3rd Stress Echo Interpretation Course

Ischaemia Detection and Viability Assessment

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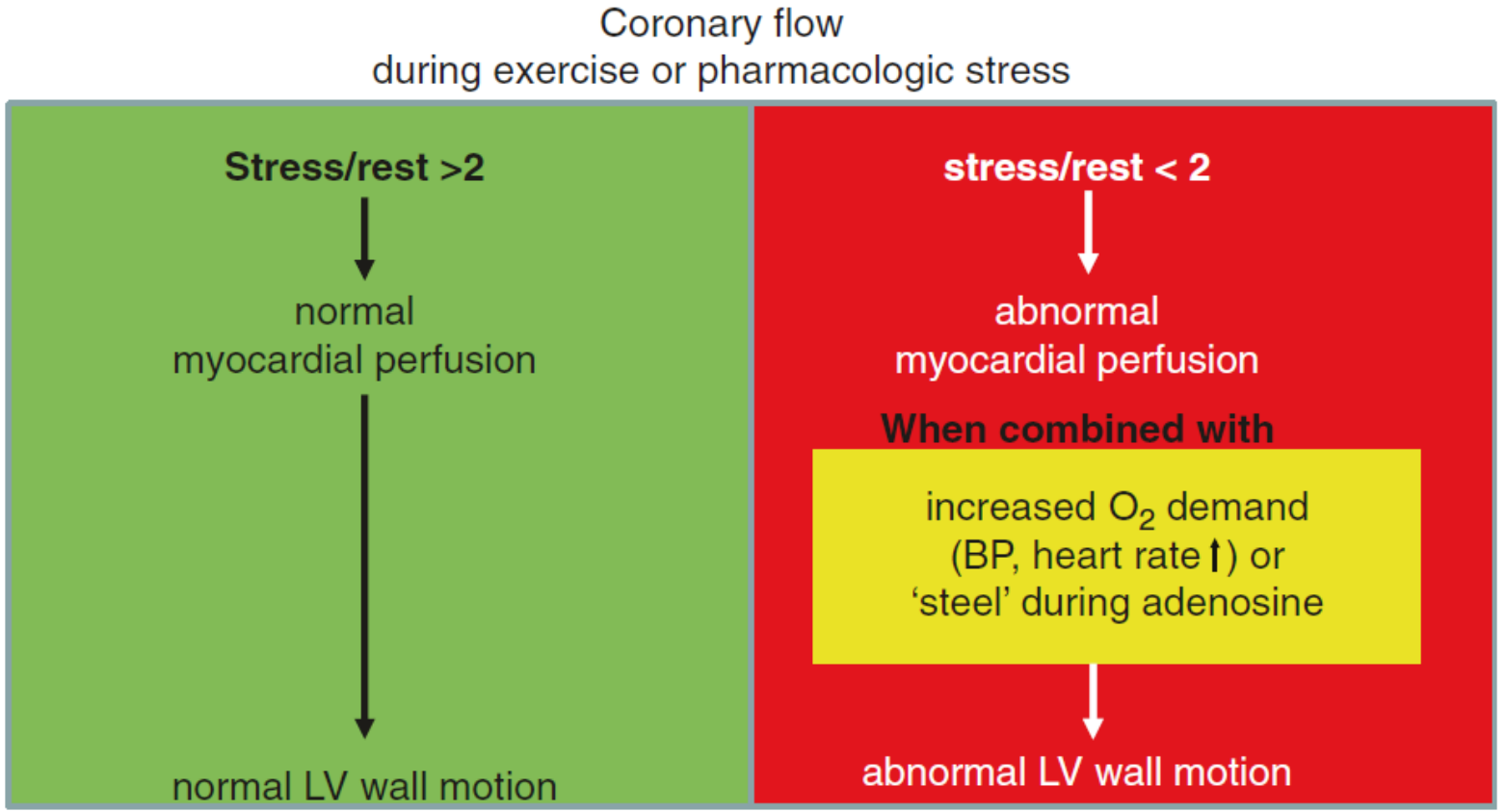
Questions to be answered after stress echocardiography

- Is there significant coronary heart disease with >50%coronary stenosis?
- Which coronary artery territories are involved?
- What is the risk of cardiac events (MACE)?
- Is coronary angiography/intervention indicated?

Coronary Flow and LV wall motion



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Contrast echocardiography
Compendium for clinical Practice
Springer 2019

