Ischemic Mitral Regurgitation

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Ischemic Mitral Regurgitation
Definition

Ischemic mitral regurgitation is mitral regurgitation due to complications of coronary artery disease, in particular, myocardial infarction, and not the fortuitous association of coronary artery disease with intrinsic valve disease such as rheumatic disease, or mitral valve prolapse.

Ischemic Mitral Regurgitation

- In the acute phase of myocardial infarction, ischemic mitral regurgitaion is frequent and appears to carry an adverse prognosis.
- In the chronic post-myocardial infarction phase, angiographic mitral regurgitaion is frequent (> 19% grade II MR) and is predictive of survival, even if mild to moderate in severity.
- For diagnosis purposes, murmur is of limited value. Objective methods are therefore required.

Ischemic Mitral Regurgitation

Prognostic value of MR in ischemic heart disease

- 303 patients (mean age 70 ± 10 yrs) with a first Q-wave MI older than 16 days before baseline assessment.

- Exclusion criteria :
  - MI ≤ 16 days
  - Previous surgery
  - Papillary muscle rupture
  - MR of organic origin
  - Significant AR

Grigioni et al., ***Circulation***. 2001;103:1759.

Ischemic Mitral Regurgitation

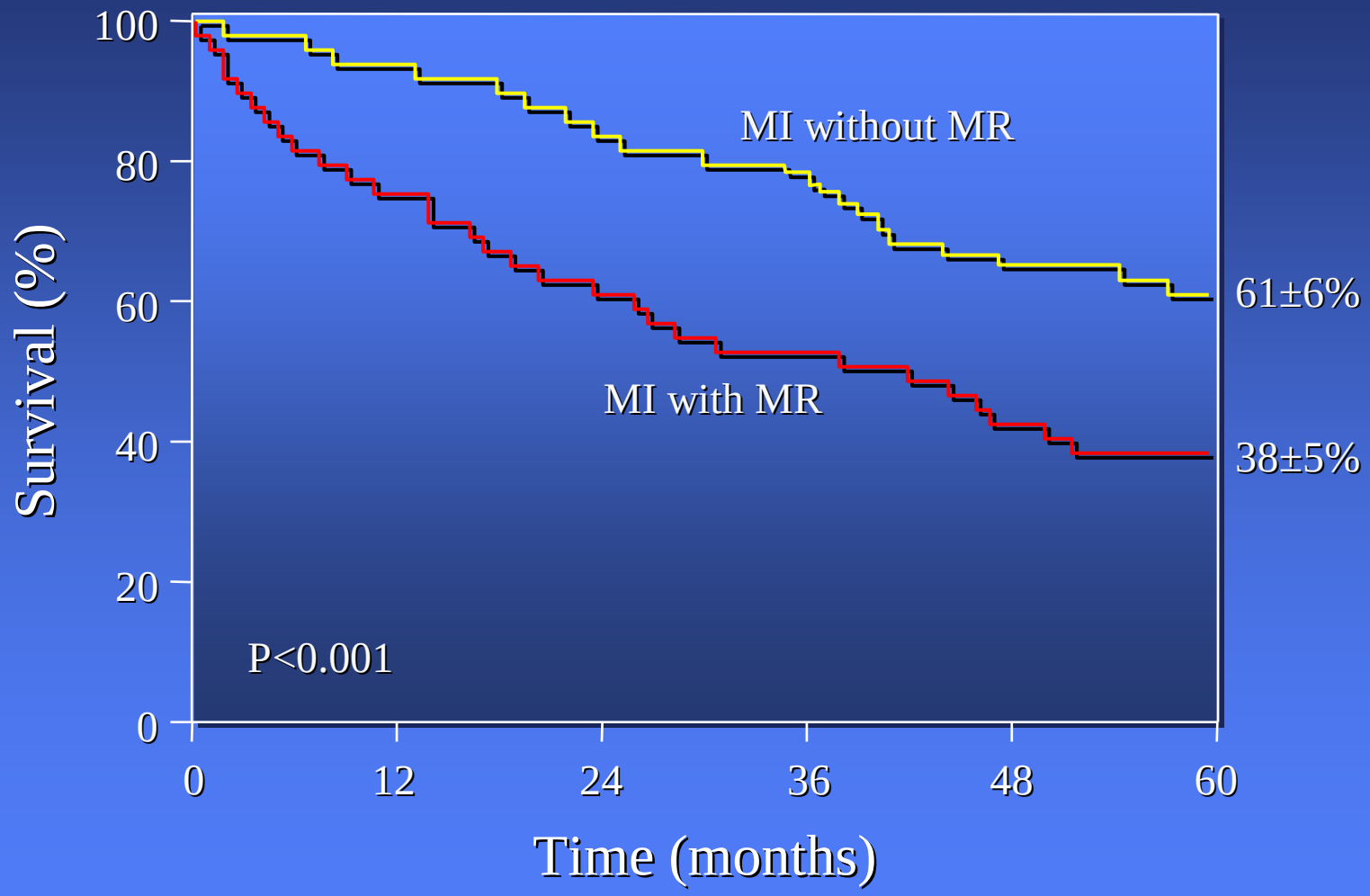
Prognostic value of MR in ischemic heart disease

	IMR (n=194)	no IMR (n=109)	p value
Age, y	71±11	70±9	0.20
Men	135 (70%)	86 (79%)	0.08
NYHA III–IV	92 (47%)	38 (35%)	0.034
A. Fib.	30 (15%)	5 (5%)	0.004
SBP	132±26	141±26	0.004
Anterior MI	40 (21%)	44 (40%)	0.001
EF, %	33±14	34±11	0.14
LVS, mm/m²	28±6	26±6	0.003
LVD, mm/m²	33±5	31±5	0.001

Grigioni et al., ***Circulation***. 2001;103:1759.

Ischemic Mitral Regurgitation

Prognostic value of MR in ischemic heart disease



Grigioni et al., ***Circulation***. 2001;103:1759.

Ischemic Mitral Regurgitation

Multivariate predictors of overall survival

	RR	95% CI	p value
Age	1.03	1.01-1.05	< 0.001
EF	0.98	0.97-1.00	0.030
NYHA III-IV	1.88	1.27-2.79	0.002
Diabetes	1.48	0.99-2.20	0.054
A. Fib.	1.62	1.00-2.62	0.049
1/Creatinine	0.44	0.21-0.94	0.034
R. Vol. < 30 mL	1.64	0.98-2.75	0.059
R. Vol. ≥ 30 mL	2.05	1.30-3.23	0.002

Grigioni et al., ***Circulation***. 2001;103:1759.

Ischemic Mitral Regurgitation

Prognostic value of MR in ischemic heart disease

ERO > 20 mm^2

and/or

RV > 30 mL

adjusted RR: 2.01 - 2.38

Grigioni et al., ***Circulation***. 2001;103:1759.

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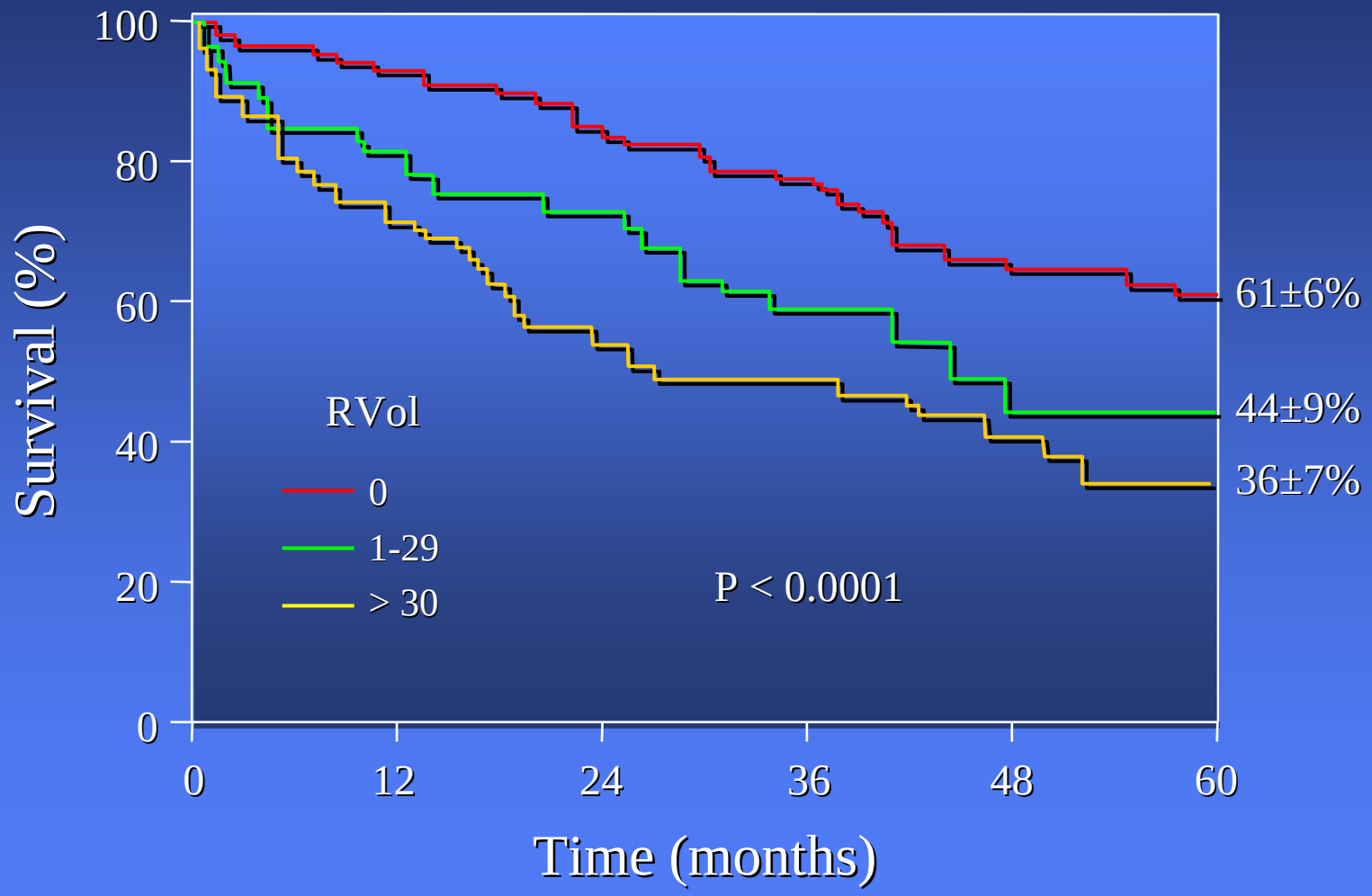
Prognostic value of MR in ischemic heart disease



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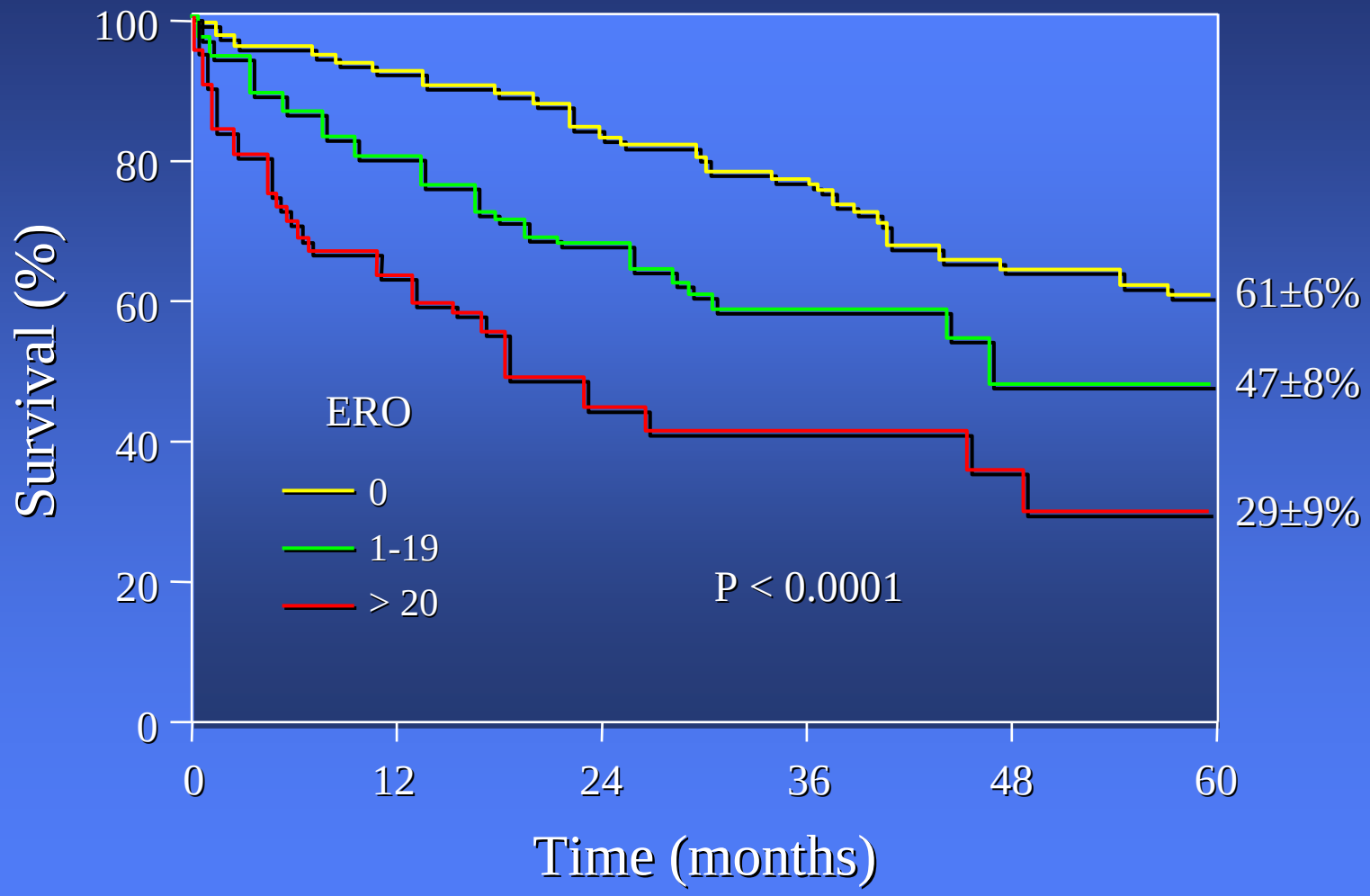
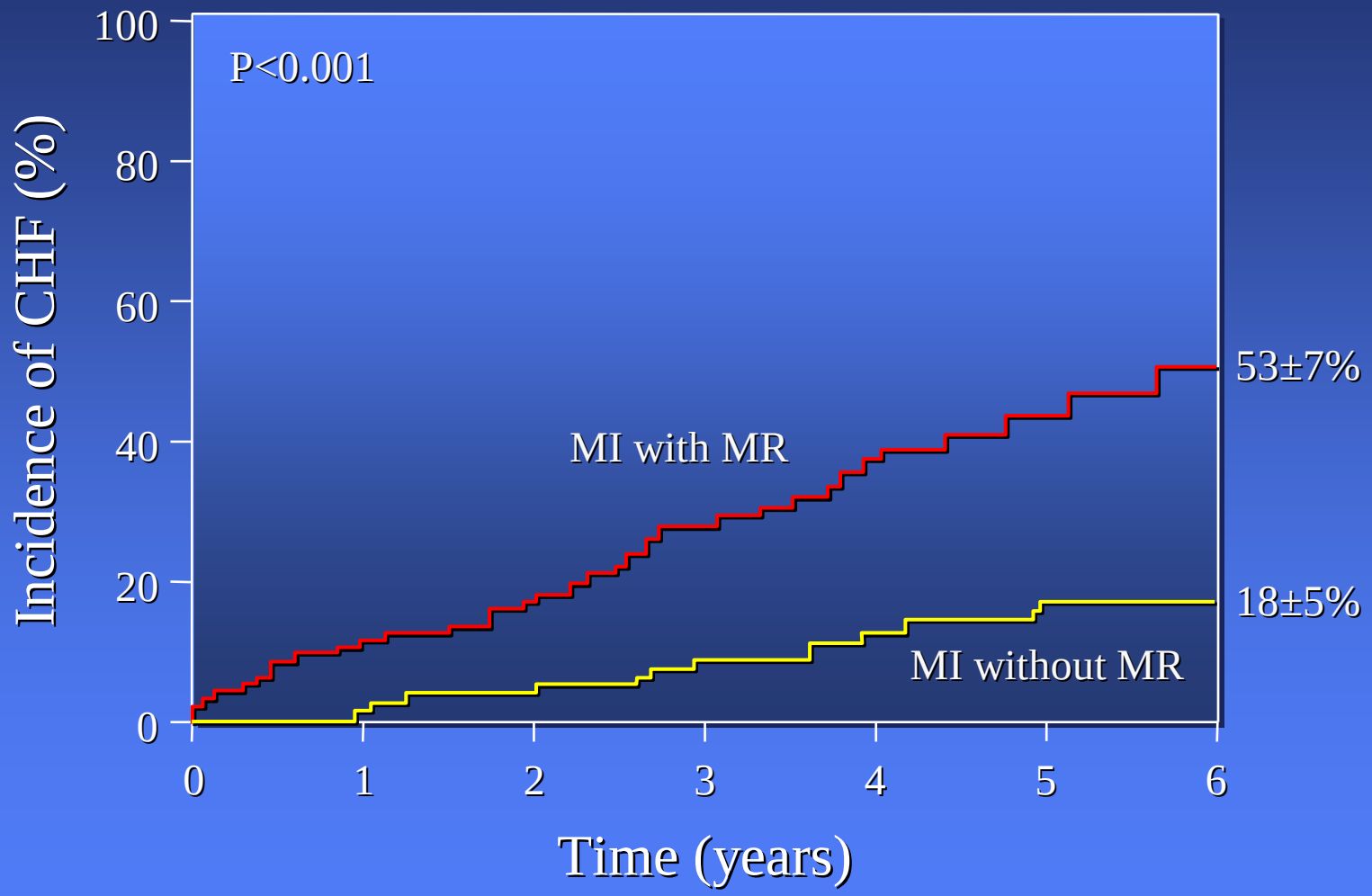
Prognostic value of MR in ischemic heart disease



Grigioni et al., ***Circulation***. 2001;103:1759.

Ischemic Mitral Regurgitation

Impact of iMR on the development of heart failure



Grigioni et al., ***J Am Coll Cardiol***. 2005;45:260.

