

Stress Echo: How to Improve Your Batting Average

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1

Disclosures

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- Siemens Healthineers: research grant
- Philips Imaging: funding for regional rounds
- Ultromics: consulting, research grant
- Springer publisher, Oxford University press: book royalties

2

Telephone call from the cath lab



Objectives:

Tips for exercise and dobutamine stress
How to communicate abnormal findings

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Tip 1: Consider the pre-test probability of obstructive CAD in symptomatic patients



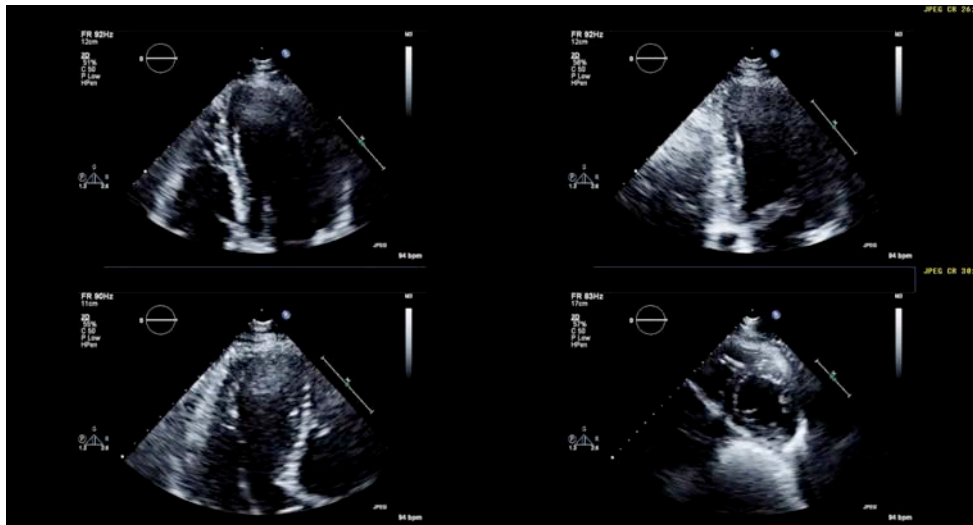
	Typical		Atypical		Non-anginal		Dyspnoea ^a	
Age	Men	Women	Men	Women	Men	Women	Men	Women
30–39	3%	5%	4%	3%	1%	1%	0%	3%
40–49	22%	10%	10%	6%	3%	2%	12%	3%
50–59	32%	13%	17%	6%	11%	3%	20%	9%
60–69	44%	16%	26%	11%	22%	6%	27%	14%
70+	52%	27%	34%	19%	24%	10%	32%	12%

77% ESC 2013
Diamond/Forrester

Knuuti J et al. 2019 ESC guidelines
Chronic Coronary Syndrome, Eur Heart J

4

72 yrs, male, smoker, atypical angina



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72 yrs, male, smoker, atypical angina



- 1A. Stress echo is not indicated because of low diagnostic yield
- 2B. UEA is not needed
- 3C. UEA may be considered at peak stress
- 4D. UEA should be given both at rest and during stress

