Ischemic Mitral Regurgitation

Impact of imaging on clinical decision making

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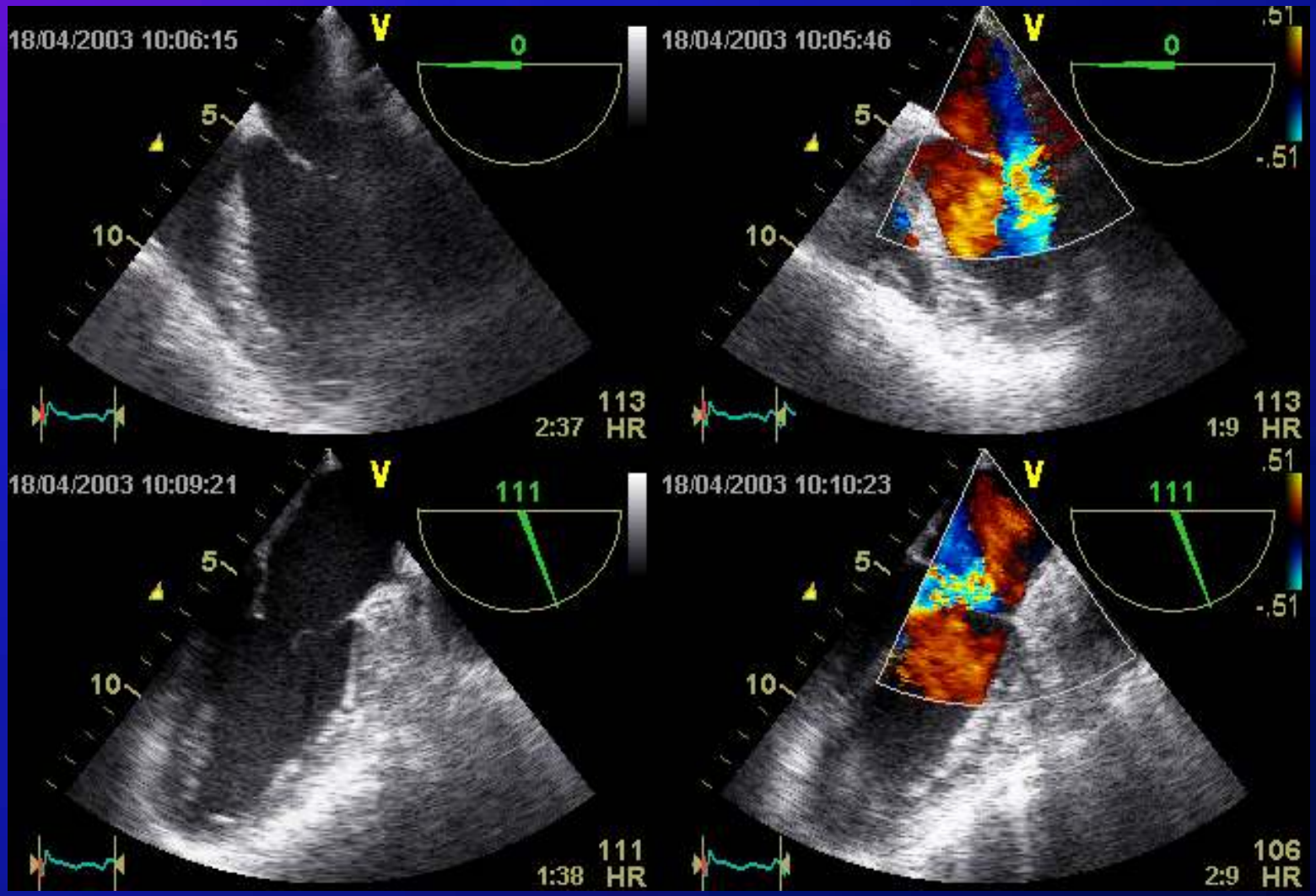
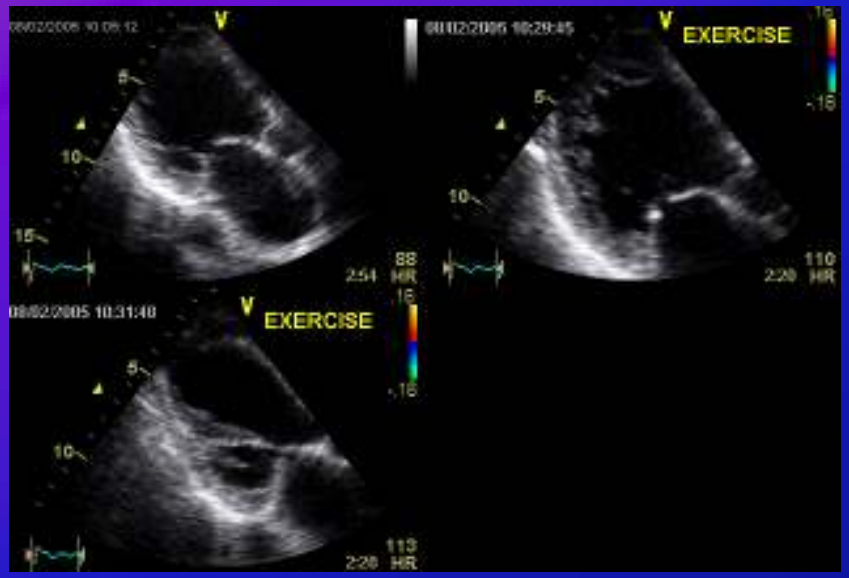
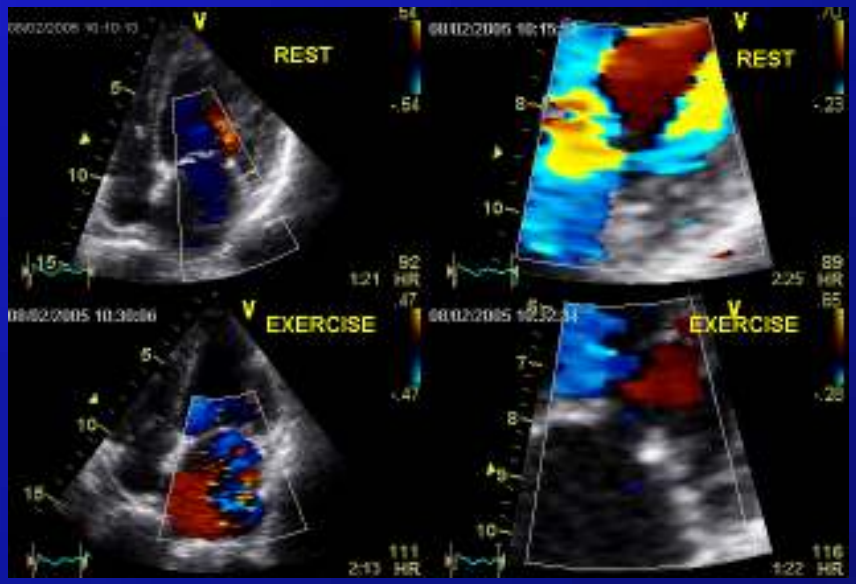
No Disclosure

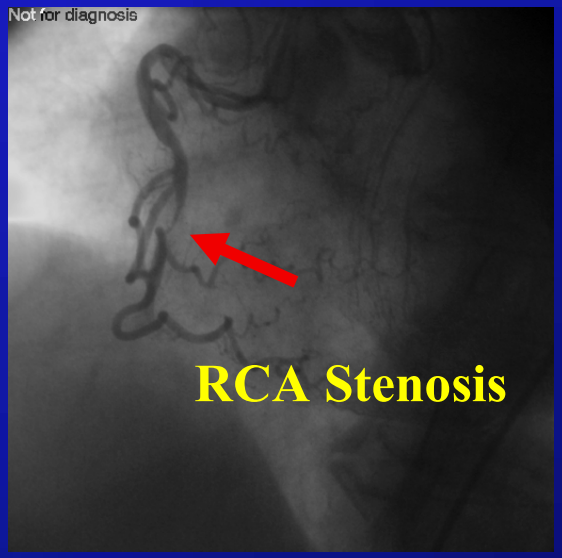
ACUTE ISCHEMIC MR
RUPTURED PAPILLARY MUSCLE



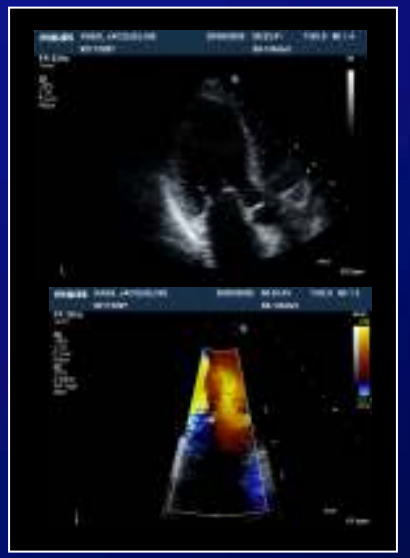
TRANSIENT ISCHEMIA-INDUCED MR







1 month F-UP



FUNCTIONAL IMR IN ACUTE AMI

Incidence

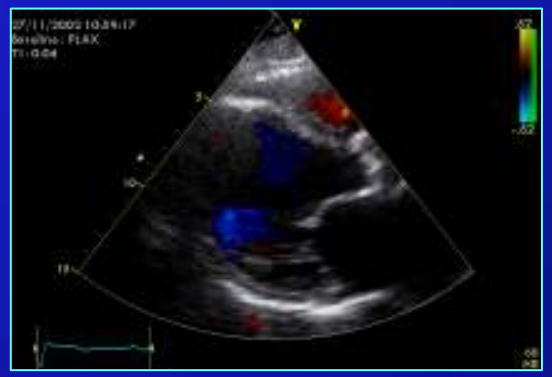
Ventriculography → 1.6 - 19 %

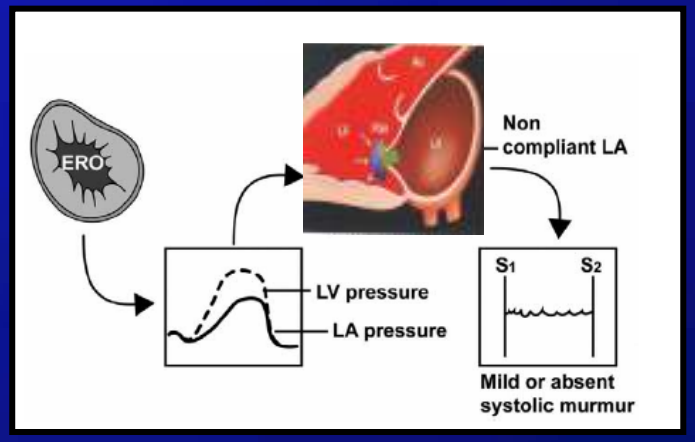
Echocardiography → 8 – 74 %

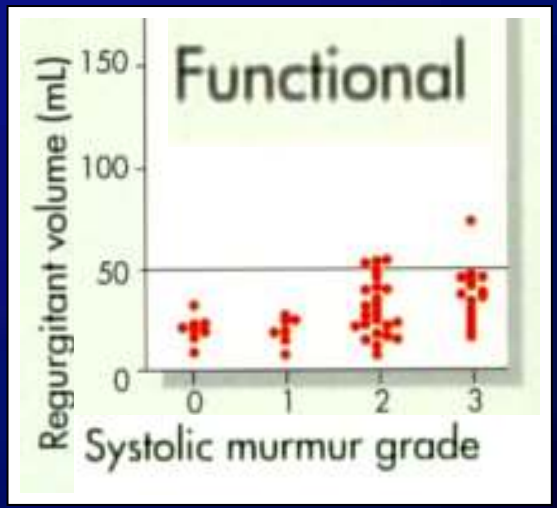
Moderate to severe → 6 % (Bursi Circ 2005)

Clinically silent : majority of pts

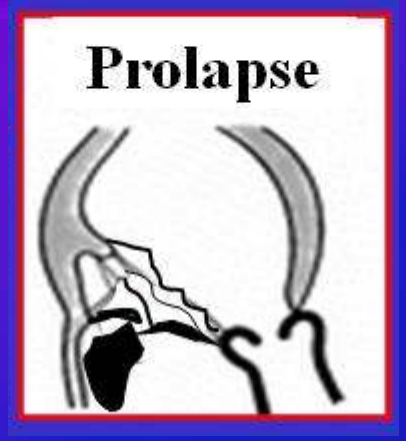
- Women
- Older
- Hypertension
- Diabetes
- Severe CAD
- Previous MI



