

EuroValve

March 10-11, 2016

Improving risk stratification in asymptomatic
mitral regurgitation

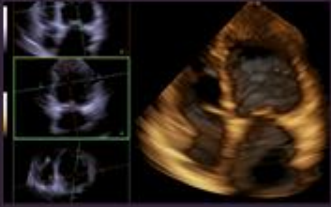
Myocardial fibrosis by MRI

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www.eurovalvecongress.com



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Faculty disclosure

I disclose the following financial relationships:

Paid speaker for Abbott Vascular

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Indications for surgery in asymptomatic severe primary MR

	Class	Level
Surgery is indicated in asymptomatic patients with LV dysfunction (LVESD \geq 45 mm and/or LVEF \leq 60%).	I	C
Surgery should be considered in asymptomatic patients with preserved LV function and new onset of atrial fibrillation or pulmonary hypertension (systolic pulmonary pressure at rest $>$ 50 mmHg).	IIa	C
Surgery should be considered in asymptomatic patients with preserved LV function, high likelihood of durable repair, low surgical risk and flail leaflet and LVESD \geq 40 mm.	IIa	C
Surgery may be considered in asymptomatic patients with preserved LV function, high likelihood of durable repair, low surgical risk, and: <ul style="list-style-type: none"> • left atrial dilatation (volume index \geq 60 ml/m² BSA) and sinus rhythm, or • pulmonary hypertension on exercise (SPAP \geq 60 mmHg at exercise). 	IIb	C



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- **Why and when to assess myocardial fibrosis?**

- ☞ To prevent deterioration of LV systolic function

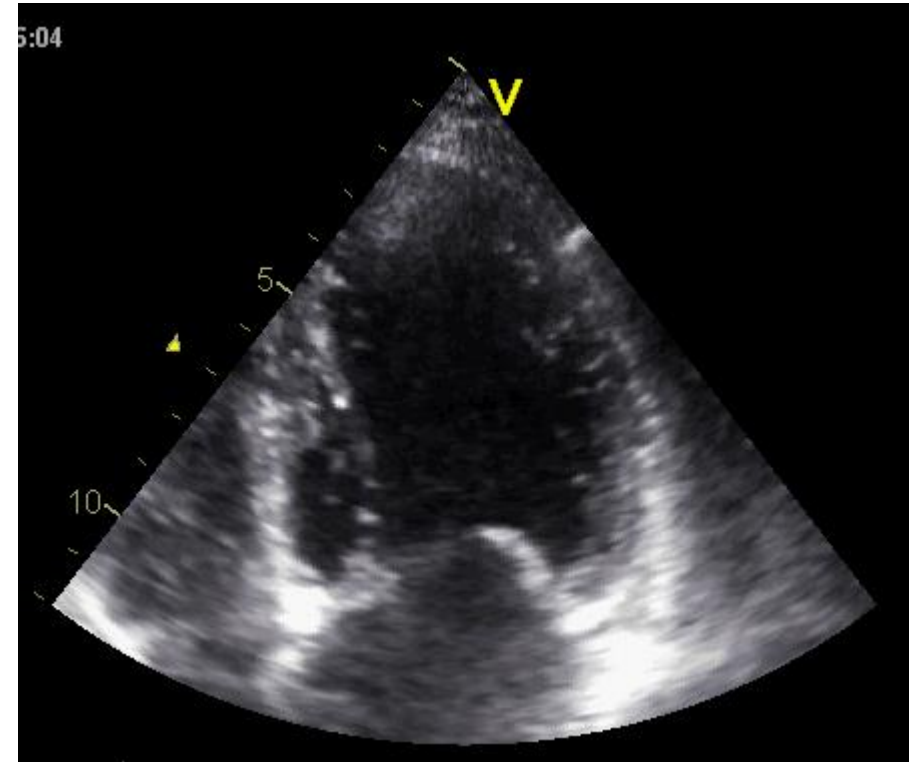
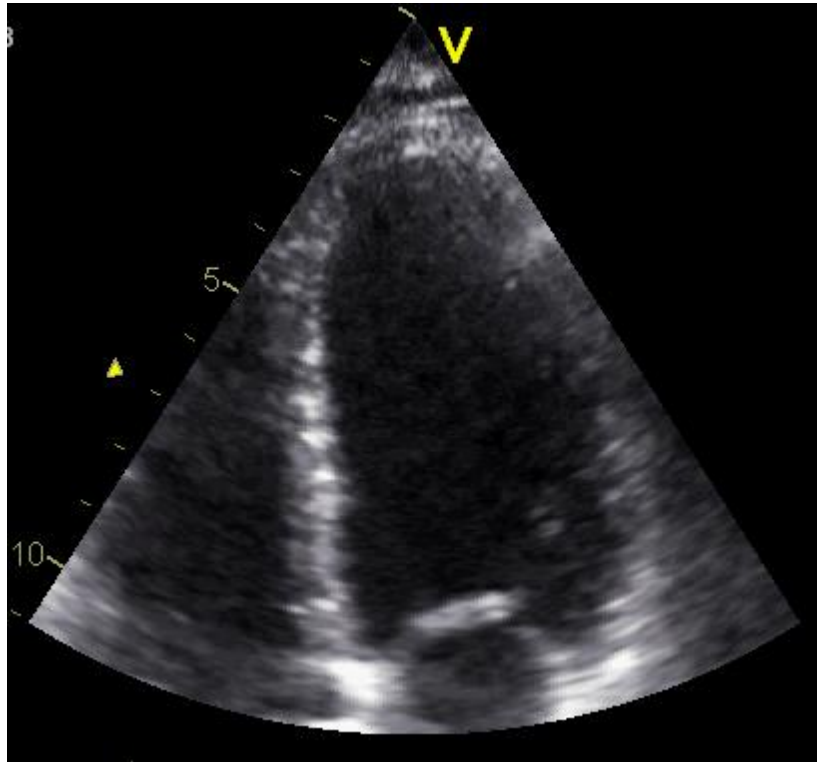
- ☞ Before LV systolic function deteriorates

- ☞ How to assess LV systolic function?

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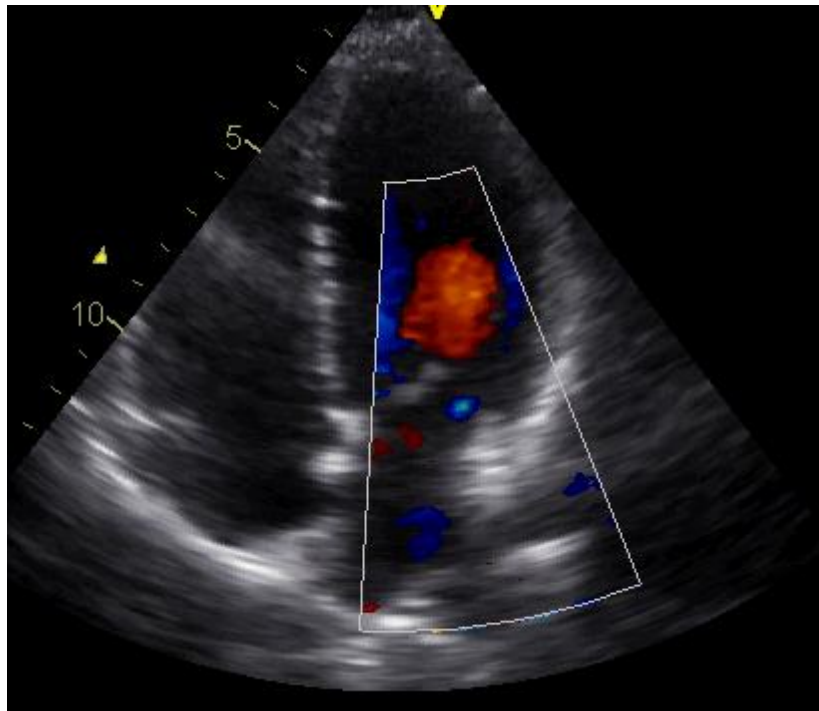


LVEF 62%
LVESD 39 mm

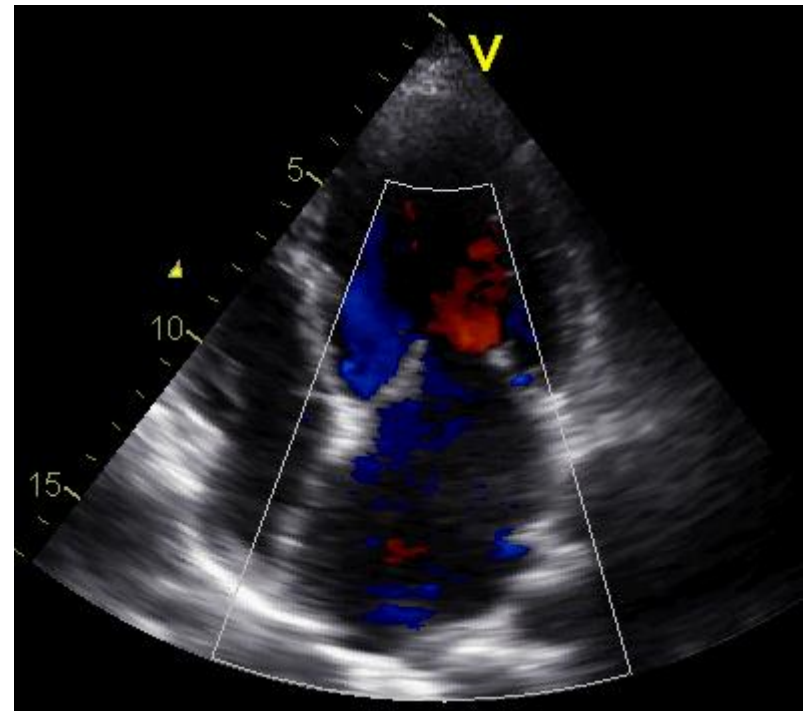
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Forward stroke volume 70 ml



Forward stroke volume 70 ml

Regurgitant volume 70 ml

Total volume 140 ml

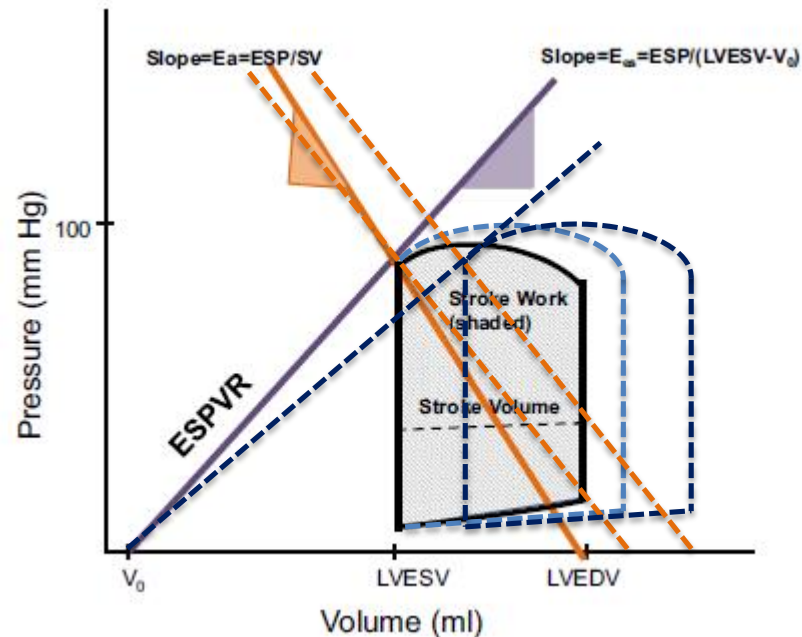
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N = 63 MV prolapse