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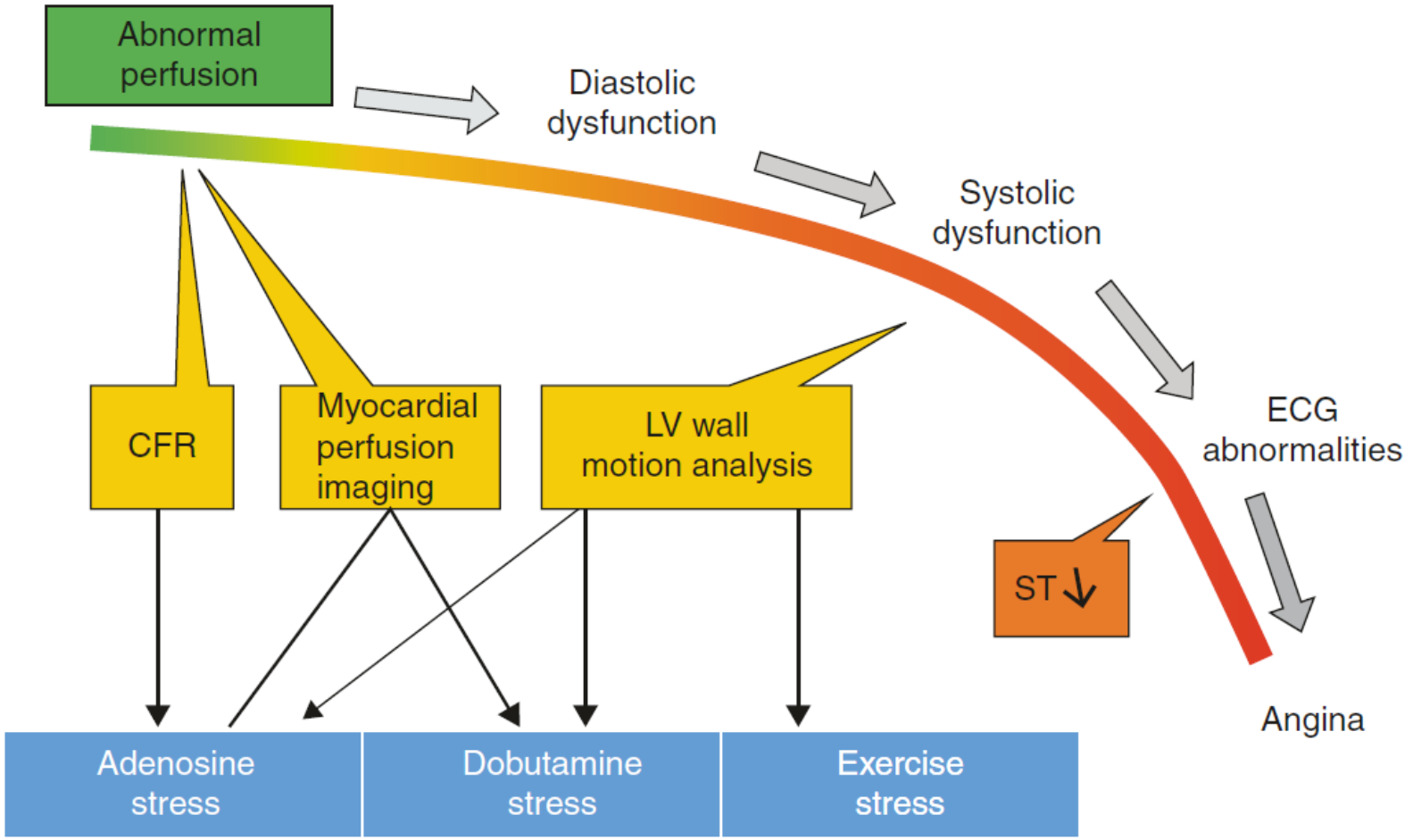
Coronary Flow and LV wall motion