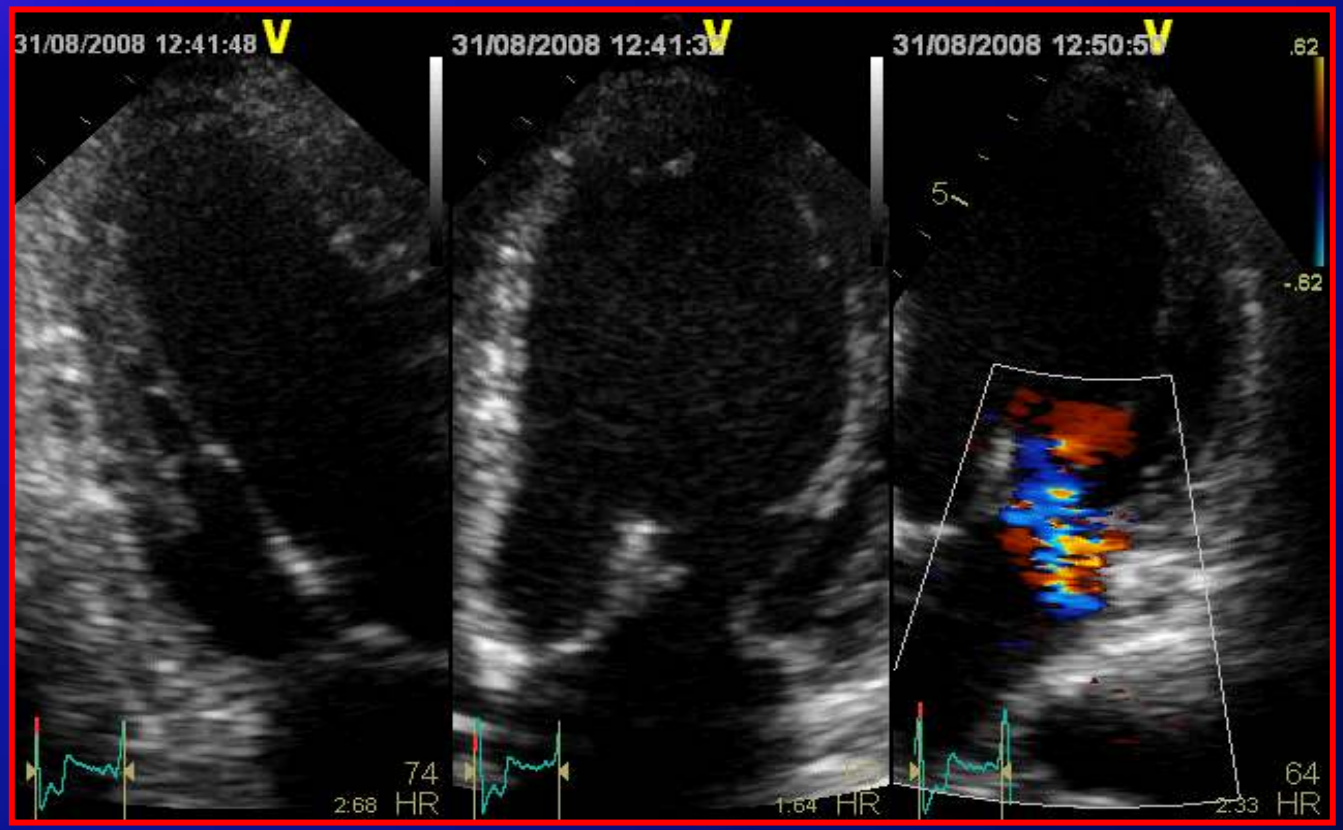




IMR IN THE CHRONIC MI PHASE



- Type II
- 5% of Chronic IMR
- Fibrotic PMs + Elongation



CHRONIC FUNCTIONAL IMR

Tethering Force

PMs displacement

Dilation/Sphericity

Annular dilatation

Closing Force

Reduced contractility

Dyssynchrony

PMs dyssynchrony

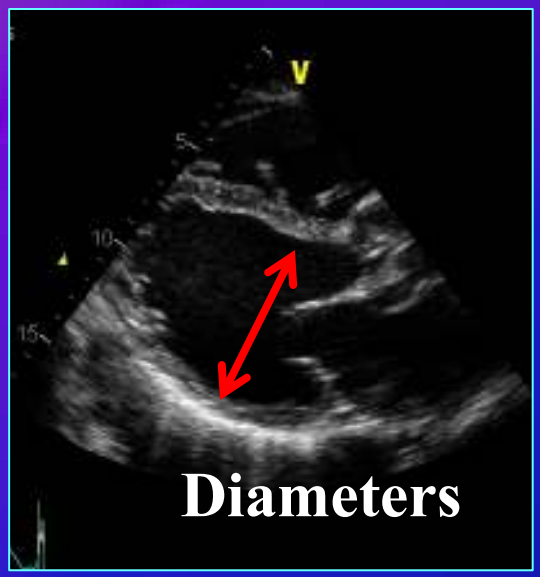
Reduced annular contraction

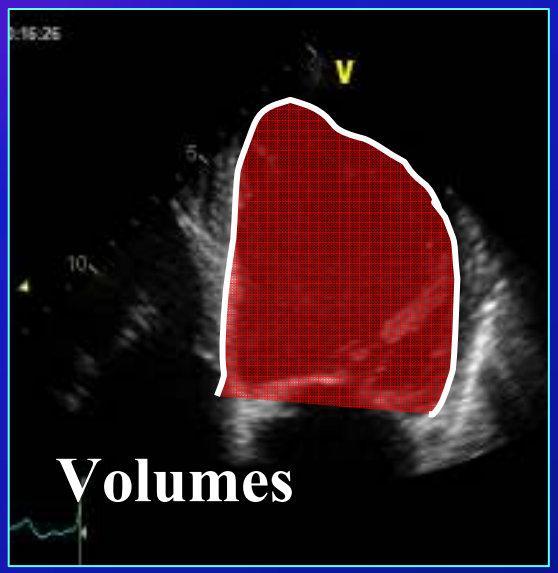
Global and Local LV Remodeling

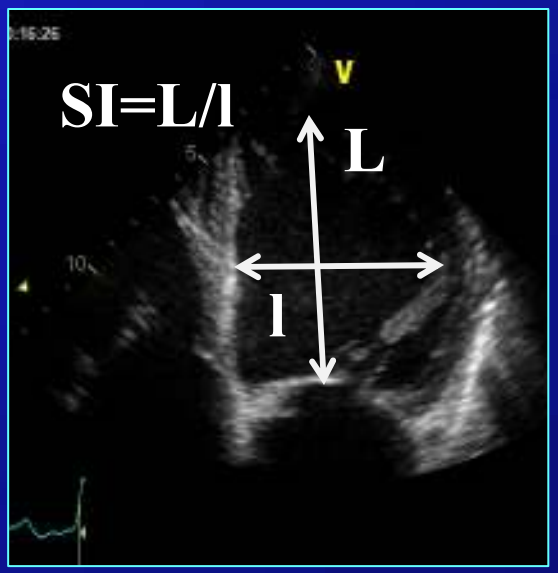
LV Asynchrony

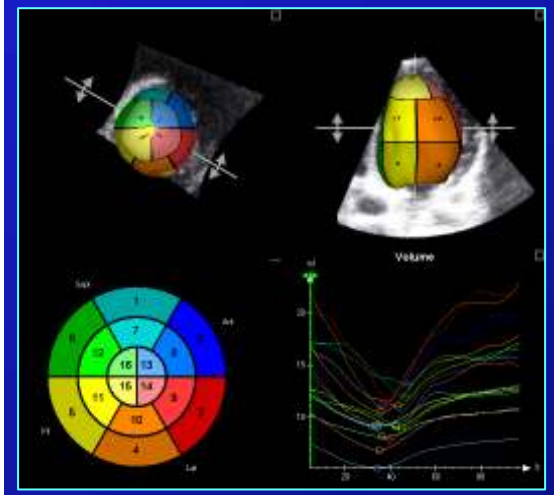
Mitral valve deformation

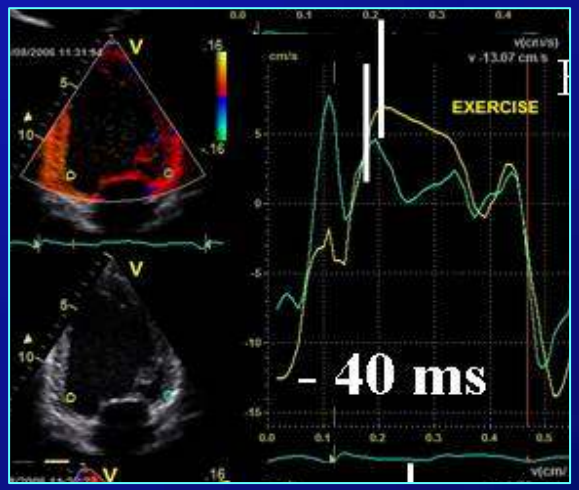
LV Remodeling + Asynchrony

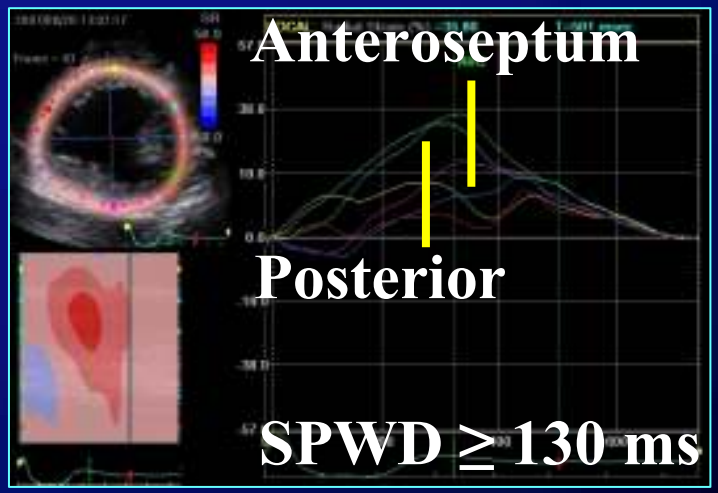


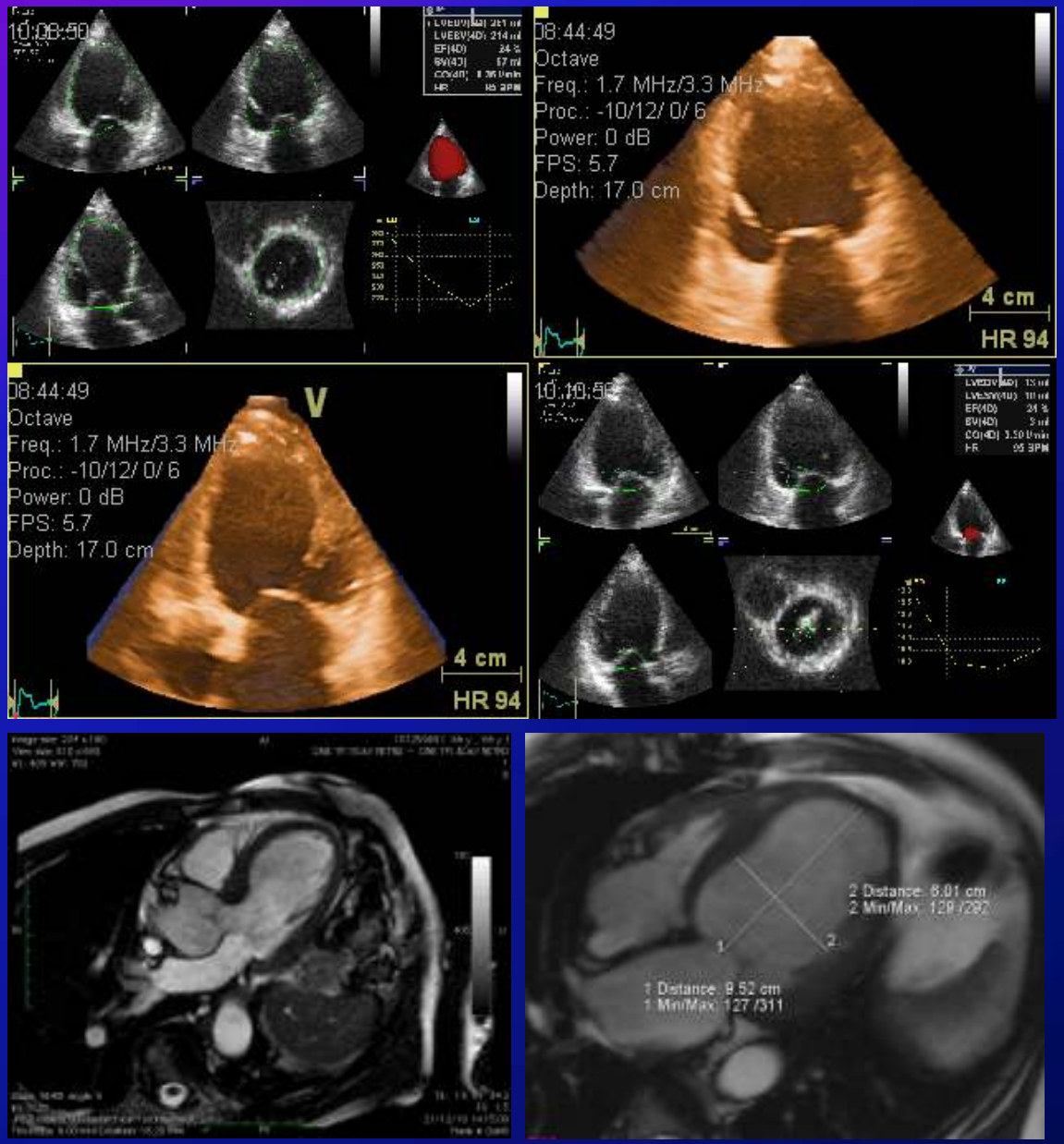






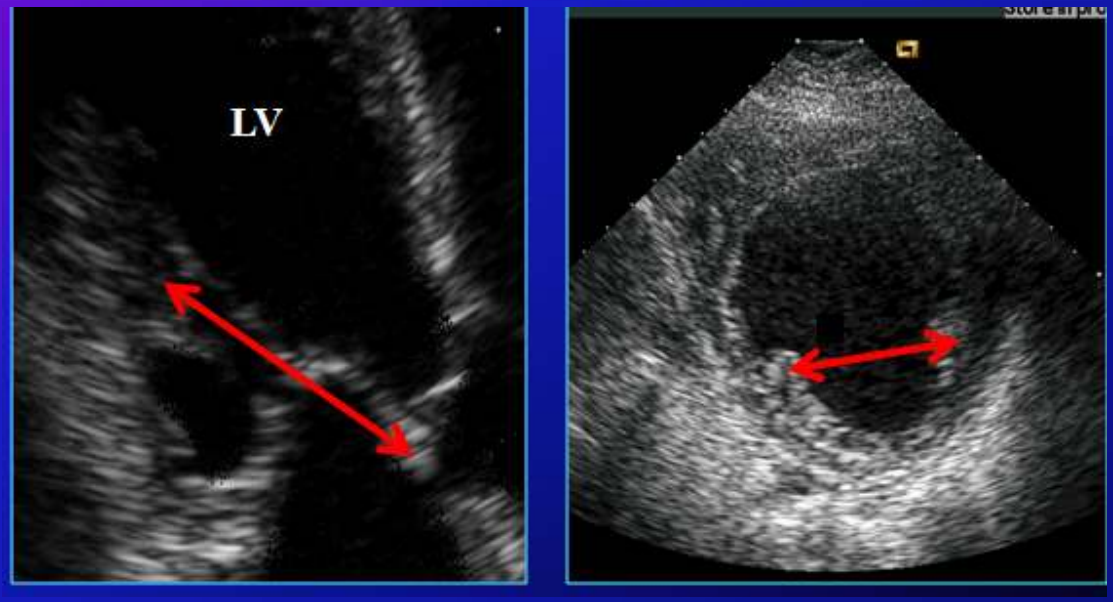






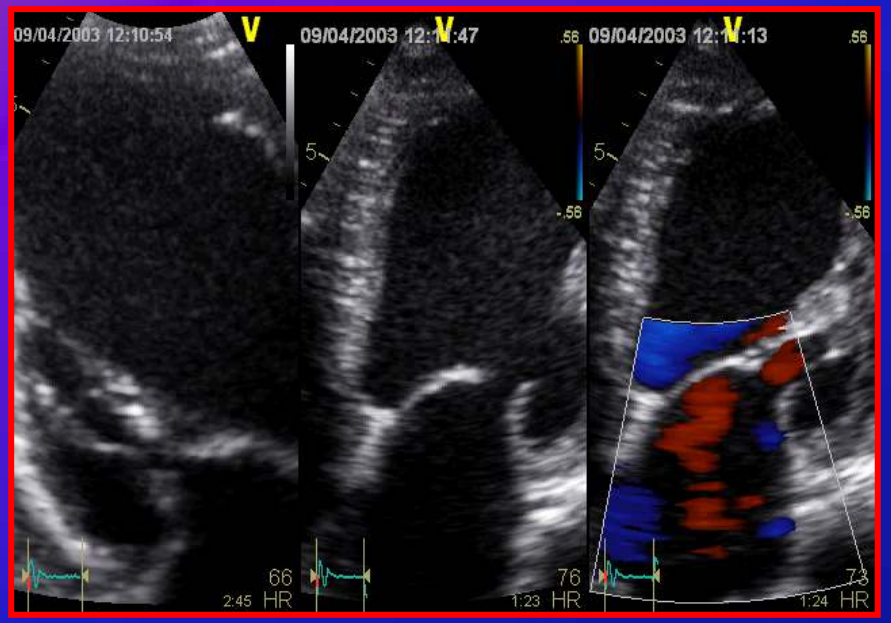
Lancellotti Heart 2008

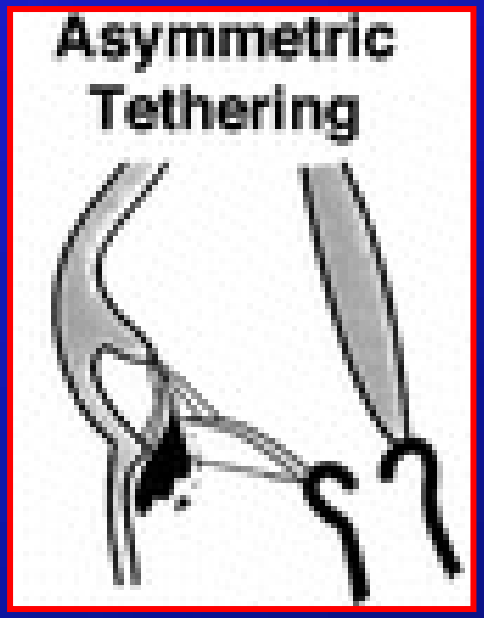
Local LV Remodeling

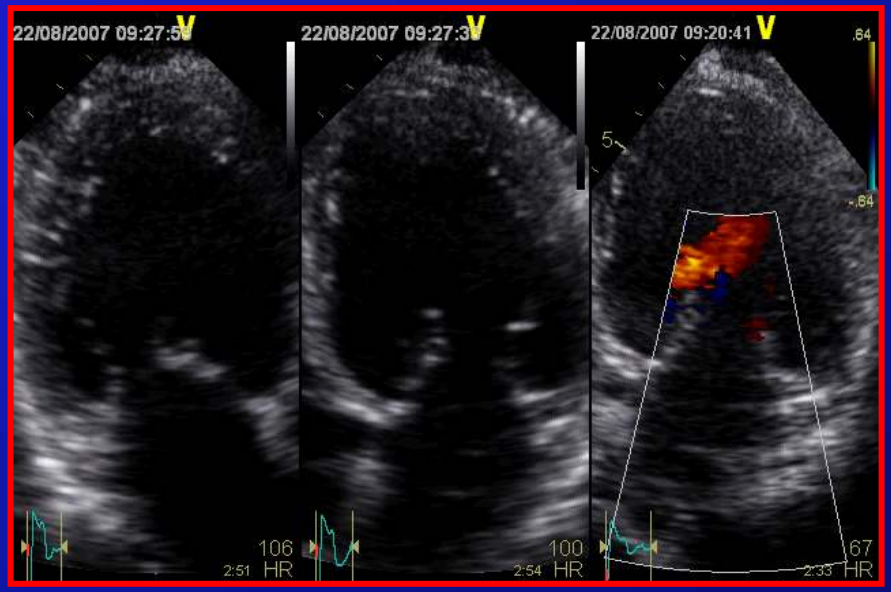


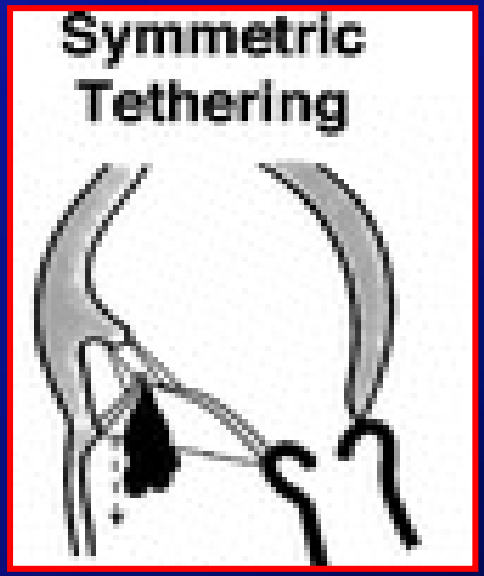
Lancellotti Heart 2008, Chan KM et al J Card Mag Res 2008