Peak Stress Pulmonary
Artery Pressure

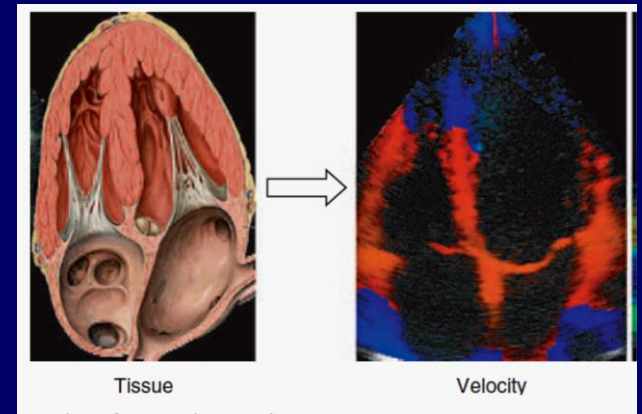
Variable	Normal (n = 42)	Elevated (n = 21)	p Value
Age (yrs)	54 ± 10	54 ± 12	NS
Heart rate (beats/min)	75 ± 11	79 ± 11	NS
Systolic blood pressure (mm Hg)	124 ± 10	122 ± 8	NS
Diastolic blood pressure (mm Hg)	78 ± 6	82 ± 4	NS
Baseline LV ejection fraction (%)	68 ± 5	66 ± 6	NS
Peak LV ejection fraction (%)	70 ± 8	68 ± 8	NS
LV ejection fraction % slope (x 10 ⁻²)	4 ± 18	3 ± 26	NS
End-diastolic volume (ml)	124 ± 40	124 ± 38	NS
End-systolic volume (ml)	40 ± 15	43 ± 16	NS
Baseline systolic pulmonary artery pressure (mm Hg)	29 ± 7	36 ± 12	0.02
Peak systolic pulmonary artery pressure (mm Hg)	30 ± 7	51 ± 10	0.001
Baseline systolic blood pressure/end-systolic volume index	6 ± 2	6 ± 2.5	NS
Peak systolic blood pressure/end-systolic volume index	12.5 ± 4.5	8.4 ± 3.1	0.01
FFR index slope (x 10 ⁻²)	13 ± 9	5.1 ± 4.9	0.001
Critical heart rate (beats/min)	126 ± 18	117 ± 28	NS
Recovery contractility overshoot (%)	11%	41%	0.007



- LV end-systolic elastance = slope of the end-systolic pressure volume relationship
- Arterial elastance
- Arterial elastance / LV end-systolic elastance → cardiac efficiency

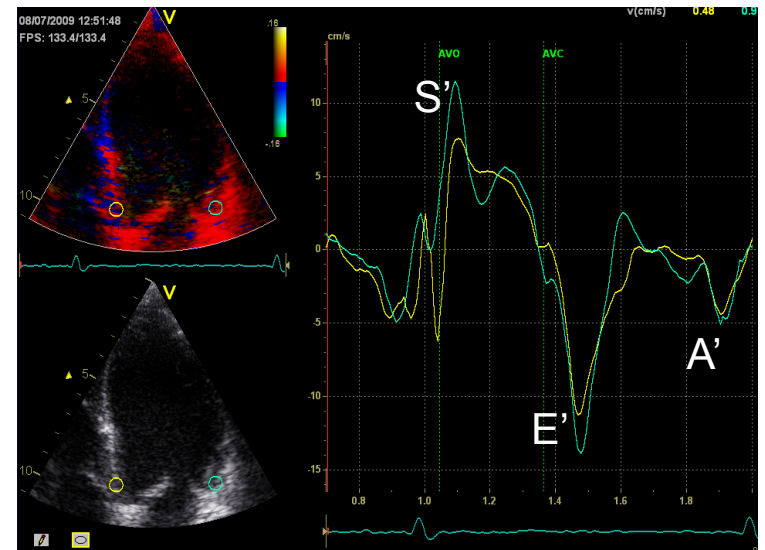
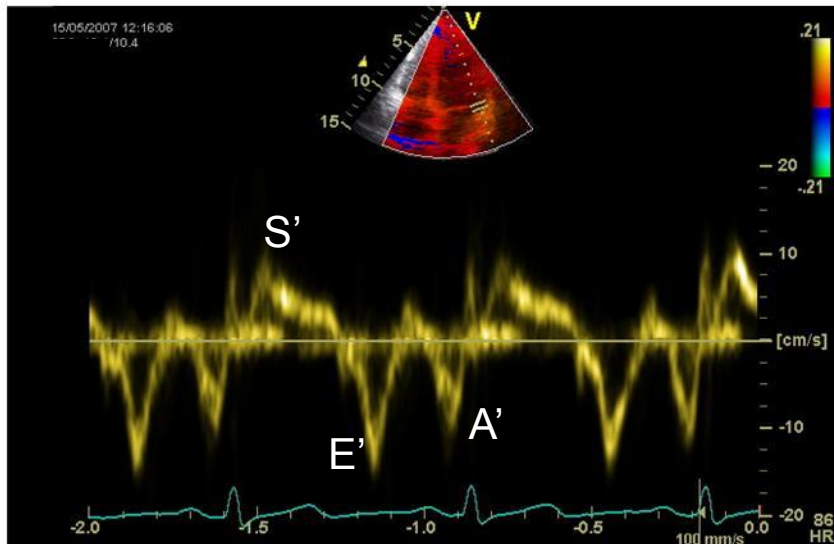
Tissue Doppler Imaging

- Motion of the myocardial tissue
- Myocardial velocity



Pulsed-wave TDI

Color-coded TDI

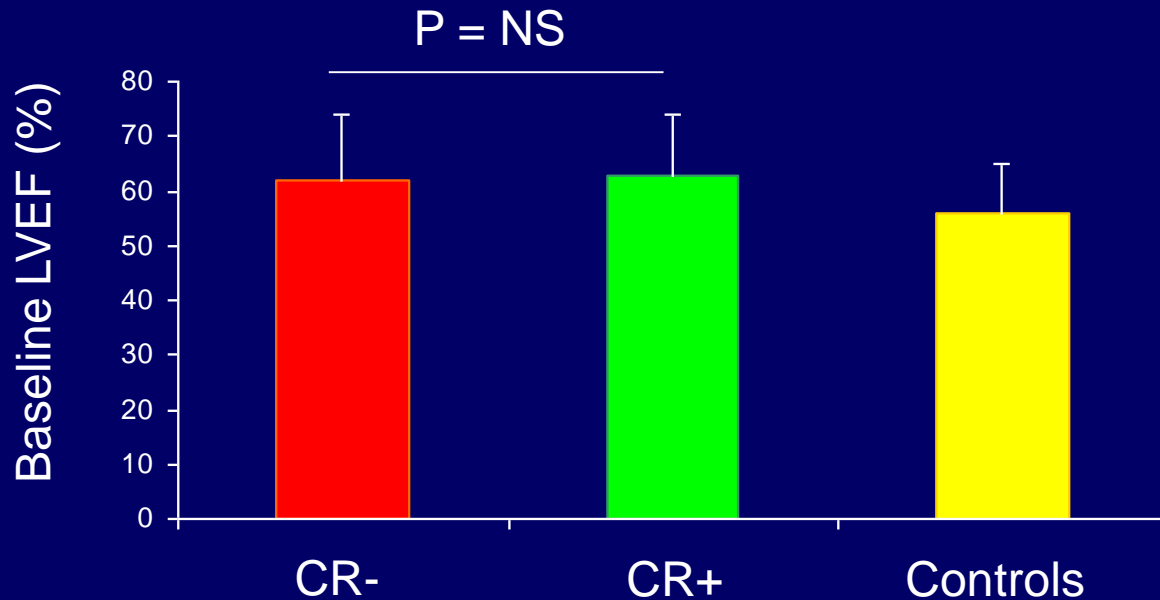


Tissue Doppler Imaging

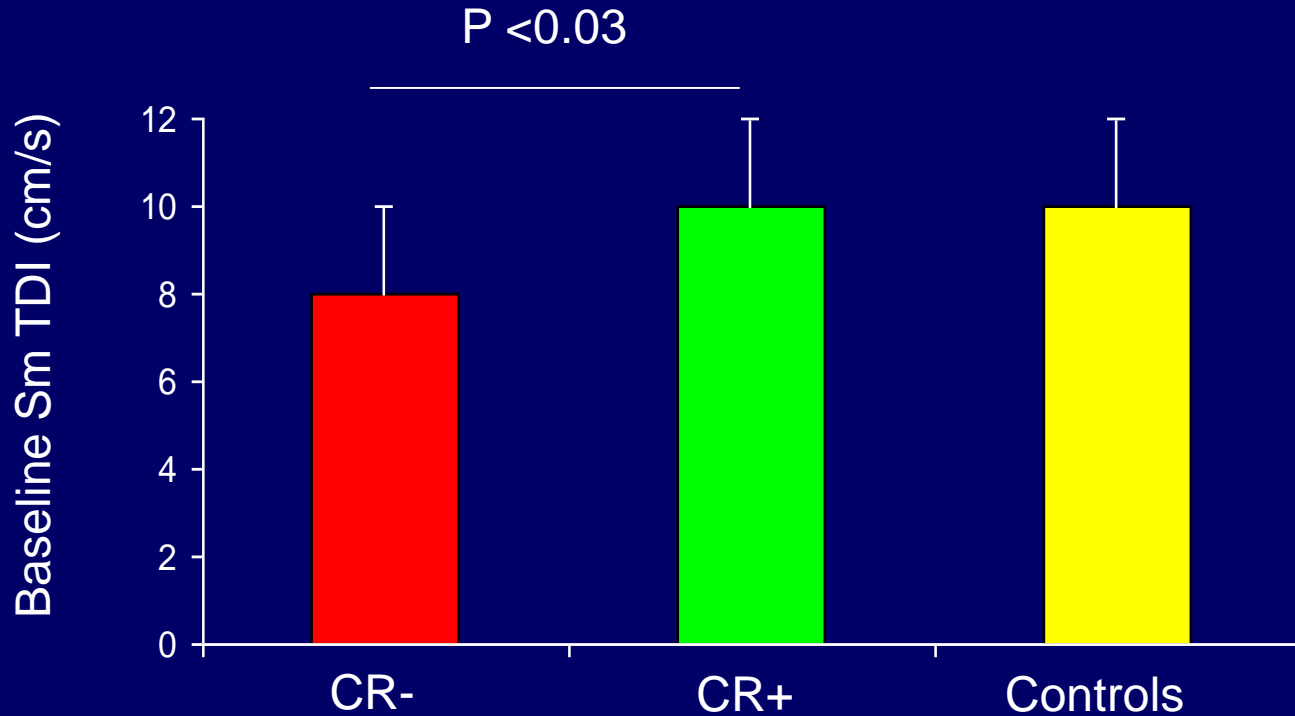
72 asymptomatic
severe MR patients



Exercise echo to
evaluate contractile
reserve (CR)



