

Lady Davis  
Carmel Medical Center



Rappaport  
Faculty of Medicine

# Mitral Valve Disease

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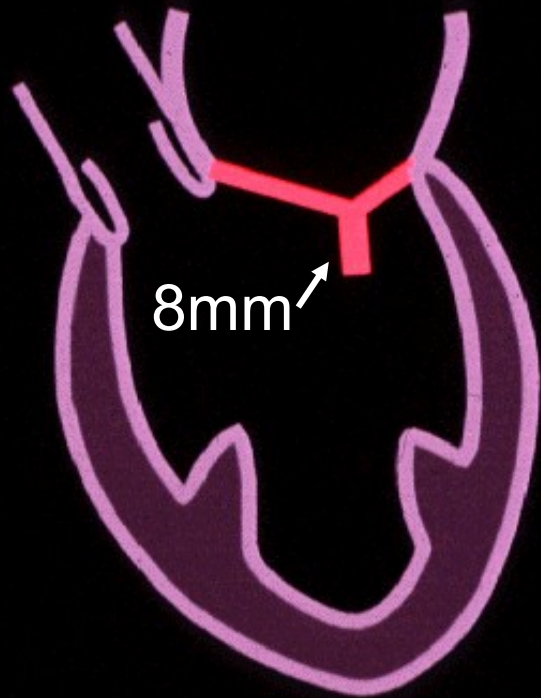
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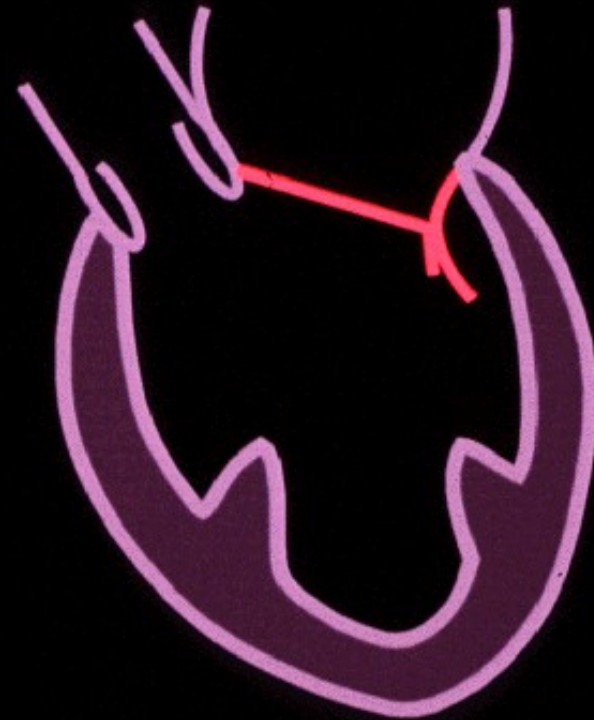
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Caesarea 11/2008