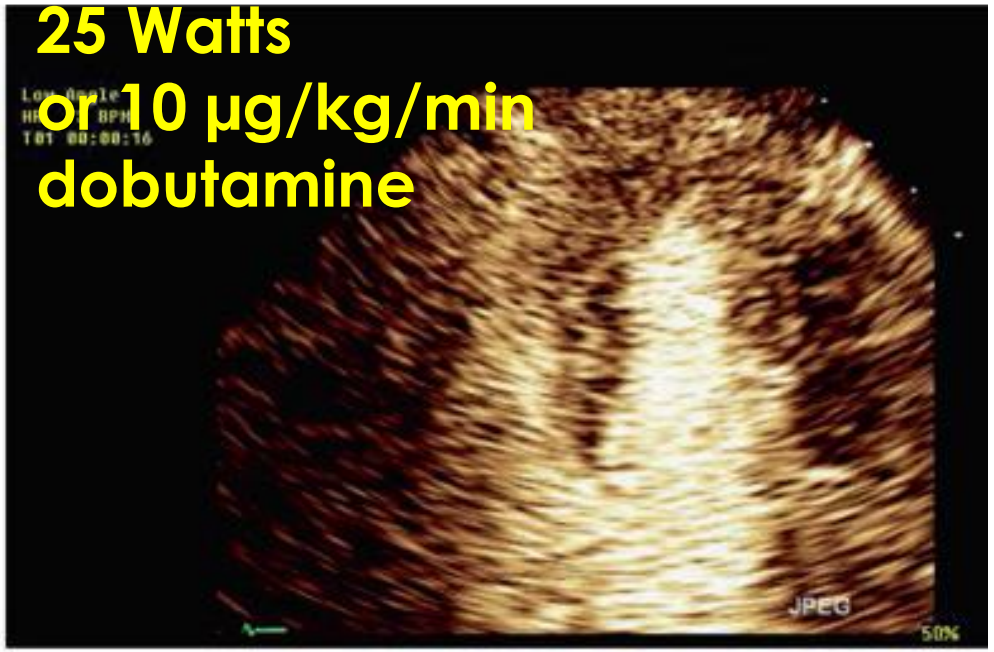


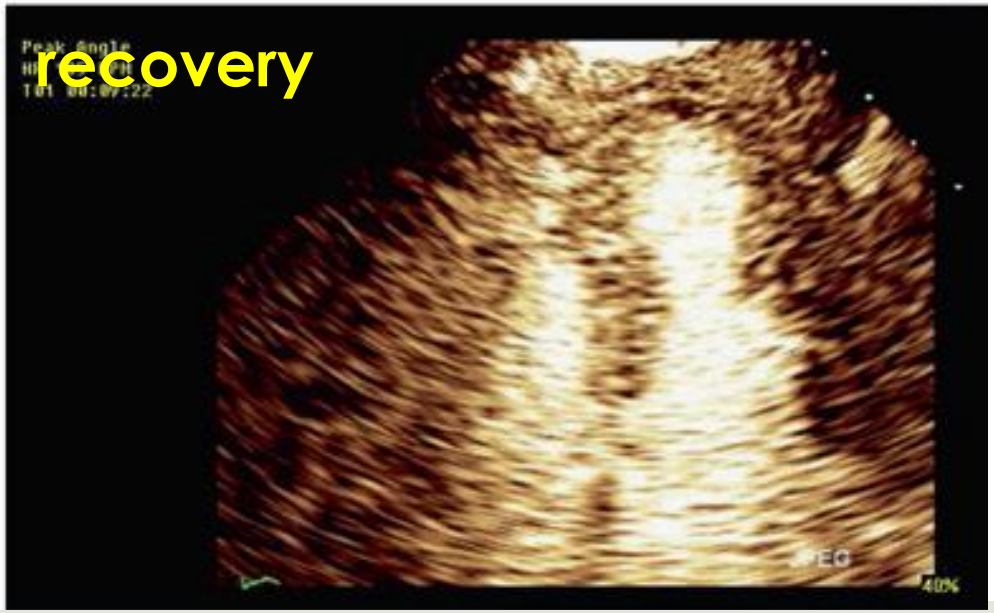
Severity of chest pain

1.	Very mild
2.	Mild
3.	Moderate
4.	
5.	Severe
6.	
7.	Very severe
8.	
9.	Very, very severe
10.	Maximum

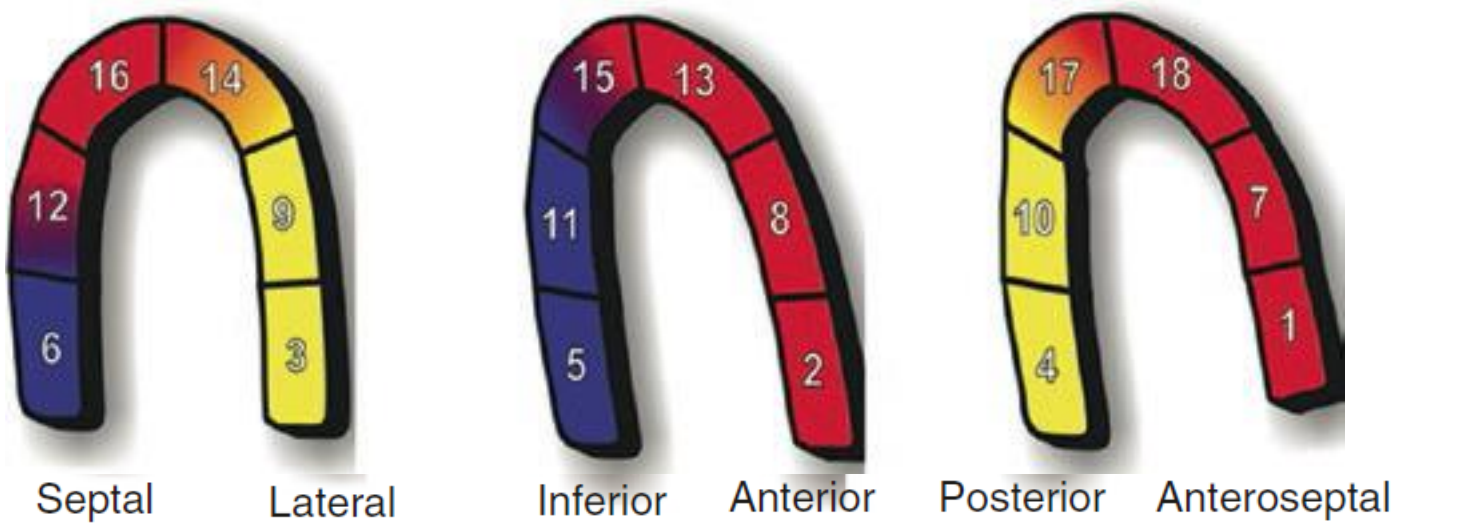

Rest
Worst
I
LVL 0.1
SLP 3
LVL -0.3
SLP 1
Recovery 6:30
aVR
LVL -0.1
SLP -3
LVL -0.1
SLP -3
Rest
V1
LVL 0.4
SLP 1
LVL -0.4
SLP -9
Recovery 0:30
V4
LVL 0.1
SLP 0
LVL -1.4
SLP -10
3 3:22
II
LVL 0.1
SLP 1
LVL -1.3
SLP -2
3 2:42
aVL
LVL 0.0
SLP 2
LVL 0.0
SLP 2
Rest
V2
LVL 0.2
SLP 0
LVL -1.7
SLP -12
3 2:52
V5
LVL 0.0
SLP 0
LVL -1.2
SLP -8
3 3:22
III
LVL 0.0
SLP -2
LVL -1.6
SLP -13
3 3:22
aVF
LVL 0.0
SLP 0
LVL -1.4
SLP -8
3 3:12
V3
LVL 0.2
SLP 1
LVL -1.6
SLP -12
3 3:22
V6
LVL -0.1
SLP 1
LVL -2.1
SLP 1
3 1:42
Echo trumps ECG

end-systolic frames





Territories of the coronary arteries



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Coronary territories:

- Right coronary artery
- Left anterior descending artery (LAD)
- Circumflex artery