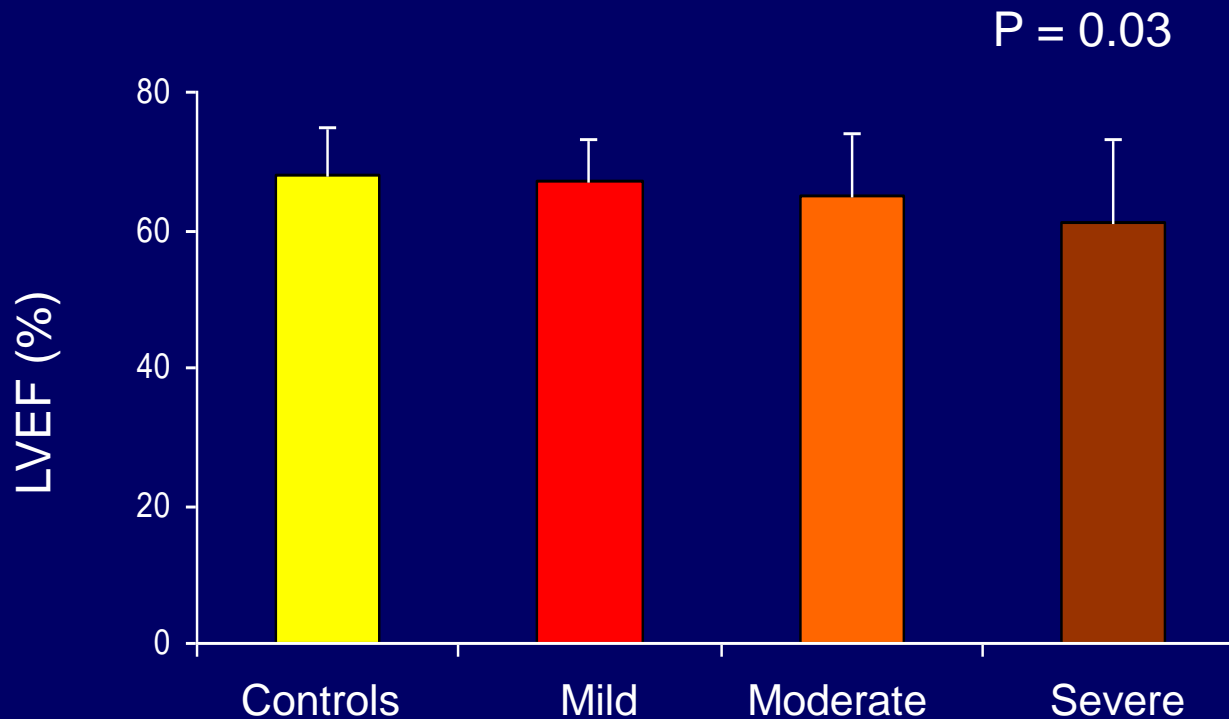
Tissue Doppler Imaging



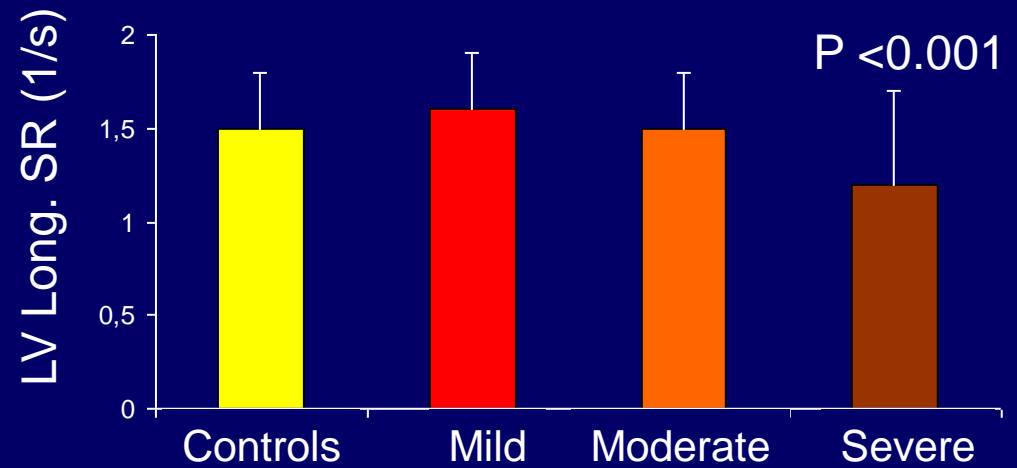
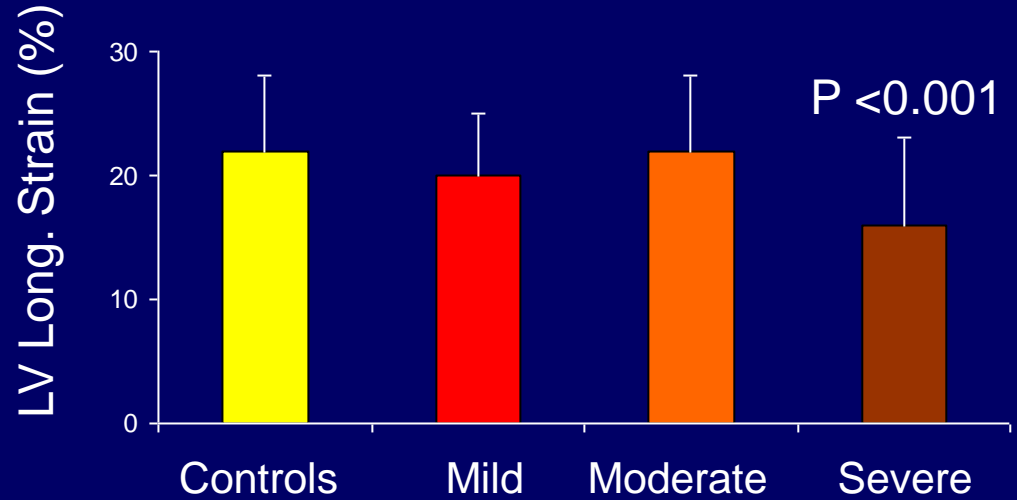
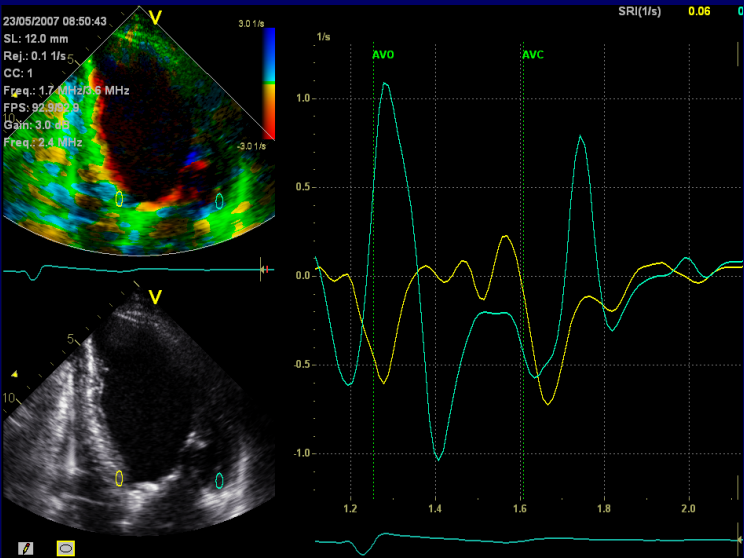
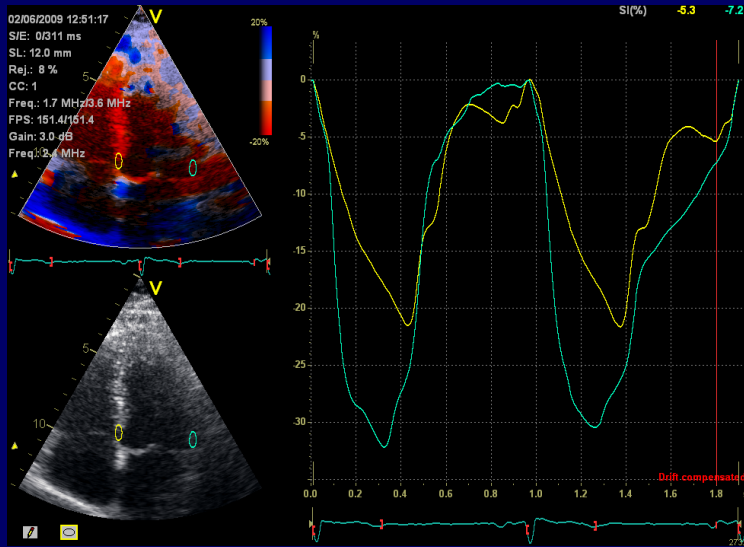
LV longitudinal velocity can detect silent LV dysfunction

