INSUFICIÊNCIA MITRAL ISQUÉMICA VALVULOPLASTIA SEMPRE?

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Controversial Issues

- Correcting MR in cardiac failure is still controversial
  - Aproach
  - Benefit of treating moderate isquemic MR /Cabg
  - Repair/replacement
- Untill we have the results of prospective randomized trials clinical decision making is based on observational series and anedoctal experience

MITRAL REGURGITATION - CLASSIFICATION

	ETIOLOGY	LESION TYPE	MITRAL LEAFLETS
ANATOMICAL	RHEUMATIC DEGENERATIVE INFECTIOUS	VALVULAR ANNULAR	ABNORMAL
GEOMETRICAL	ISCHEMIC DILATATED CARDIOMYOPATHY	ANNULO- VENTRICULAR DISTORTION	NORMAL

HEART FAILURE
MITRAL REGURGITATION

FUNCTIONAL CLASSIFICATION OF MITRAL REGURGITATION (A. Carpentier)

- TYPE I: NORMAL LEAFLET MOTION
- TYPE II: PROLAPSE or RUPTURE
- TYPE III: RESTRICTED LEAFLET MOTION
  - III a: restriction during DIASTOLE
  - III b: restriction during SYSTOLE

Carpentier classification

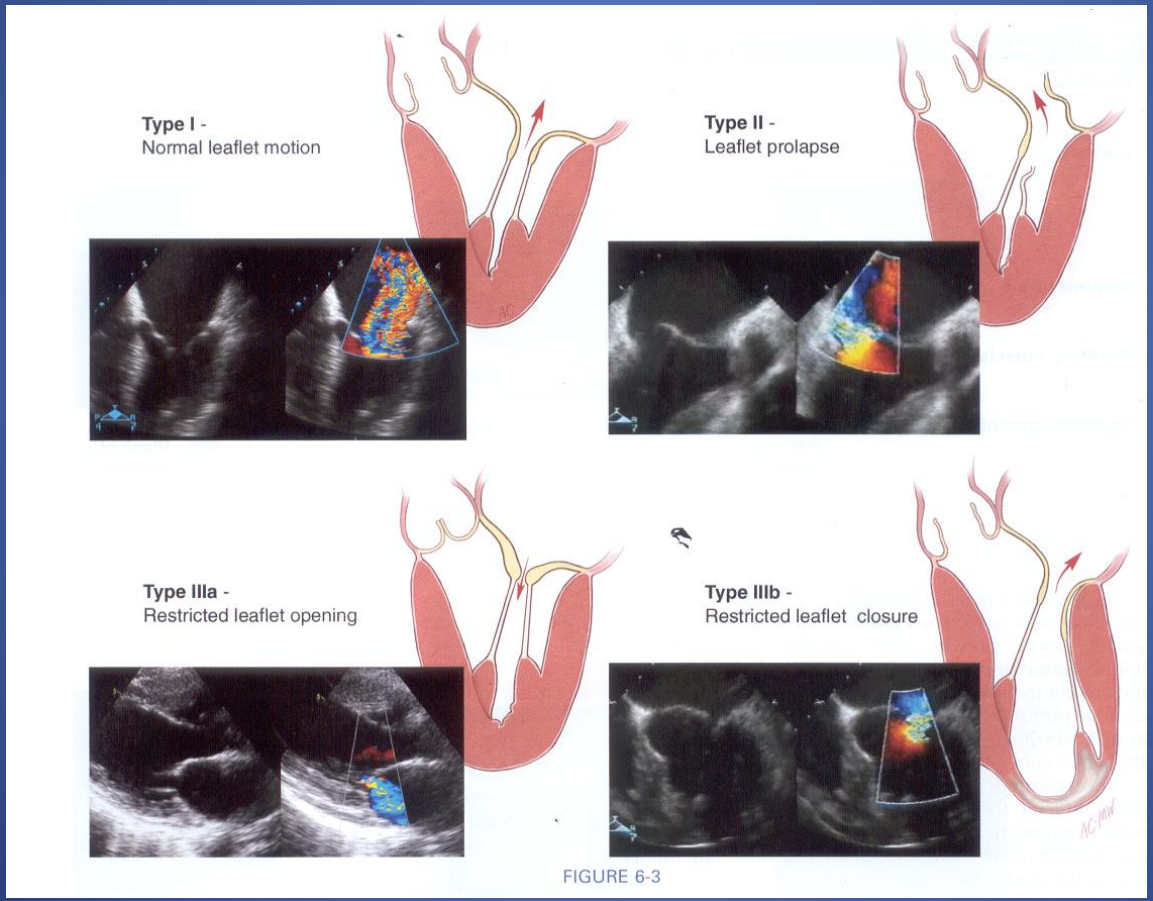


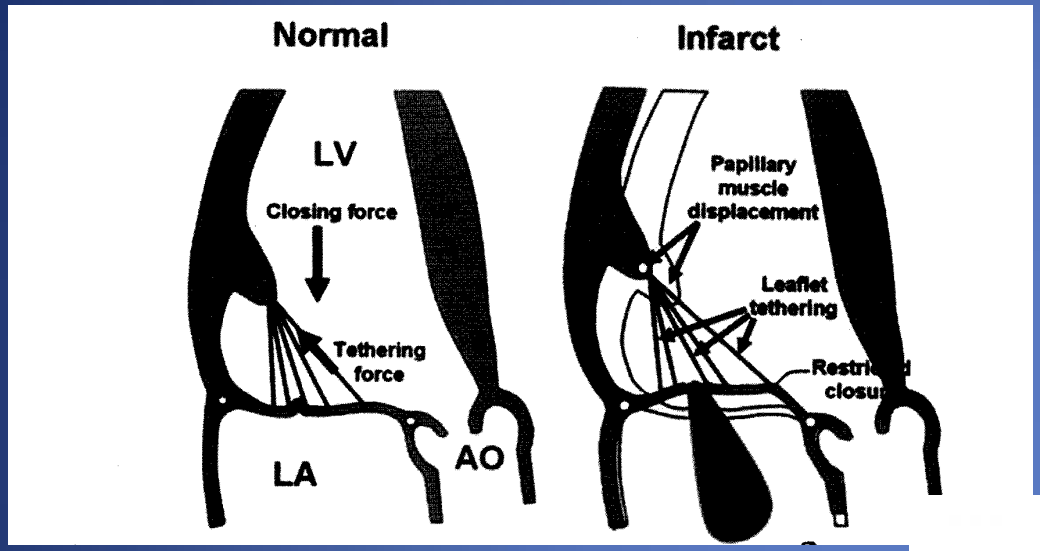
FIGURE 6-3

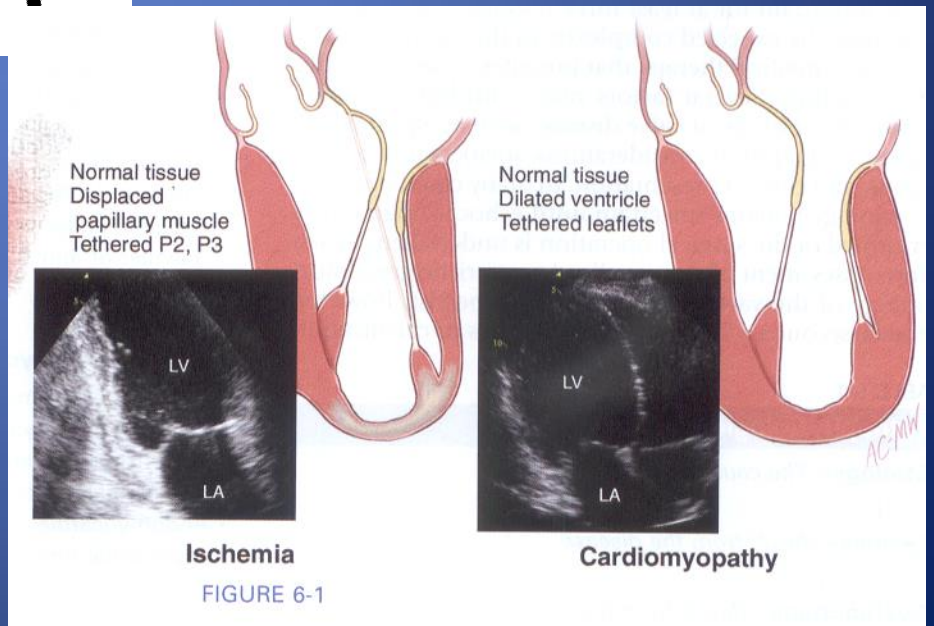
HEART FAILURE
MITRAL REGURGITATION

FUNCTIONAL CLASSIFICATION OF MITRAL REGURGITATION (A. Carpentier)