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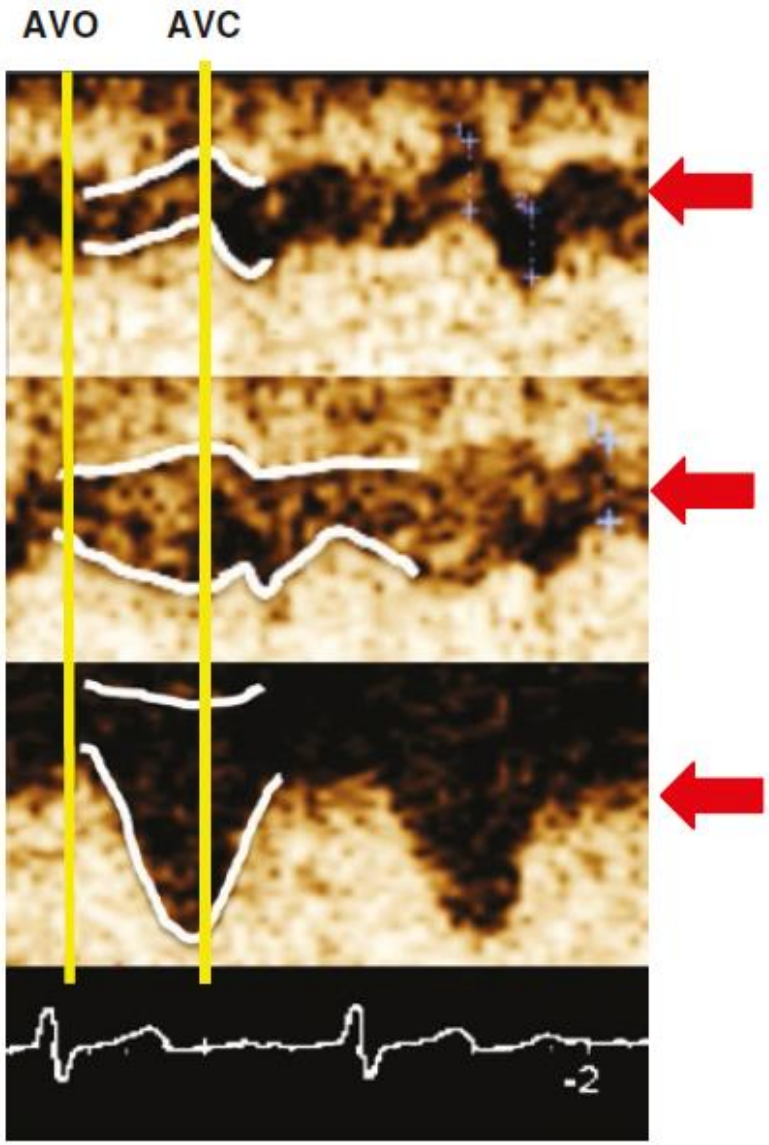
Rest	+	Stress	=	Diagnosis
Normo-kinesis	+	Normo/ Hyperkinesis	=	Normal
Hypo-Kinesis	+	Normo/ Hyperkinesis	=	Normal
Normo-/	+	Hypo, A,Dyskinesis	=	Ischaemia
Hypo-Kinesis	+	A, Dyskinesis	=	Ischaemia



dyskinesis:

- no septal thickening, but stretching and paradoxical motion during systole, postsystolic shortening

hypokinesis:

- reduced septal thickening during systole. subendocardial > subepicardial
- additional septal thickening after aortic valve closure (postysstolic shortening)

normokinesis:

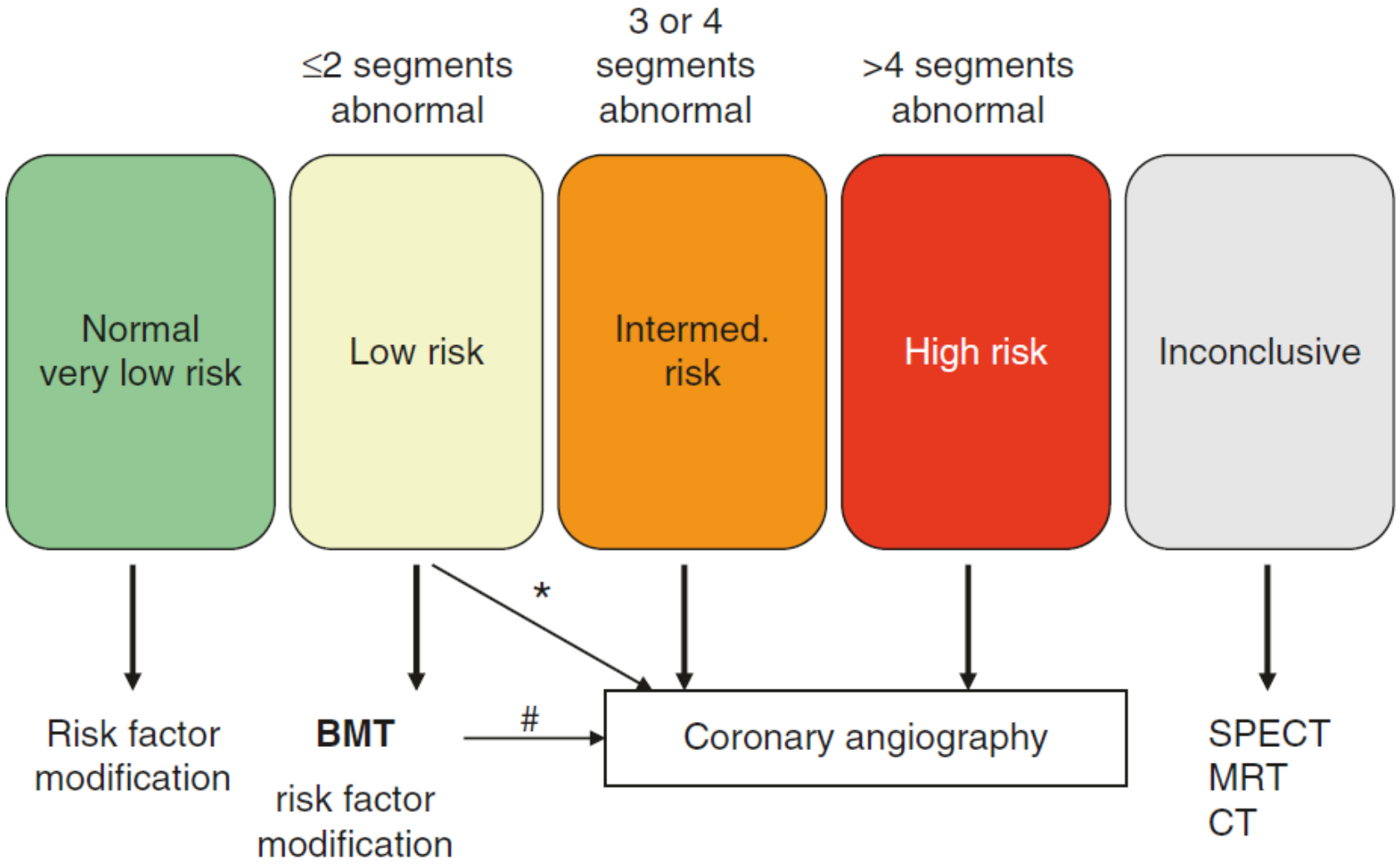
- thickening >50% during systole, subendocardial > subepicardial

akinesis:

- no thickening, during diastole postsystolic shortening

Becher H, Helfen A. Contrast Echocardiography – Compendium for clinical Practice, Springer 2019

Management after stress echocardiography



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Remember

A normal stress echocardiogram does not rule out coronary stenoses > 50% (for example, when there is sufficient collateral flow, or only a small ischemic myocardial segment), but a normal stress echocardiogram makes it very unlikely that the patient will have major cardiac events (death, myocardial infarction) within the year after the stress echocardiogram (good prognosis)

Referral to coronary angiography

Low risk study Minor area of ischemia	Patients with angina despite best medical therapy
Intermediate to high risk study Ischemia at low level of stress and/or LV wall motion abnormalities or Perfusion defects in multiple segments/regions	Symptomatic and asymptomatic patients

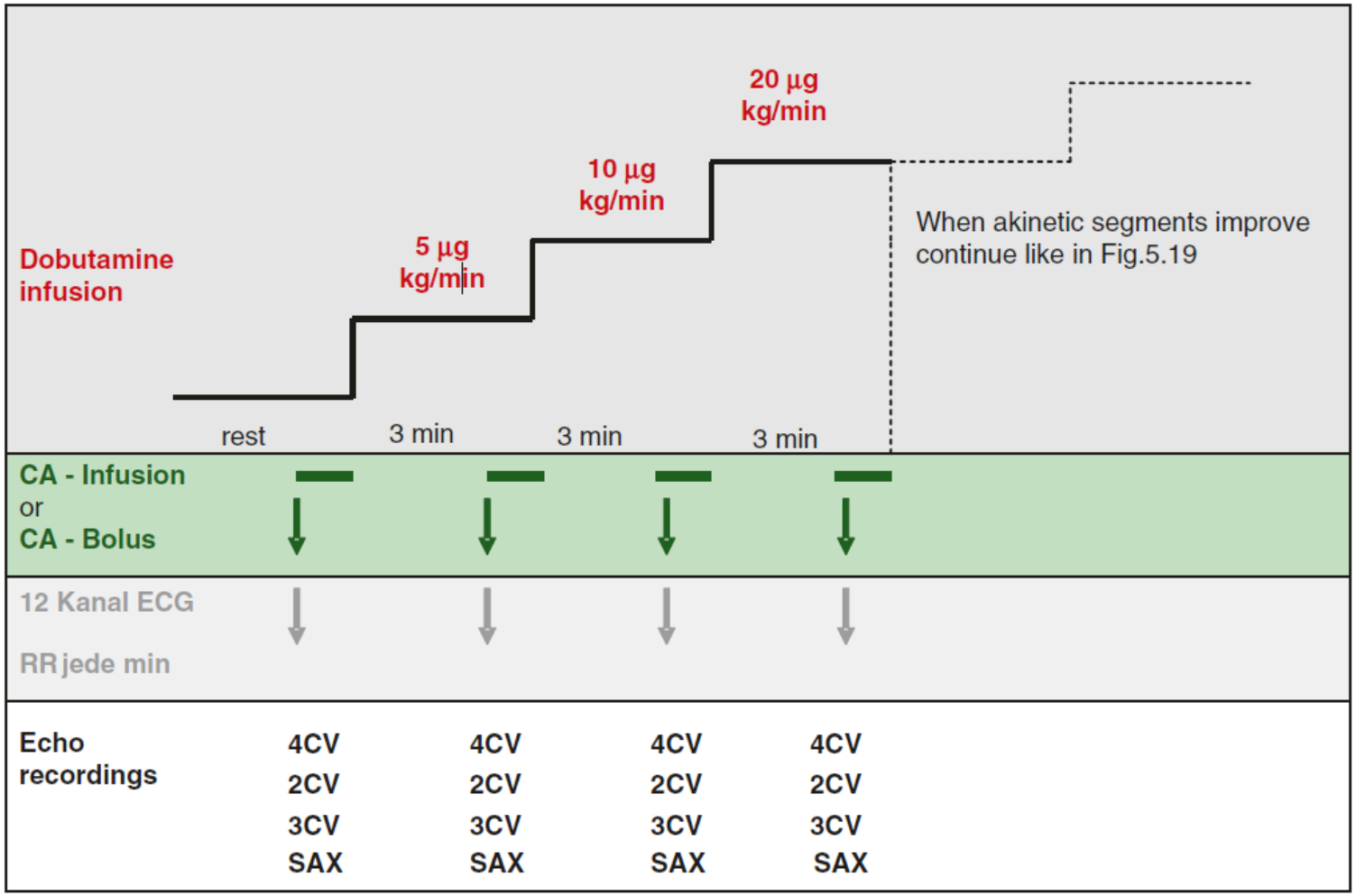
Indication for viability testing in patients with heart failure

2016 ESC Guidelines for acute and chronic heart failure
Non-invasive stress imaging (CMR, stress echocardiography, SPECT, PET) may be considered for the assessment of myocardial ischaemia and viability in patients with heart failure and CAD (considered suitable for coronary revascularization) before the decision on revascularization. Class IIb, Level of evidence B

Echocardiographic Methods for Assessment of Myocardial Viability

Rest echocardiography
Diastolic LV wall thickness (rest) < 6 mm: viability unlikely
Homogeneous opacification in myocardial contrast echocardiography indicates viability (Table 5.43)
Dobutamine stress echocardiography
Improvement in contractility by more than 1 level in 5 segments
Wall motion score index (WMSI) increases > 0.25 during low-dose dobutamine
Biphasic response (improvement at low-dose dobutamine, deterioration at higher dose)