Ischemic Mitral Regurgitation

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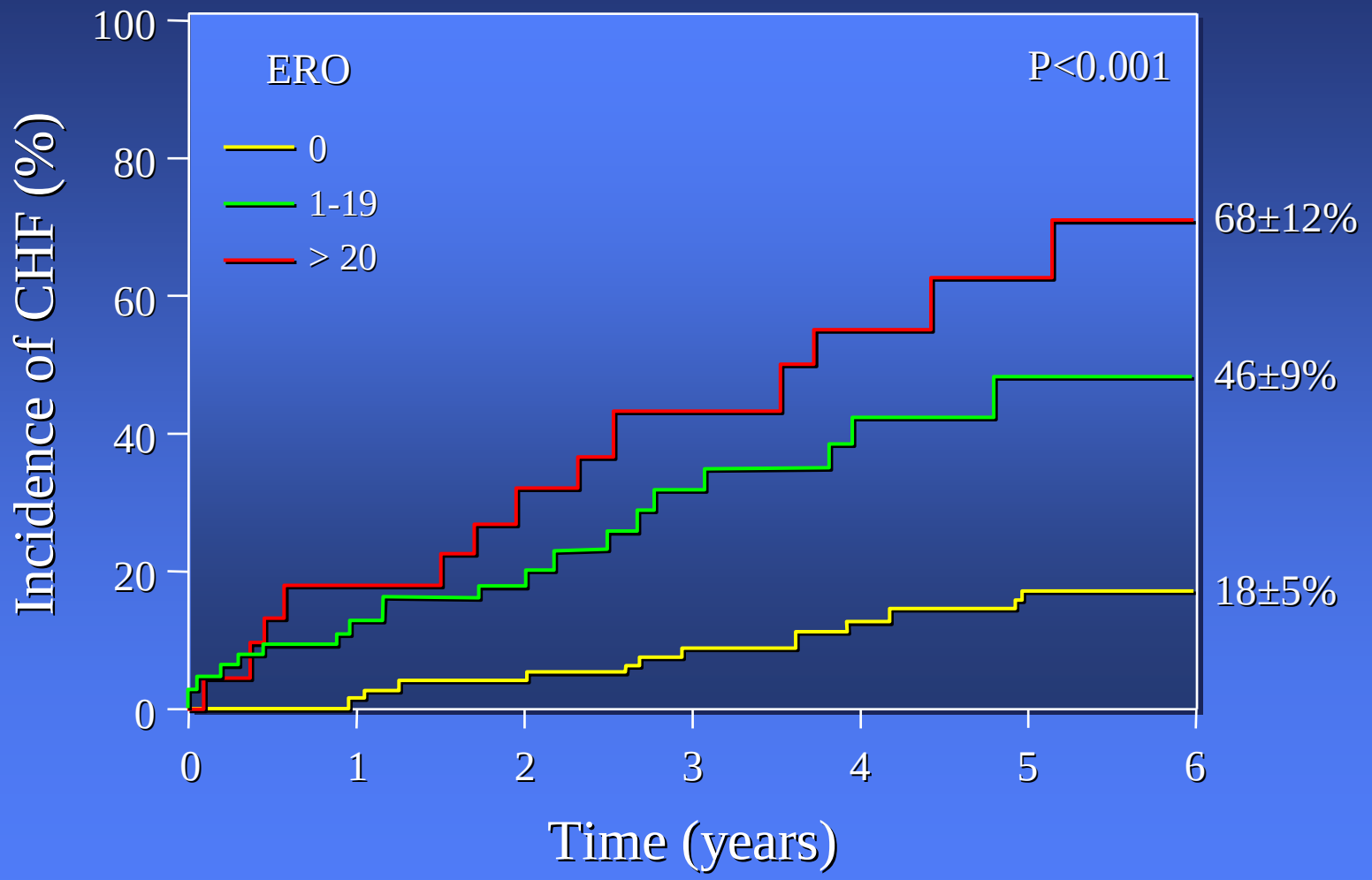
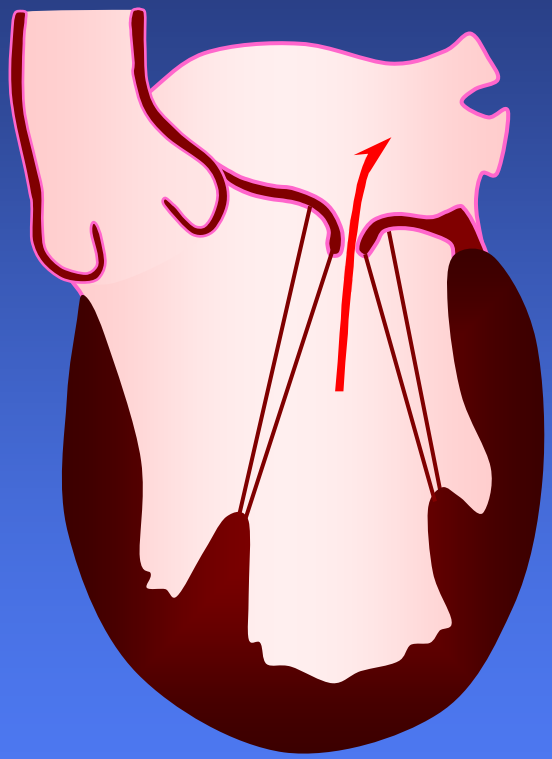


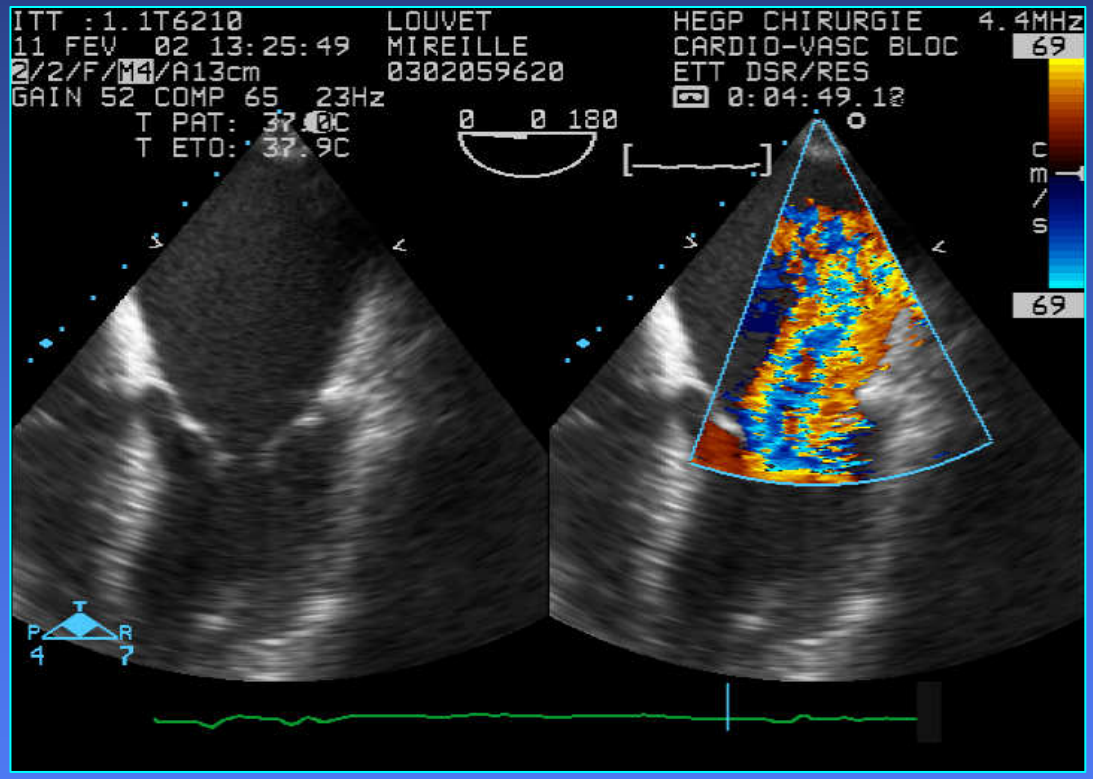
Grigioni et al., ***J Am Coll Cardiol***. 2005;45:260.

Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Type I dysfunction

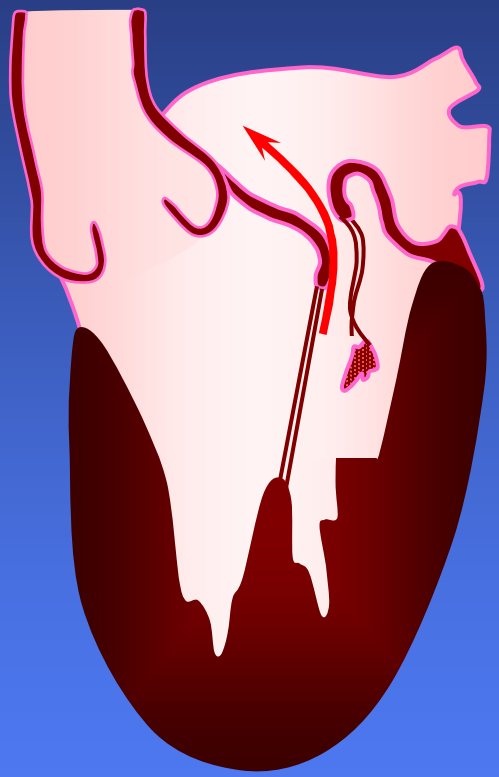


Type I
annular dilatation



Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Type II dysfunction



Type II
Papillary muscle
rupture

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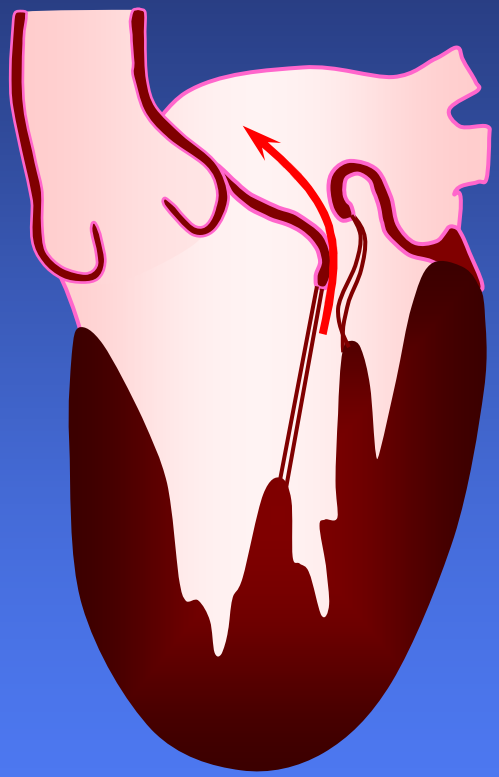
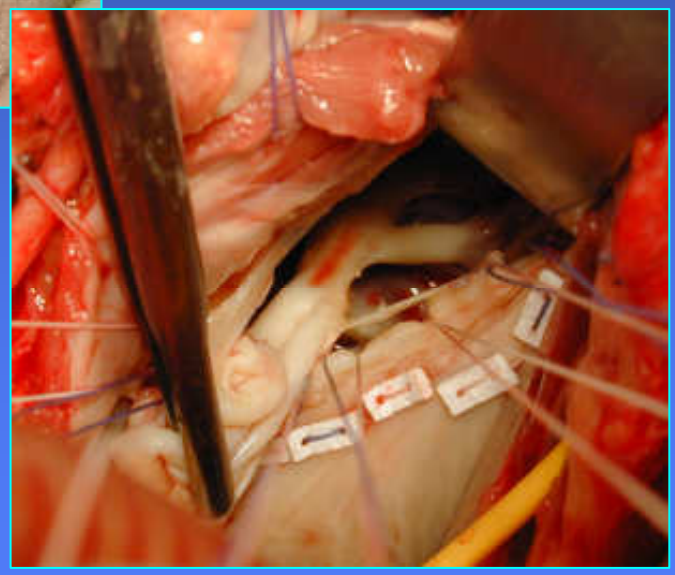
Ischemic mitral regurgitation: Type II dysfunction

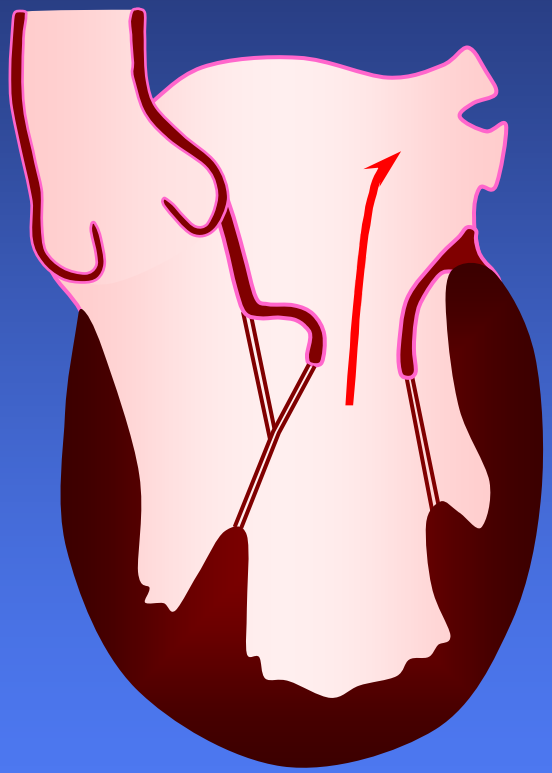


Type II
Papillary muscle
elongation



Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Type III dysfunction



Type IIIb
Leaflet restriction

Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Decreased closing forces

- Incomplete leaflet and scallop coaptation
  - Decreased closing forces
  - Annular dilatation and loss of annular contraction
  - Increased tethering forces

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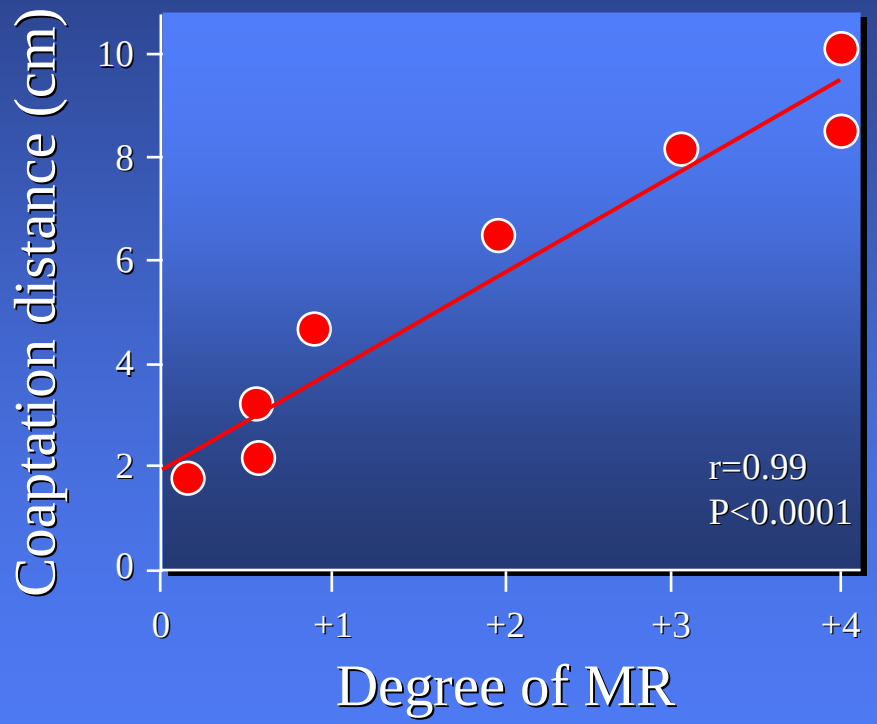
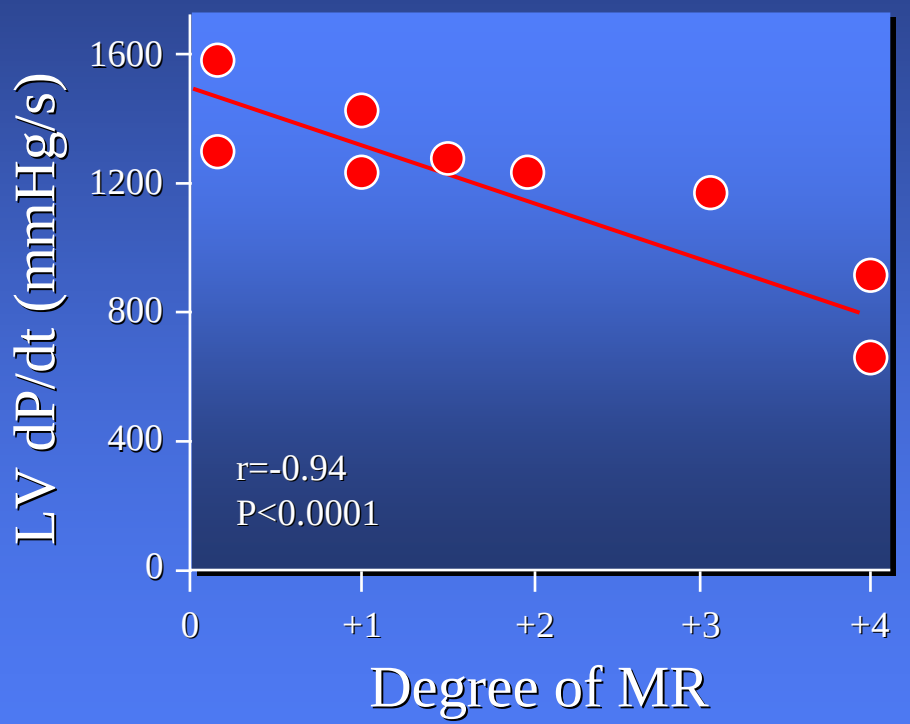
Ischemic mitral regurgitation: Decreased closing forces





Kaul et al., ***Circulation*** 1991;84:2167

Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Annular dilatation

- Incomplete leaflet and scallop coaptation
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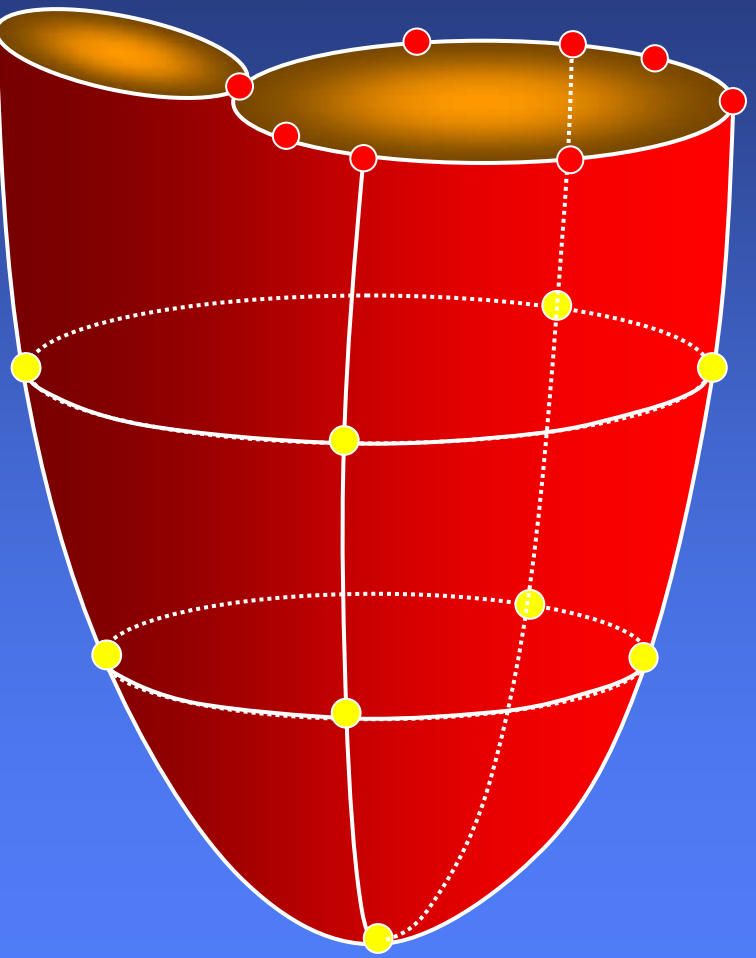
Ischemic Mitral Regurgitation

