Mechanical Complications of IHD

부산의대 제형곤

Contents

- Ischemic MR (Chp. 92)
  - Carpentier's type IIIB dysfunction
  - Acute Papillary Muscle Rupture
  - Chronic Type II Ischemic Mitral Regurgitation
- Post-MI VSD & Ventricular Rupture (Chp. 93)
- Left Ventricular Aneurysm (Chp. 100)

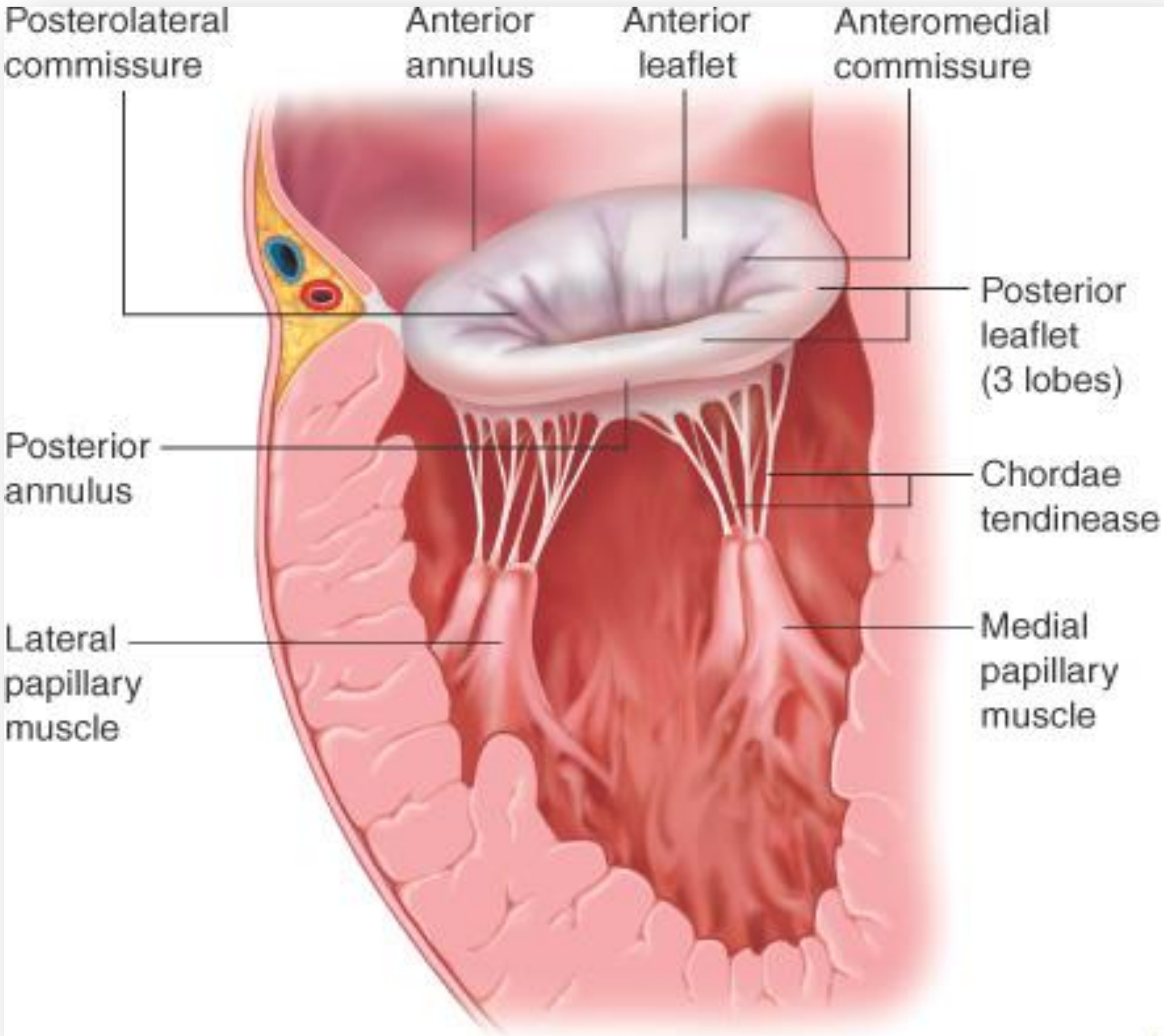
Ischemic MR

부산의대 제형곤

Ischemic MR Definition

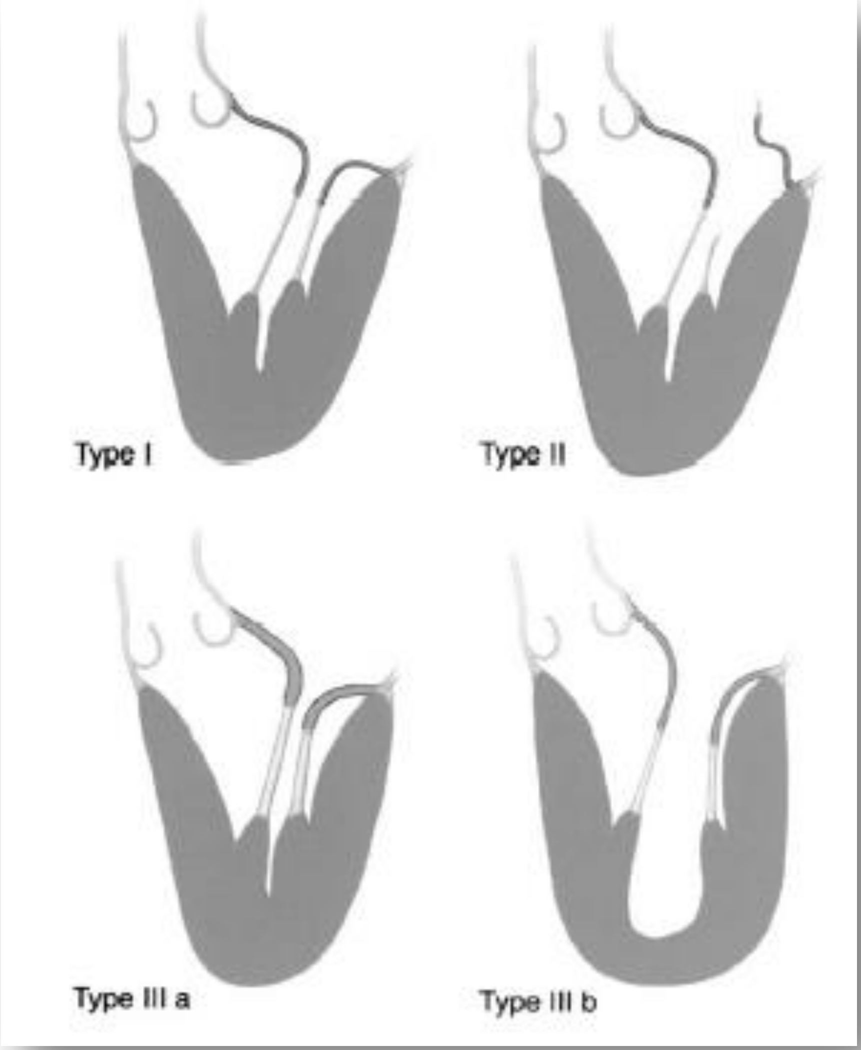
- **Etiology:** MI with regional or global dysfunction
- **Primary lesion:** tethering of the valve leaflets
- **Valve dysfunction:** MR restriction of leaflet motion, in systole **(Carpentier's type IIIB dysfunction)**

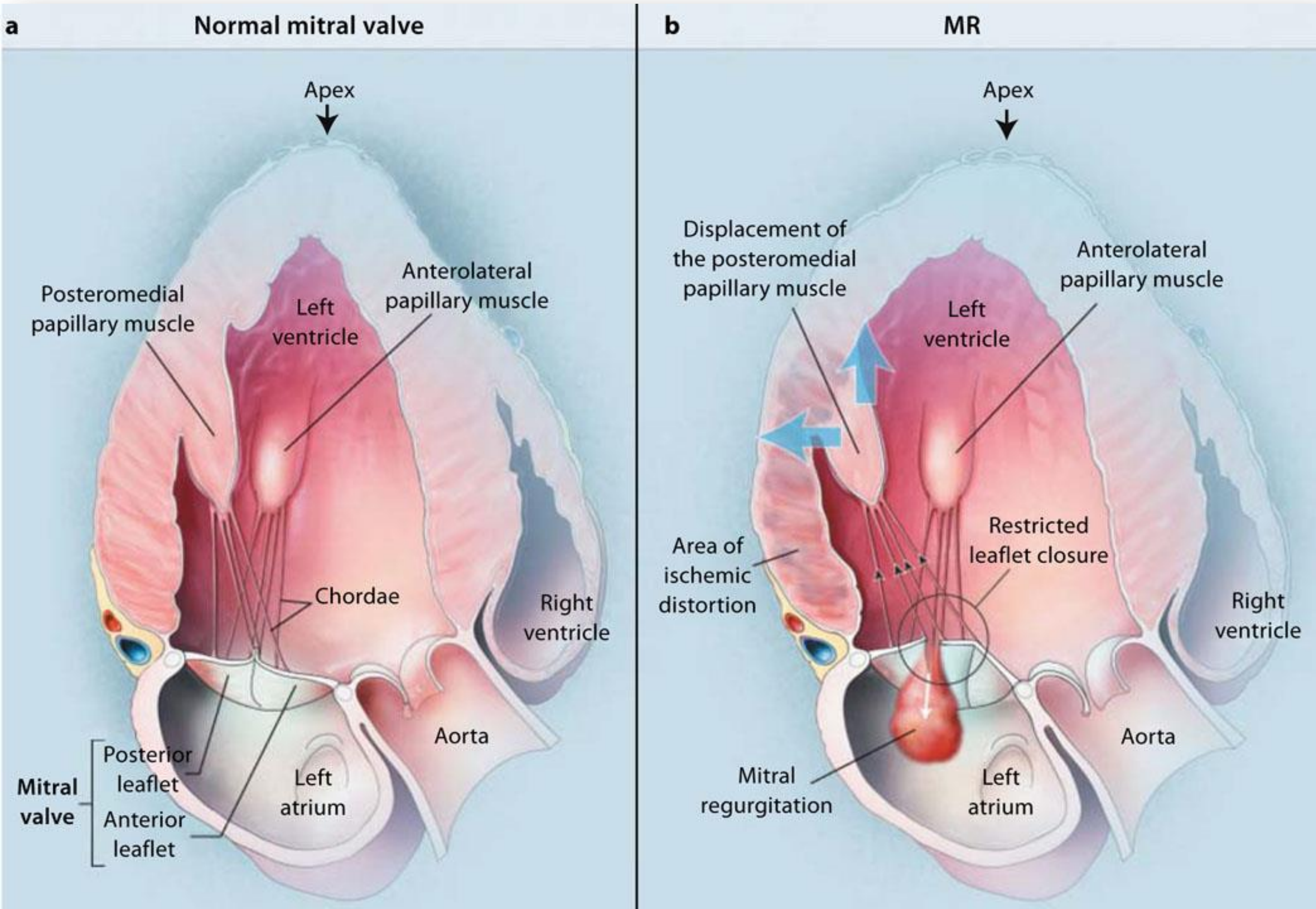
Mitral valve anatomy



Functional classification of MR

- Type I : nl motion,leaflet perforation, annular dilatation
- Type II : chordae elongation or rupture
- Type IIIa : restricted motion(sys and dia) d/t rheumatic change
- **Type IIIb : restricted motion(sys) secondary to PM displacement**




a
Normal mitral valve
Apex
Posteromedial papillary muscle
Left ventricle
Anterolateral papillary muscle
Chordae
Right ventricle
Aorta
Left atrium
Mitral valve
Posterior leaflet
Anterior leaflet
b
MR
Apex
Displacement of the posteromedial papillary muscle
Anterolateral papillary muscle
Left ventricle
Restricted leaflet closure
Area of ischemic distortion
Right ventricle
Aorta
Mitral regurgitation
Left atrium

Prevalence of IMR

- "Contaminated", usually mild & disappear
- 17%-55% develop mitral systolic murmur or echocardiographic evidence of IMR early after AMI
- 18% cardiac catheterization within 6 hrs of the onset of Sx of AMI

Degree of the of IMR

- Significant 2′ mitral regurgitation:
  - Regurgitant volume ≥ 30 mL
  - Effective regurgitant orifice area ≥20 mm^2
  - Flow-convergence proximal isovelocity surface area > 8~9, rather than > 10

TEE Assessment of IMR

- **Downgrading of MR** d/t unloading effect of anesthesia
- **Provocative testing :**

  - Preload challenge; PCWP 15~18 mmHg

  - Afterload challenge; mean AP > 100 mmHg

  - if positive, inspection & repair of MV

Byrne et al, Brigham & Women's Hospital, The Lancet '00

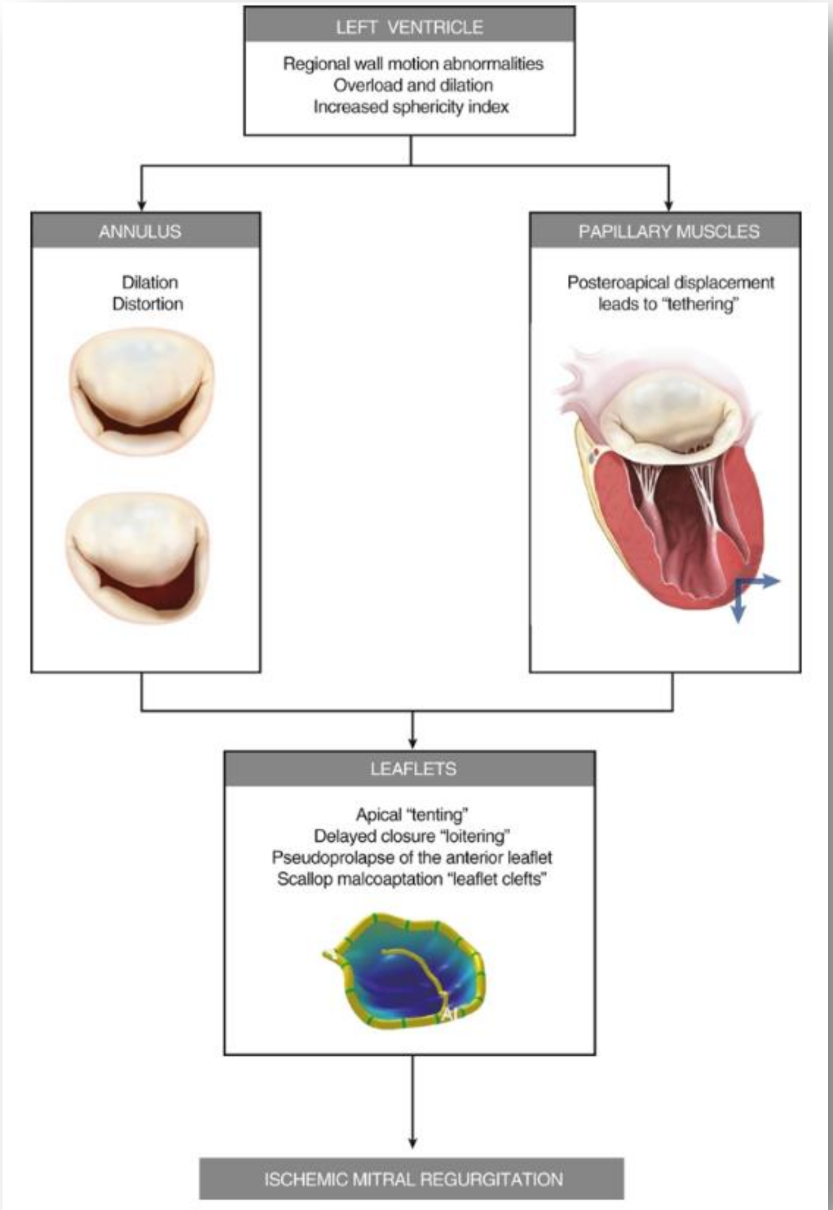
Clinical Presentation

- Acute MR d/t papillary muscle rupture after AMI
- Majority:
  - Prior MI, generally permanent and chronic
  - Incidental finding at echo
  - Symptoms and signs of heart failure

2 Most common clinical scenarios

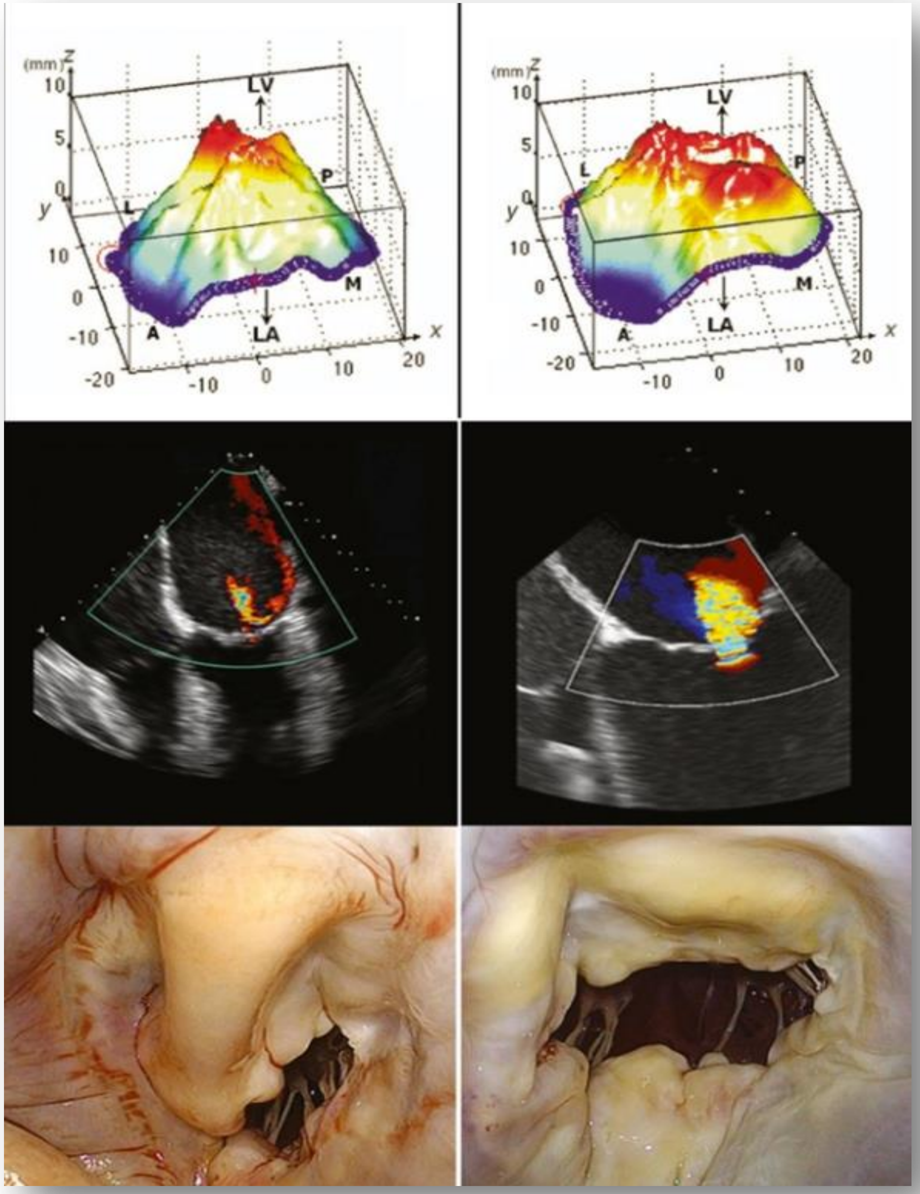
	Primarily Ischemia	Primarily Heart Failure
		
Mechanism	Posterior leaflet restriction	Leaflet restriction and annular dilation
Severity of MR	Mild to moderate	Moderate to severe
LV dysfunction	Mild to moderate	Moderate to severe
Ejection fraction (%)	30-50	15-40
Indication for surgery	Coronary artery disease	Congestive heart failure

Pathophysiology of IMR



Pathophysiology of IMR

- LV sphericity is more important than LV volumes or EF
- Inf. MI: tethering in medial posterior leaflet
- Ant. MI: widespread tethering of both leaflets



Long term outcome

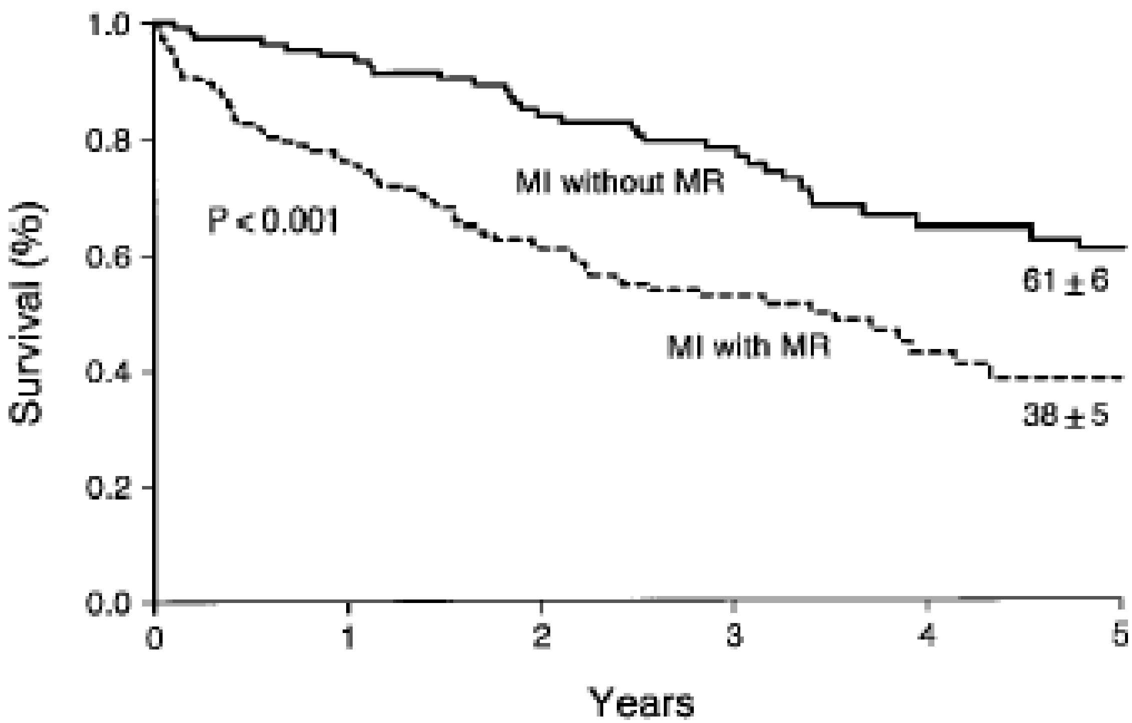
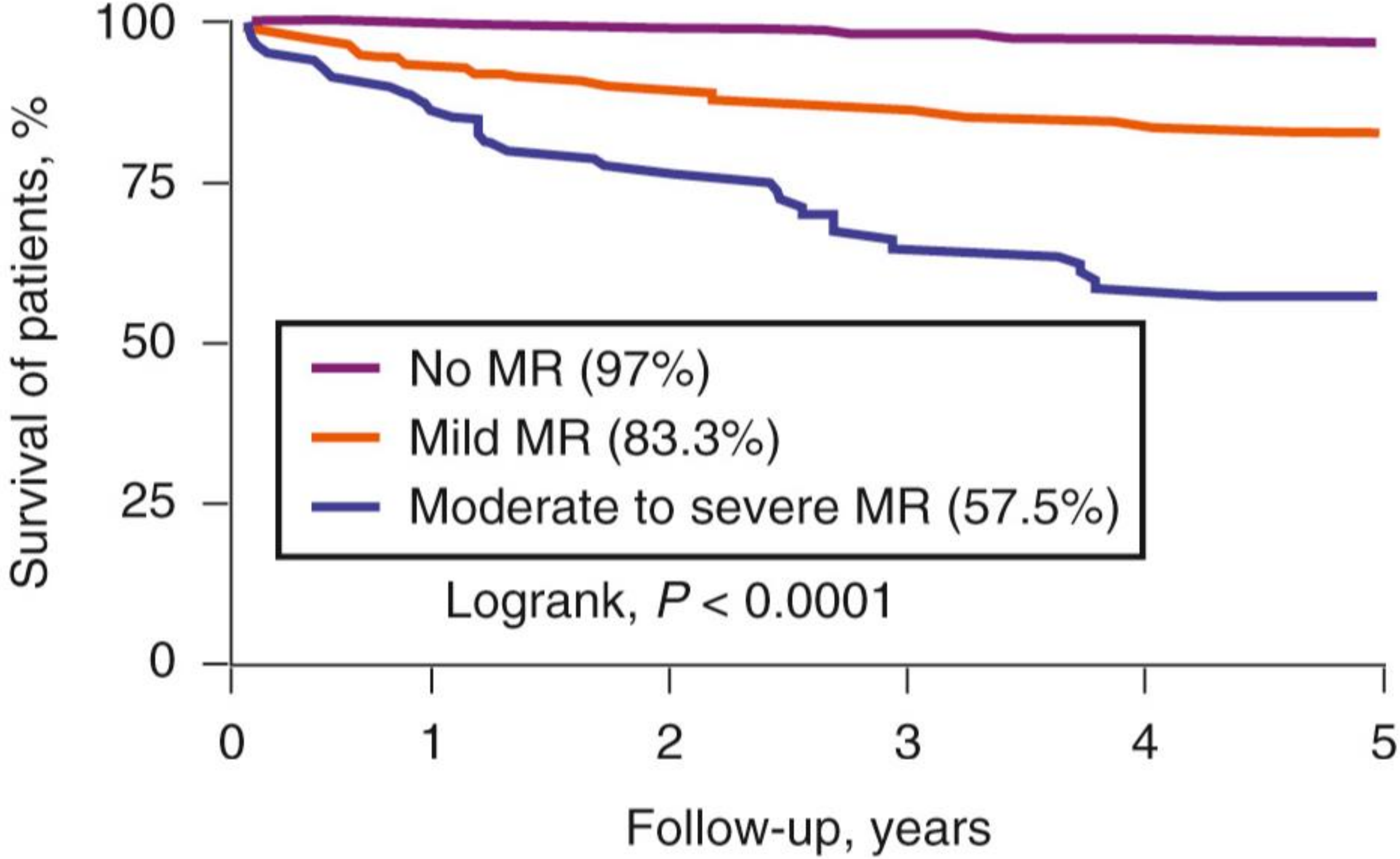


Figure 1. Survival (±SE) after diagnosis according to presence of IMR.

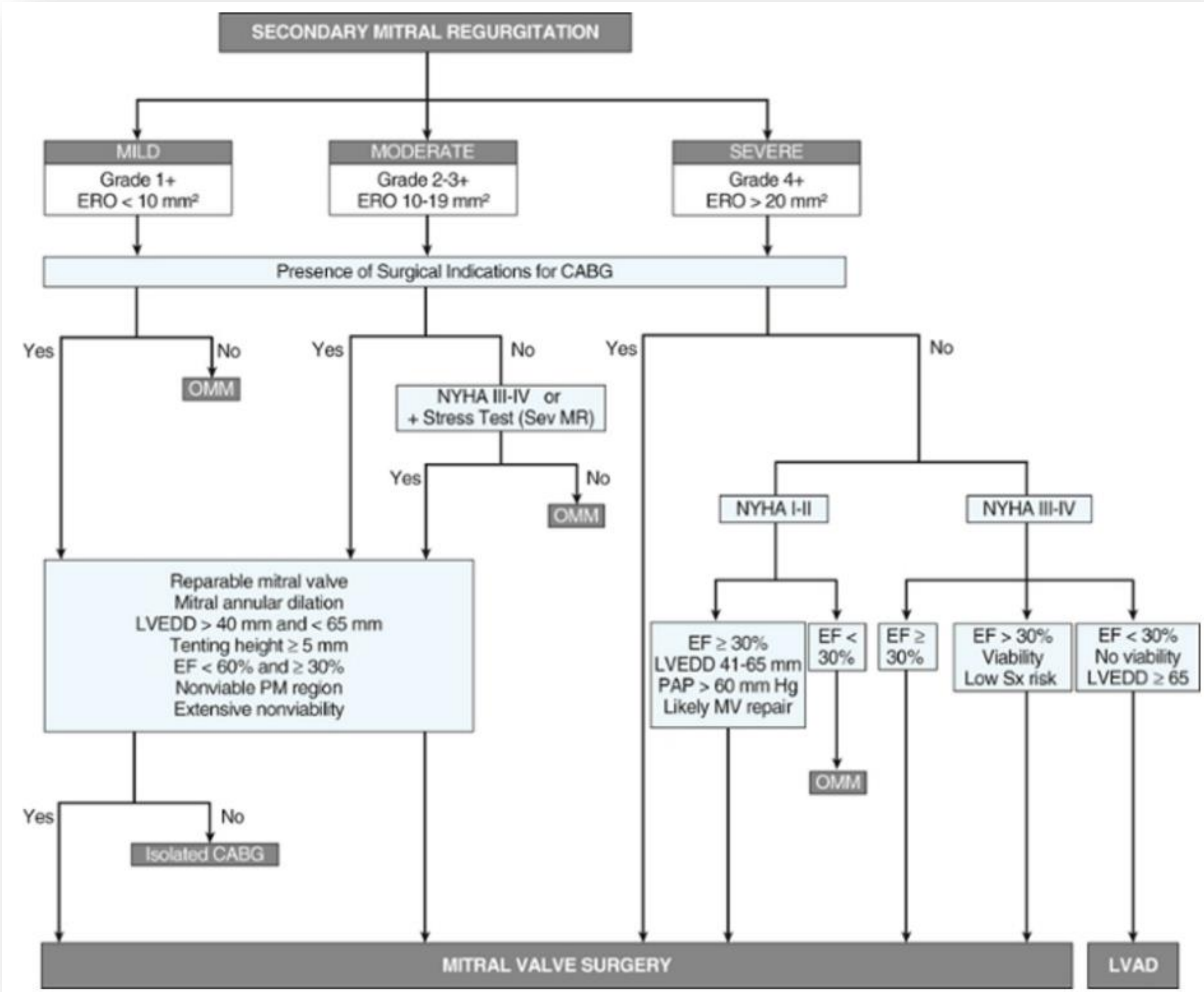
Worsens long term Px, increasing mortality

- Grigioni, Circulation 2001

Survival after PCI



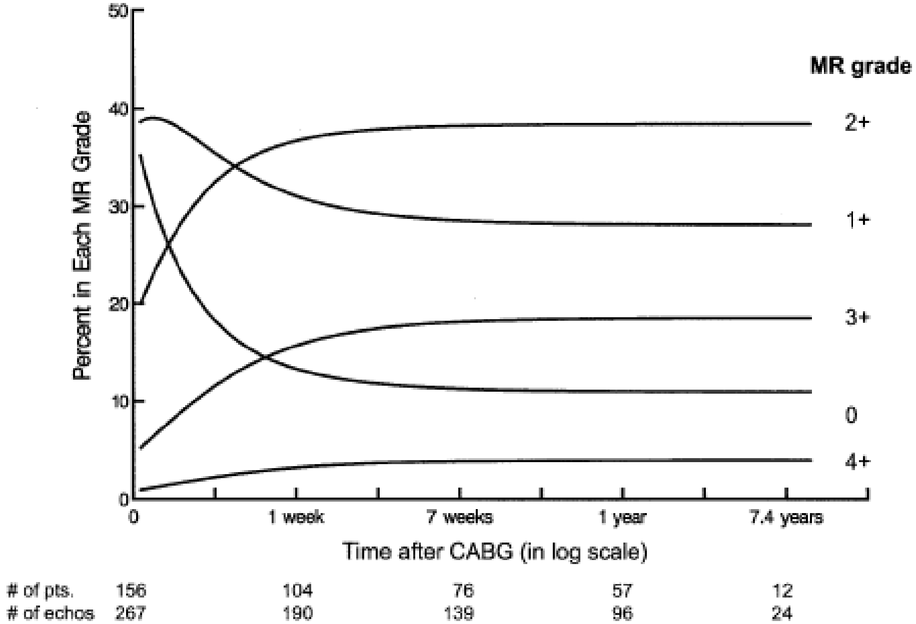
Preoperative Decision Making

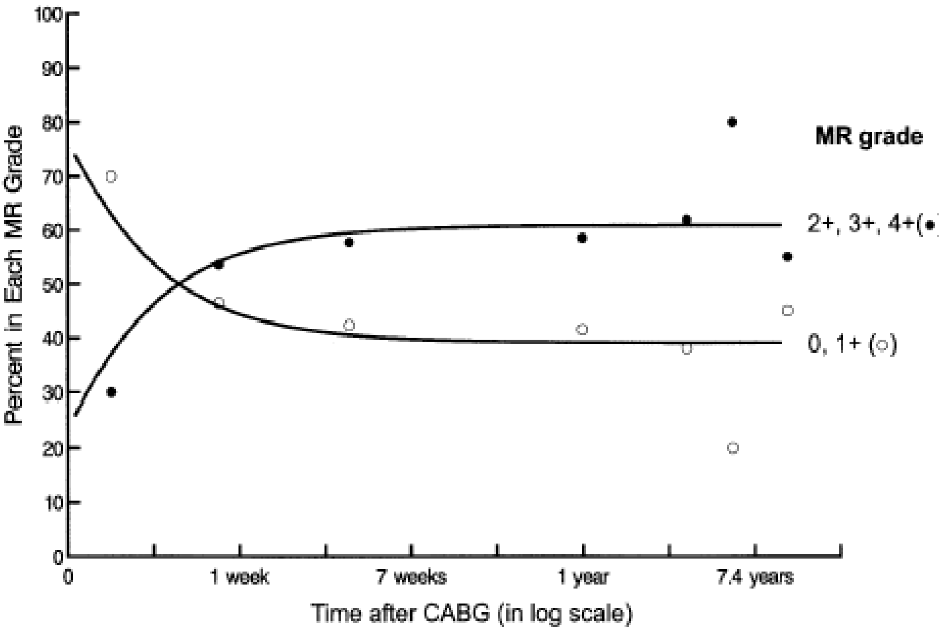


Therapeutic Targets in IMR

- Coronary Artery Disease: CABG
- **Mitral Annulus: Principal target**
- Subvalvular Apparatus
- Leaflets
- Left Ventricle