- CHRONIC ISCHEMIA MR: TYPE III b
  - PAPPILARY MUSCLE DISPLACEMENT
  - VALVULAR RESTRICTION
- DILATED CARDIOMYOPATHY:
  - TYPE I (ANNULAR DILATATION) + Type III b

Classification





Ventricular remodeling

- Chronic regurgitation leads to myocite “dropout” and fibrosis
- If the stage of ventricle remodeling is irrevirsible correction of MR may not be benneficial (reverse remodeling viability?)

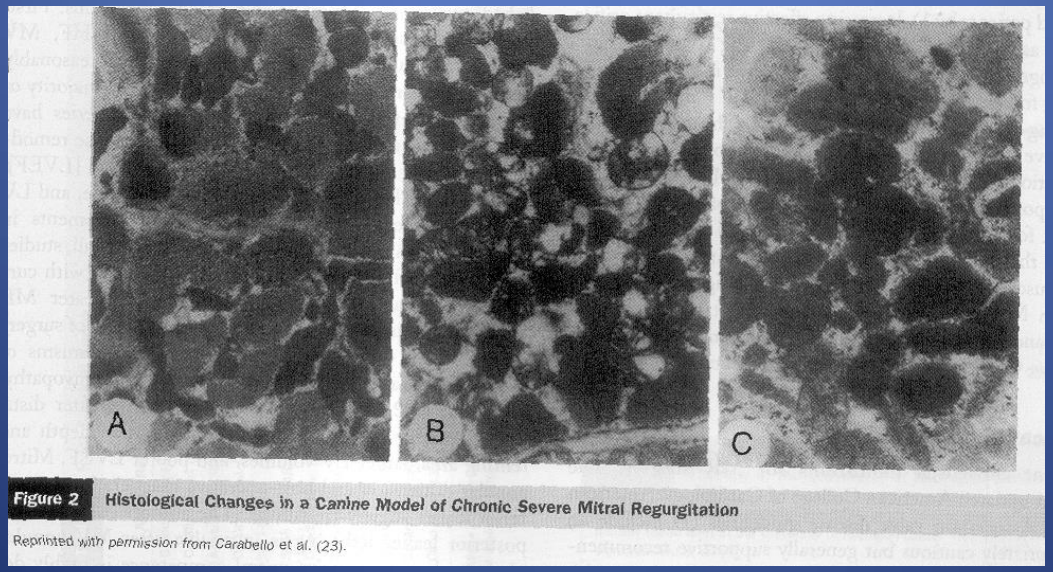
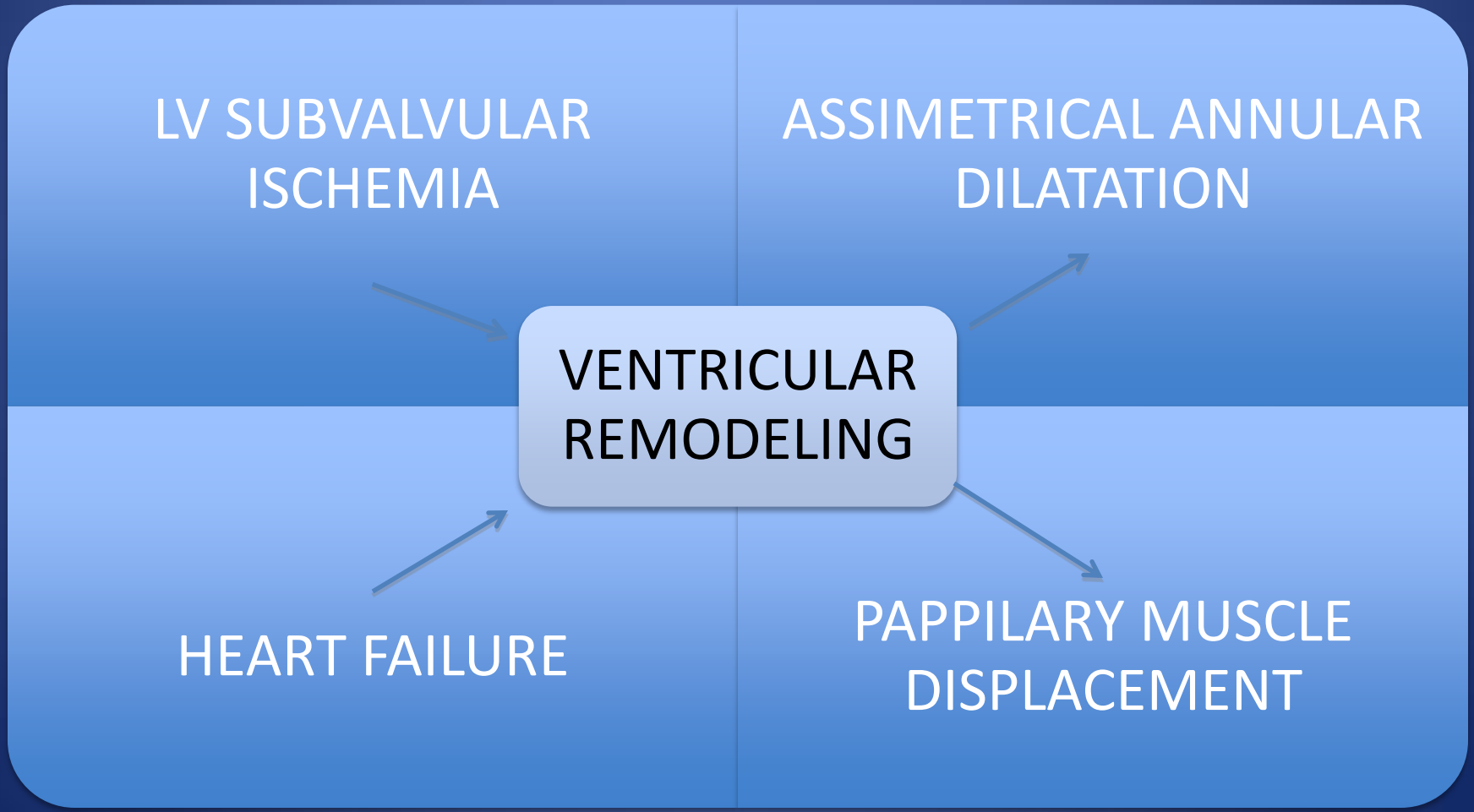


Figure 2 Histological Changes in a Canine Model of Chronic Severe Mitral Regurgitation

Reprinted with permission from Carabello et al. (23).