Low dose dobutamine stress echocardiography



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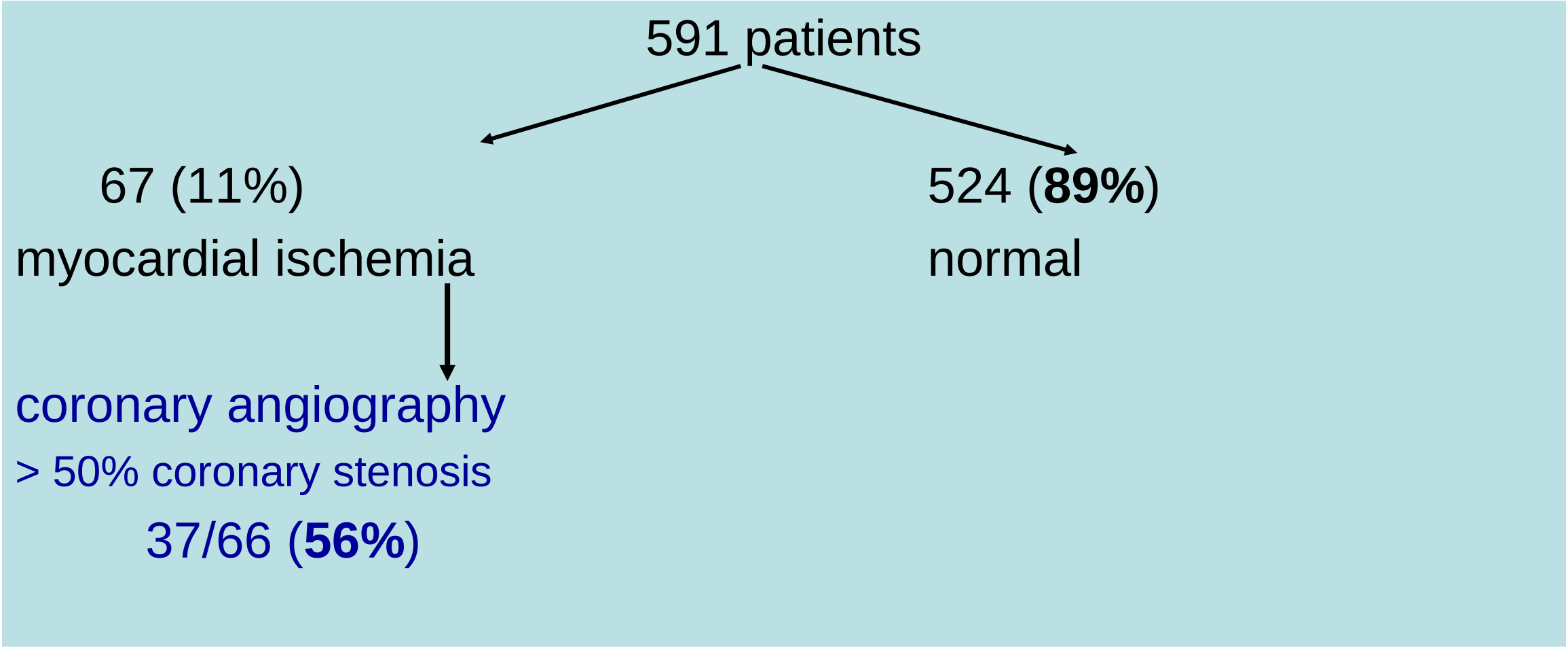
Stress Echo in Patients with Chest Pain and no previous history of CAD



Ahmadvazir S et al. Am Heart J 2014; 168:229-36

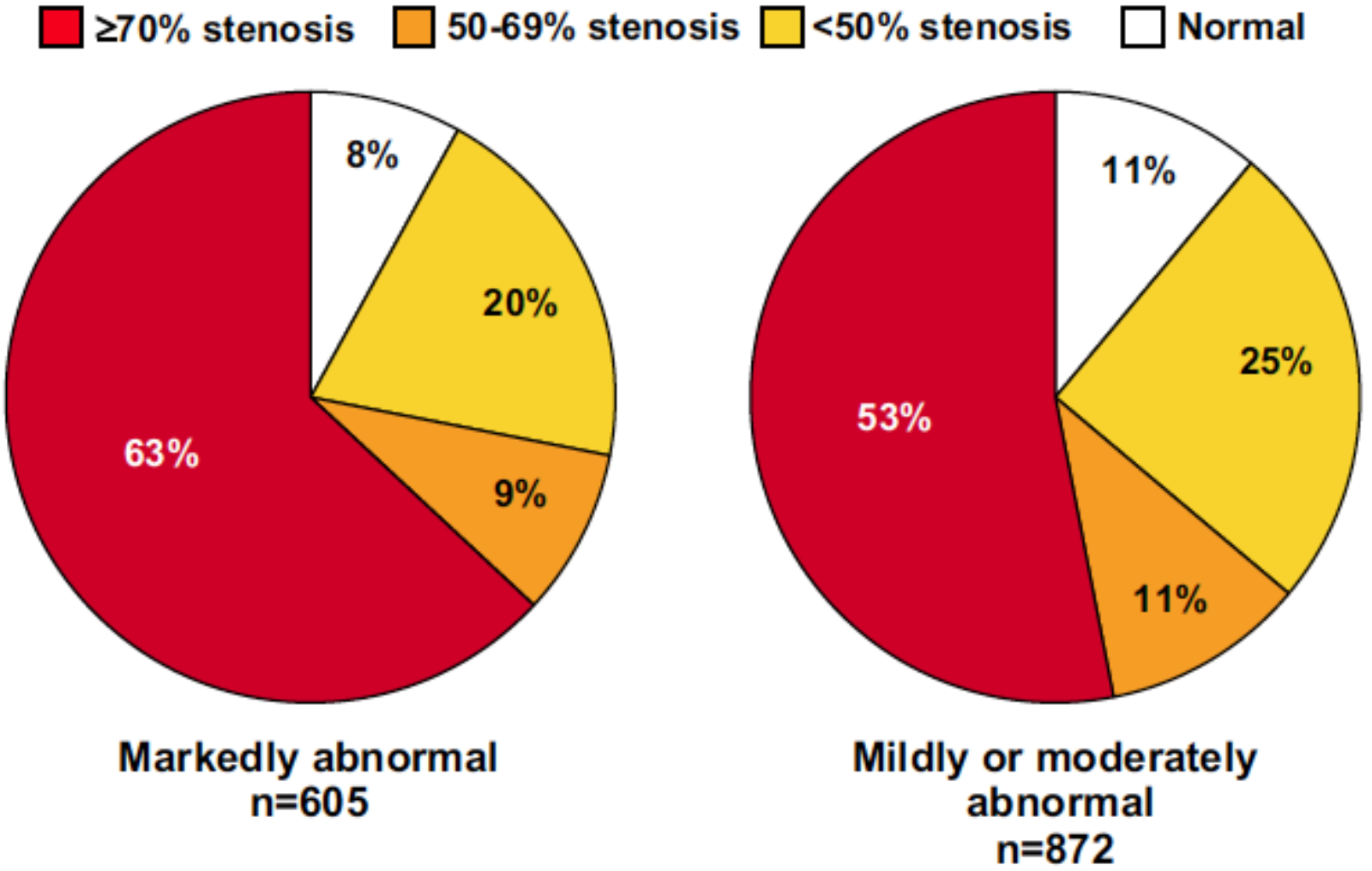
Characteristics and Outcomes of Patients With Abnormal Stress Echocardiograms and Angiographically Mild Coronary Artery Disease (<50% Stenoses) or Normal Coronary Arteries