6

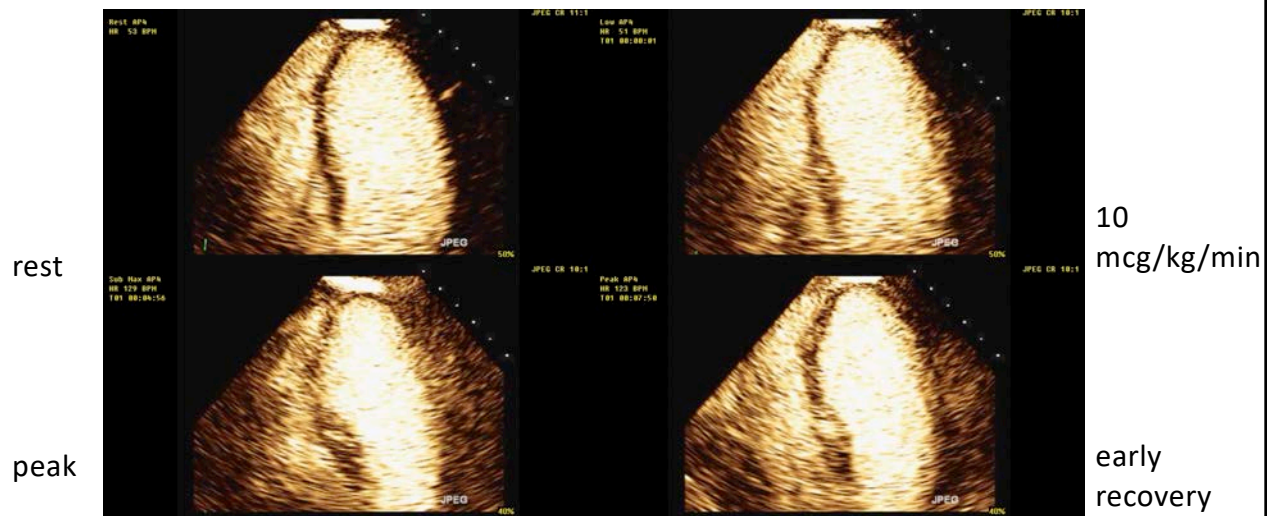
72 yrs, male, smoker, atypical angina



- 1A. Stress echo is not indicated because of low diagnostic yield
- 2B. UEA is not needed
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- 4D. UEA should be given both at rest and during stress**

7

Tip 1: use UEA



8

1.Tip: use UEA



- The only FDA-approved use for UEAs in cardiovascular disease is for LV opacification at rest.
- However, given significant scientific literature support, other off-label uses of UEAs (such as MP, pediatric and vascular applications, and use during stress echocardiography) are recommended.

Clinical Applications of Ultrasonic Enhancing Agents in Echocardiography: 2018 American Society of Echocardiography Guidelines Update

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Clinical Applications of Ultrasonic Enhancing Agents in Echocardiography: 2018 American Society of Echocardiography Guidelines Update



	COR*	LOE#
UEAs should be used whenever adequate segmental visualization within any coronary artery territory cannot be achieved with resting unenhanced echocardiography	I	A
Very Low MI imaging is the preferred imaging mode and should be used with intermittent flash high-MI impulses (five to 15 frames at an MI of 0.8–1.0) to achieve homogeneous LVO and analysis of RWM	IIa	B-R

*class of recommendation
#level of evidence

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UEA when there is 'adequate' non contrast image quality ASE American Society of Echocardiography

classification of segments with and without UEAs

NO UEA	with UEA			
	normal	hypokinetic	akinetic	dyskinetic
normal	2311	345	27	0
akinetic	185	207	44	6
hypokinetic	27	38	73	10
dyskinetic	1	2	2	1