HEART FAILURE
MITRAL REGURGITATION

MR MECHANISM



Current consensus Indications for MR surgery

- ACC guidelines
  - Appropriately cautious generally supportive recommendations for mv surgery in advanced CHF (M Repair os MVR with chordal preservation)
  - “even though such a patient is likely to have persistent LV disfunction, surgery is likely to improve symptoms and prevent further deterioration of LV function”

Surgical options

- No randomized trials
  - MV surgery/ medical therapy severe MR and advanced CHF
  - Diferent repair techniques or Mvrepair/replacement
  - Cabg / Cabg + MV repair in moderate MR
  - Mv repair versus MV replacent with chordal preservation in severe ischemic MR
    - (last 2 running NHLBI)

Surgical Series

Table 2 Prior Surgical Series

Author (Ref. #)	Year	n	IDCM (%)	CABG (%)	NYHA Functional Class III/IV (%)	LVEF (%)	LVEDD (cm)	Operation	30-Day Mortality (%)	Survival (%)	NYHA Baseline to Follow-Up
Geidel et al. (45)	2007	121	16	70	N/A	30 ± 9	63 ± 8	MVA in all	3.3	91% at 30 months	3.4 to 1.5
Calafiore et al. (42)	2007	49	25	67	49/51	27 ± 7	N/A	MVA in 29; MVR in 20	4.2	78% at 5 yrs	3.5 to 2.2
Acker et al. (38)	2006	193	94	0	72/5	24 ± 9	70 ± 9	MVA 85; MVR 15	1.6	85% at 2 yrs	2.82 to 2.25
De Bonis et al. (44)	2005	77	34	51	75/25	28 ± 4	68	MVA in 23; ETE + MVA in 54	3.8	91% at 2.7 yrs	3.4 to 1.4
Wu et al. (9)	2005	126	29	0	N/A	23 ± 7	65 ± 8	MVA in all	4.8	60% at 5 yrs	N/A
Shah et al. (48)	2005	101	84	0	N/AA	34 ± 9	61 ± 9	MVA in all	2.9	70% at 5 yrs	N/A
Calafiore et al. (41)	2004	102	0	91	68/30	37 ± 12	N/A	MVA in 82; MVR in 20	3.9	74% at 5 yrs	3.2 to 2.1
Gummert et al. (46)	2003	66	80	0	N/A	23 ± 6	69 ± 10	MVA in all	6.1	66% at 5 yrs	3.0 to 2.0
Rothenburger et al. (47)	2002	31	66	33	21/10	23 ± 7	66 ± 8	MVA in 16; MVR in 15	6.5	77% at 5 yrs	3.3 to 2.1
Bitran et al. (39)	2001	21	0	100	90/10	<25	N/A	CABG + MVA	0.0	86% at 2 yrs	67% I–II, 17% III
Bishay et al. (40)	2000	44	30	0	34/27	28 ± 6	65 ± 8	MVA in 35; MVR in 9	2.3	67% at 5 yrs	2.8 to 1.2
Chen et al. (43)	1998	81	23	77	N/A	<30	N/A	MVA in most	11.0	38% at 5 yrs	3.3 to 1.6

CABG = coronary artery bypass graft surgery; ETE = edge-to-edge; IDCM = idiopathic dilated cardiomyopathy; LVEDD = left ventricular end-diastolic dimension; LVEF = left ventricular ejection fraction; MVA = mitral valve annuloplasty; MVR = mitral valve repair; N/A = not available; NYHA = New York Heart Association functional class.

- Carefully selected patients mortality 1,6% - 5%
- Modest but statistically signifficant reverse remodeling
- Striking improvements in quality of life and NYHA functional class
- Moderate MR or + recurs 1 year after surgery in as mucha as 35%

Mecanisms of recurrence of MR

- Larger tenting area and coapation depth
- Larger LV volumes and poorer LV function
  - Lee et al

- Tethering of posterior leaflet and poorer mobility of anterior leaflet
- Use of flexible rings rather than rigid
  - Bolling et al

Results

- Reverse remoddeling
  - Longer repair durabillity after MVR
- Repair/ replacement risk/benefit
  - Unclear
    - Higher risk of Mv replacement but less failure
- Mortality benefit of MV surgery versus medical therapy in either ischemic and non ischemis HF is unclear

MV repair/ medical treatment

- Wu et al
- Propensity analisis 126 pts LV<65mm annd Lvef 23% severe MR and advanced HF
- MV repair not better but : Period(95-02), rings, Beta blockers sprinolactone and implantable cardioverter-defib. Were underused in the surgical group

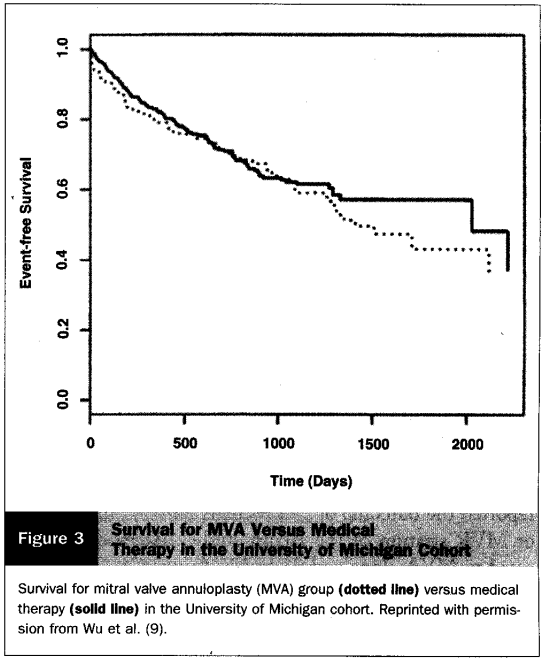


Figure 3 **Survival for MVA Versus Medical Therapy in the University of Michigan Cohort**

Survival for mitral valve annuloplasty (MVA) group **(dotted line)** versus medical therapy **(solid line)** in the University of Michigan cohort. Reprinted with permission from Wu et al. (9).

CABG/ Cabg + MV repair

- Mihaljevic et al
- Annuloplasty for patients with moderate to severe MR and CABG
- Non randomized no echo data on patients cabg alone
- No data on viability
- Similar results 1, 5, 10 years

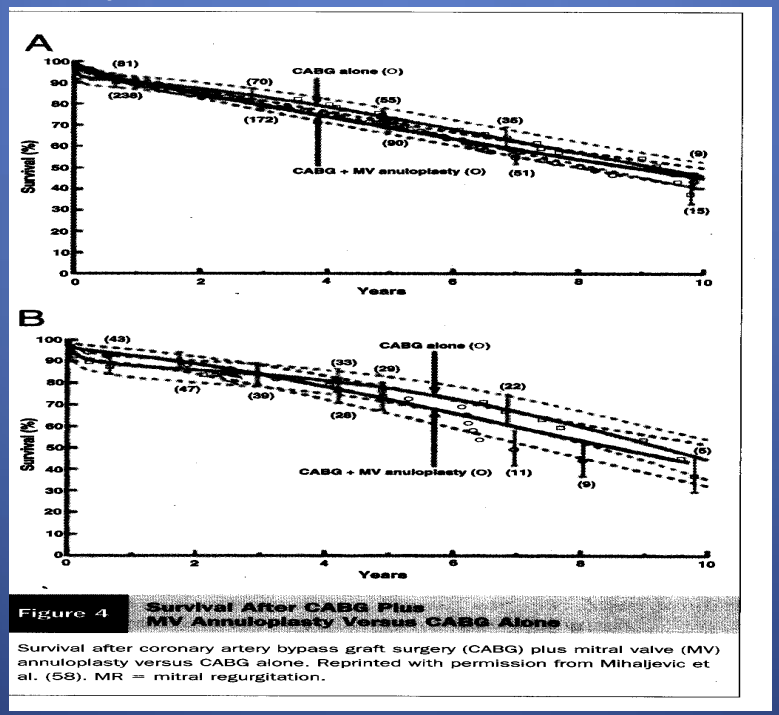


Figure 4 Survival After CABG Plus MV Annuloplasty Versus CABG Alone

Survival after coronary artery bypass graft surgery (CABG) plus mitral valve (MV) annuloplasty versus CABG alone. Reprinted with permission from Mihaljevic et al. (58). MR = mitral regurgitation.