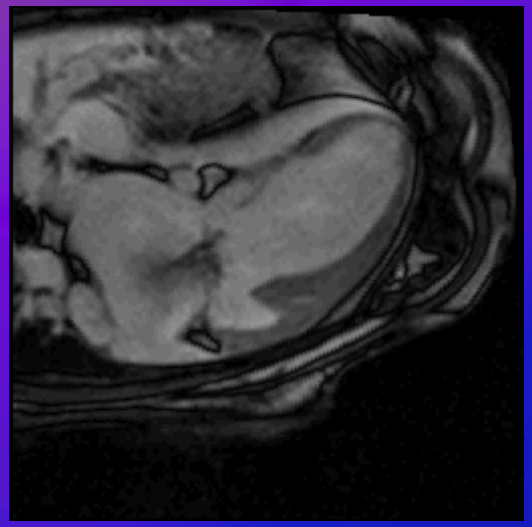
MV Deformation

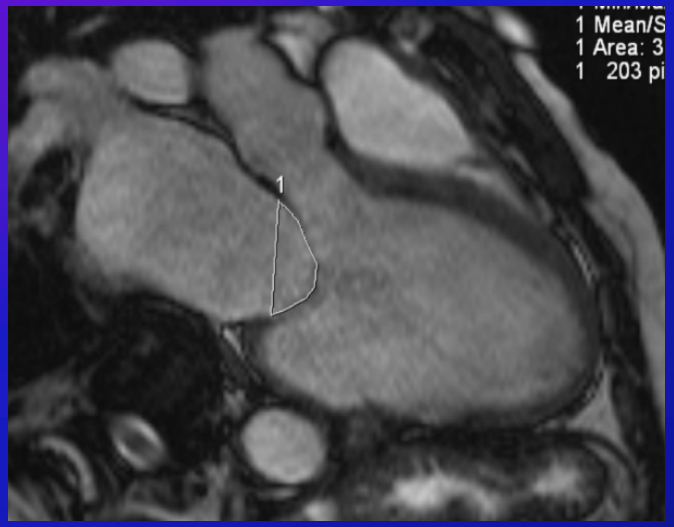


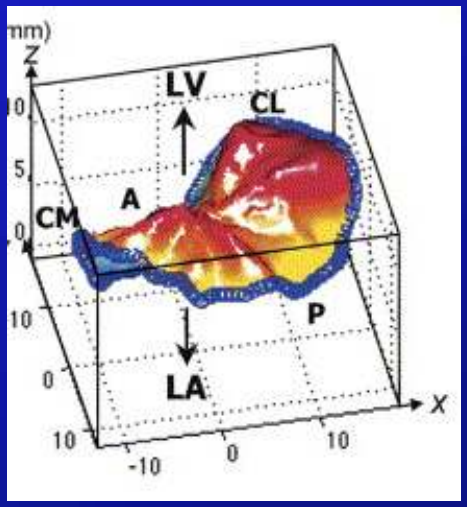









1 Mean/S
1 Area: 3
1 203 pi
1


mm)
Z
LV
CL
A
CM
P
LA
X
10
5
0
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-10
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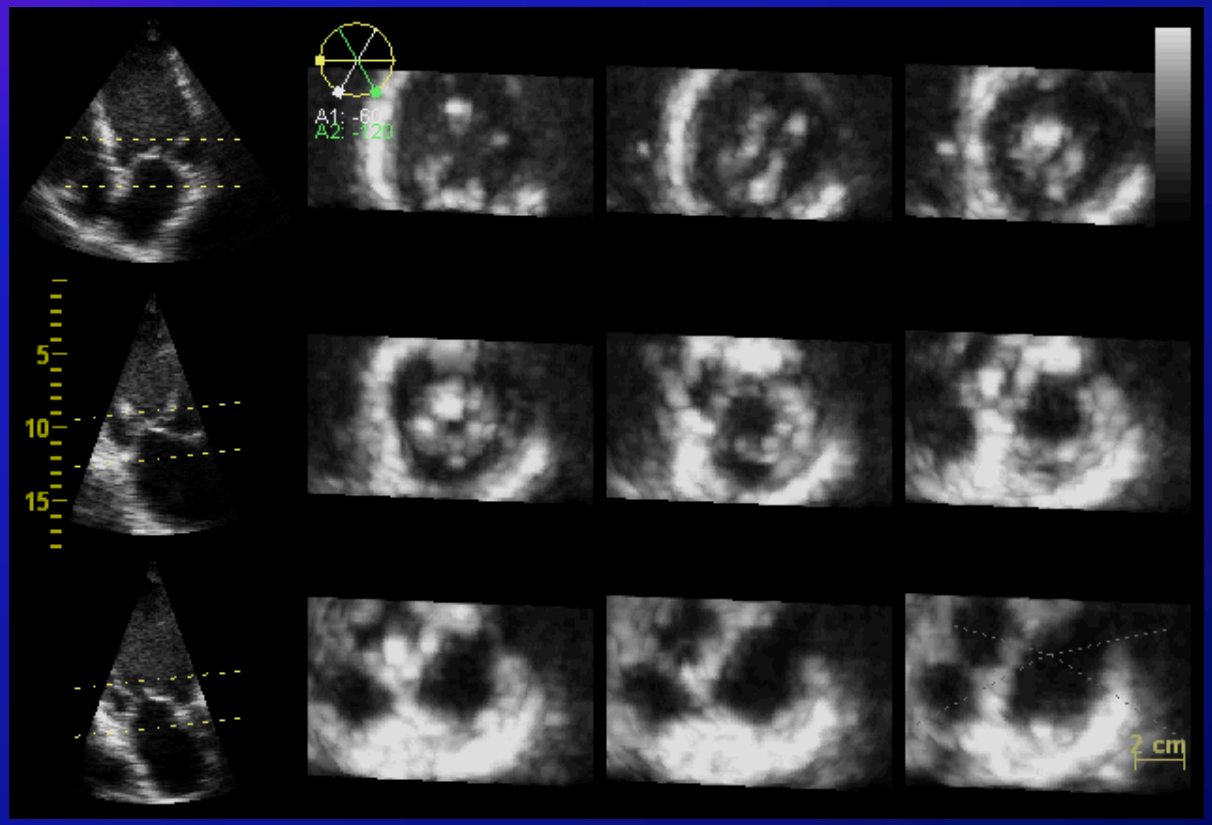
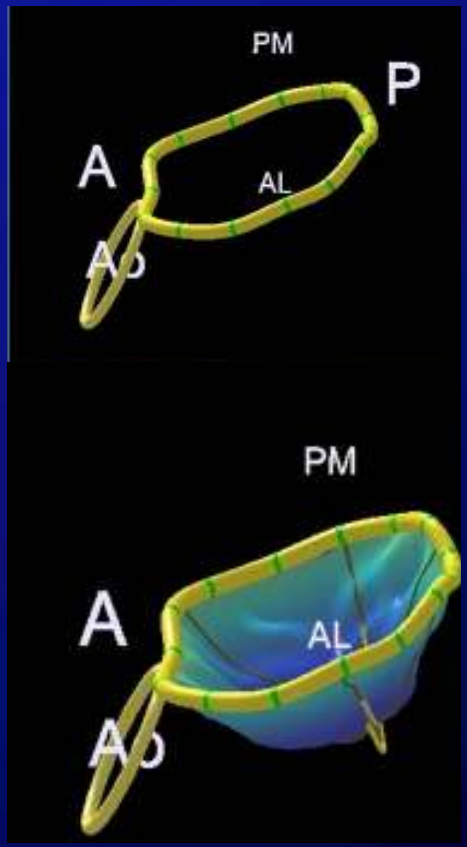
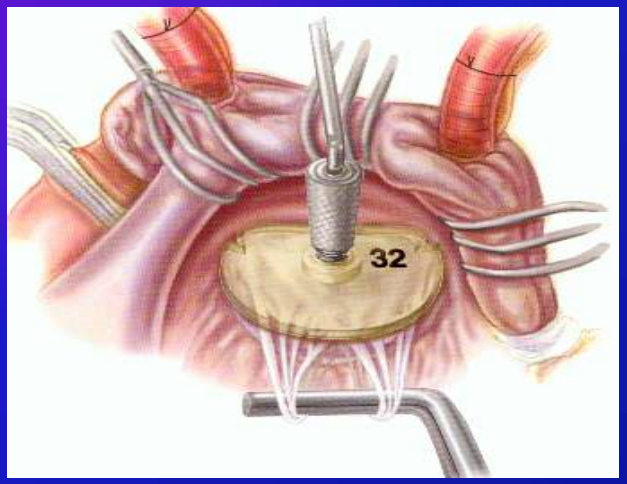
10


A1: -6
A2: -120
5
10
15
2 cm

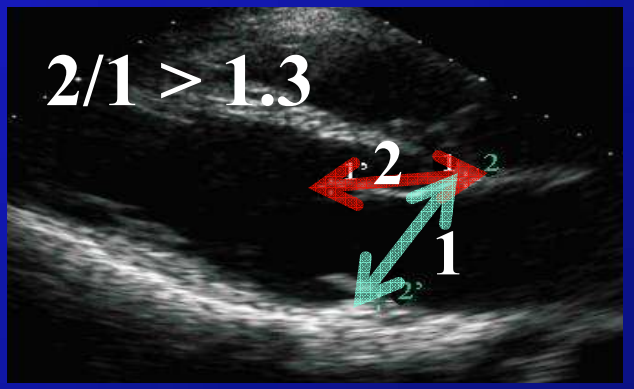

PM
P
A
AL
Ao
PM
A
AL
Ao

Echo measurement help select the ring size ?

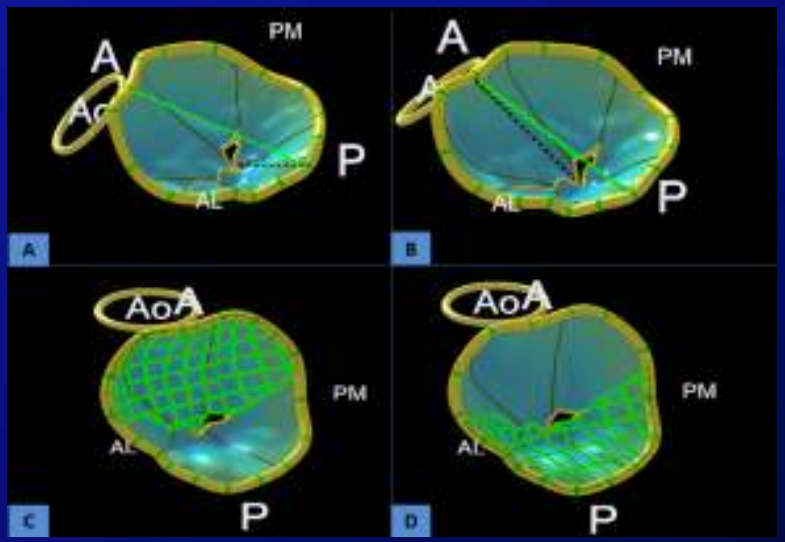


Undersizing ring is at least two sizes smaller

Annulus dilatation



A2 height = Classic Ring Size



Anterior Surface Area = Classic Ring Size

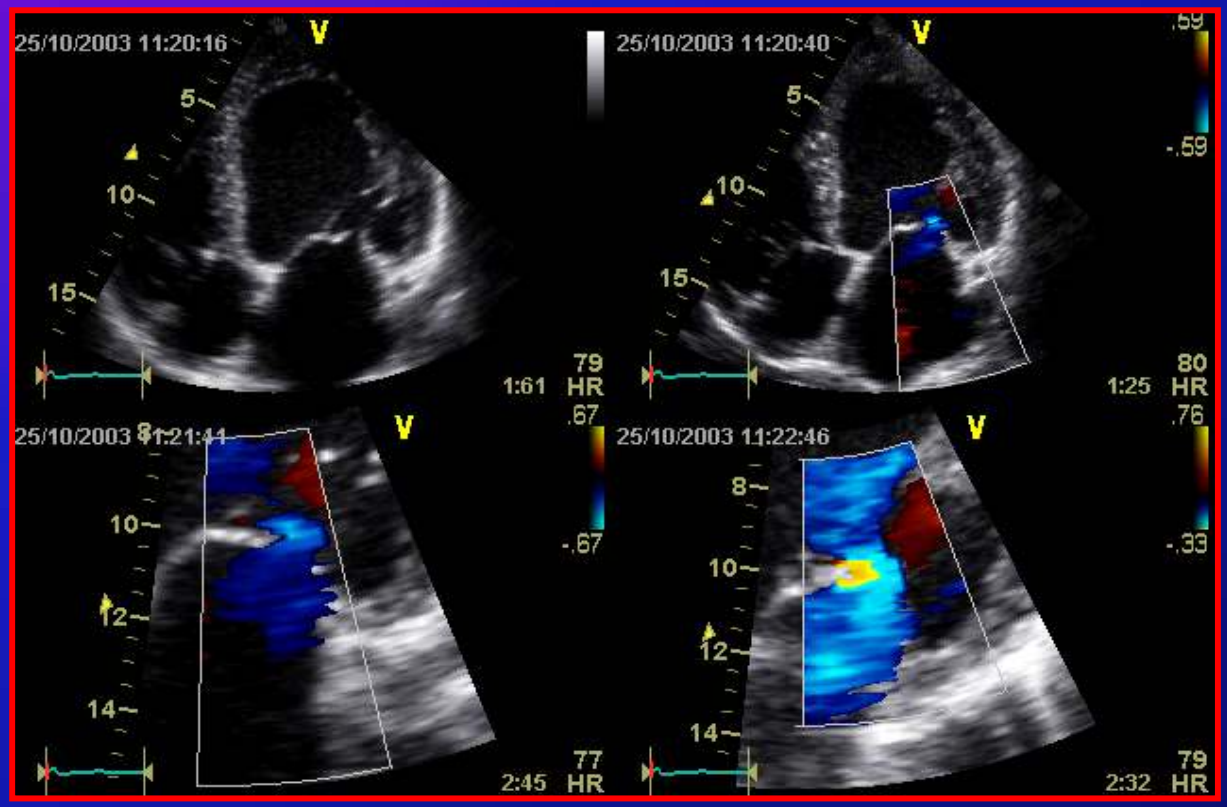
TTE markers of MVR failure or Adverse LV remodeling

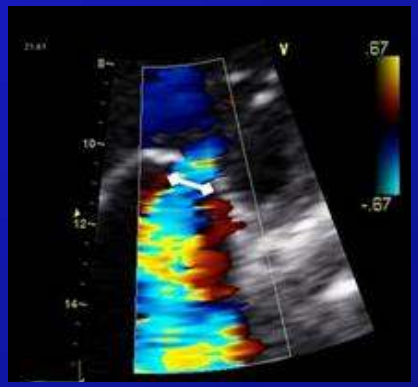
-Valve deformation
- Coaptation height ≥ 1 cm
- Tenting > 2.5-3 cm^2
- Symmetric pattern, Central jet or Complex jets
- PLA > 45 °

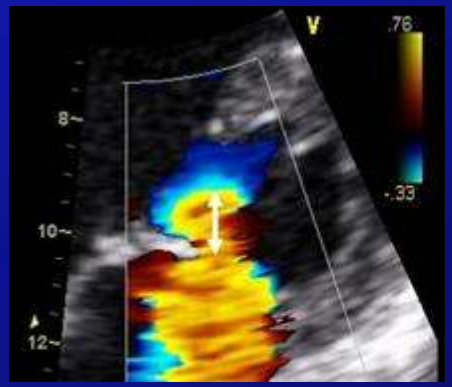
- Local LV remodeling
- Interpapillary muscle distance > 20 mm
- Posterior leaflt tethering > 40 mm
- Lateral WMA

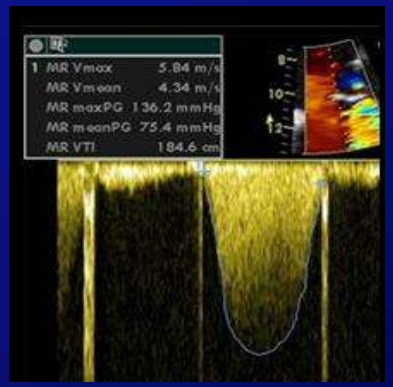
- Global LV remodeling
- EDD > 65 mm, ESD > 51 mm (ESV > 140 ml)
- Systolic sphericity index > 0.7