Larsson et al. Cardiovascular Ultrasound (2016) 14:2

11

UEA in patients with adequate non contrast image quality

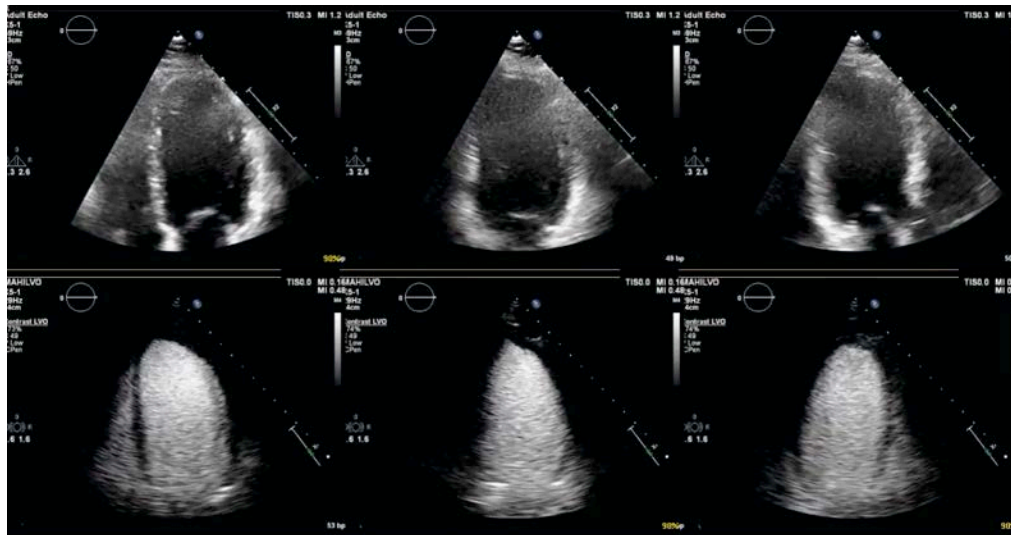


- 192 patients without indications for contrast echocardiography, referred for stress echocardiography
- Intra-class correlation coefficient:
 - EF **0.95 (contrast)** 0.8 (non contrast)
 - WMSI **0.87 (contrast)** 0.61 (non contrast)
- Intra- and interobserver variability for experienced readers as well as the variability between inexperienced and experienced readers decreased for WMSI and EF after contrast analysis.

Larsson et al. Cardiovascular Ultrasound (2016) 14:2

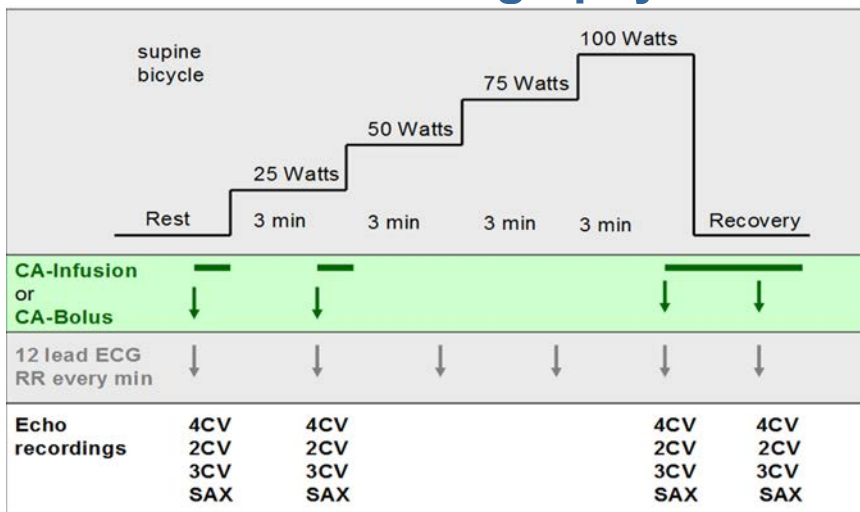
12

Optimize imaging planes with UEA



13

Stress 2D Echocardiography with UEA

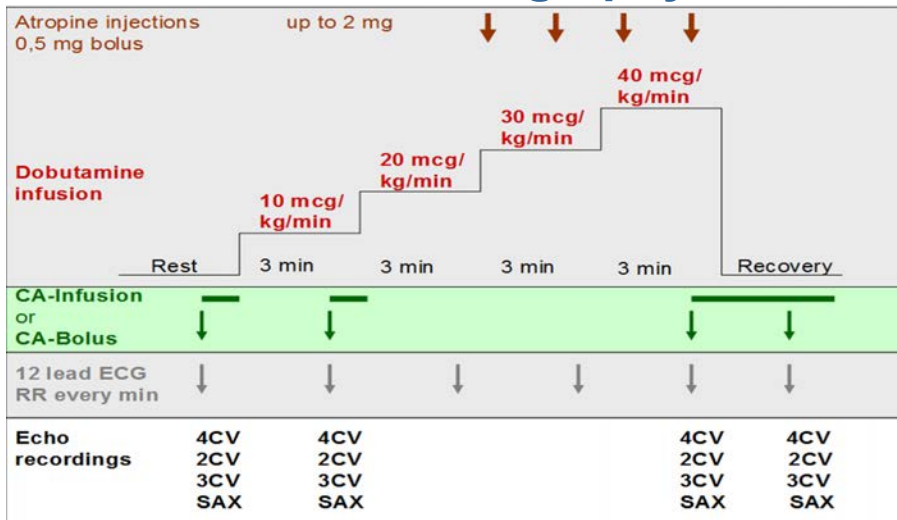


Becher H, Helfen A. Contrast Echocardiography Compendium for Clinical Practice, Springer 2019