# Abnormal coaptation

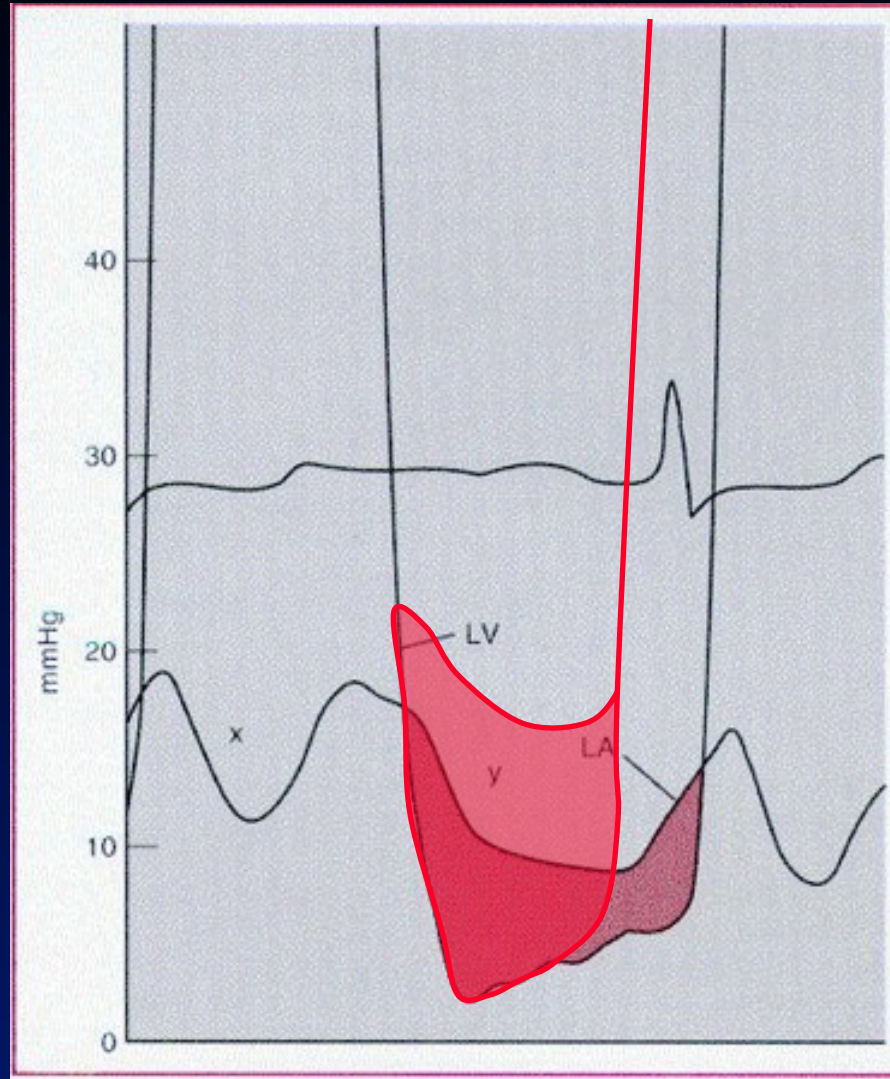


**Normal coaptation**

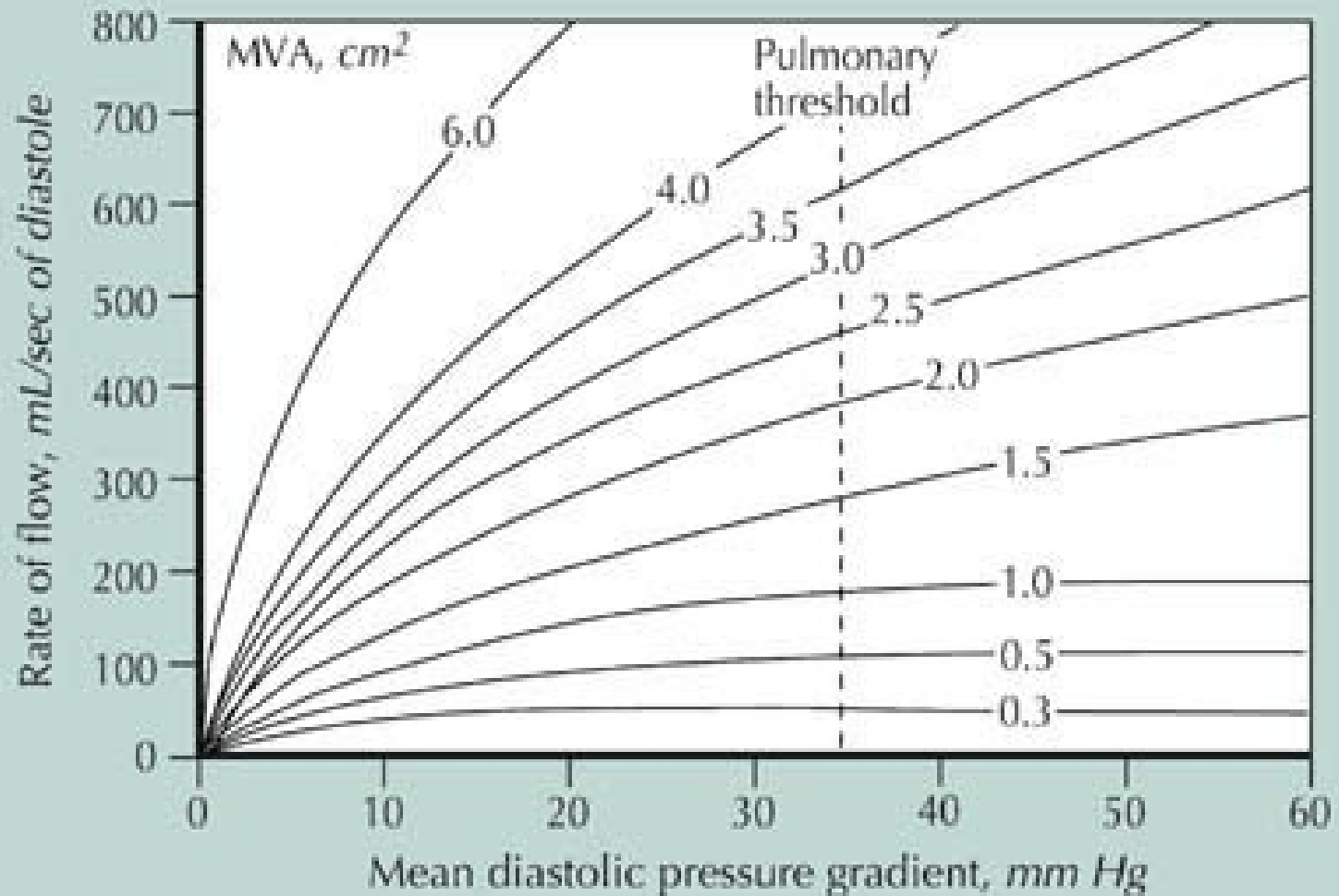


**Abnormal coaptation**

# MS: Pathophysiology



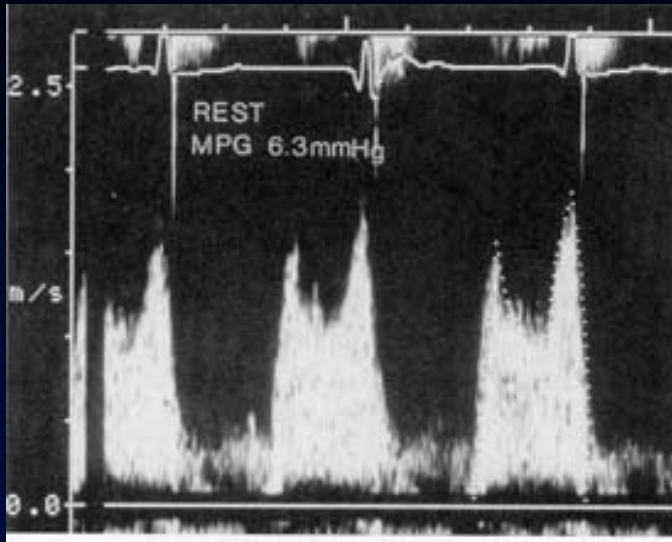
# Pathophysiology



# Physical findings

- PMI- normal
- RV lift
- 1<sup>st</sup> heart sound↑
- Opening snap
- Diastolic murmur – presystolic accentuation
- $P_2$ ↑
- TR (TS)
- CHF

# Echo-Doppler



AR, ASD,  
→MVA↑  
LVH→MVA↓

# Medical treatment

- ∇  $\beta$  blockers (Ca blockers, Digoxin)
  - Diuretics
  - Anticoagulation
- ∇  $\beta$  arrhythmics/ cardioversion

# Balloon valvuloplasty ACC/AHA 2006

## Class I

- FC II-IV,  $MVA \leq 1.5 \text{cm}^2$ , favorable anatomy, no thrombus,  $MR < +3$
- Asymptomatic with sys PAP  $> 50$  mmHg at rest,  $> 60$  mmHg during exercise

## Class IIa

- FC III-IV, calcified valve, high risk surgery



# Balloon valvuloplasty ACC/AHA 2006

## Class IIb

- FC I, new onset atrial fibrillation
- FC II-IV, MVA > 1.5 cm<sup>2</sup> but sys PAP > 60 mmHg, PCWP > 25 mmHg or mean  $\Delta P$  > 15 mmHG during exercise
- FC III-IV, calcified valve

# Surgery

- Open commissurotomy
- MVR
- Tricuspid annuloplasty if >mild TR or tricuspid annulus diameter  $\geq 3.5$  cm\*

# Surgery – ACC/AHA 2006

## Class I

- FC III-IV,  $MVA \leq 1.5 \text{cm}^2$ , and PBMV is not an option
- FC III-IV,  $MVA \leq 1.5 \text{cm}^2$  and  $MR+3-4$   
– MVR unless repairable

## Class IIa

- MVR: FC I-II,  $MVA \leq 1.0 \text{cm}^2$ ,  $\text{sys PAP} > 60 \text{ mmHg}$ , and PBMV or repair is not an option

# Surgery – ACC/AHA 2006

## Class IIb

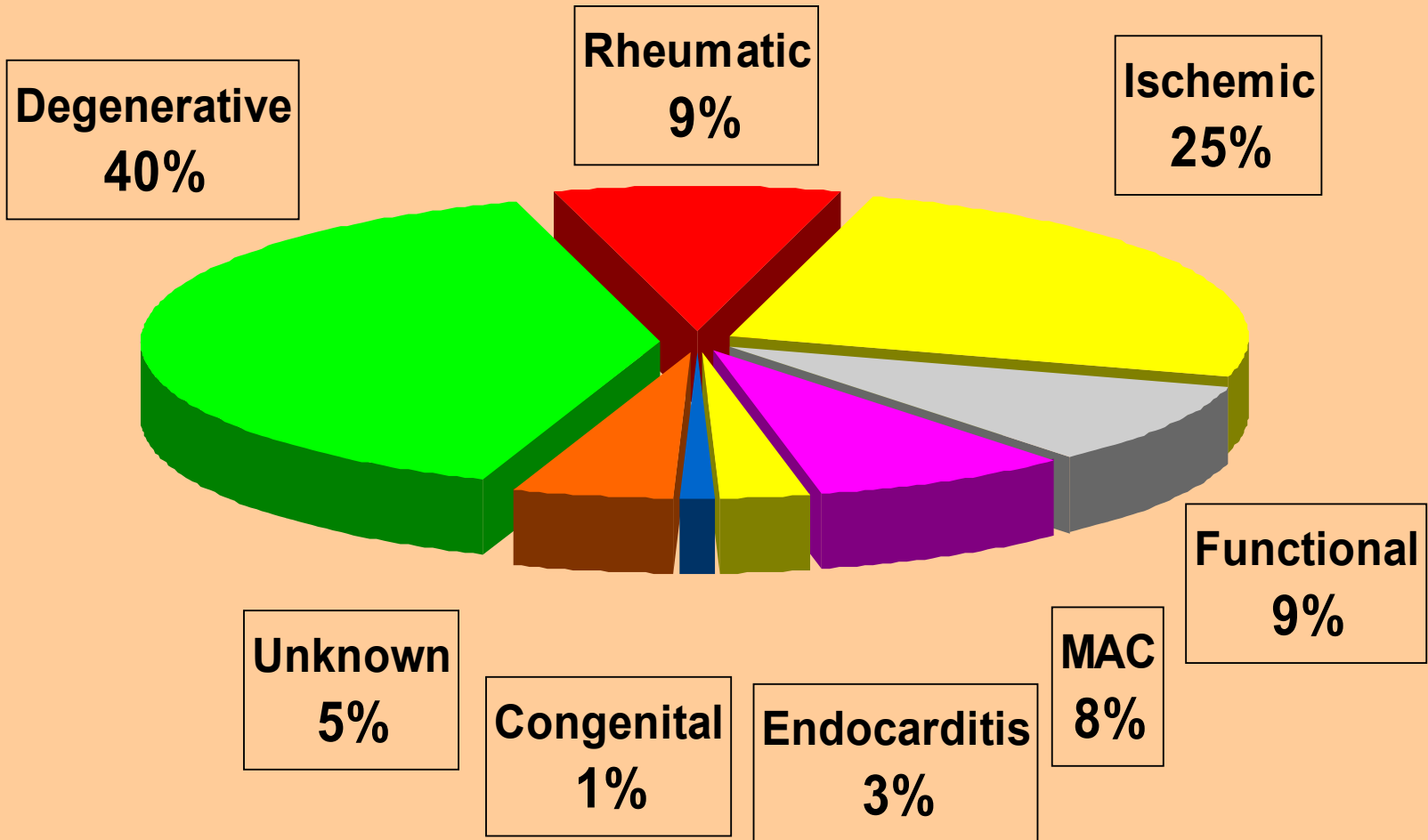
- MV repair for  $MVA \leq 1.5 \text{cm}^2$ , favorable anatomy and recurrent emboli despite adequate anticoagulation

# Acute MR

- Etiology: ruptured papillary muscle, acute ischemic MR, BE, MV repair/replacement failure, ruptured chordae
- Clinical presentation: pulmonary edema and cardiogenic shock. Mitral murmur often inaudible
- Diagnosis: immediate echo
- Rx: IABP±mechanical ventilation, immediate TEE, coronary angio and surgery