MR SEVERITY









VC width = 0.61 cm

$$ERO = \frac{6.28 \times (0.79)^2 \times 33}{5.8}$$

ERO = 22 mm²

RV = 22 x 1.85 = 41 ml

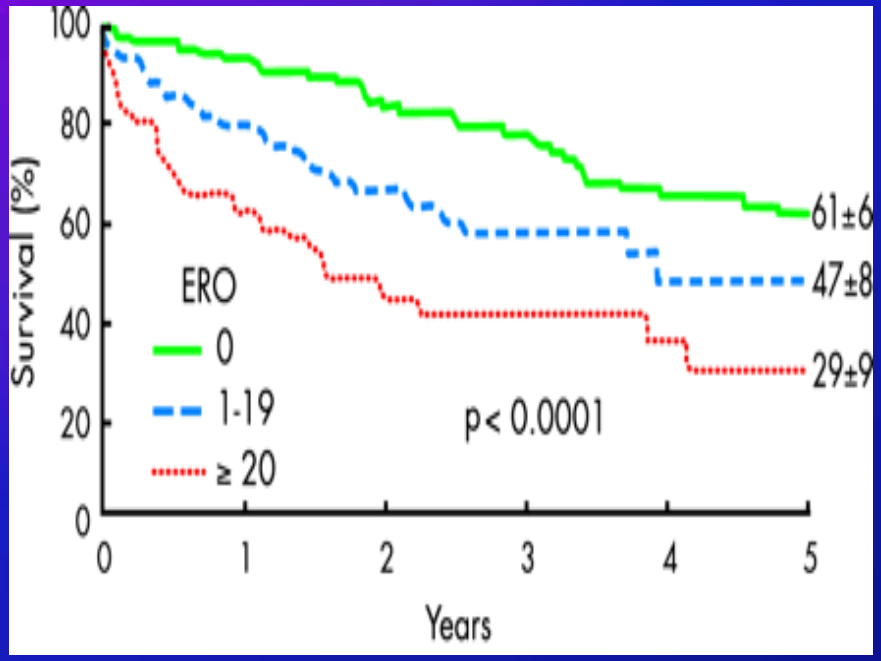
European Journal of Echocardiography
doi:10.1093/ejechocard/jeq031

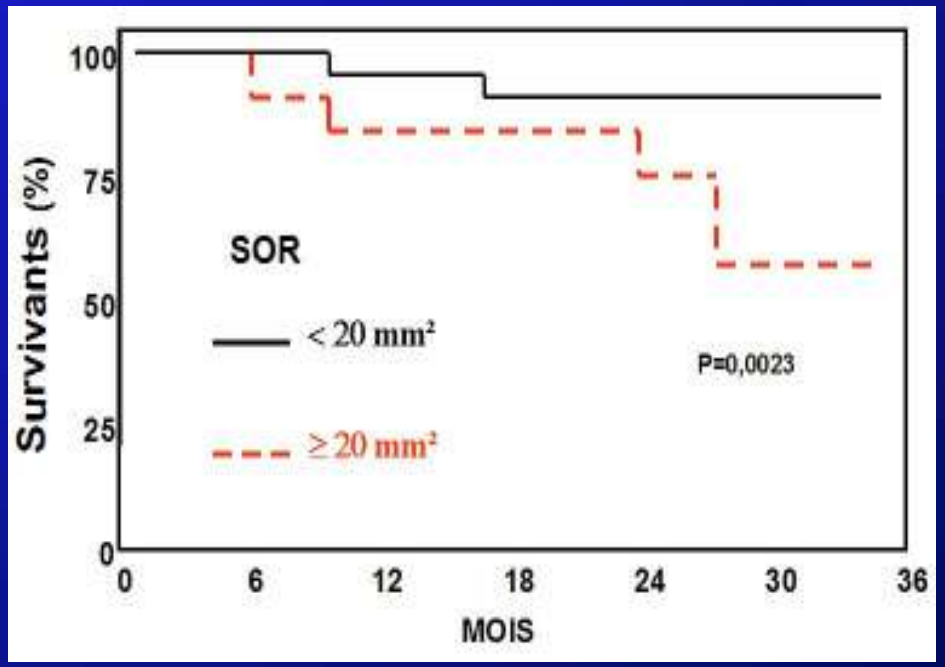
European Association of Echocardiography recommendations for the assessment of valvular regurgitation. Part 2: mitral and tricuspid regurgitation (native valve disease)

Patrizio Lancellotti (Chair)[1*], Luis Moura[2], Luc A Pierard[1], Eustachio Agricola[3], Bogdan A. Popescu[4], Christophe Tribouilloy[5], Andreas Hagendorff[6], Jean-Luc Monin[7], and Luigi Badano[8], and Jose L. Zamorano[9] on behalf of the European Association of Echocardiography

Lancellotti et al, Eur J of Echocardiogr 2010; 11, 307–332

PROGNOSIS OF FMR





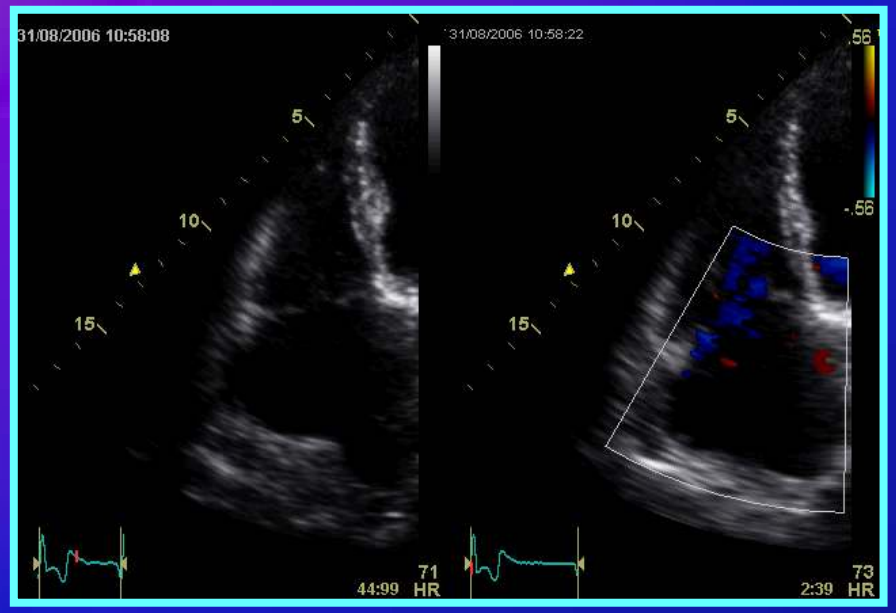
MI > 16 days
NYHA Class IV

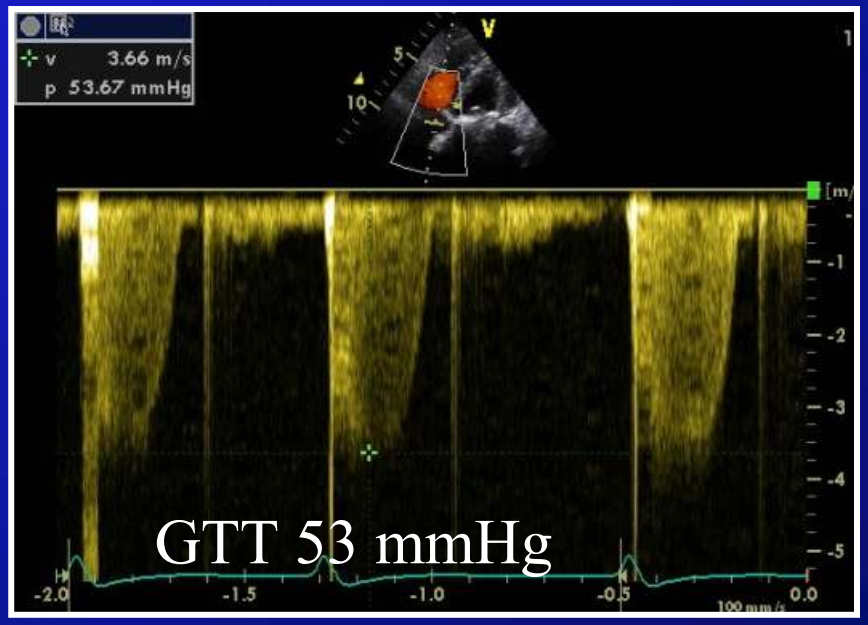
MI > 6 months
No NYHA IV

Grigioni et al Circulation 2001, 103; 1759

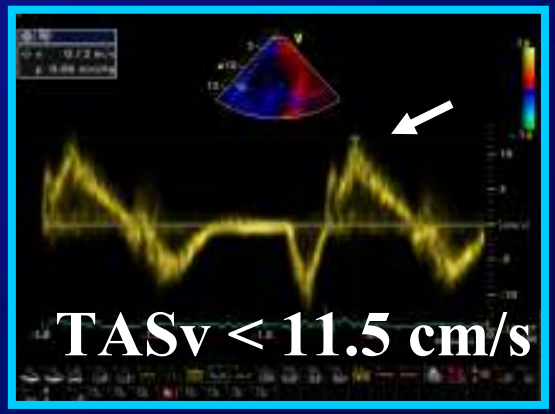
Lancellotti et al Circulation 2003, 108:1713

MR CONSEQUENCES



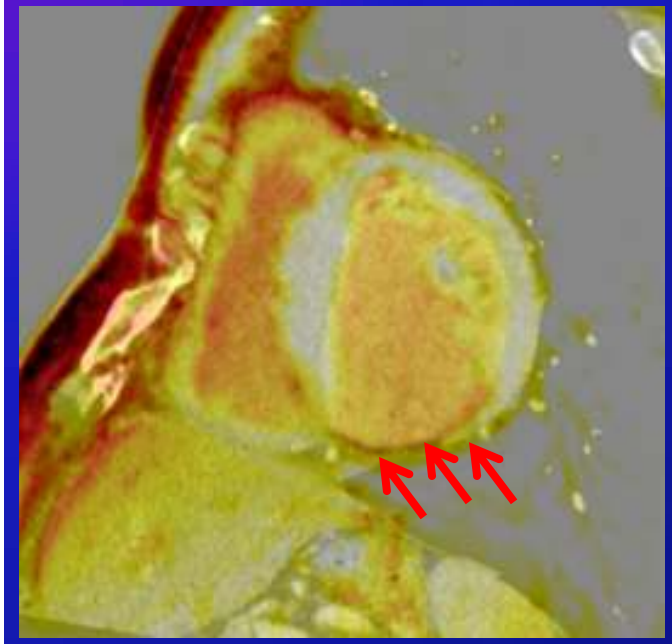


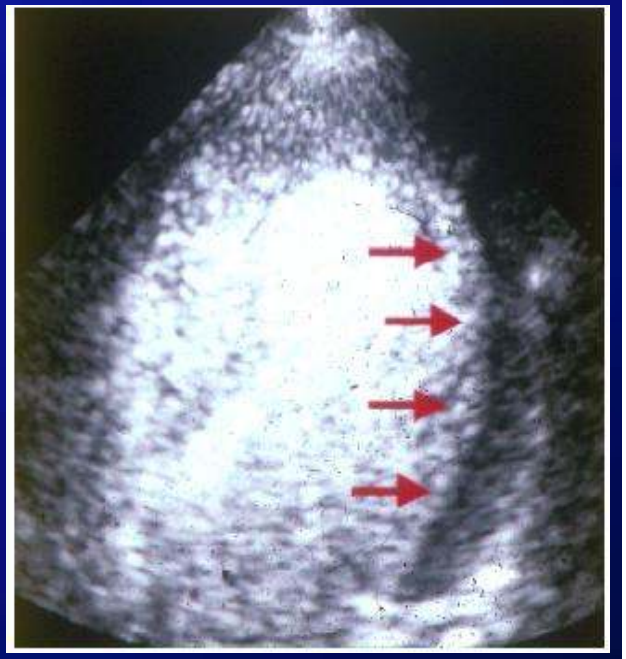
- Tenting area > 1.63 cm²
- Coap distance > 0.76 cm
- Tr An Diameter > 40 mm



Is Myocardial Necrosis Transmural?

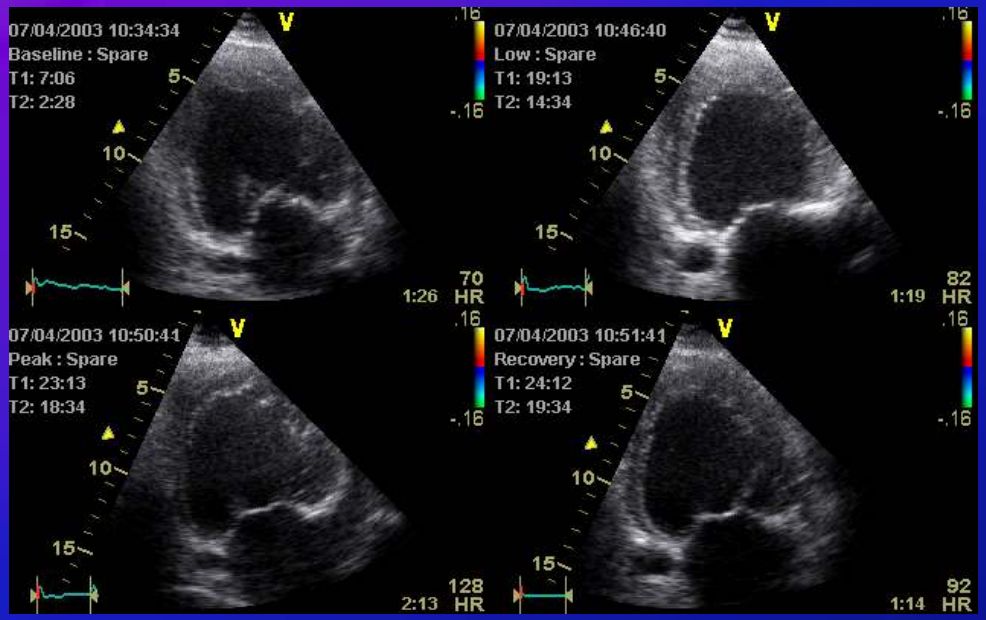
Delayed enhancement **Thin myocardium** **Microvascular damage**

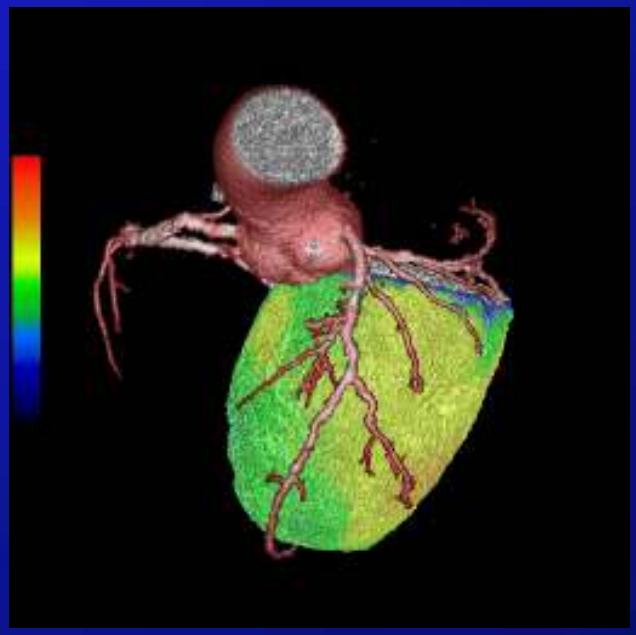




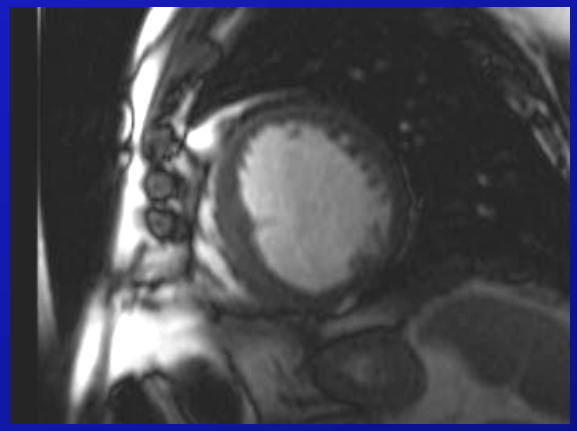
Cardiac MR **Resting echo** **Contrast echo**