CABG alone or CABG + MV



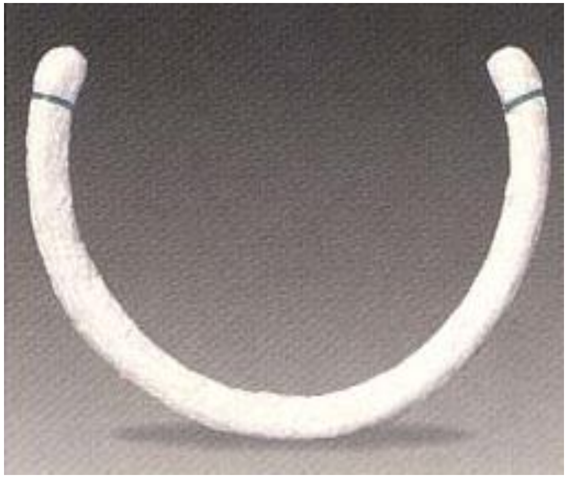


- ***"Treatment of Mitral valve should be considered if the degree is 2+ more ."*** *Lam, Gillinov 2005 ATS*

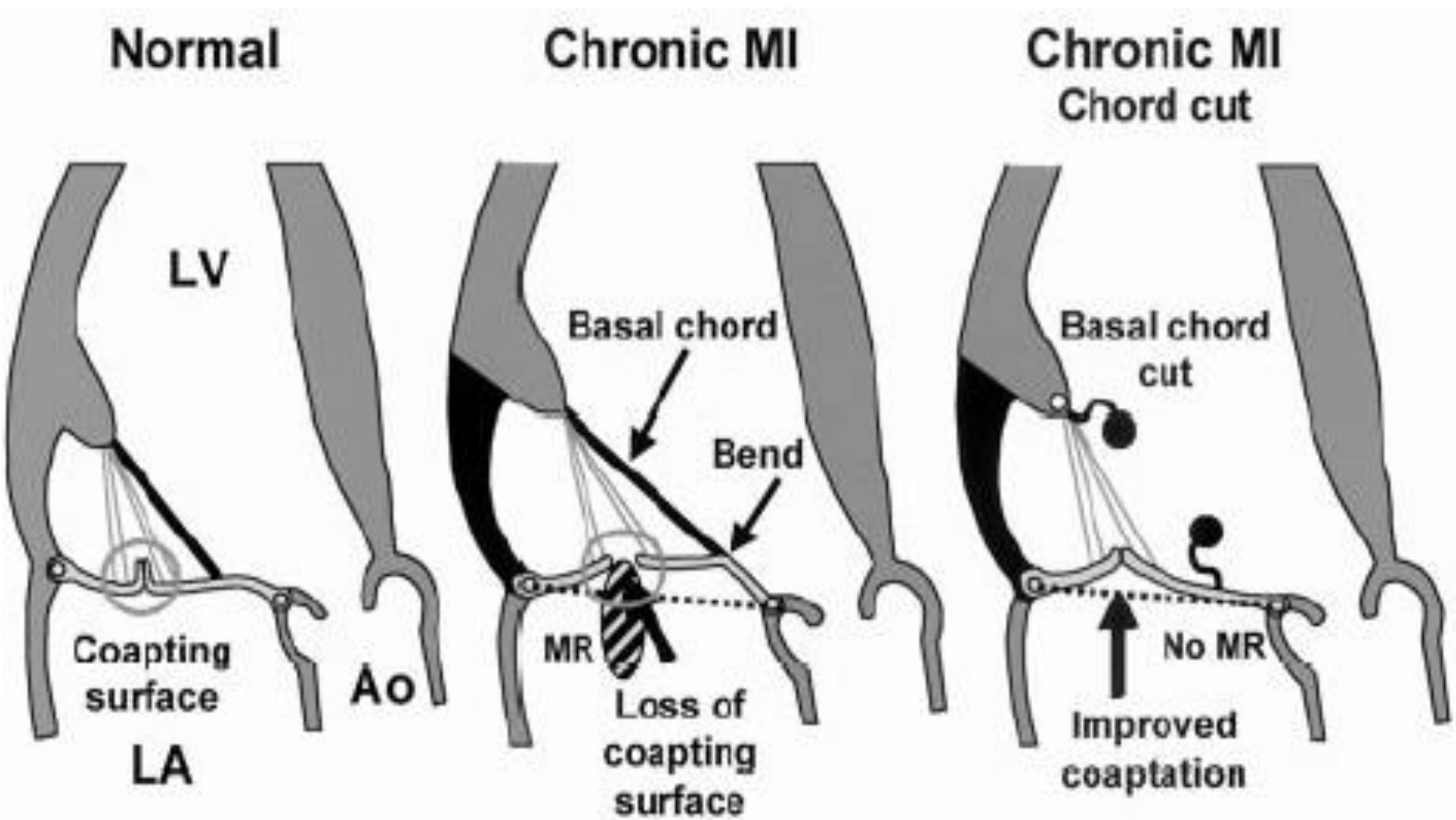
Annulus: Restrictive annuloplasty

- Complete rigid or semirigid rings are preferred
- Incomplete annuloplasty, flexible bands: not reduce the SL dimension

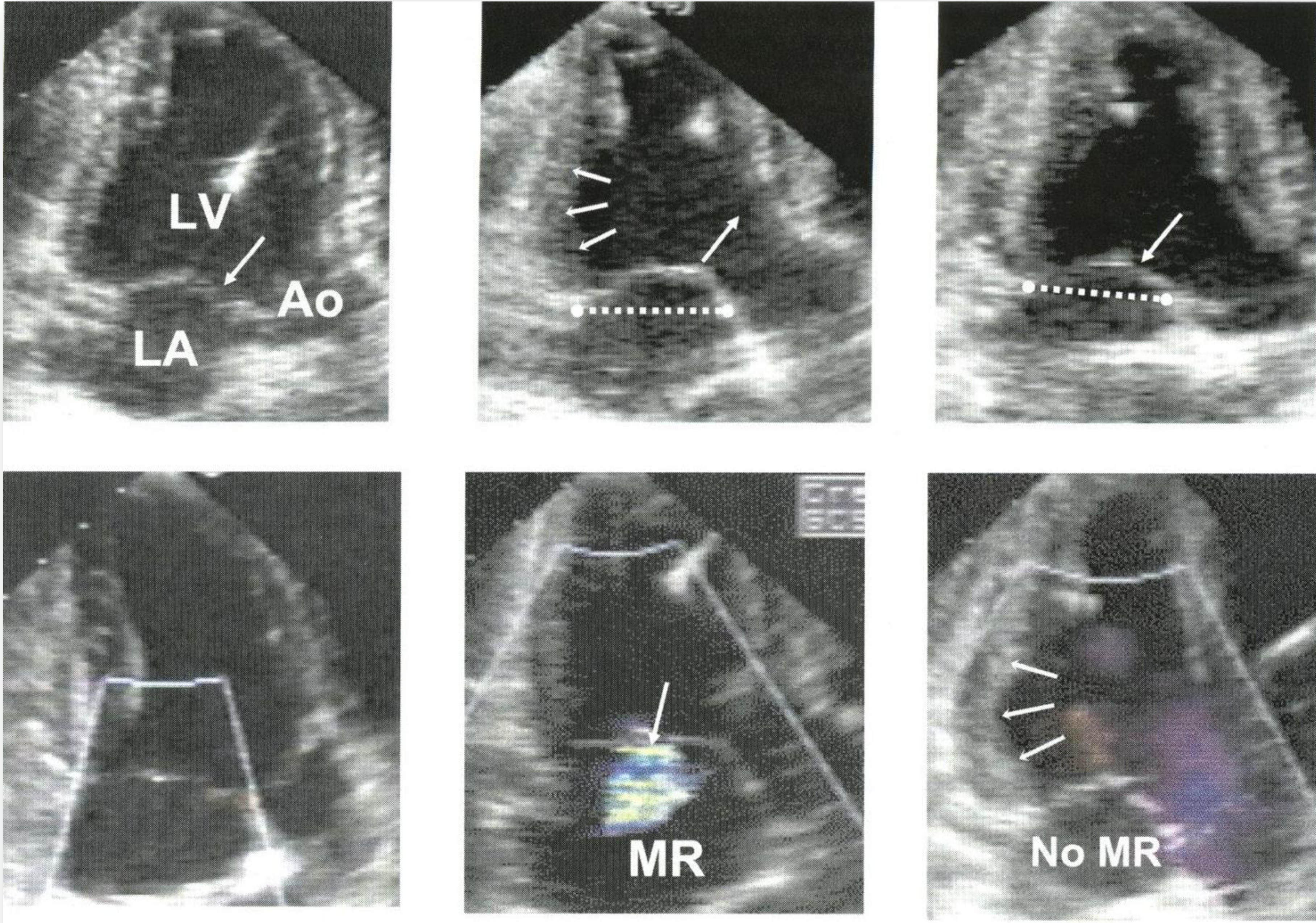
>>



Subvalvular Apparatus; Chordae cutting



Surgical approach to " Tethering " ; Cutting the secondary chordae to the AMVL
Messas Circulation 2003

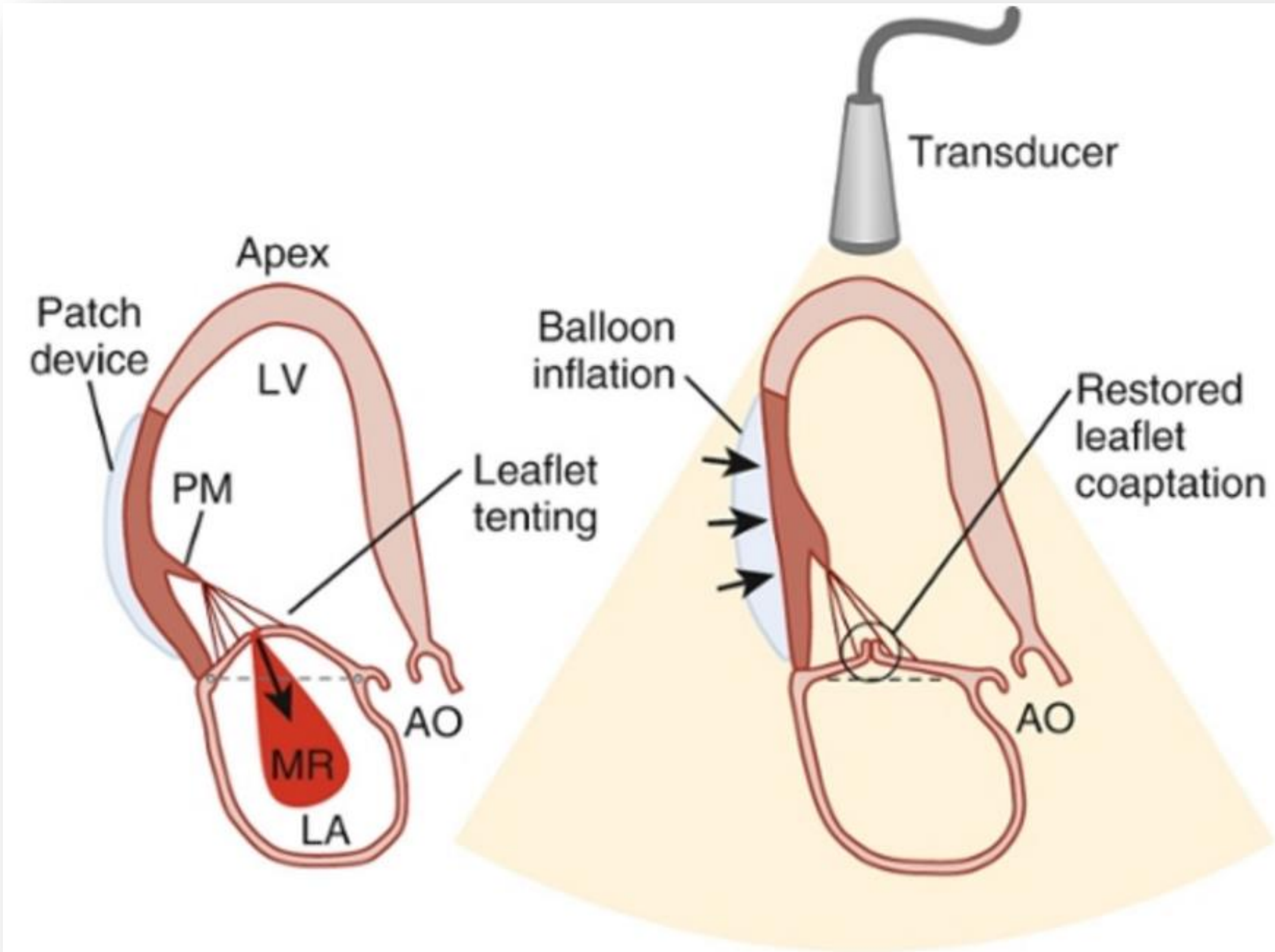


Baseline
Normal

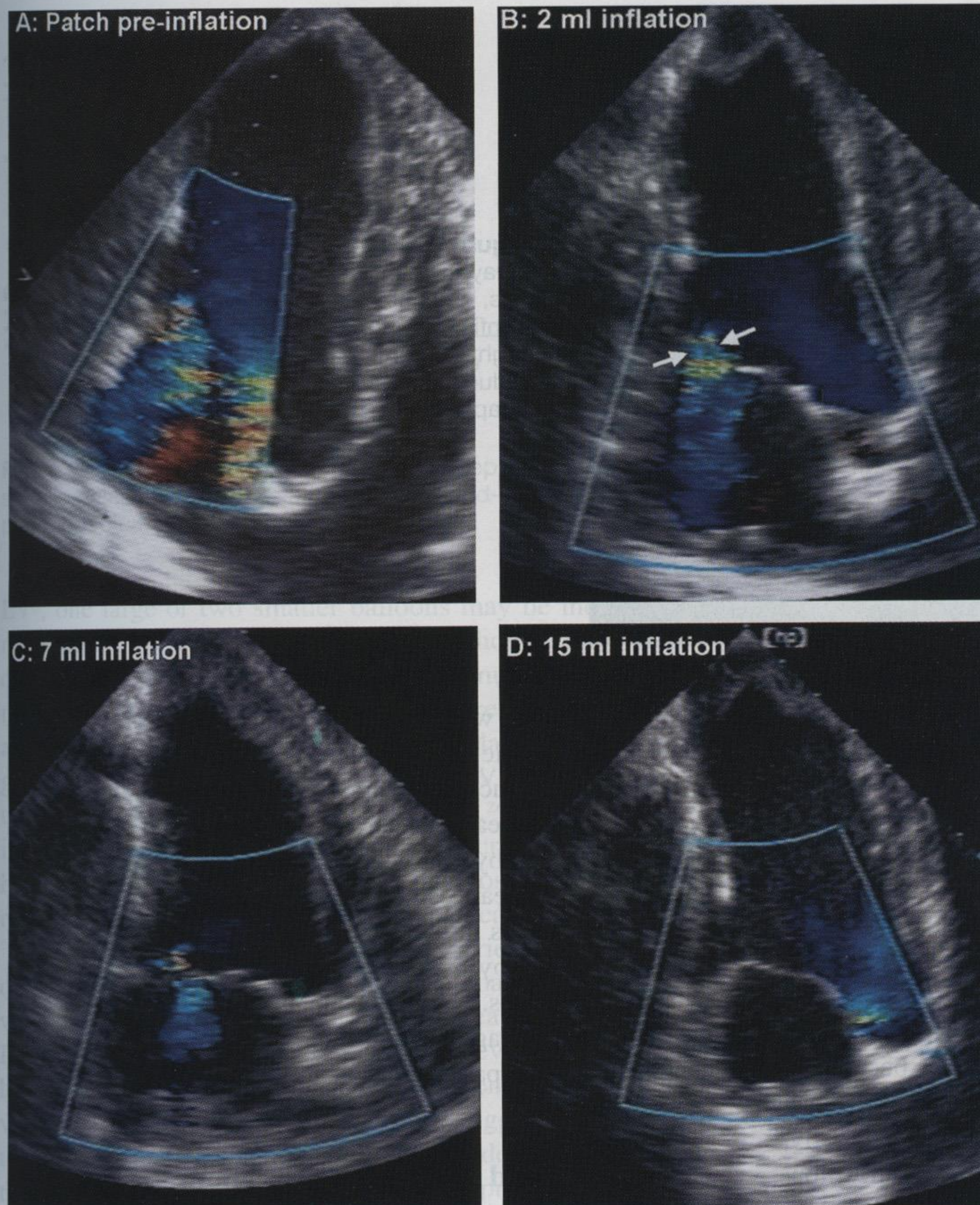
Post-Infarct
PM Displacement

Post-Infarct
Chordal Cutting

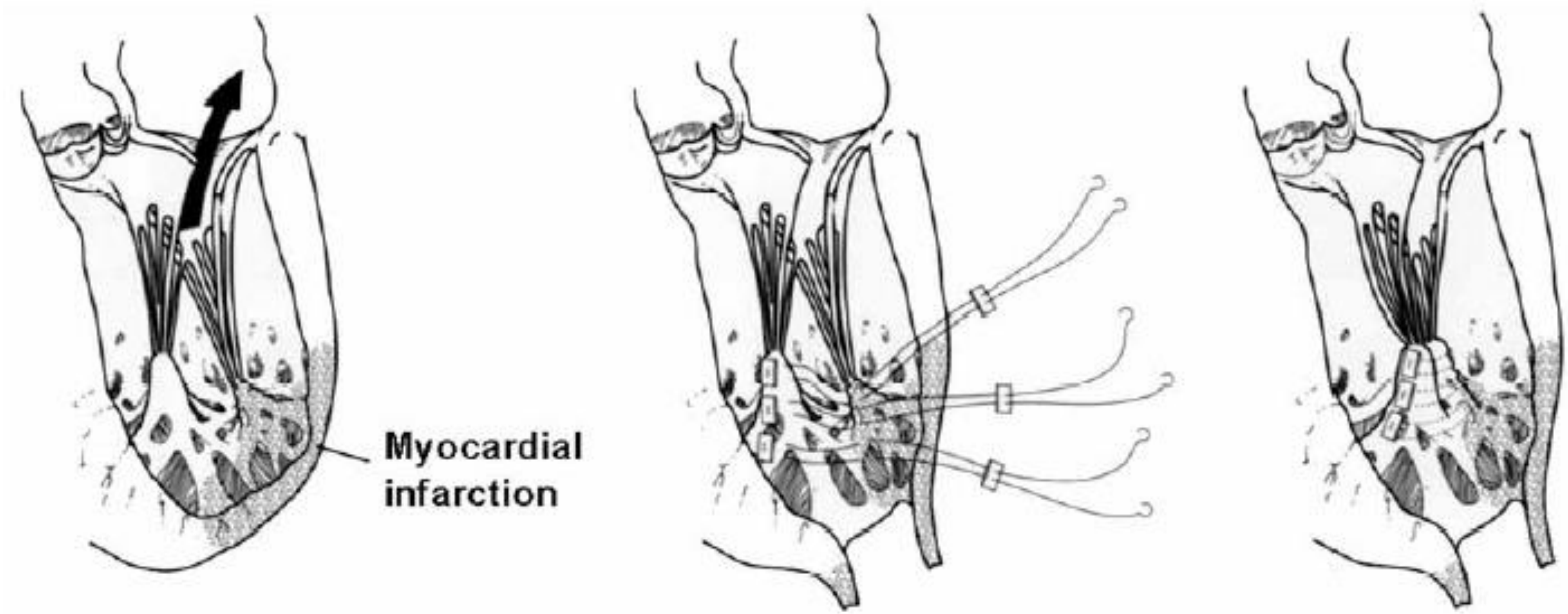
Subvalvular Apparatus; External devices



Hung J, Guerrero, et al, MGH, Circ '02

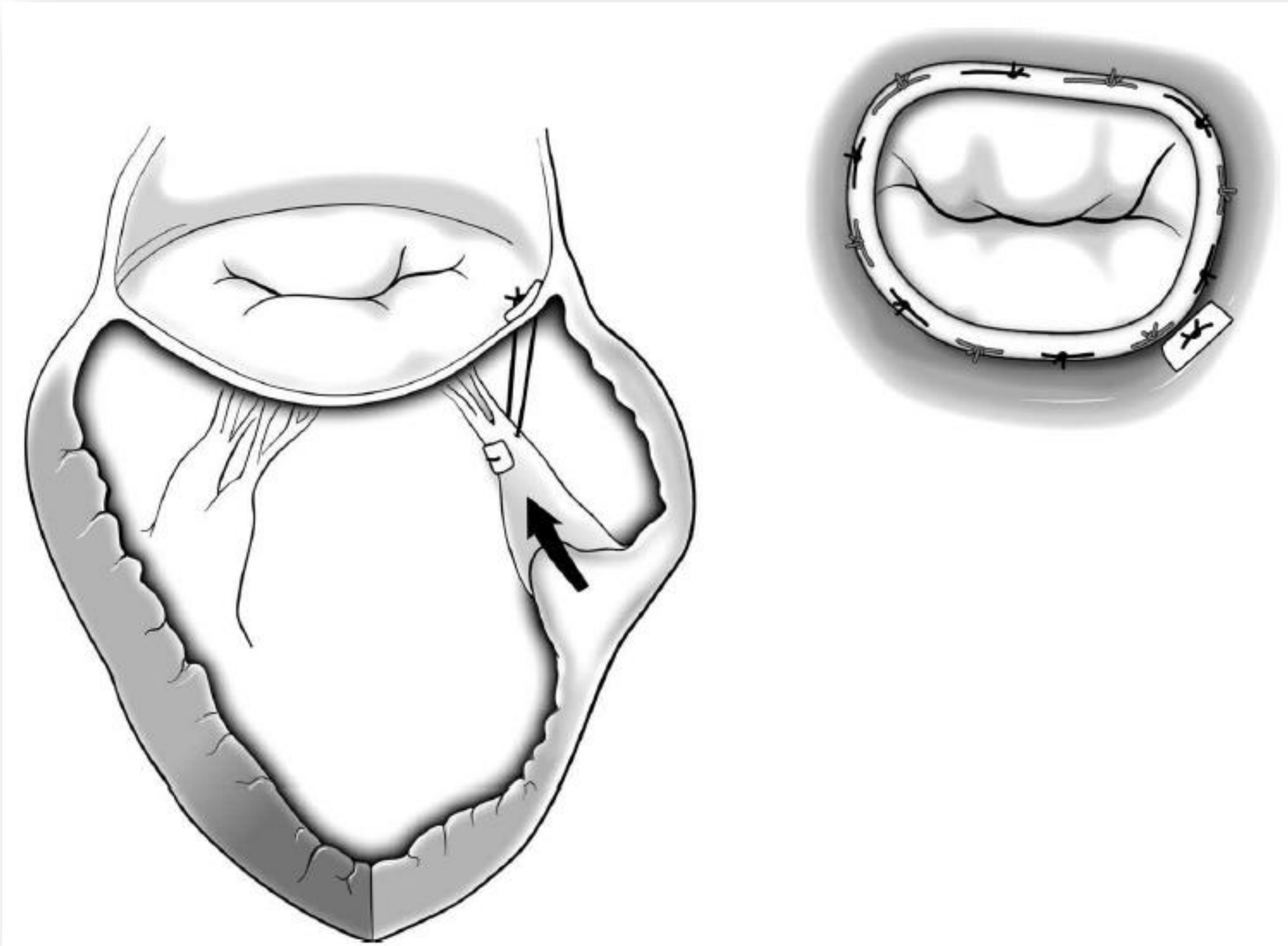

A: Patch pre-inflation
B: 2 ml inflation
C: 7 ml inflation
D: 15 ml inflation

Subvalvular; PM reapproximation



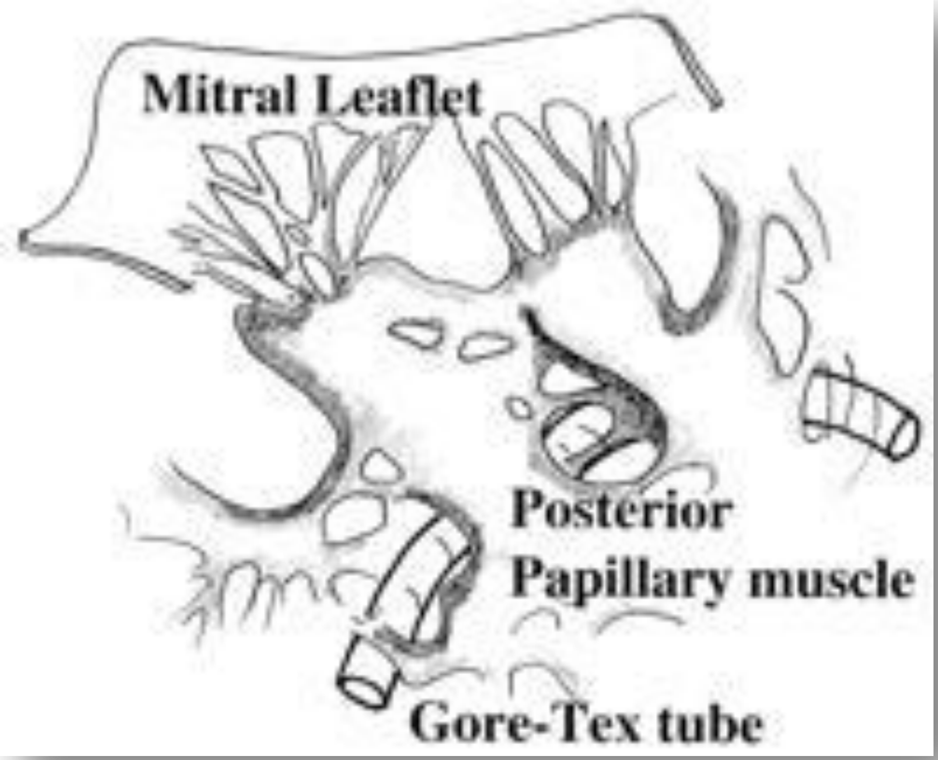
Surgical approach to " Tethering "; APM & PPM reapproximation
Matsui JTCS 2004

Subvalvular; PM Kron-repositioning



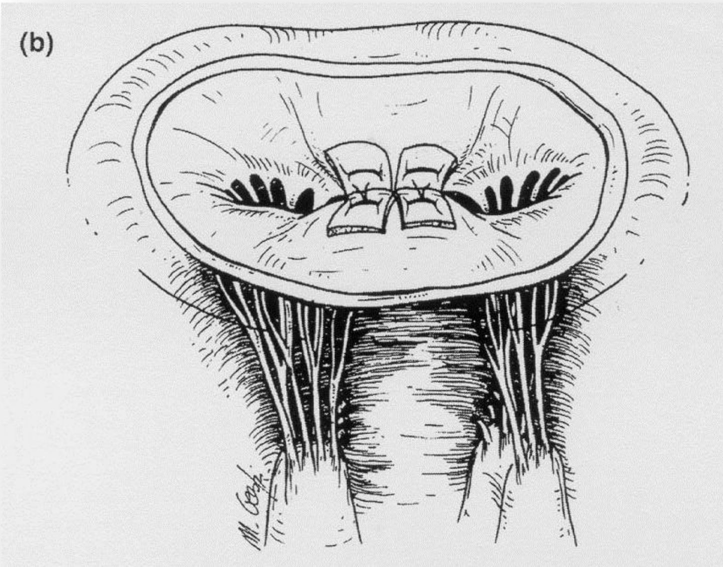
Subvalvular; Papillary Muscle Sling

- Hvass and Joudinaud, Paris.
- Goretex 4mm tube passed around both PM and approximated
- 37 pts since 2000
- 2 op deaths
- LVEDD 70 -> 56 at 1 yr
- EF 30-> 49



J Thorac Cardiovasc Surg 2010;139:418-23

Leaflets; Edge-to-edge



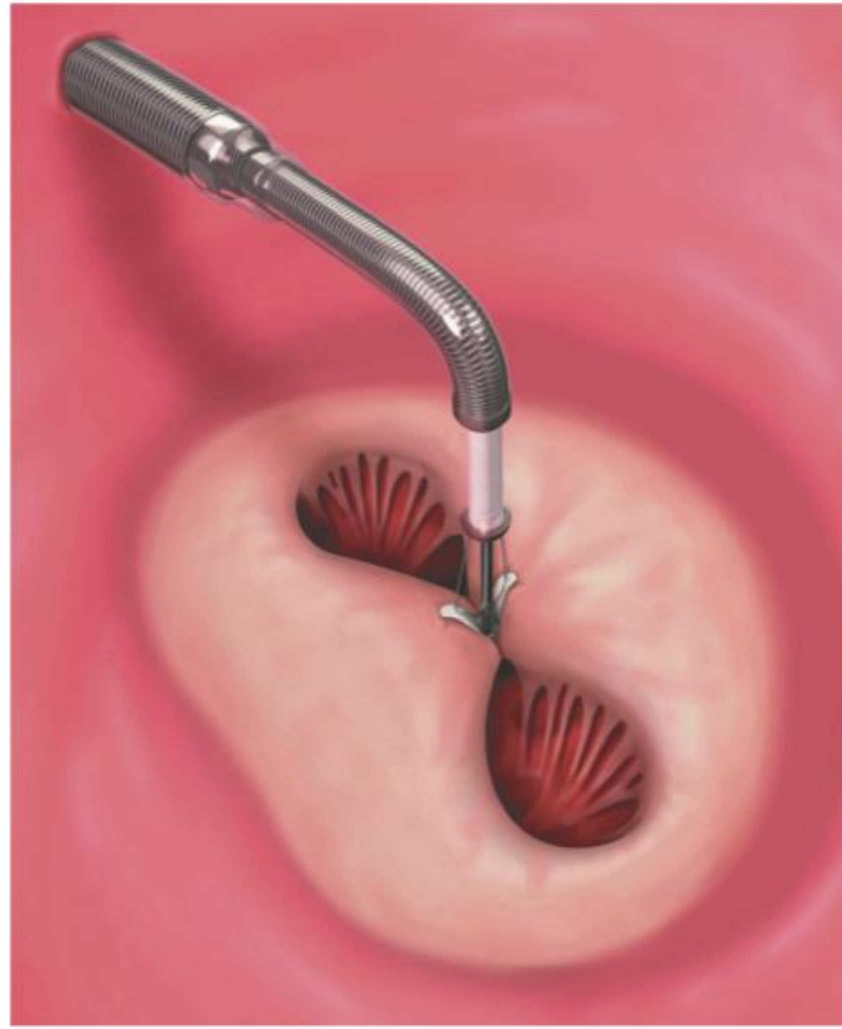
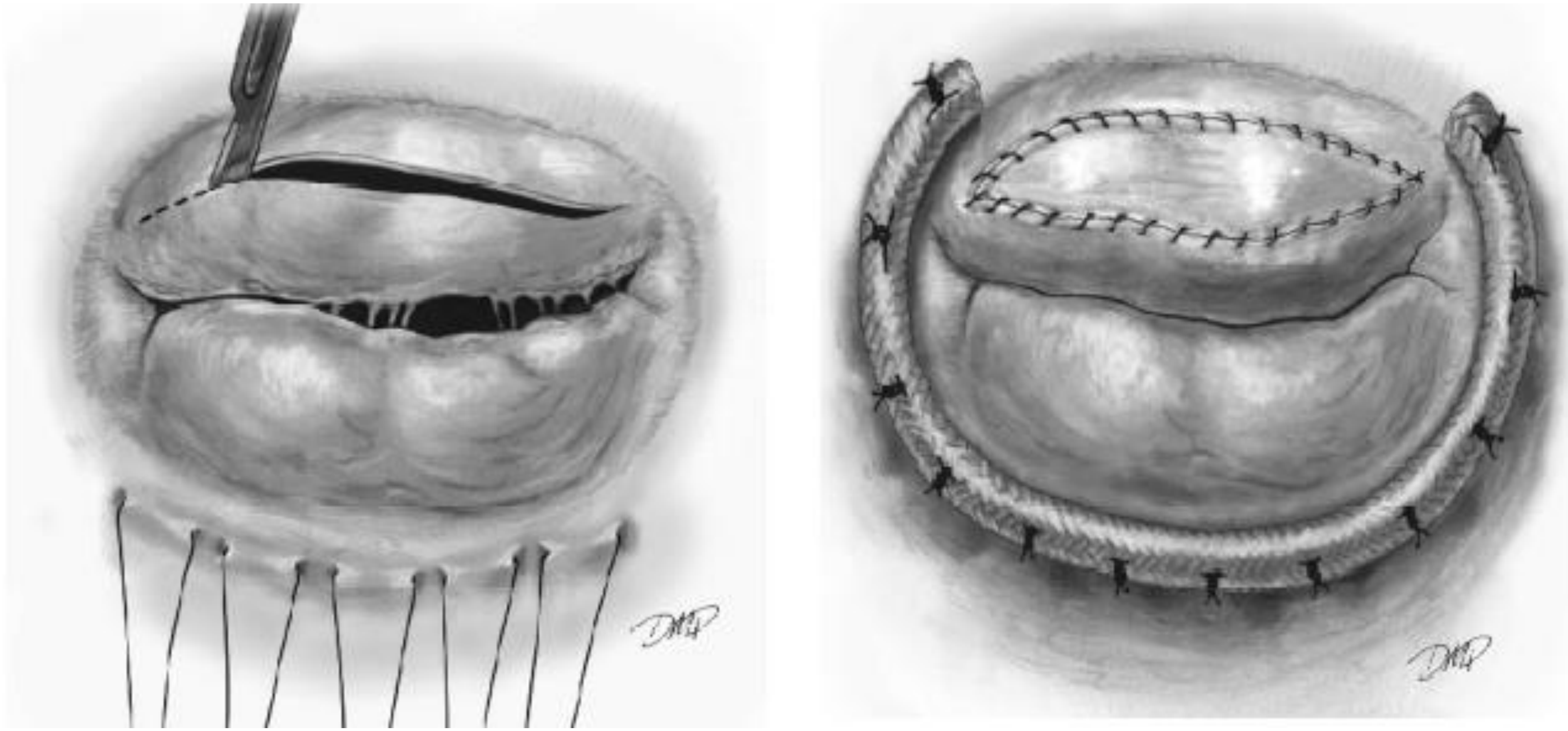


Figure 2. An atrial view of the MitraClip device (Abbott Vascular) grasping both leaflets of the mitral valve.