# **Chronic Severe Mitral Regurgitation**

# Etiology of MR (n=180)



# Degenerative Mitral Valve Disease

- “Spontaneous” ruptured chordae
- Myxomatous, MVP, Barlow’s disease
  - Can be genetic: Marfan, rarely- familial, x-linked: Filamin A mutation\*
  - Incidence 1-2% ( $\geq 2$ mm PLAX)
  - Dynamic mid systolic click late systolic murmur
  - May progress to severe MR, ruptured chordae, at risk for endocarditis

\*Kyndt et al, Circ 2007



# Pathophysiology of MR

- LV volume overload
- Normal or reduced afterload

LA size:	Normal	Large
LA compliance:	↓	↑
LA pressure:	↑	N
PA pressure:	↑	N

# Physical Examination

- Hyperdynamic/displaced PMI
- LA lift (late systolic)
- S1↓ P2↑ III
- Holosystolic apical murmur
  - Radiates to axilla/LSB
  - Intensity does not necessarily correlate with MR severity
- Diastolic “functional” apical murmur
- TR

# MR Severity By Echo

- LA & LV size
- MV anatomy
- Color Doppler mapping: jet area, jet area/LA
- PW
- CW
- Pulmonary venous flow
- Calculated regurgitant volume/fraction & EROA
- PISA
- Vena contracta
- Pulmonary pressure

# Assessment of the Severity of MR

	<u>Mild</u>	<u>Moderate</u>	<u>Severe</u>
LA & LV	normal	LA↑	LA & LV↑
Jet area	< 4 cm <sup>2</sup>	4-10 cm <sup>2</sup>	≥10 cm <sup>2</sup>
PV sys flow	normal	blunting	reversal
RV	<30 ml	30-59 ml	≥ 60 ml
EROA	<0.2 cm <sup>2</sup>	0.2-0.4 cm <sup>2</sup>	≥0.4 cm <sup>2</sup>
RF	<20%	20-50%	≥50%
Vena contracta	<0.3 cm		≥0.7 cm

# Management

Surgery

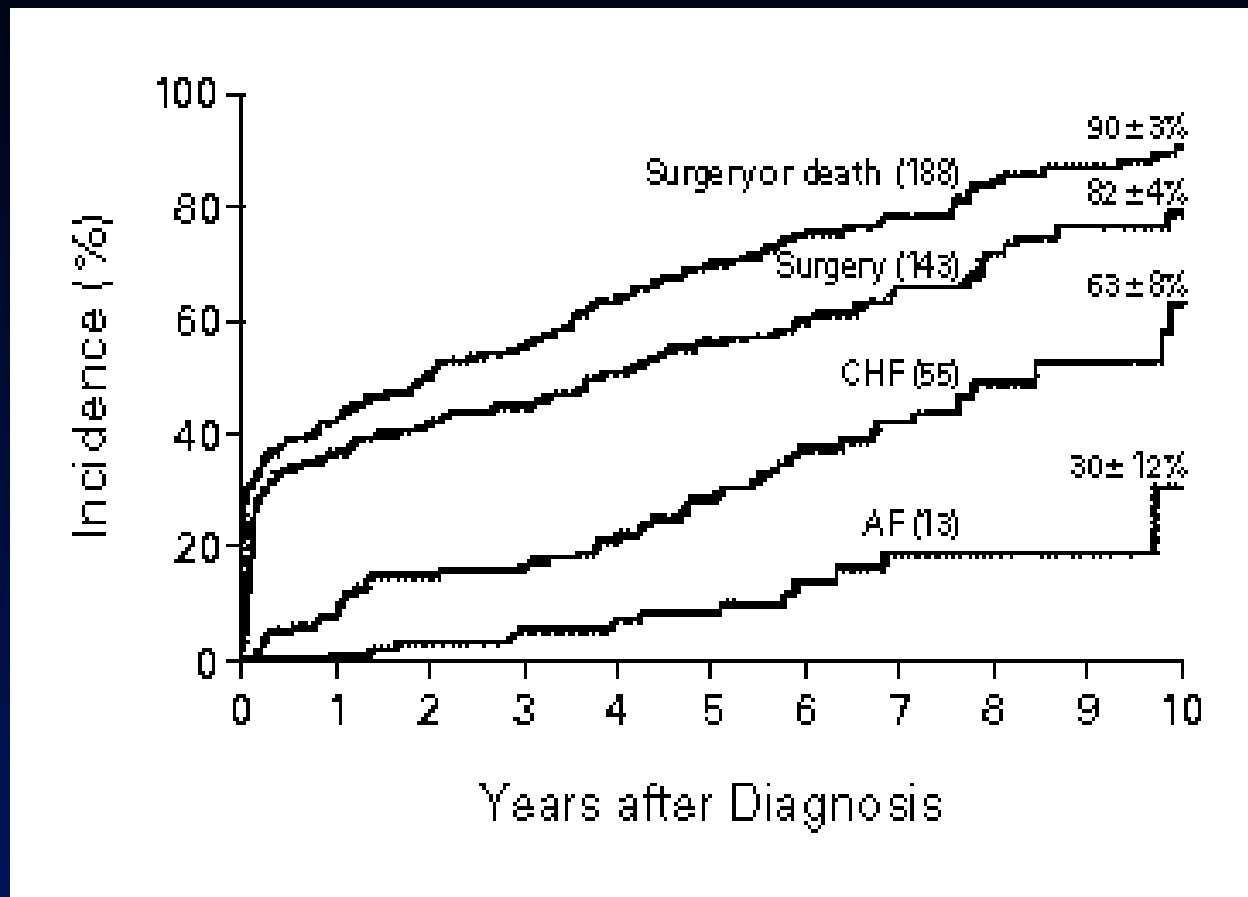


Medical  
Treatment

# Afterload Reduction in MR

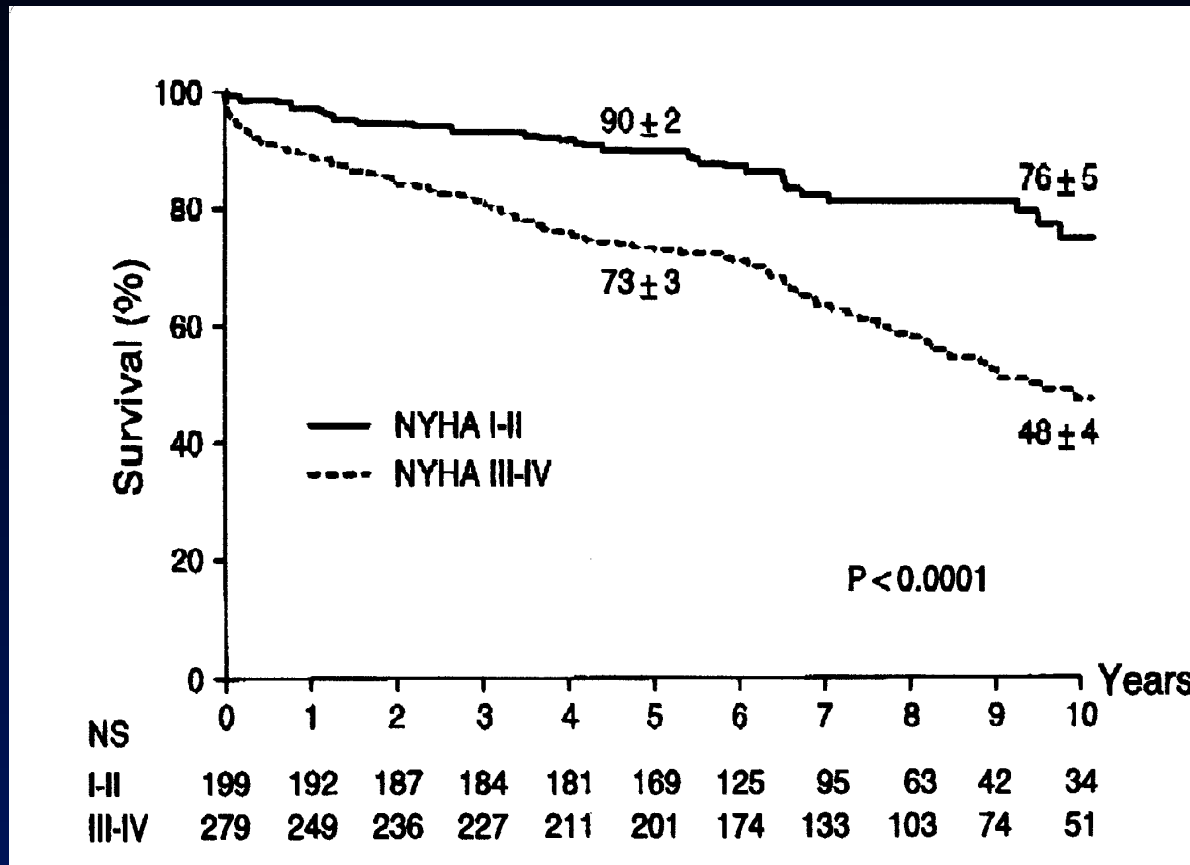
- Role in acute MR
- Role in patients with CHF, LV dysfunction, hypertension
- No data to support use in chronic asymptomatic MR