Strain/strain rate Imaging

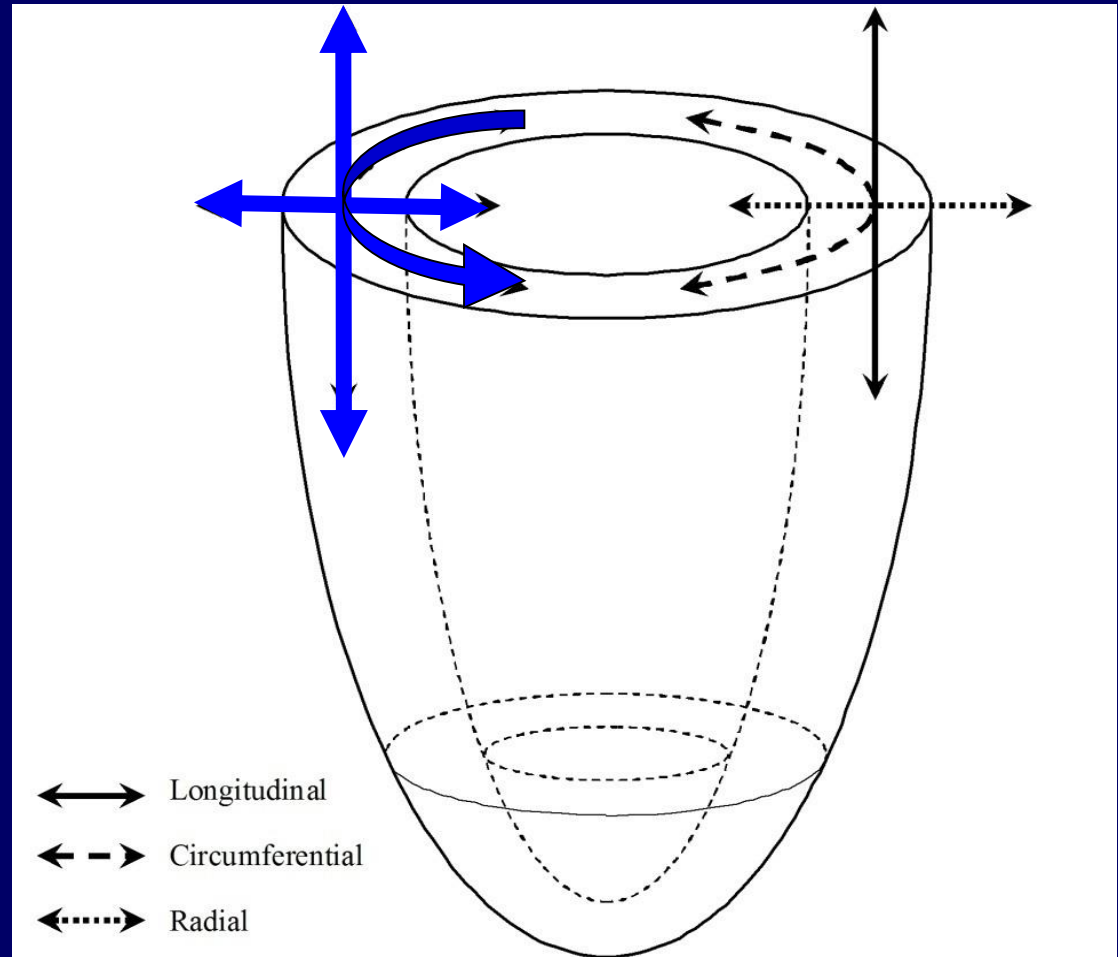
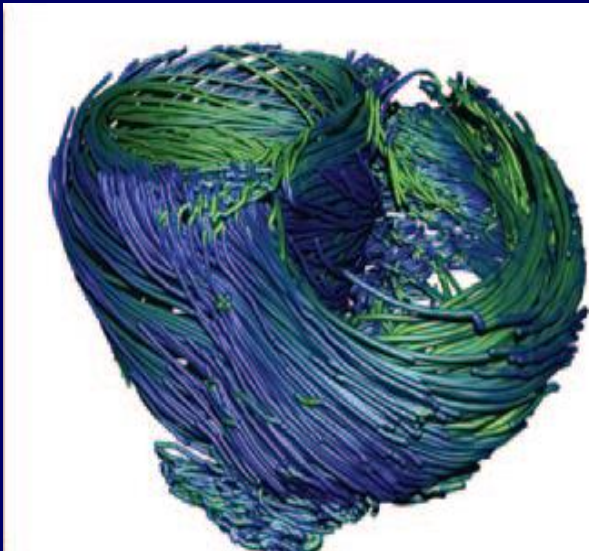
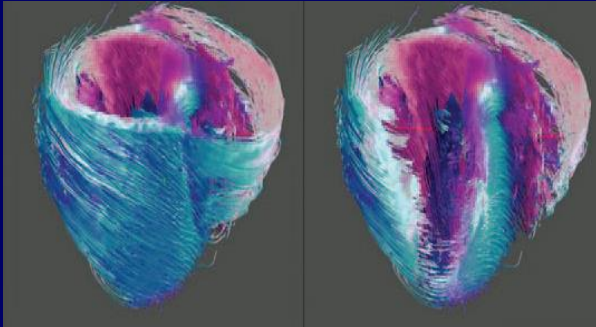
54 asymptomatic MR patients and preserved LVEF



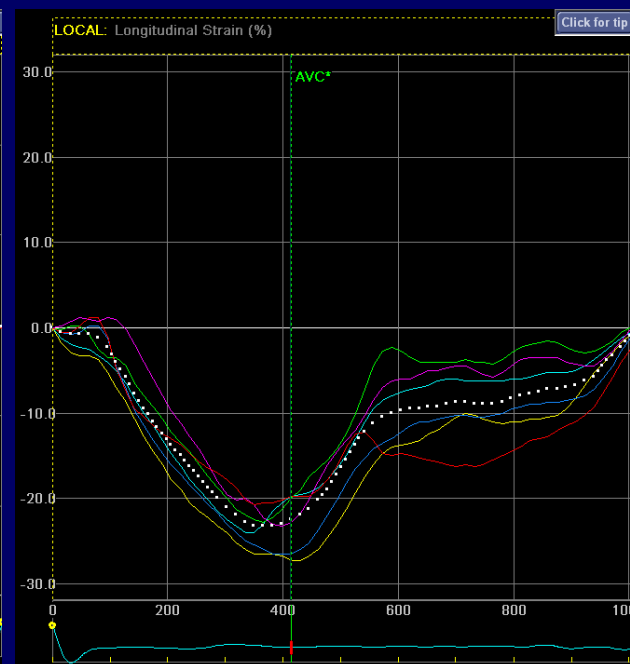
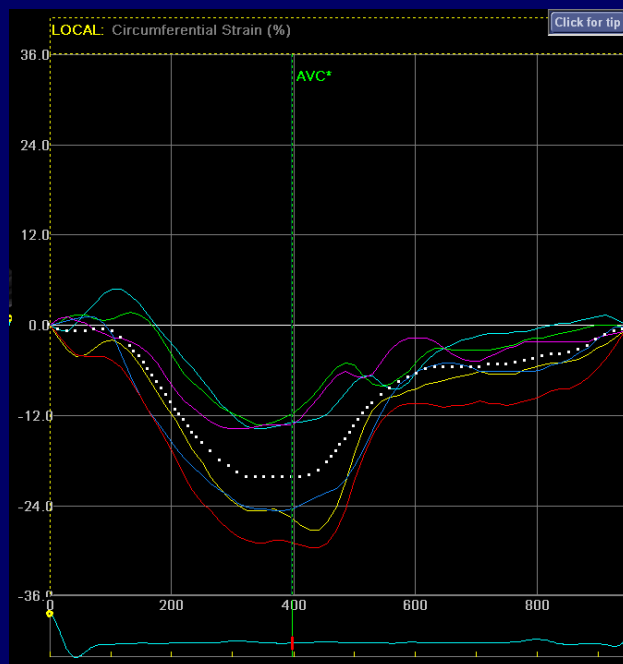
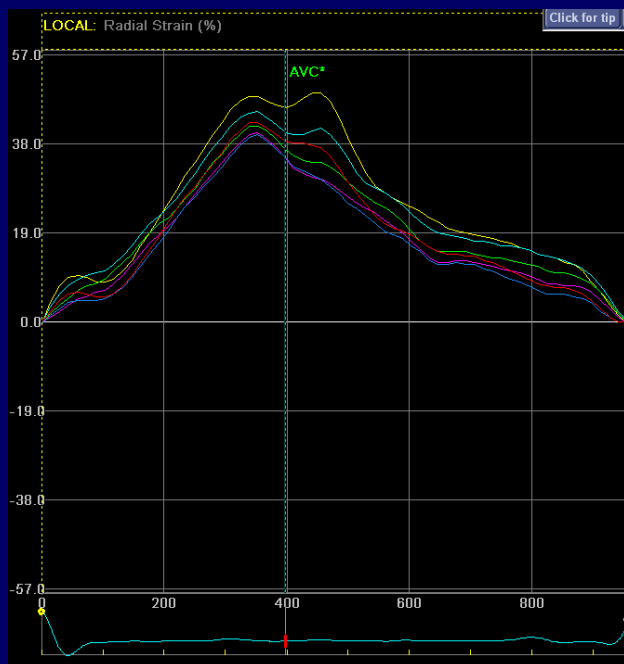
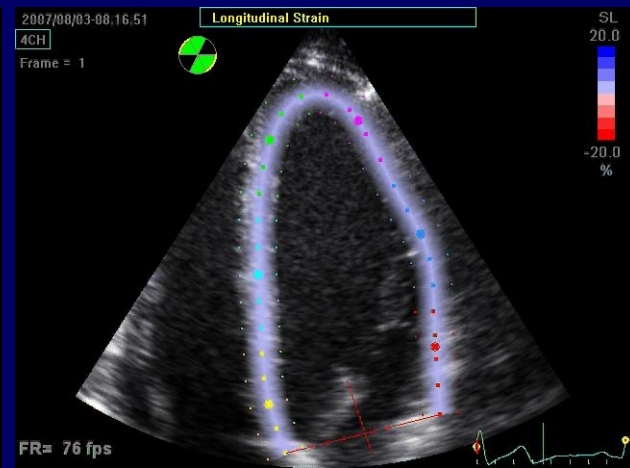
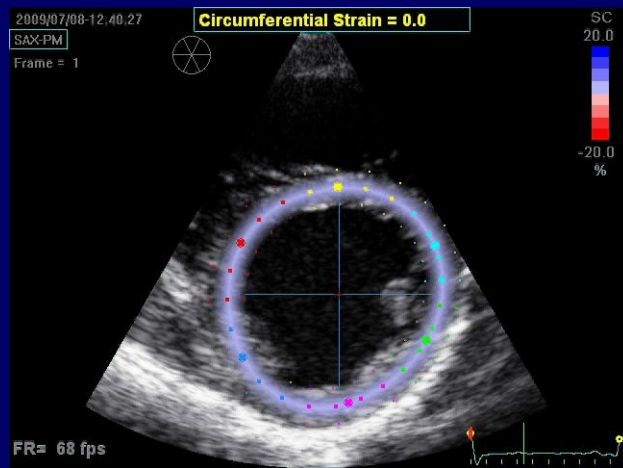
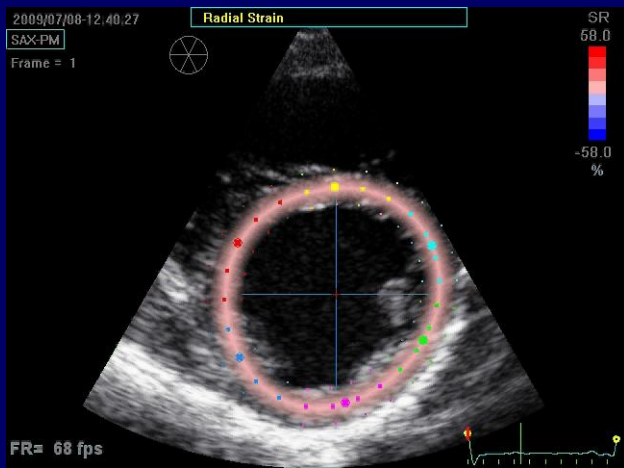
Strain/strain rate Imaging