DES → Biphasic response

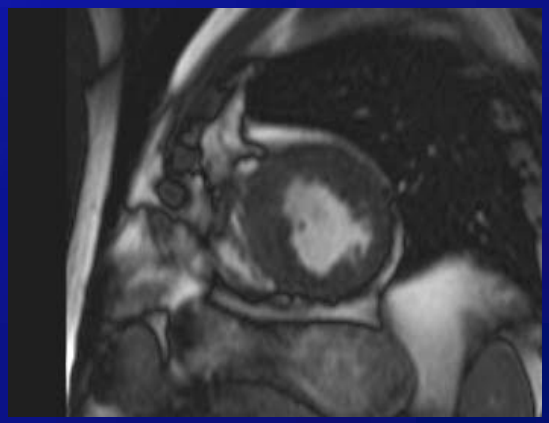




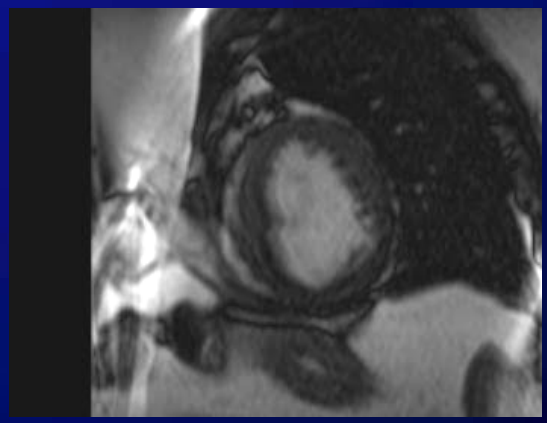
REST

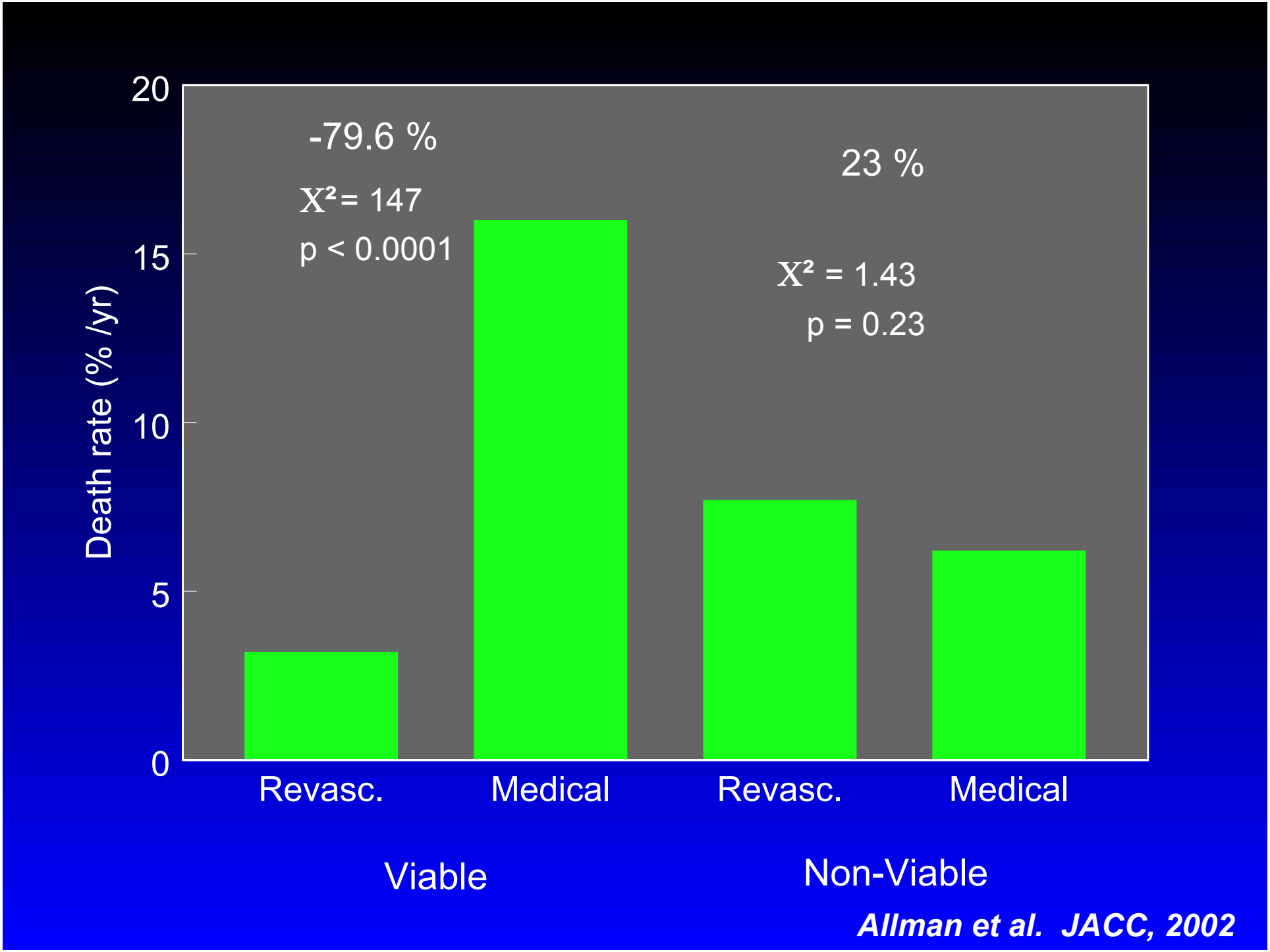


Low

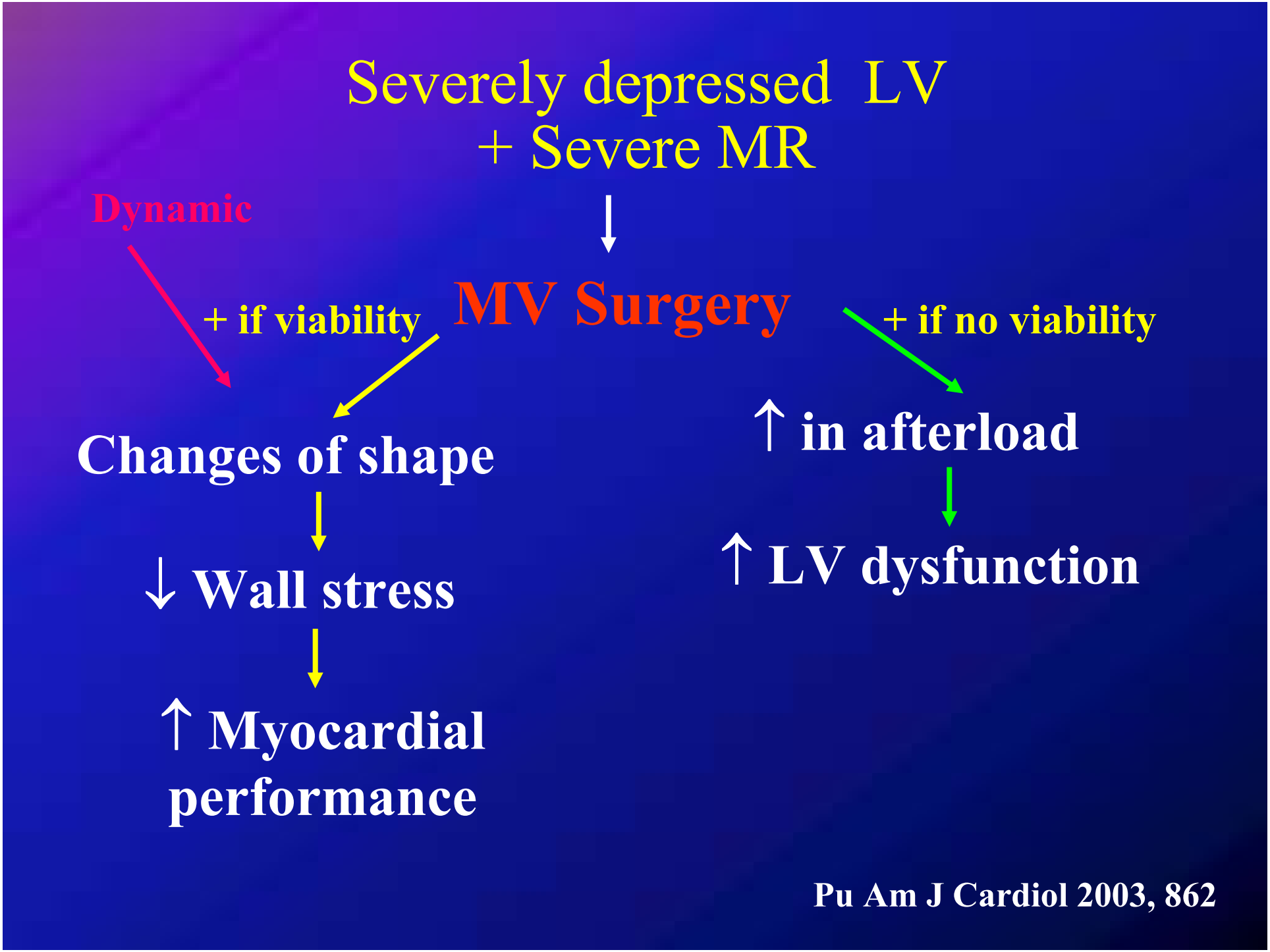


High





Allman et al. JACC, 2002


Severely depressed LV
+ Severe MR
Dynamic
+ if viability
MV Surgery
+ if no viability
Changes of shape
↓ Wall stress
↑ Myocardial performance
↑ in afterload
↑ LV dysfunction
Pu Am J Cardiol 2003, 862

DYNAMIC MR

REST DOBU 20 μg

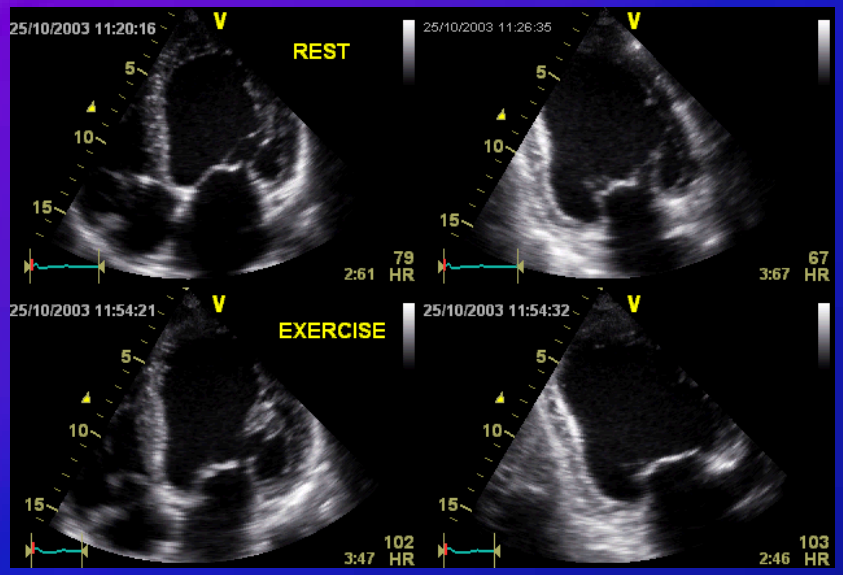
- ↓ PRELOAD, ↓ AFTERLOAD, ↑ INOTROPY

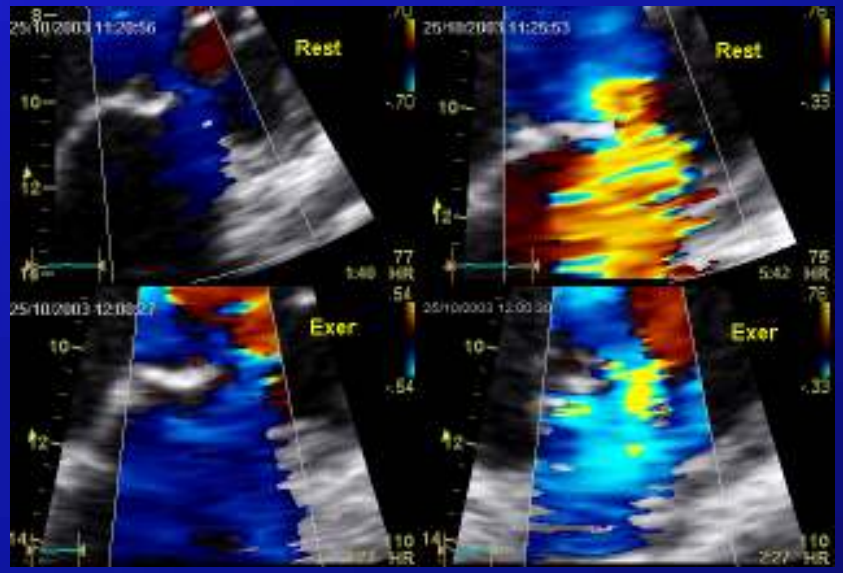
  → ↓ MITRAL ORIFICE SIZE & ↓ REGURG VOLUME

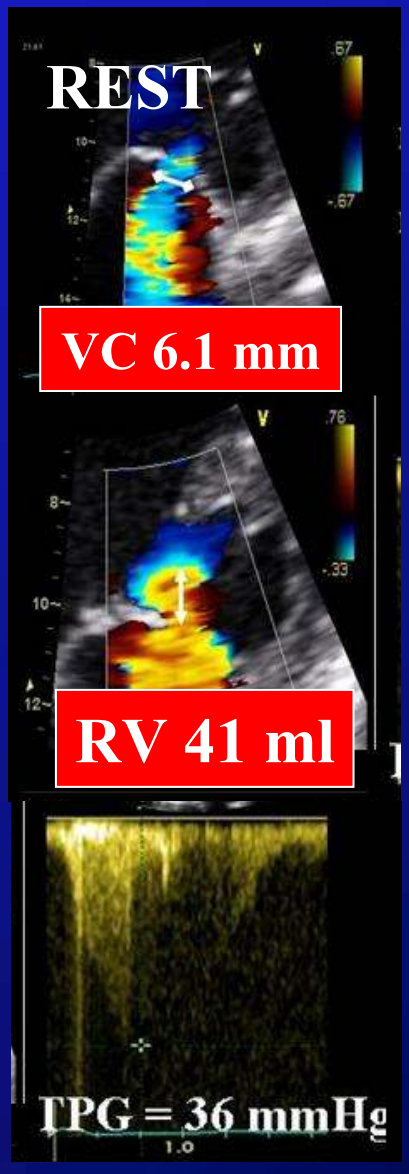
DYNAMIC MR → EXERCISE ECHO

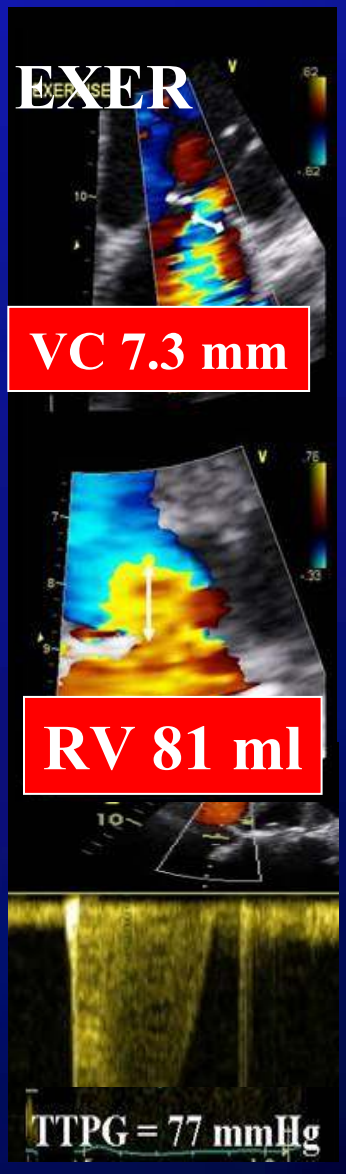
CASE 1

Man of 52 y old , History of inferior MI, PCMK
NYHA III, Episodes of acute dyspnea