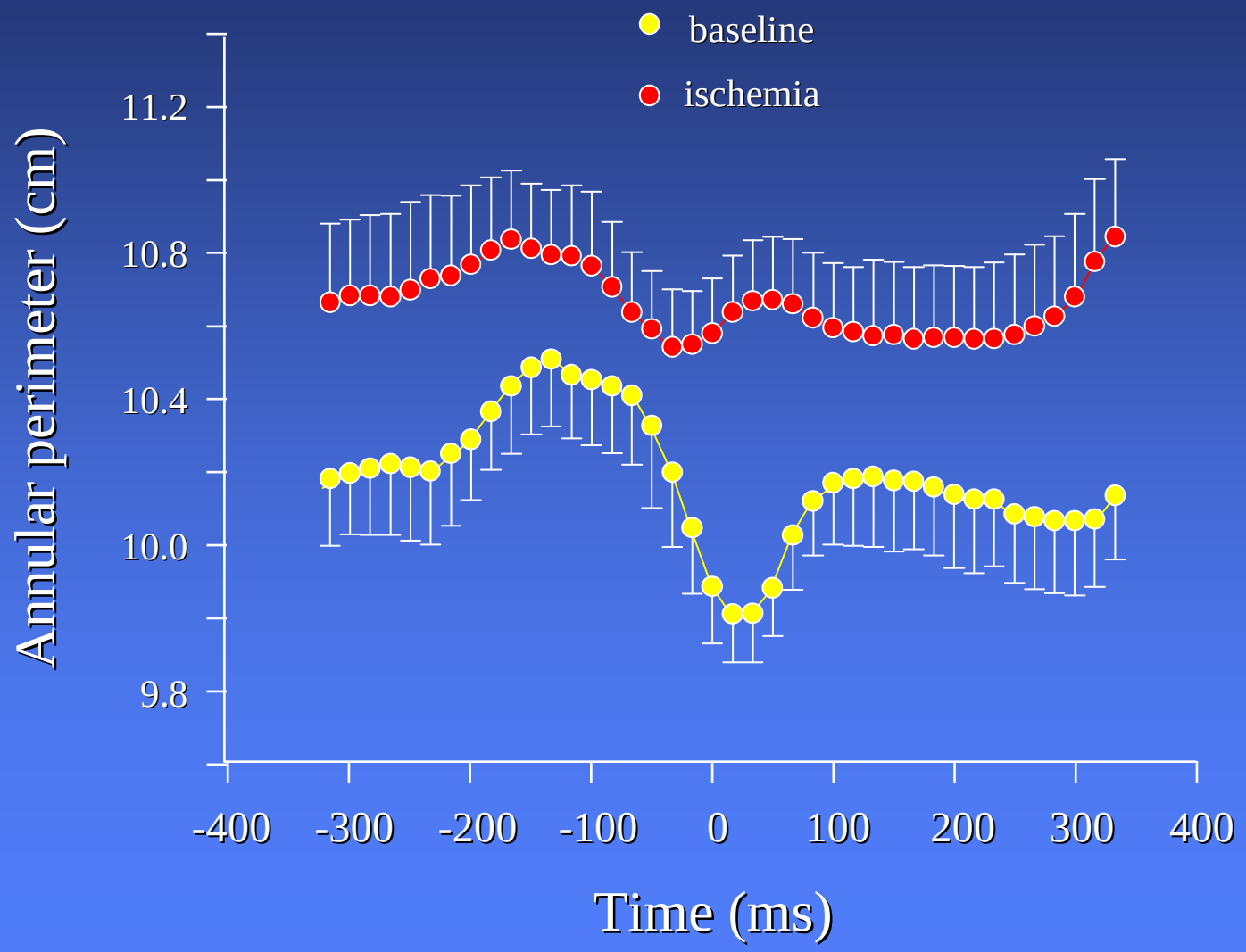
Ischemic mitral regurgitation: Annular dilatation



Timek et al., ***Circulation*** 2002;106 (suppl I):I-33

Ischemic Mitral Regurgitation

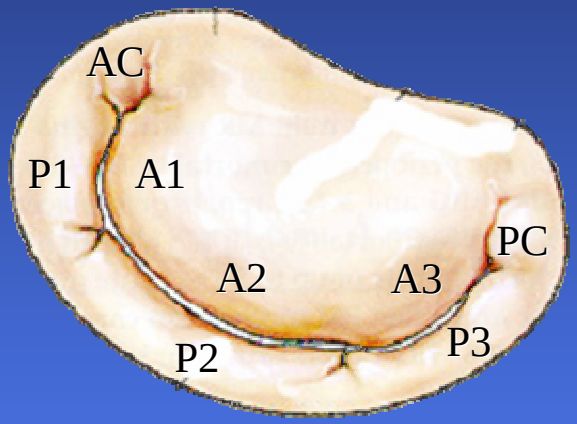
Ischemic mitral regurgitation: Annular dilatation



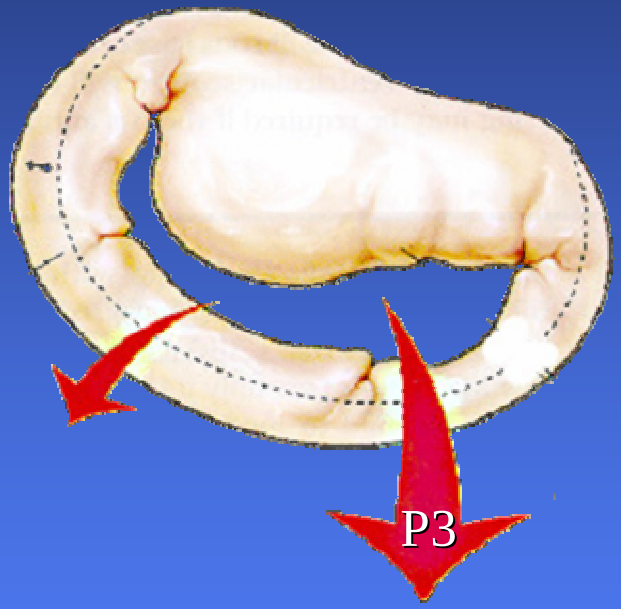
Timek et al., ***Circulation*** 2002;106 (suppl I):I-33

Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Posterior commissure involvement



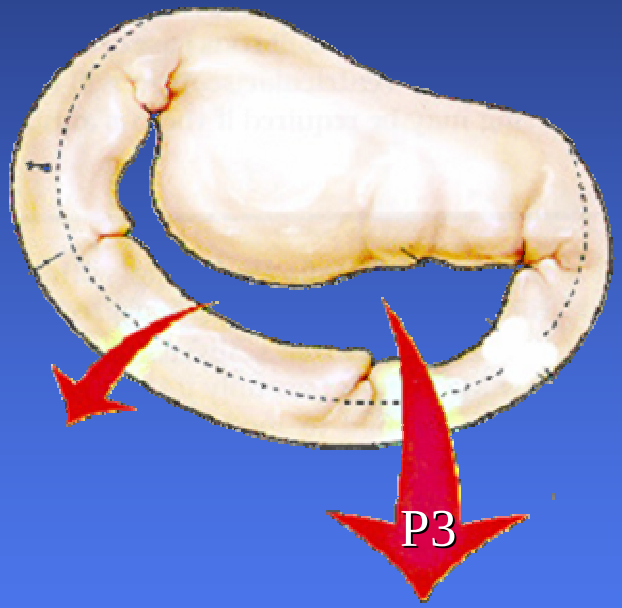
Normal



Ischemic

Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Posterior commissure involvement



Ischemic

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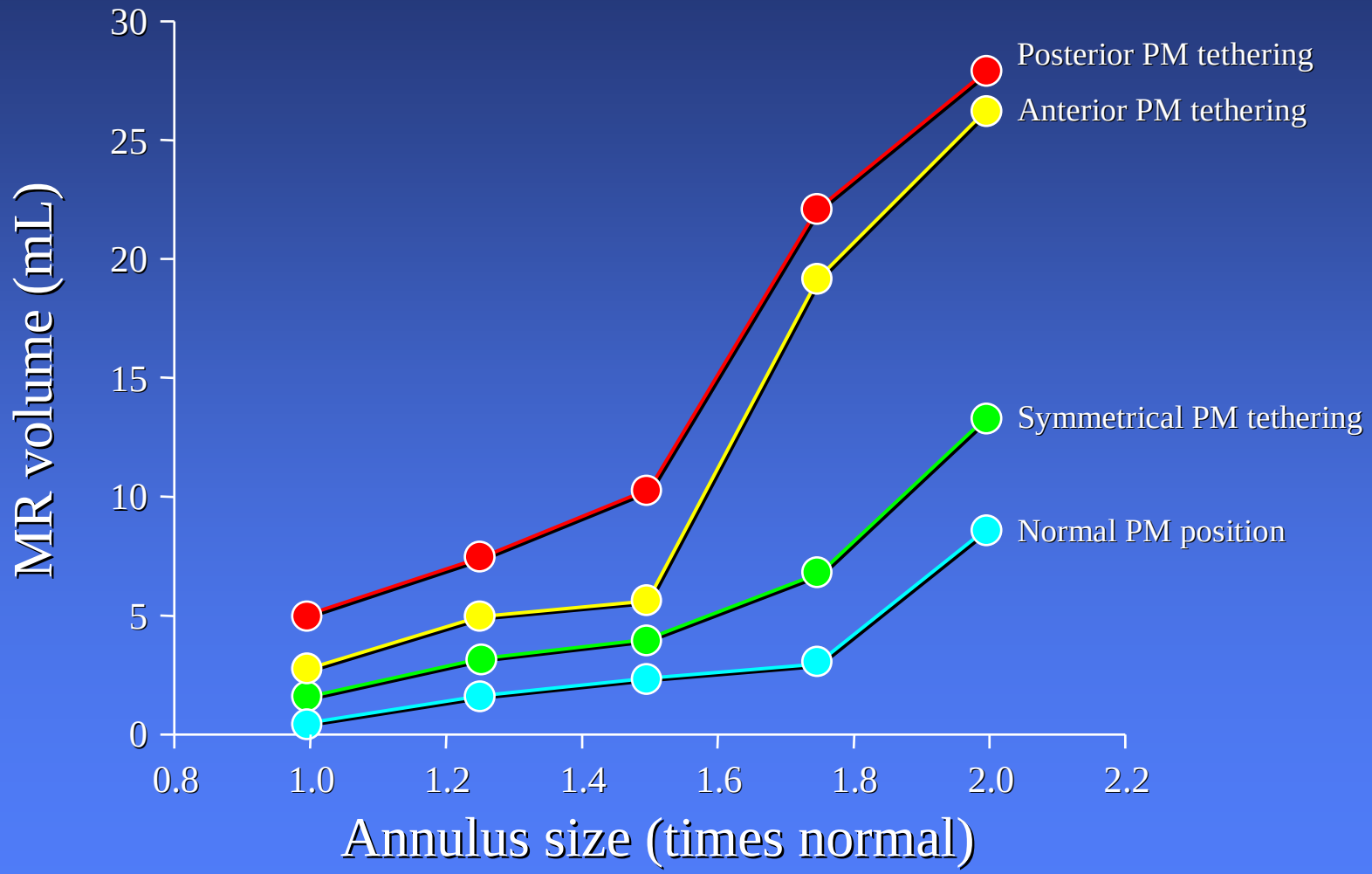
Ischemic mitral regurgitation: Annular dilatation



He and al. ***J Heart Valve Dis*** 1999;8:294

Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Increased tenting

- Incomplete leaflet and scallop coaptation
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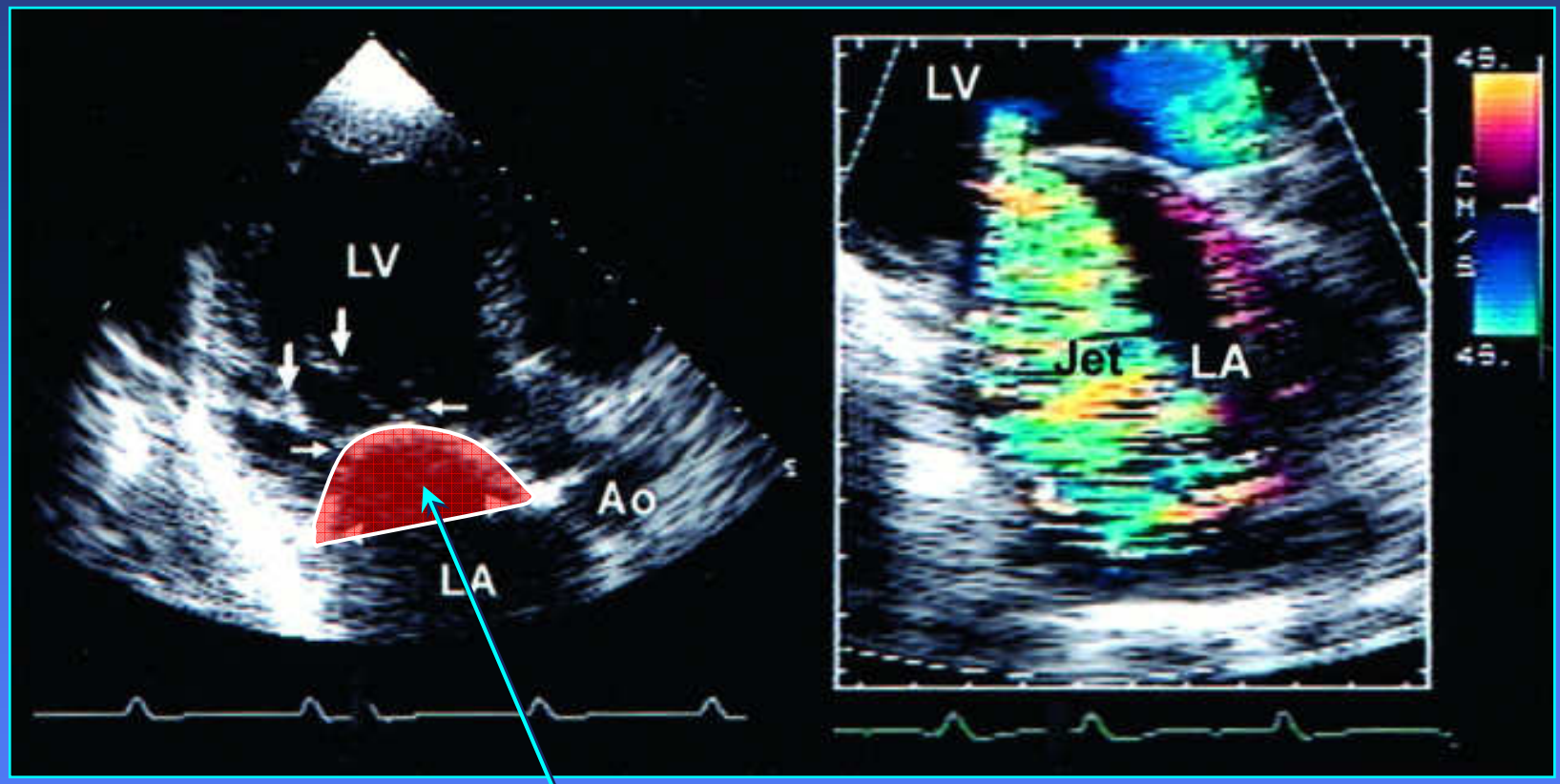

Tenting area

Yiu et al., ***Circulation*** 2000;102:1400

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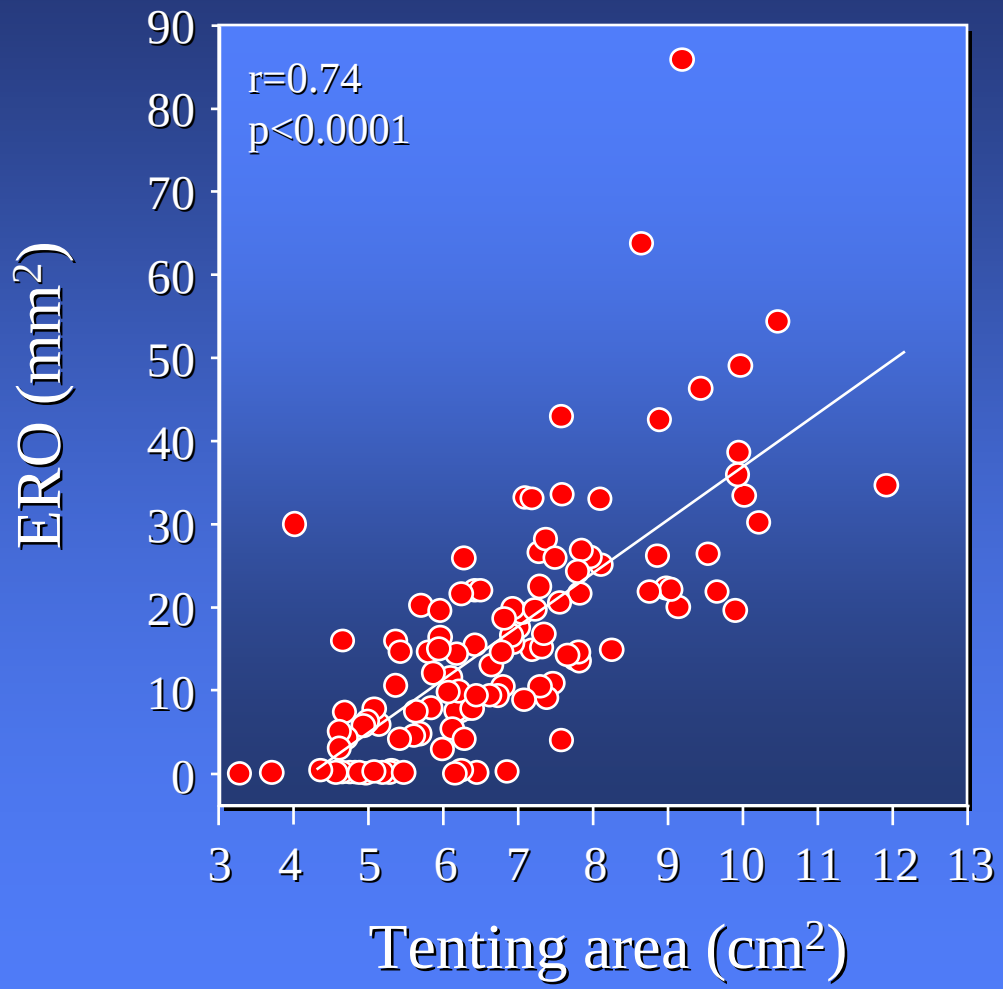