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14

Stress 2D Echocardiography with UEA

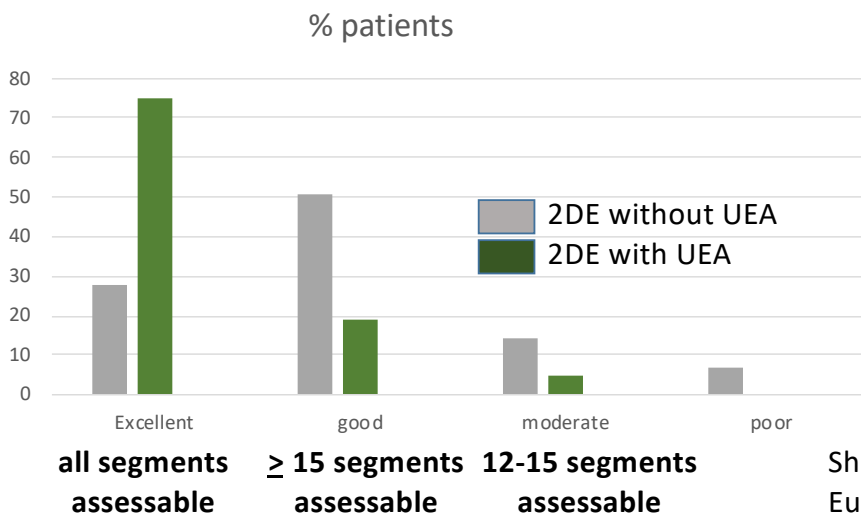


Becher H, Helfen A. Contrast Echocardiography Compendium for Clinical Practice, Springer 2019

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15

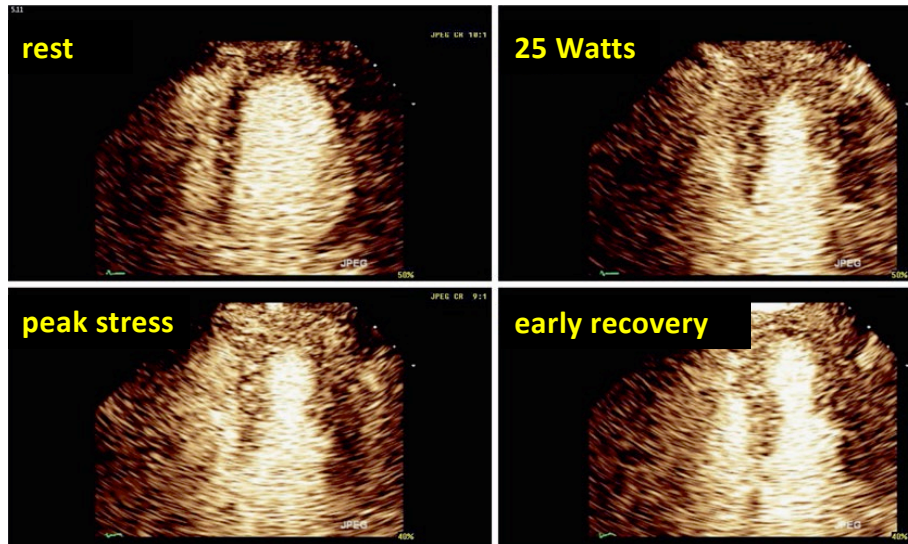
Image quality at peak stress in 718 patients



Shivalkar B et al.
European Heart Journal –
Cardiovascular Imaging (2019)