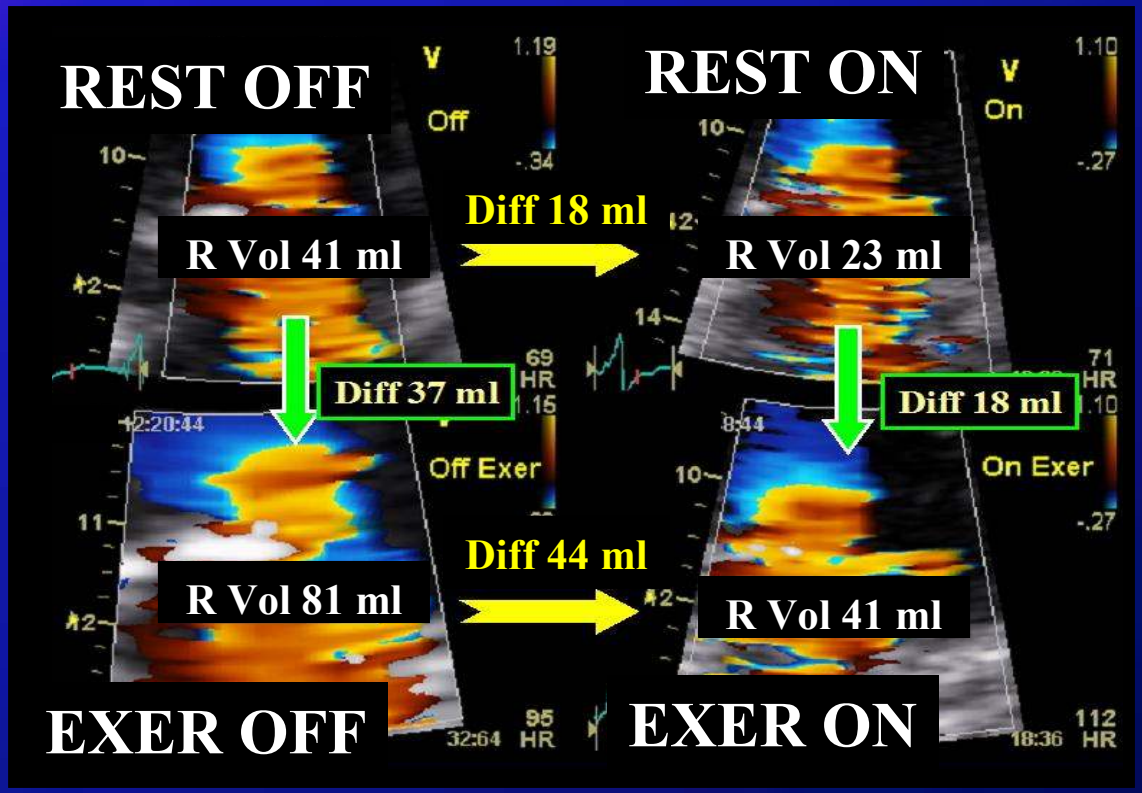




CASE 1

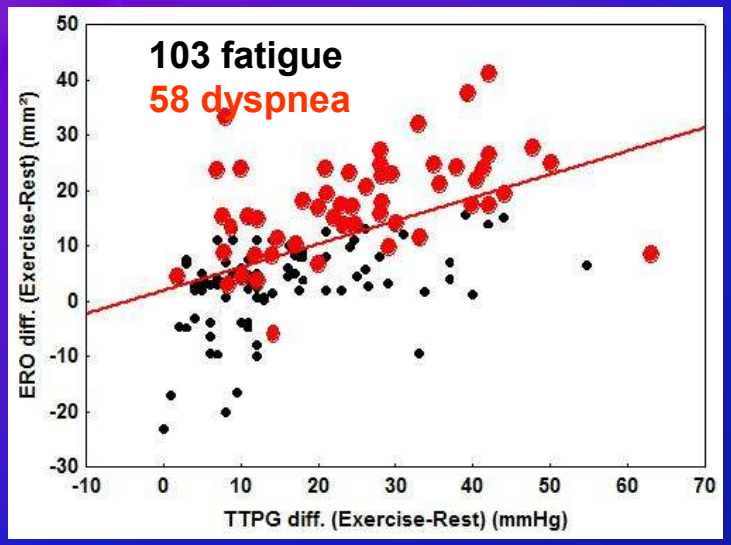
- QRS > 130 ms
- Angio: no significant stenosis

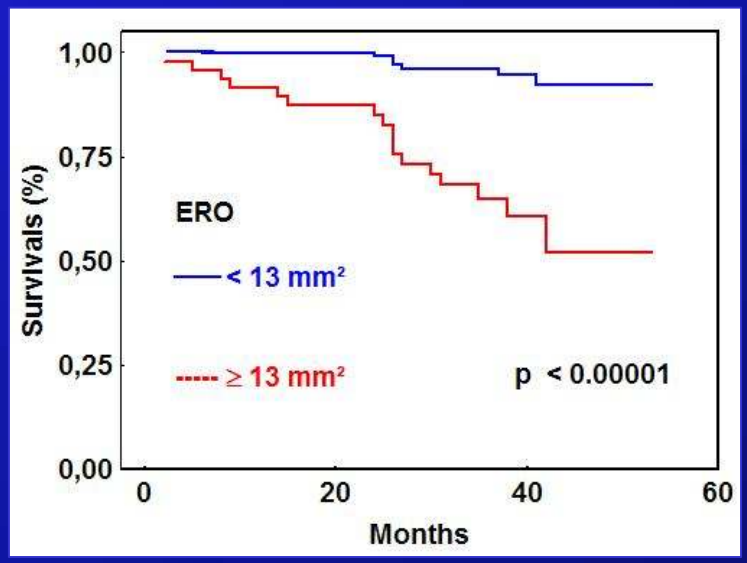
--> Upgrade to CRT



Lancellotti et al, Am J Cardiol 2004, 94

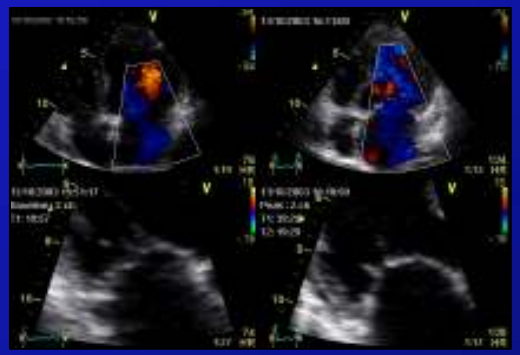
WHY TO LOOK FOR ?





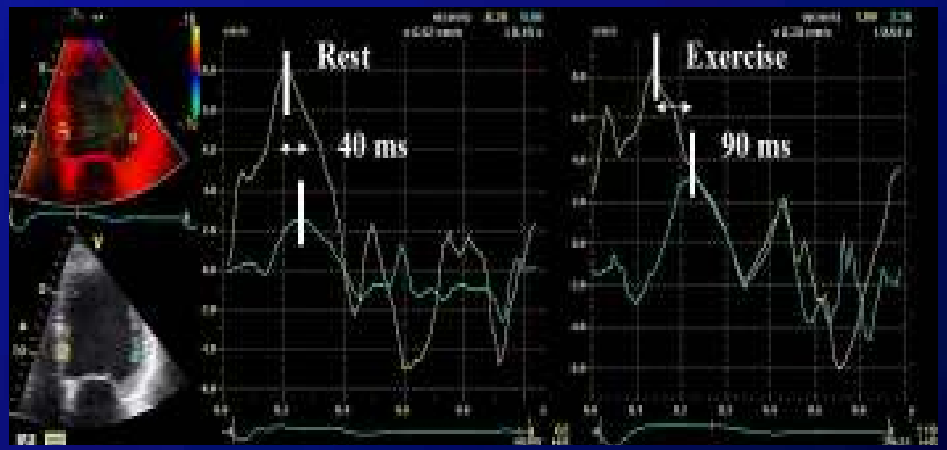
Lancellotti et al Circulation 2003; Eur Heart J 2005, N Engl J Med 2004, 2006

TENTING AREA



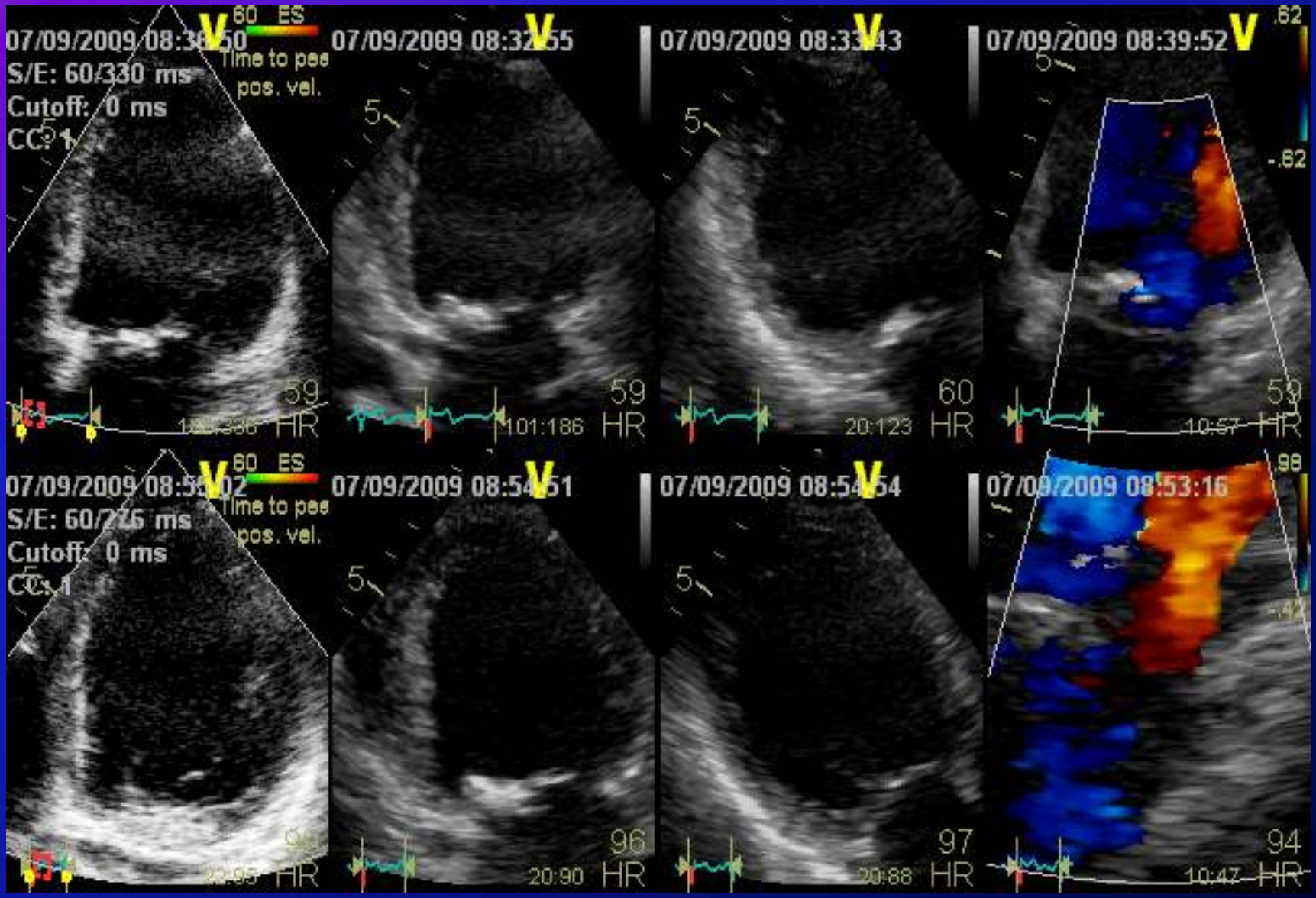
Lancellotti et al, JACC 2003
Giga et al, Eur HJ 2005

DYNAMIC DYSSYNCHRONY

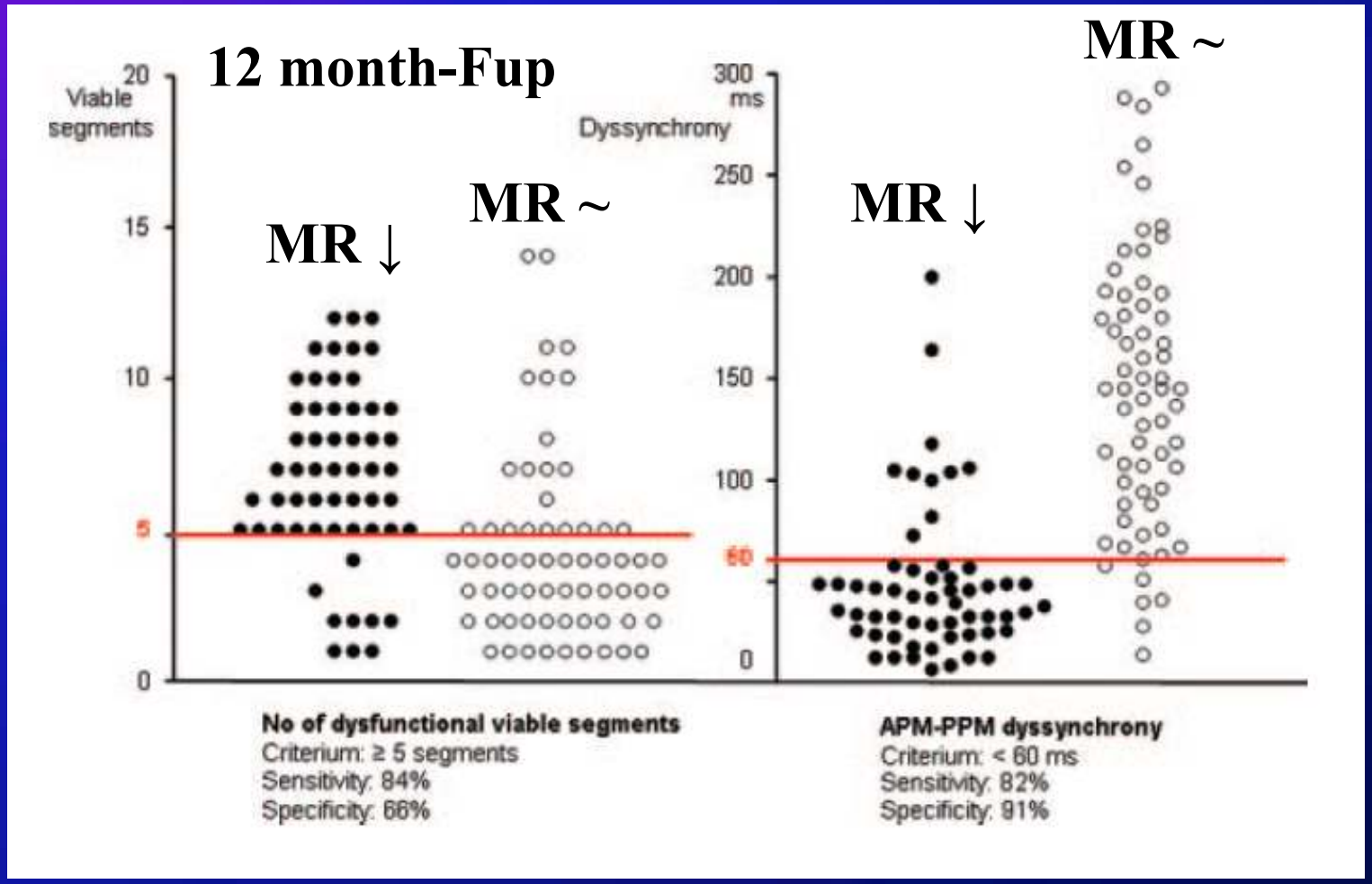


Lancellotti et al Am J Cardiol 2005,96:1304

CASE 2 NYHA II, Episodes of acute dyspnea



Predictors of Improvement of Unrepaired Moderate Ischemic Mitral Regurgitation in Patients Undergoing Elective Isolated Coronary Artery Bypass Graft Surgery