# Clinical Outcome of Mitral Regurgitation Due to Flail Leaflet



Ling et al, NEJM 96 (Mayo Clinic)

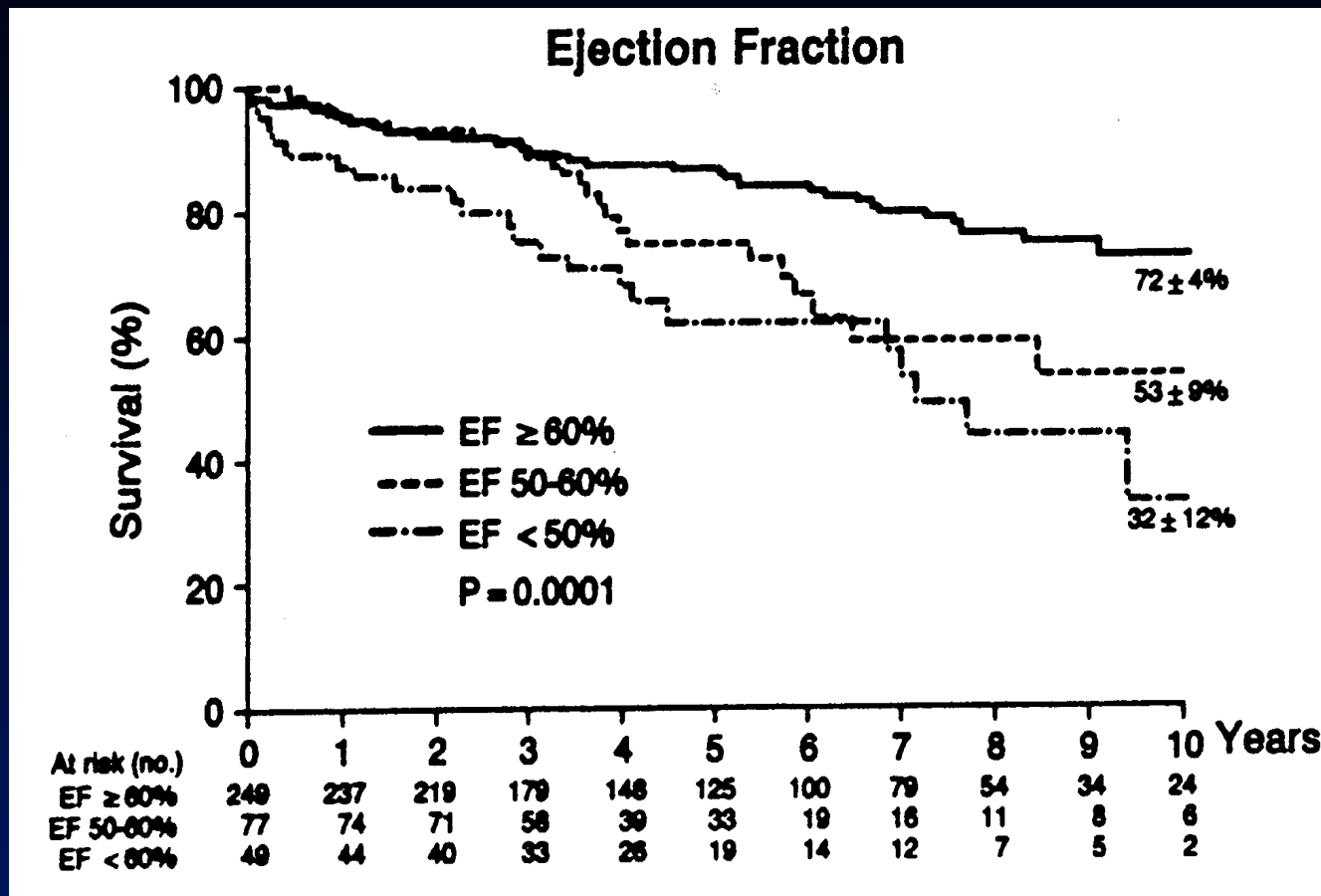
# Impact of Preoperative Symptoms on Survival After Surgical Correction of Non-ischemic MR



Tribouilloy et al, Circ 99 (Mayo Clinic)

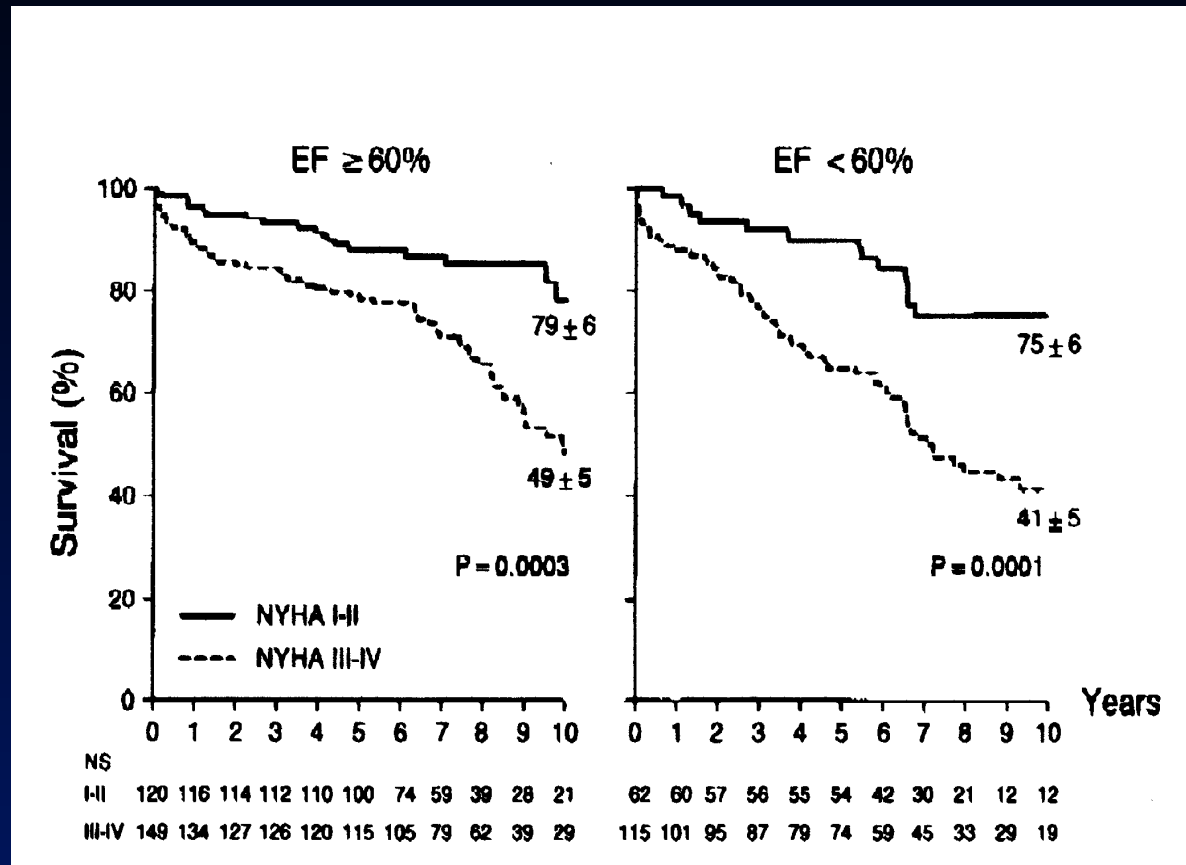


# Survival After Surgical Correction of Non-ischemic MR by Preoperative EF



Enriquez-Sarano et al, Circ 94 (Mayo Clinic)

# Survival After Surgical Correction of Non-ischemic MR by Preoperative EF and Symptoms



Tribouilloy et al, Circ 99 (Mayo Clinic)

# When to Operate?

- **Symptoms ( $F_c \geq II$ )**
- **EF < 60%**

# MV Surgery ACC/AHA 2006

## Class I

- **Acute symptomatic severe MR**
- **Chronic severe MR, FC $\geq$ 2, EF $\geq$ 30% and/or LVEDD $>$ 55MM**
- **Asymptomatic chronic severe MR, EF 30-60%, LVEDD $\geq$ 40mm**
- **Repair is better than replacement**