HEART FAILURE & MR (I)

- 100 CONSECUTIVE PATIENTS WITH ISCHEMIC MR & HEART FAILURE (III/IV)
- SURGICAL THERAPY: UNDERSIZED ANNULOPLASTY (< 2 SIZES) & CABG
- SEMI-RIGID RING (PHISIORING CARPENTIER)
- INTRAOPERATIVE ECHO: WITHOU RESIDUAL MR
- MITRAL COAPTATION (A2-P2): > 8mm

Restrictive Mitral Anuloplasty Cures Ischemic Mitral Regurgitation and Heart Failure
Robert A. E. Dion et al. The Annals of Thoracic Surgery 2008; 85: 430-437

HEART FAILURE & MR (II)

- OPERATORY MORTALITY: 8%
- LATE MORTALITY : 18%
- 5-YEARS SURVIVAL: 71% ± 5.1%
- NYHA: 2.9 ± 0.8 → 1.6 ± 0.6
- MR < 2^{+} : 85%

Restrictive Mitral Anuloplasty Cures Ischemic Mitral Regurgitation and Heart Failure
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HEART FAILURE & MR (III)

- LVEDD ≤ 65 mm
  - UNDERSIZED ANNULOPLASTY + CABG
  - 5-YEARS SURVIVAL: 80%

- LVEDD > 65 mm: PREDICTOR OF LATE MORTALITY
  - 5-YEARS SURVIVAL : 49%
  - WORST OUTCOMES: ADDITIONAL LV RECONSTRUCTION TECHNIQUES (?)

Restrictive Mitral Anuloplasty Cures Ischemic Mitral Regurgitation and Heart Failure
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HEART FAILURE & MR (IV)

- IF LVEDD ≤ 65 mm:
  - UNDERSIZED ANNULOPLASTY + CABG = DEFINITVE TREATMENT OF ISCHEMIC MR AND HEART FAILURE
- IF LVEDD > 65mm:
  - 25%: REVERSE LV REMODELING
- ABSENCE OF REVERSE REMODELING
  - ADVANCED LV DISEASE
  - TREATMENT:
    - LV RECONSTRUCTION
    - EXTERNAL CARDIAC SUPPORT (CORCAP; ACORN DEVICE) (LVEDD > 65mm e < 80mm)

Restrictive Mitral Anuloplasty Cures Ischemic Mitral Regurgitation and Heart Failure
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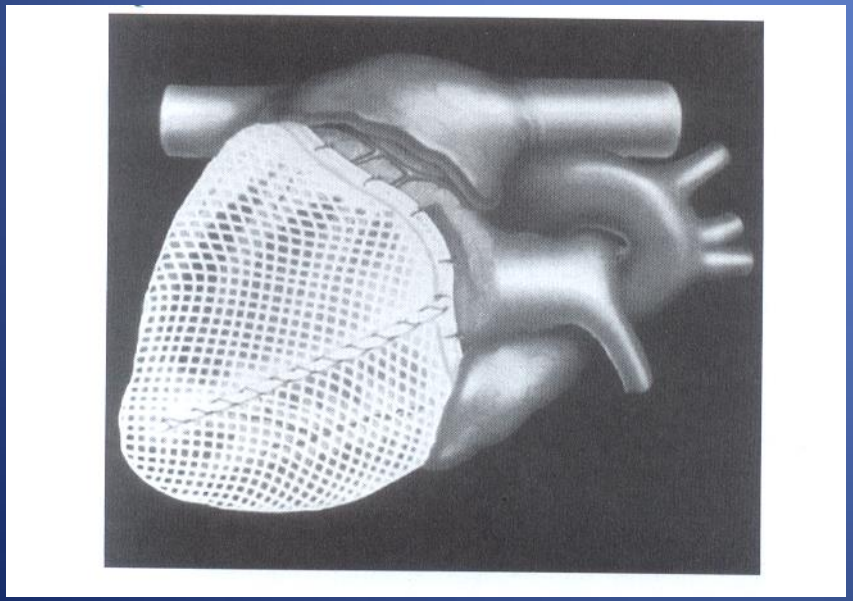
MV repair/ MV repair + corecap

- ACKER ET AL
- Acorn device in dilated cardiomyopathy and non ischemic MR
- 193 pts randomized into MVA and MVA* corecap
  - Corecap more improvement in sphericity index and LV diastolic and sistolyc volumes but not in grade of MR



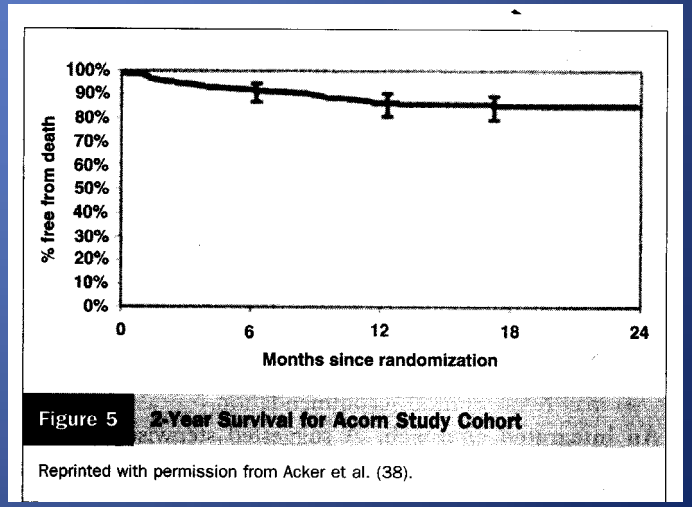


Figure 5 2-Year Survival for Acorn Study Cohort

Reprinted with permission from Acker et al. (38).

Aproach to MR in CHF

Table 4 Suggested Approach to the Management of Severe MR in Advanced Heart Failure

1. Optimize medical therapy
   - Angiotensin-converting enzyme inhibitor/angiotensin receptor-blocker, beta-blockers, aldosterone antagonists, flexible sliding-scale diuretic program, hydralazine-isosorbide dinitrate
   - Define adequacy of medical therapy by cardiac catheterization in selected instances
   - Ensure compliance with medical therapy and lifestyle accommodations
2. Evaluate for revascularization in patients with coronary artery disease
3. Provide CRT
   - Indications: LV ejection fraction <35%, QRS interval >120 ms, New York Heart Association functional class III to IV
   - Reassess clinical response and MR severity
4. Reconfirm the severity of MR
   - "Definitive" imaging modality after optimizing medical therapy, revascularization, and CRT with cardiac magnetic resonance imaging or echocardiography
5. For patients who remain intolerably symptomatic, define perioperative risk and surgical options
   - Ideally, perioperative risk should be ≤2% on the basis of composite medical and surgical factors
   - Ideal candidates will have heart failure duration <5 years, resting heart rate <100 beats/min, systolic blood pressure >80 mm Hg with normal proportional pulse pressure, serum sodium >135 mmol/dl, blood urea nitrogen >100 mg/dl, creatinine >2.5 mg/dl, normal total bilirubin, LV end-diastolic diameter <80 mm, peak VO_2 >14 $mg \cdot kg^{-1} \cdot min^{-1}$, 6-min walk test >350 m, no cachexia, no prior cardiac surgery, reversible pulmonary hypertension, no refractory right heart failure
6. Estimate LV reverse remodeling viability on the basis of aggregate clinical data
7. Discuss mitral valve surgery frankly with the patient and family
   - Issues to discuss: 1) perioperative risk; 2) durability of planned correction; and 3) clinical outcomes on the basis of available data: functional capacity, long-term LV remodeling and function, and mortality.

CRT = cardiac resynchronization therapy; LV = left ventricular; MR = mitral regurgitation.

Favorable candidates for surgery

Table 3 **Abbreviated Criteria for Selection of Appropriate Operative Candidates**

- Favorable surgical considerations
  - Coronary artery disease and concurrent revascularization
  - Ventricular reconstruction (e.g., Dor)
  - Reversible pulmonary hypertension
  - No prior operations
- Favorable medical considerations
  - NSR (or likelihood of restoration)
  - "Tolerance" of reasonable doses of vasodilators and beta-blockers
  - Preservation of renal function
  - Absence of hyponatremia
  - Absence of refractory right heart failure
  - Absence of cachexia
- Favorable LV reverse remodeling viability
  - Absence of severe ventricular dilation (LVEDD >80 mm)
  - Lower sphericity index
  - Preservation of LV torsion
  - Presence of contractile reserve
  - Beneficial response to cardiac resynchronization

LV = left ventricle; LVEDD = left ventricular end-diastolic diameter; NSR = normal sinus rhythm.