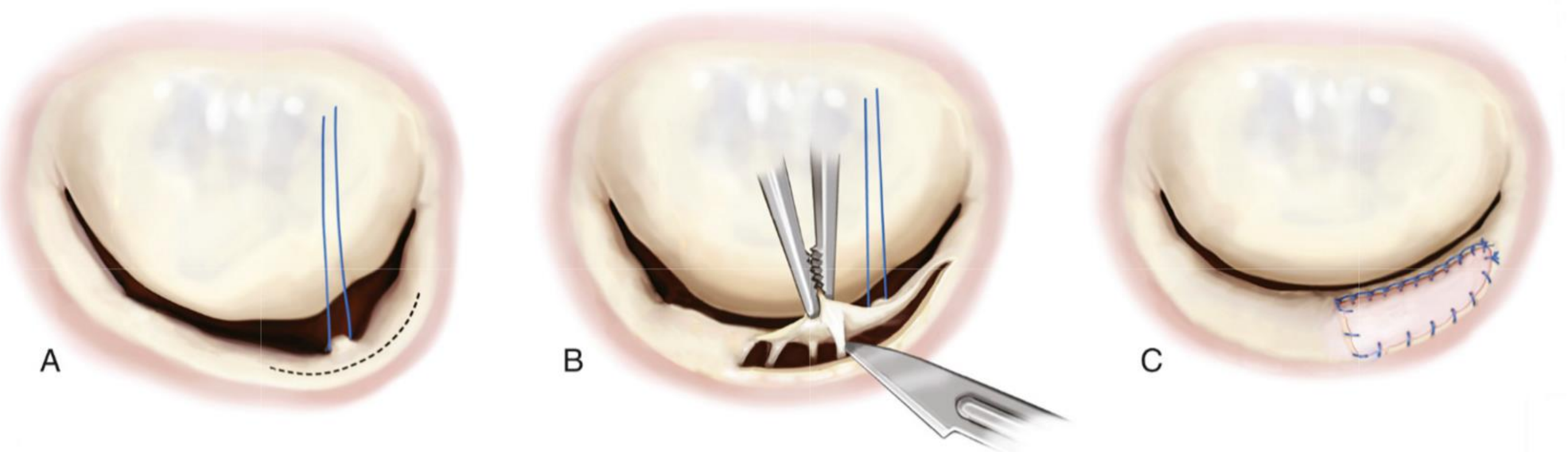
Leaflets; AMVL augmentation



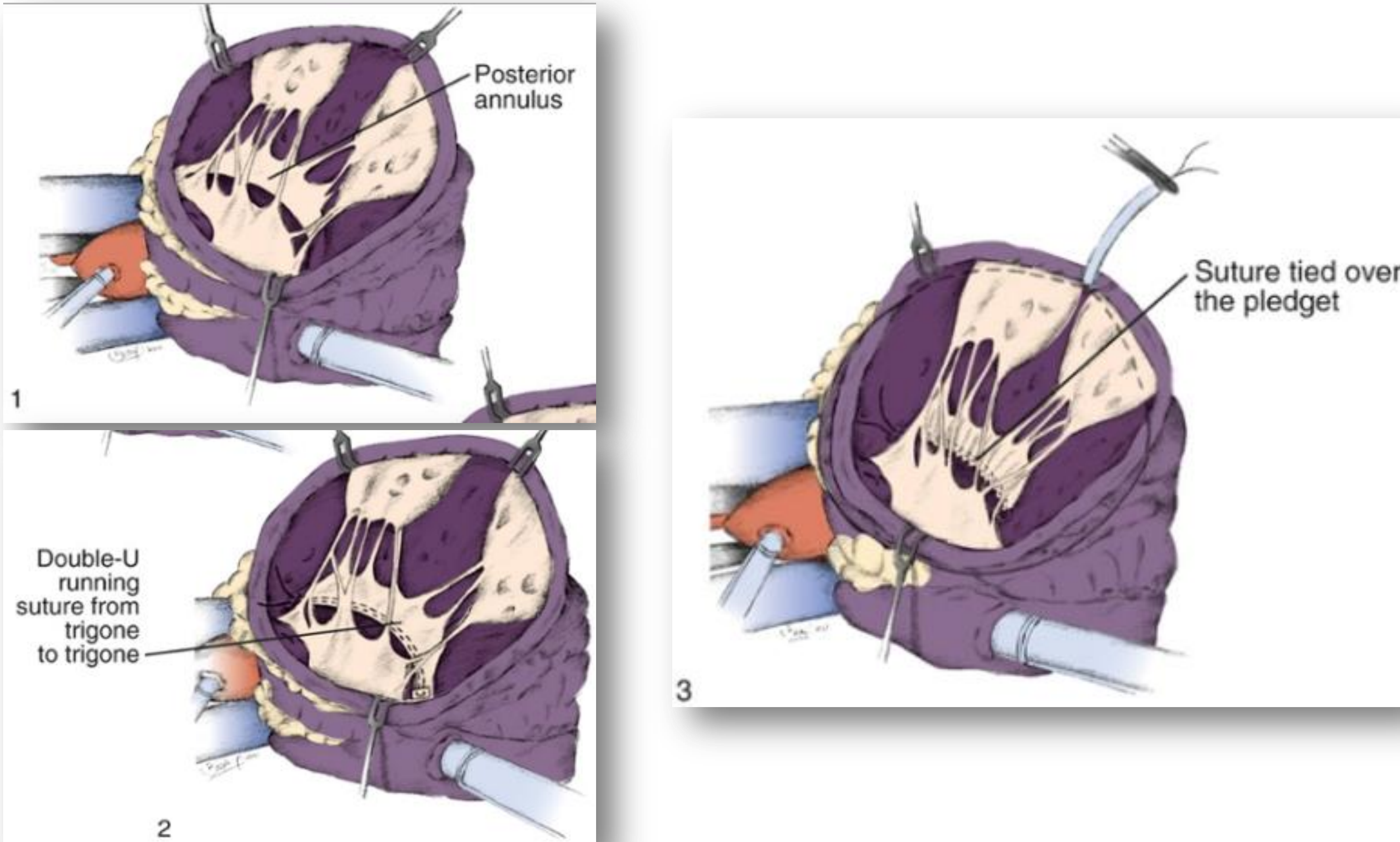
AMVL augmentation (bovine pericardium)

Kincaid ATS 2004

Leaflets; PMVL augmentation

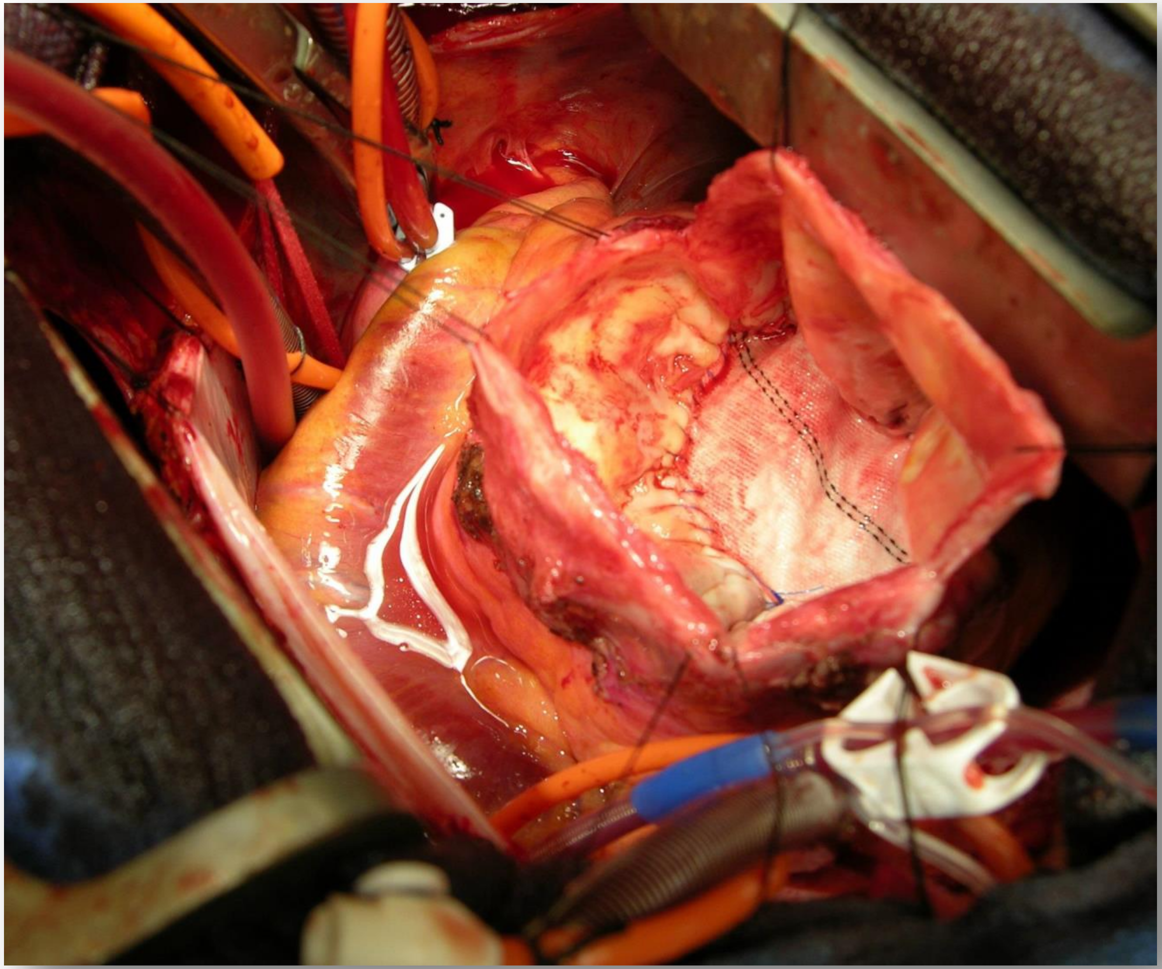


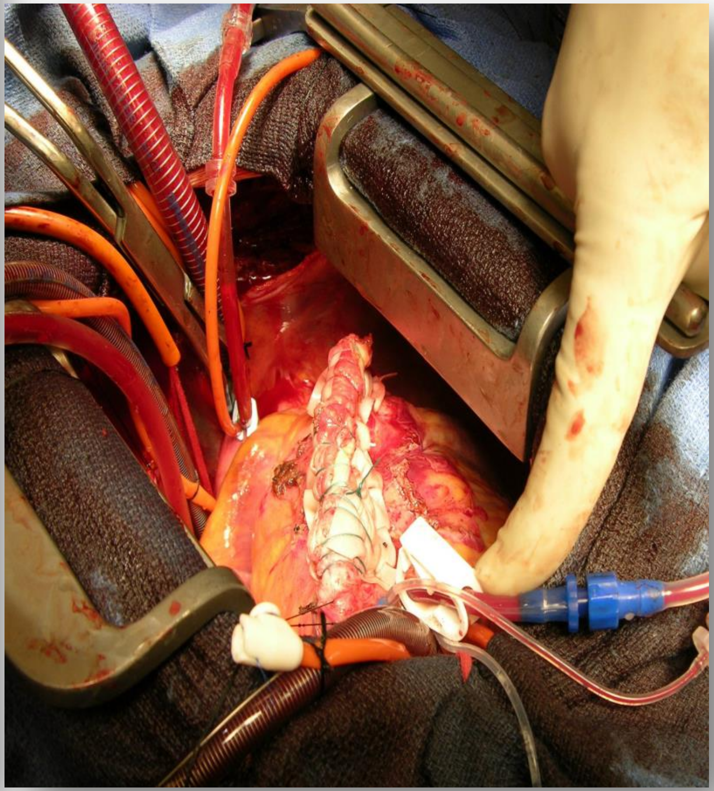
Left Ventricle; Menicanti's



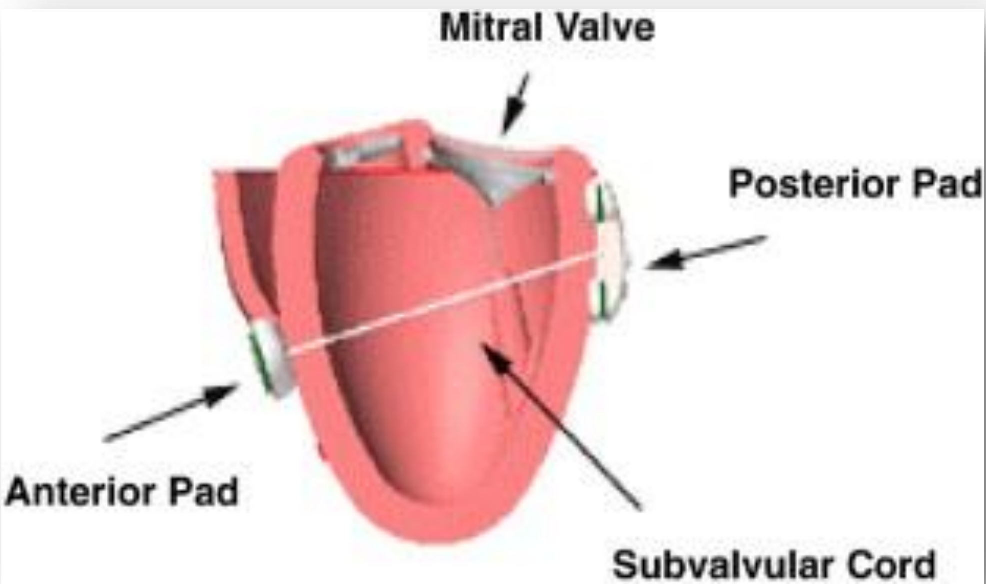
MVP with Intraventricular papillary muscle imbrication, Heart Fail Review 2004