# MV Surgery ACC/AHA 2006

## Class IIa

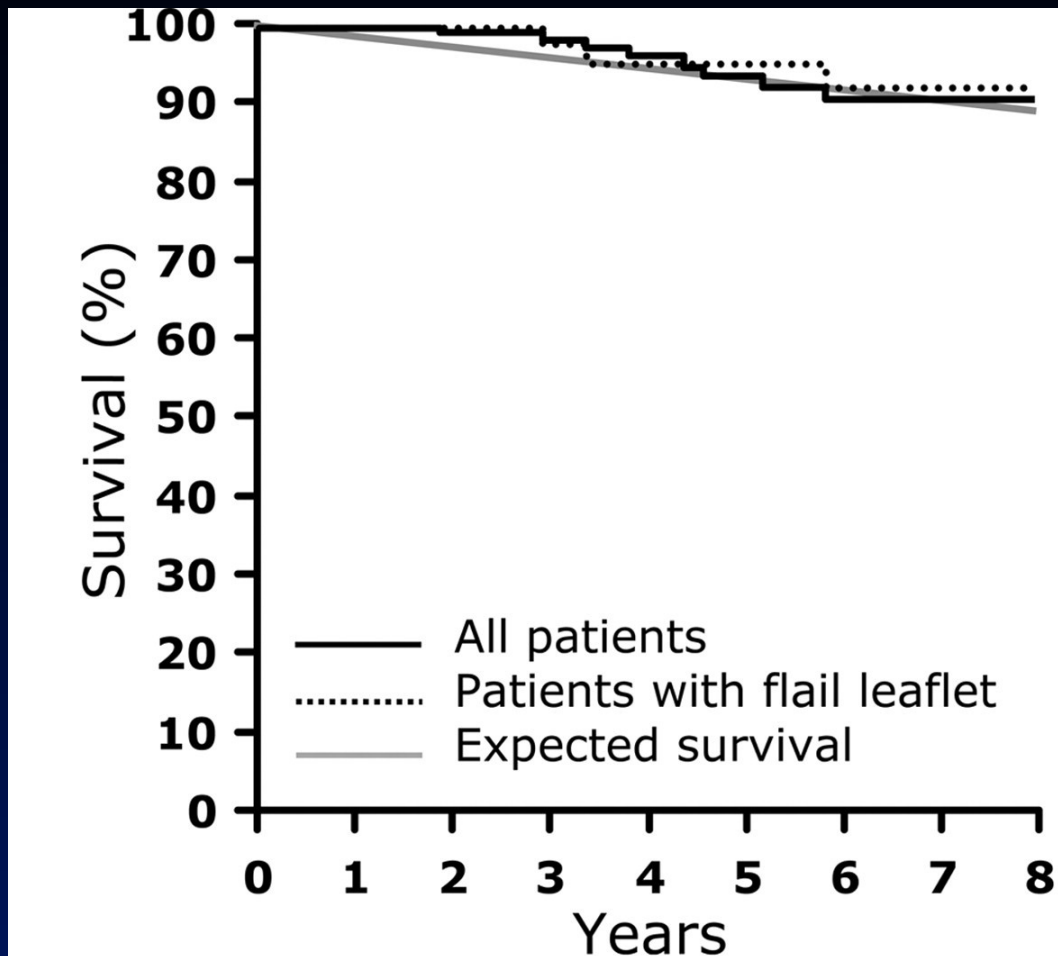
- MV repair for asymptomatic severe MR, EF>60%, repair success>90% (IIb Eu)
- New onset AF
- Sys PAP>50mmHg at rest, >60mmHg during exercise
- Chronic severe MR (primary), FC 3-4, EF<30% or LVEDD>55mm and repair is highly likely

# MV Surgery

## Class IIb

- MV repair for secondary severe MR, FC 3-4 despite optimal therapy (+CRT), EF<30% (IIa Eu)

# Survival of Asymptomatic Severe MR with Watchful Waiting According to Guidelines



## All patients

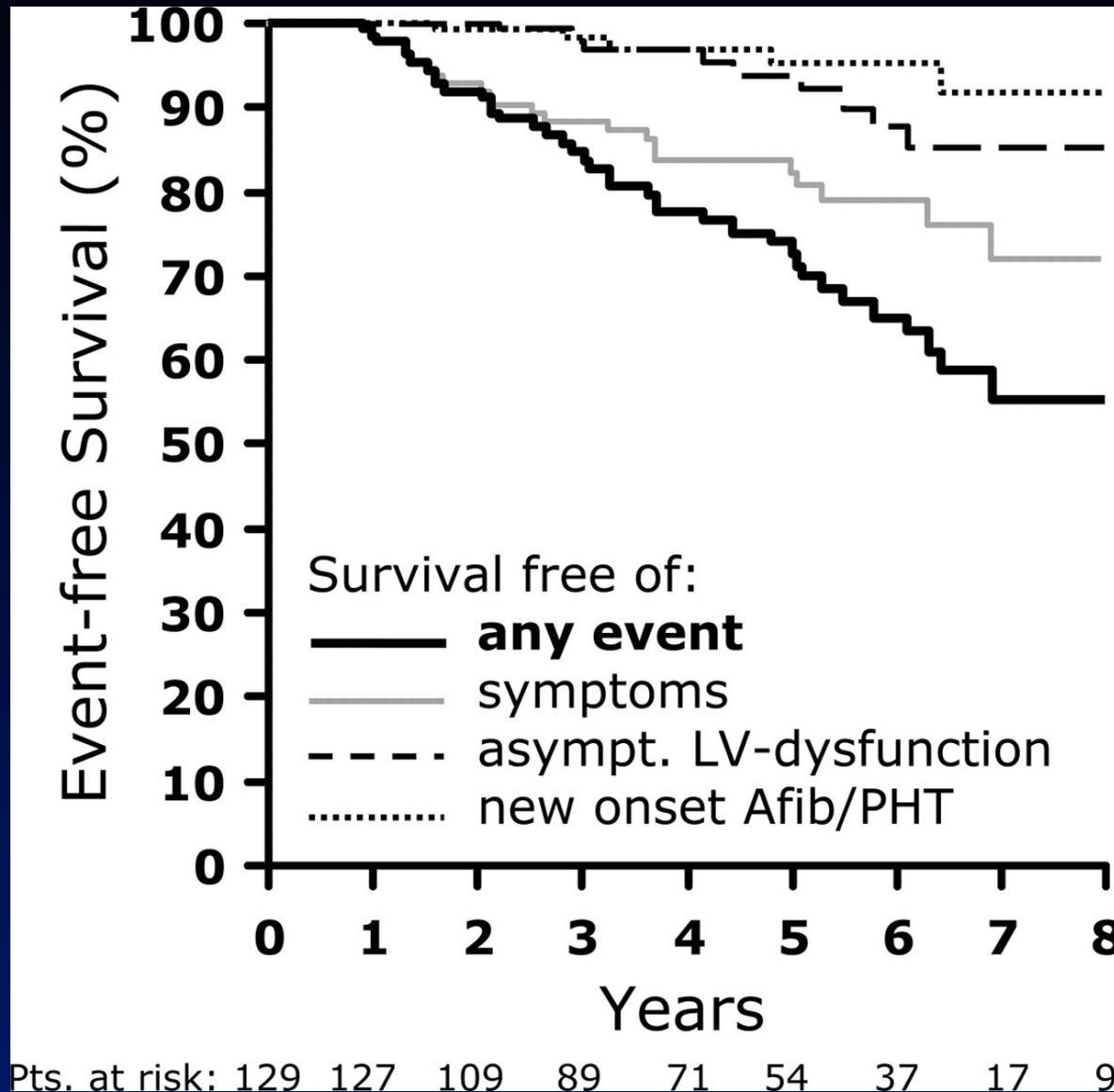
Pts. at risk: 129 129 118 103 87 70 53 24 10