Aaron M. From, MD, Garvan Kane, MD, PhD, Charles Bruce, MD, Patricia A. Pellikka, MD, Christopher Scott, MS, and Robert B. McCully, MD, *Rochester, Minnesota*

JASE 2010; (23) 207-214

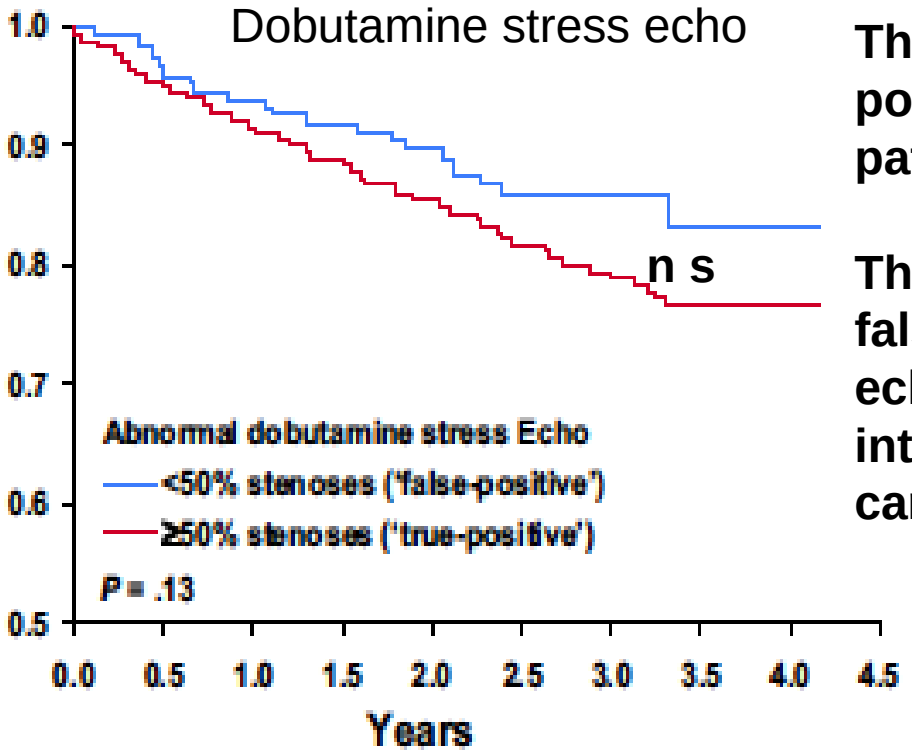
- 1,477 patients with positive stress echo
- All underwent coronary angiography
- 480 (32.5%) had “false-positive” results

The Mayo Clinic Experience:
1,477 patients with positive stress echo



From AM, JASE 2010

Mortality According To Stress Echo Results



The outcomes of patients with false-positive results were similar to those of patients with true-positive results.

This finding suggests that patients with false-positive results on stress echocardiography should still receive intensive risk factor management and careful clinical follow-up.

From AM, JASE 2010

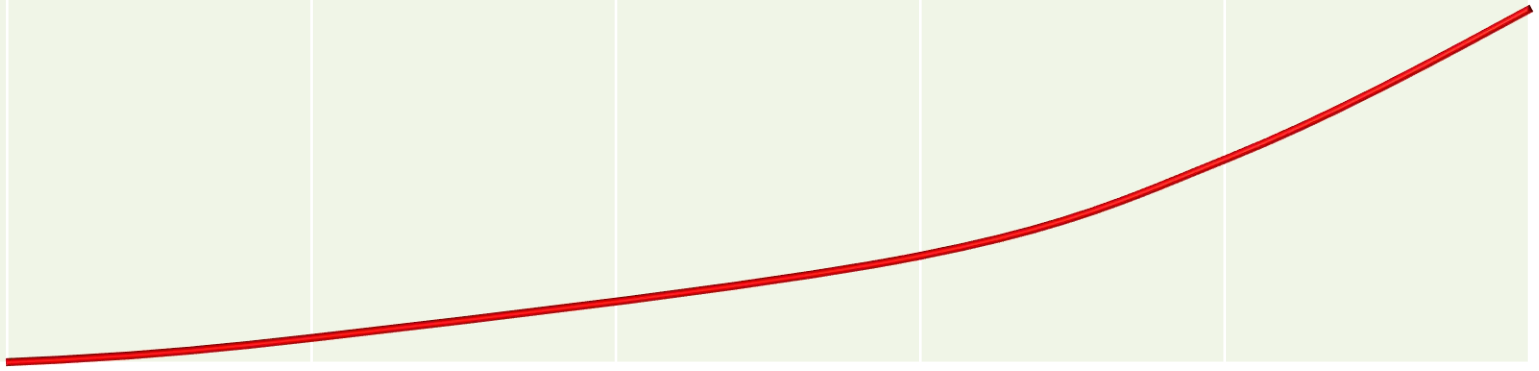
Benefits of adding perfusion imaging in Dobutamine Stress Echocardiography