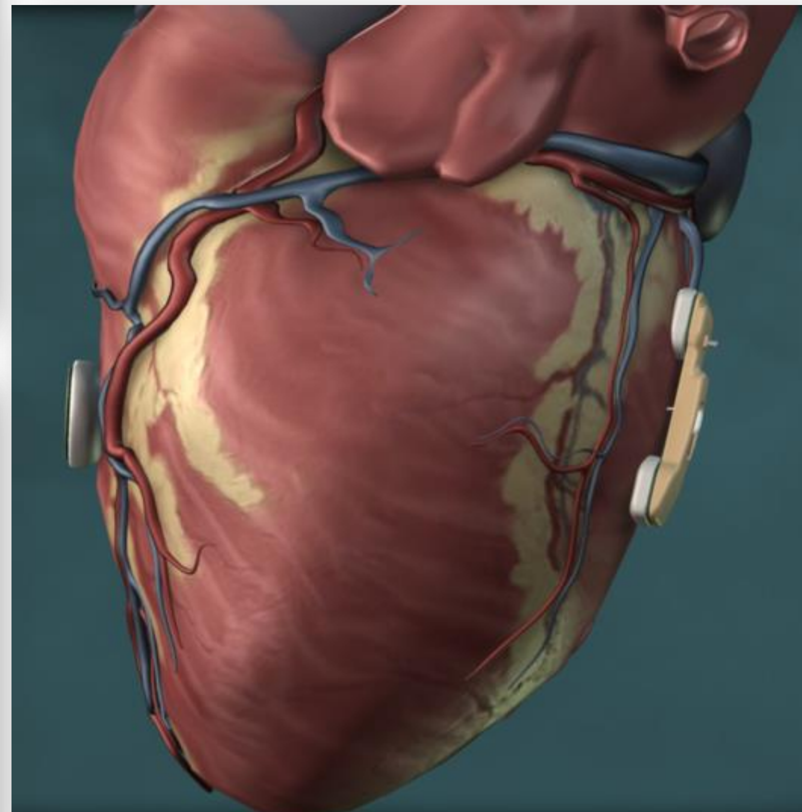
Left Ventricle; Dor operation





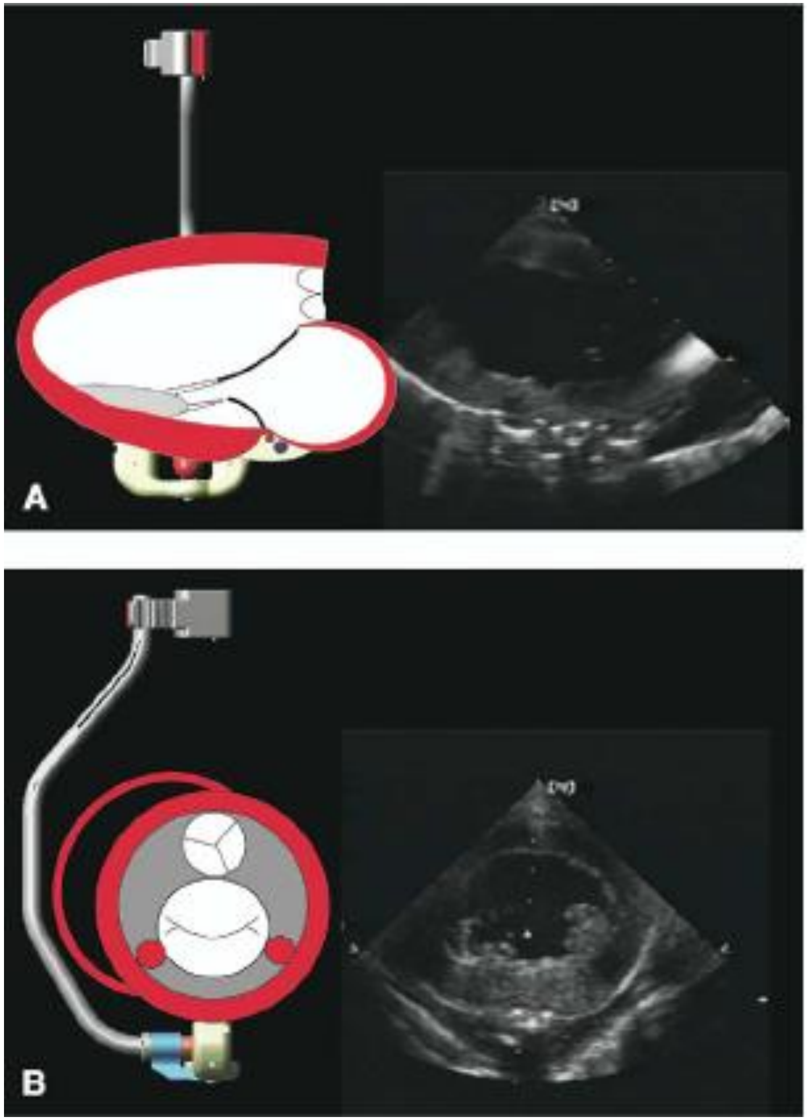
Left Ventricle: Coapsys

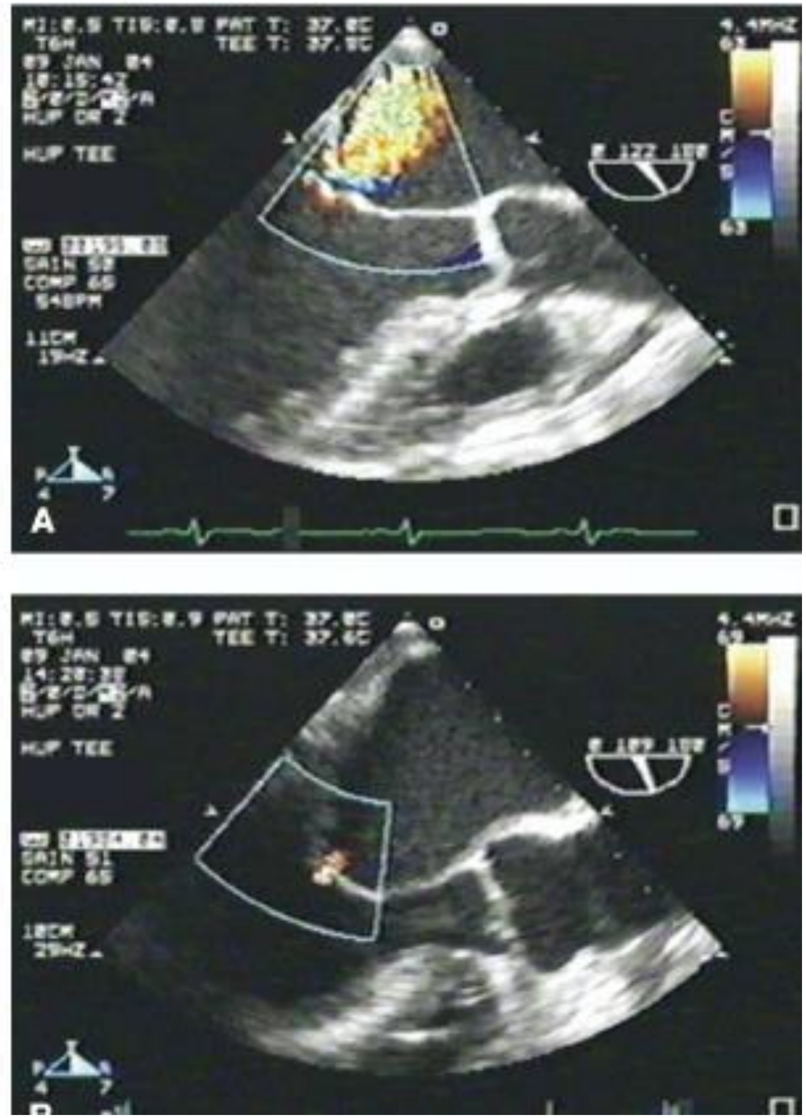




Grossi, RESTOR-MV, JACC'2010

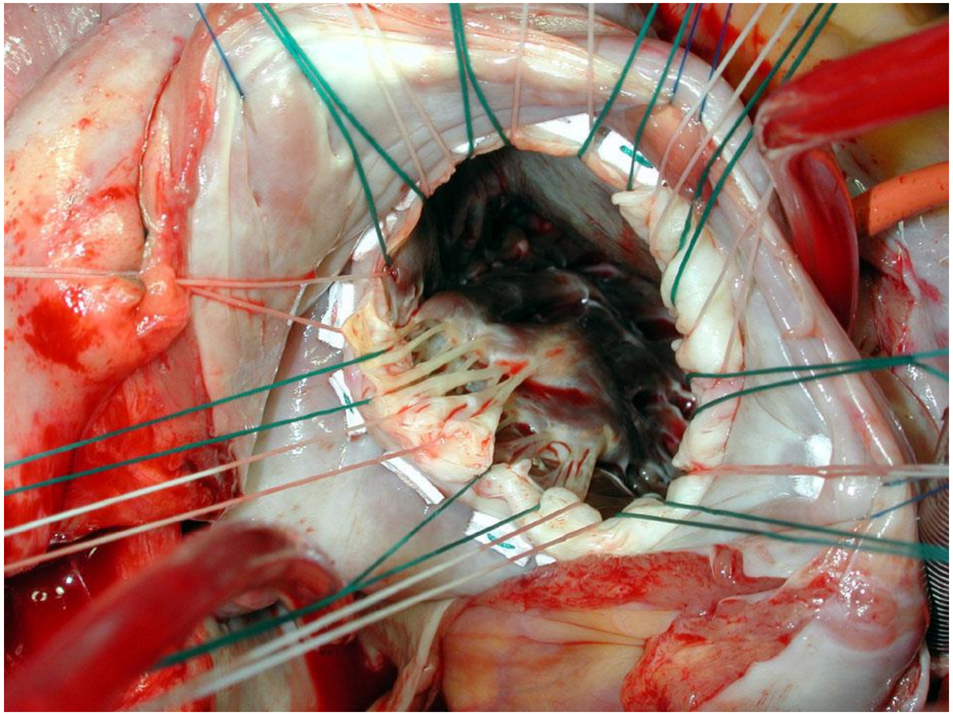
Left Ventricle: Coapsys

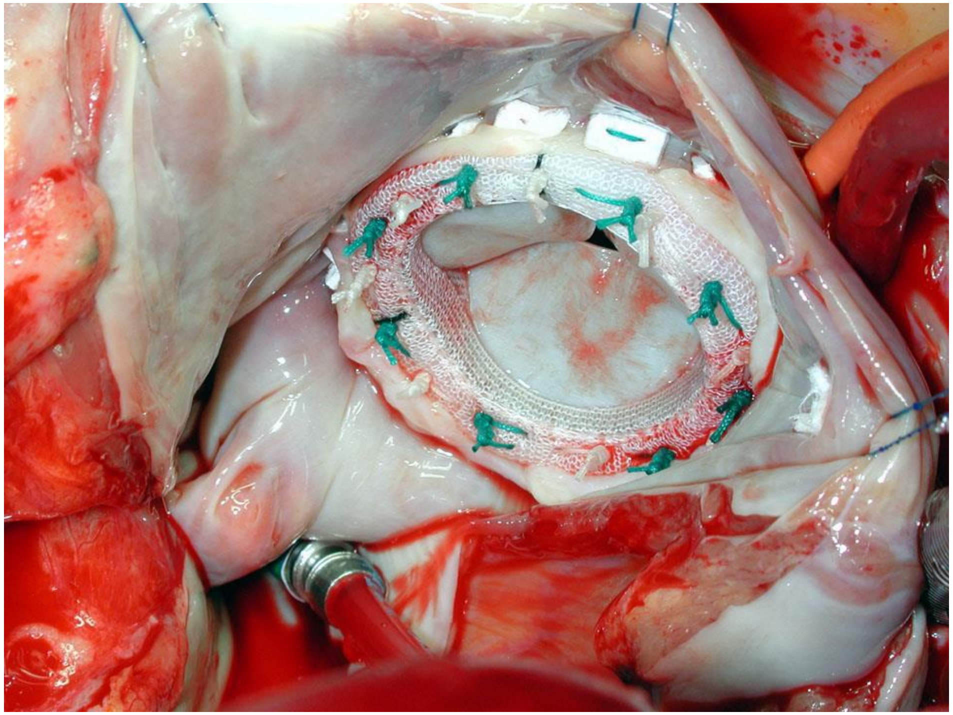




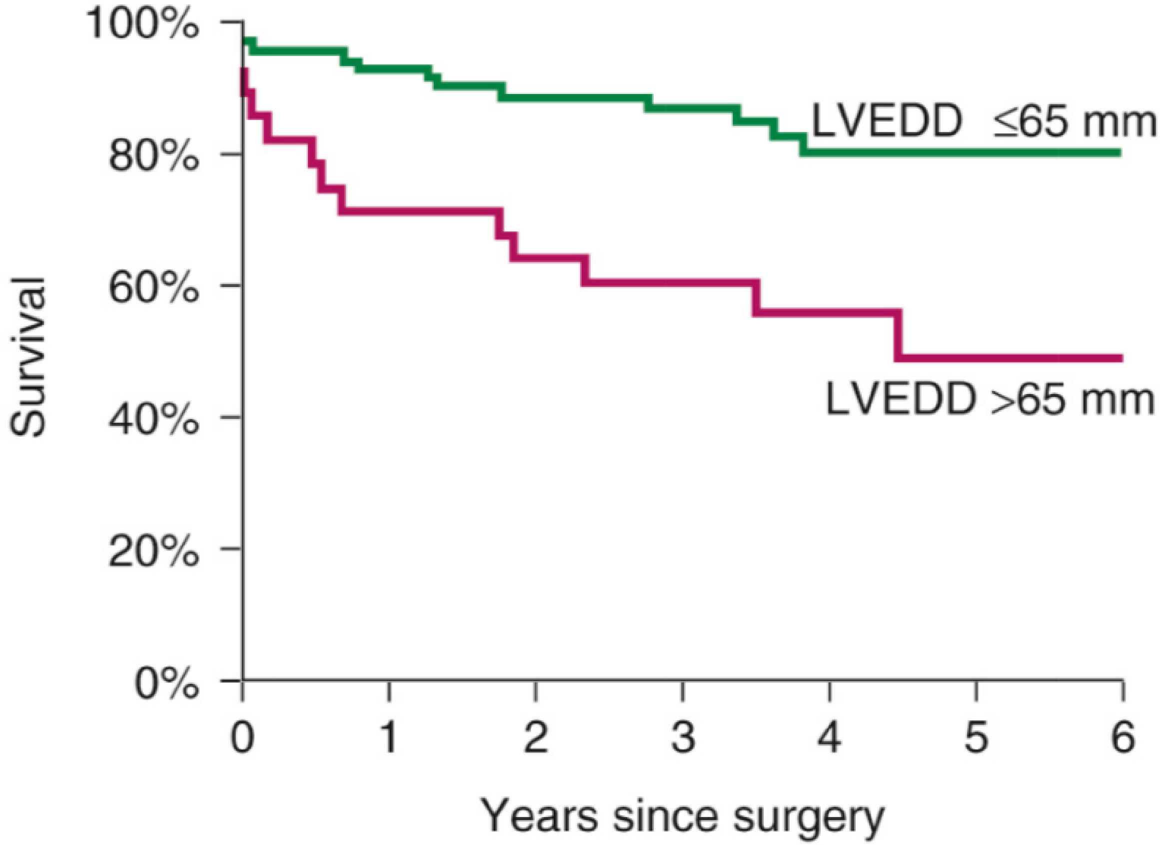
Grossi, RESTOR-MV, JACC'2010

Chordal Sparing Replacement





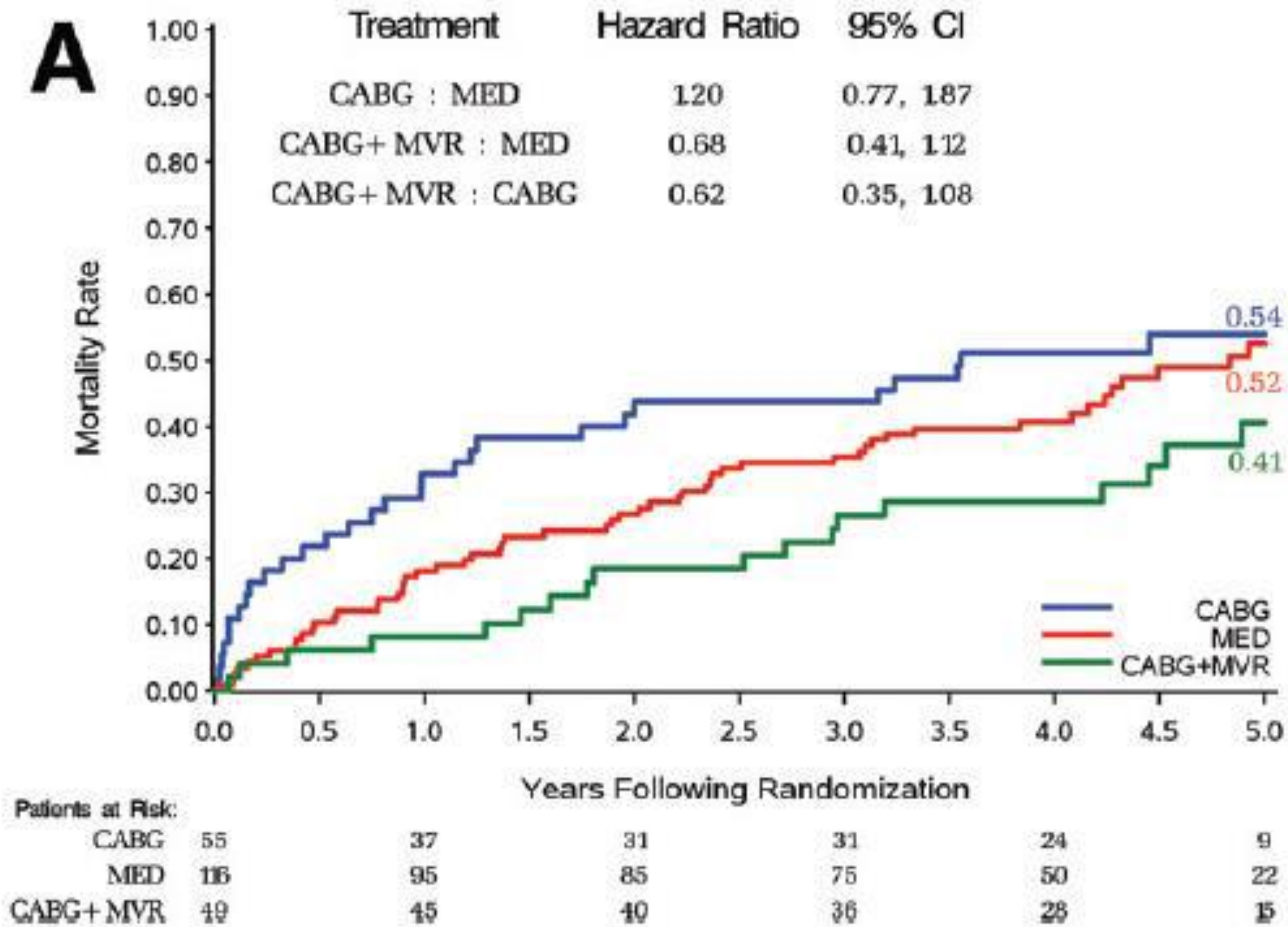
Annuloplasty: preoperative LVEDD



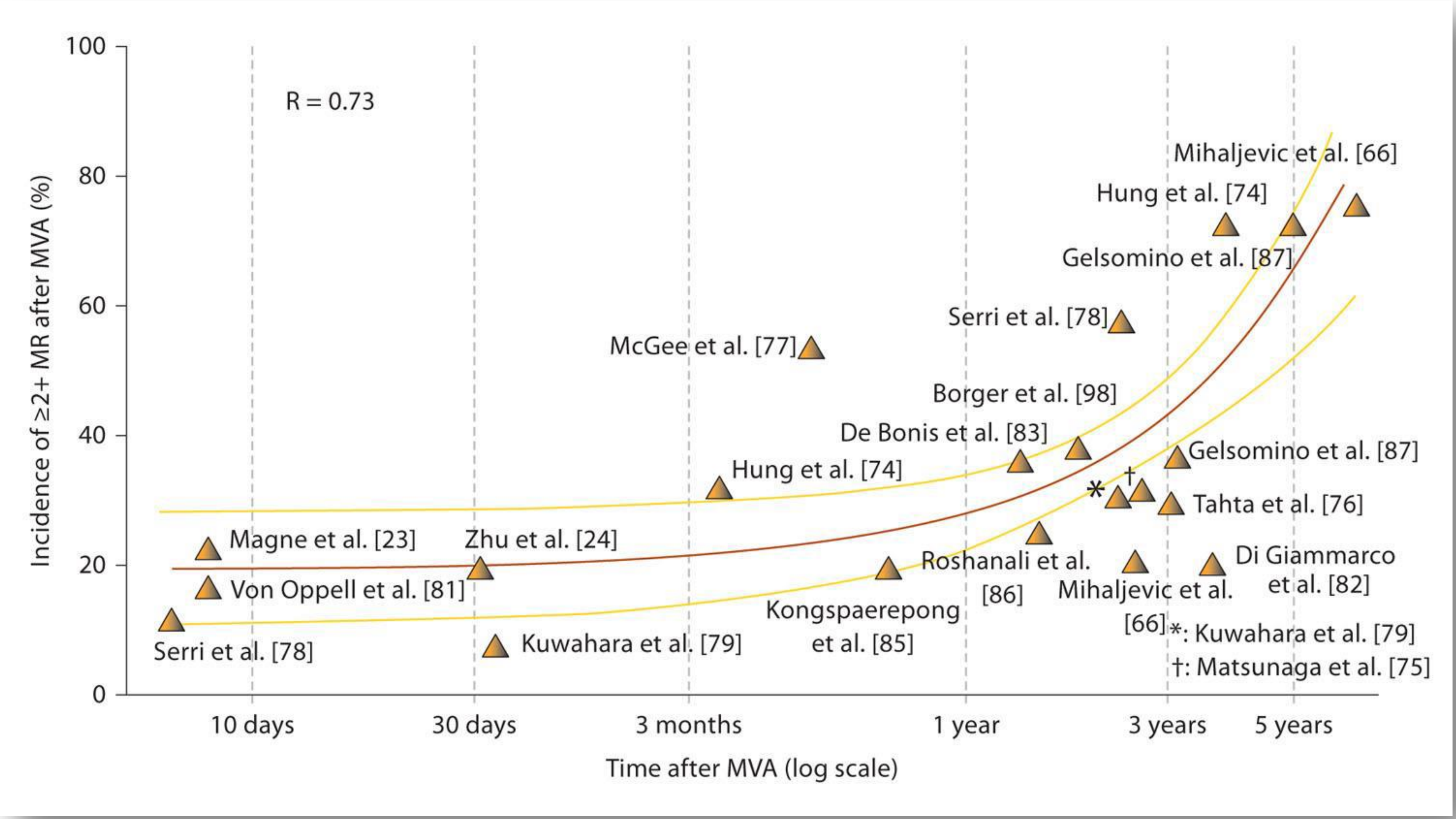
Patients at risk							
LVEDD ≤65	72	67	64	46	31	21	8
LVEDD >65	28	20	18	14	9	6	3

STICH: 3-4+ IMR: Trend towards CABG alone worse than Med Rx, worse than CABG + MV Repair

Circulation. 2012;125:2639-2648



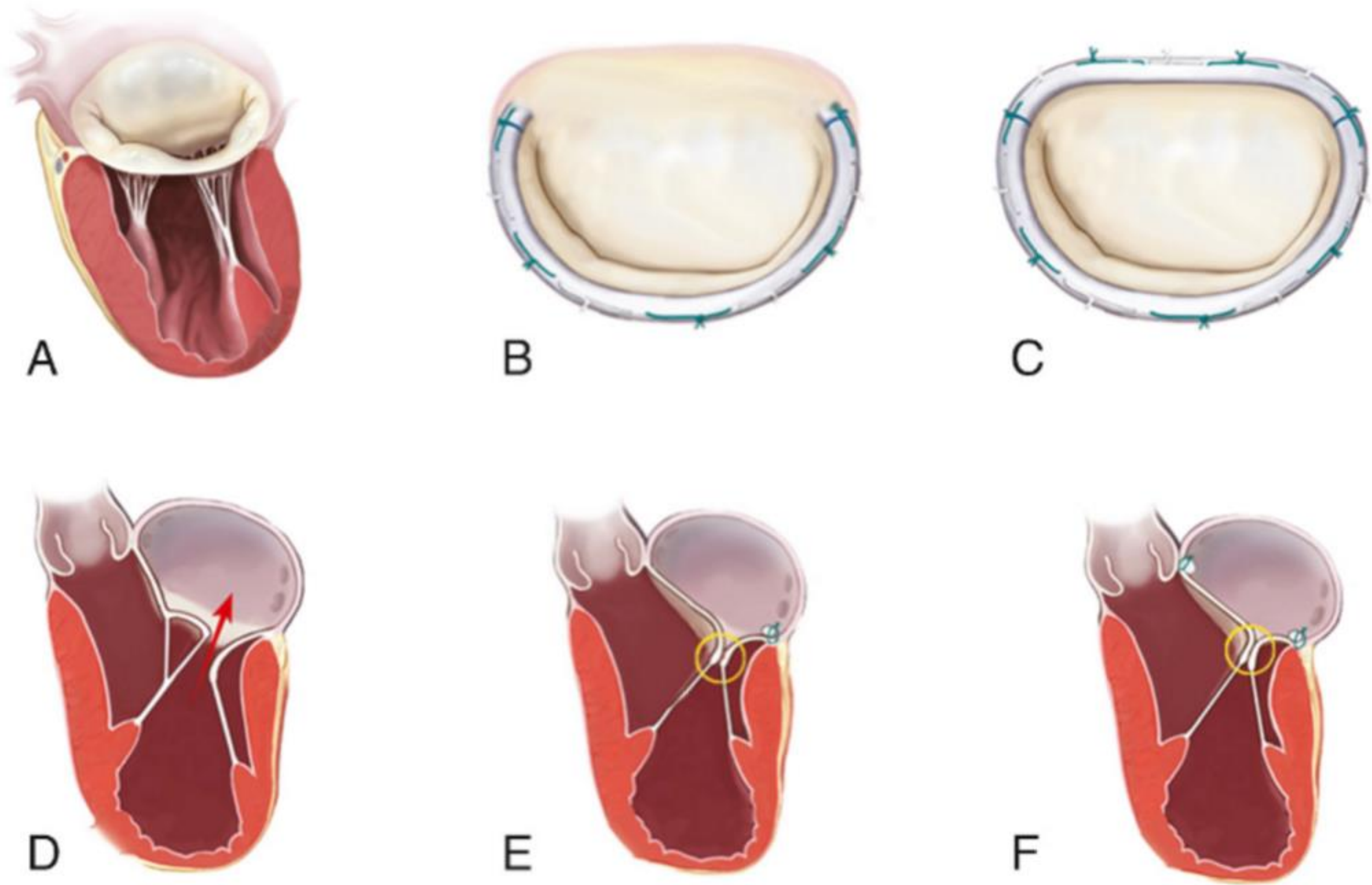
MR > 2+ After Annuloplasty



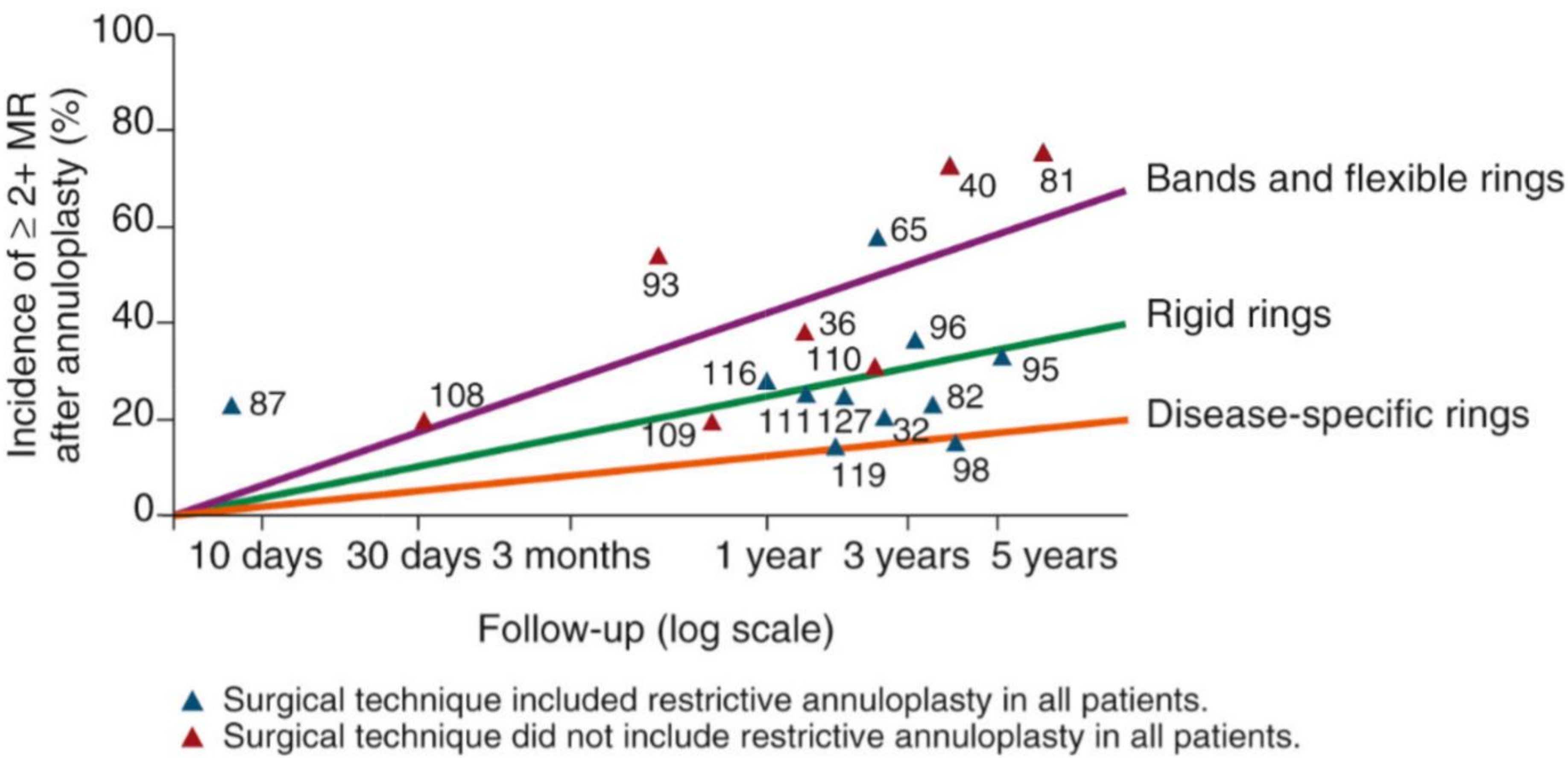
Magne: Cardiology 2009;112:244–259

Possible Mechanisms of Residual MR

Length of the coaptation zone >8 mm



Ring type and Residual MR



Predictors of Recurrent MR after Annuloplasty for IMR

- TTE- Indicators of Severe Mitral Valve Tenting
  - Systolic tenting area ≥ 2.5 cm^2
  - Systolic tenting height ≥ 10 mm
  - Posterior mitral leaflet angle ≥ 54 degrees
  - Distal anterior mitral leaflet angle ≥ 19 degrees
  - Posterior mitral leaflet angle ≥ 45 degrees
  - Anterior mitral leaflet tethering angle ≥ 39.5 degrees
  - MR jet direction: central or complex

Predictors of Recurrent MR after Annuloplasty for IMR

- TTE- Indicators of Advanced LV Remodeling
  - LVESD > 51 mm, LVEDD > 65 mm, LVESV ≥ 145 mL
  - Interpapillary muscle distance > 20 mm
  - Systolic sphericity index ≥ 0.7
- TTE other:
  - Myocardial performance index ≥ 0.9
  - Wall motion score index ≥ 1.5
  - Diastolic LV function: restrictive filling

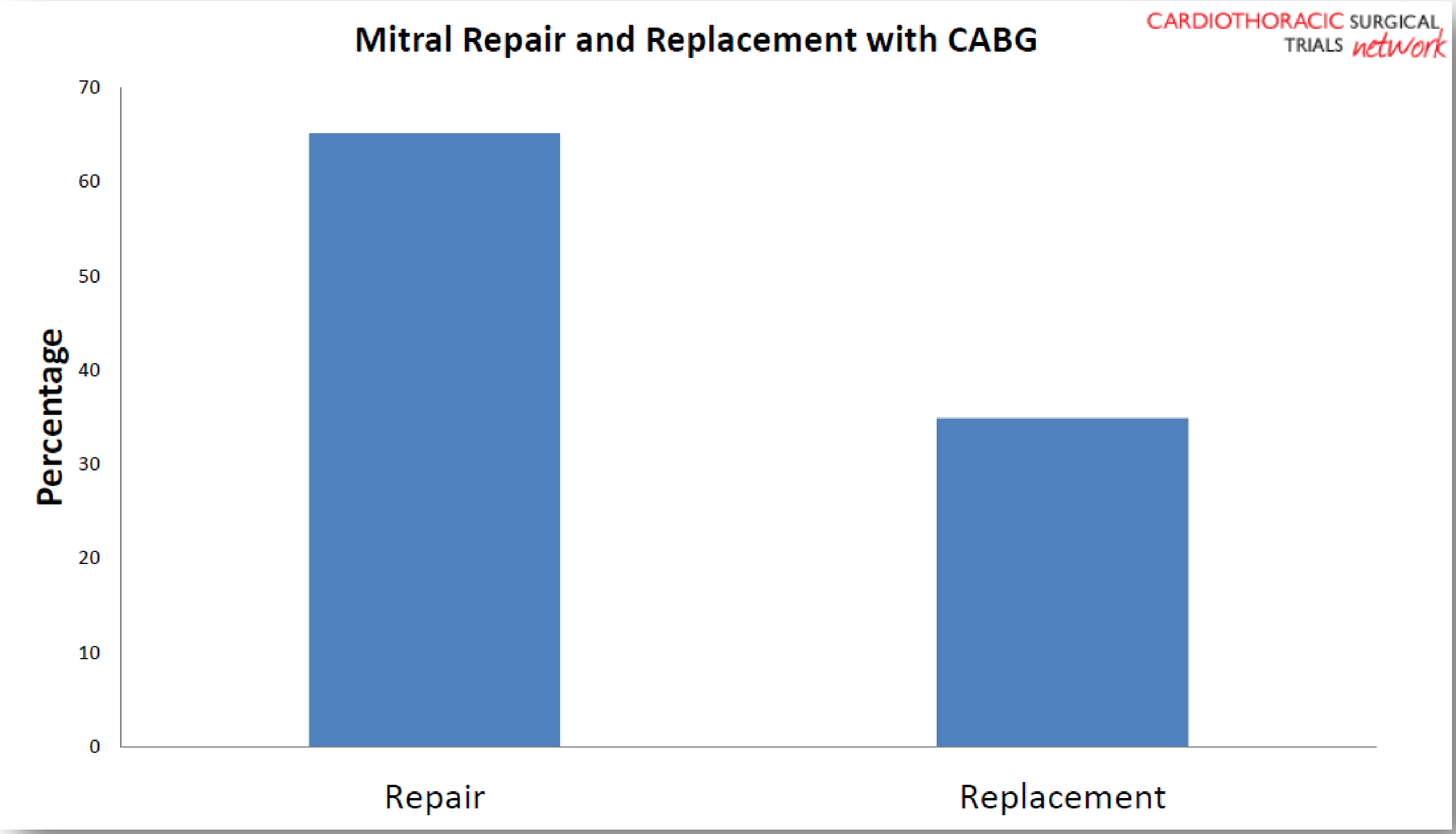
Predictors of Recurrent MR after Annuloplasty for IMR

- TEE:
  - Mitral annular diameter in diastole > 3.7 cm
  - Tethering area > 1.6 cm2
  - MR severity > 3.5
- Surgical:
  - Use of flexible ring
  - Use of incomplete ring
  - Inadequate ring sizing
  - Length of leaflet coaptation < 8 mm
  - Residual MR at OR or discharge
  - Absence of early LV remodeling (decrease of LVESV < 15%)

MVP for IMR: in Sabiston

- Severe IMR: should be corrected at CABG
  - MVR is a reasonable option
- Moderate IMR: No consensus but…
  - MVP should undergo unless prohibitive risk:
    - Extensive MAC
    - Strong indication for OPCAB: heavily diseased aorta
  - MVR: unclear efficacy and safety

Surgeons Prefer Repair



Years 2008-2012, The Adult Cardiac Surgery Database, The Society of Thoracic Surgeons

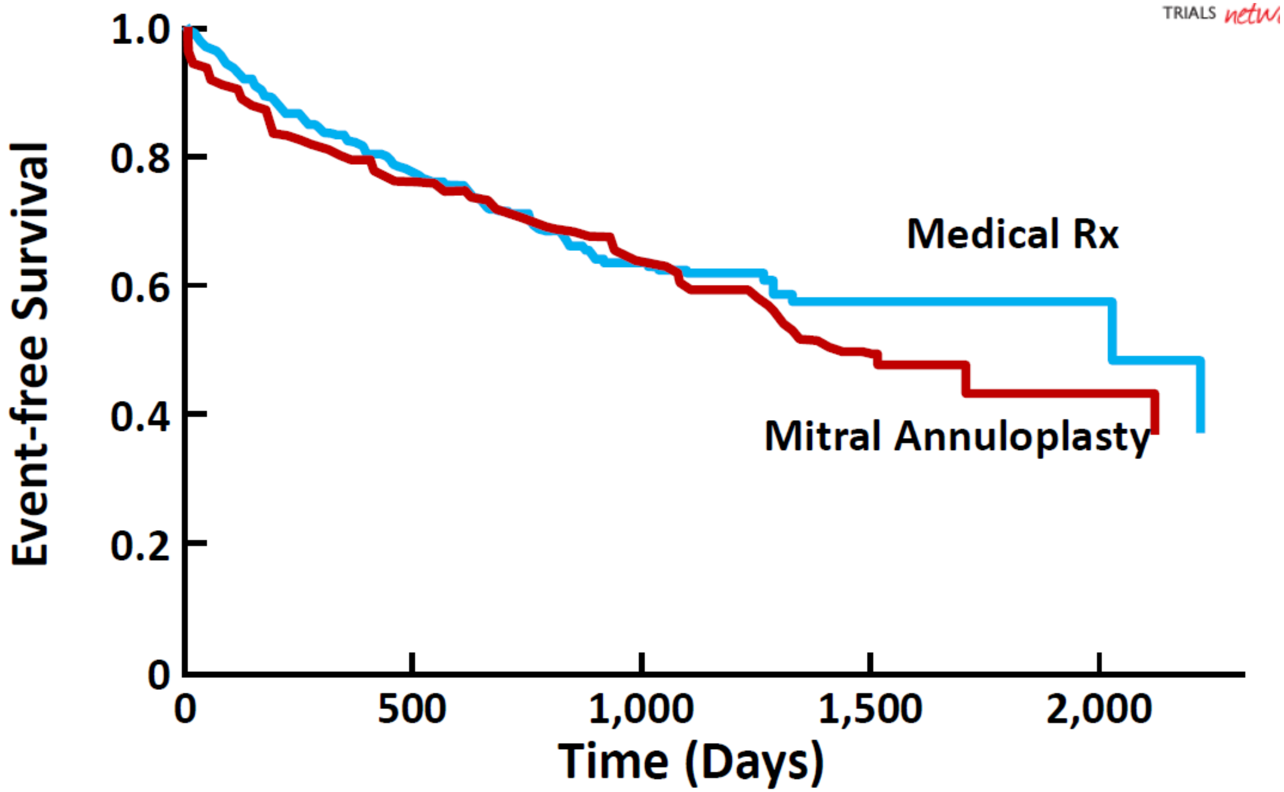
Journal of the American College of Cardiology
© 2005 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 45, No. 3, 2005
ISSN 0735-1097/05/$30.00
doi:10.1016/j.jacc.2004.09.073

Left Ventricular Dysfunction

Impact of Mitral Valve Annuloplasty on Mortality Risk in Patients With Mitral Regurgitation and Left Ventricular Systolic Dysfunction

Audrey H. Wu, MD, MPH,* Keith D. Aaronson, MD, MS,* Steven F. Bolling, MD, FACC,†
Francis D. Pagani, MD, PhD, FACC,† Kathy Welch, MS, MPH,‡ Todd M. Koelling, MD, FACC*
Ann Arbor, Michigan



Journal of the American College of Cardiology
Published by Elsevier Inc.

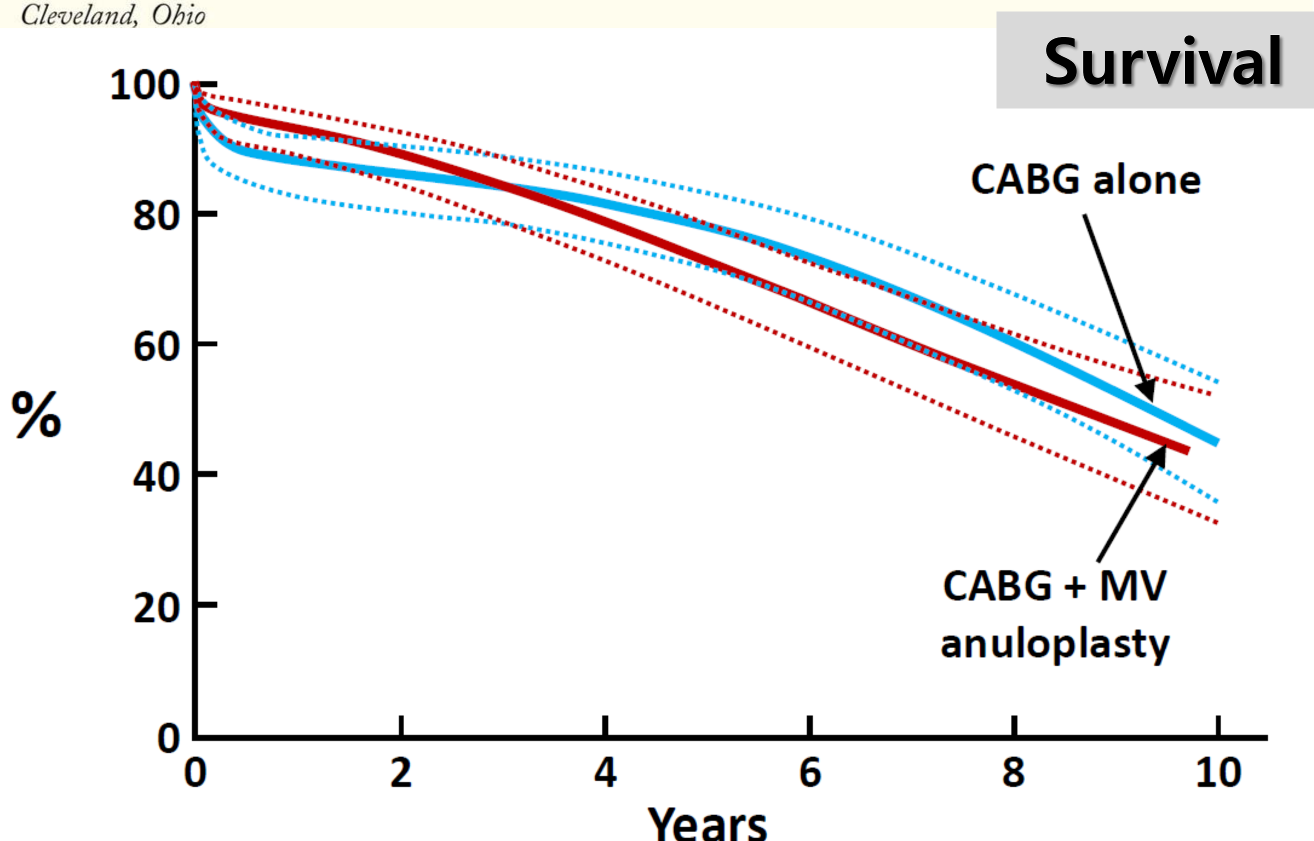
Vol. 49, No. 22, 2007
ISSN 0735-1097/07/$32.00
doi:10.1016/j.jacc.2007.02.043

Cardiac Surgery

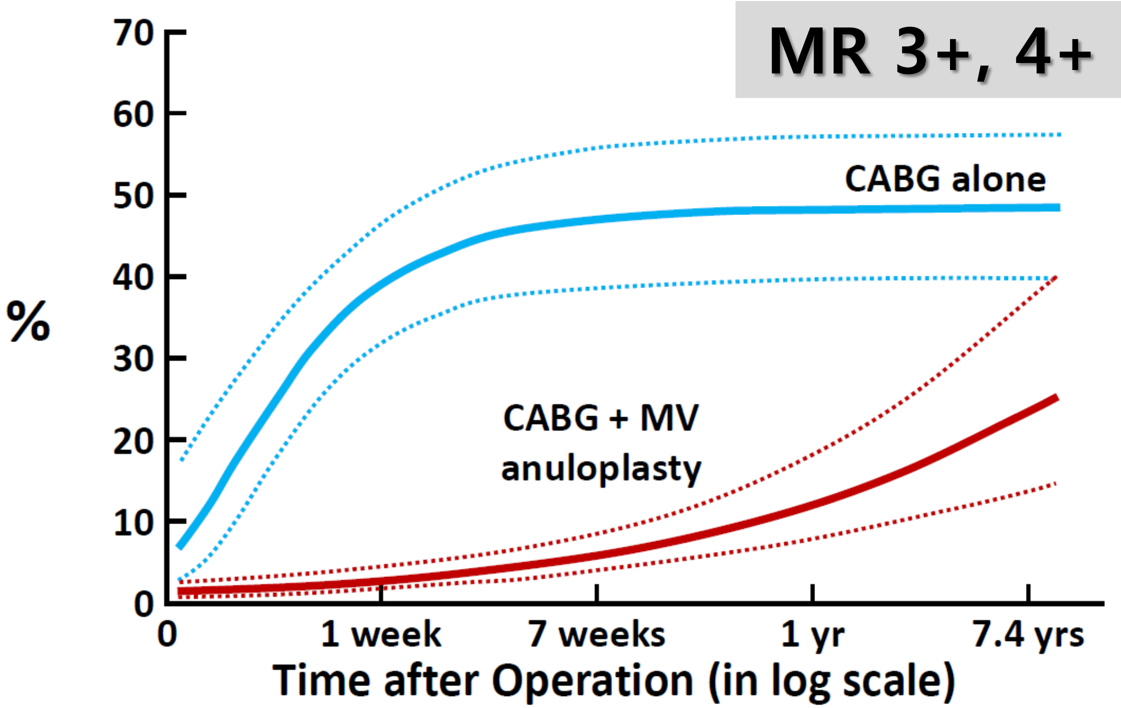
Impact of Mitral Valve Annuloplasty Combined With Revascularization in Patients With Functional Ischemic Mitral Regurgitation