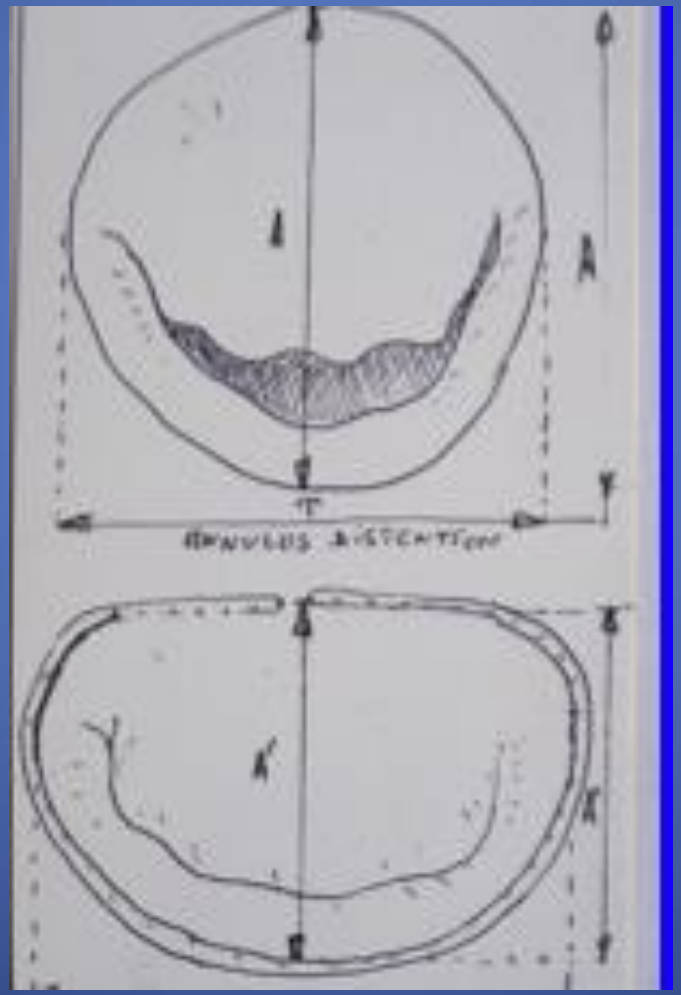
Surgical techniques

Table 5 Current and Evolving Options for Mitral Valve Surgery in Advanced Heart Failure

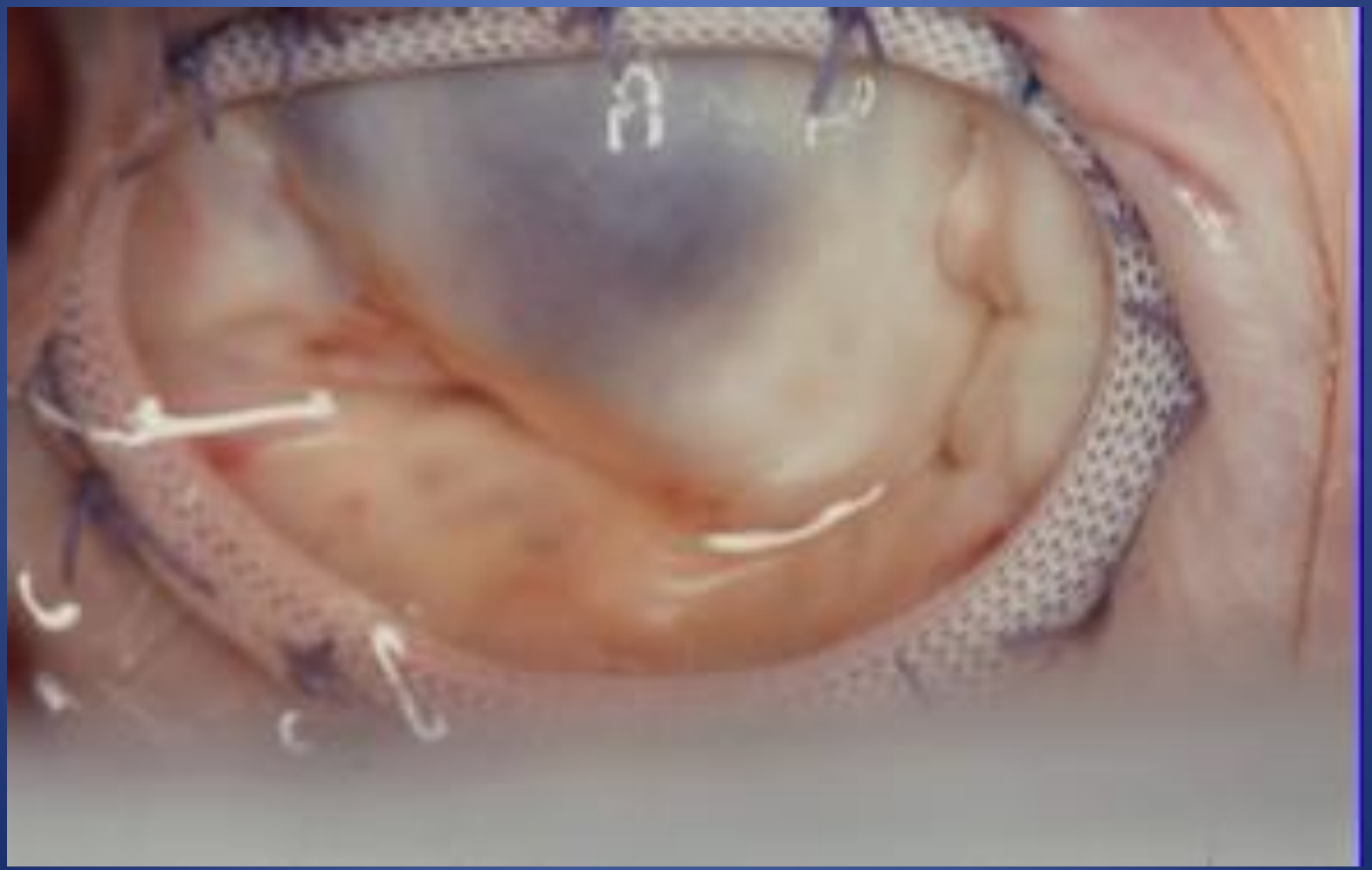
1. Mitral repair
    - Annulus (annuloplasty)
        - Ring (rigid, flexible; undersized)
        - Asymmetrical
        - Percutaneous techniques
    - Leaflets
        - Edge-to-edge leaflet (Alfieri)
        - Leaflet lengthening
    - Chordae
        - Basal chordae resection
    - Papillary muscle
        - Scar excision with papillary muscle "reimplantation"
        - Internal slings
        - Surgical "buckles"
        - External bands
        - Mesh patches
    - Ventricular "reshaping" (with annuloplasty)
        - Infarct plication
        - Infarct excision and patching (e.g., Dor)
        - Localized infarct patch with epicardial balloon
        - External restraint (e.g., Acorn CorCap)
2. Mitral replacement with chordal sparing

