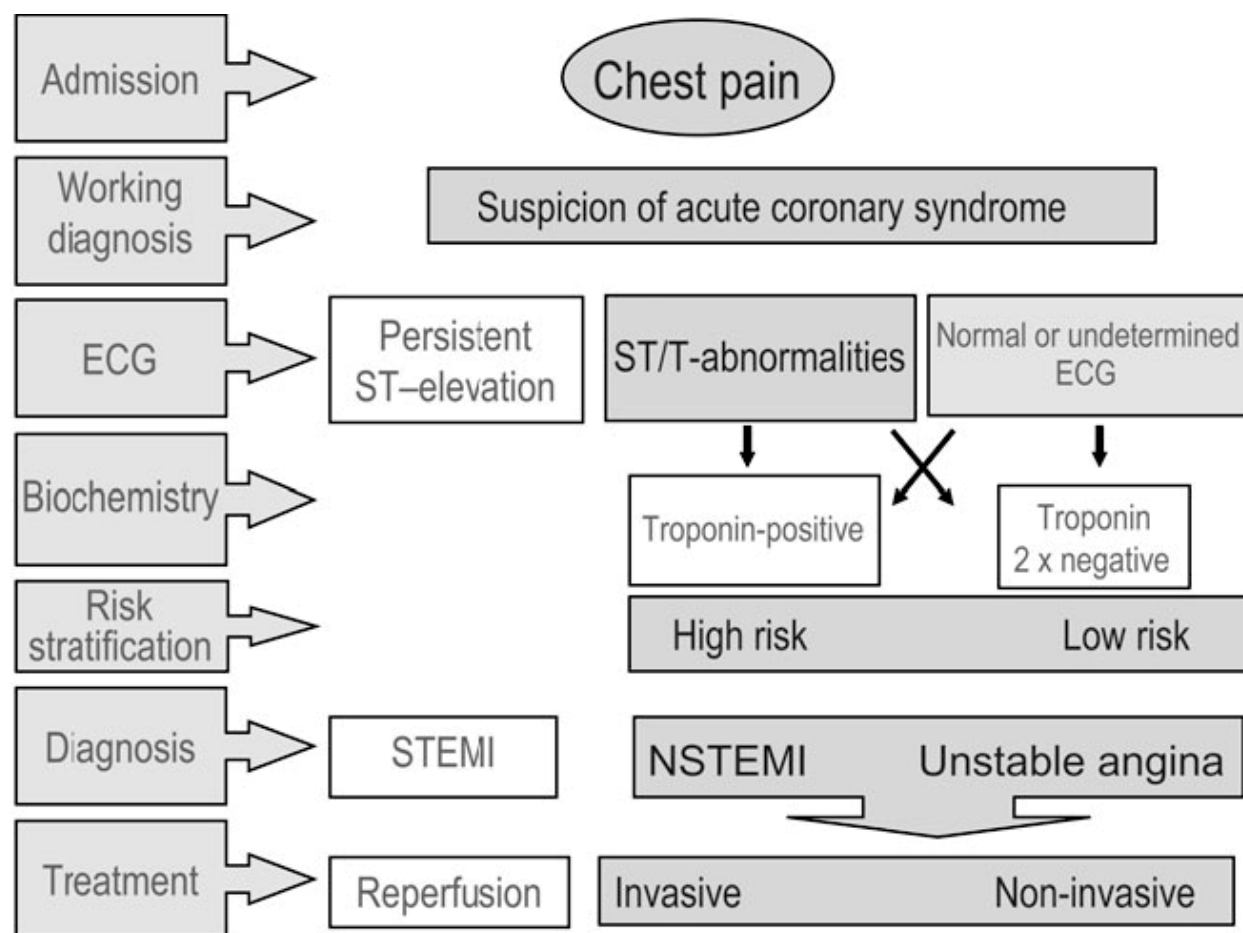


Noninvasive assessment
before intervention.
Can we do better?