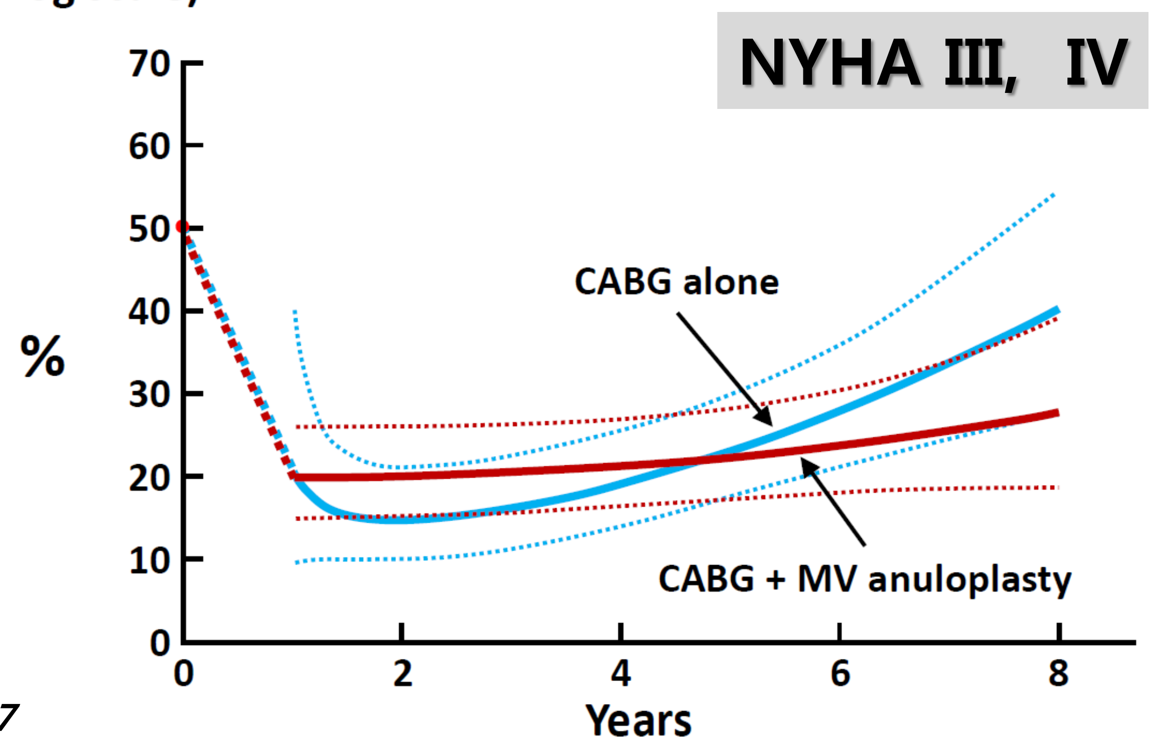
Tomislav Mihaljevic, MD,* Buu-Khanh Lam, MD,* Jeevanantham Rajeswaran, MSc,†
Masami Takagaki, MD,* Michael S. Lauer, MD,‡ A. Marc Gillinov, MD,*
Eugene H. Blackstone, MD,*† Bruce W. Lytle, MD*

Cleveland, Ohio



Mihaljevic et al.,JACC Vol. 49, No. 22, 2007





Mihaljevic et al.,JACC Vol. 49, No. 22, 2007

The NEW ENGLAND JOURNAL of MEDICINE
370:23-32. 2014

ORIGINAL ARTICLE

Mitral-Valve Repair versus Replacement for Severe Ischemic Mitral Regurgitation

Michael A. Acker, M.D., Michael K. Parides, Ph.D., Louis P. Perrault, M.D., Alan J. Moskowitz, M.D., Annetine C. Gelijns, Ph.D., Pierre Voisine, M.D., Peter K. Smith, M.D., Judy W. Hung, M.D., Eugene H. Blackstone, M.D., John D. Puskas, M.D., Michael Argenziano, M.D., James S. Gammie, M.D., Michael Mack, M.D., Deborah D. Ascheim, M.D., Emilia Bagiella, Ph.D., Ellen G. Moquete, R.N., T. Bruce Ferguson, M.D., Keith A. Horvath, M.D., Nancy L. Geller, Ph.D., Marissa A. Miller, D.V.M., Y. Joseph Woo, M.D., David A. D'Alessandro, M.D., Gorav Ailawadi, M.D., Francois Dagenais, M.D., Timothy J. Gardner, M.D., Patrick T. O'Gara, M.D., Robert E. Michler, M.D., and Irving L. Kron, M.D., for the CTSN*

ABSTRACT

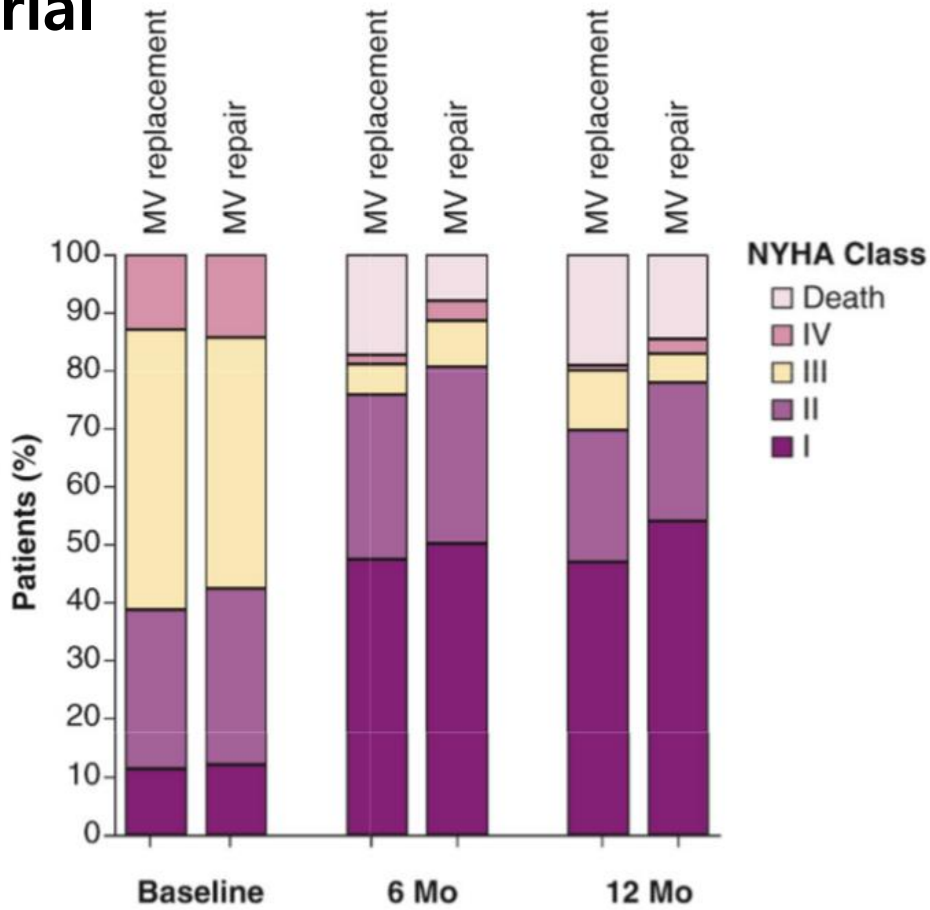
BACKGROUND

Ischemic mitral regurgitation is associated with a substantial risk of death. Practice guidelines recommend surgery for patients with a severe form of this condition but

MVP vs. MVR for IMR

NEJM, Acker et al. 370:23-32. 2014

- **1st multicenter, randomized trial**
- No difference in
  - Survival
  - LV remodeling
  - QoL at 12 months
- MVP: higher recurrent MR
  - at 12 mo. (32.6% vs. 2.3%)



Repair for Moderate Ischemic MR

- Longer CPB and ACC times
- More transfusions, Afib
- Greater LOS
- **Perhaps: improved functional status**
- **Definitely: no survival benefit**

Ischemic MR: Today's Options

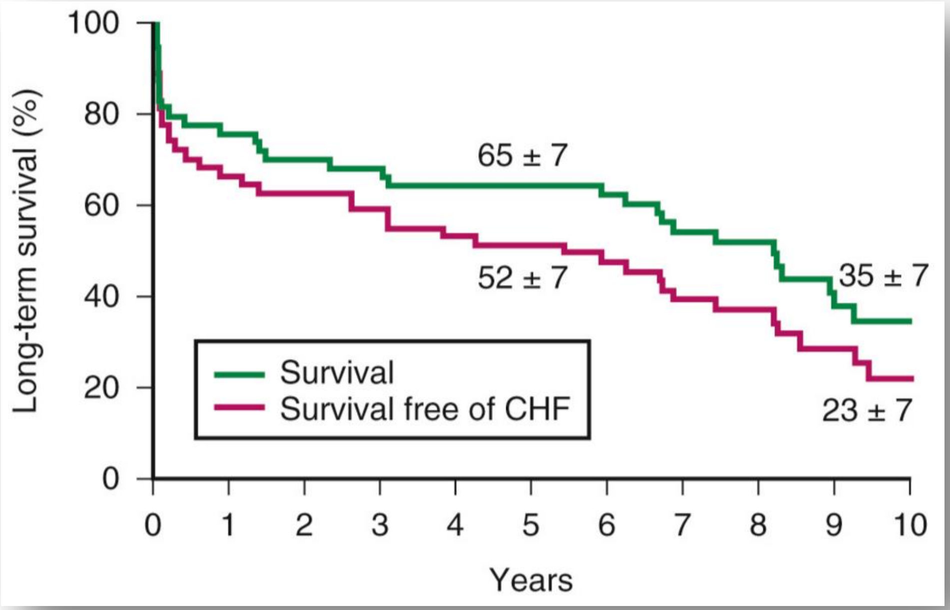
- **Residual regurgitation: poor long-term outcomes**
- Severe ischemic MR
  - Repair: trend of survival benefit STICH -> only if simple**: coaptation depth < 1.0 cm, tenting area < 2.5 cm^2, LVEDD < 65mm, (anterior tethering angle < 26, posterior tethering angle < 45)**
  - **Replace: high risk pts. (STS PROM > 4, frail, aged)**
- Moderate ischemic MR
  - Replacement: rarely needed
  - Repair: improve Sx. and LV, LA dilation but **NO SURVIVAL BENEFIT of annuloplasty**
  - CABG+MV repair < **CABG alone**

Acute Papillary Muscle Rupture

- Historically, up to 5% of STEMI
- Reduced remarkably in the era of early reperfusion
- Post. PM: susceptible to ischemia d/t single vascular supply
- Ant. PM: dual supply from LAD and Diagonal br.
- About 1 week after AMI
- Sx: new systolic murmur, hemodynamic collapse, shock
- DDx: infarct VSD, LV free-wall rupture, global LV dysfunction

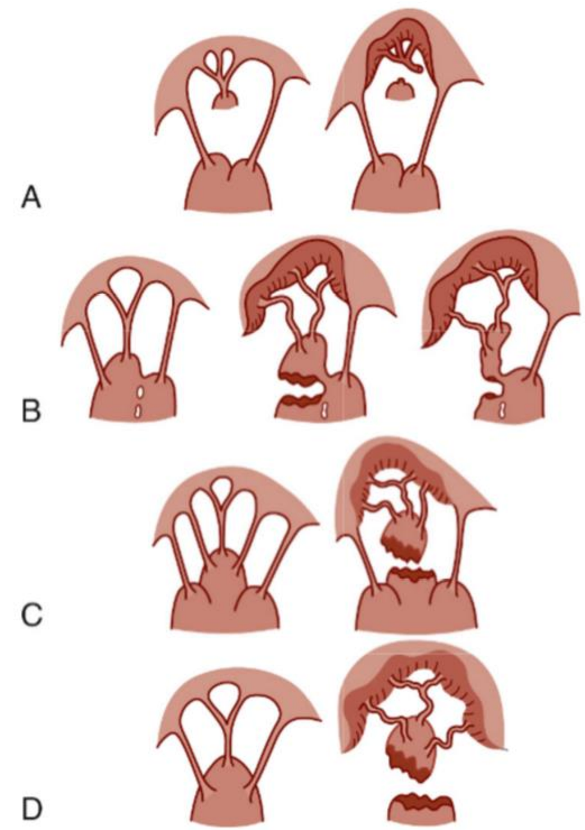
Acute Papillary Muscle Rupture

- Surgery should not be delayed
- MVR: most common Tx
- MVP with reimplantation of PM
- Hospital mortality: 20%



Chronic Type II IMR

- Chronic elongation, thinning, and fibrosis or rupture of PM
- Fibrotic and thinned-out PM with normal chords
- Usually repairable
- PTFE-NCF, chordal transfer, PM-transposition, downsized annuloplasty

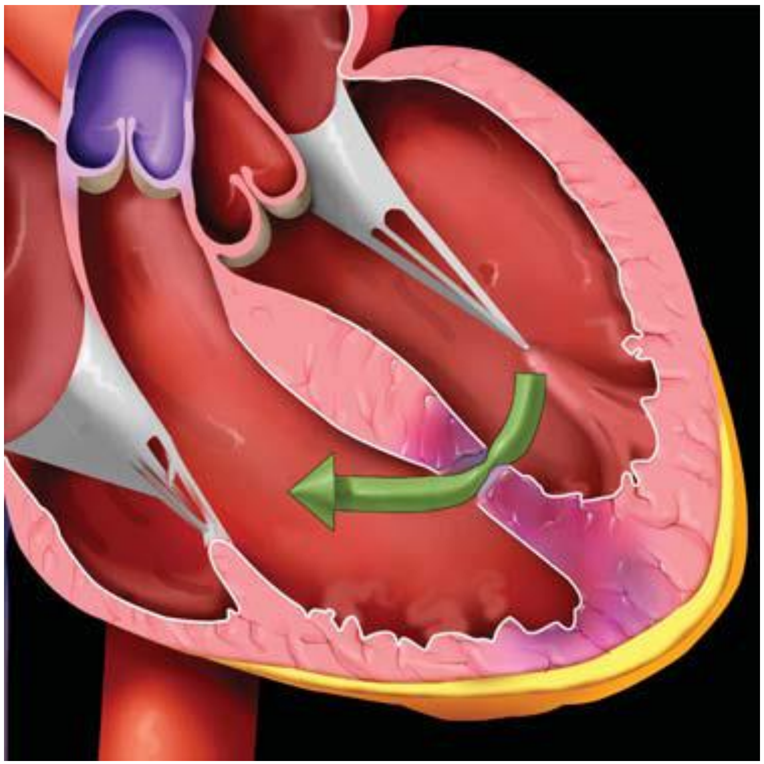


Classification of papillary muscle rupture

Post-MI VSD & Ventricular Rupture

부산의대 제형곤

History of VSR



- Latham in 1845
  - First described at autopsy
- Cooley in 1956
  - First successful surgical repair in a patient after 9 weeks through RVtomy after VSR
- Heimbecker,Allen,Woodwark,Iben
  - Late 1960s: surgery for acute phase

Incidence and Demographics

- 1-2% of AMI and **0.2% in thrombolytic era**
- 5% of early deaths after MI
- Male : Female = 3 : 2
- 1 vessel (64%), 2 vessels (7%), 3 vessels (29%)
- Average age: 62 yrs (range, 44-81)
- Most often after the 1st AMI

Etiology and Pathogenesis

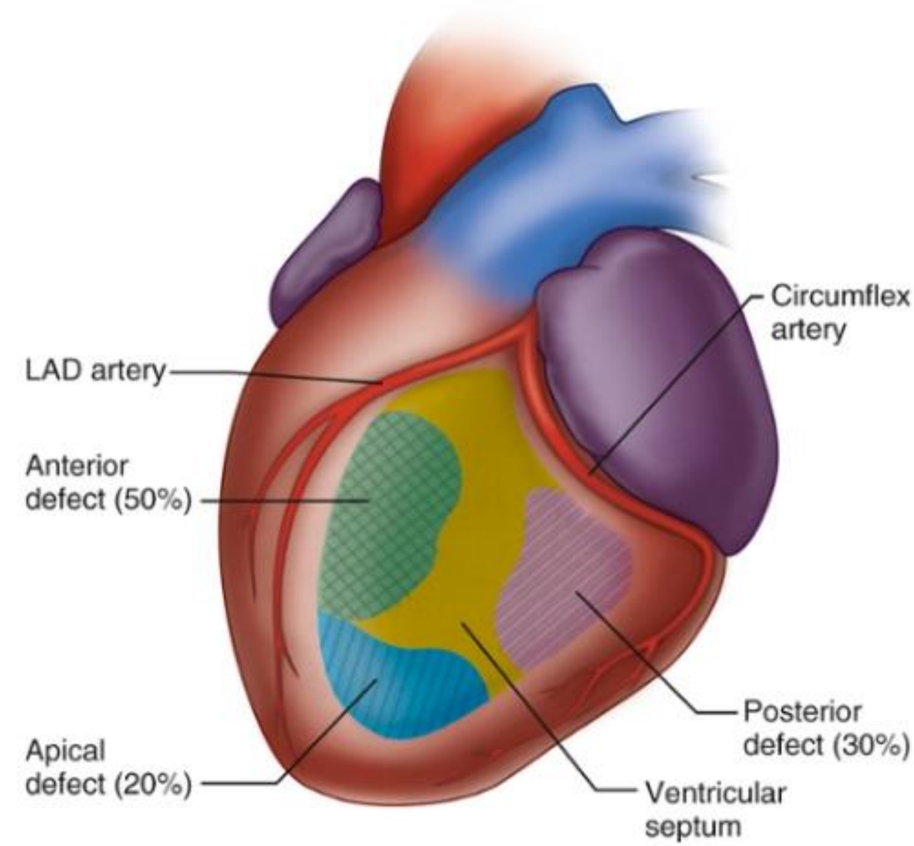
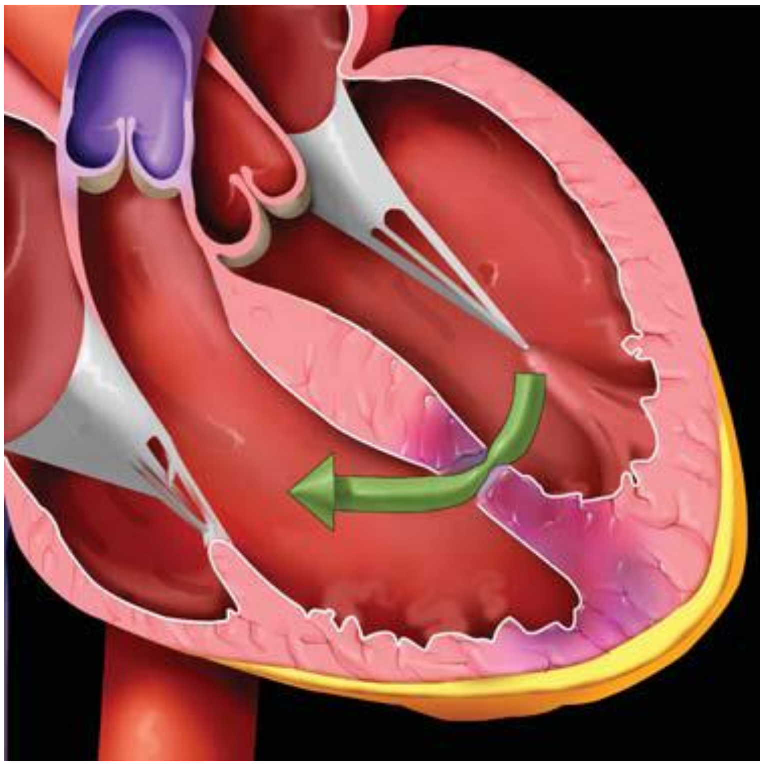


FIGURE 93-1 Distribution of postinfarction ventricular septal defects. *LAD*, Left anterior…

Etiology and Pathogenesis

- Post MI VSD:
  - Timing: usually 2 ~ 4 days
  - A few hours ~ 2 weeks
  - Closer to 1 day in thrombolytic era
  - Chronic VSR: more than 4 ~ 6 weeks
- LV free-wall rupture:
  - Occur 4%-8% of AMI
  - 15% of deaths after AMI
  - typically occurs 1-4 days after MI
  - Dx: echocardiogram

Pathophysiology



- Heart failure
  - Size of infarction
  - Amount of L-R shunt
- Anterior septal rupture
  - LV dysfunction
- Posterior septal rupture
  - RV dysfunction

Pathophysiology

Natural History

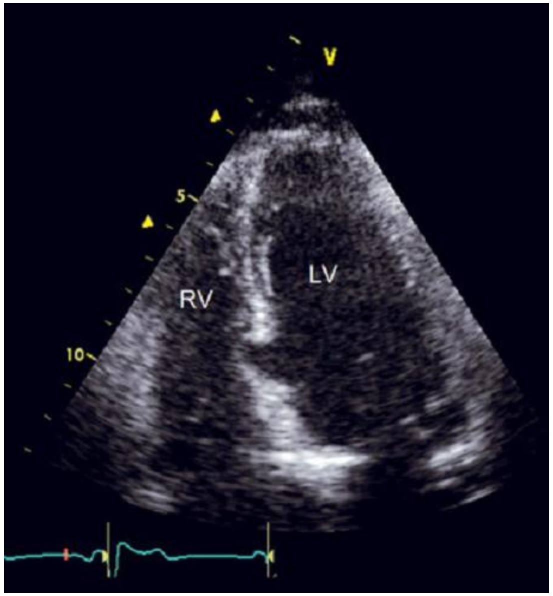
- Without surgical intervention:
  - 25% of pts: Died within first 24 hours
  - 50% of pts: Died within 1 week
  - 75% of pts: Died within 1 month
  - 7% of pts: Lived longer than 1 year

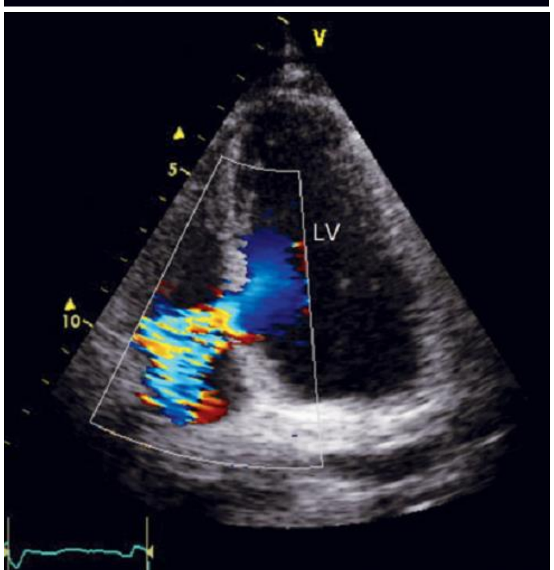
- Defer early op: deprives chance for successful op.

Clinical Presentation

- Harsh new holosystolic murmur: radiate to axilla
- recurrent chest pain
- RV failure and pulmonary edema is rare ??
- Resemble acute MR with PM rupture
  - VSD: Ant. AMI with condunction abnormality
  - IMR with PM rupture: post. AMI, no conduction abn'l

Diagnosis



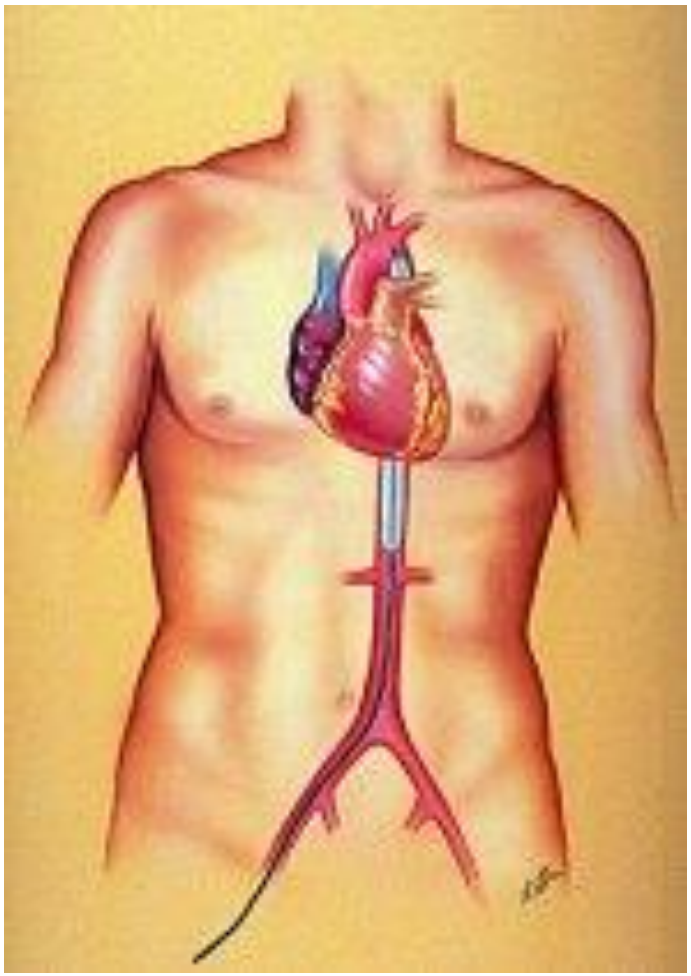


- History of AMI
- Physical Examination and Monitoring
  - New systolic murmur
  - Abrupt deterioration in hemodynamics
- Imaging Studies
  - Echo: Gold standard
  - Coronary angiography
  - LV catheterization : Not recommended
    - 9% step-up in the O_2 saturation

Preoperative Management

- Dx: indication for operation
- Shock: surgical emergency
- Preop multisystem organ failure:
  - unlikely to survive
  - benefit from a mechanical bridge: IABP, VAD
- Intermediate status: within 12 to 24 hours
- Completely stable(<5%): semi-elective

Preoperative Management



- IABP
  - Cardiac output ⇧
  - Lt. to Rt. shunt ⇩
  - Coronary Perfusion ⇧
- Medications
  - Inotropics
  - Diuretics
  - Vasodilators (?)

Predictors of Risk

TABLE 93-1 Preoperative Predictors of Death after Surgical Repair of Postinfarction VSD

Variable	Predictor of Early Death	Predictor of Late Death
Need for preoperative catecholamines	$P = 0.001$	P = NS
Emergent operation	$P < 0.0001$	P = NS
Anterior VSD	$P = 0.04$	P = NS
Age > 65 years	$P = 0.009$	P = NS
Right-sided heart failure	$P = 0.01$	$P = 0.005$
Elevation in blood urea nitrogen	$P = 0.02$	P = NS
Elevation of serum creatinine	P = NS	$P < 0.05$
Previous myocardial infarction	P = NS	$P < 0.05$
Presence of left main coronary disease	P = NS	$P < 0.05$

Predictors of Risk

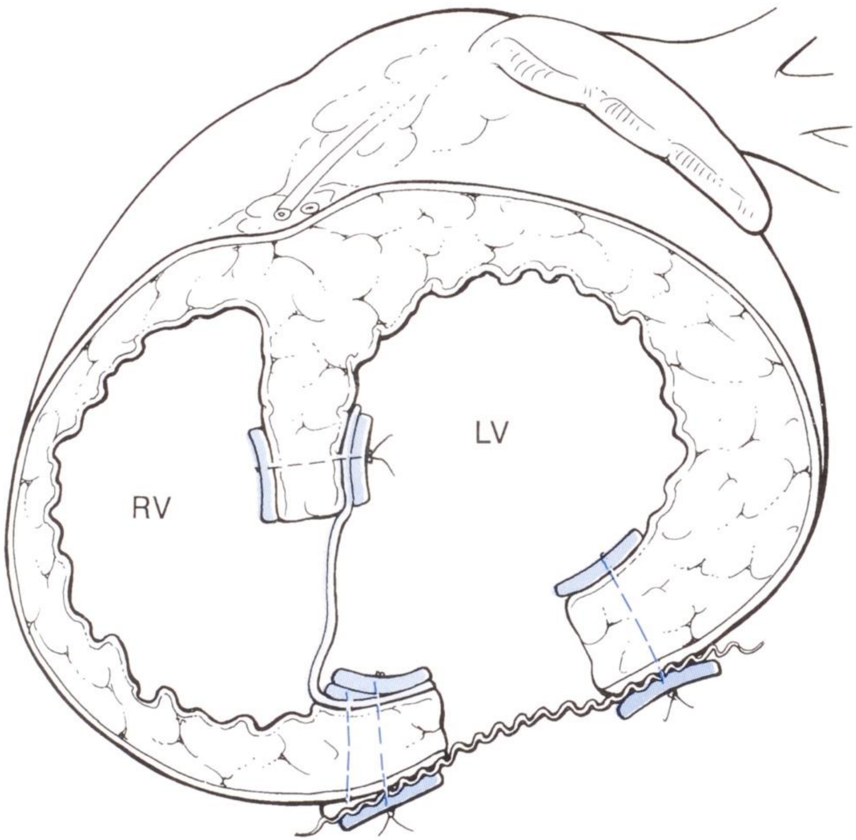
- Post. VSD increased operative mortality:
  - Technically difficult
  - Risk of mitral regurgitation is increased
  - RV failure with RV infarction
- Proximal VSDs strongly predict early mortality
  - Largest infarctions