MR ↓ in 47% of patients

Penicka et al Circulation 2009

CASE 3

EVOLUTION

2000

NYHA II
Pulmonary edema
History of MI

2001

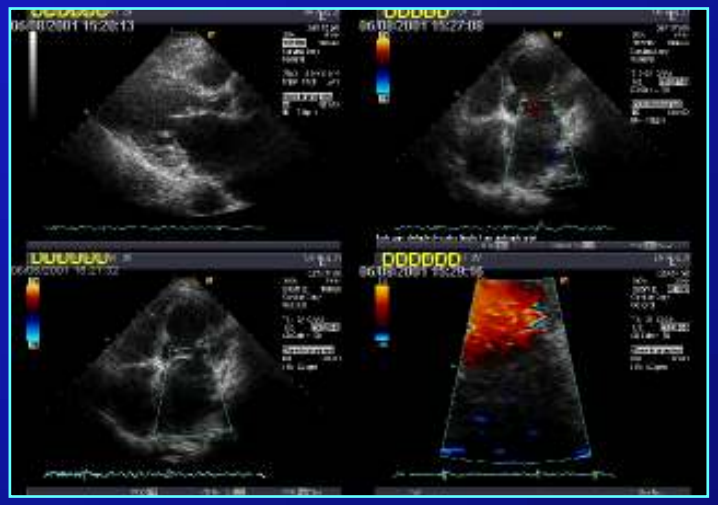
NYHA III
HF admissions

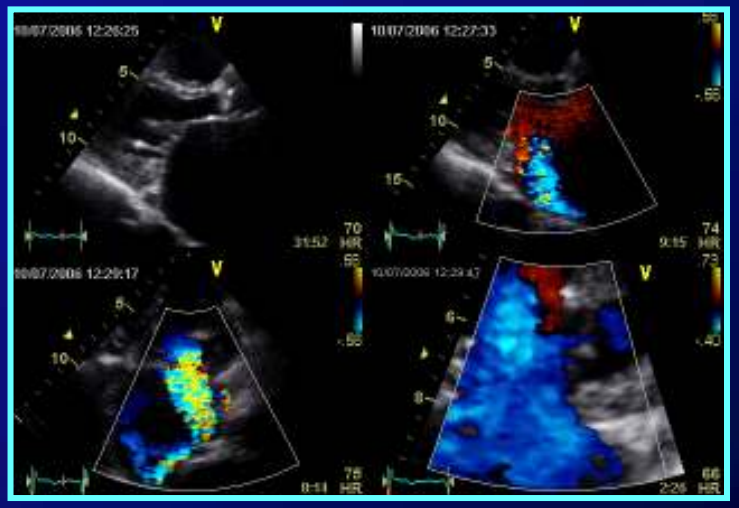
2006

NYHA IV
AMBULATORY
No pulmonary edema

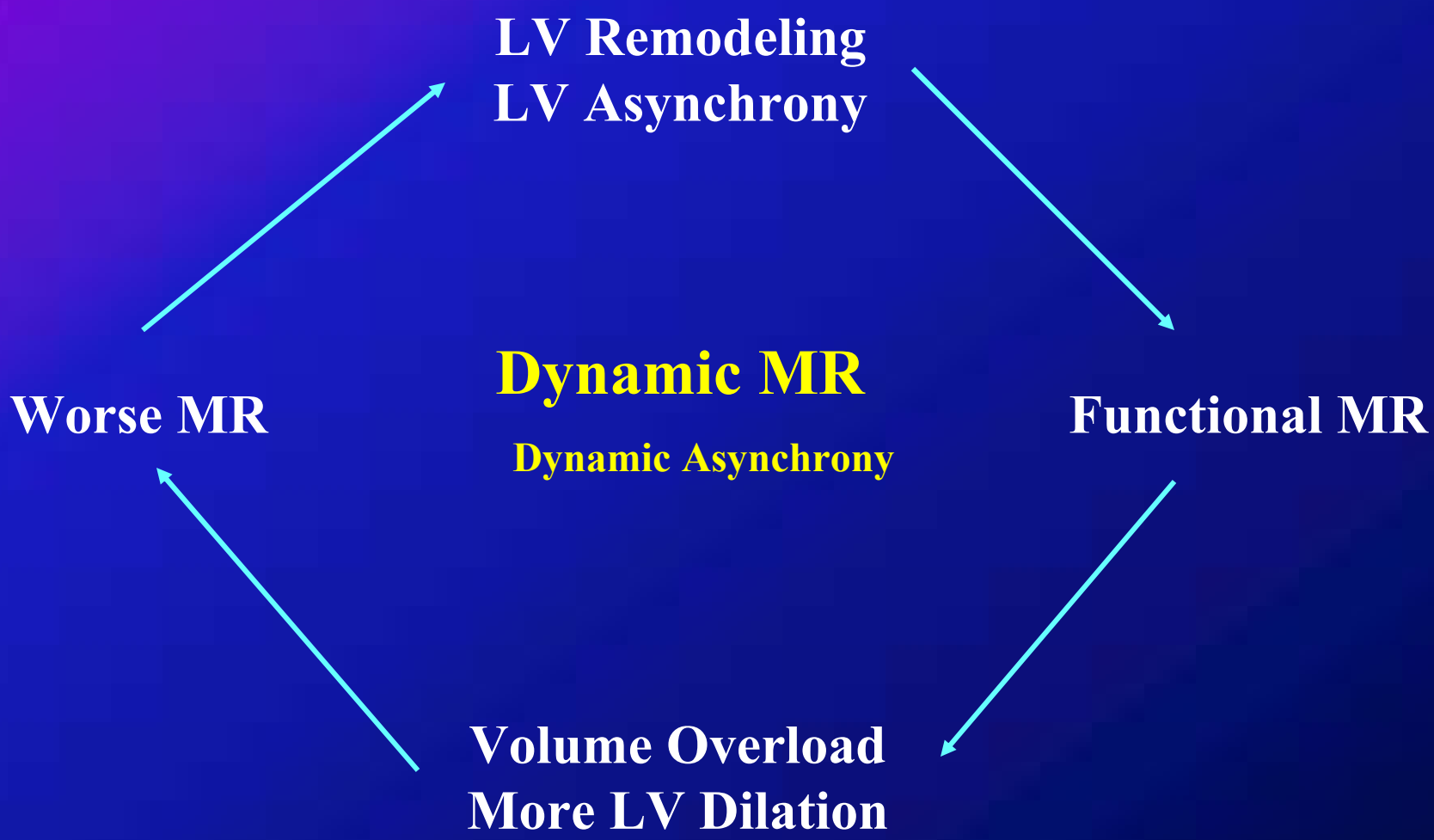
Dynamic MR+ progressive LV remodeling

	2001	2004	2005	2006
	Rest/Exer	Rest/Exer	Rest/Exer	Rest
MAD (cm)	4.6/4.4	4.8/5.7	4.9	5.1
ERO (mm^2)	18/31	35/52	36/50	50
R Vol (ml)	34/53	68/87	63/59	79
EDV (ml)	168	197	247	262

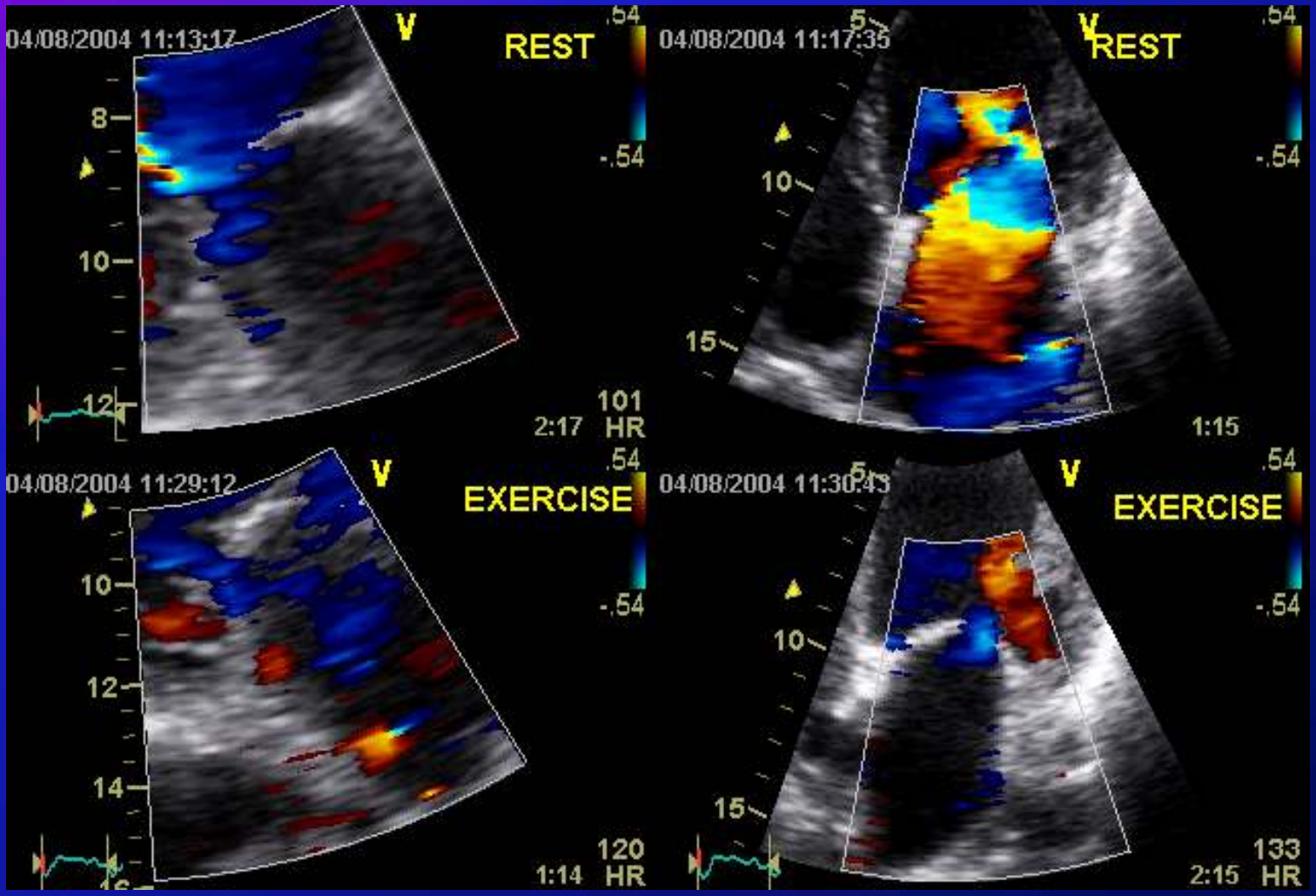




Deleterious vicious circle

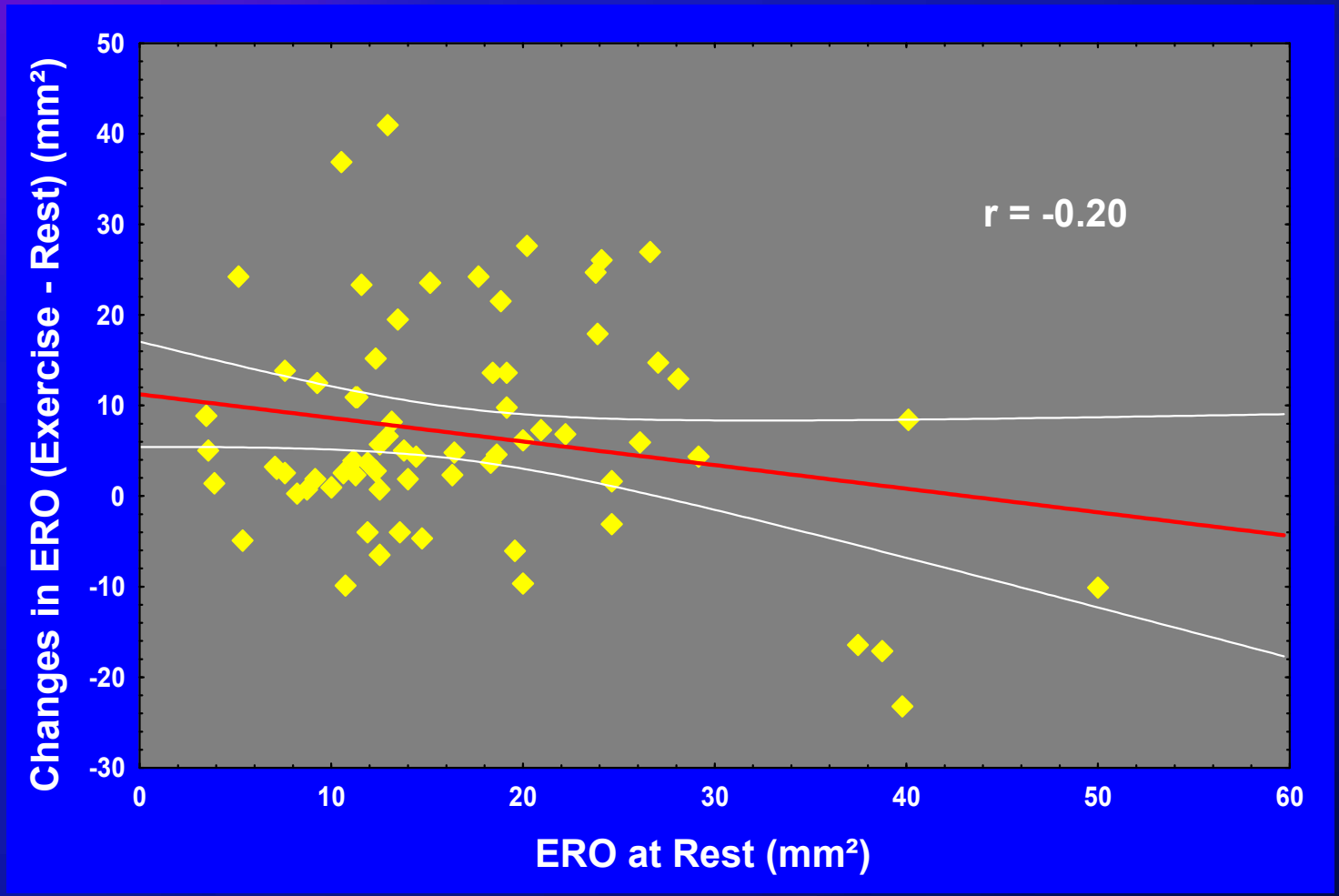


CASE 4 NYHA II



Lancellotti et al JACC 2003, 42,1921

EXERCISE-INDUCED CHANGES IN MR ?



Lancellotti et al JACC 2003, 42,1921

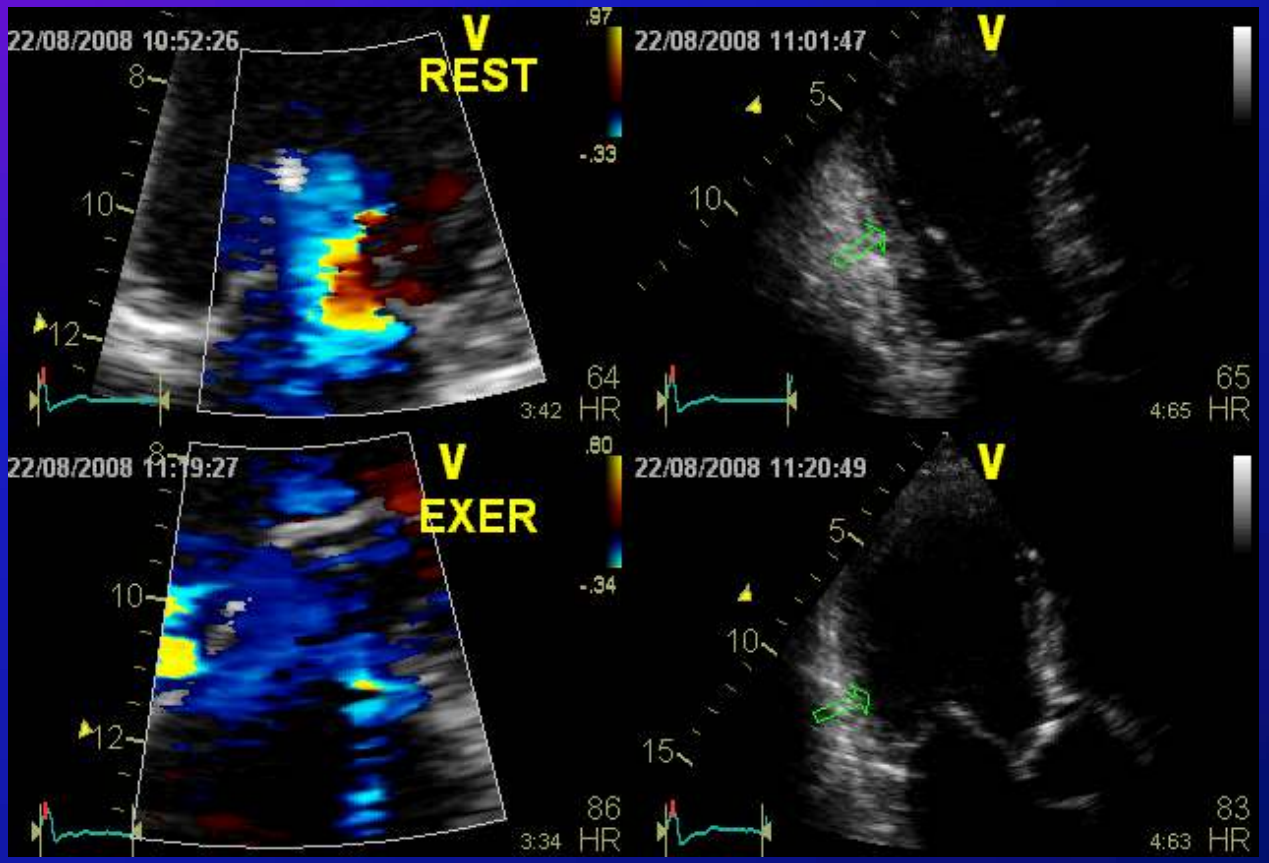
EXERCISE-INDUCED CHANGES IN MR

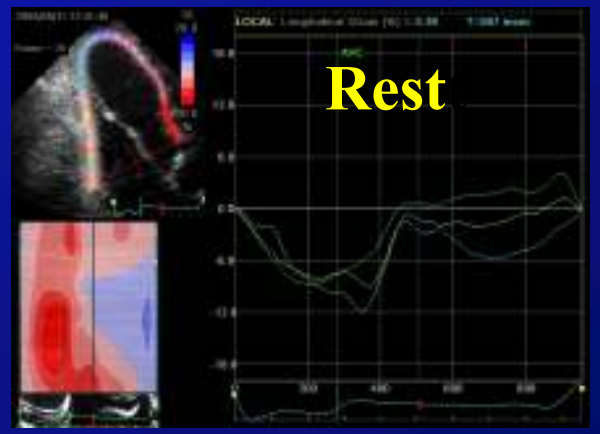
About 30 % have dynamic MR

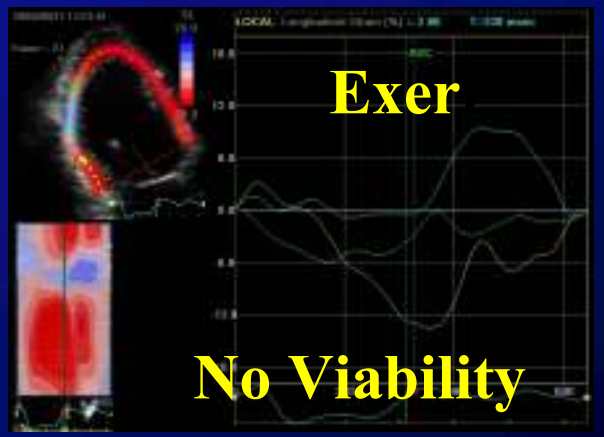
CASE 5

Man of 72 y old who was in NYHA III, QRS 122 ms,
No significant coronary stenosis