16

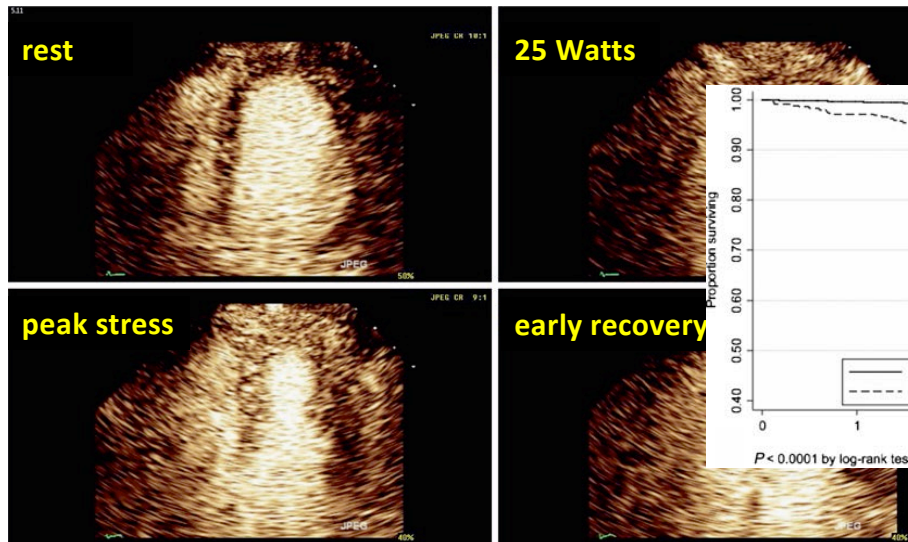
Tip 2: look for decrease in LV size (end-systole)



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17

Tip: look for decrease in LV size (end-systole)



Turakhia MP et.
Eur Heart J 2009

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UEAs for assessment of LV wall motion



What does it add to assessment of LV wall motion?

Increased accuracy for detecting CAD

Reduced inter-observer variability

Increased confidence to rule out disease

Does it complicate the stress protocol?

minor

What is the catch?

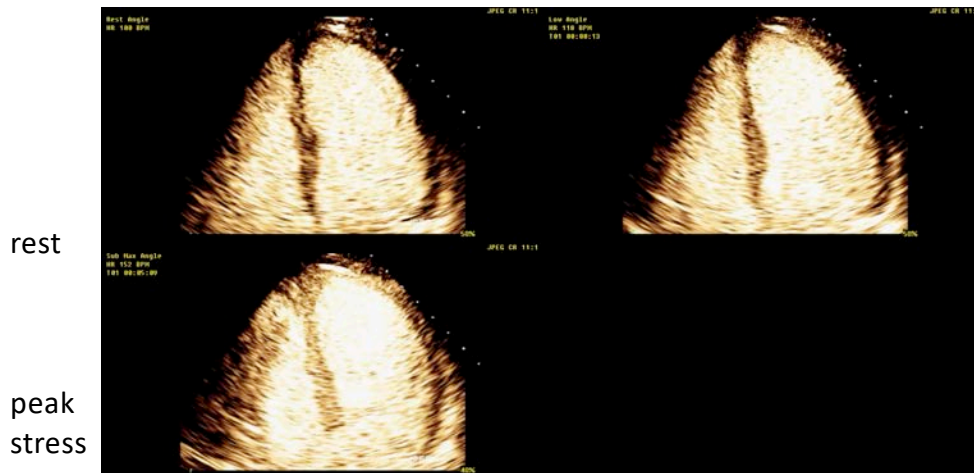
Very small risk of adverse events due to UEA

Additional costs

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19

Tip 3: assess myocardial perfusion in addition to LV wall motion – dobutamine stress



10 mcg/kg/min

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20

Clinical Applications of Ultrasonic Enhancing Agents in Echocardiography: 2018 American Society of Echocardiography Guidelines Update