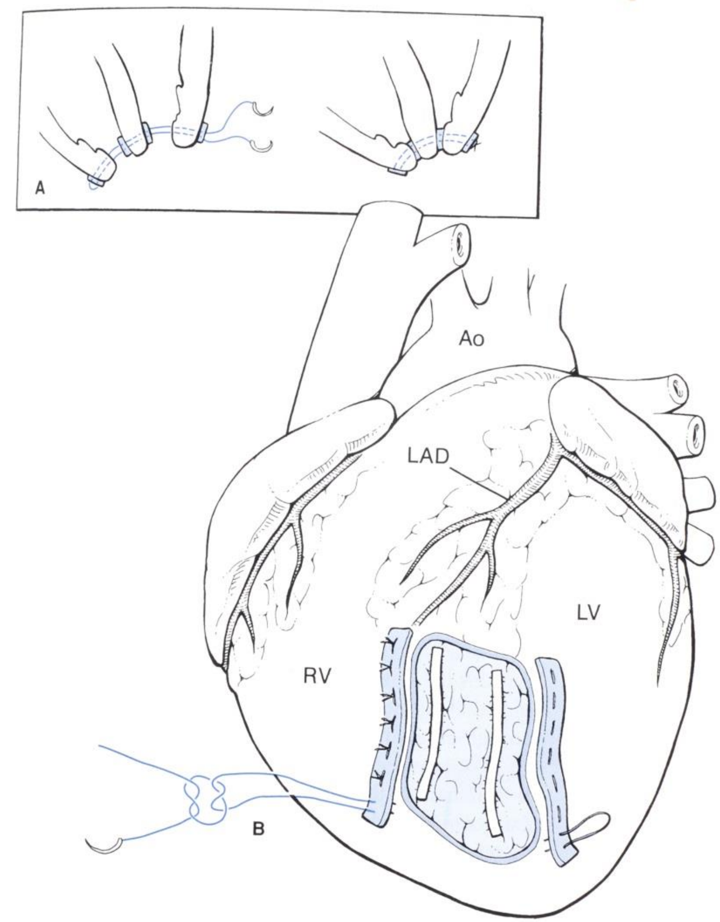
Goal of Surgery

Exclusion or removal of infarcted myocardium

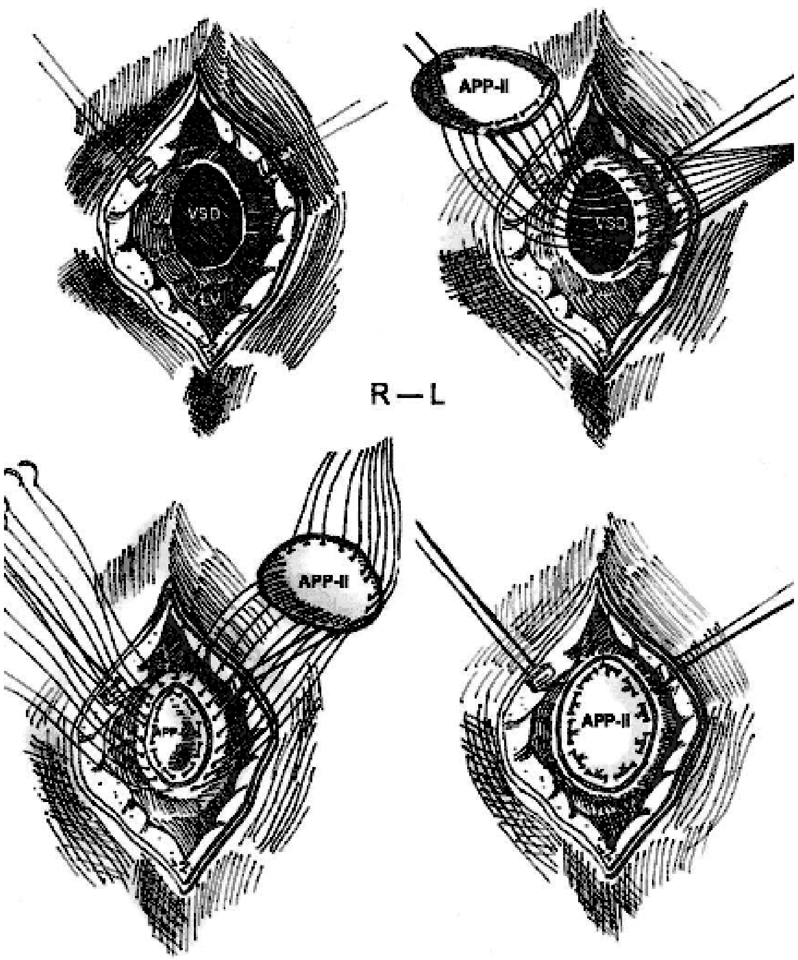
Elimination of Lt. to Rt. shunt

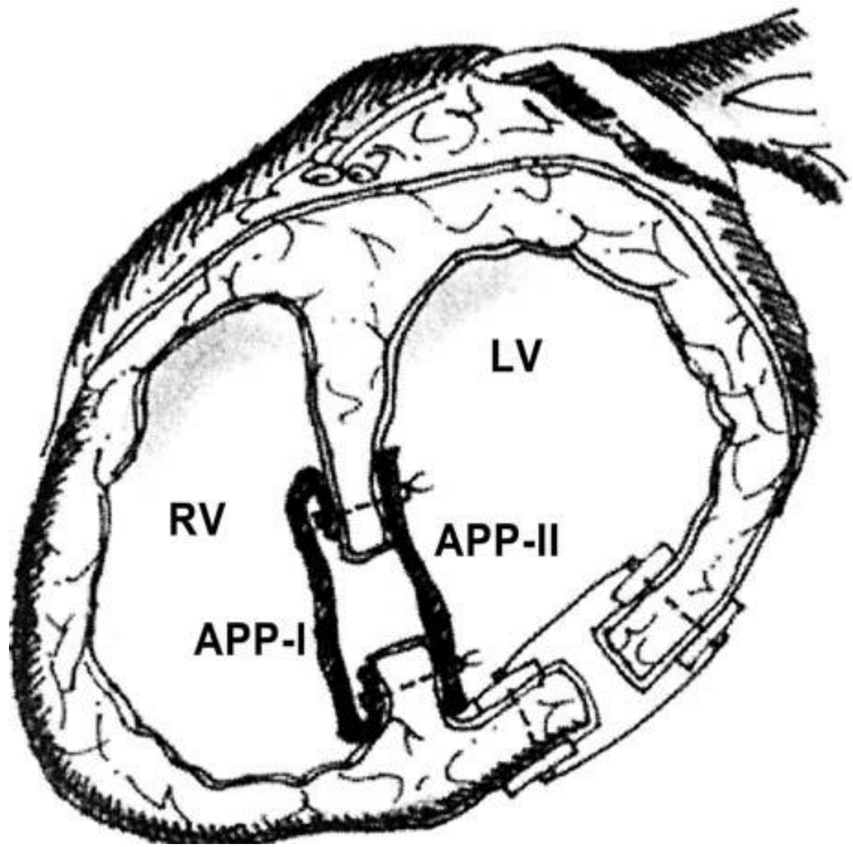
Resection of Infarcted Myocardium





Double Patch Repair of VSR

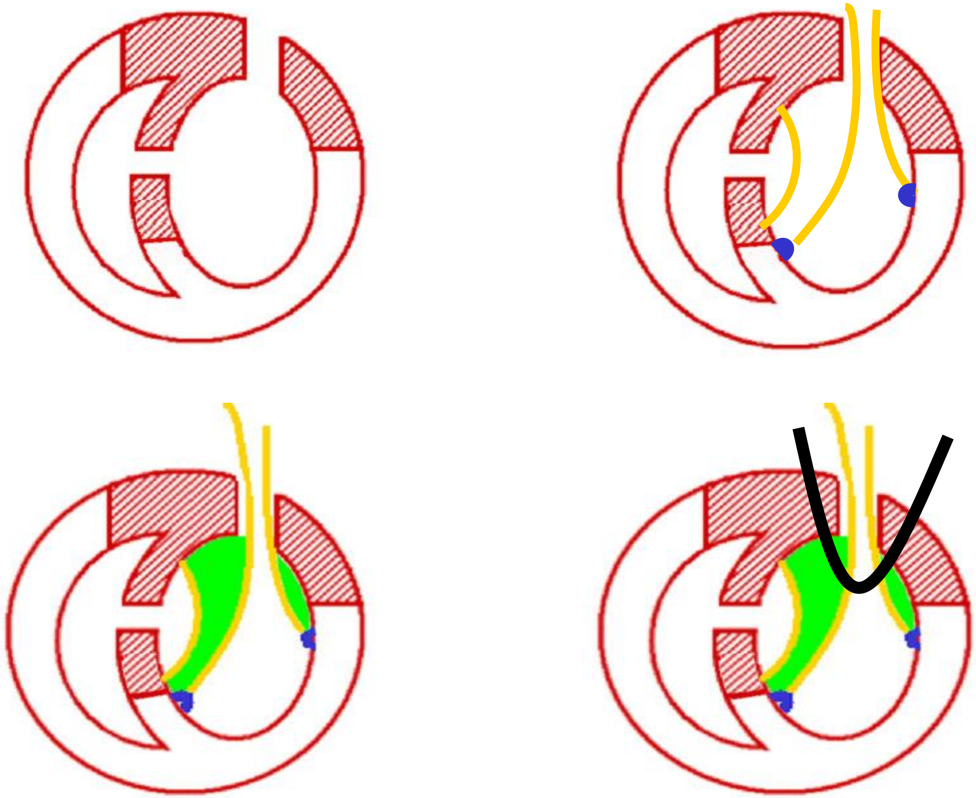




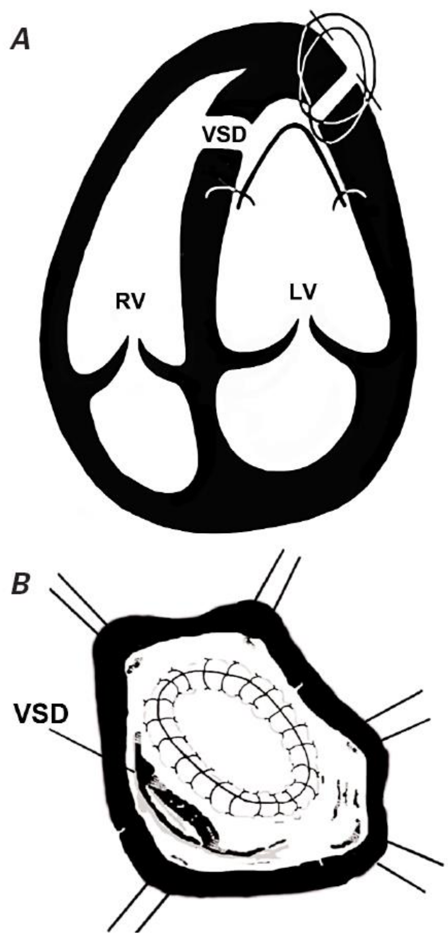
Balkanay et al.
Tex Heart Inst J 2005;32:43-6

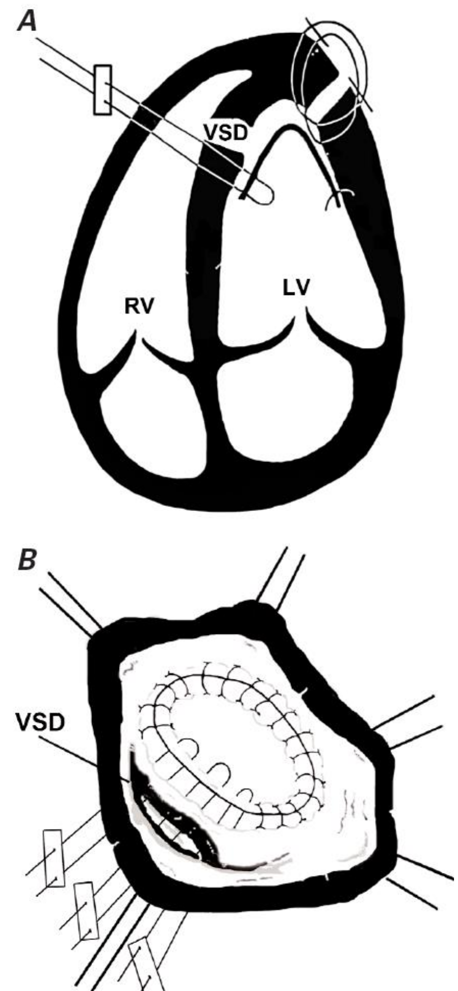
Surgical Techniques

Three Patch Technique

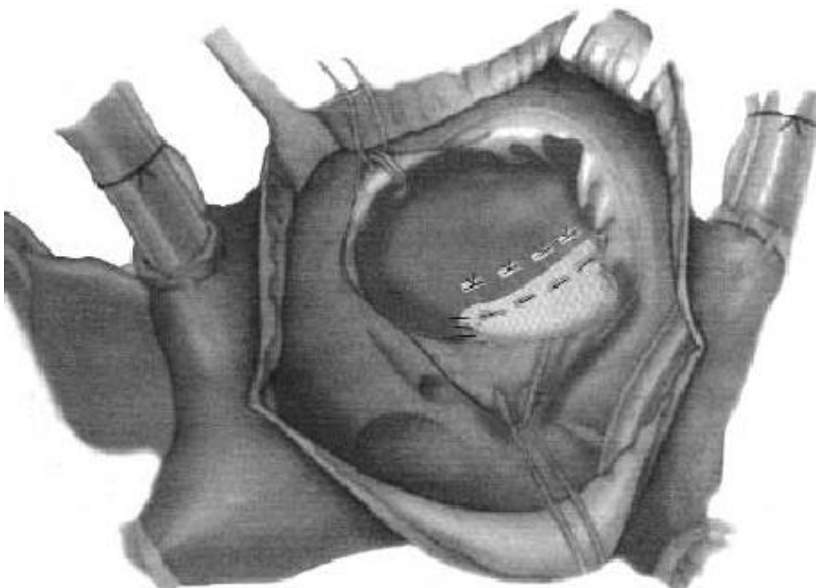


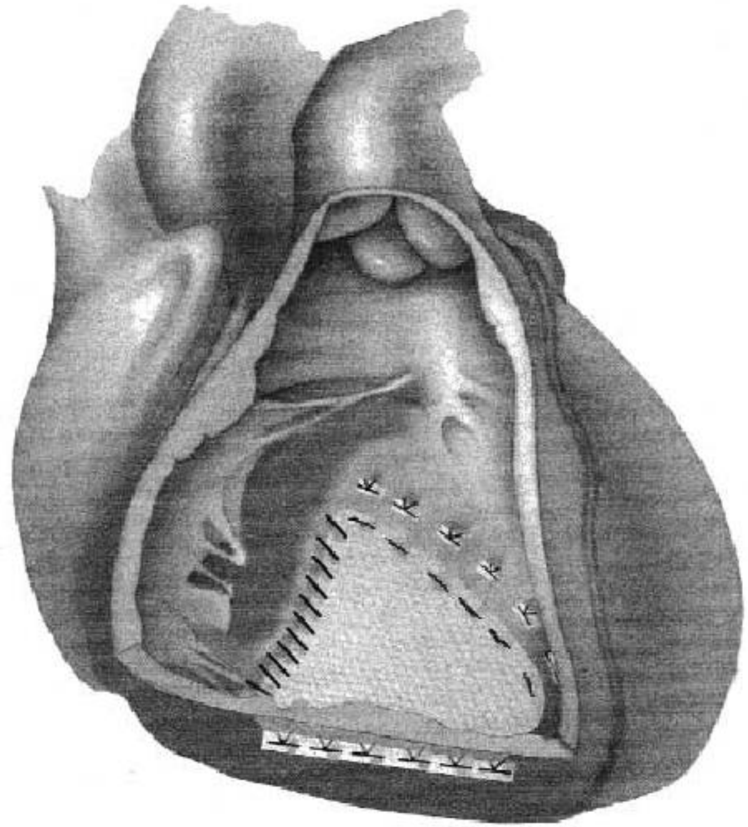
Infarct Exclusion Technique





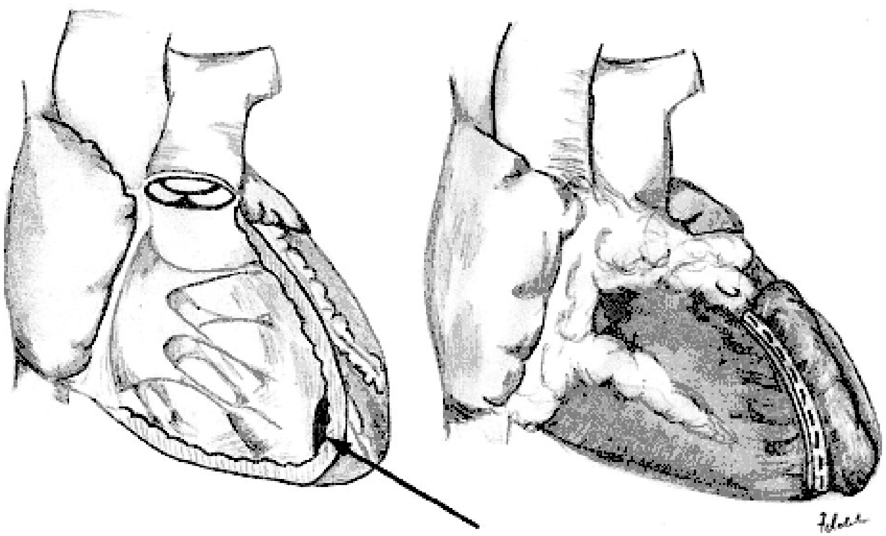
Repair through Rt. Atrium

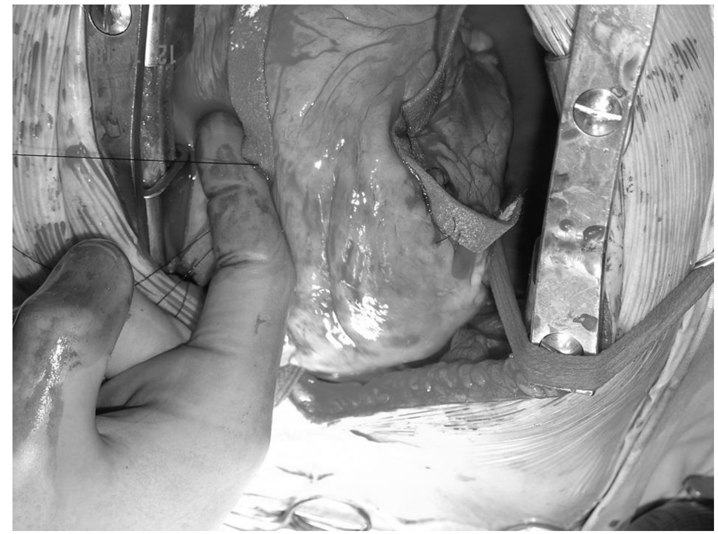


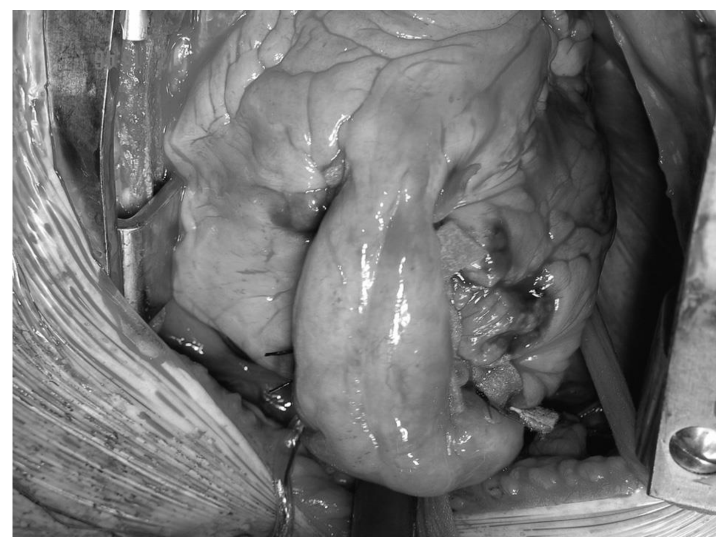


Massetti et al. (J Thorac Cardiovasc Surg 2000;119:784-9)

Closure of VSR on Beating Heart

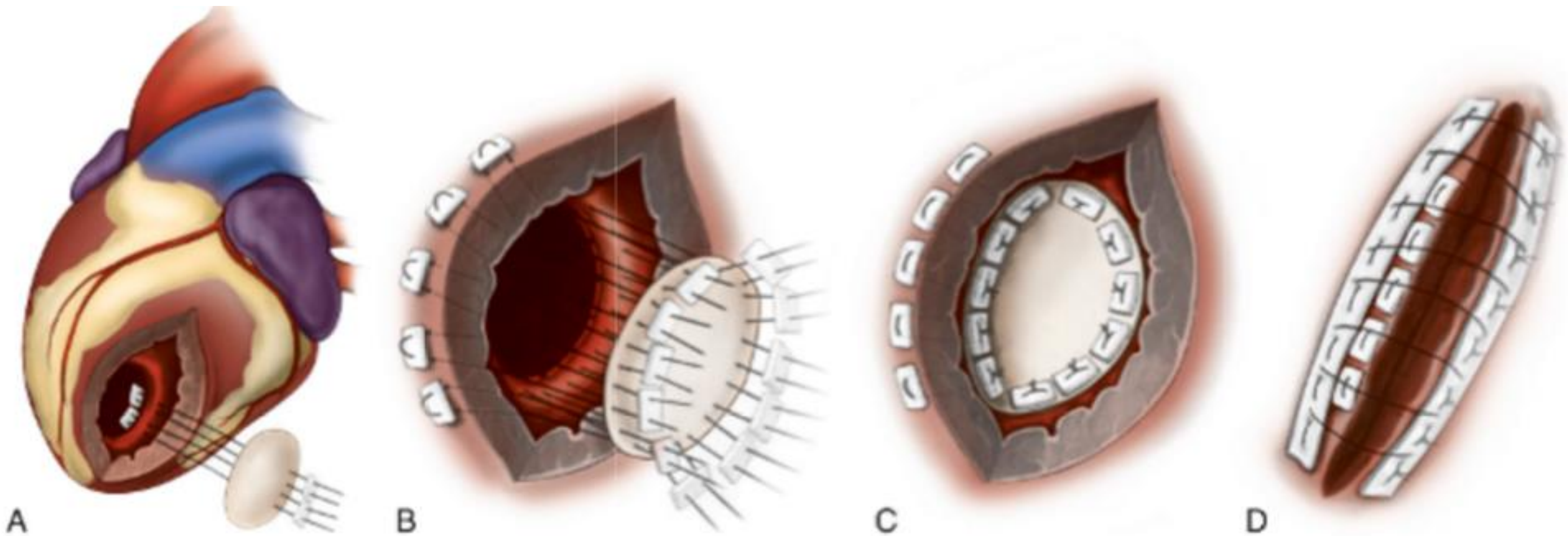




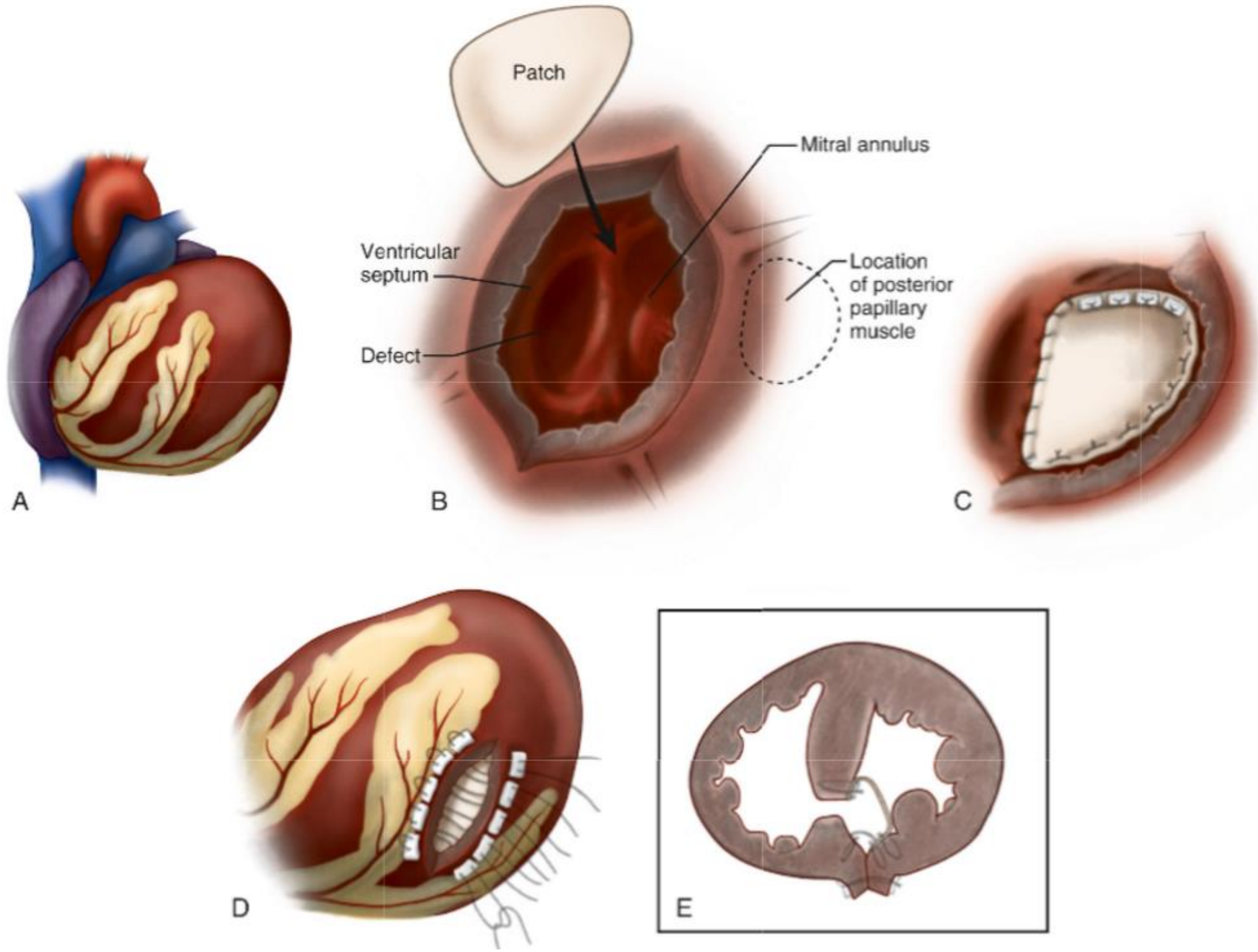


Piotr Siondalski,
Interactive CardioVascular and Thoracic Surgery 6 (2007) 160–162

Repair of Ant. PMI VSD



Repair of Post. PMI VSD



Weaning from CPB

- Bleeding
- Low cardiac output
  - IABP, Milrinone
- RV failure (especially posterior VSR)
  - Volume loading, Inotropics
  - PGE-1 (0.5 to 2.0 mg/min), NO gas (20 to 80 ppm)
- VAD, ECMO

Outcomes

- Operative mortality: 30% to 50%
- Most common cause of death
  - Low cardiac output: 52%
  - Technical failures(recurrent or residual VSD): 22%
  - Sepsis:17%, Recurrent infarction: 9%
  - CVA: 4%, Intractable ventricular arrhythmias

Long-Term Results

TABLE 93-2 Recent Clinical Experience* with Surgical Repair of Postinfarction V Septal Defect

Institution	City	Year	Patients (N)	Hospital Mortality (%)	5-year Survival (%)
Massachusetts General Hospital[1]	Boston	2002	114	37	45
University Hospital[63]	Zurich	2000	54	26	52[†]
Glenfield General Hospital[27]	Leicester	2000	117	37 (30-day)	46
The Toronto Hospital[24]	Toronto	1998	52	19	65[†]
Southhampton General[20]	Southampton	1998	179	27	49
MidAmerica Heart Institute[46]	Kansas City	1997	76	41	41
Green Lane Hospital[31]	Auckland	1995	35	31 (30-day)	60[†]
Hôpital Cardiologique du Haut-Lévèque[28]	Bordeaux	1991	62	38	44
CHU Henri Mondor[53]	Créteil	1991	66	45	44

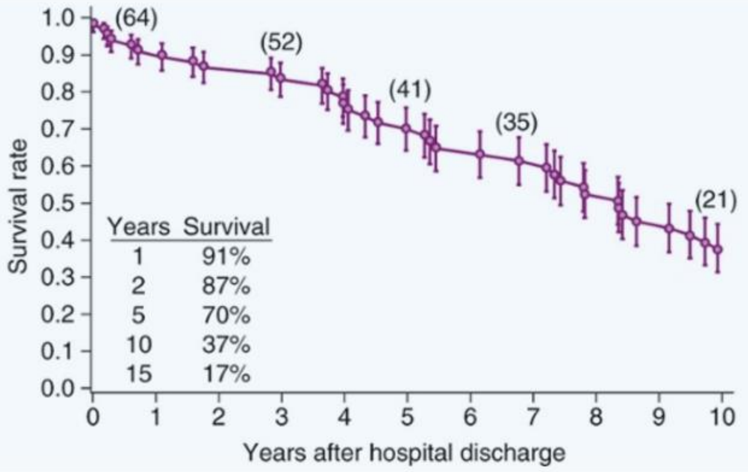
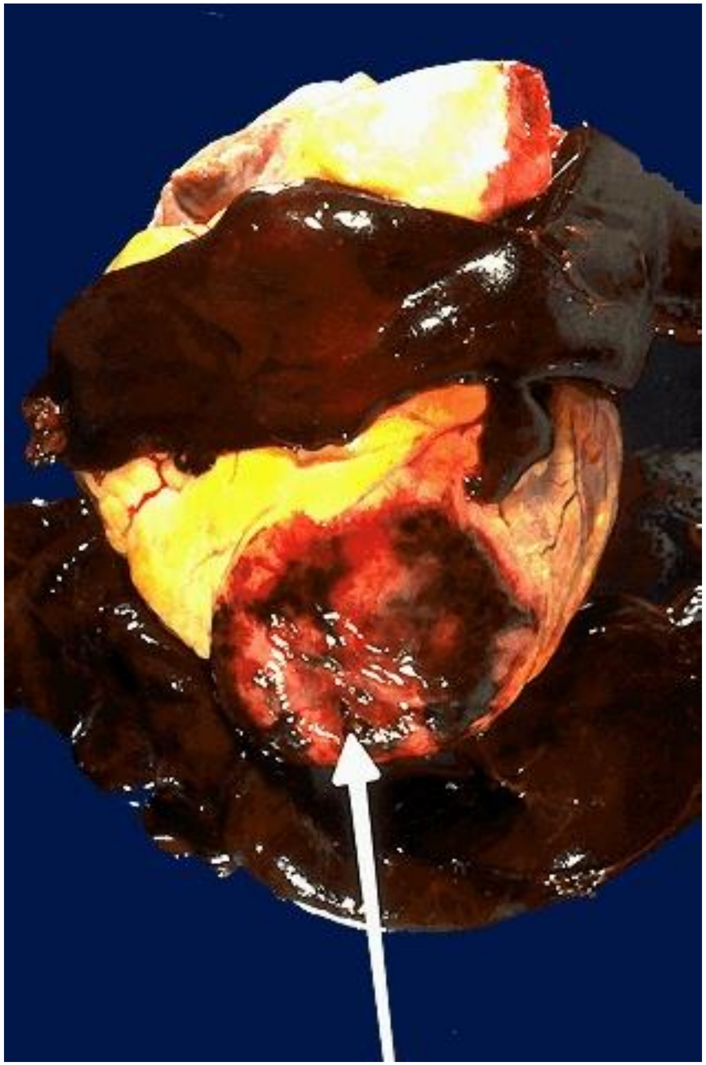


FIGURE 93-4 Postdischarge survival rates after repair of postinfarction ventricular sept…

History of Free wall Rupture



- William Harvey
  - First described the free wall rupture of the heart after AMI in 1647
- Hatcher, FitzGibbon, Montegut
  - First successful repairs in early 1970s

Incidence

- 11% of AMI (VSR x 10)
- Elderly women, first infarction, within 5 days
- Ant. > Lat.
- Simple versus complex (50:50)

Pathogenesis and Pathophysiology

- Transmural MI
- Infarct expansion
  - Acute regional thinning and dilatation of infarct zone
- Systemic HT, lack of collateral
- After extensive hemorrhagic transformation of AMI

Diagnosis

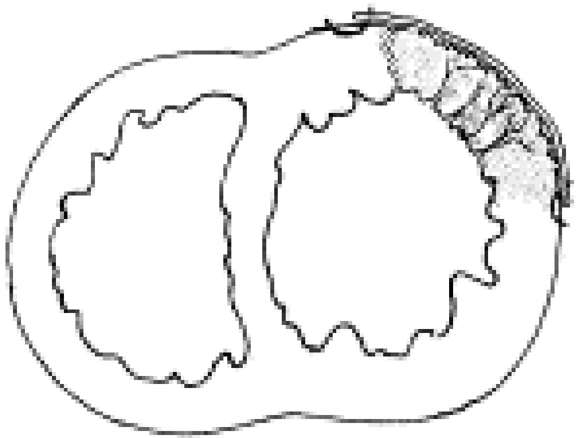
- Clinical picture of pericardial tamponade
- Echocardiography
  - Effusion thickness > 10mm
  - Echo-dense masses in the effusion
  - Ventricular wall defect

Natural History

- Acute
  - Death in a few minutes
- Subacute
  - Median survival : 8 Hours
  - Smaller tear, temporarily sealed by clot or fibrinous pericardial adhesions
- Chronic
  - False aneurysm

Surgical Technique

Epicardial patching



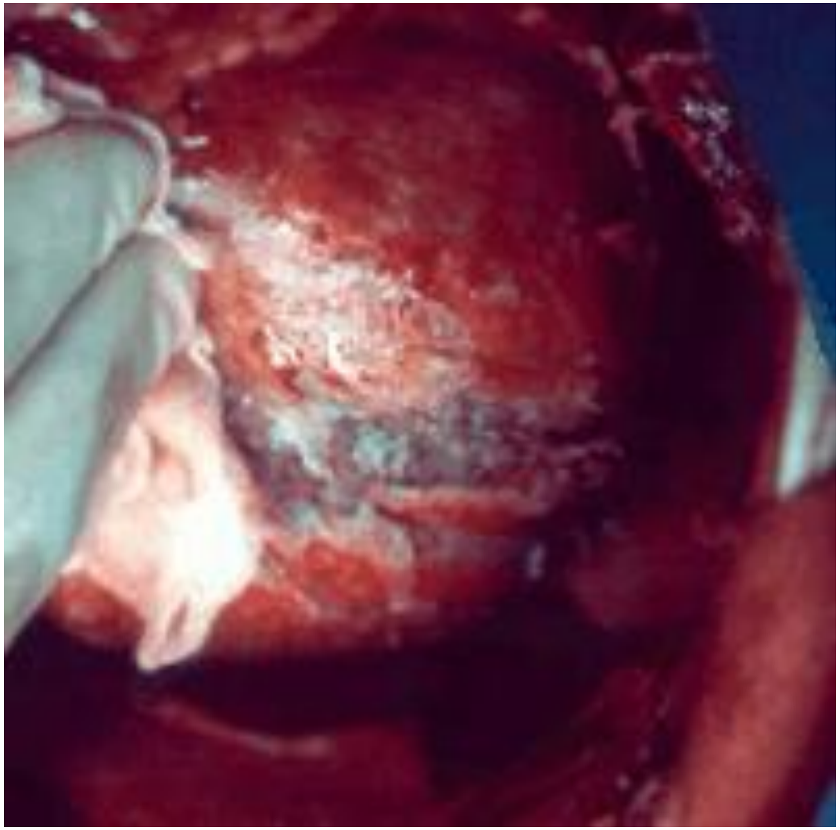
Direct suture

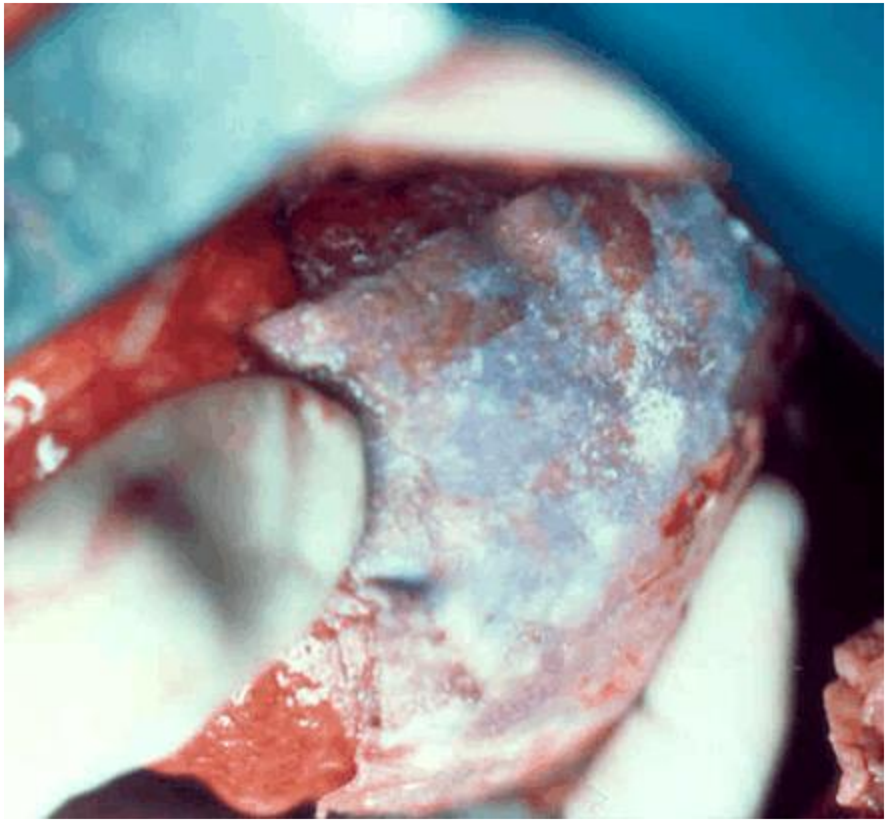
Debridement and patch closure

Infarct exclusion

Prêtre R, Ann Thorac Surg 2000;69:1342-5

Sutureless Tech.