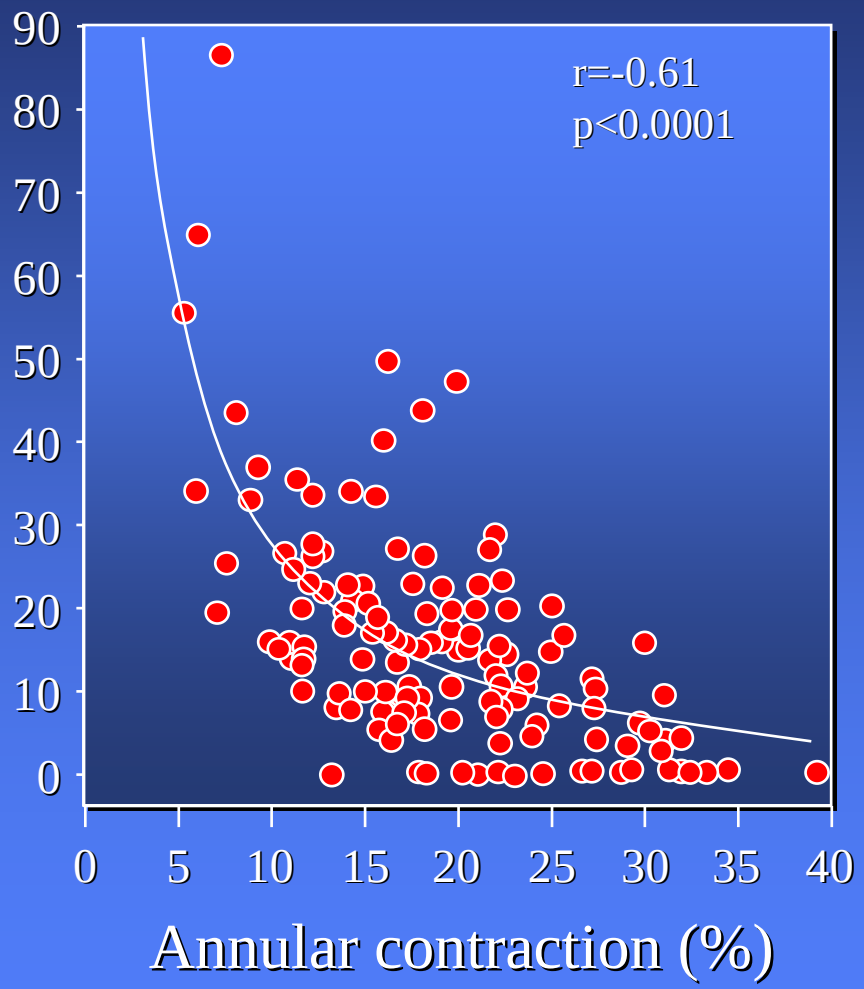

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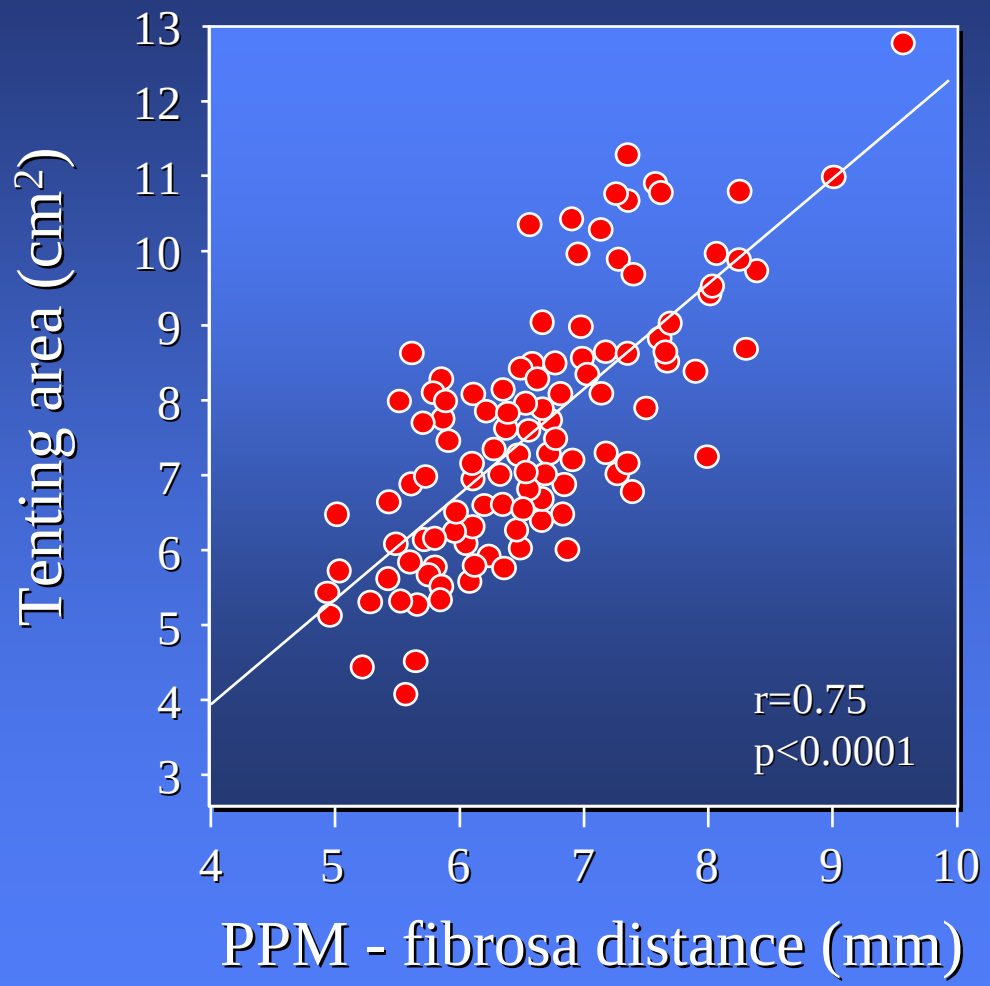

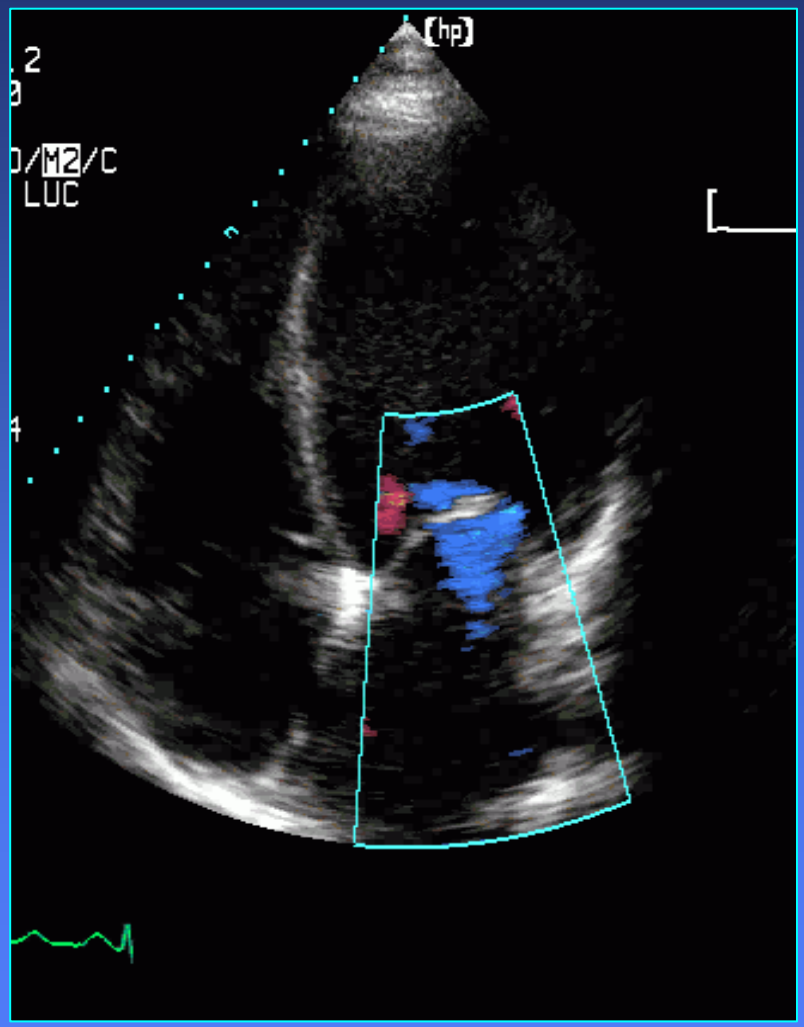

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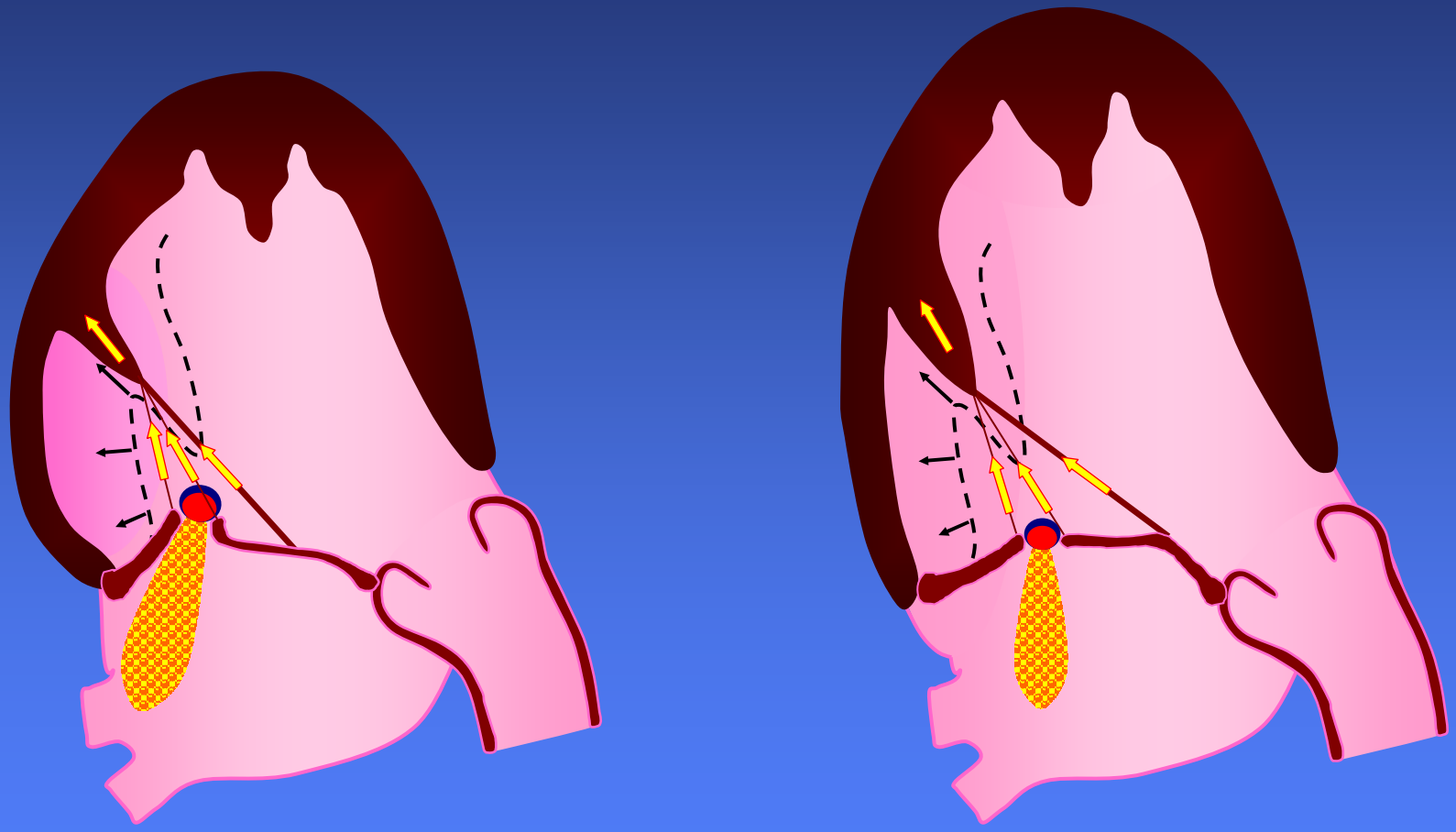
Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Asymmetrical vs symmetrical tenting



Agricola et al., ***Eur J Echocardiogr*** 2004;5:326

Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Asymmetrical vs symmetrical tenting

Table 2 Mitral deformation indexes, global and local LV remodeling

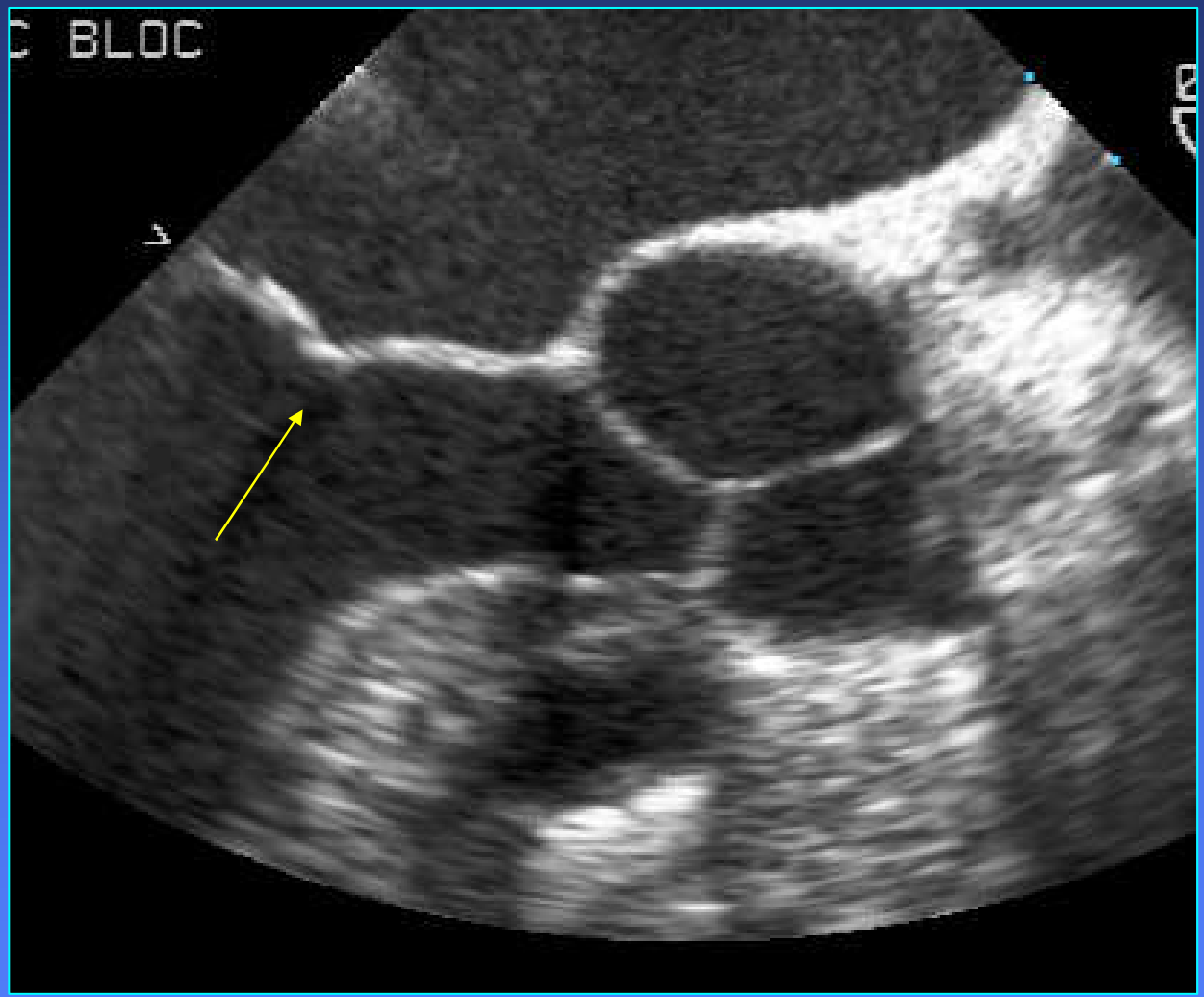
	Controls ($n=25$)	Asymmetric group ($n=54$)	Symmetric group ($n=38$)	p ANOVA
Mitral deformation indexes				
Tenting area (cm^2)	0.6 ± 0.2	3.2 ± 1*	4 ± 1.1*†	0.0001
Coaptation height (cm)	0.4 ± 0.1	1.2 ± 0.5*	1.6 ± 0.3*†	0.0001
Systolic MA area (cm^2)	7.6 ± 1.1	13 ± 2.6*	12 ± 2.2*	0.0001
Global LV remodeling				
EDV (ml)	70.5 ± 13	195 ± 21*	228 ± 18*†	0.0001
ESV (ml)	33.5 ± 7	102 ± 15*	152 ± 17*†	0.0001
EF (%)	66.4 ± 6.5	45 ± 9.5*	31 ± 7.5*†	0.0001
WMSI	1	1.5 ± 0.3*	2 ± 0.5*†	0.0001
Systolic *D/L*	0.42 ± 0.02	0.56 ± 0.07*	0.66 ± 0.10*†	0.0001
Local LV remodeling				
PPM posterior *D* (cm)	1.4 ± 0.5	3 ± 0.7*	3.1 ± 0.8*	0.0001
APM posterior *D* (cm)	1.7 ± 0.5	2.5 ± 0.6*	2.3 ± 0.7*†	0.0001
PPM lateral *D* (cm)	1.2 ± 0.3	2.3 ± 0.5*	2 ± 0.5*	0.0001
APM lateral (cm)	1.2 ± 0.3	2 ± 0.5*	2.2 ± 0.3*†	0.0001
PAC separation (cm)	2.5 ± 0.5	3 ± 0.5*	3.3 ± 0.7*†	0.0001
PPM-fibrosa *D* (cm)	2.6 ± 0.4	2.8 ± 0.6*	4.4 ± 1.1*	0.0001
PM WMI	1 ± 0	2.1 ± 0.6*	1.9 ± 0.6*†	0.0001
APM WMI	1 ± 0	1.2 ± 0.4*	1.6 ± 0.7*†	0.0001

Values are mean ± SD. MA = mitral annulus; EDV = end-diastolic volume; ESV = end-systolic volume; EF = ejection fraction; WMSI = wall motion score index; *D/L* = short-to-long-axis dimension ratio; PPM = posterior papillary muscle; APM = anterior papillary muscle; *D* = distance; WMI = wall motion index. *$p<0.05$ vs control group; †$p<0.05$ vs asymmetric group.