HEART FAILURE
MITRAL REGURGITATION

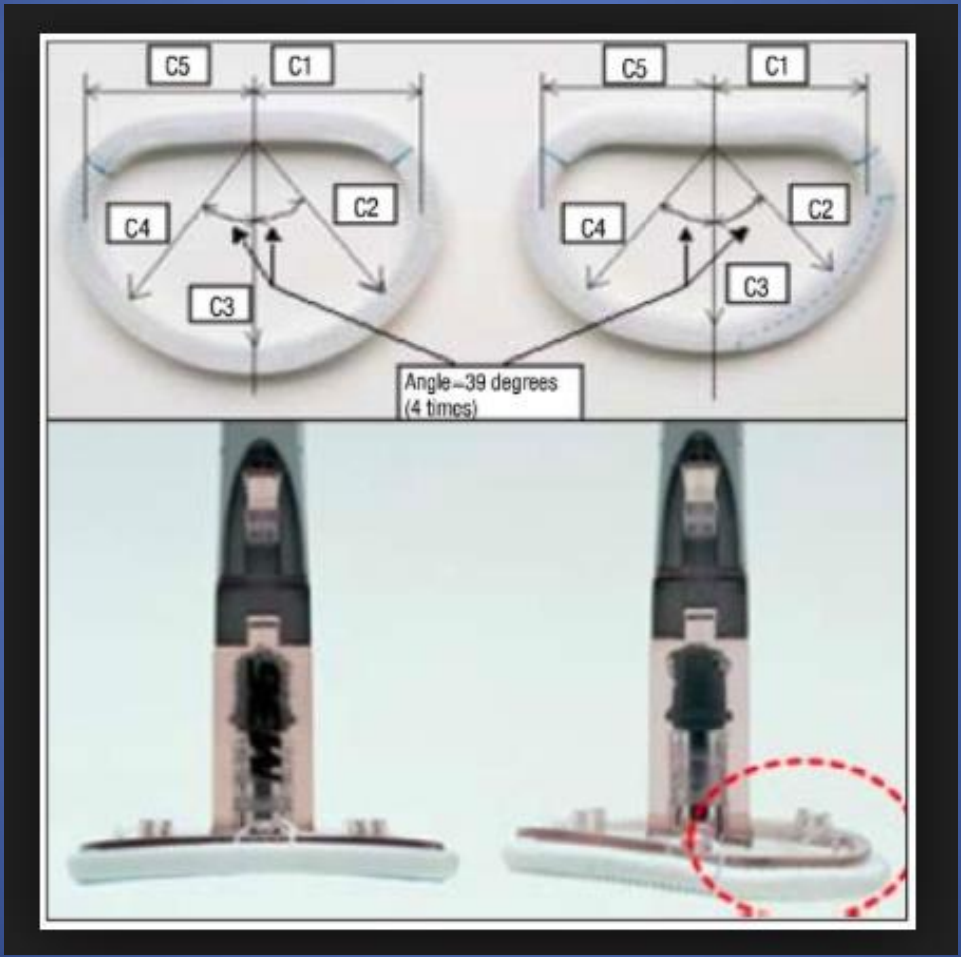
ANNULUS DISTENTION



MITRAL RING

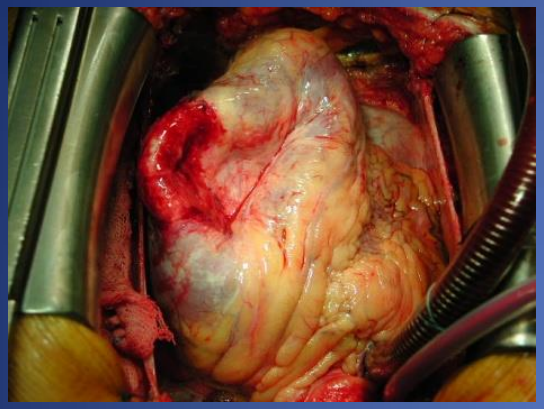
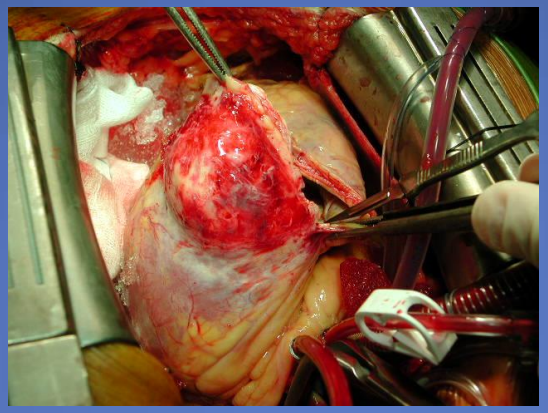
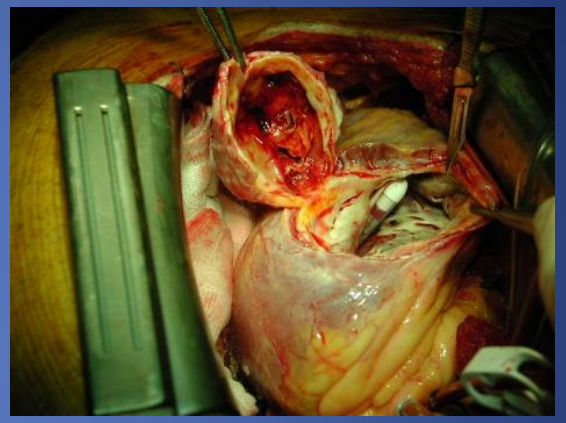
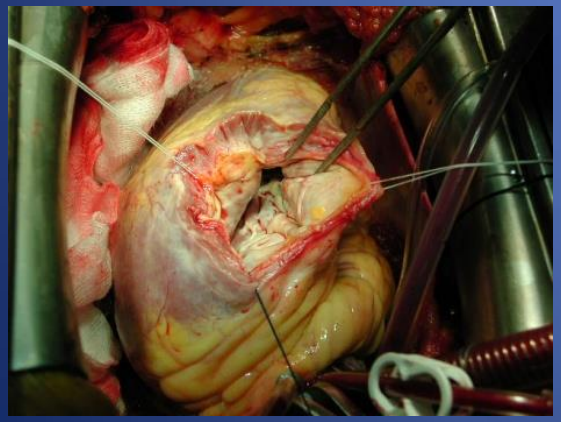
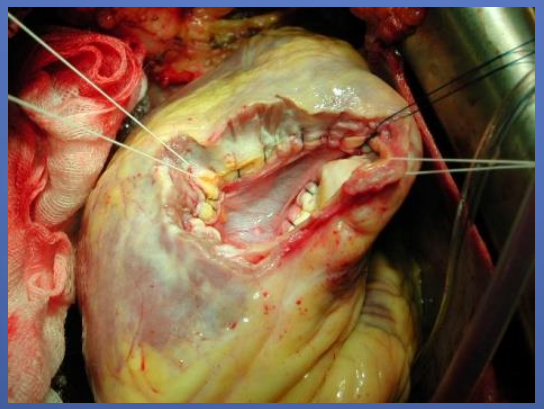
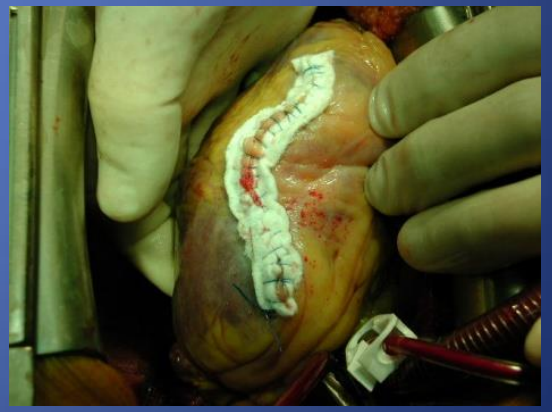


Assimetric Ring



Saddle Ring

Operação de Dor

UNDERSIZED ANNULOPLASTY (I)

- UNDERSIZED ANNULOPLASTY + CABG:
  - BEST TREATMENT CHOICE FOR ISCHEMIC MR ASSOCIATED WITH HF
- UNDERSIZED ANNULOPLASTY
  - EFECTIVE > 80% OF PATIENTS
- PROBLEMS:
  - POST-MI SUBVALVULAR GEOMETRICAL REMODELING IS NOT CORRECTED
  - MR IS A VENTRICULAR DISEASE
  - UNIPLANAR ANNULOPLASTY