Left Ventricular Aneurysm

부산의대 제형곤

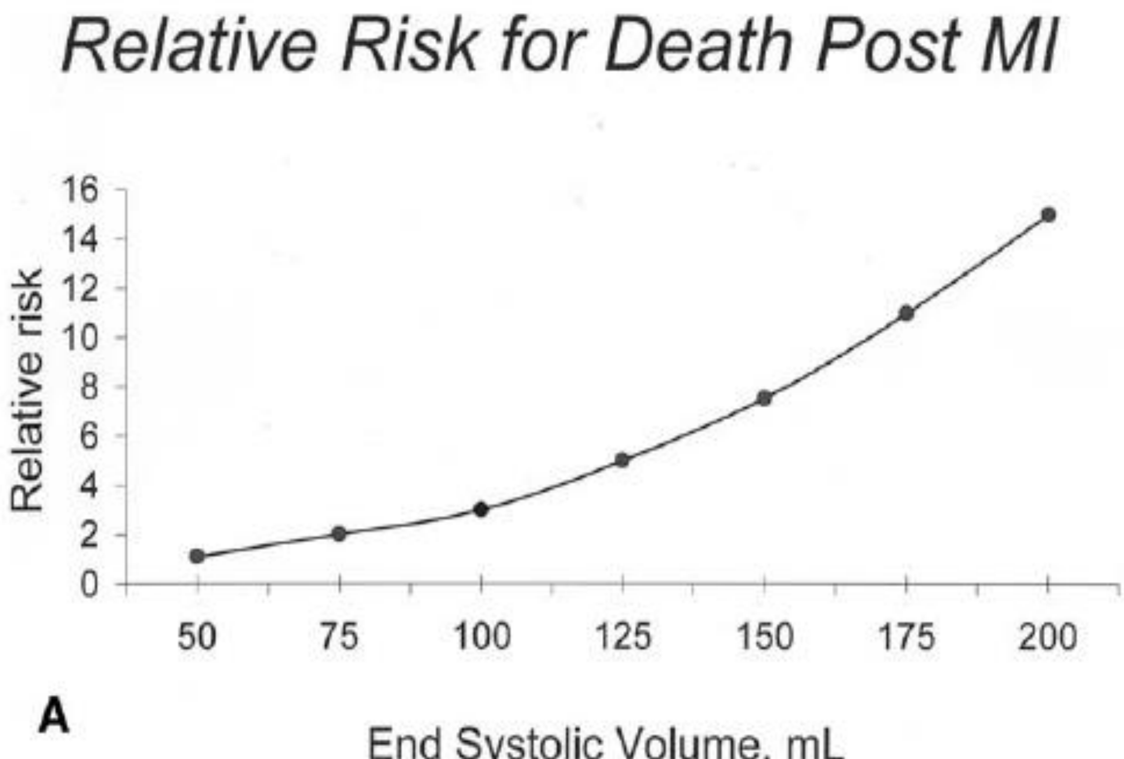
Historical background

- 1957, Bailey: 1st successful surgical correction of an LV aneurysm
- 1958, Denton Cooley: open resection and simple closure on CPB
- 1968, Favaloro: 130 patients, resection for LV aneurysm, with 13% mortality

Natural course

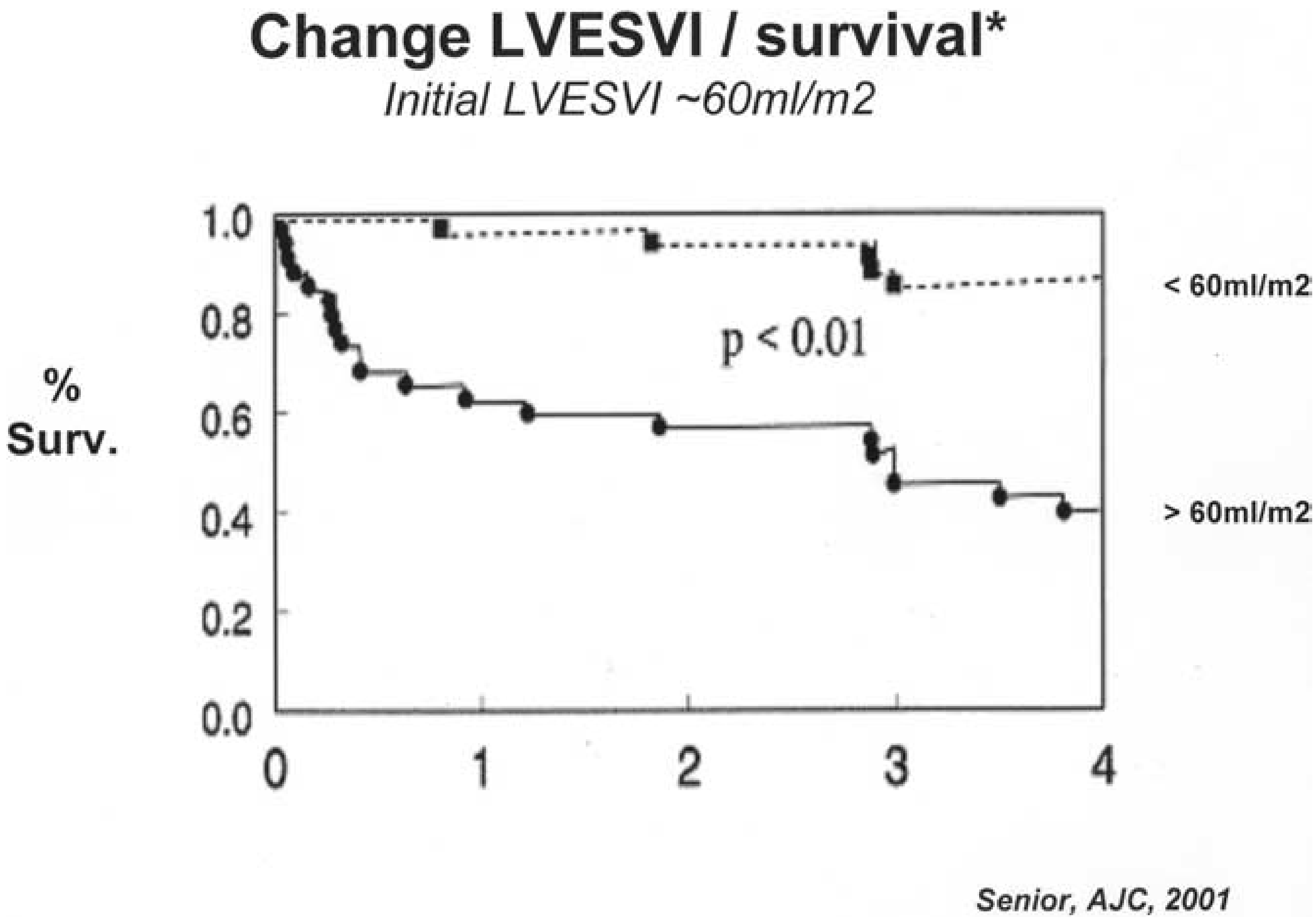
- Recent 5YRS for medically managed LV dyskinesia : 47~70%
- Cause of death
  - Arrhythmia 44% : Heart failure 33%
  - Recurrent MI 11% : Non cardiac cause 22%
- Factors influencing survival of LV dyskinesia
  - Age : HF score : Coronary disease severity
  - Angina duration : Prior infarction : MR
  - Function of residual ventricle

Direct correlation between LV volume and survival



White HD. *Circulation* 1987

LVESVI greater than 60ml/m² : poor long term prognosis



Left Ventricular Remodeling

Box 100-1
Left Ventricular Remodeling

Myocardial Changes

- Myocyte loss
- Necrosis
- Apoptosis

Alterations in Extracellular Matrix

- Matrix degradation
- Replacement fibrosis

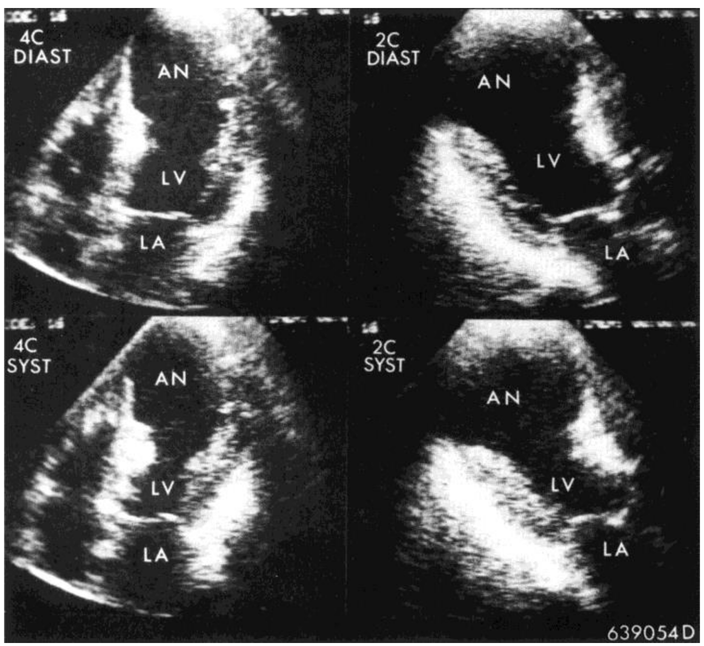
Alterations in LV Chamber Geometry

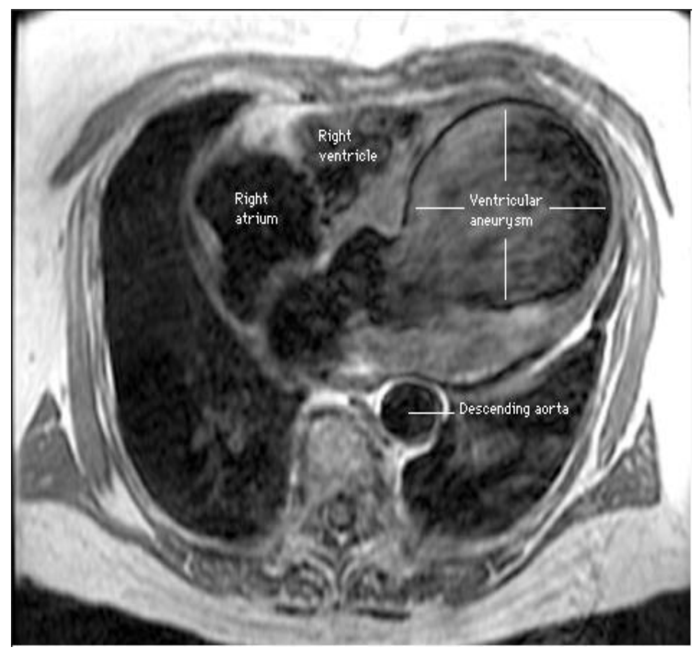
- LV dilation
- Increased LV sphericity
- LV wall thinning
- Mitral valve insufficiency

LV, Left ventricular.

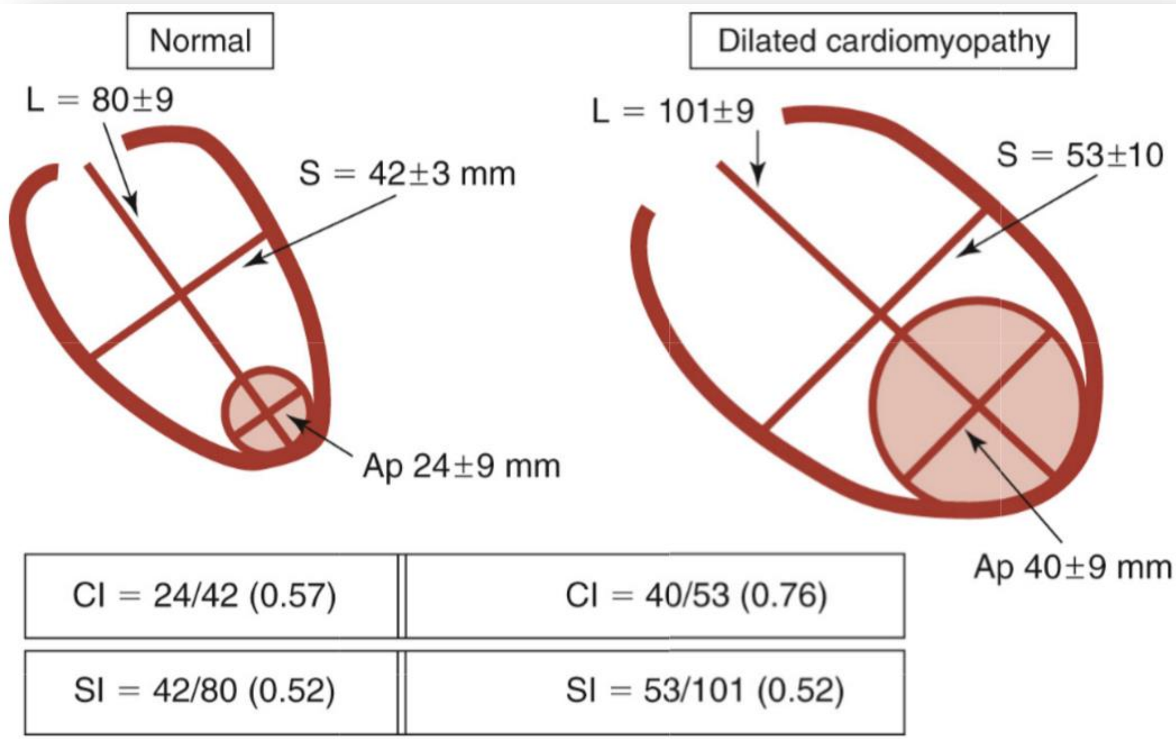
Diagnostic modality

- Echocardiography
  - Screening method for detecting LV aneurysm
  - Useful for assessing MV function
- Cardiac MRI





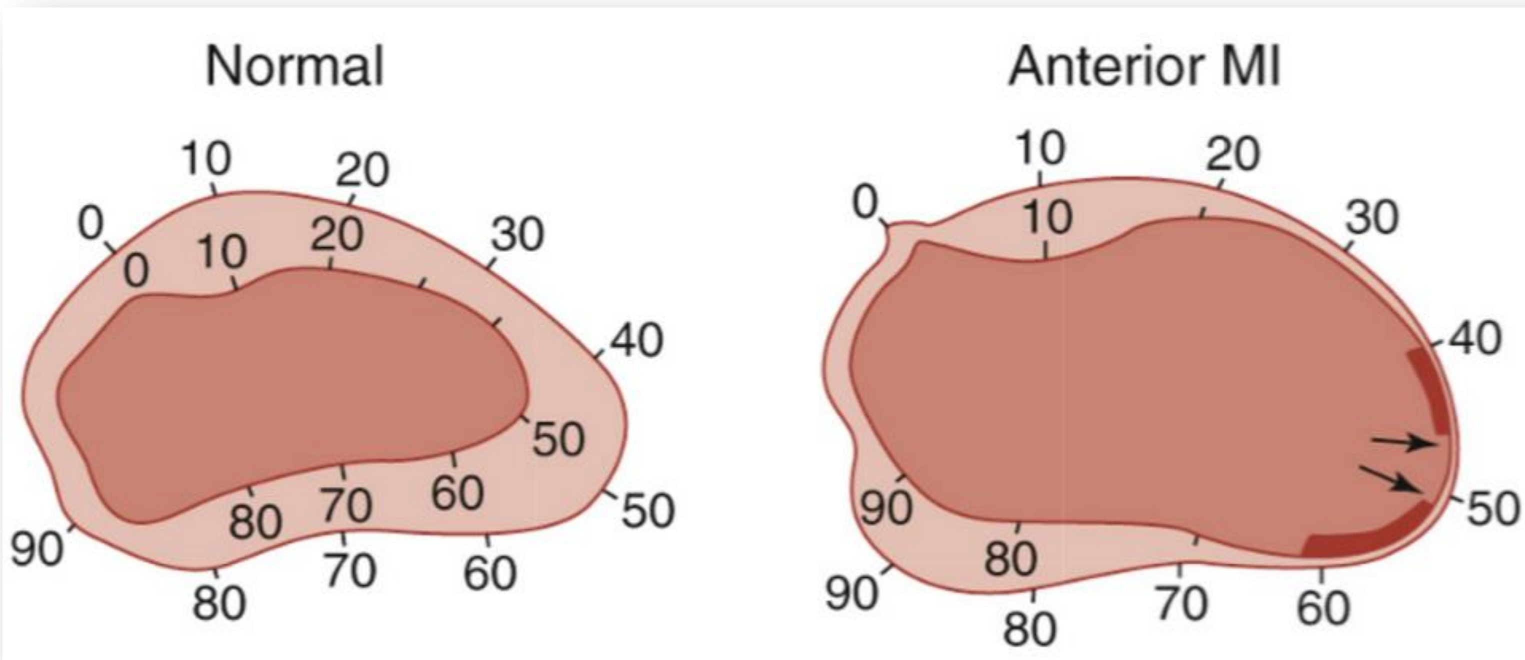
Geometric measures



- Sphericity index (SI): short- to long-axis ratio (S/L)
- Conicity index (CI): apical to short-axis ratio (Ap/S)
- Apical diameter: best fits the apex
- SI has the same value in normal subjects and in patients with DCM
- Because the elongation of LV is proportional to the increase in width
- Whereas the CI is markedly abnormal in the patients.

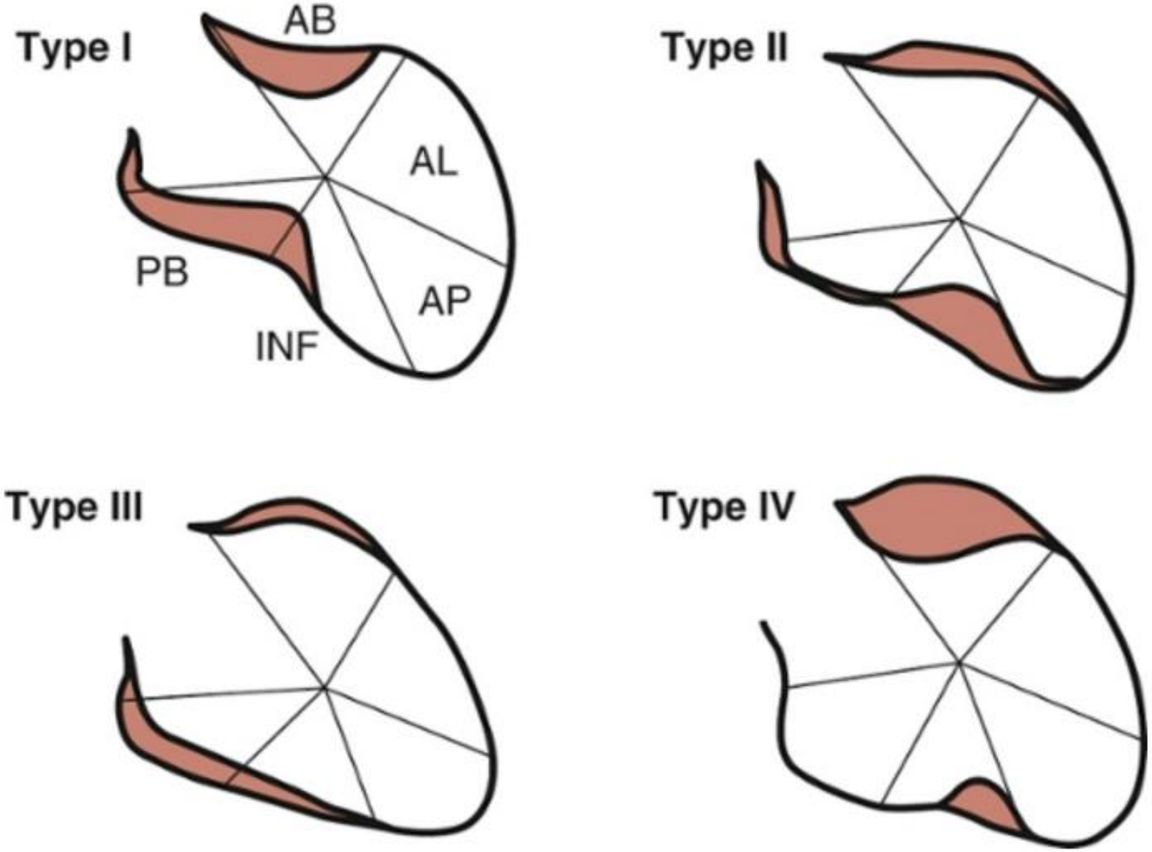
Shape of LV

- Apex: enlarged(less conical) and shifted downward and toward the mitral plane in both systole (inner line) and diastole (outer line)



Silhouettes of LV shape abnormalities

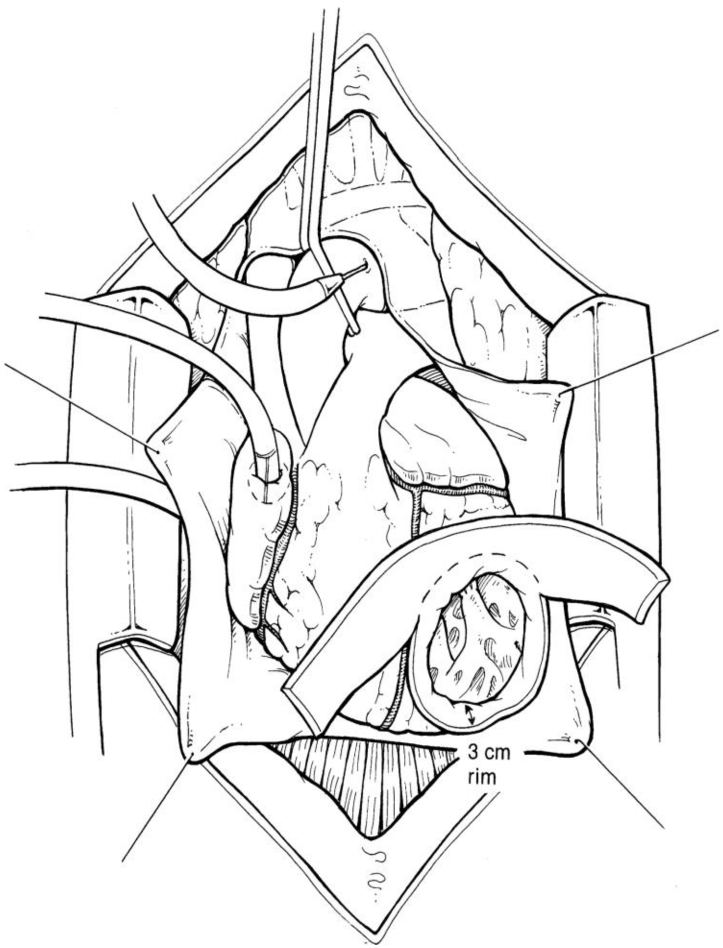
Angiographic LV silhouettes—RAO 30

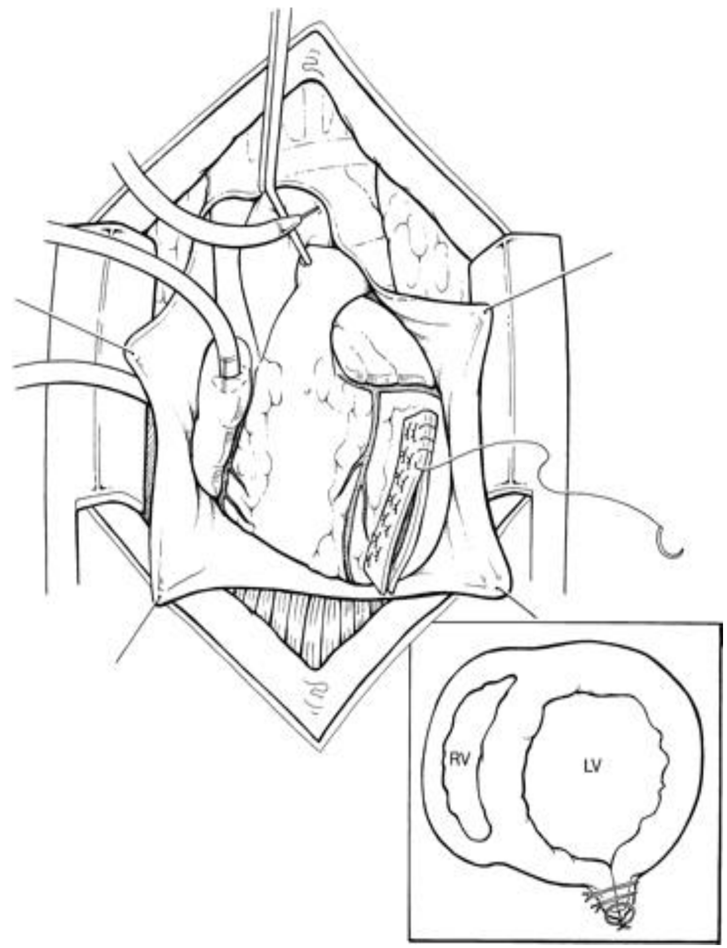


SVR for ICMP

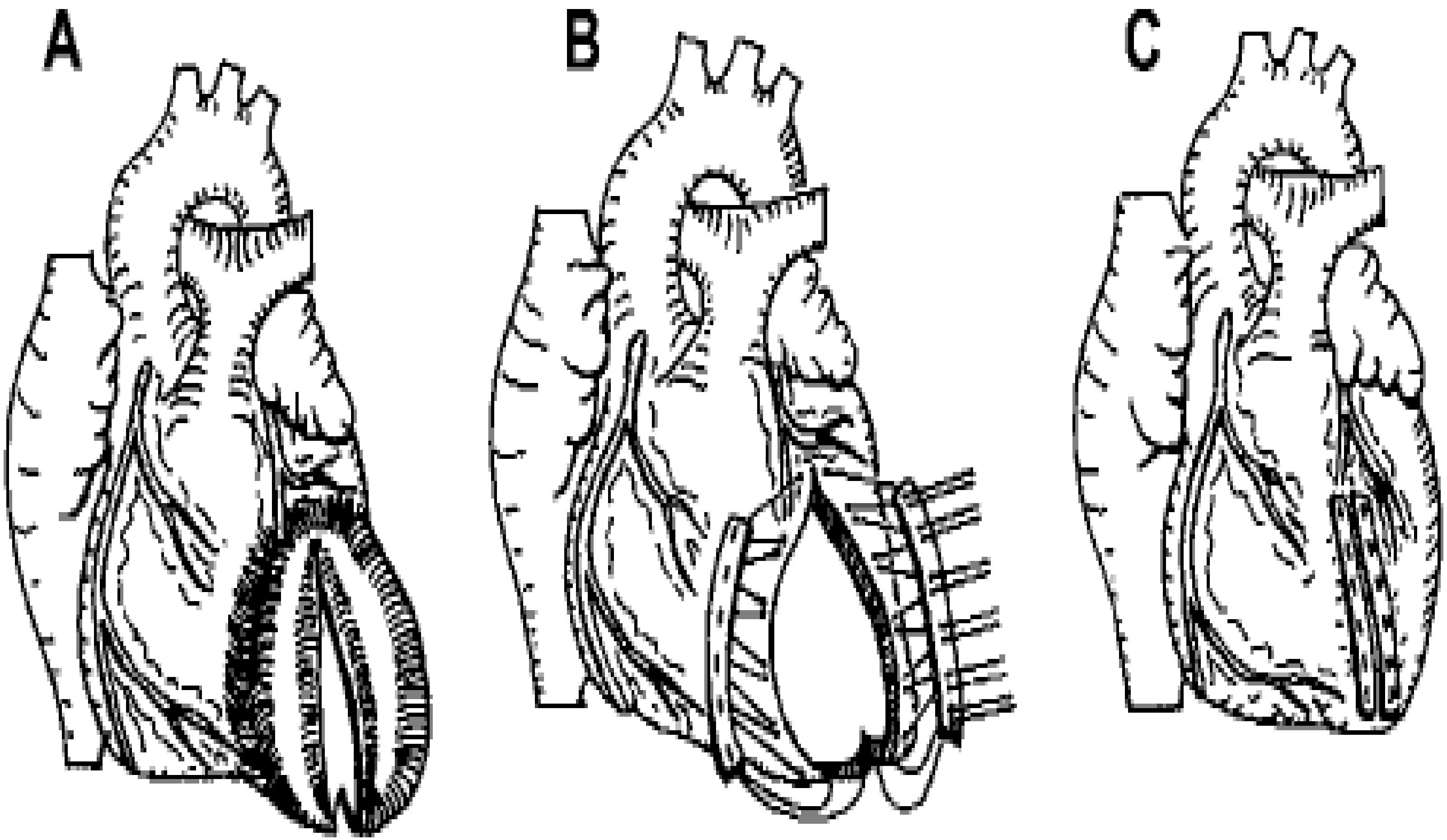
- Dor, 1984: LV reconstruction
  - If needed, CABG ± MVP or MVR
- Technique: not standardized, many variations
  - Jatene: linear closure
  - Mickleborough: modified linear closure
  - Dor and Menicanti: circular closure with patch
  - McCarthy: double cerclage closure without patch