Agricola et al., ***Eur J Echocardiogr*** 2004;5:326

Ischemic Mitral Regurgitation

Ischemic mitral regurgitation: Asymmetrical tenting - the seagull sign



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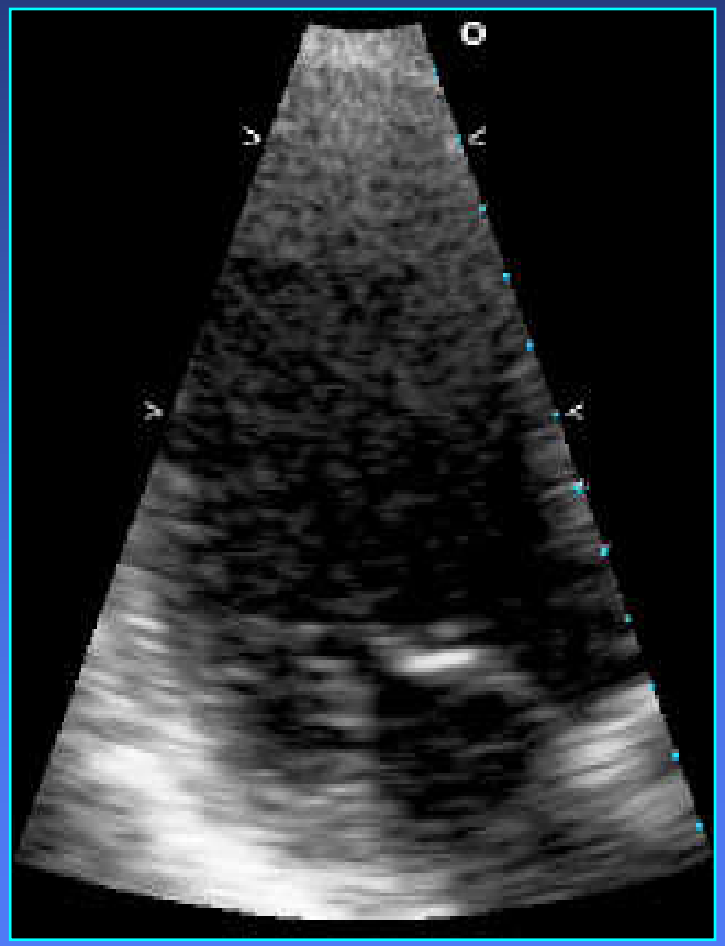
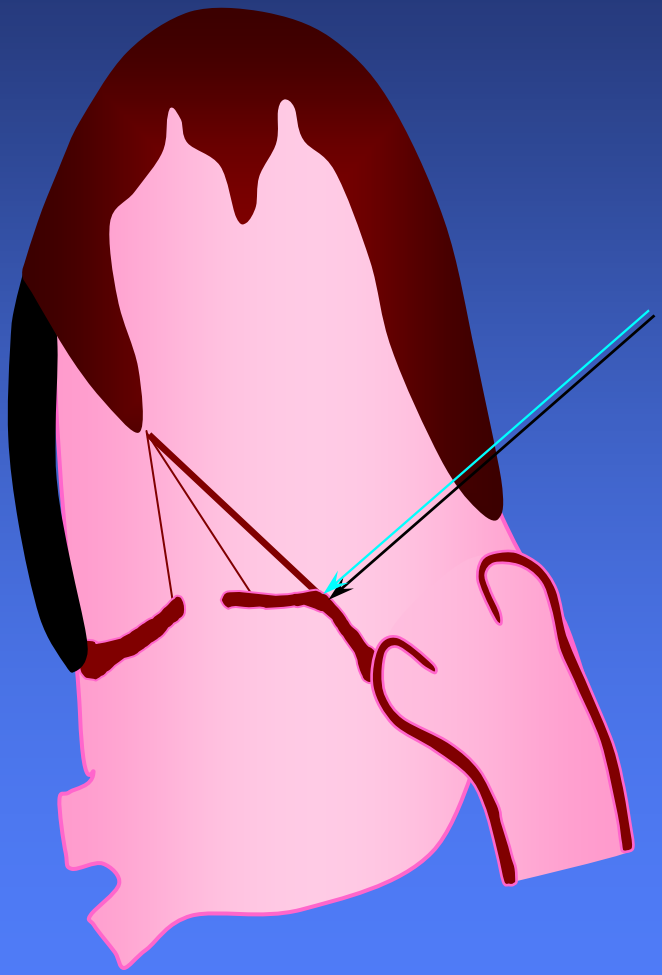


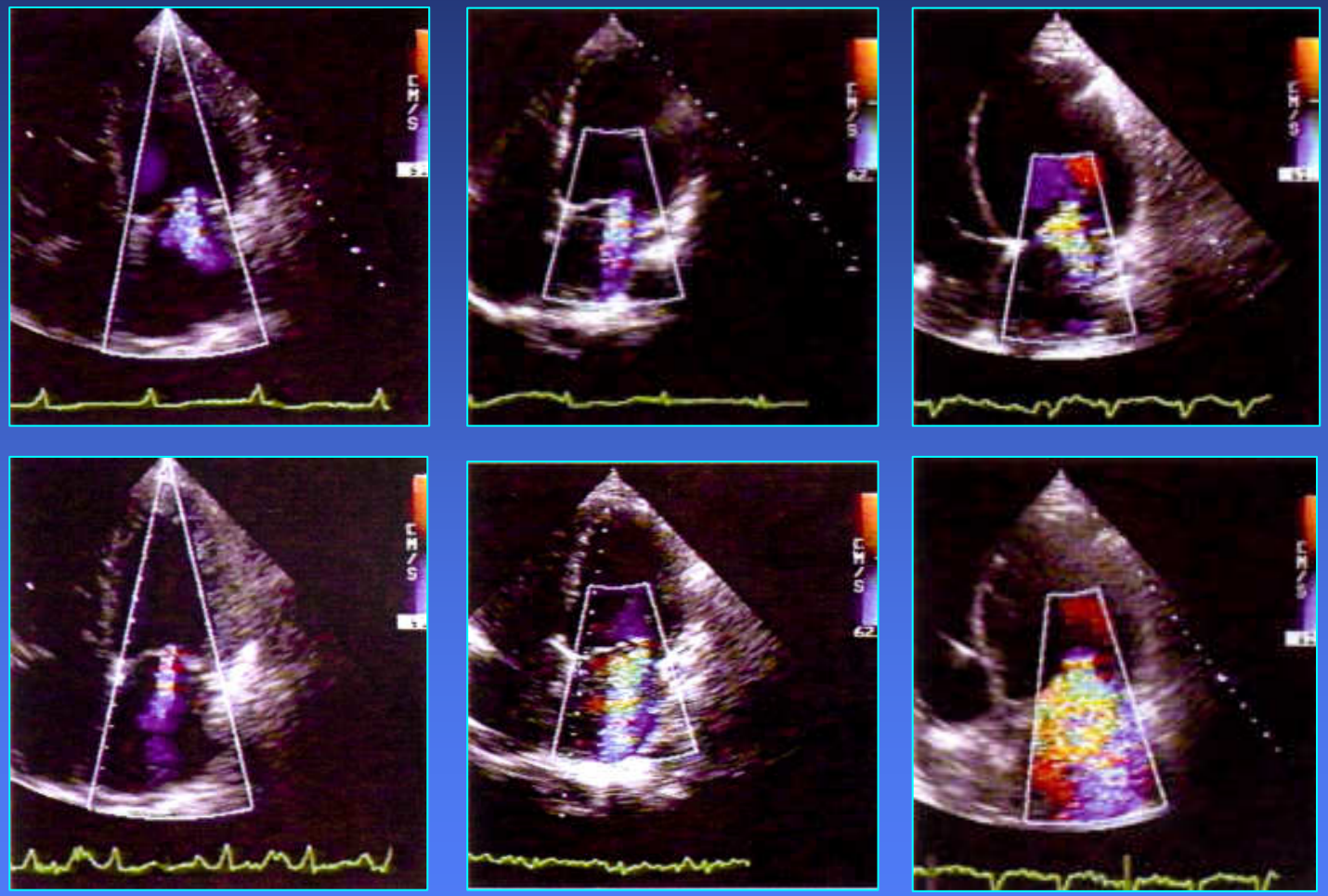


Ischemic Mitral Regurgitation

Exercise-induced changes in MR severity in dilated cardiomyopathy

rest

exercise

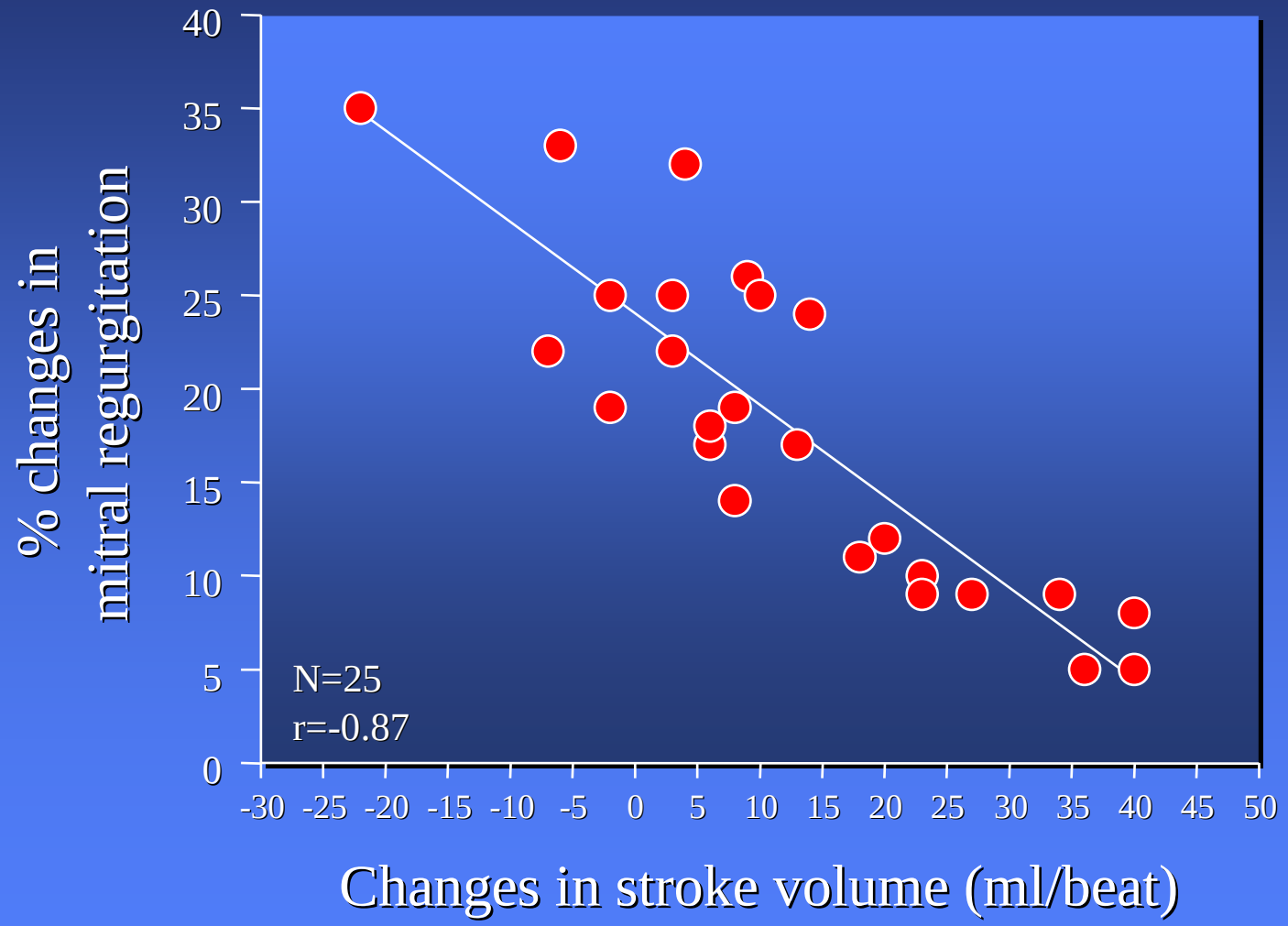


Pt #1 Pt #2 Pt #3

Lapu-Bula et al., ***Circulation*** 2002;106:1342

Ischemic Mitral Regurgitation

Exercise-induced changes in MR severity in dilated cardiomyopathy



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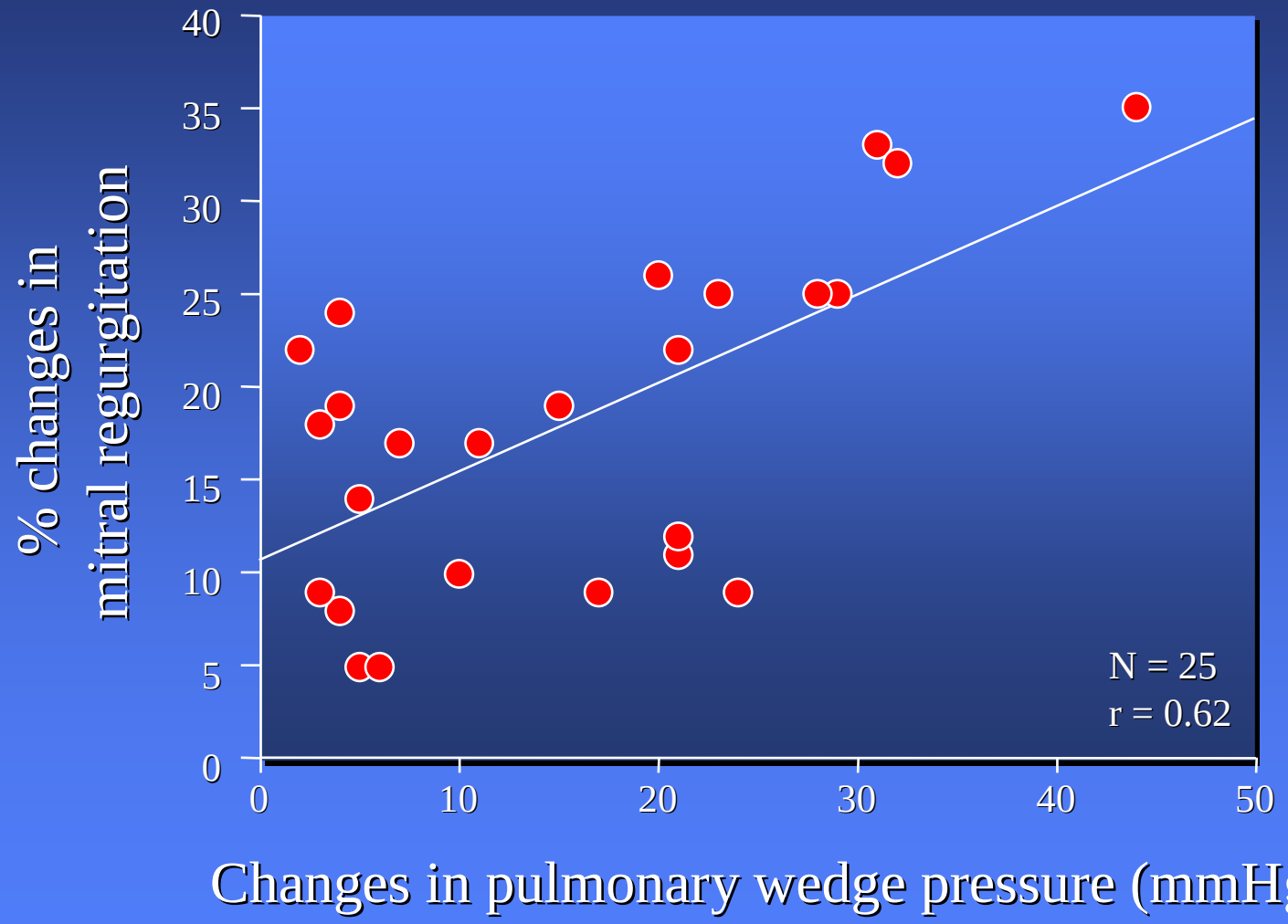
Ischemic Mitral Regurgitation

Impact of exercise-induced mitral regurgitation on exercise tolerance



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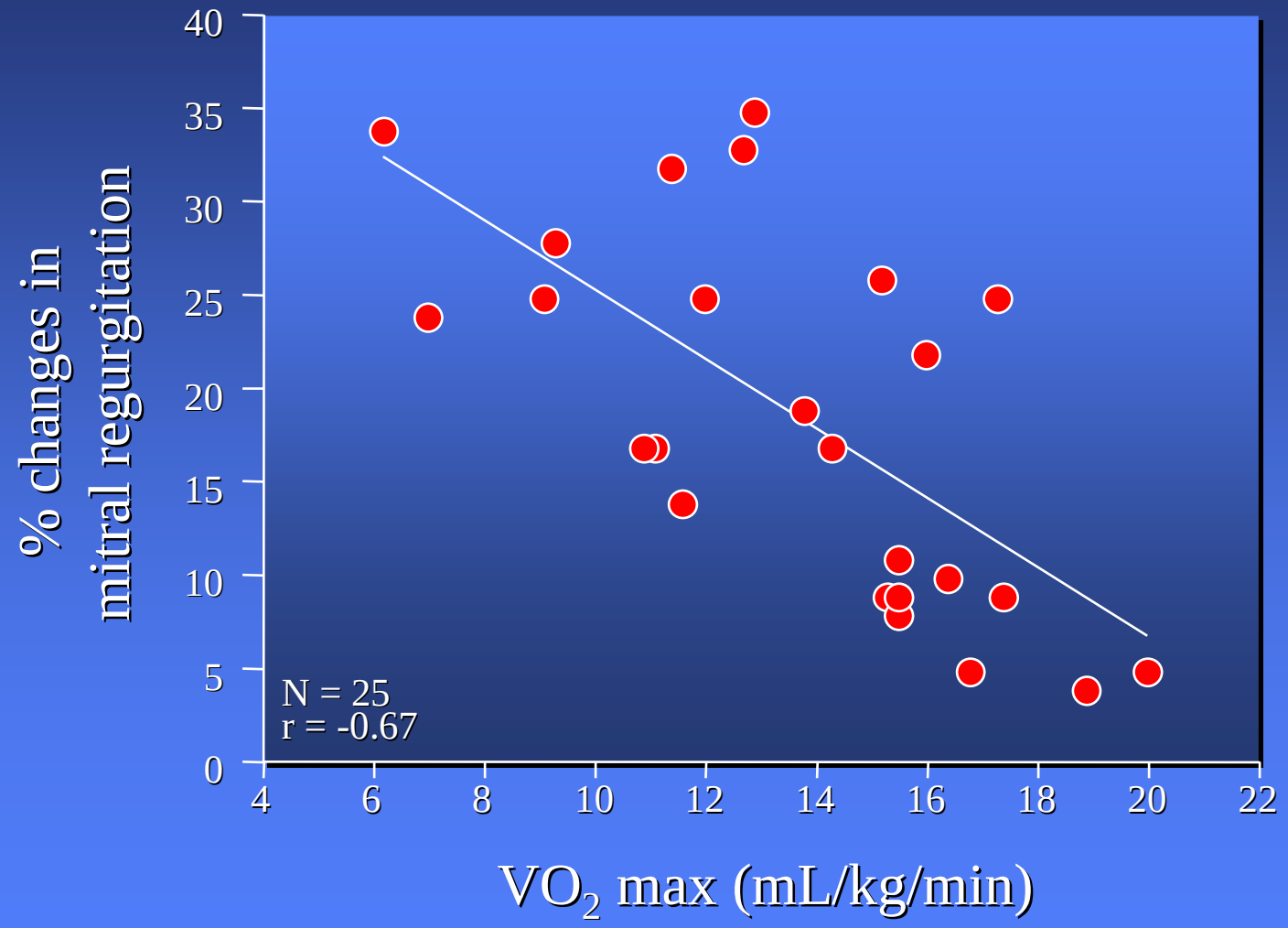

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Ischemic Mitral Regurgitation

