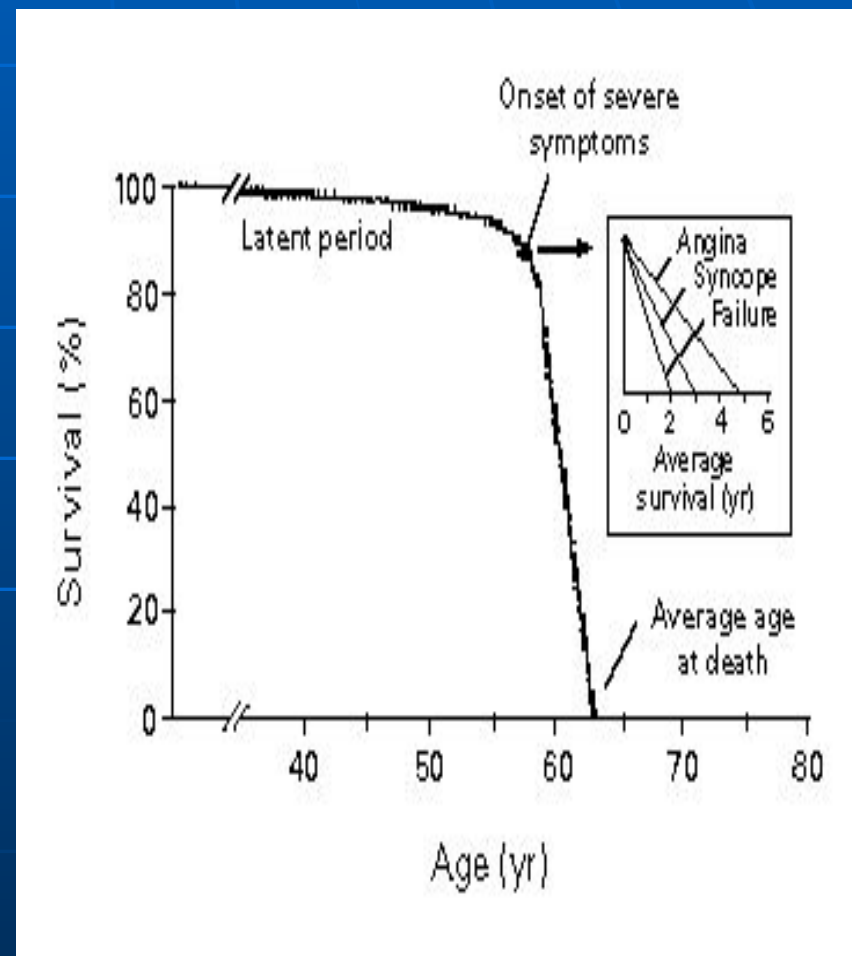
**Therapy: Valve replacement for severe aortic stenosis**

Operative mortality (elderly) ~ 4%/Morbidity ~ 3-11%

Event rate in asymptomatic severe AS ~ 1%/year

# Natural History of Aortic Stenosis

- Heart failure reduces life expectancy to less than 2 years
- Angina and syncope reduce life expectancy between 2 and 5 years
- Rate of progression ↓ @ 0.1 cm<sup>2</sup>/year





# Operative mortality of AVR in the elderly

- ~ 4-24%/year
- Risk factors for operative mortality
  - Functional class
  - Lack of sinus rhythm
  - HTN
  - Pre-existing LV dysfunction
  - Aortic regurgitation
  - Concomitant surgical procedures: CABG/MV surgery
  - Previous bypass
  - Emergency surgery
  - CAD
  - Female gender