Linear closure by Jatene

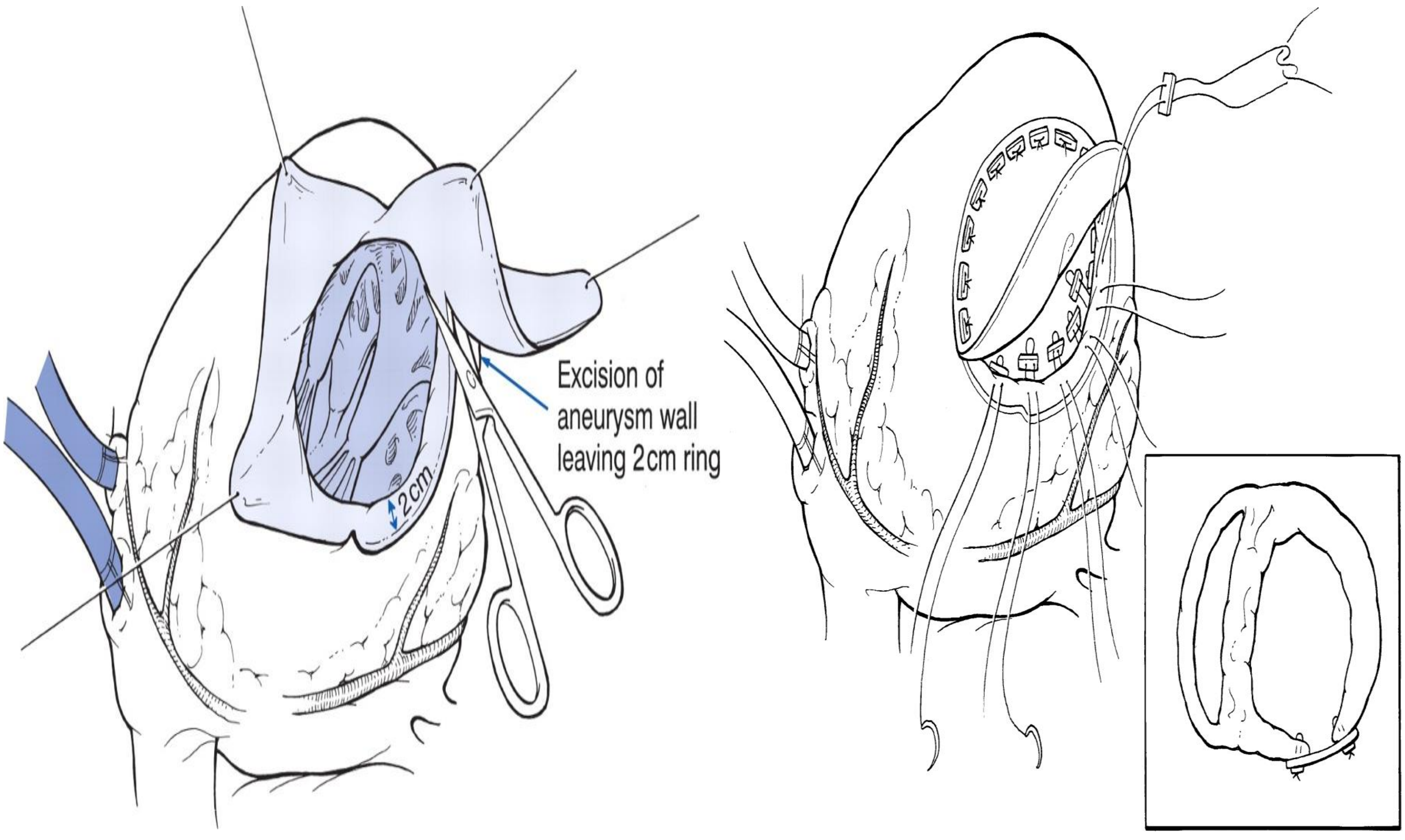




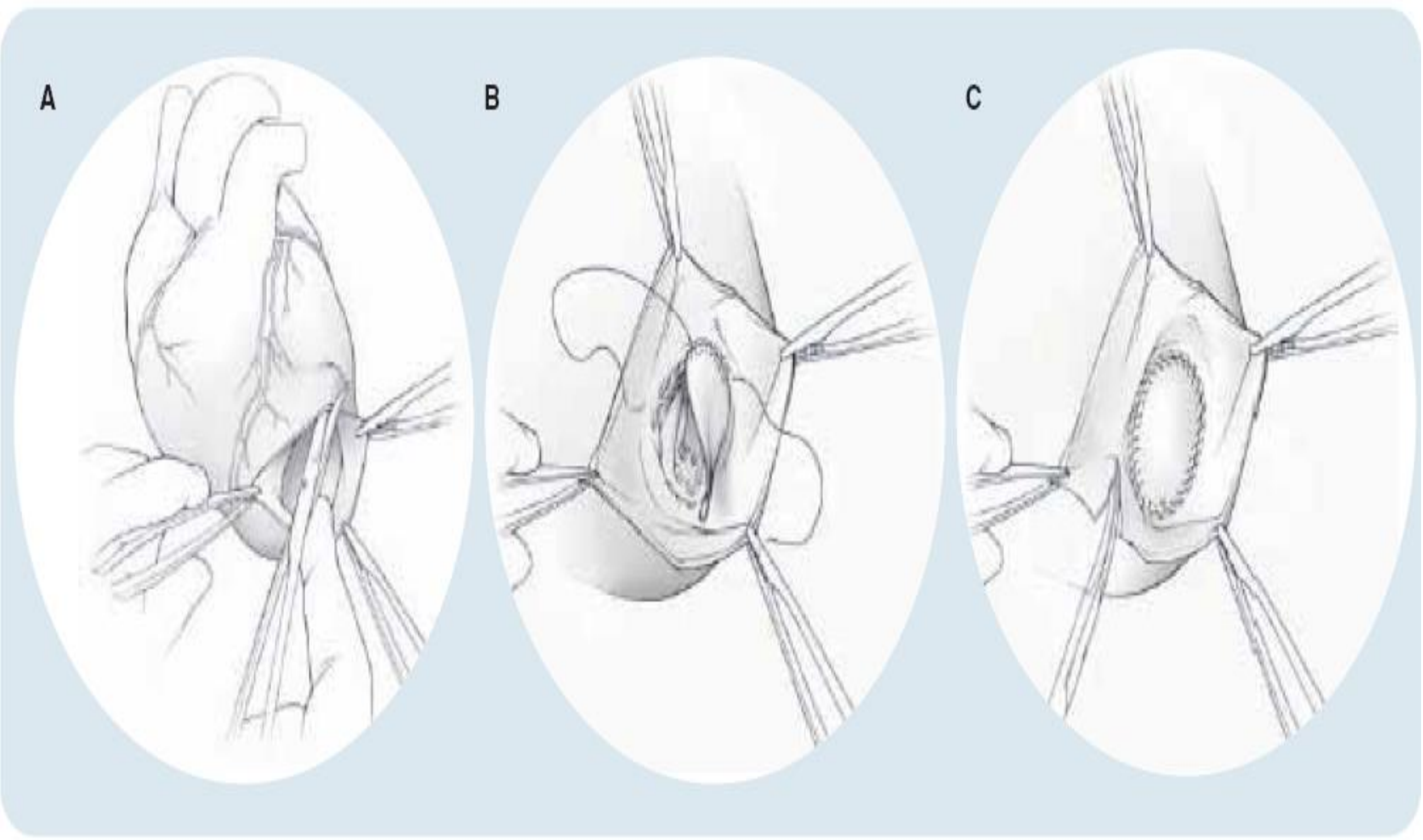
Mickleborough procedure



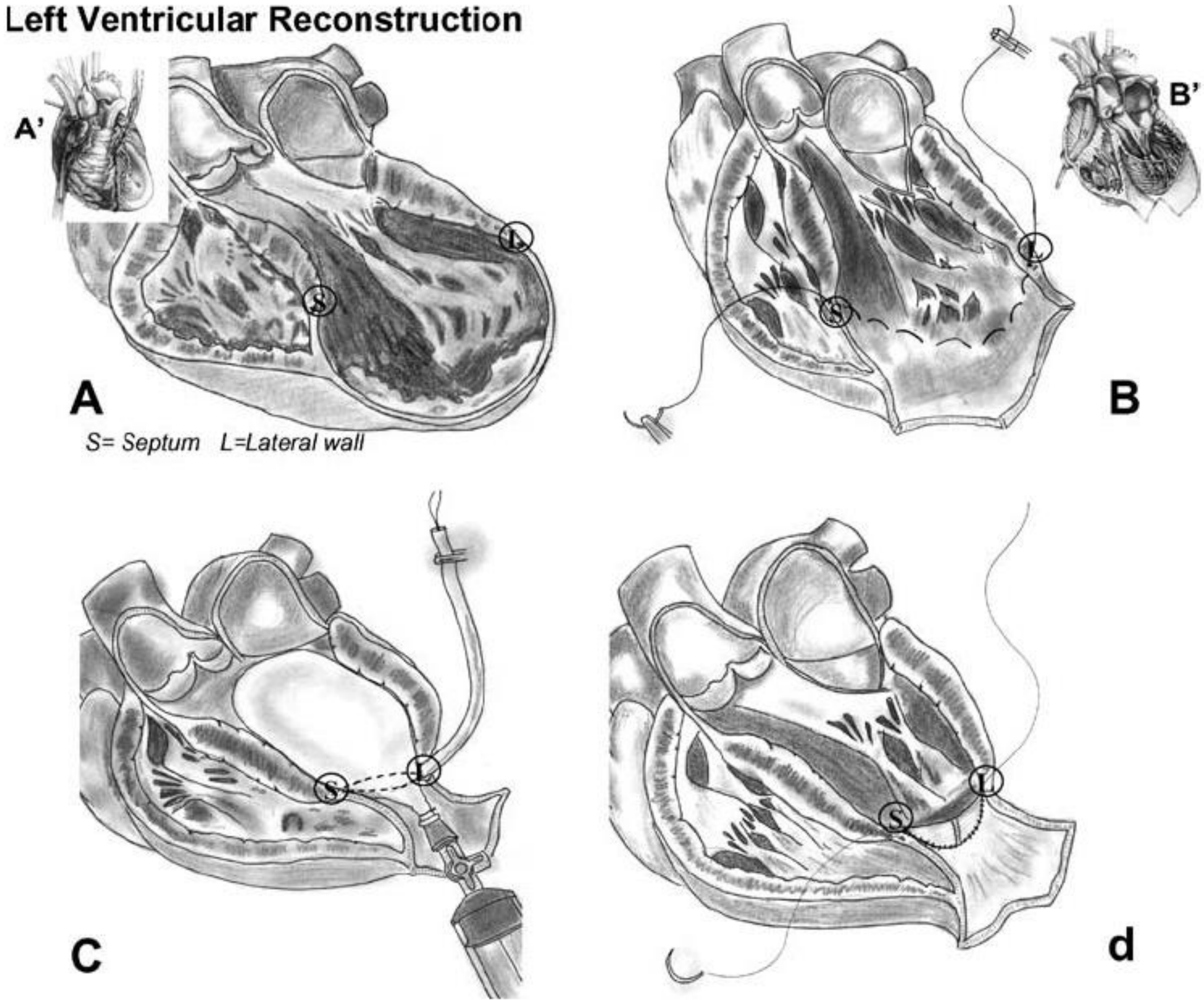
Circular patch plasty



Endoventricular patch plasty



Surgical Ventricular Restoration



Surgical pitfalls during SVR

Box 100-3

Surgical Pitfalls

- Incorrect indications
- Incomplete revascularization
- Embolism
- Cavity dimension: too large or too small
- Cavity shape: spherical or distorted

Surgical Details of Anterior SVR

- Menicanti, 2001: RESTORE Group
  - If needed, CABG ± MVP 26mm sizer
- Mannequin:
  - 50 to 60 mL/m^2
  - New apex = apex of the Mannequin
  - Start 2/0 endoventricular circular suture
  - Reduces risk: too small residual cavity
  - Rebuilding of LV: in elliptical way

- If closure plane is parallel to MV: spherical LV

Surgical Ventricular Restoration

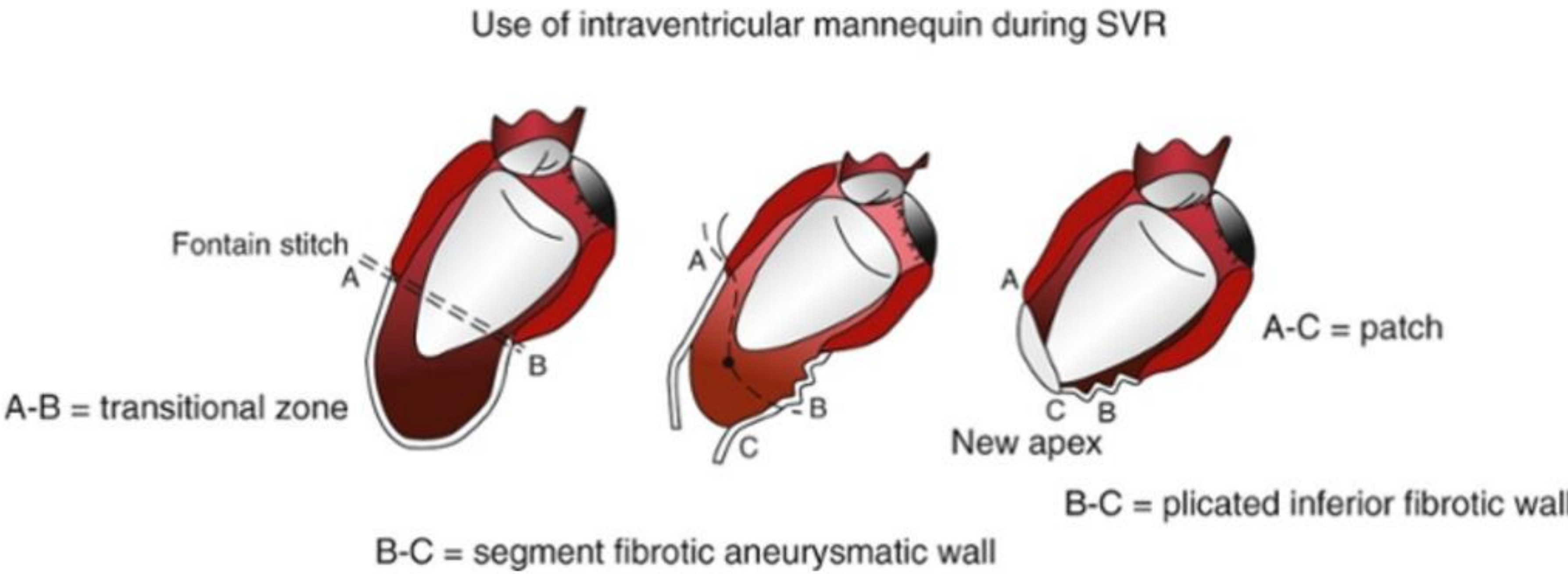
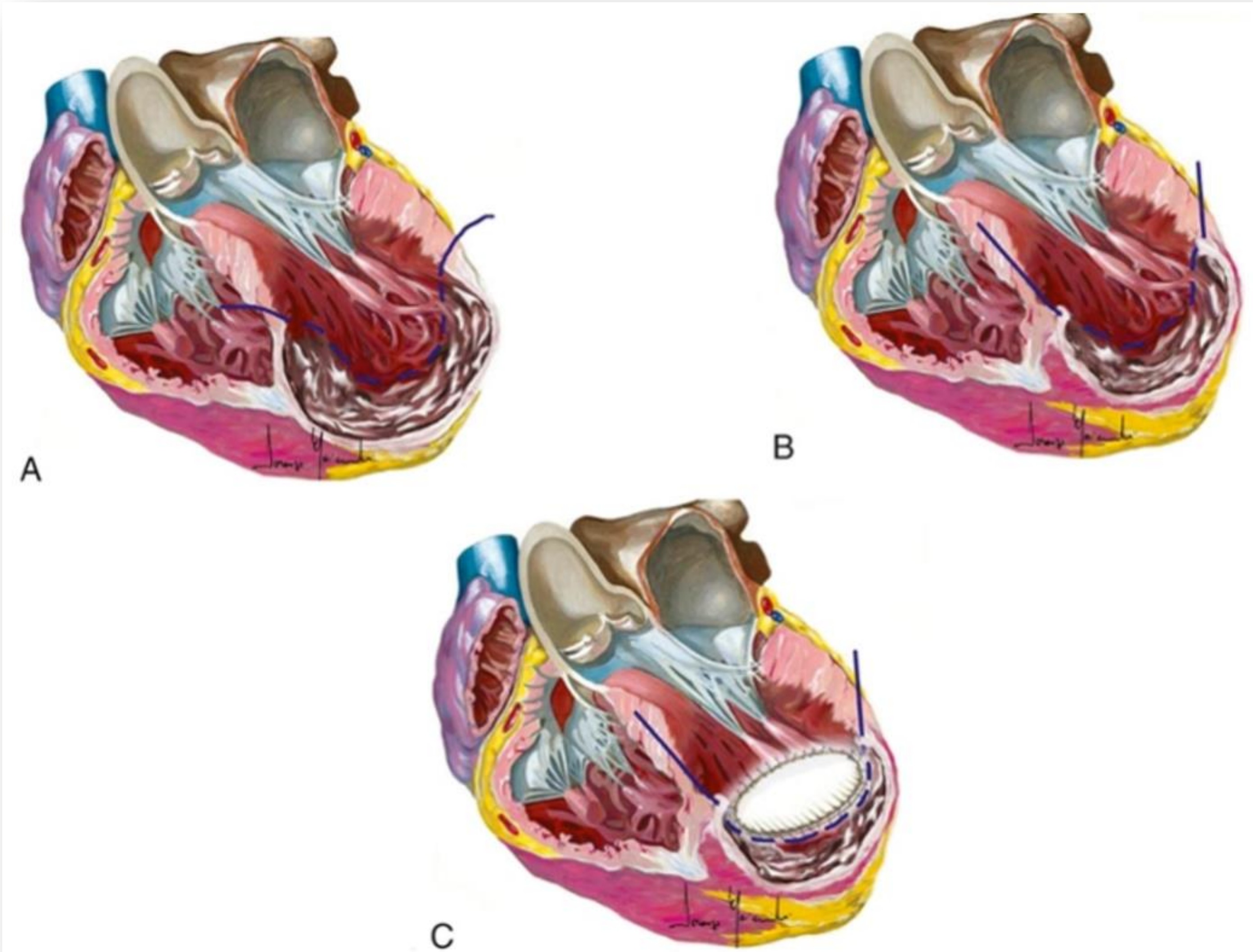


FIGURE 100-11 The use of the intraventricular mannequin during surgical left ventricle reconstruction

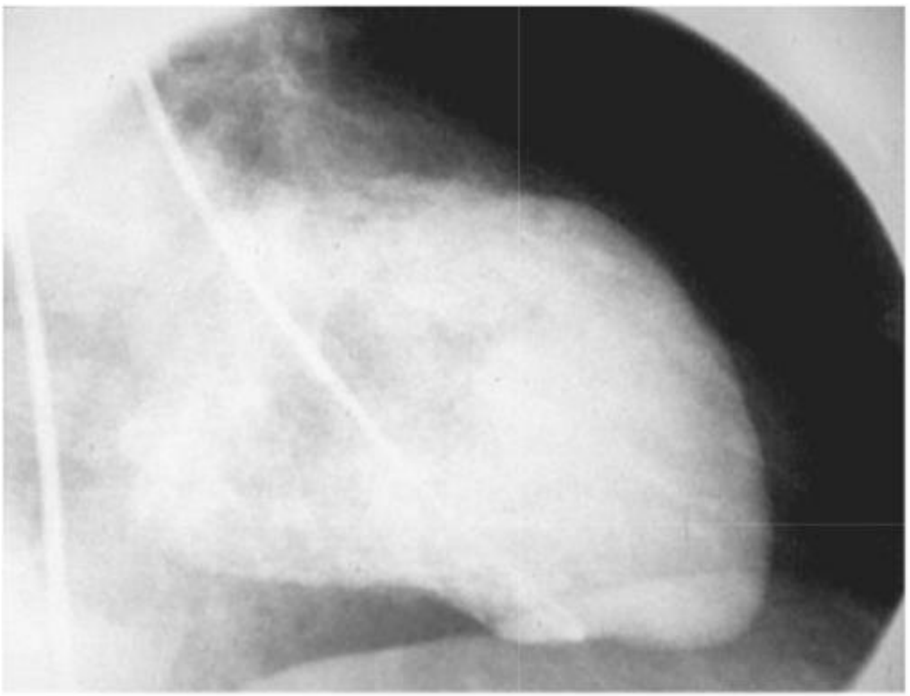
Suboptimal endoventricular suture



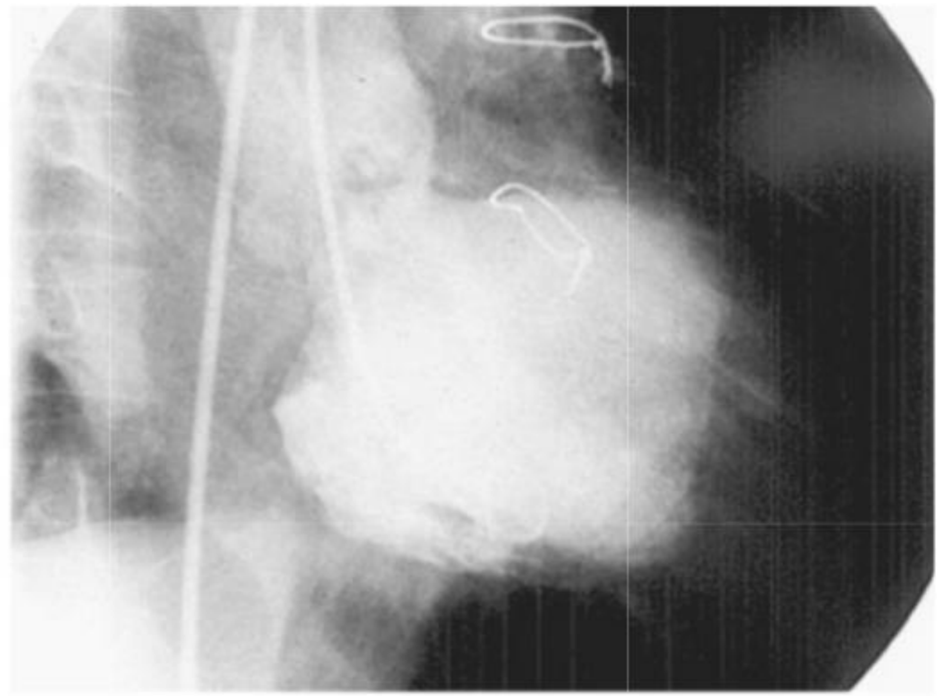
A, Suturing is done on a plane parallel to the mitral valve. B, The suture is tightened. C, The patch is inserted, and its resultant position is parallel to the mitral valve

Suboptimal endoventricular suture

Note the spherical left ventricular chamber achieved after surgery

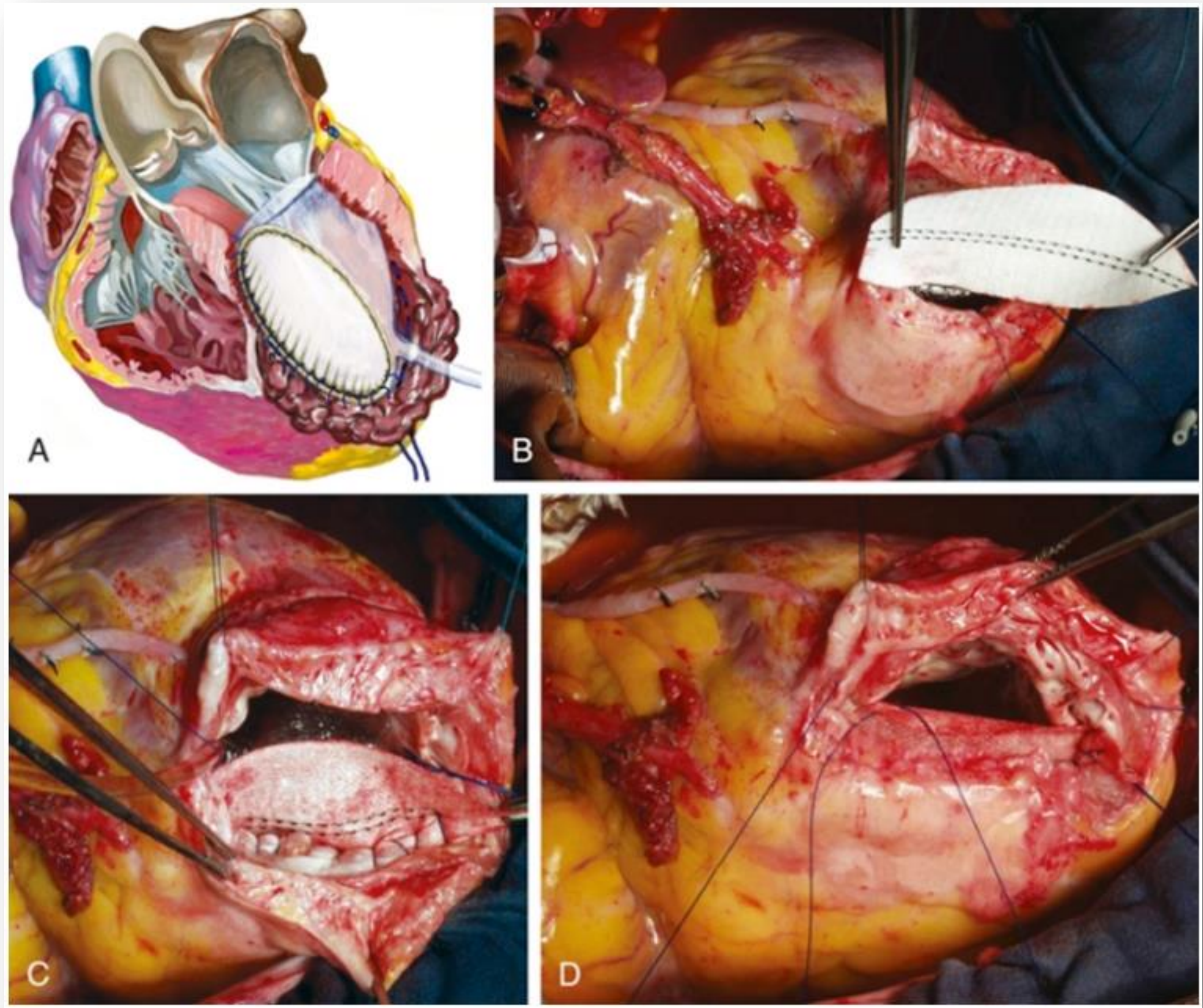


Pre-op



Post-SVR

Surgical Ventricular Restoration



Outcomes and Prognosis

- Low early mortality
  - 2-13%
- Acceptable 5 and 10 year mortality
  - 5 year survival 58-80%
  - 10 year survival 30% (better than medical Tx)
- Most patients experience increased LV performance
  - LVEF↑ PHTn↓ LV volume↓ MV O_2 demand ↓ Exercise tolerance ↑

The STICH trial

(Surgical Treatment for Ischemic Heart Failure)

- Target registry 2800 patients with 90 participating centers
- Objectives to seek best treatment for coronary disease and heart failure (Inclusive of SVR)
- Groups
  - Medical therapy alone
  - Medical therapy & CABG
  - Medical therapy & CABG and SVR

STICH SVR Trial Design

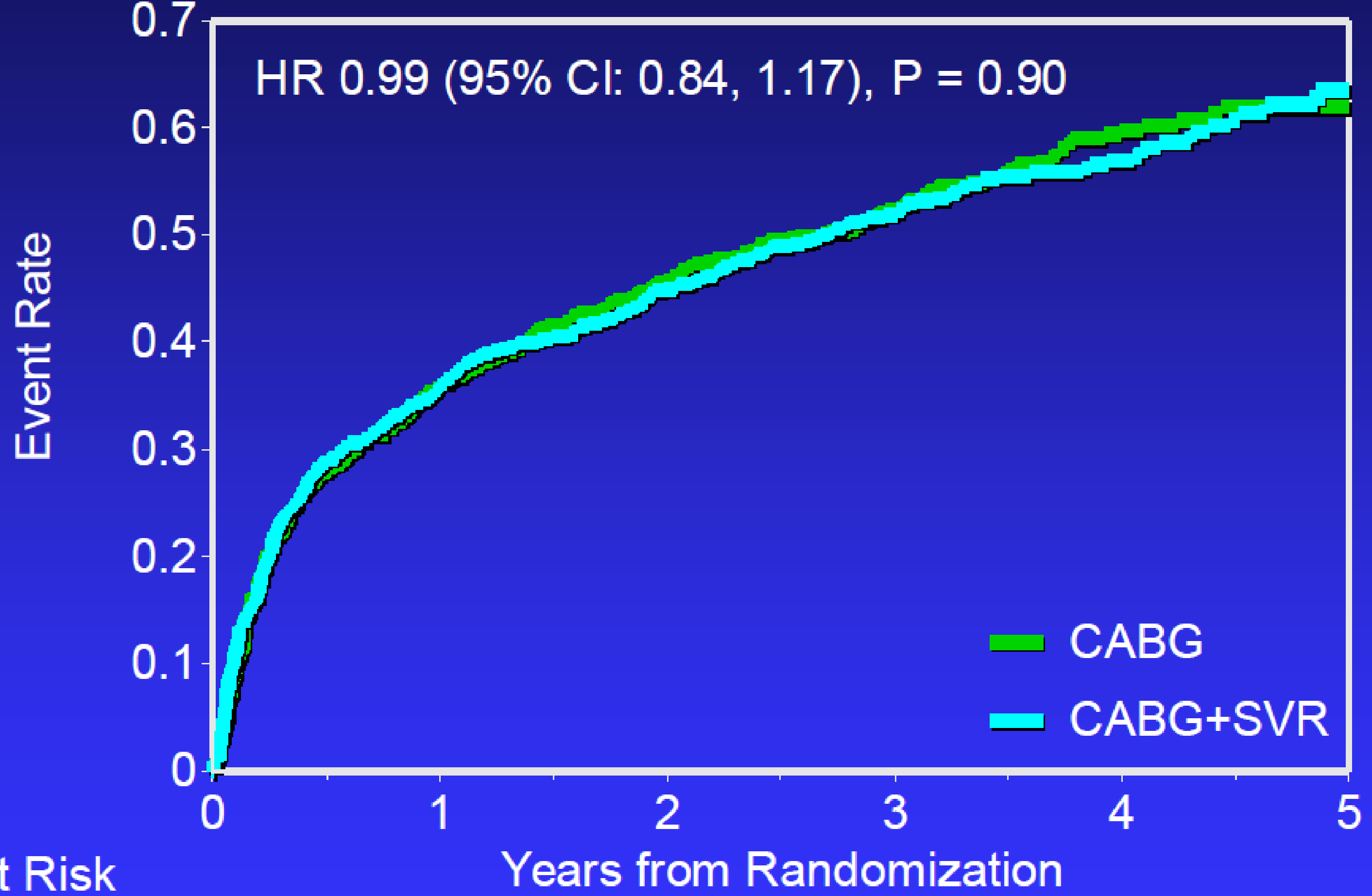
1000
Patients randomized 2002-2006
CAD, EF ≤ 35%
Anterior akinesia/dyskinesia amenable to SVR

Randomized

499 **CABG only**	**501** **CABG + SVR**

Follow-up 99% complete at 48-months
~ 50% Mild Angina/ ~ 41% CCS III
~ 50% Class I/II NYHA/ ~ 43% Class III
Range for ESVI was 23 – 284 ml/m^2

Kaplan-Meier Estimates of the Rate of Hypothesis 2 Primary Endpoints of Death or Cardiac Hospitalization



No. at Risk

CABG	499	319	270	220	99	23
CABG+SVR	501	319	275	216	11	23

Insights into the STICH Trial

- CABG alone or CABG +SVR-Hypothesis 2
- SVR + CABG: no impact over CABG alone
  - Mortality
  - Heart failure hospitalizations
  - Exercise tolerance
  - Quality of life

limitations of the STICH trial

(1) Pt. inclusion bias: not randomized,

(2) Smaller reduction of ESV

- Questions: performed properly in a majority?

- SVR Goal: LVESVI < 60 mL/m^2
- ESC & EACTS: COR IIb, LOE B
  - **Scar in the LAD territory**
  - **Baseline LVESVI ≥ 60 mL/m^2**

Summary of SVR

- Choice to add SVR to CABG should be based on
  - heart failure symptoms
  - LV volumes
  - mitral valve: geometry and MR severity
  - transmural extent of myocardial scar tissue and viability
  - surgical expertise
- Appropriate patient selection criteria:
  (1) ventricular properties - better hemodynamic effects
  (2) hemodynamic - clinical outcomes