Myocardial strain = deformation in 3 directions



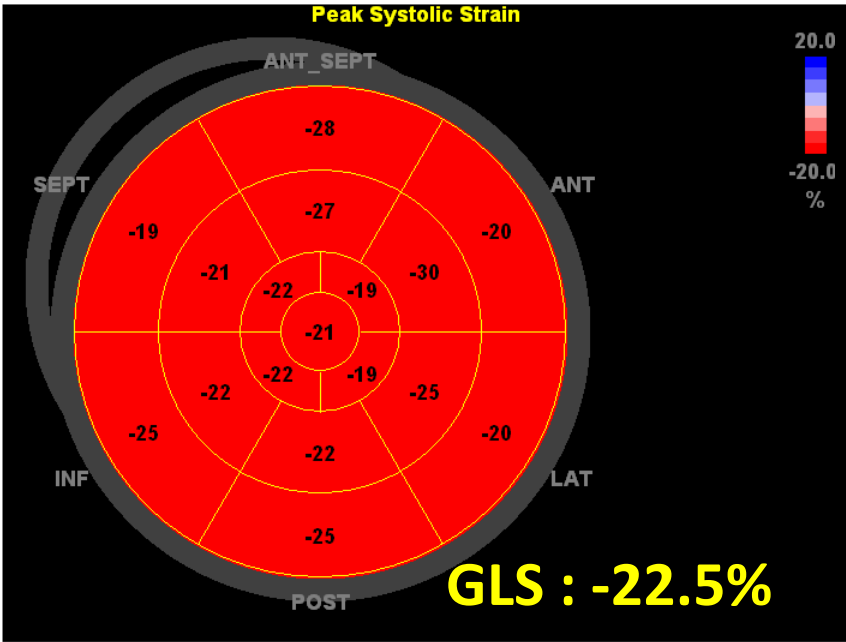
Speckle tracking echocardiography



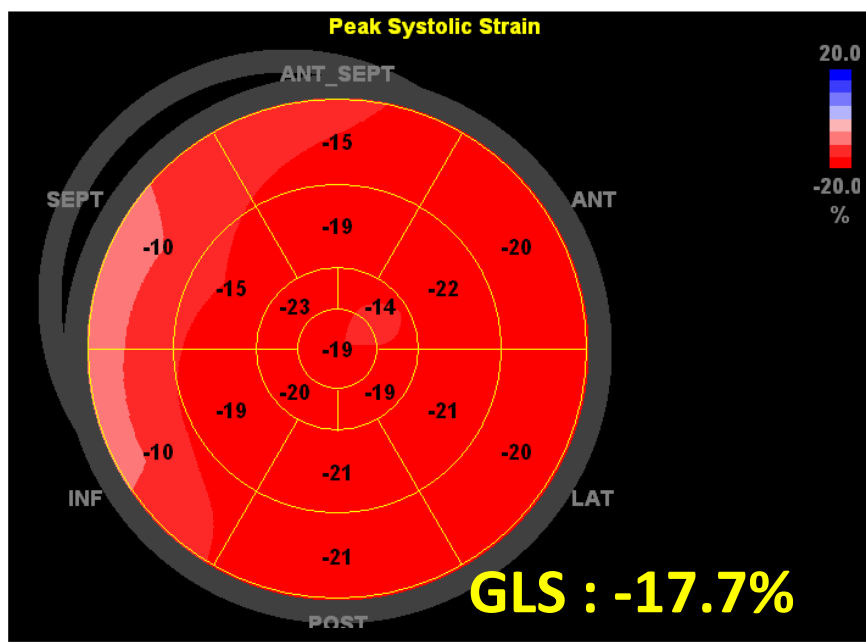
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No MR



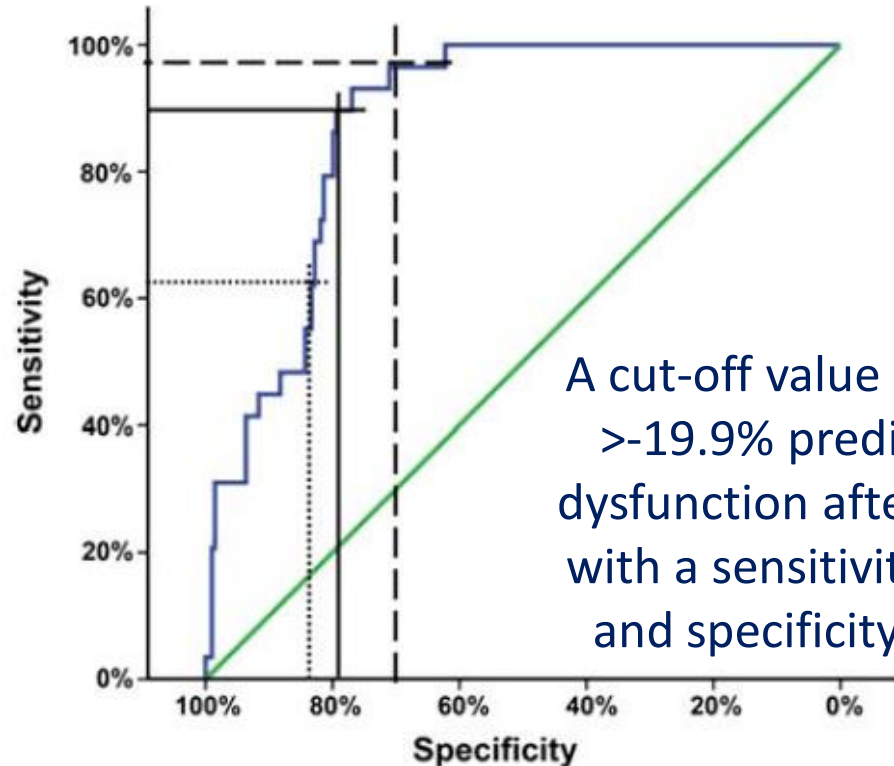
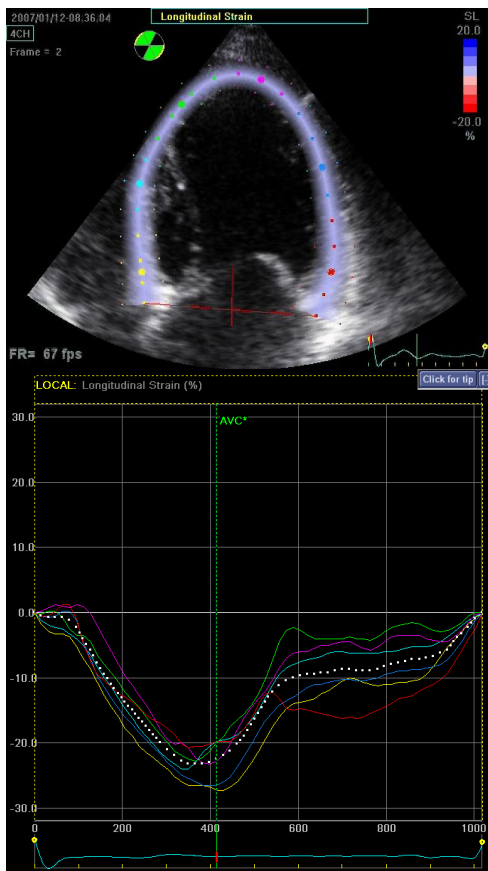
Severe MR



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- **Strain imaging**



A cut-off value of LV GLS >-19.9% predicted LV dysfunction after surgery with a sensitivity of 90% and specificity of 79%

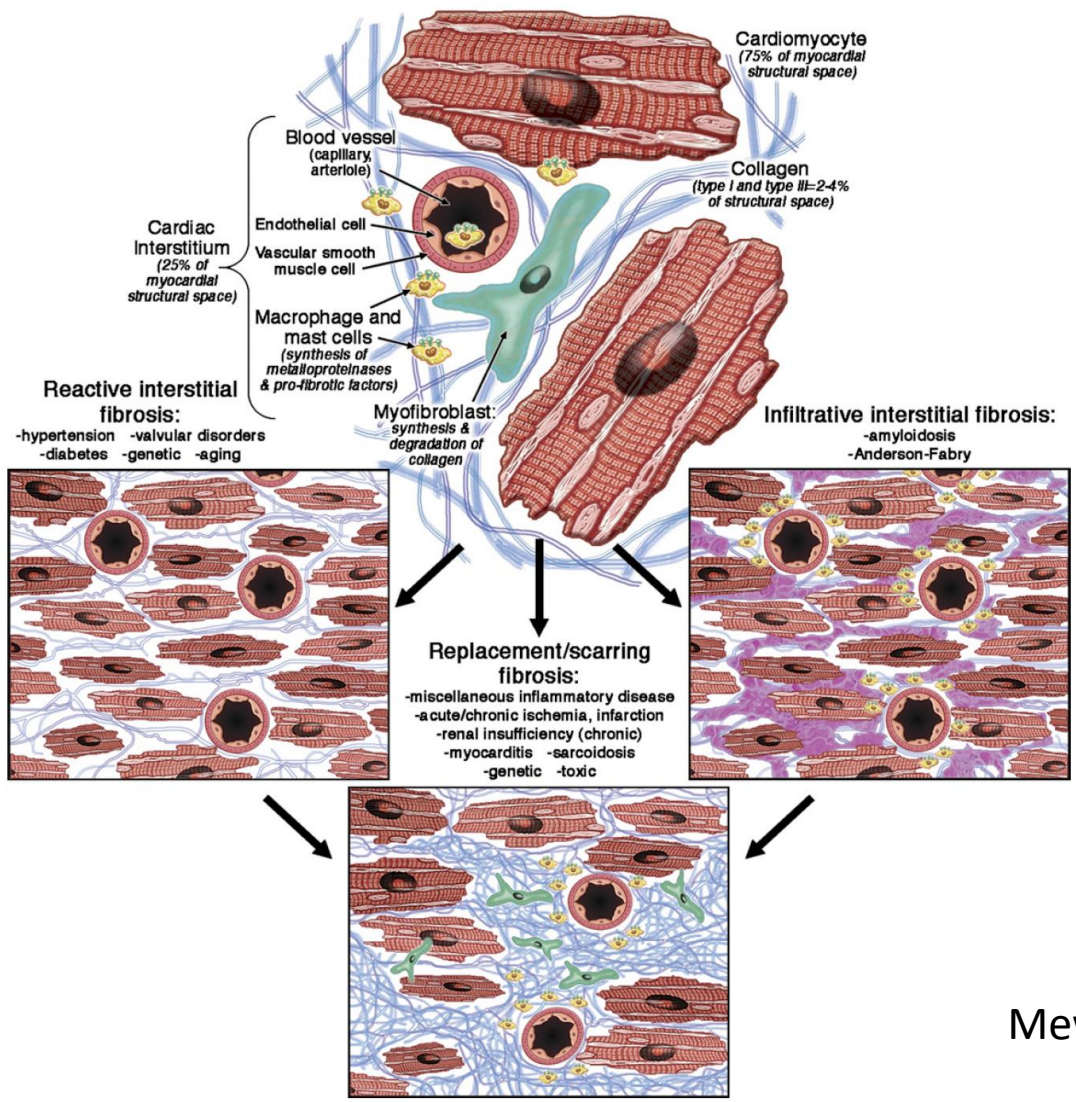
Area under curve: 0.88 (95%CI 0.83 - 0.93), $p < 0.001$