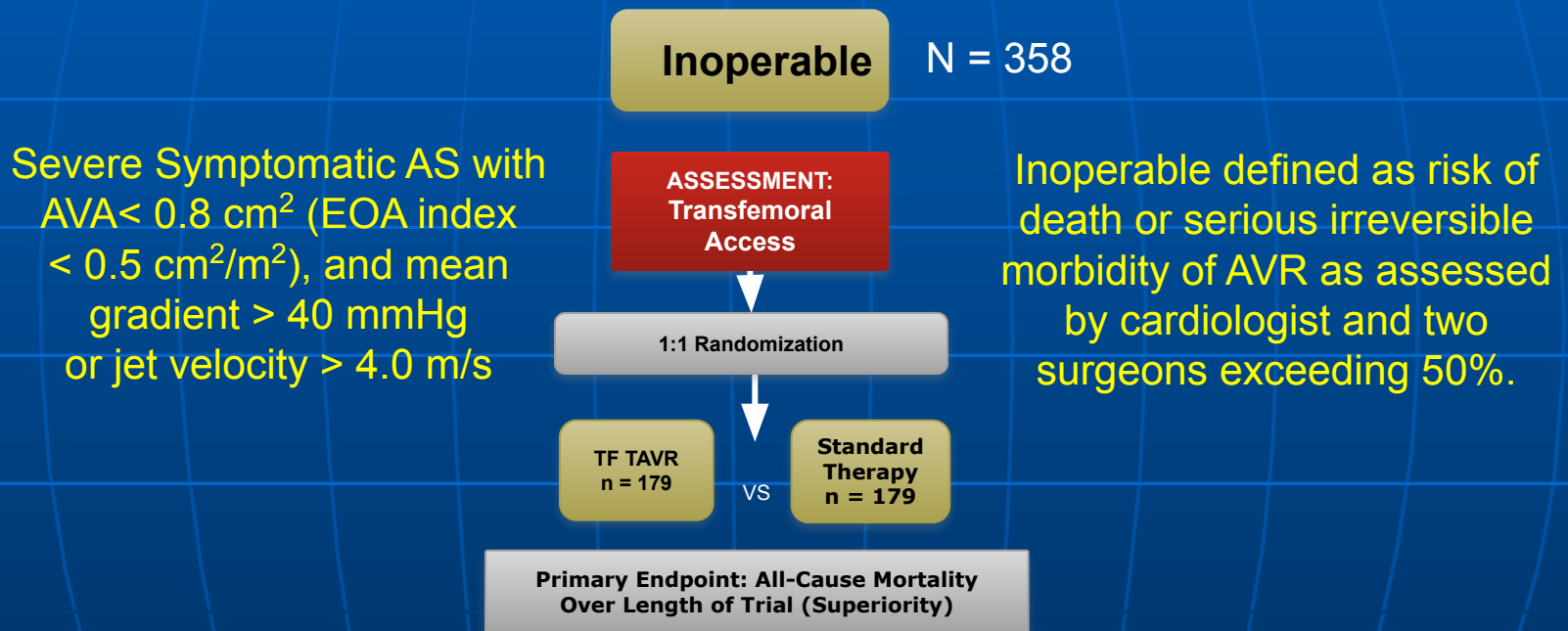
AVR is recommended in symptomatic patients with severe AS (stage D1) with :

Decreased systolic opening of a calcified or congenitally stenotic aortic valve; **and**

- An aortic velocity 4.0 m per second or greater or mean pressure gradient 40 mm Hg or higher; **and**
- Symptoms of HF, syncope, exertional dyspnea, angina, or (pre)syncope by history or on exercise testing.

# PARTNER Study Design

## Symptomatic Severe Aortic Stenosis



- Primary endpoint evaluated when all patients reached one year follow-up.
- After primary endpoint analysis reached, patients were allowed to cross-over to TAVR.

# All-Cause Mortality Landmark Analysis







# Prosthetic Heart Valves

# Caged-Ball Valve

# Disc Valve

# Bio-prosthetic Valve

# Prosthetic Valves

## ■ MECHANICAL

- Durable
- Large orifice
- High thromboembolic potential
- Best in Left Side
- Chronic warfarin therapy

## ■ BIO-PROSTHETIC

- Not durable
- Smaller orifice/functional stenosis
- Low thromboembolic potential
- Consider in elderly
- Best in tricuspid position