UNDERSIZED ANNULOPLASTY(II)
RESULTS IMPROVEMENT

- IMPROVE SURVIVAL AND PREVENT RECURRENT MR:
  - 3D RING
  - ACORN DEVICE:
    - REDUCES "WALL STRESS"
    - IMPROVES LV REMODELING

- FUTURE CLINICAL BENEFIT OF PRESENT EMERGING TECHNOLOGIES

Conclusions

- Issue still very controversial
- No randomized trials
- Select better candidates with low operative mortality risk
- Remember it is a ventricular disease (Dor,Corecap , revascularize)
- Check reversibility of remmodelling
- Use appropiate surgical techniques
- Undersize ring and if LV >65mm restrain the ventricle

LV GEOMETRICAL REMODELING

- ACUTE ISCHEMIC MR:
  - MULTIPLE and DISCRETE (< 5mm)
  - DIFFICULT DIAGNOSIS AND SURGICAL TREATMENT
- CHRONIC ISCHEMIC MR:
  - 1 / 2 cm CHANGES
  - ANNULAR DILATATION / SUBVALVULAR RESTRICTION
  - EASIER DIAGNOSIS AND SURGICAL TREATMENT

INDICATION FOR SURGERY

- POINTS TO CONSIDER:
  - IMPACT OF CABG IN MR PROGRESSION
  - IMPACT OF CABG – with or without MITRAL REPAIR - IN SURVIVAL
  - ADDED RISK OF MITRAL REPAIR PLUS CABG
  - VALVULAR REPAIR vs. VALVULAR REPLACEMENT

THERAPY FOR MAJOR CHRONIC MR

1. CORONARY DISEASE SEVERITY AND ANATOMY

2. DEGREE OF MR (>1^+ ou 2^+)

   ADVERSE FACTORS TO MITRAL REPAIR

   - MAJOR ANNULAR DILATATION
   - MAJOR RESTRICTION OF BOTH LEAFLETS
   - ECCENTRIC and COMPLEX MR

3. SEVERITY OF LV SYSTOLIC DYSFUNCTION – difficult evaluation in the presence of MR

SURGICAL THERAPY

- OBJECTIVE: LV GEOMETRICAL PRESERVATION
- GEOMETRICAL RECONSTRUCTION:
  "UNDERSIZED" ANNULOPLASTY
- VALVULAR REPLACEMENT WITH SUBVALVULAR PRESERVATION: BIOPROTHESIS

SURGICAL THERAPY

- 3^+ or 4^+: MITRAL and CORONARY SURGERY
- 2^+ : MITRAL SURGERY(?) and CORONARY SURGERY
- 1^+ : CORONARY SURGERY ONLY

  EXCEPT IF:

  - PRE-OPERATIVE EPISODES OF SEVERE MR
  - INTRAOPERATIVE ECHO:
    - MAJOR ANNULAR DILATATION
    - MAJOR VALVULAR RESTRICTION

SURGICAL THERAPY

- "UNDERSIZED" ANNULOPLASTY
- RISK FACTORS:
  - PRE-OP SEVERE MR
  - COMPLEX MR JETS
  - SEVERE LV DYSFUNCTION
- *CLEVELAND CLINIC* (2002)
  - POST-ANNULOPLASTY MR: FIRST 6 MONTHS - 28% (3^+ a 4^+)

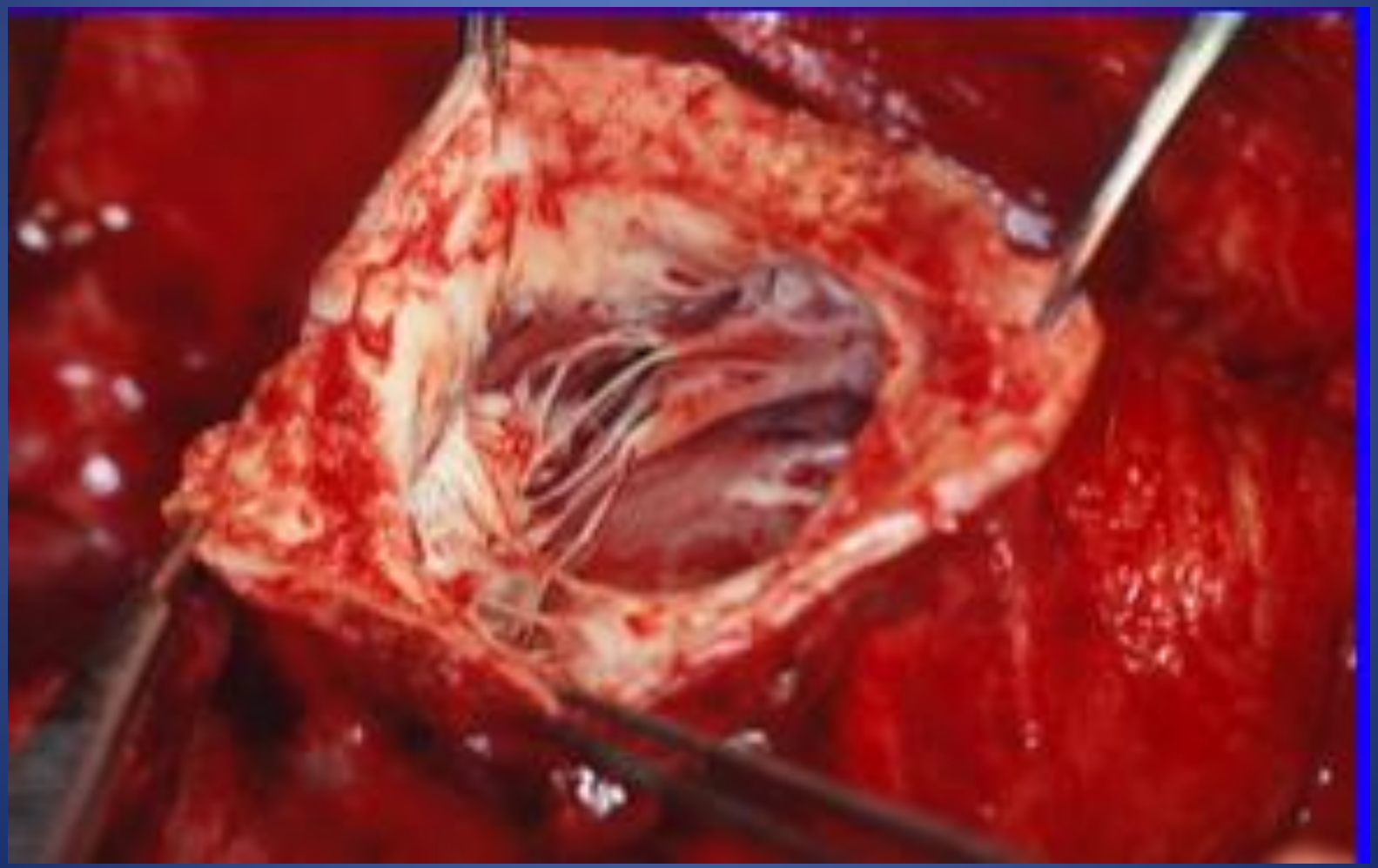
SURGICAL THERAPY

- INTRAOPERATIVE ECHO:
  - CENTRAL JET + ANNULAR DILATATION = ANNULOPLASTY RING
  - ECCENTRIC and COMPLEX JET + SEVERE RESTRICTION OF BOTH LEAFLETS + PAPPILARY MUSCLE DYSFUNCTION (RUPTURED / STRETCHED) = VALVULAR REPLACEMENT
  - " UNDERSIZE" ANNULOPLASTY : allows SAM prevention (posterior leaflet pulled and restricted)