## Patients with flail leaflet

Pts. at risk: 56 55 53 43 37 32 28 10 4

Rosenhek et al,  
Circ 2006

# Event-Free Survival of Asymptomatic Severe MR with Watchful Waiting



24/38 pts with events had symptoms

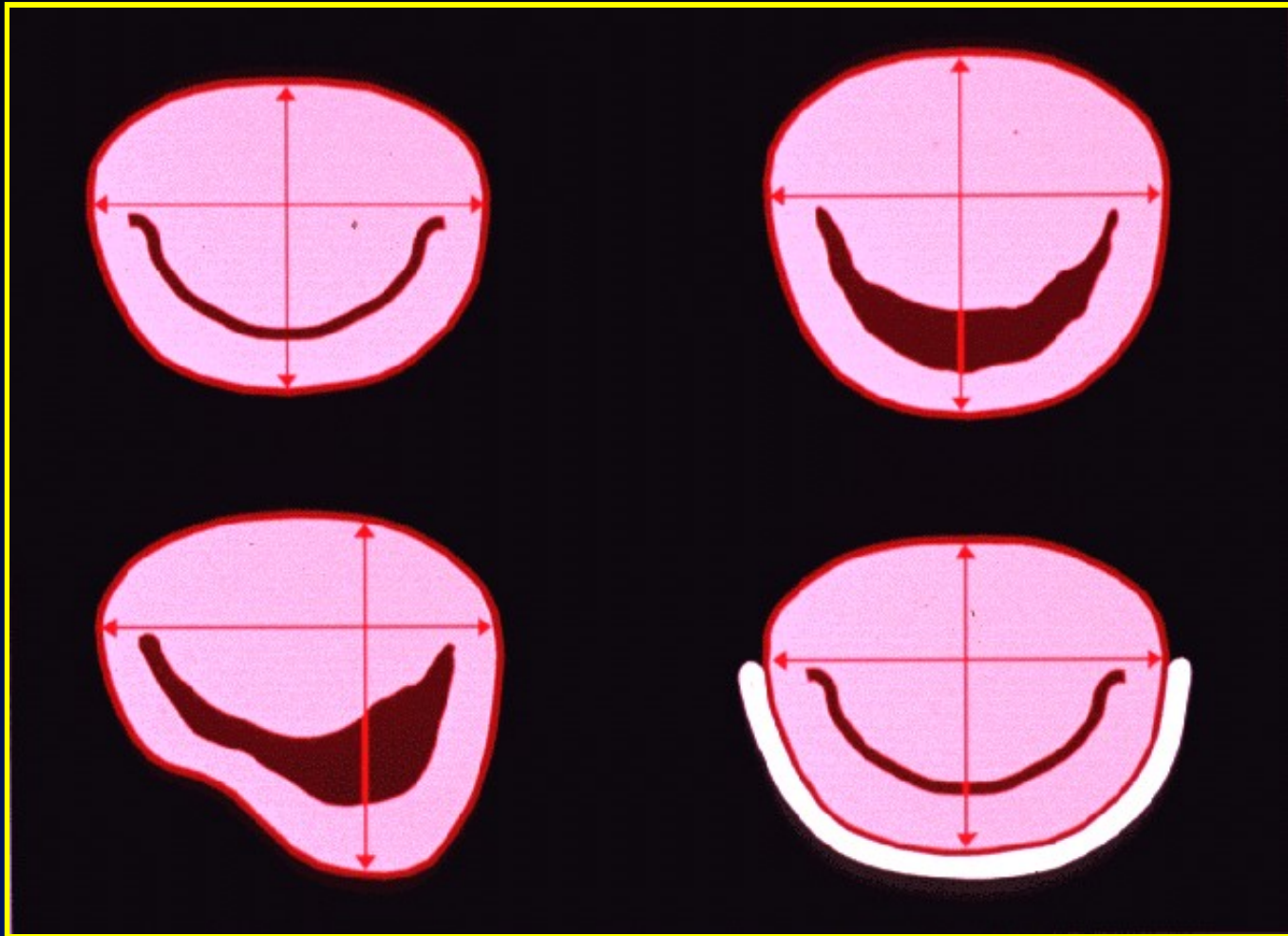
Rosenhek et al,  
Circ 2006



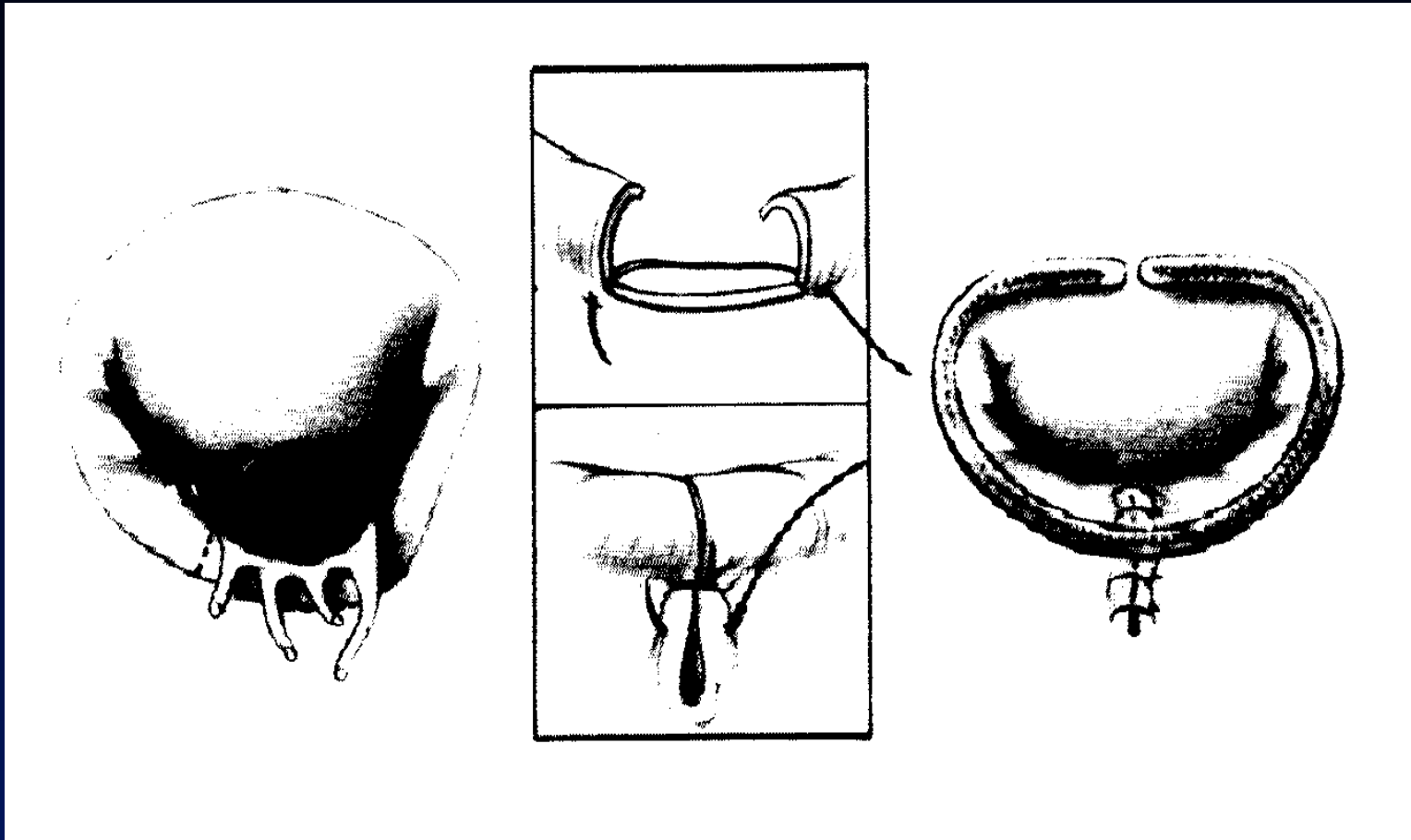
# Why Repair?

“Valve replacement is simply exchanging one disease with another”