Witkowski et al. Eur Heart J Cardiovascular Imaging 2013

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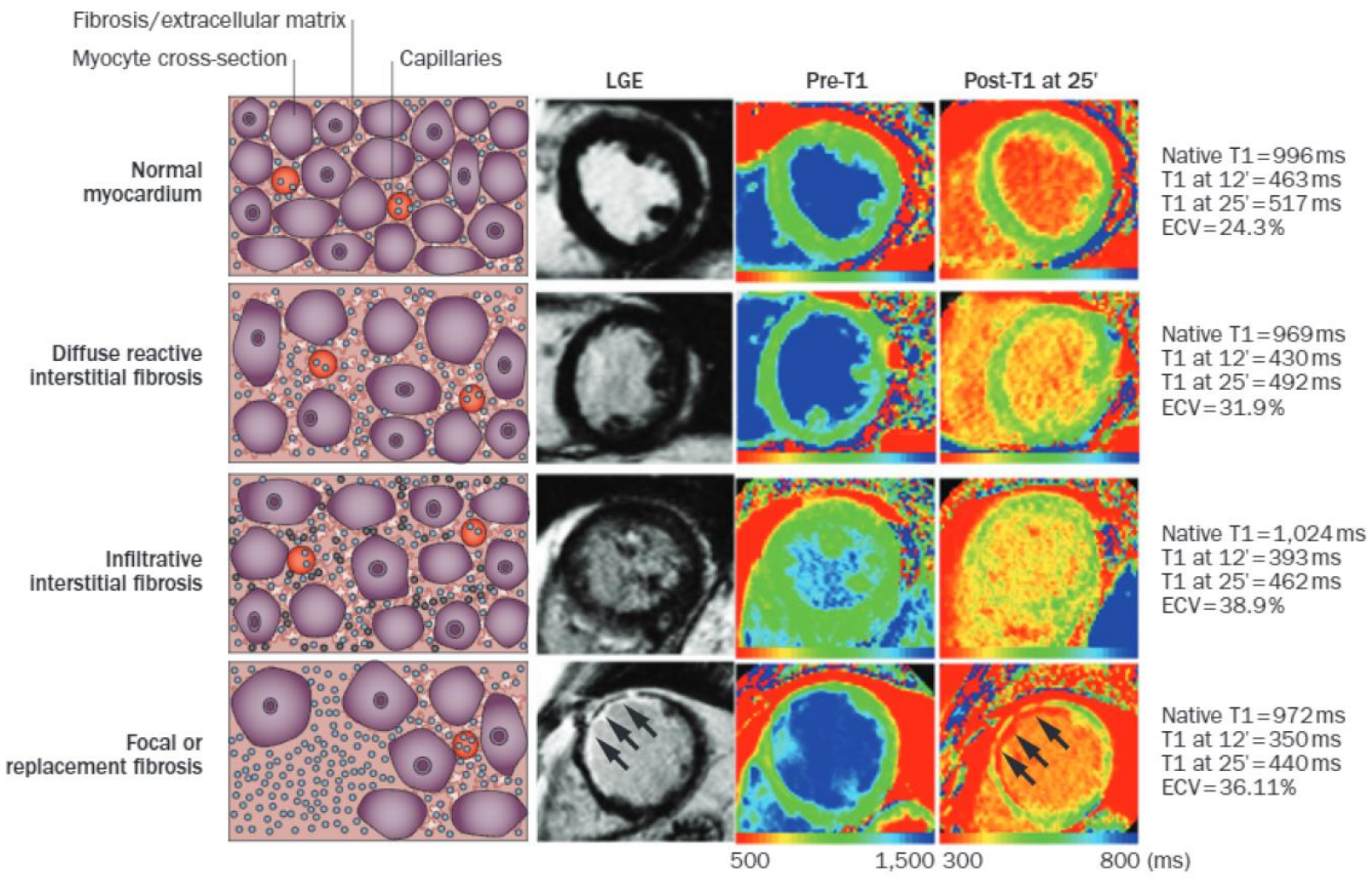
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Myocardial fibrosis patterns



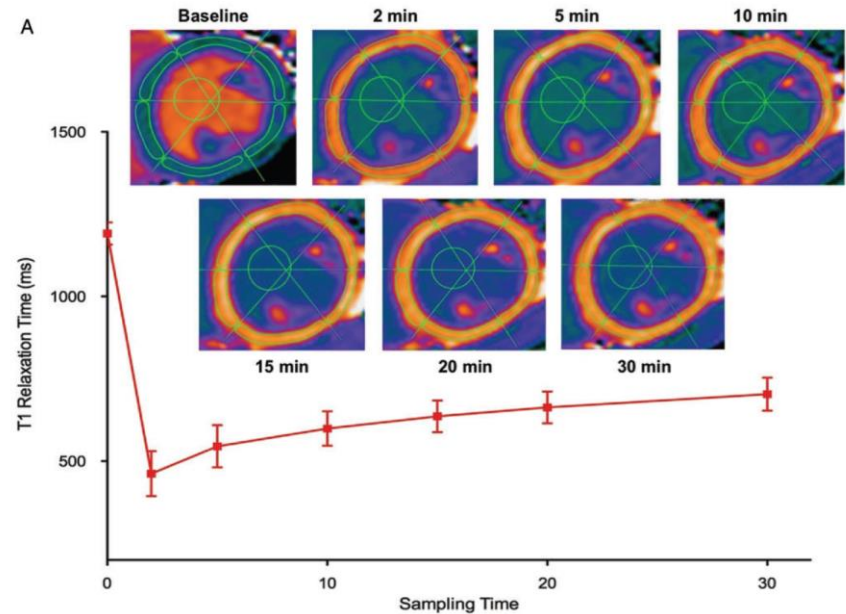
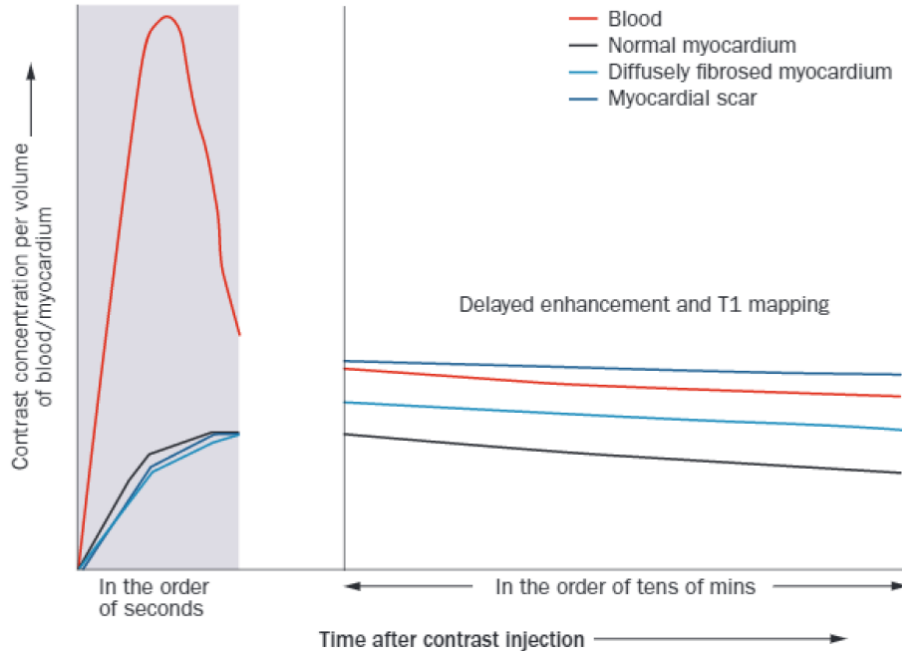
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$$\lambda = \Delta R1_{\text{myocardium}} / \Delta R1_{\text{bloodpool}}, \text{ where } R1 = 1/T1$$

$$ECV = (1 - \text{hematocrit}) \times \lambda$$

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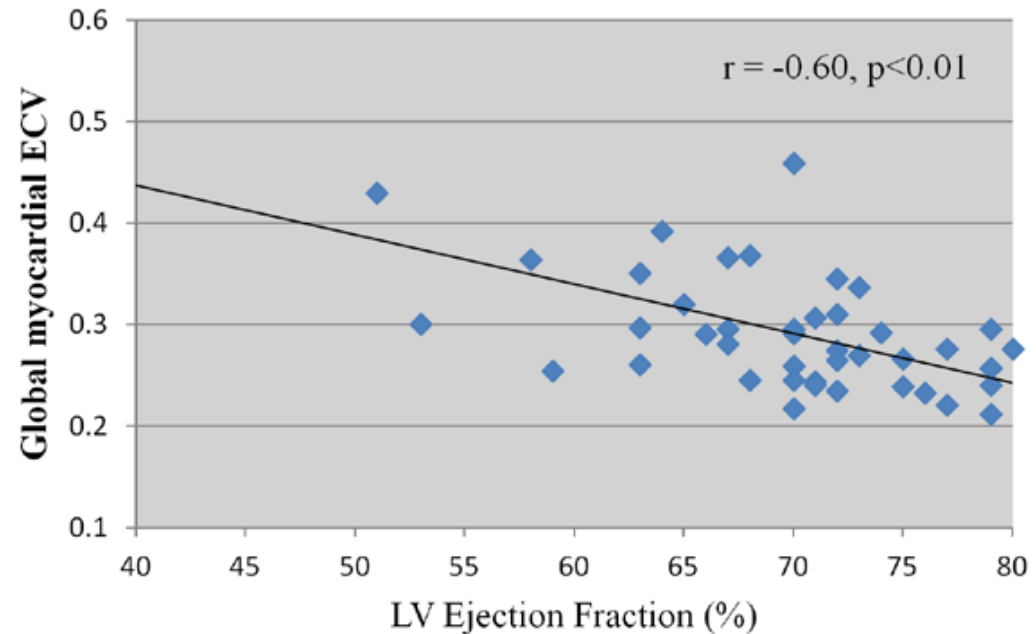
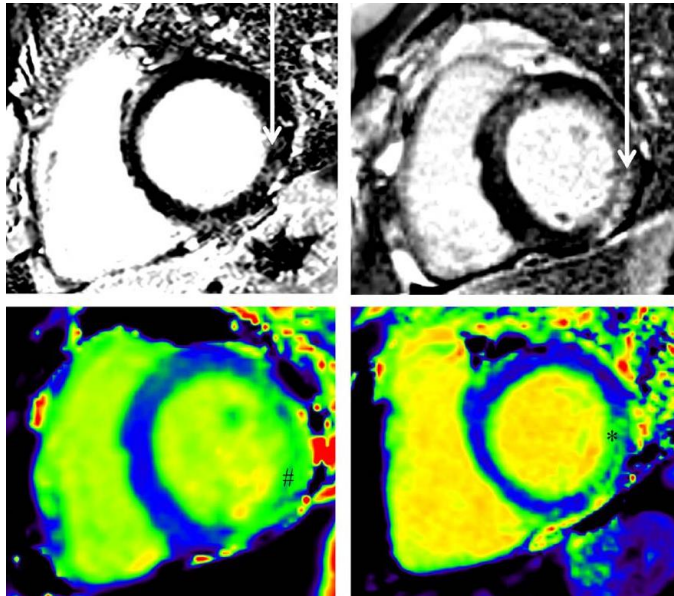
- Myocardial fibrosis with CMR: diffuse fibrosis**