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Acute coronary syndrome



Acute Ischemia and regional myocardial contractility

Ischemic

Non-ischemic

Onset

delayed

normal

Peak velocity

reduced

initial \uparrow \rightarrow normal

Ejection time

shortened

shortened

End-systole

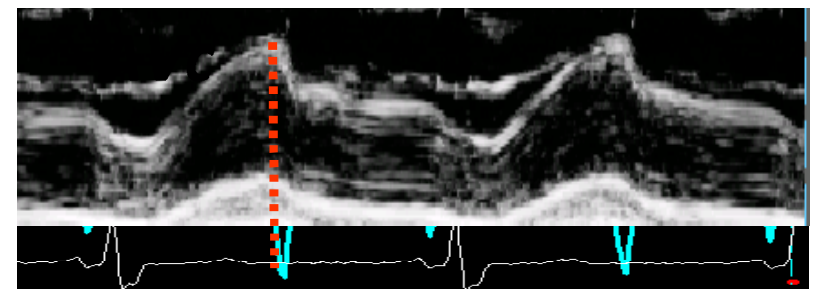
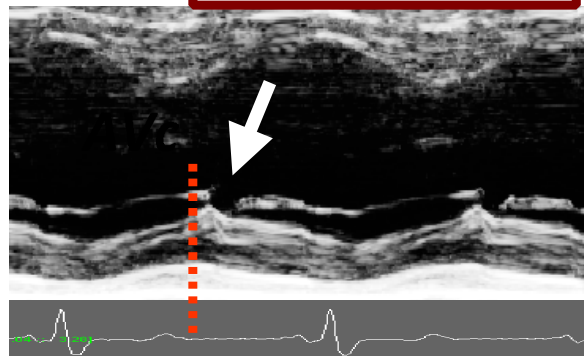
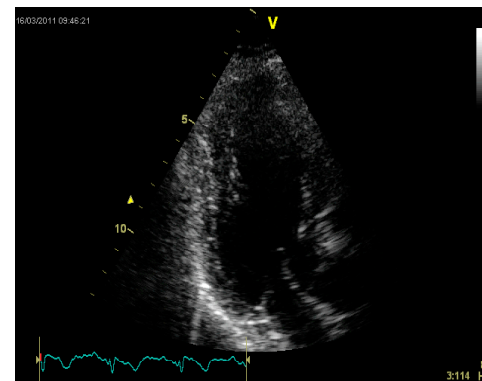
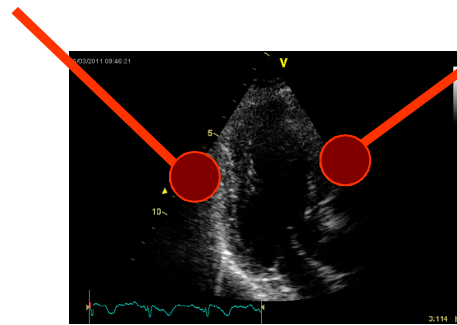
thinning