HEART FAILURE

MITRAL REGURGITATION

LEFT VENTRICLE AND MITRAL VALVE



HEART FAILURE
MITRAL REGURGITATION

ISCHEMIC MITRAL VALVE

HEART FAILURE
MITRAL REGURGITATION

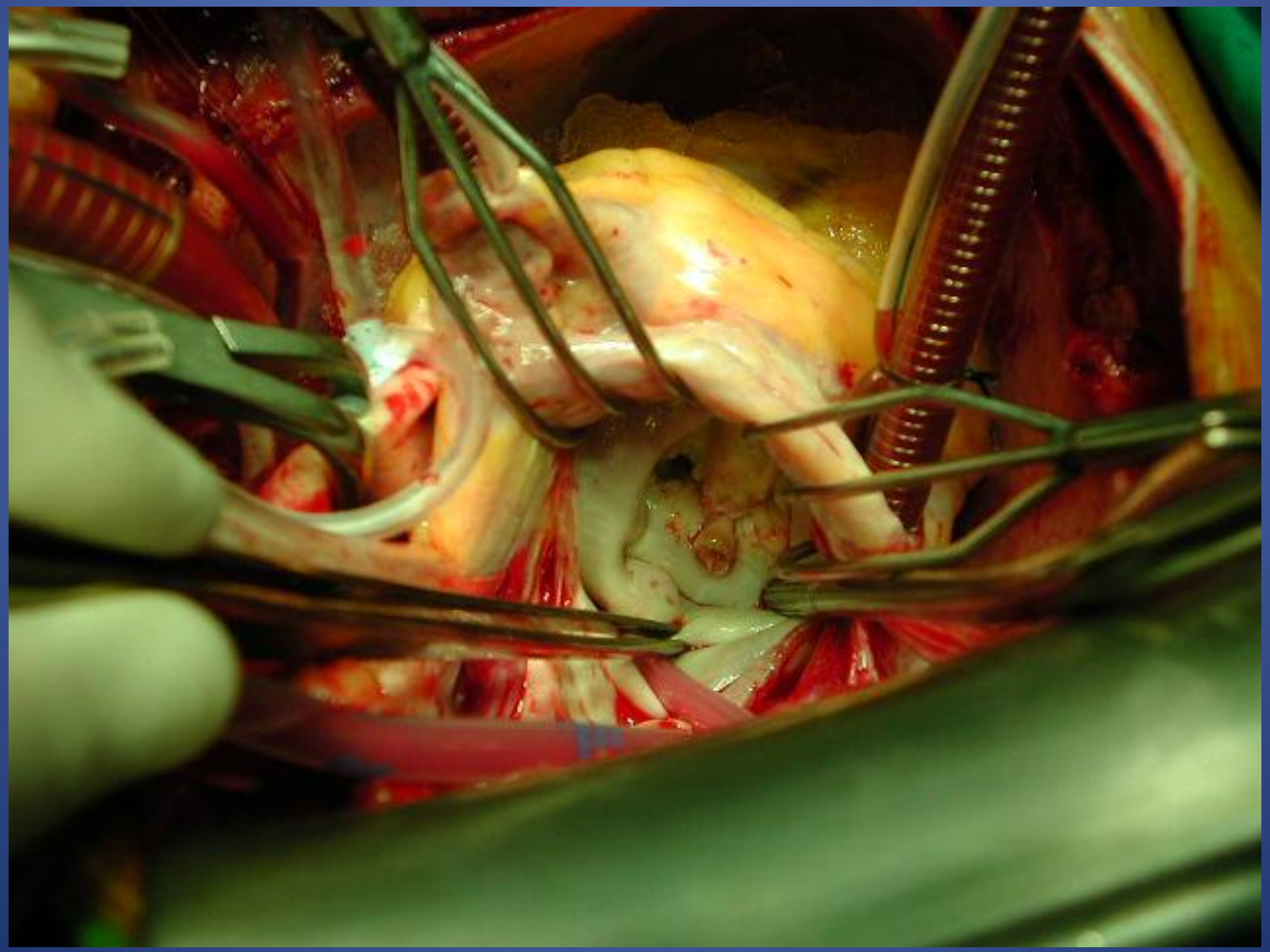
ISCHEMIC MITRAL VALVE

ISCHEMIC MITRAL VALVE

HEART FAILURE

MITRAL REGURGITATION

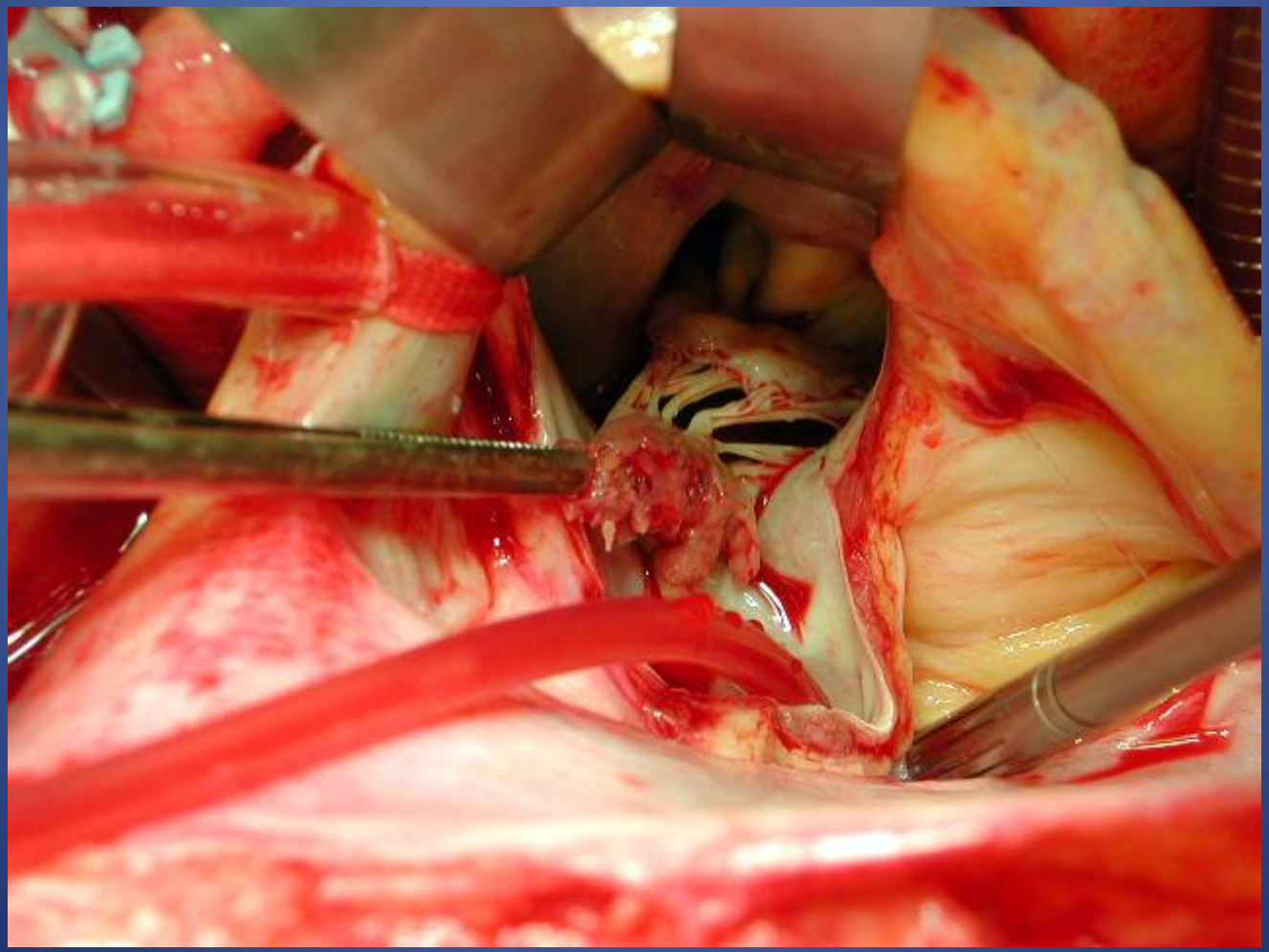
PAPPILARY MUSCLE RUPTURE



HEART FAILURE

MITRAL REGURGITATION

PAPPILARY MUSCLE RUPTURE



PAPPILARY MUSCLE RUPTURE