	Controls, n=35	MR, n=35	MR + diffuse LGE, n=11	MR + no LGE, n=21
LV ejection fraction, %	74±6	67±10**	67±7	71±6
LV end-diastolic volume index, mL/m ²	62±11	88±21**	91±23	86±21
LV end-systolic volume index, mL/m ²	17±7	30±13**	30±10	26±10
LV stroke volume, mL	86±16	113±35**	120±35	117±36
LV mass index, g/m ²	59±13	69±13**	73±14	71±123
Presence of noninfarct pattern of LGE, n	0	11**	11	0
Presence of infarct pattern of LGE, n	0	2
RV ejection fraction, %	68±9	56±7**	56±6	55±6
RV end-diastolic volume index, mL/m ²	67±13	78±18**	87±21	76±13
RV end-systolic volume index, mL/m ²	22±10	35±11**	38±11	34±9
RV stroke volume, mL	83±15	81±22	92±18	81±23
→ Mean global ECV	0.25±0.02	0.32±0.07**	0.35±0.05	0.27±0.03‡
LA volume index, mL/m ²	34±7	57±13**	65±14	54±12‡
MAPSE, mm	16±3	14±3*	13±1	15±2
Regurgitant volume, mL	1±7	41±17**	45±15	40±19
Regurgitant fraction, %	1±8	34±9**	35±5	34±10
→ Global longitudinal strain, %	16.3±2.4	11.3±3.3**	9.8±4.3	11.7±2.9
Global longitudinal strain rate, s ⁻¹	0.85±0.2	0.64±0.2*	0.54±0.17	0.56±0.33
Global circumferential strain, %	18.2±2.2	15.4±4.0**	15.4±5.0	15.5±4.0
Global circumferential strain rate, s ⁻¹	1.0±0.2	0.77±0.3**	0.71±0.28	0.84±16.0

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- **Myocardial fibrosis with CMR: diffuse fibrosis**

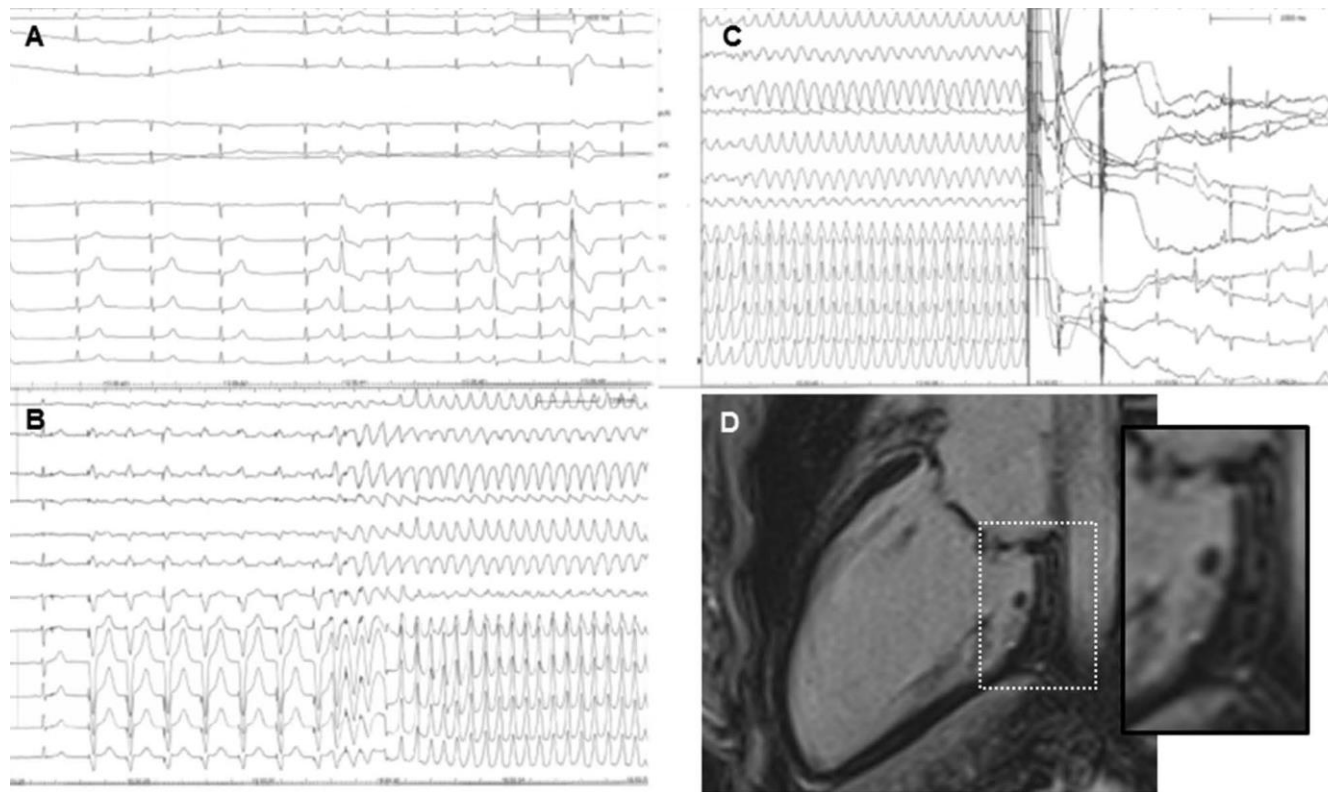


Edwards et al. Circ Cardiovasc Imag 2014

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- **Myocardial fibrosis with CMR: macroscopic scar**

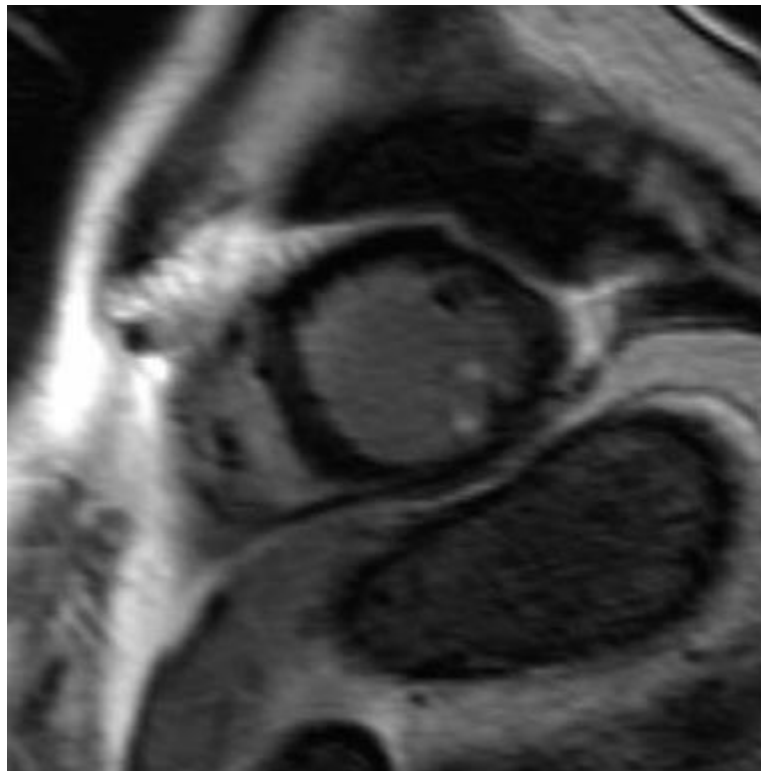


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- **Myocardial fibrosis with CMR: macroscopic scar**

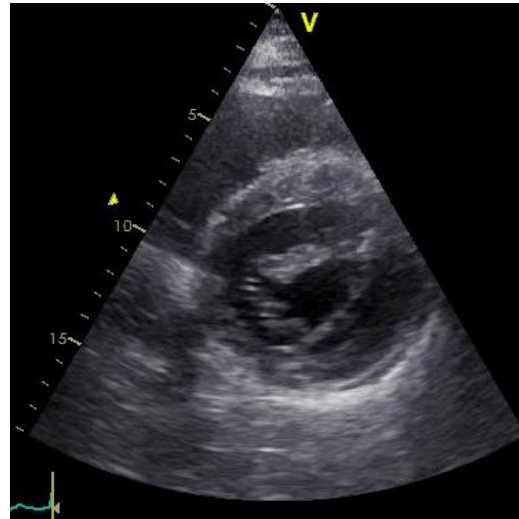
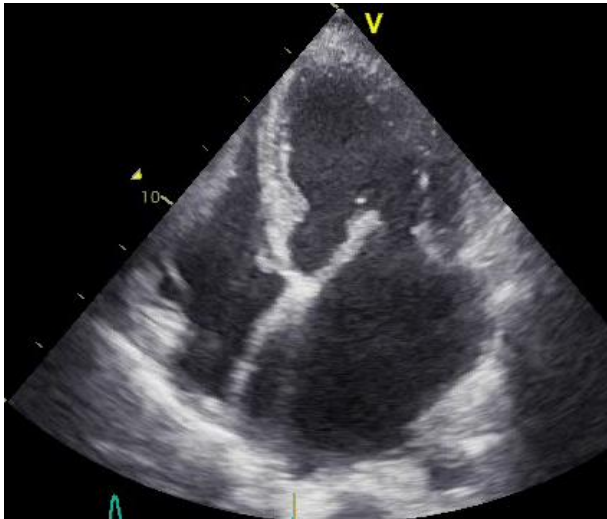


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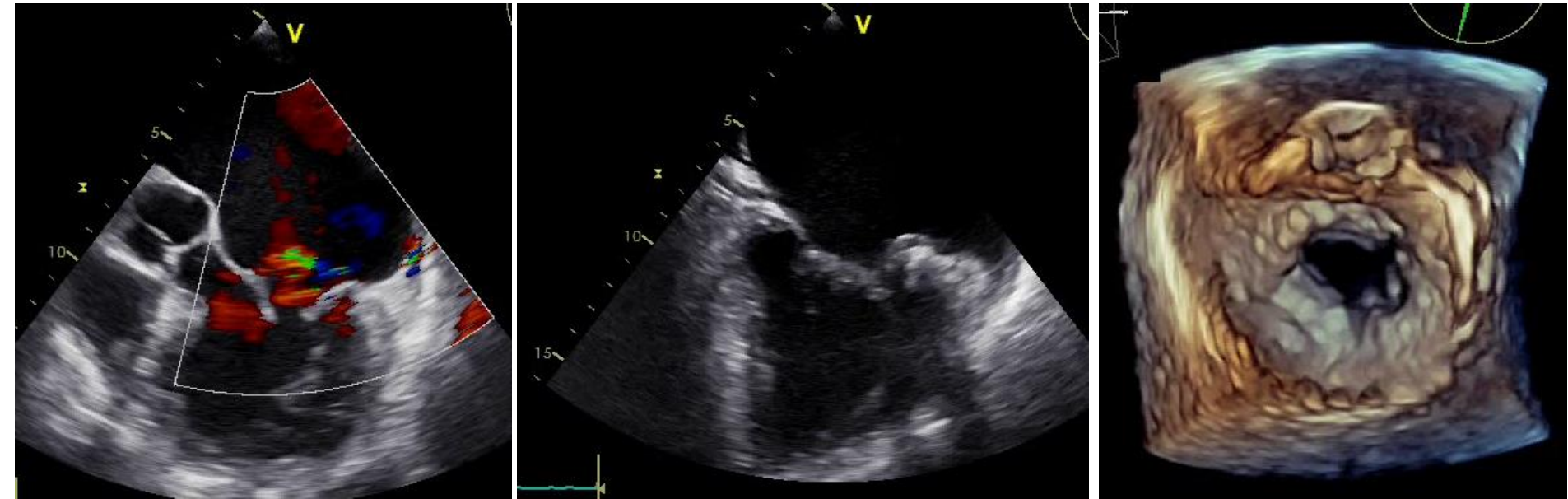
- 63 year old female
- 2005 Mitral valve prolapse
- 2013 atrial fibrillation
- Asymptomatic (exercise test, 150%, VO2 24.8)