thickening

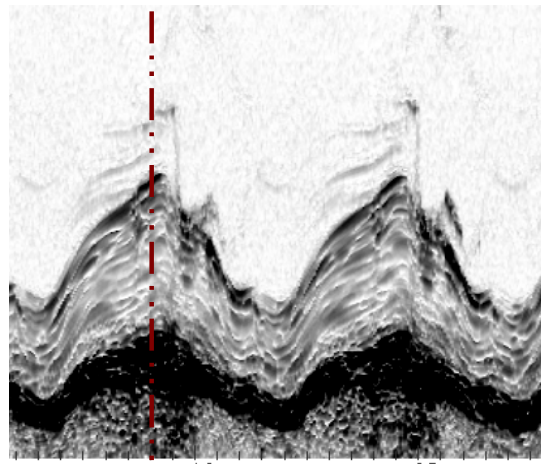
Early- diastole

thickening

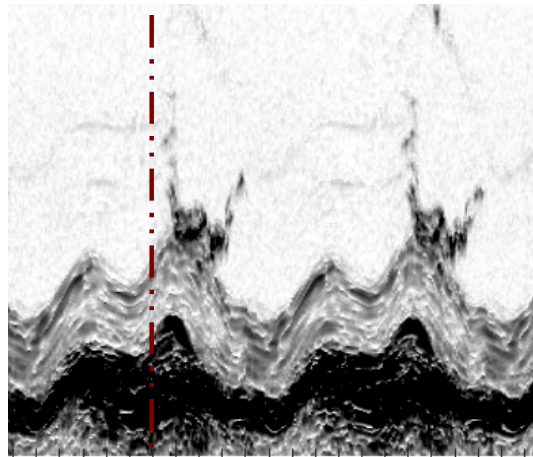
thinning



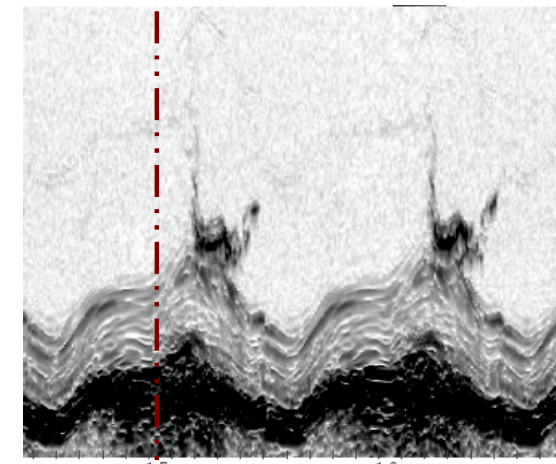
Acute Ischemia -Experimental



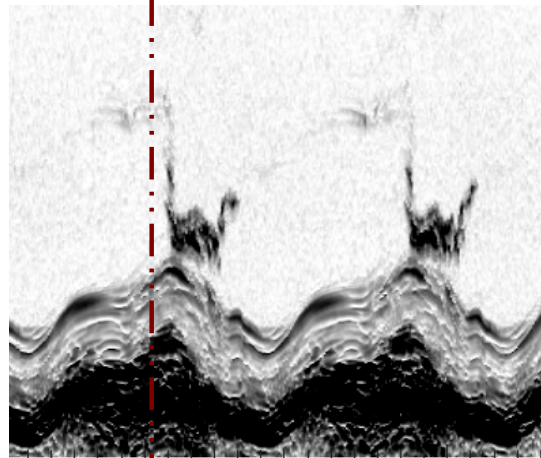
Baseline



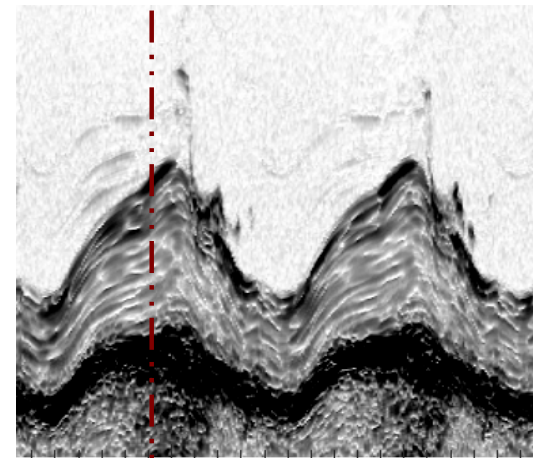
Occlusion - 20 s



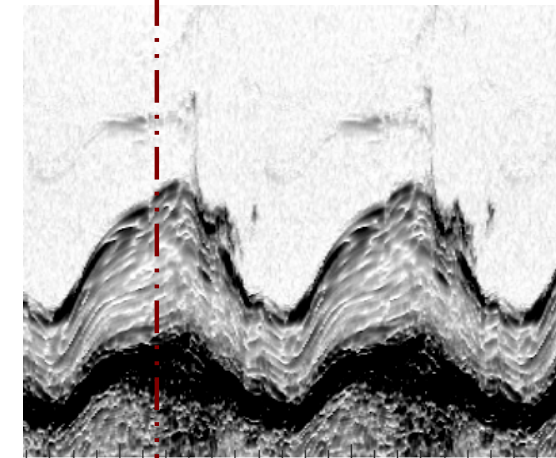
Occlusion - 40 s



Occlusion - 60 s



Reperfusion - 20 s



Reperfusion - 2 min

Regional Post Systolic Thickening

Occurs before:

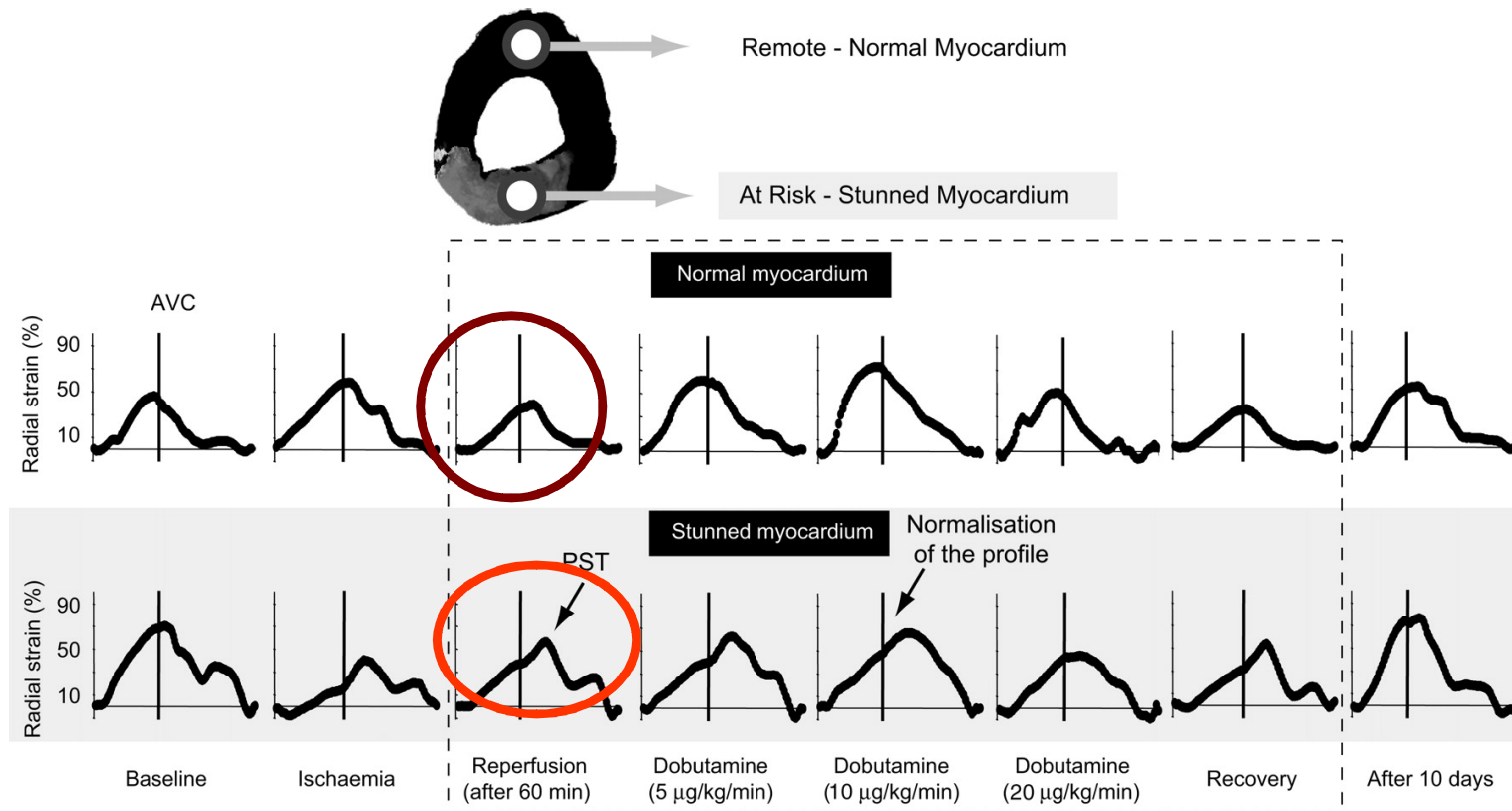
- **changes in epicardial ECG**
- **changes in lactate extraction**
- **changes in global hemodynamics**

Leone et al.