Mechanisms of dyspnea ? + CRT ?,

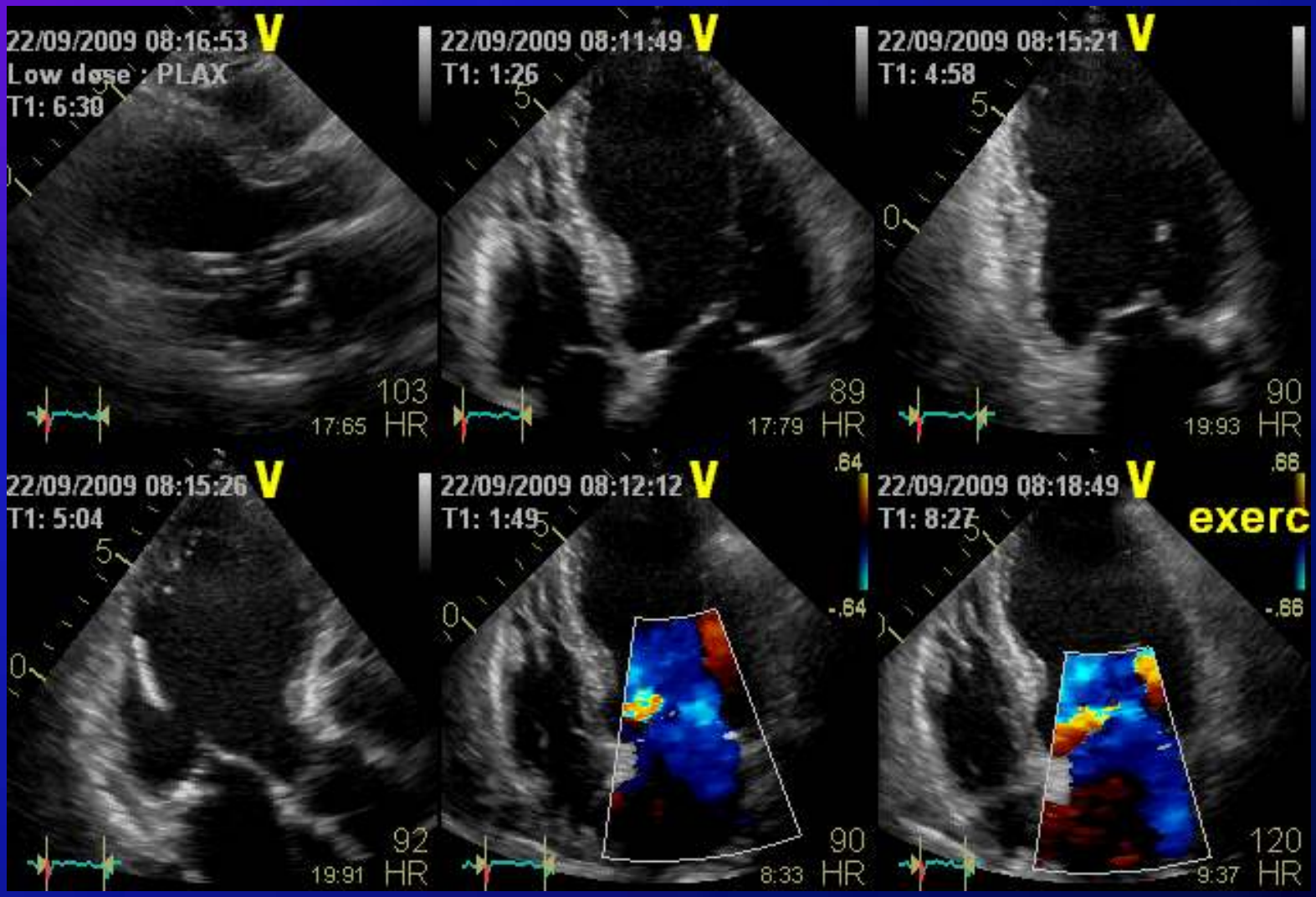


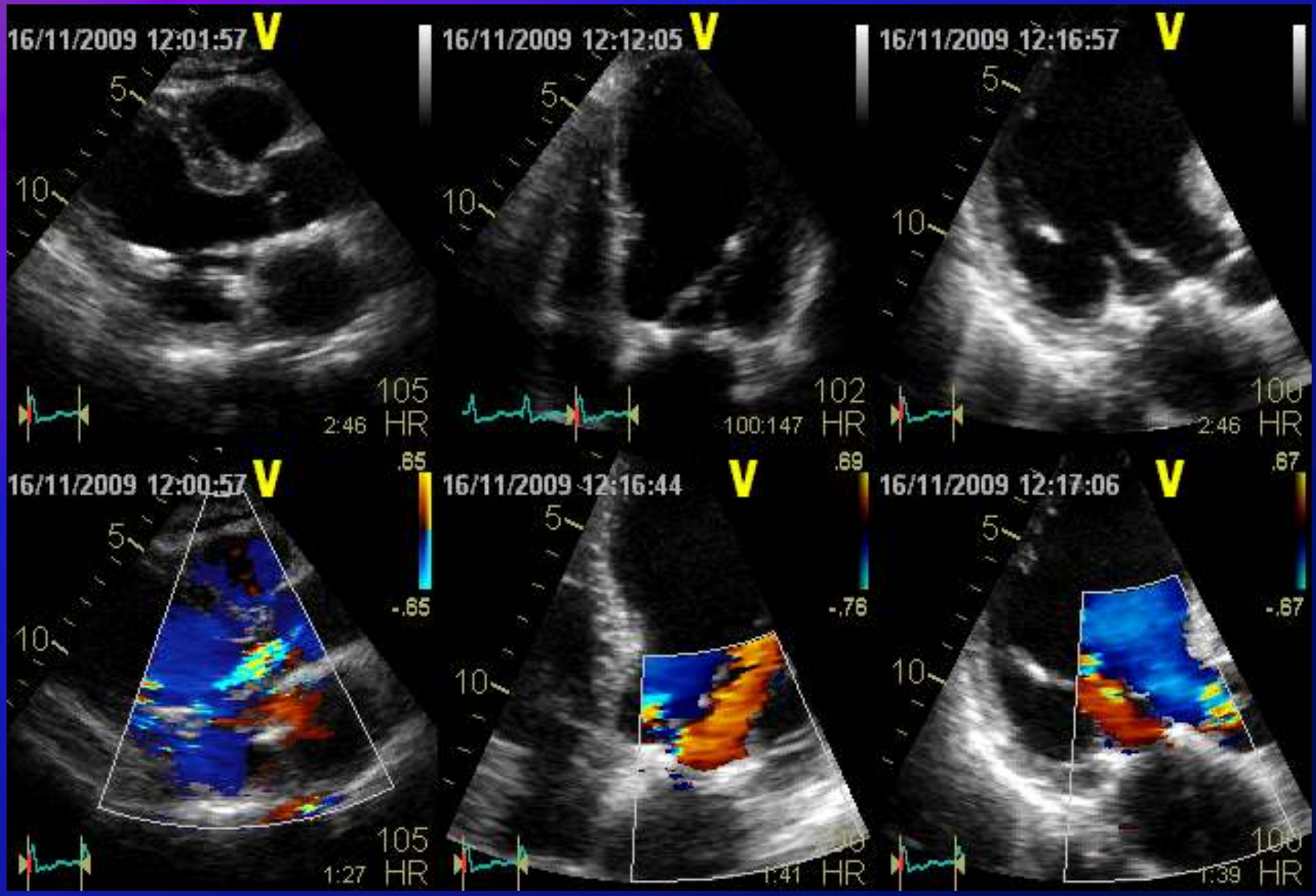




Lancellotti et al. Heart 2008;94:1497-1502

CASE 6 Man of 51 y old, NYHA III, APE, Renal Failure




16/11/2009 12:01:57 V
105 HR
2:46
16/11/2009 12:12:05 V
102 HR
100:147
16/11/2009 12:16:57 V
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2:46
16/11/2009 12:00:57 V
.65
-.65
105 HR
1:27
16/11/2009 12:16:44 V
.69
-.76
HR
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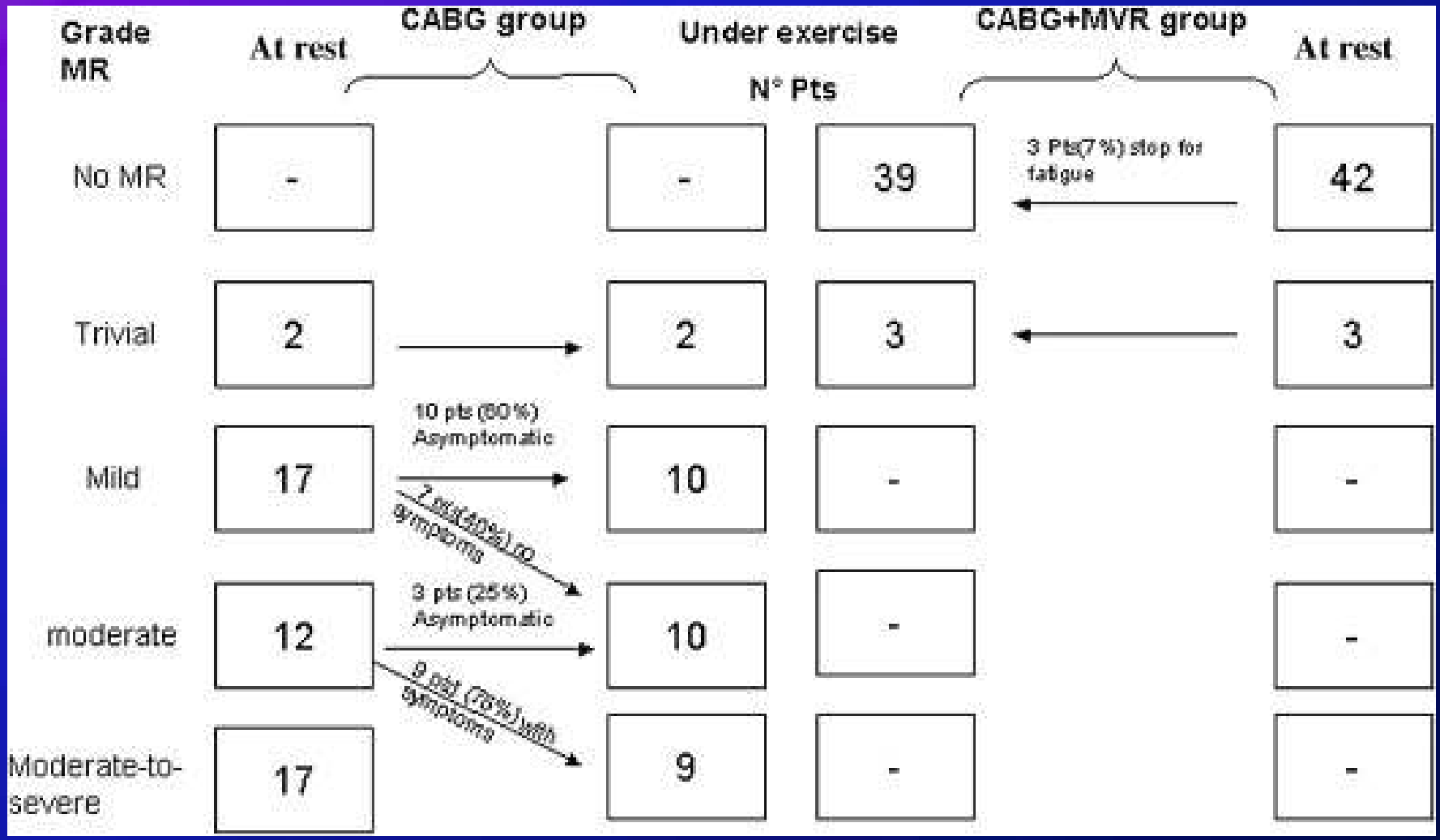
16/11/2009 12:17:06 V
.67
-.67
HR
1:39

PERSISTENT DYNAMIC MR AFTER CABG ALONE



Fattouch K, JTCS 2009

EXERCISE ECHO : IN WHOM ?

- Unexplained (LV systolic dysfunction)
  - Dyspnea
  - Acute pulmonary edema

- Risk stratification

- Before bypass grafting in pts with moderate MR

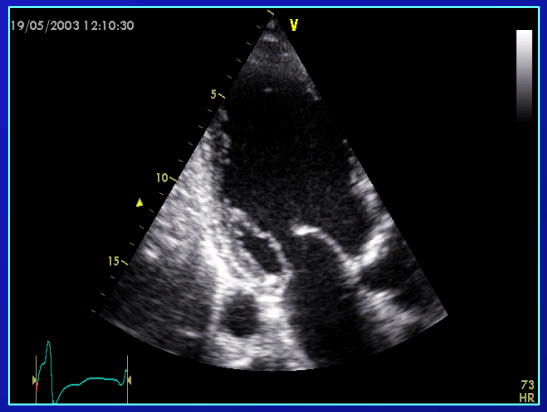
Lancellotti Eur Heart J 2005, Heart 2008

MANAGEMENT OF ISCHEMIC MR

Clinical : HF symptoms, Decompensated HF, Comorbid factors

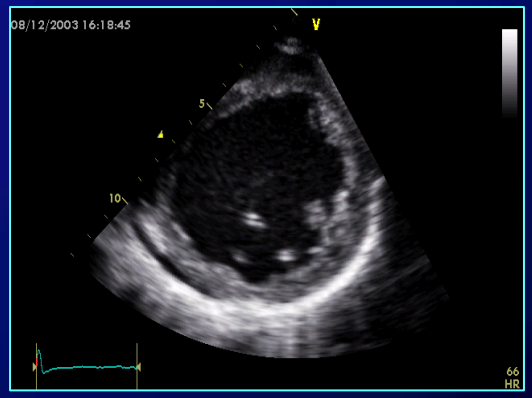
Echo : ERO > 20 mm², Dynamic MR (MR > 13 mm² at exercise) LV remodeling and sphericity, LV asynchrony
Viability +/- Ischemia (stress echo or MRI)

TETHERING FORCE

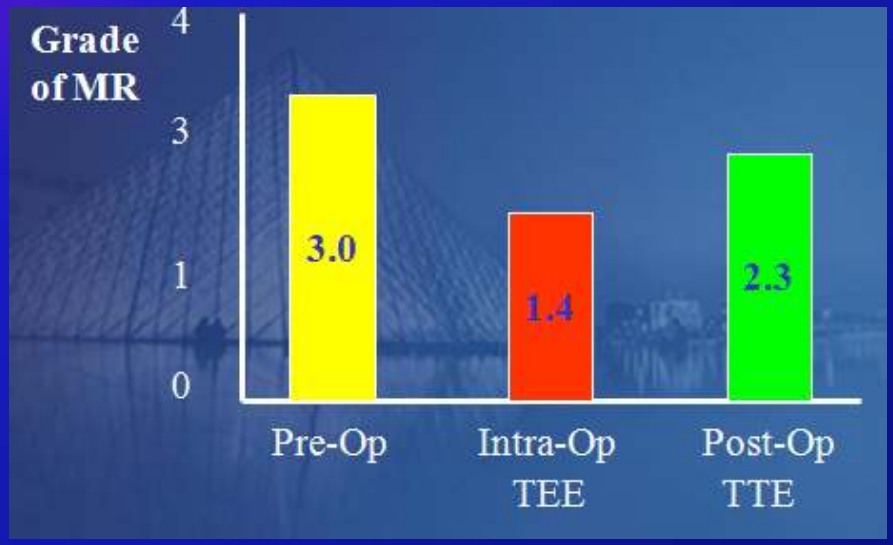


MEDICAL ONLY
CRT +/- ICD
PCI/CABG
MV REPAIR
LV RESHAPE

CLOSING FORCE



Intraoperative TEE Downgrades Functional MR



Possible methods :

Intraoperative TEE

+ preload and afterload challenges

rapid volume loading until PCWP 15 to 18 mmHg

IV phenylephrine until mean arterial P = 100 mmHg

Aklog et al. Circulation 2001,104 suppl I-68-75

ROLE OF IMAGING IN ISCHEMIC MR

- Diagnosis, severity and repercussion
- Risk stratification
  - Rest : ERO $\geq$ 20 mm²
  - Dynamic MR at exercise: $\geq$ 13 mm²
  - Viability/Ischemia
  - LV Remodeling
- Help to management
  - Patient selection for CRT
  - Patient selection for surgery
  - Identify markers of MV annuloplasty failure

I'm not the famous heart surgeon, but I do stress echo

Magritte: La clairvoyance