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- Severe MR, high likelihood of successful repair, dilated LA and AF
- CAG: no CAD
- Referred for mitral valve repair

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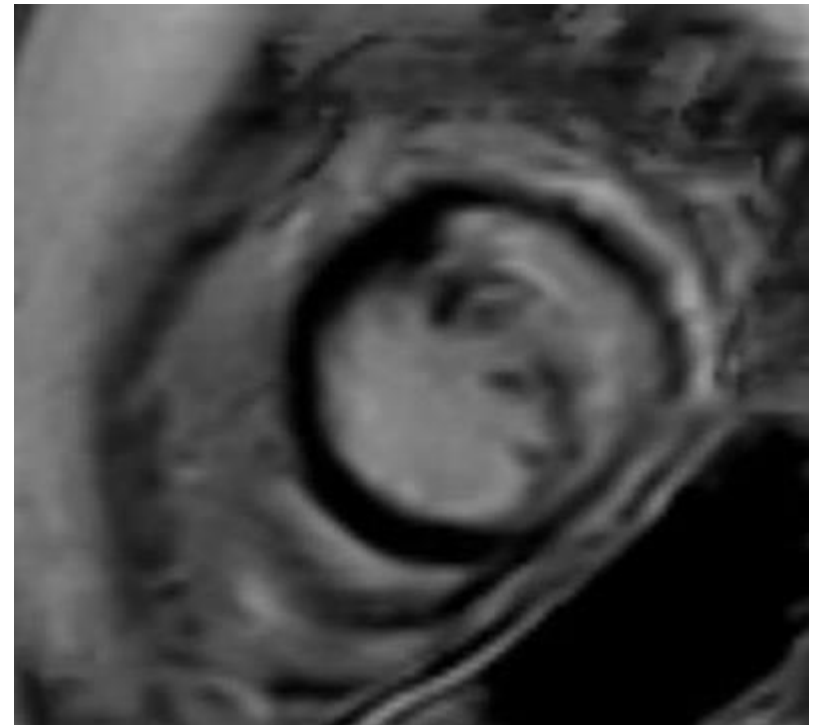
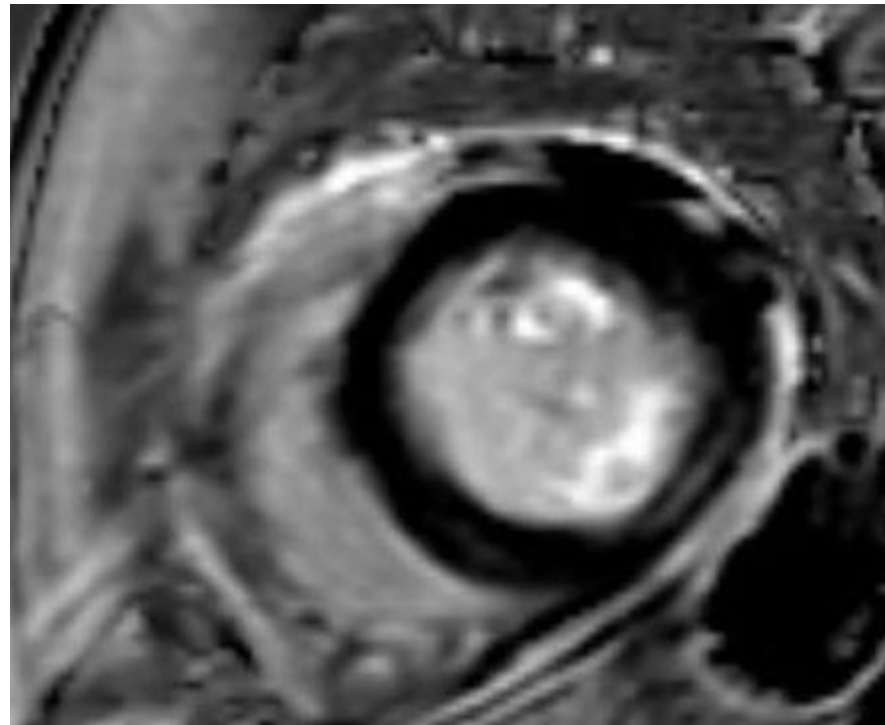
- One year after surgery, still NYHA III and no recovery of LVEF



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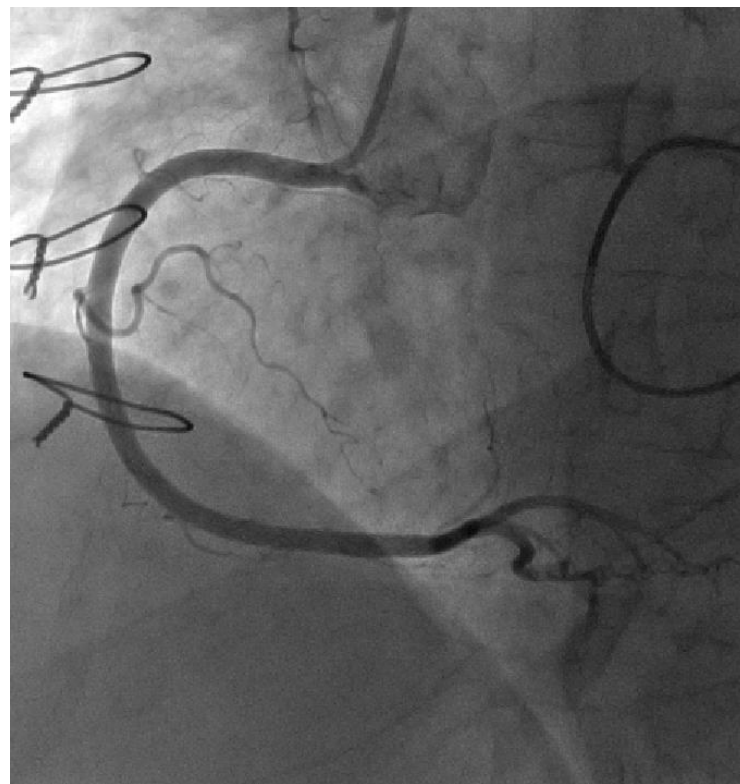
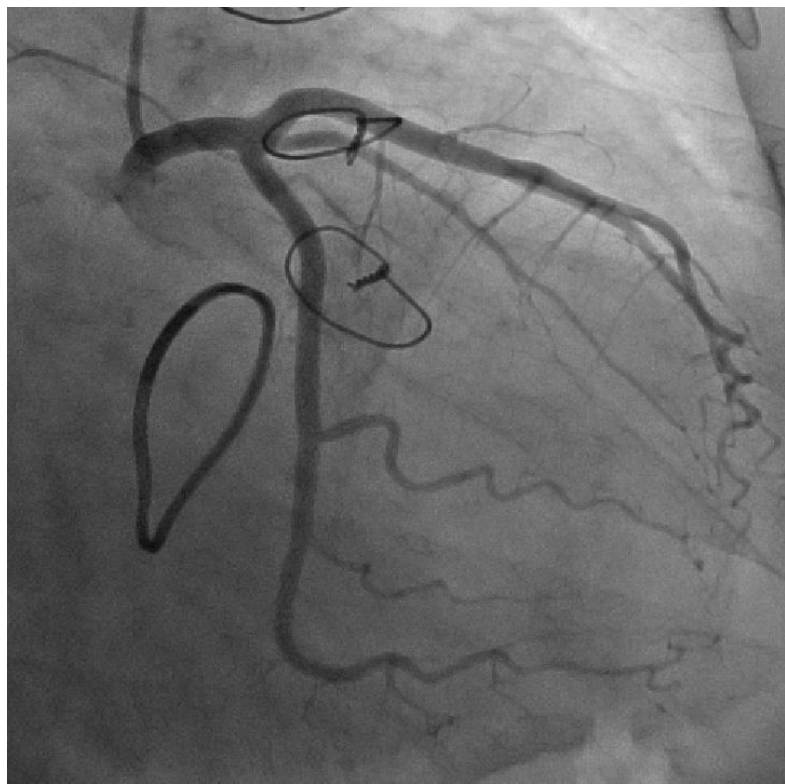




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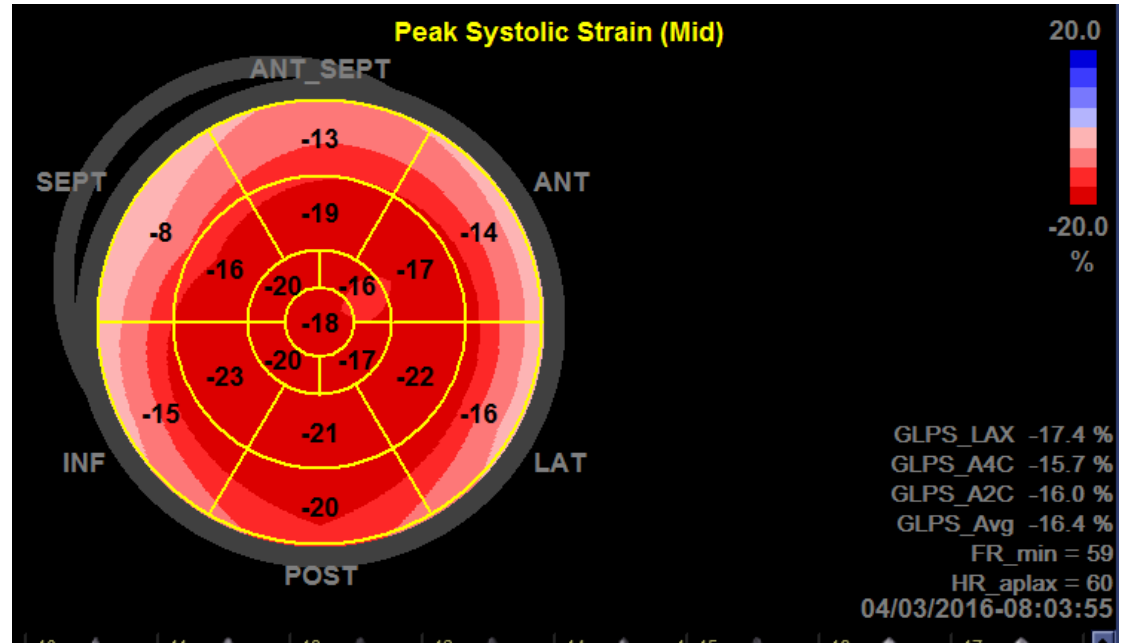
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The top of the slide features a banner with a night view of European architecture. The text 'EuroValve' is written in a large, white, serif font. Below it, 'March 10-11, 2016' is written in a yellow, sans-serif font. At the bottom of the banner, 'Hotel Bloom, Brussels, BELGIUM' is written in a white, sans-serif font.

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- Cardiac magnetic resonance in asymptomatic mitral regurgitation:
 - Assessment of diffuse fibrosis
 - Assessment of replacement fibrosis
 - Association with LV systolic function
 - Association with prognosis
- Role in clinical practice?