Cardiovascular Research 1992

Strain Imaging

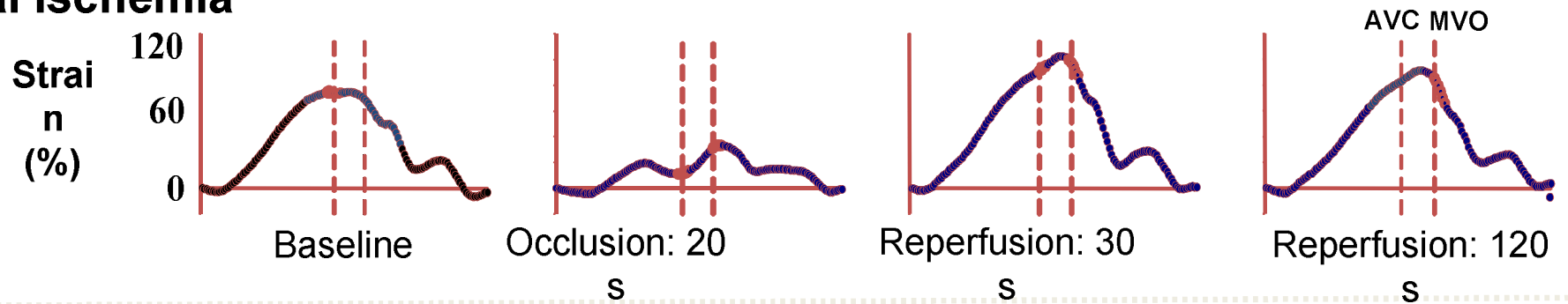
Changes in radial strain of the at-risk posterior wall and remote normal septum during hypoperfusion, reperfusion, and a dobutamine challenge



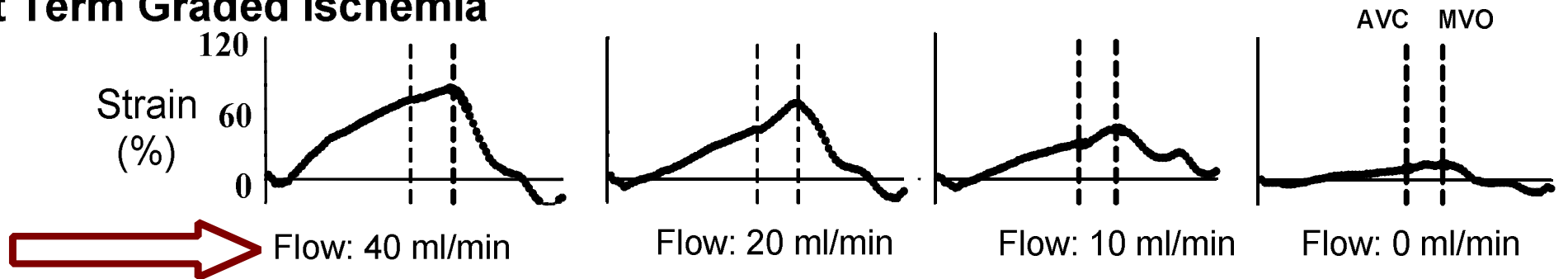
Gallagher KP, *Am J Physiol Heart Circ Physiol.* 1984

Strain Imaging - Ischemia

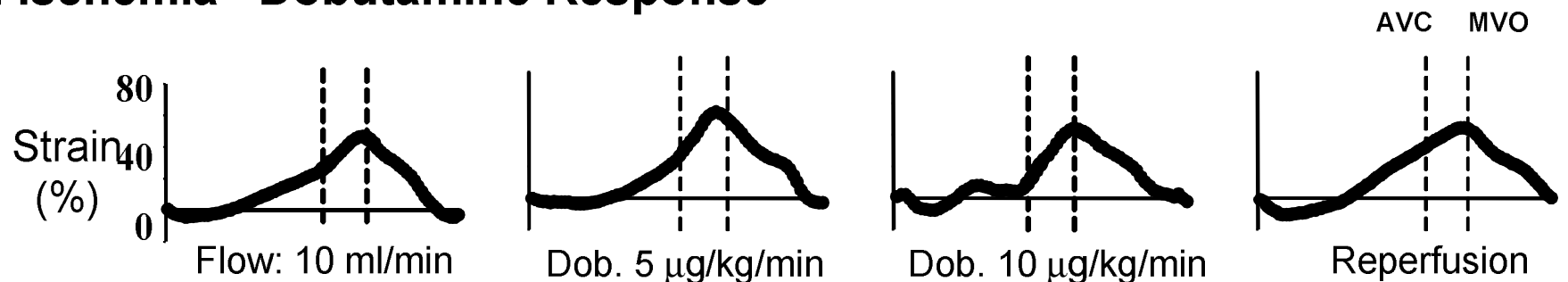
Acute total Ischemia



Short Term Graded Ischemia



Prolonged Ischemia - Dobutamine Response



Stress echocardiography

- detection of myocardial ischemia

= transient worsening of LV wall contractility

- Similar diagnostic and prognostic accuracy to SPECT
- no biohazards for pts. and