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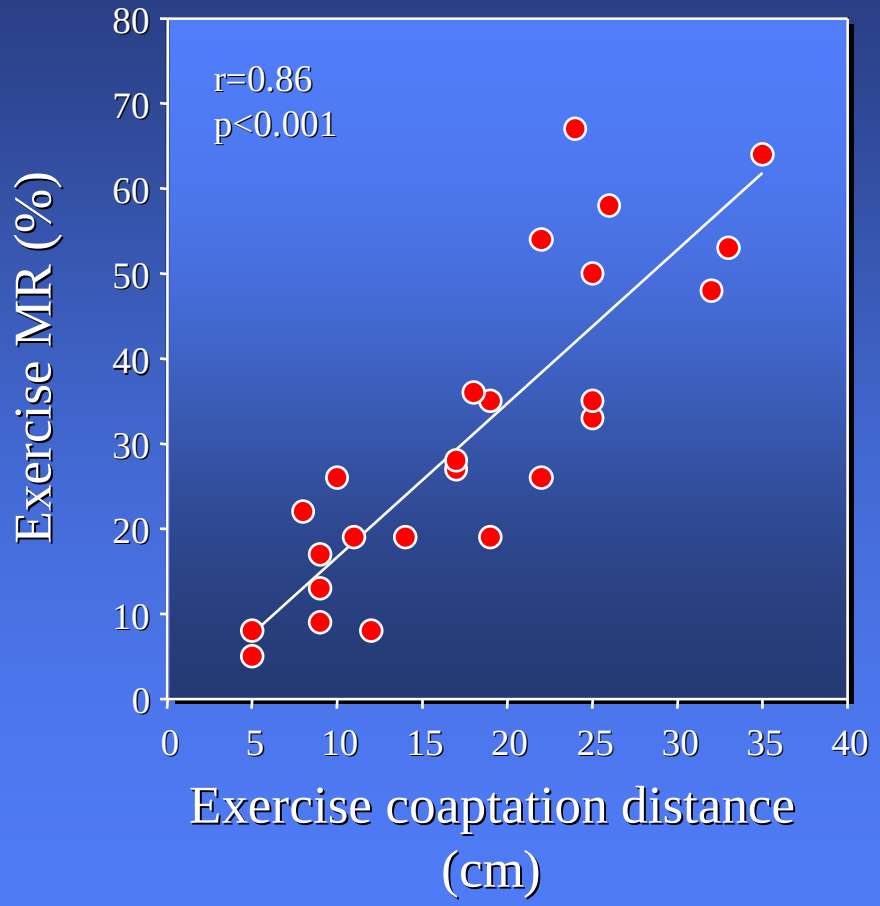

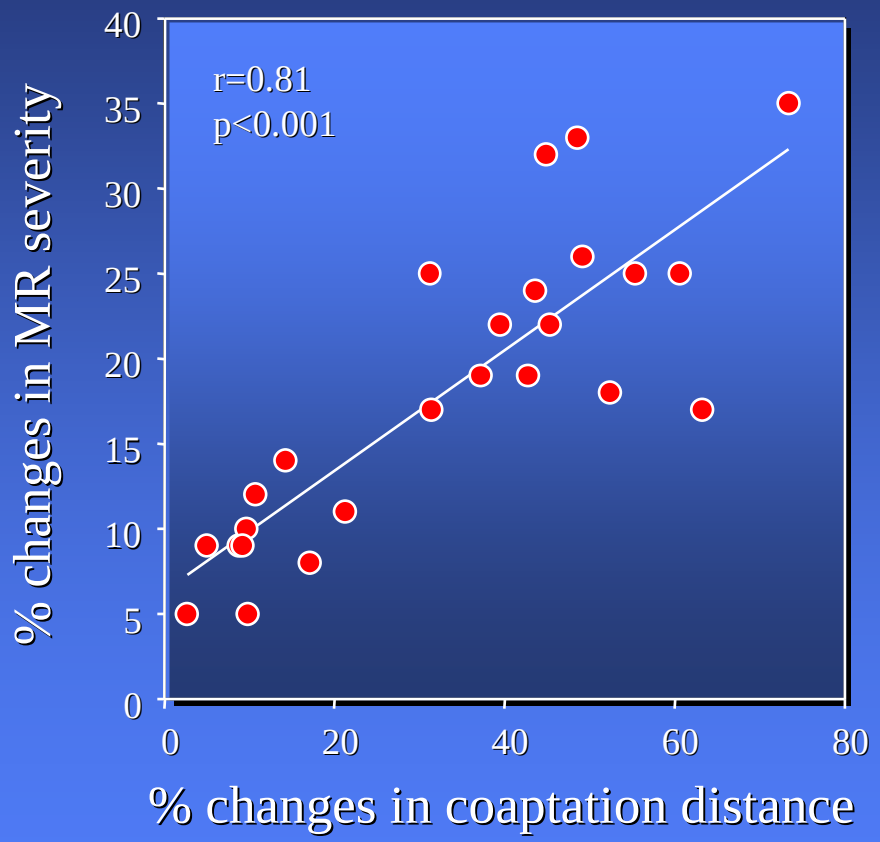

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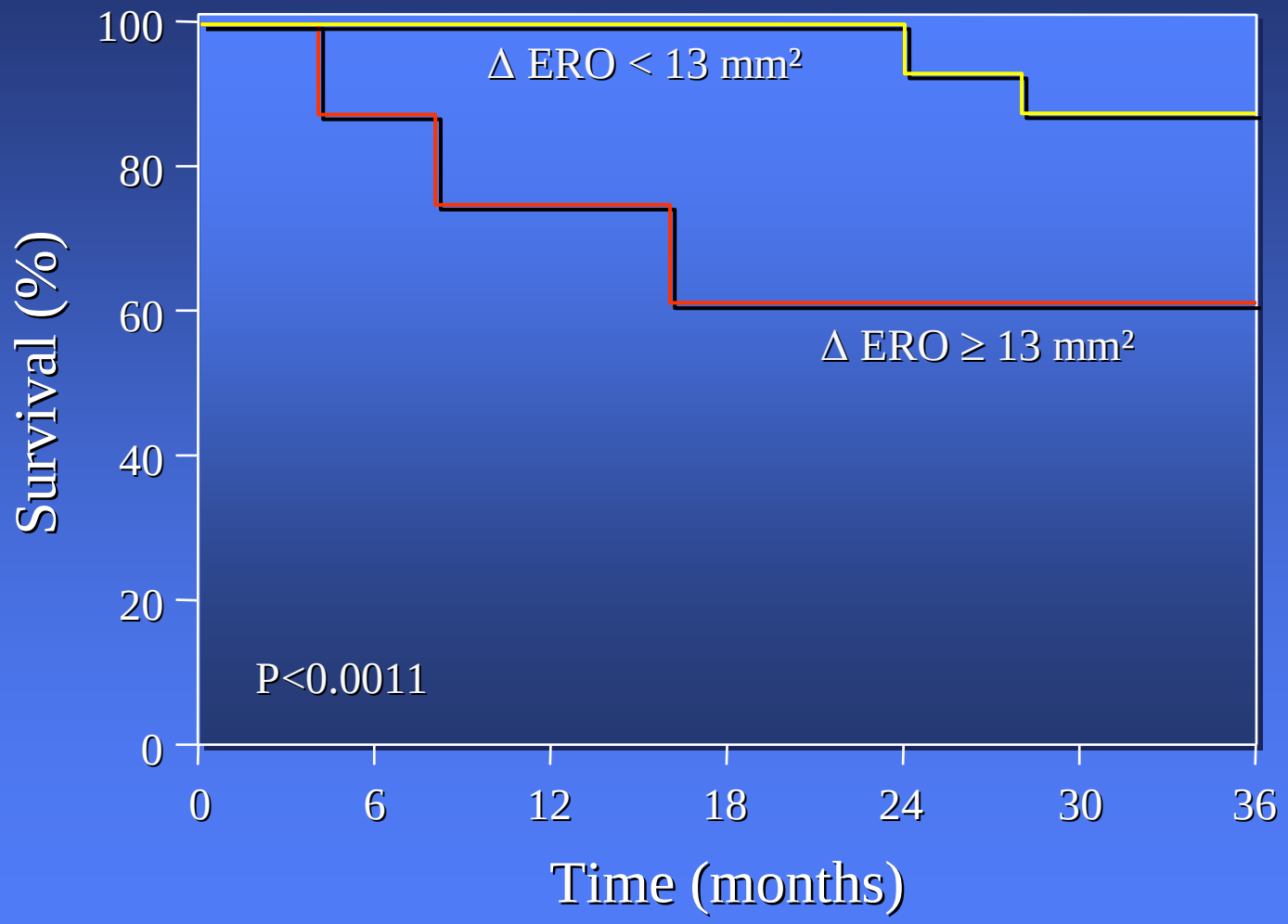
Prognostic value of MR in ischemic heart disease



Lancellotti et al., ***Circulation*** 2003;108:1713.

Ischemic Mitral Regurgitation

Treatment of ischemic mitral regurgitation

- Restore leaflet and scallop coaptation
  - Improve closing forces
  - Reduce annular size
  - Decrease tethering forces

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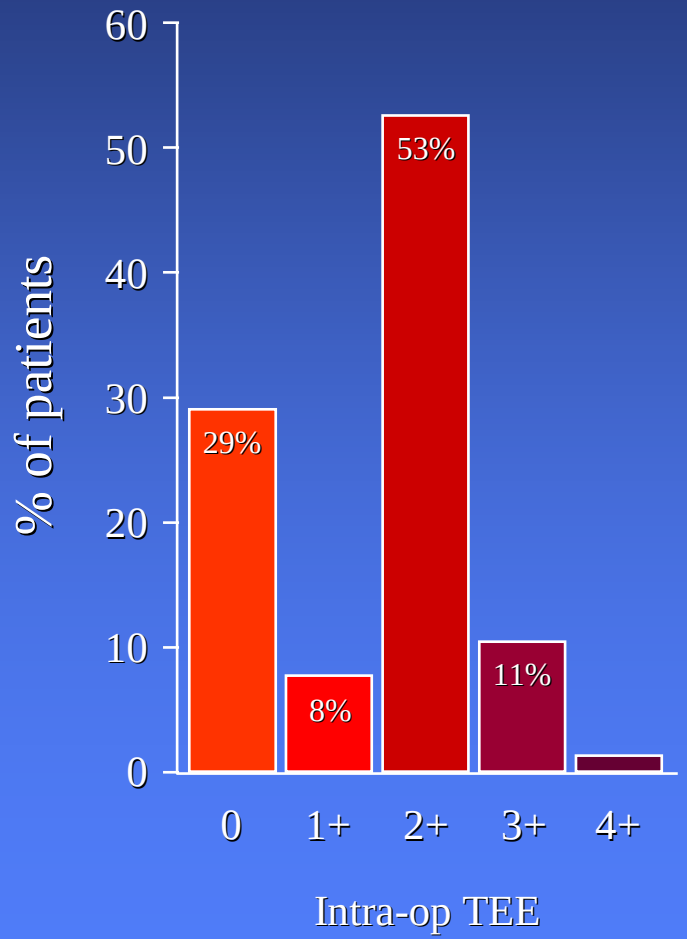
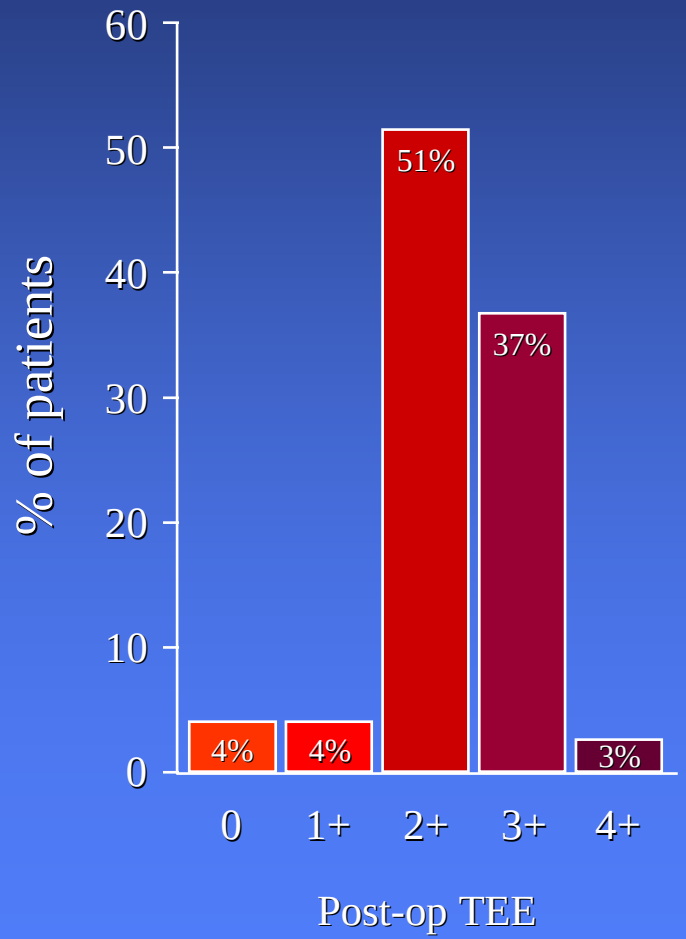
Ischemic Mitral Regurgitation

Treatment of ischemic MR: Role of CABG





Aklog et al., ***Circulation*** 2001;104:I68

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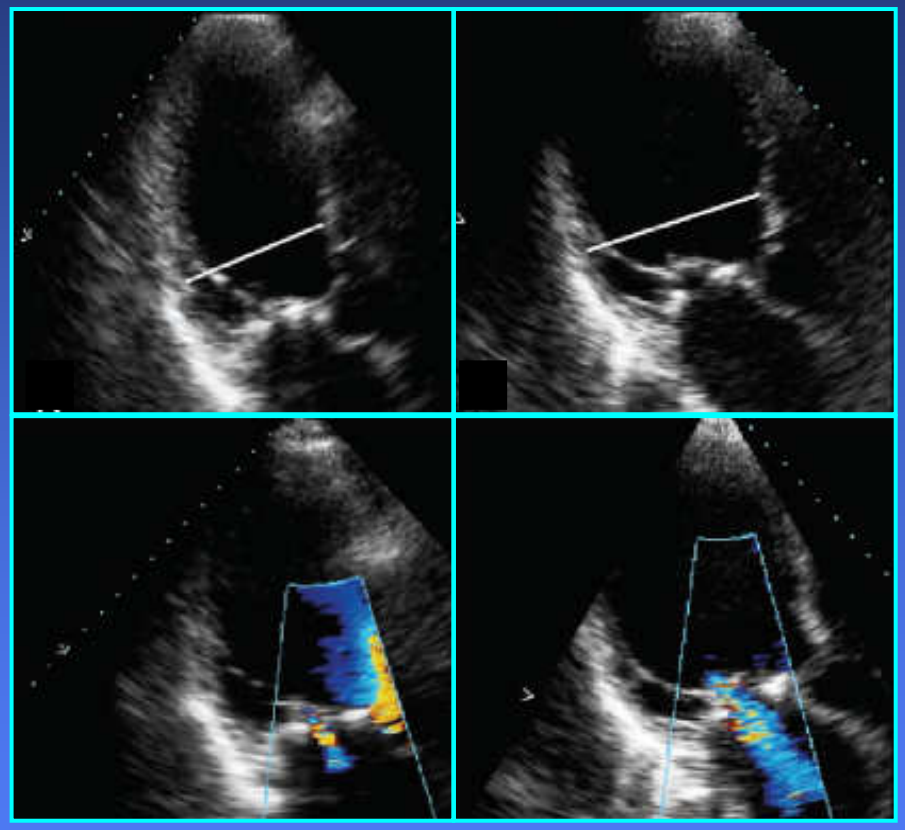
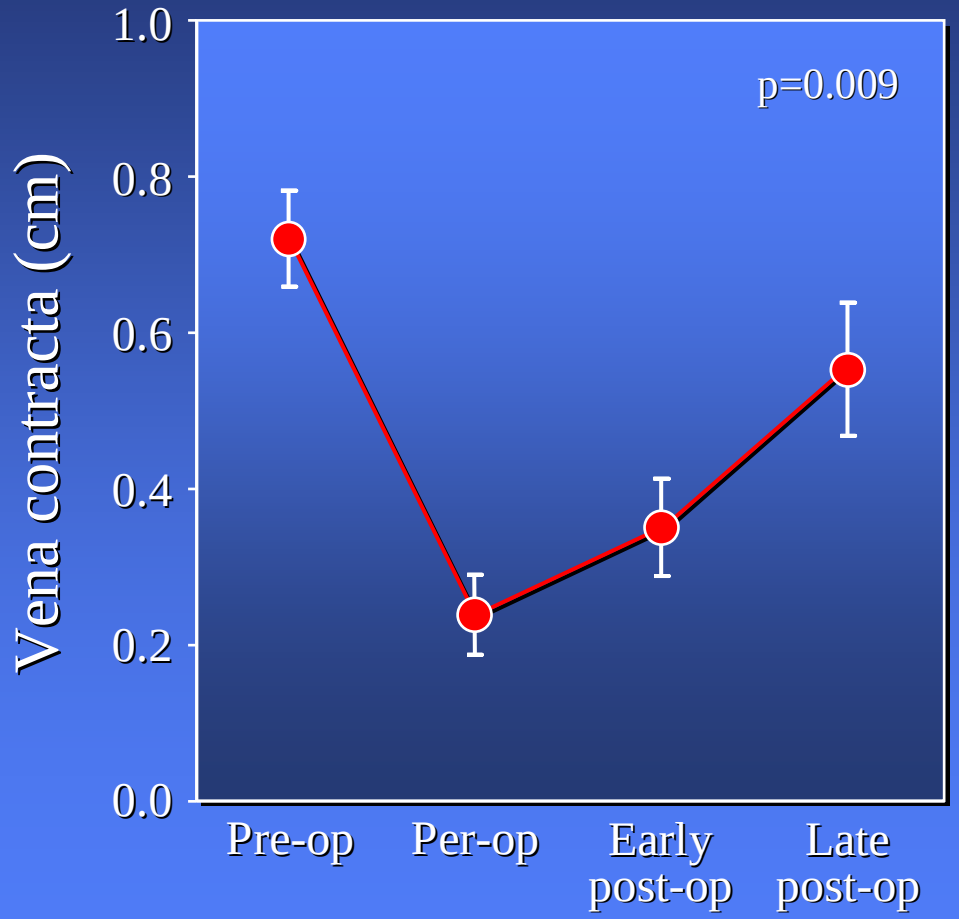
Ischemic Mitral Regurgitation