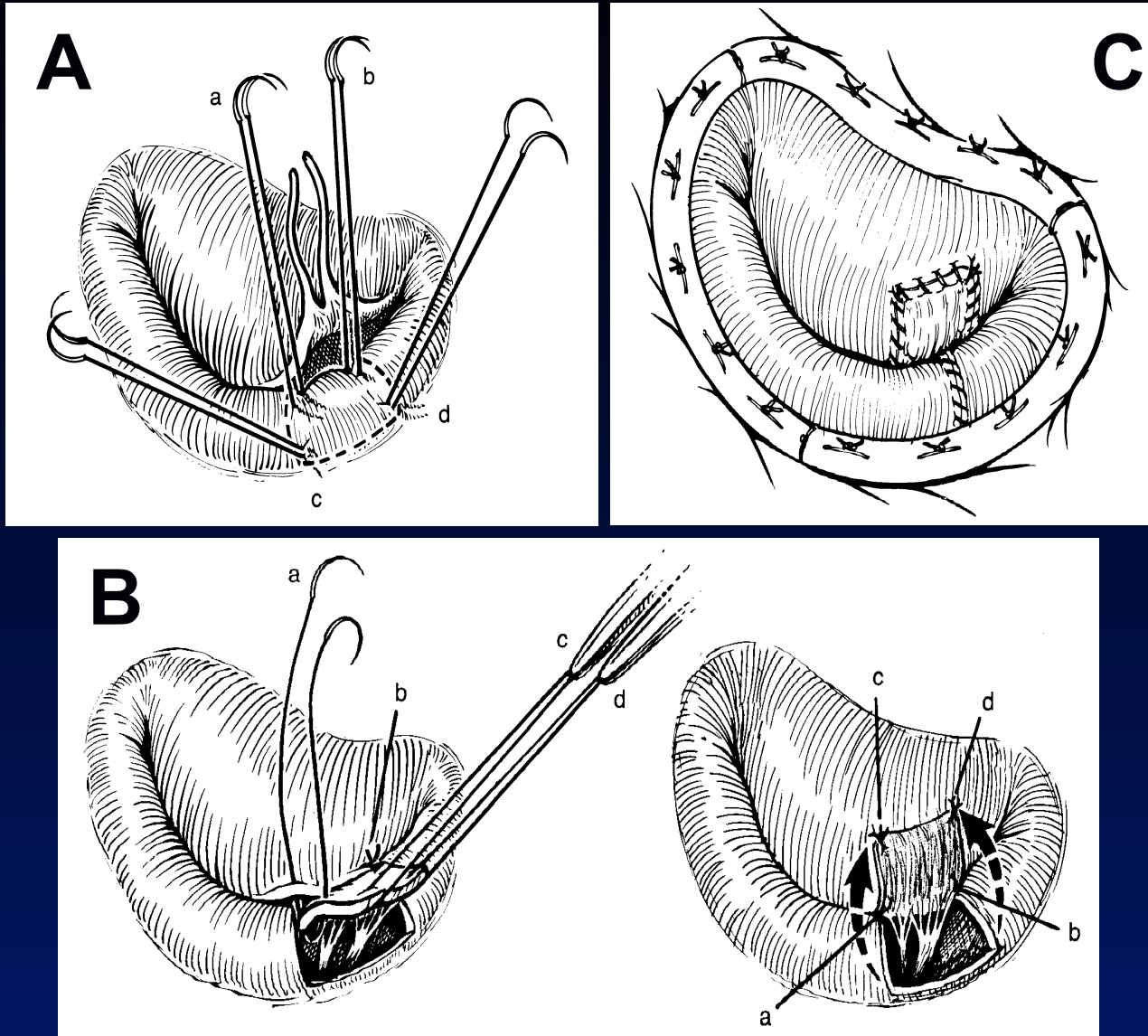
# Mitral Prosthetic Ring Annuloplasty



# Posterior Leaflet Repair With Quadrangular Resection



# Anterior Leaflet Repair: Chordal Transposition



# Low Probability of Successful Repair

- Extensive bileaflet prolapse
- Extensive anterior leaflet involvement
- Posterior leaflet involvement >50%
- Significant MAC
- papillary muscle rupture
- Rheumatic MR
- Congenital
- Prior repair

# Intraoperative TEE for Mitral Valve Repair

## Preop:

- Assess severity of MR
- Define mechanism of MR and anatomy of MV
- Detect associated important findings (TR, AV dis, etc.)

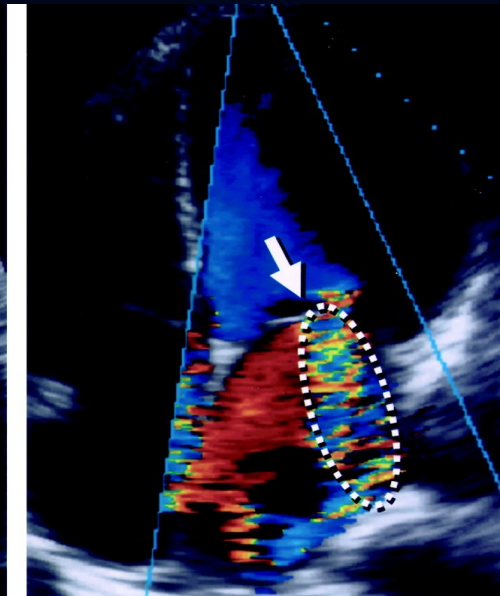
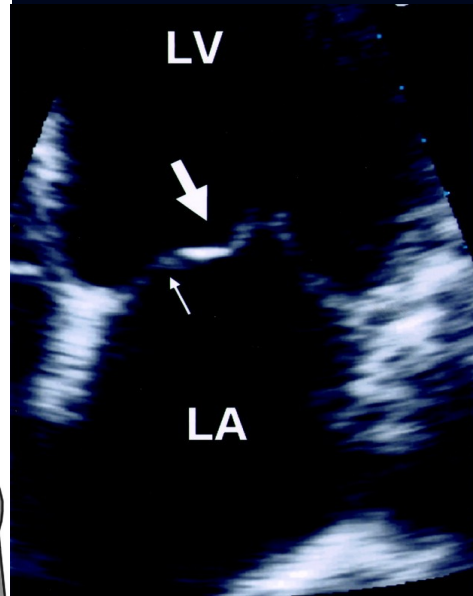
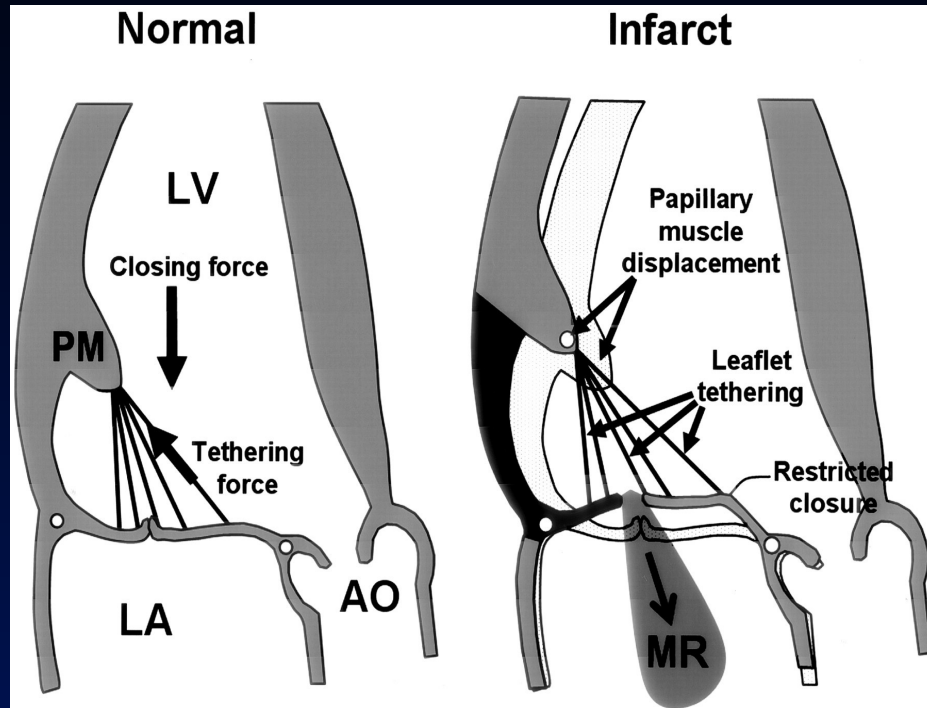
## Postop:

- Detect residual MR/ Assess anatomical adequacy
- Detect outflow tract obstruction
- Residual air, LVF, volume status, others

# Ischemic Mitral regurgitation

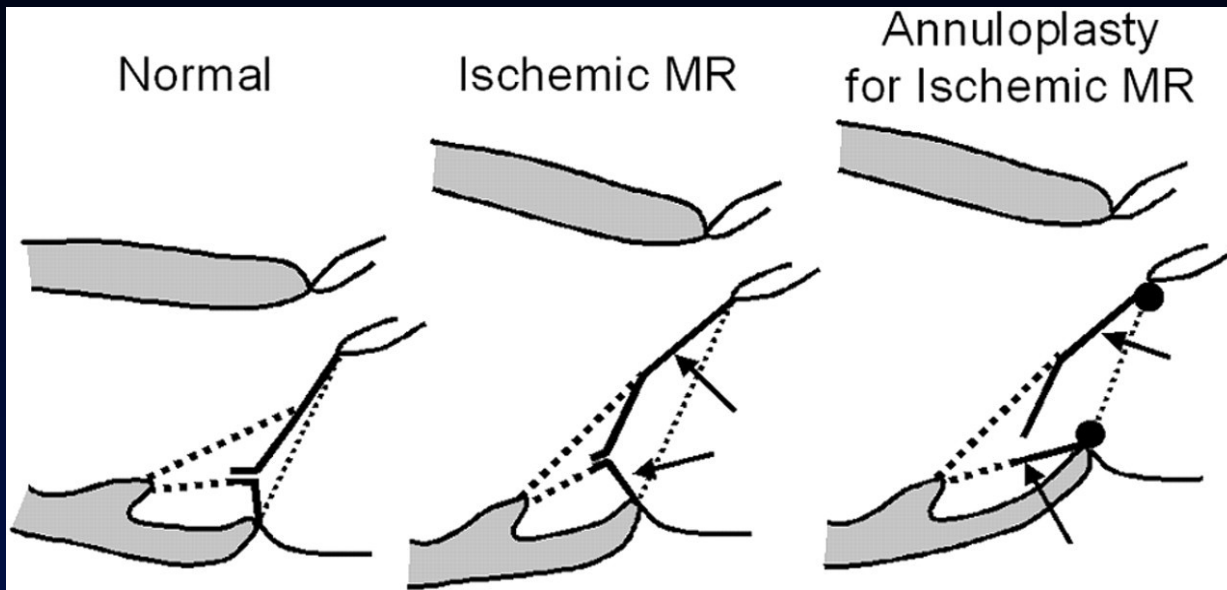
- Dynamic, not static
- Predicts poor survival and CHF
- Increased operative mortality (11%-28%)
- Indication for surgery?
- Type of surgery?