medical staff

Stress echocardiography expert consensus statement

Table 2

Stress echocardiography in four equations

Rest + Stress = Diagnosis
 Normokinesis + Normokinesis = Normal
 Normokinesis + Hypo, A, Dyskinesis = Ischaemia
 Akinesis + Hypo, Normokinesis = Viable
 A-, Dyskinesis +, Dyskinesis = Necrosis

Table 9

Safety profile of pharmacologic stress echocardiography

	Dobutamine	Dipyridamole
% submaximal tests	10	5
Side effects	1/300 exams	1/1000
TV, FV	++	+
High grade AV block		++
Death	1/5000	1/10 000

Regional deformation of the different ischemic substrates at rest and how they respond to dobutamine

		Rest					Dobutamine Low dose			Dobutamine High dose			
		SR	S	PSS	ESWT	EDWT	SR	S	PSS	SR	S	PSS	
		N	N	N	N	N	↗	↗	○	↗	↘	○	Normal
Reduced perfusion	Flow reduction in coronary artery												Acute Ischaemia
	none	↘	↘	↗	↘	Z	↘	↘	↗	↘	↘	↗	
	-50%	↘↘	↘↘	↗↗	↘↘	Z	↘	↘	↗	↘	↘	↗	
	-75%	↘↘↘	↘↘↘	↗↗↗	↘↘↘	Z	↘	↘	↗	↘	↘	↗	
	-100%	○	○	↗↗↗	↘↘↘	Z	→	→	↗	→	→	↗	
Acute reperfusion	Short occlusion	Z	Z	○	Z	Z	↗	↗	○	↗↗	↘	○	
	Stunned	↘	↘	↗	↘	Z	↗	↗	↘	↗↗	↘	○	
	Non-transmural infarction	↗↗	↗↗	↗	↘	↗↗	→	→	→	↗	↗	↘	
	Transmural infarction	○	○	↗	Z	↗↗↗	→	→	→	→	→	→	
Normal flow reserve	Transmurality of infarction (%fibrosis)												Chronic Ischaemia
	25%	↘	↘	↗	↘	Z	↗	↗	↗	↗↗	↘	↗↗	
	50%	↘↘	↘↘	↗	↘↘	↘	↗	↗	↗	↗↗	↘	↗↗	
	75%	↘↘↘	↘↘↘	↗	↘↘↘	↘↘	→	→	↗	↗	↘	↗↗	
100%	○	○	○	↘↘↘	↘↘↘	→	→	→	→	→	→		
No flow reserve	Transmurality of infarction (%fibrosis)												Chronic Ischaemia
	25%	↘	↘	↗	↘	Z	↘	↘	↗	↘↘	↘↘	↗↗	
	50%	↘↘	↘↘	↗	↘↘	↘	↘	↗	↘↘	↘↘	↗↗	↗↗	
	75%	↘↘↘	↘↘↘	↗	↘↘↘	↘↘	↘	↗	↘↘	↘↘	↗↗	↗↗	
100%	○	○	○	↘↘↘	↘↘↘	→	→	→	→	→	→		

Conclusion

We can do better in detection of the ischemia earlier in the ischemic cascade

- Ischemic myocardial segment
 - = spectrum in contractility abnormalities not only hypokinesia or akinesia !!!
 - delayed onset of systolic deformation,
 - less deformation,
 - post systolic thickening
- Evaluation and quantification of REGIONAL myocardial function
 - = strain imaging (2D strain, Doppler myocardial imaging)

Conclusion II

- Imaging modalities usefulness

Stress ECG -- ischemia

Stress perfusion SPECT -- viability and ischemia, infarct size

Stress echo -- viability and ischemia

PET (rest) -- viability

MRI (rest, stress, contrast-enhanced)

-- LV function, infarct size, viability, and ischemia