Restrictive annuloplasty does not prevent recurrence of ischemic MR



Early post-op
LVESD = 58 mm

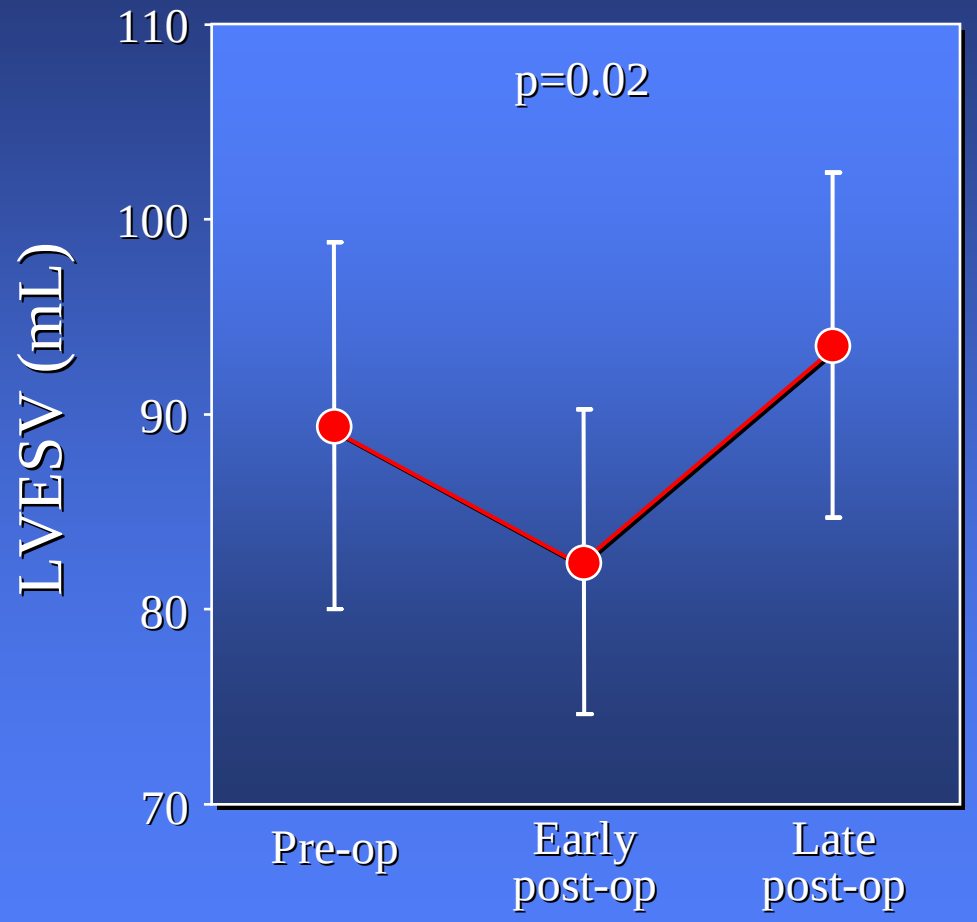
Late post-op
LVESD = 73 mm

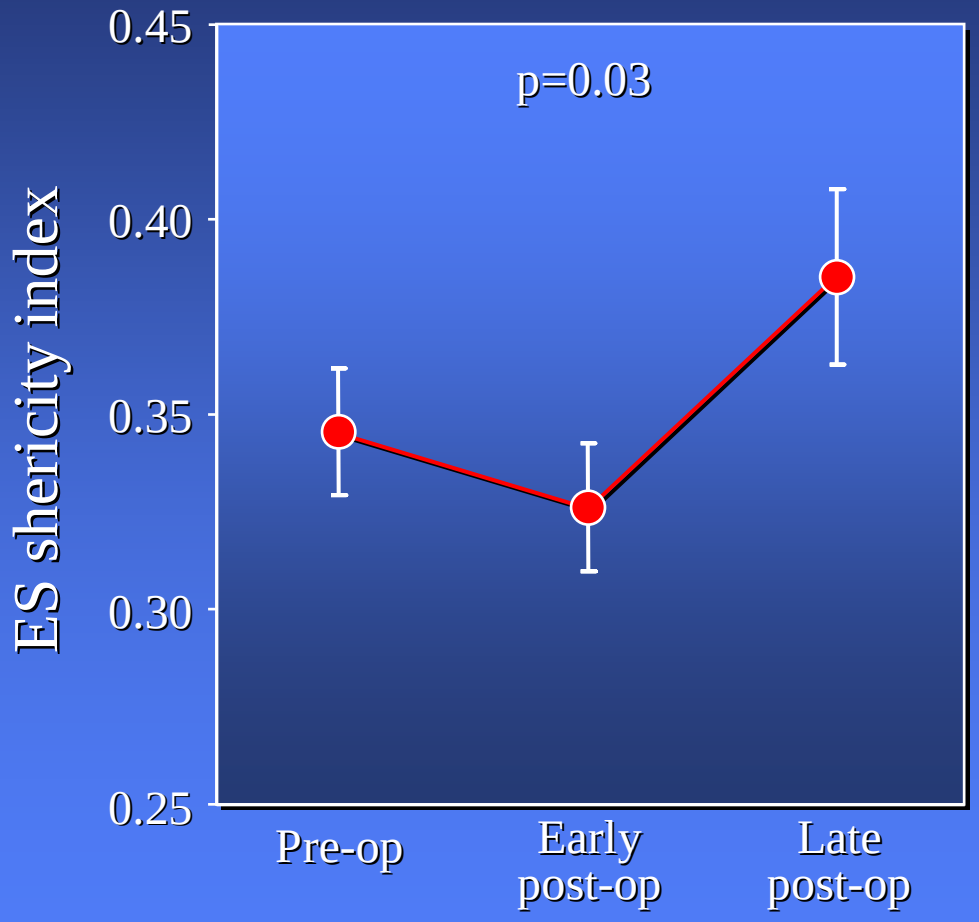


Hung et al., ***Circulation*** 2004;110:II-85

Ischemic Mitral Regurgitation

Restrictive annuloplasty does not prevent LV remodeling





Guy et al., ***J Am Coll Cardiol*** 2004;43:377

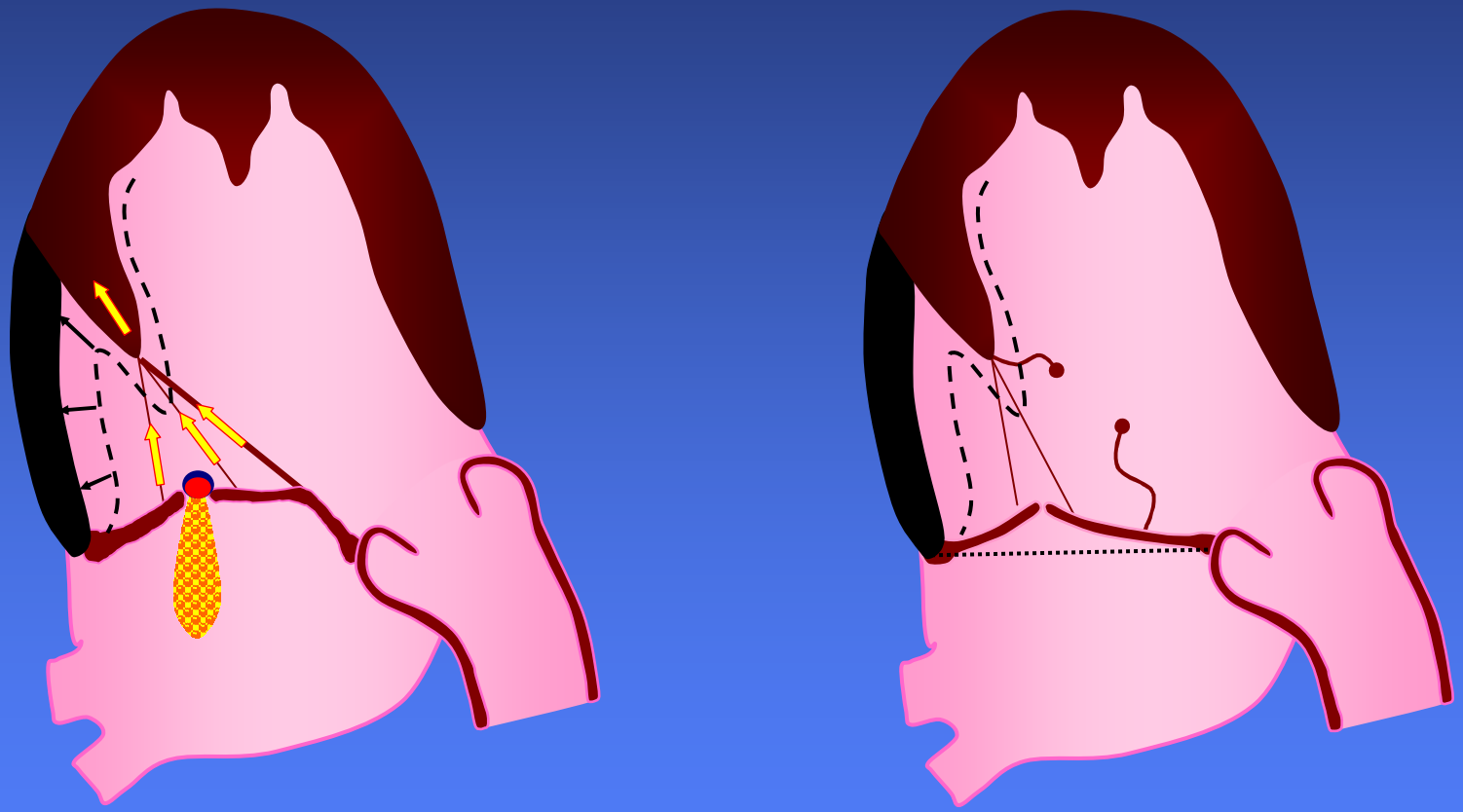
Ischemic Mitral Regurgitation

Treatment of ischemic mitral regurgitation

- Restore leaflet and scallop coaptation
  - Improve closing forces
  - Reduce annular size
  - Decrease tethering forces

Ischemic Mitral Regurgitation

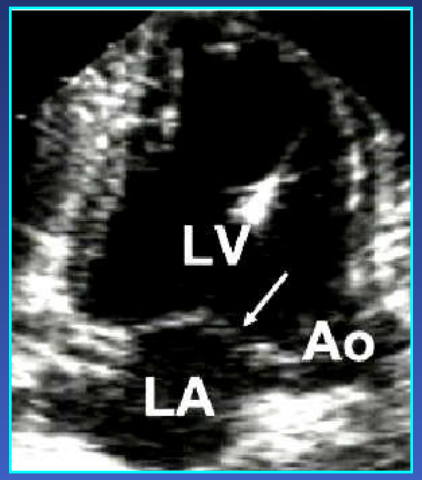
Treatment of ischemic MR: Secondary chordae cutting

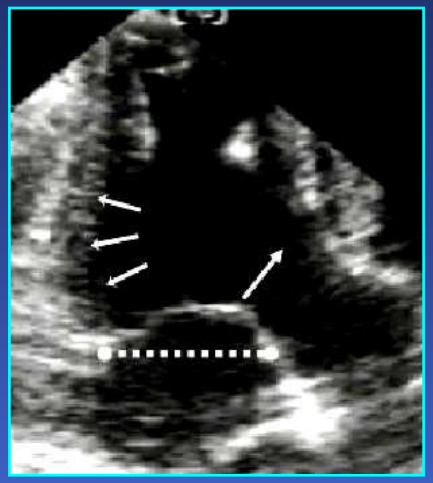


Messas et al., ***Circulation*** 2001;104:1958

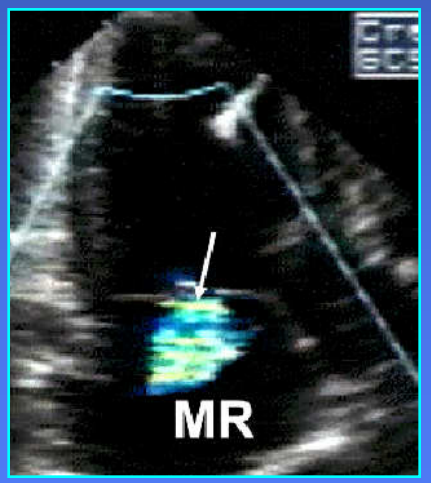
Ischemic Mitral Regurgitation

Treatment of ischemic MR: Secondary chordae cutting





baseline



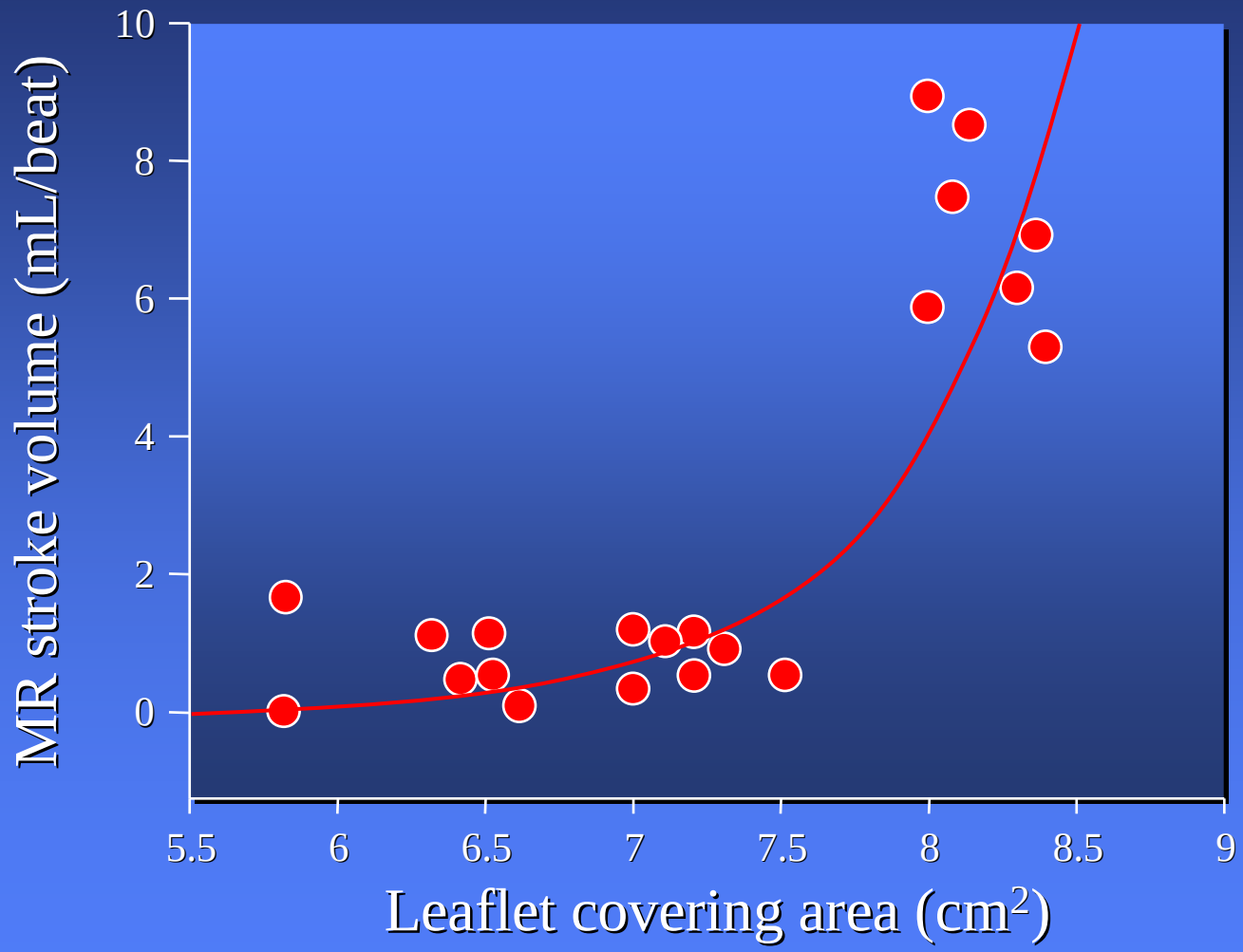
inferior ischemia

inferior + PM
chordae cutting

Messas et al., ***Circulation*** 2001;104:1958

Ischemic Mitral Regurgitation

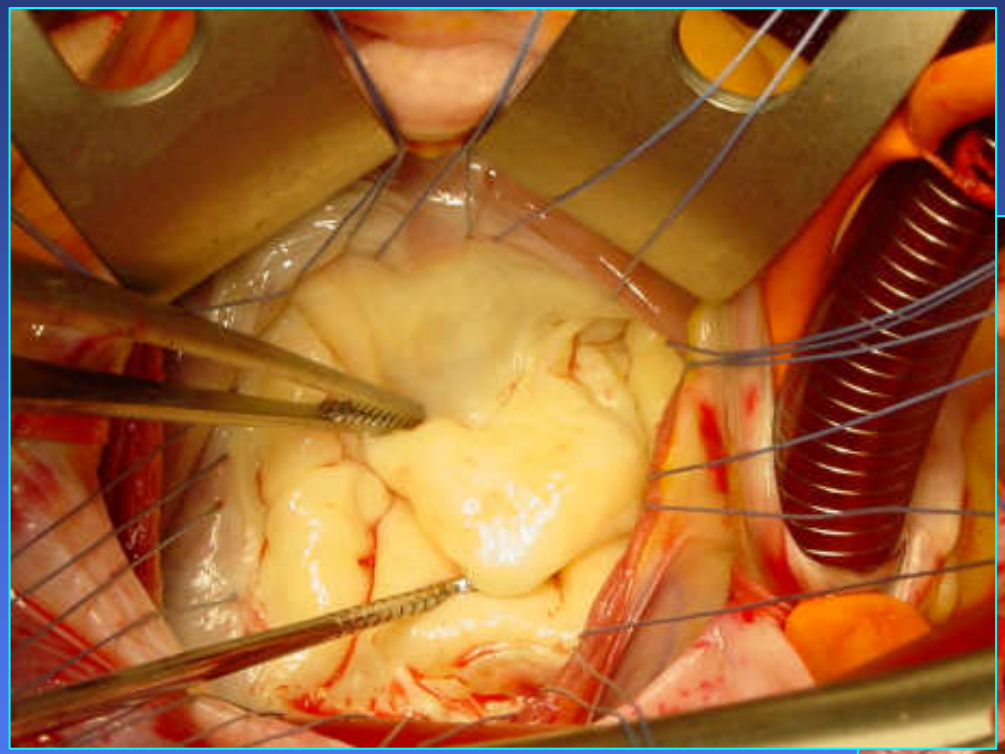
Treatment of ischemic MR: Secondary chordae cutting