# Pathophysiology of Ischemic MR

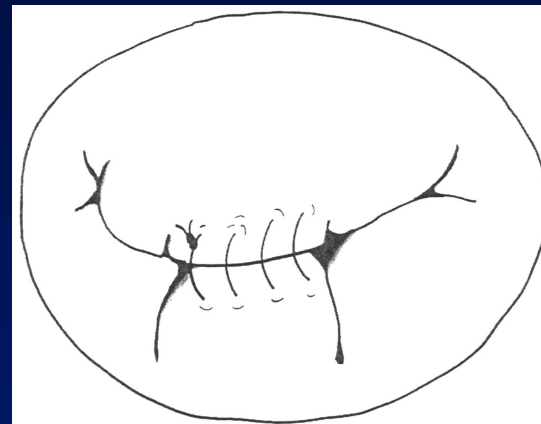




# Repair of Ischemic MR

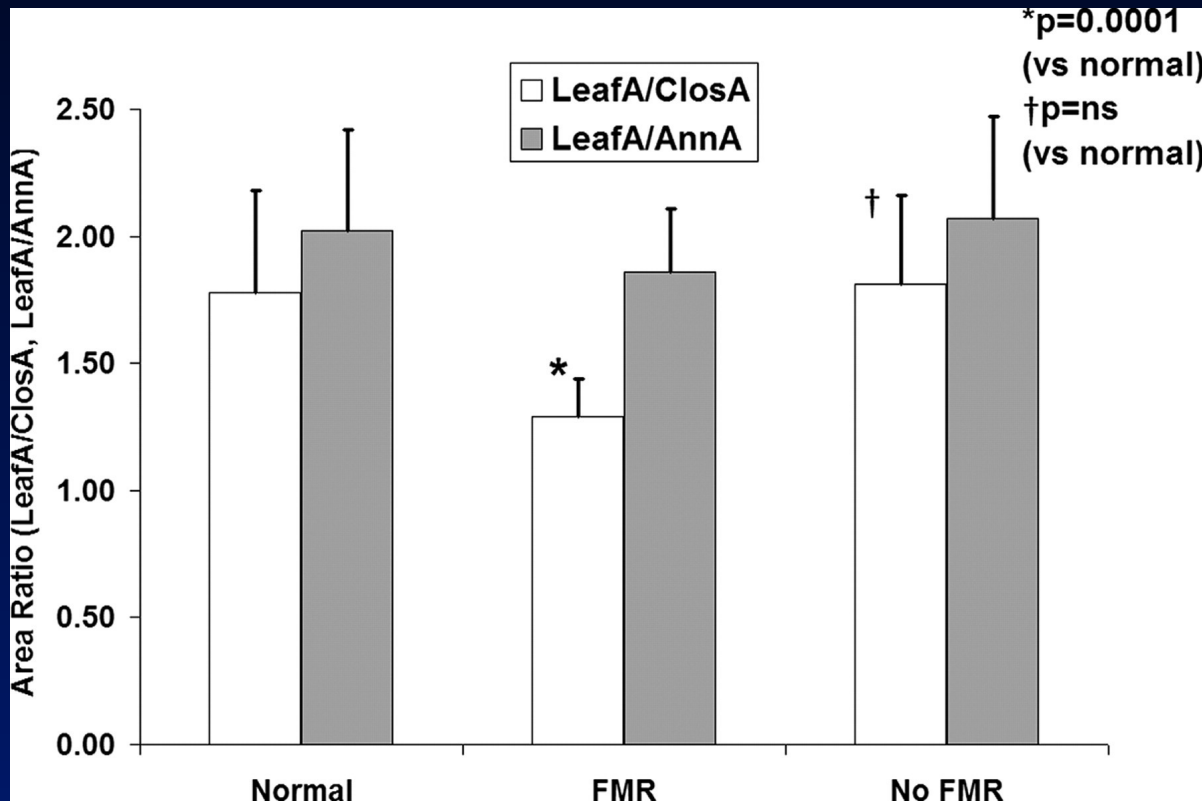
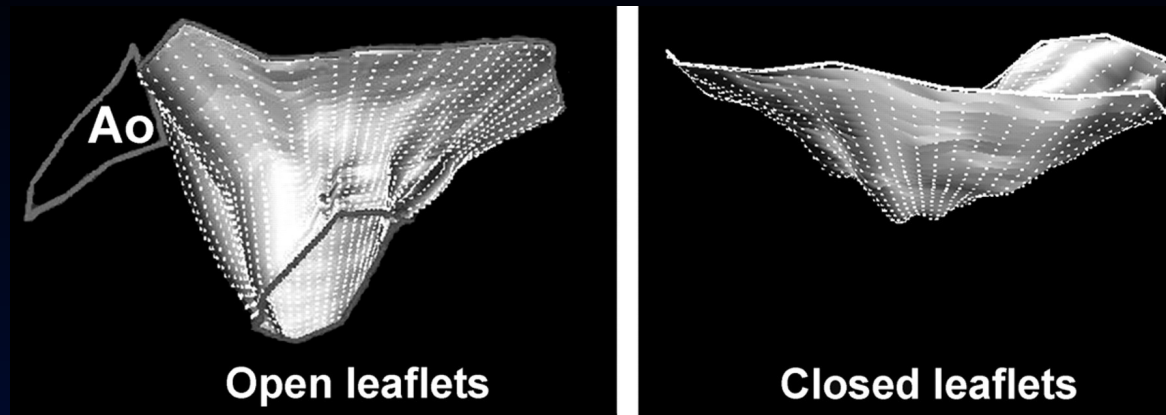


Undersized ring annuloplasty



Alfieri edge to edge repair

# Insufficient Leaflet Area in Ischemic MR



Chaput et al, Circ 2008

# Mechanical Valves

- Durable (>40 years with SE valves)
- Thrombogenic – requires life long anticoagulation: INR 2.5-3.5 ± aspirin

# Complications

- Major bleeding: 0.2-2.2%/y
- Thromboembolism: 2-3%/y
- PV thrombosis (stuck valve): 0.35%/y

# Stuck Prosthetic Valve

- High suspicion (INR↓, dyspnea/CHF)
- Echo (TEE), fluoroscopy
- Thrombolysis or surgery

# Other PV Complications

- “The dark side of the moon” (TEE necessary)
- Leaks (paravalvular usually)
- Hemolysis
- Endocarditis
- Rare mechanical failure

# Valve Selection

- Mechanical valve
  - Long expected lifetime (age < 40 years)
  - Previous dysfunctional tissue valve
  - Anticoagulation required anyway (AF)
  - Renal failure, dialysis

# Valve Selection

- Bioprosthesis
  - Short expected lifetime (age  $\geq$  65 years)
  - Unreliable anticoagulant risk
  - Previous thrombosed valve
  - Anticoagulant intolerance
  - Pregnancy anticipated



# 1) Which is true in ischemic MR?

- a) It is caused by papillary muscle dysfunction
- b) Revascularization alone will usually solve the problem
- c) MV annuloplasty with an undersized ring is a durable solution
- d) MVR with a bioprosthesis with leaflet preservation is a good solution for severe ischemic MR
- e) Ischemic MR is always under-estimated by intra-op TEE because of the unloading effect of anesthesia

## 2) Which patient will you send for surgery?

- a) Asymptomatic severe MR, normal LV contraction, diffuse bileaflet prolapse
- b) Obesity, HTN, dyspnea, MVP (P2), late systolic MR
- c) Severe MR, ruptured chord to P3, normal LV contraction, dyspnea when climbing 3 flights of stairs
- d) FC3, DCM with EF=20% and severe functional MR

### 3) Which is true for MVP?

- a) MVP is best appreciated in 4CV
- b) May be associated with a mutation in the the Filamin A gene
- c) MVP with severe MR is an indication for BE prophylaxis
- d) Common in young women (15-20%)
- e) When associated with a ruptured chord – better to replace the valve and not repair, because other chords may rupture after surgery