- Higher diagnostic confidence for exclusion significant CAD
- Normal perfusion at peak stress reassuring in segments with questionable wall motion
- Normal perfusion probably reassuring when target heart rate is not achieved

- Higher sensitivity for detection CAD and microvascular disease
- More accurate assessment of ischemic burden

Risk Assessment in Dobutamine Stress Echo

Segments with						
WMA	0	0	1 or 2	1 or 2	≥ 3	≥ 3
abnormal perfusion	0	any	segments with WMA	and in adjacent segments with no WMA	segments with WMA	and in adjacent segments with no WMA
probability of coronary stenoses >70%						

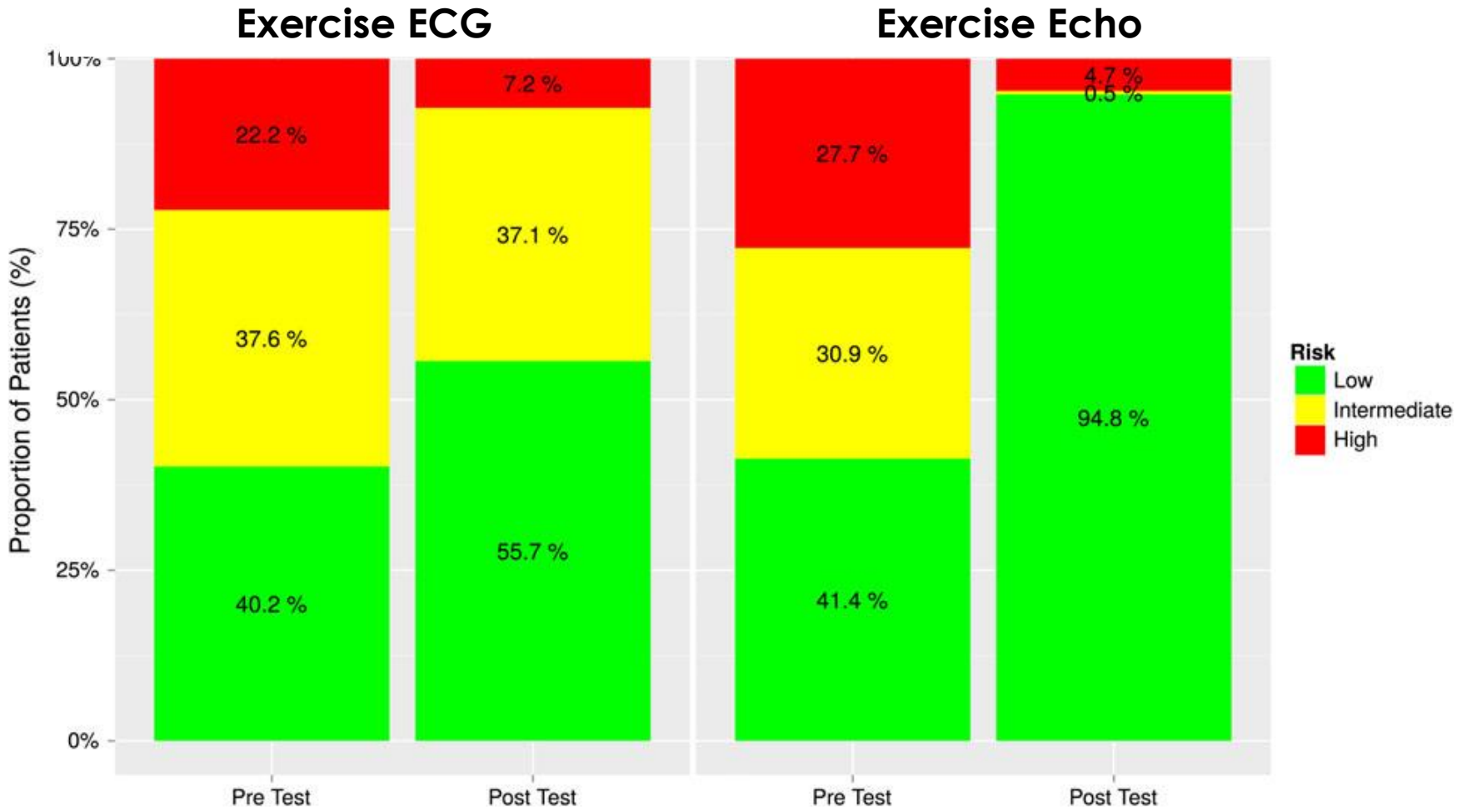


Contrast Echocardiography – Training Requirements

- Physicians should participate in a course on contrast echocardiography
- They should have basic life support (BLS) training.
- They should perform and interpret **at least 25 contrast echo studies under supervision.**
- They should maintain **competency by performing at least 50 contrast studies per year**.

2017 EACVI Clinical practice of contrast echocardiography: recommendation

Pre- and Post stress echo classification



Zacharias K et al. European Heart Journal – CVI (2017) 18, 195–202