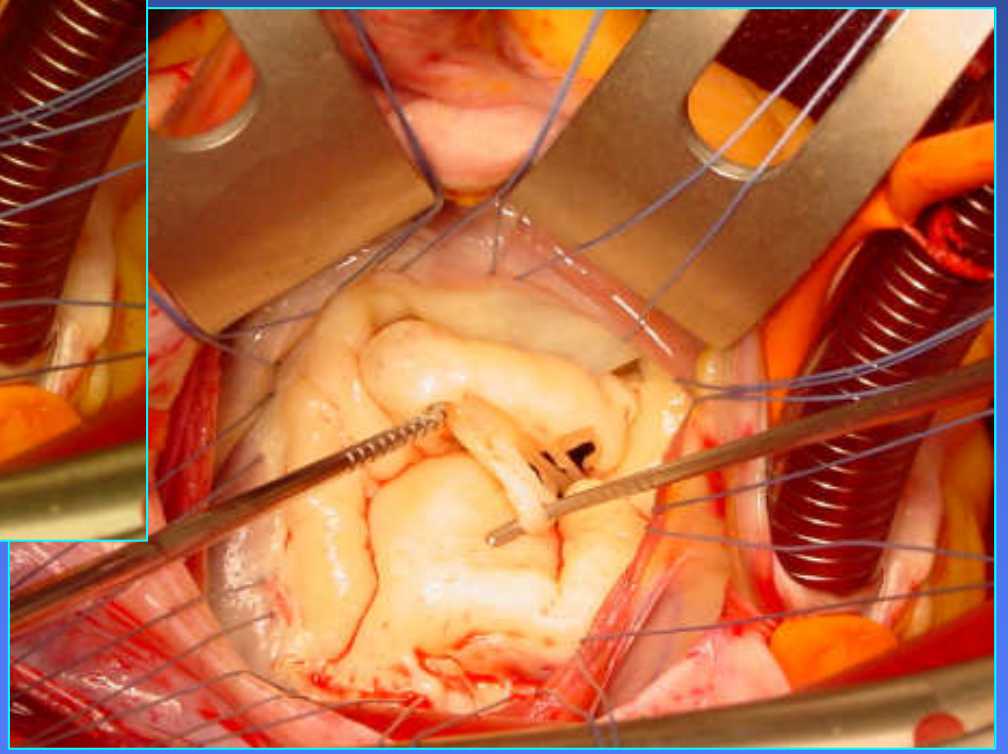


Messas et al., ***Circulation*** 2001;104:1958

Ischemic Mitral Regurgitation

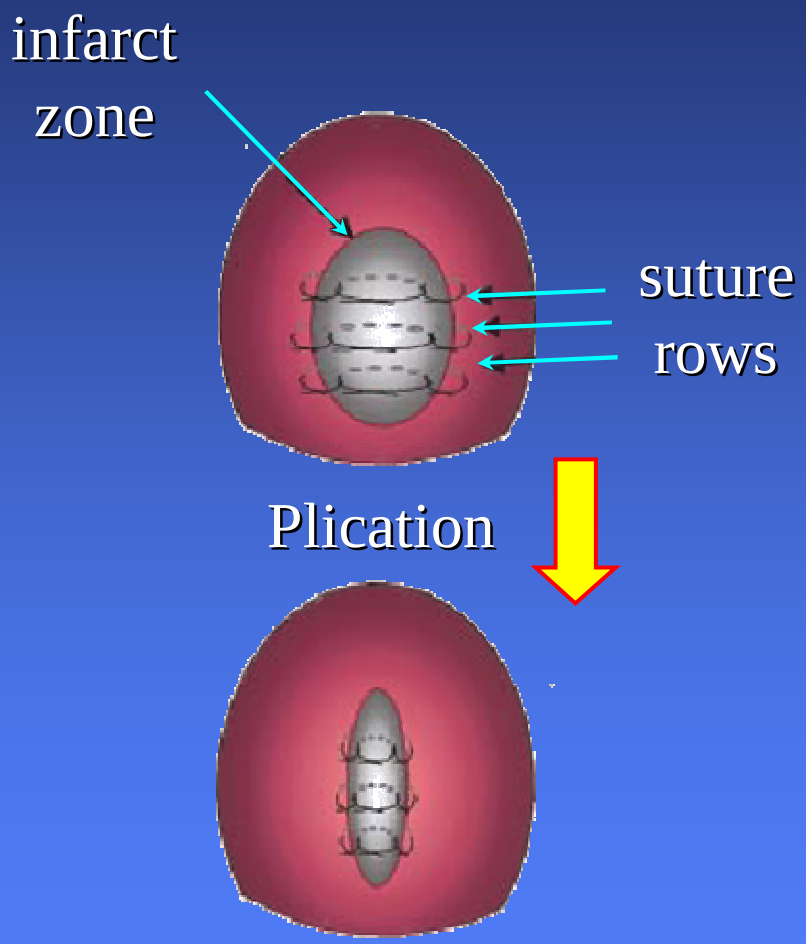
Anterior leaflet restriction: secondary chords excision

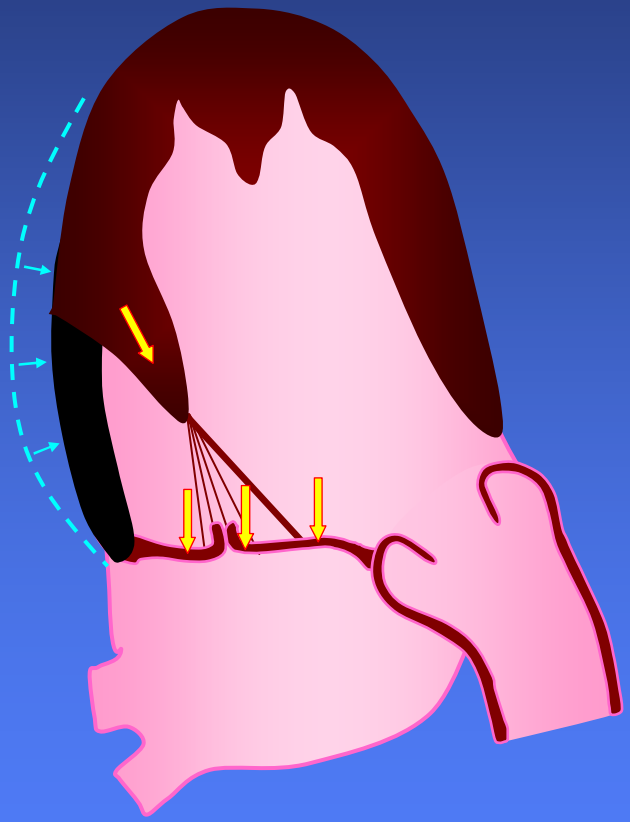




Ischemic Mitral Regurgitation

Treatment of ischemic MR: Infarct plication

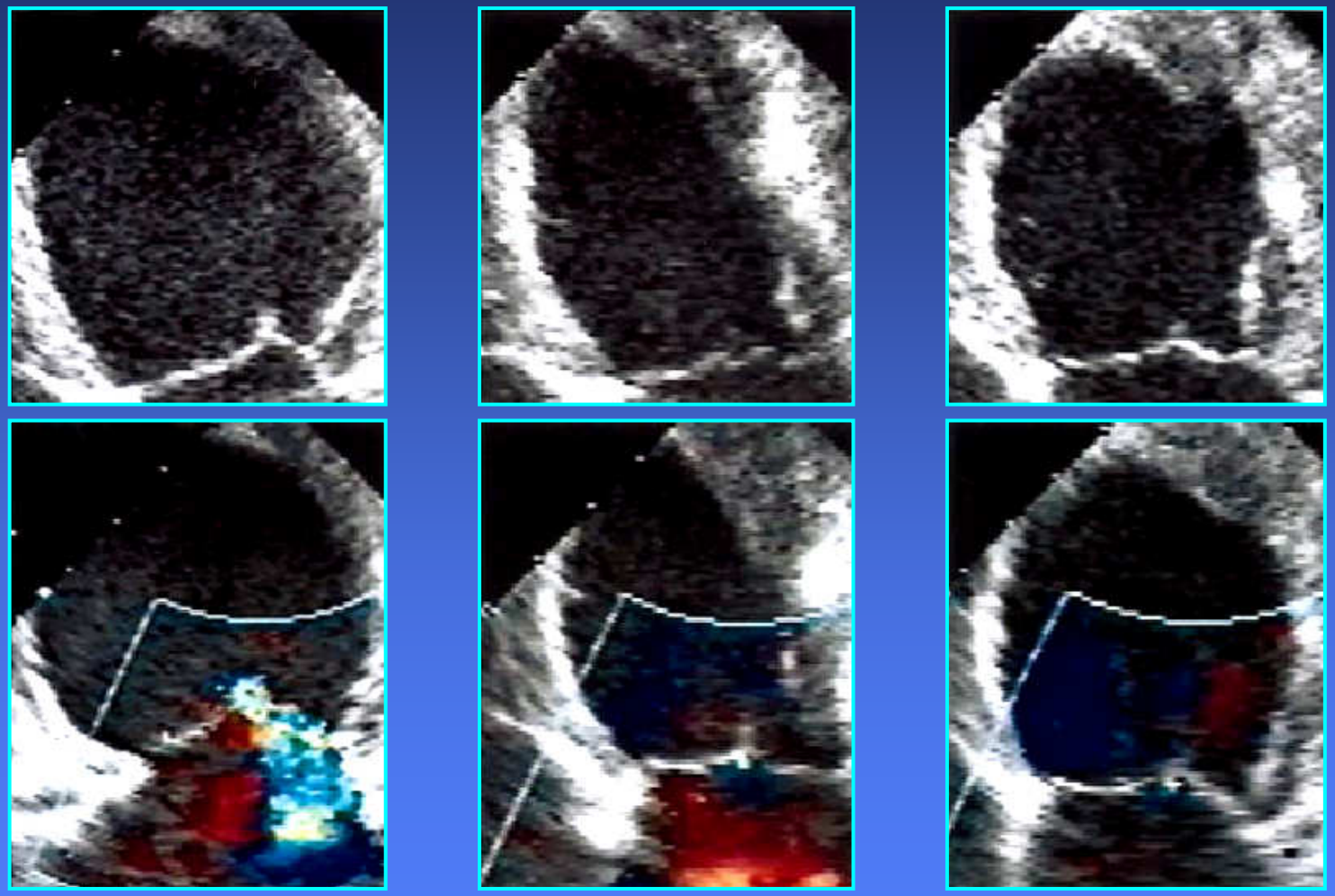




Lien-Cohen et al., ***Circulation*** 2000;101:2756

Ischemic Mitral Regurgitation

Treatment of ischemic MR: Infarct plication

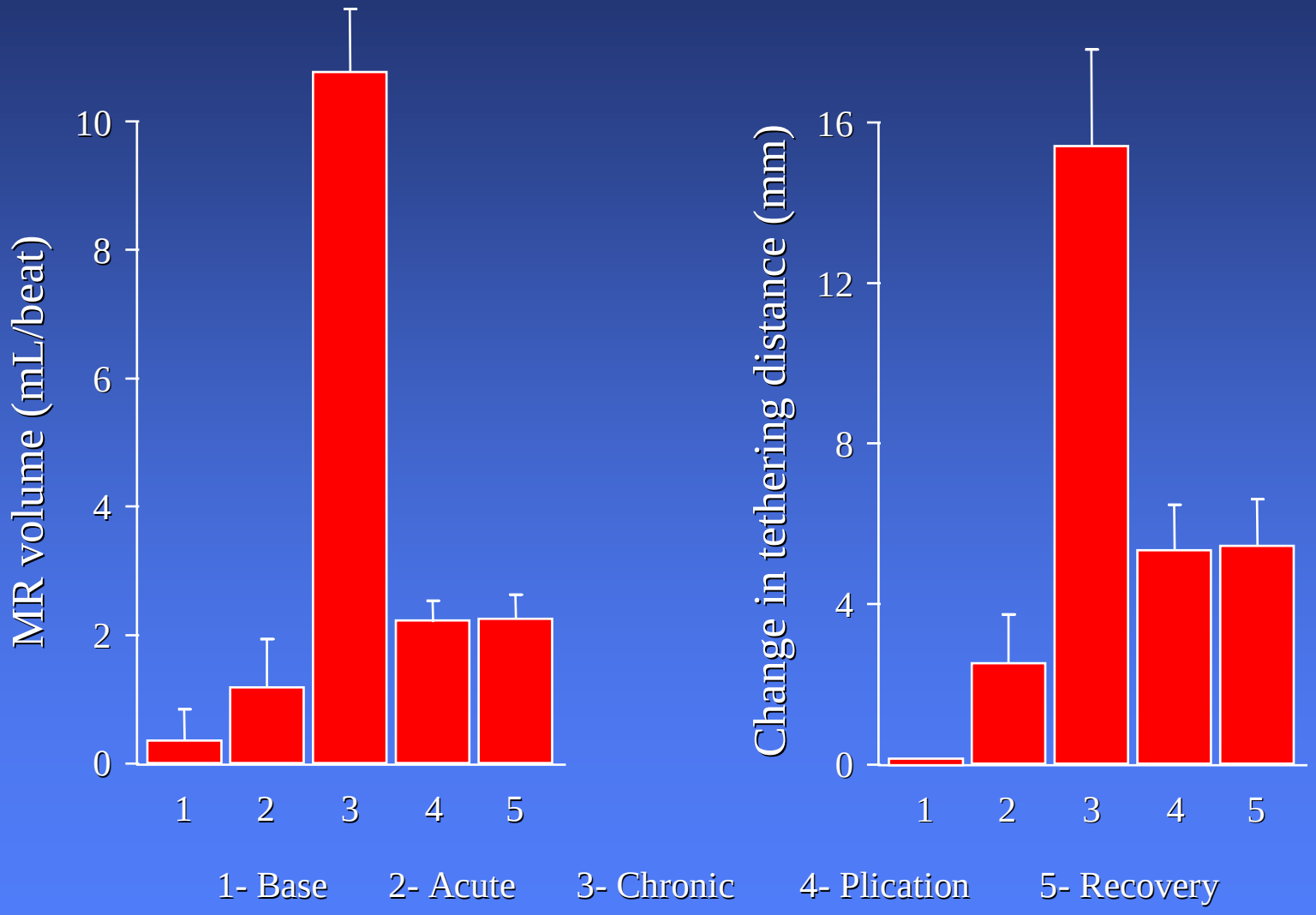


Chronic MI | Acute plication | Chronic plication

Lien-Cohen et al., ***Circulation*** 2000;101:2756

Ischemic Mitral Regurgitation

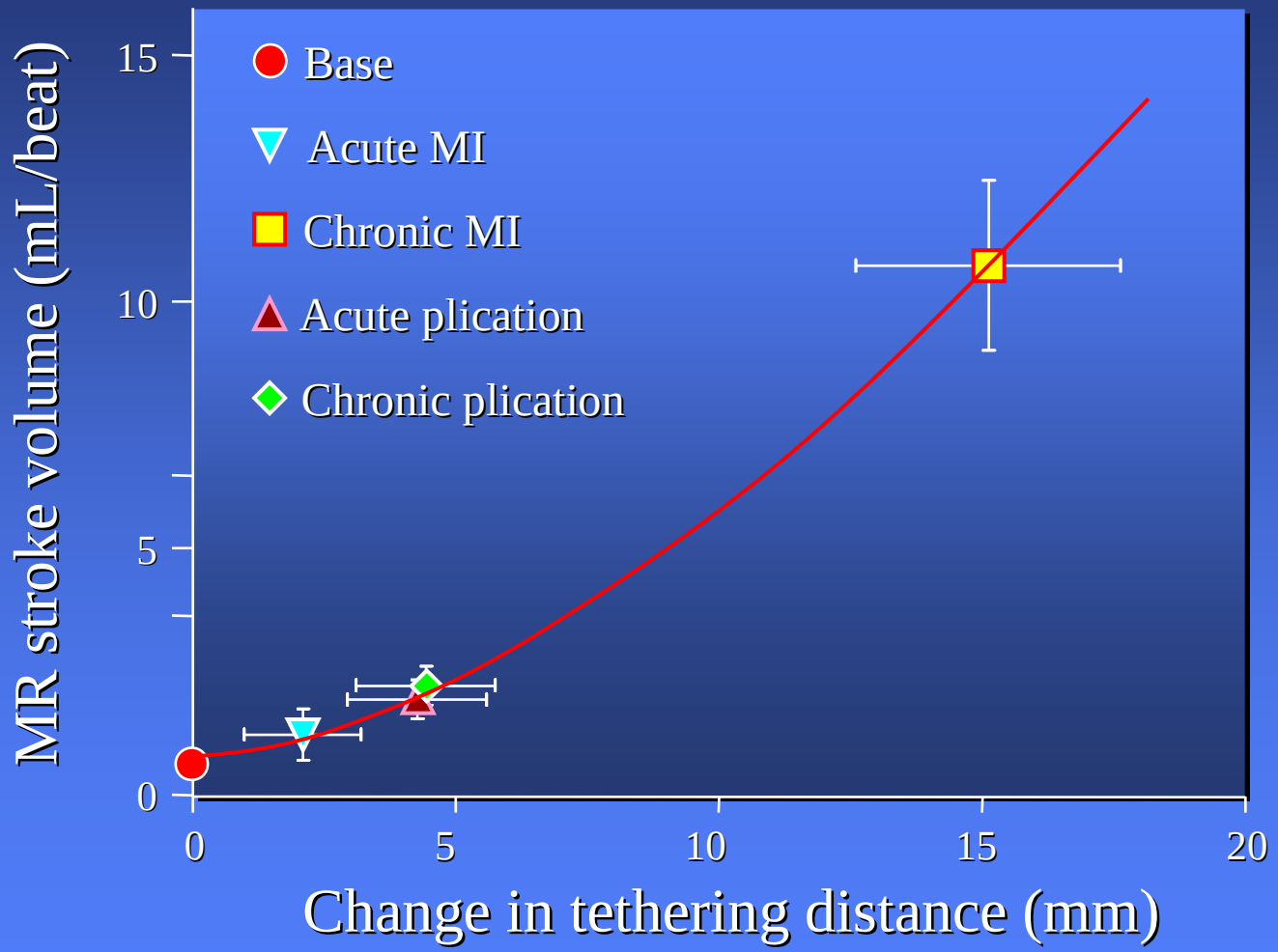
Treatment of ischemic MR: Infarct plication



Lien-Cohen et al., ***Circulation*** 2000;101:2756

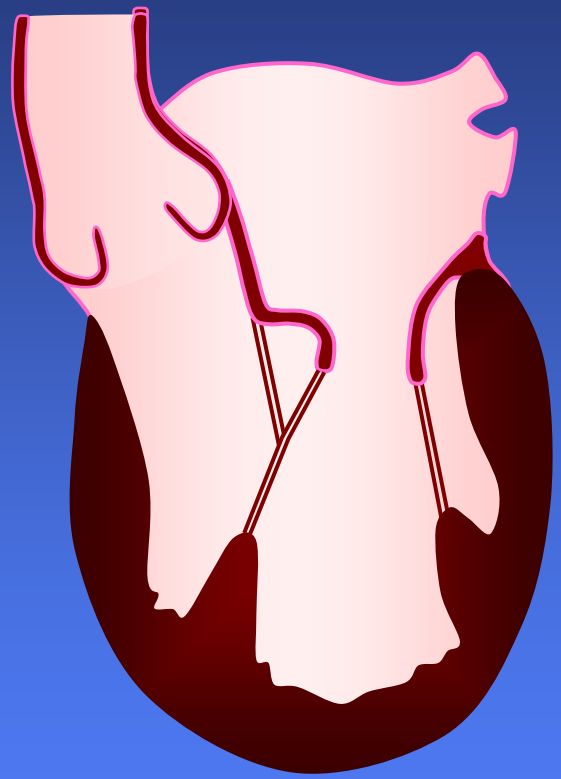
Ischemic Mitral Regurgitation

Treatment of ischemic MR: Infarct plication



Lien-Cohen et al., ***Circulation*** 2000;101:2756

Ischemic Mitral Regurgitation
Mechanims of iMR



Type I - IIIb
Incomplete mitral leaflet closure

- Normal leaflets
- ***Decreased closing forces*** due to global (and regional) LV dysfunction
- ***Annular dilatation***
- ***Increased tethering forces***:
  - apical displacement of PM
  - increased tethering distance and tenting area
  - systolic restriction of the posterior ± anterior leaflets
  - bending of mid anterior leaflet (seagull sign)