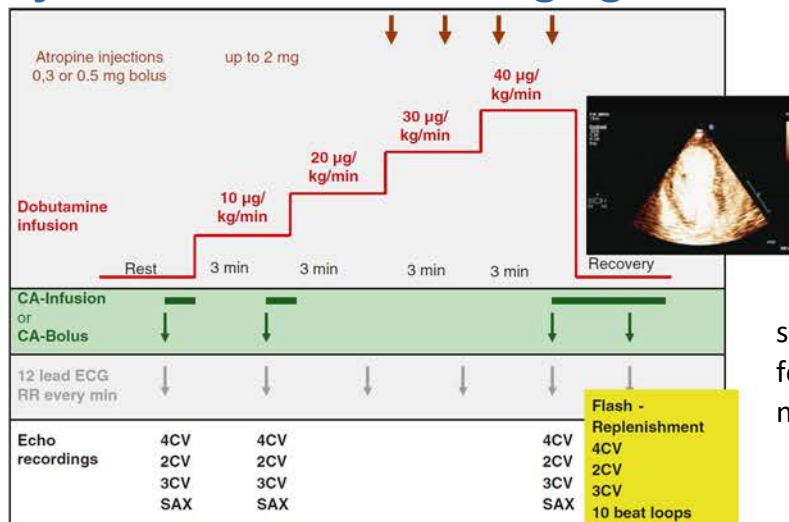
Although perfusion imaging with UEAs is off label, the detection of myocardial ischemia and viability can be enhanced when used in the correct setting by trained personnel	COR*	LOE#
Very Low MI perfusion imaging should be used with intermittent high-MI flash replenishment technique for simultaneous perfusion and wall motion assessment	Ila	B-R
Perfusion analysis combined with RWM should be considered during DSE to maximize the sensitivity and accuracy of the study for the detection of CAD and prediction of clinical outcome	Ila	B-R

*Class of recommendation
#Level of evidence

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Stress Echocardiography with Myocardial Perfusion Imaging



simplified protocol
for patient with
normal LV function at rest

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Compendium for Clinical Practice, Springer 2019

22

Flash-Replenishment-Method

Continuous infusion of UEA during peak stress

- homogenous, intensive myocardial opacification

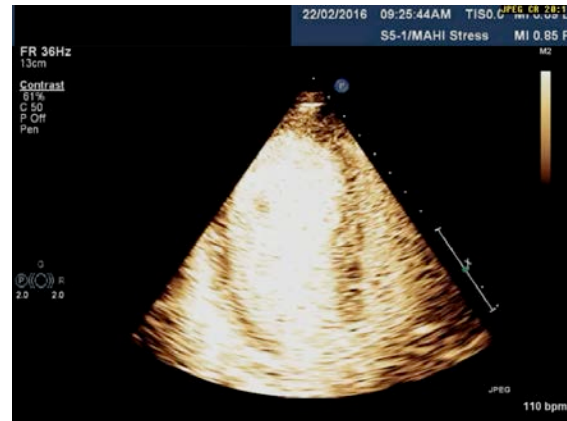
Very Low MI contrast specific imaging (MI<0.2)

Flash

- short interval (5-15 frames) of high MI imaging (MI>0.8)

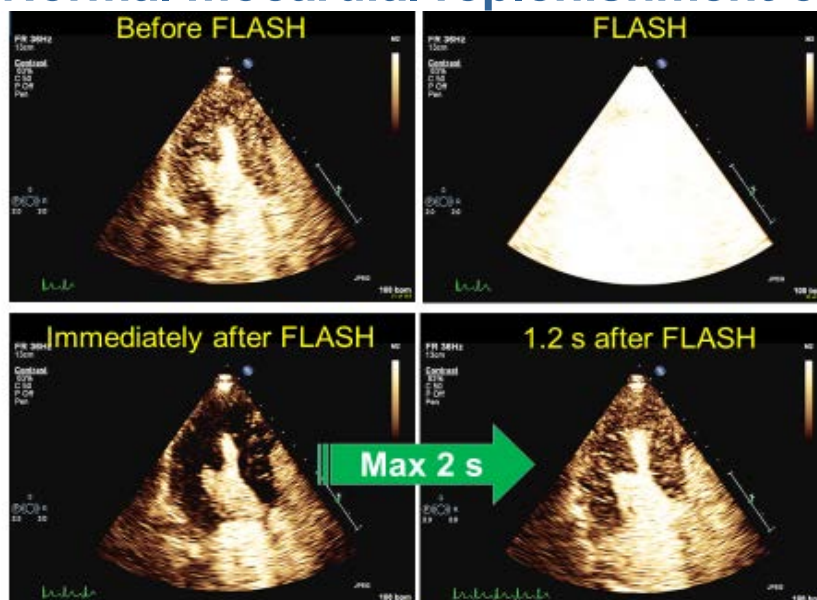
Normal replenishment

- myocardium opacified within 2 s at peak stress



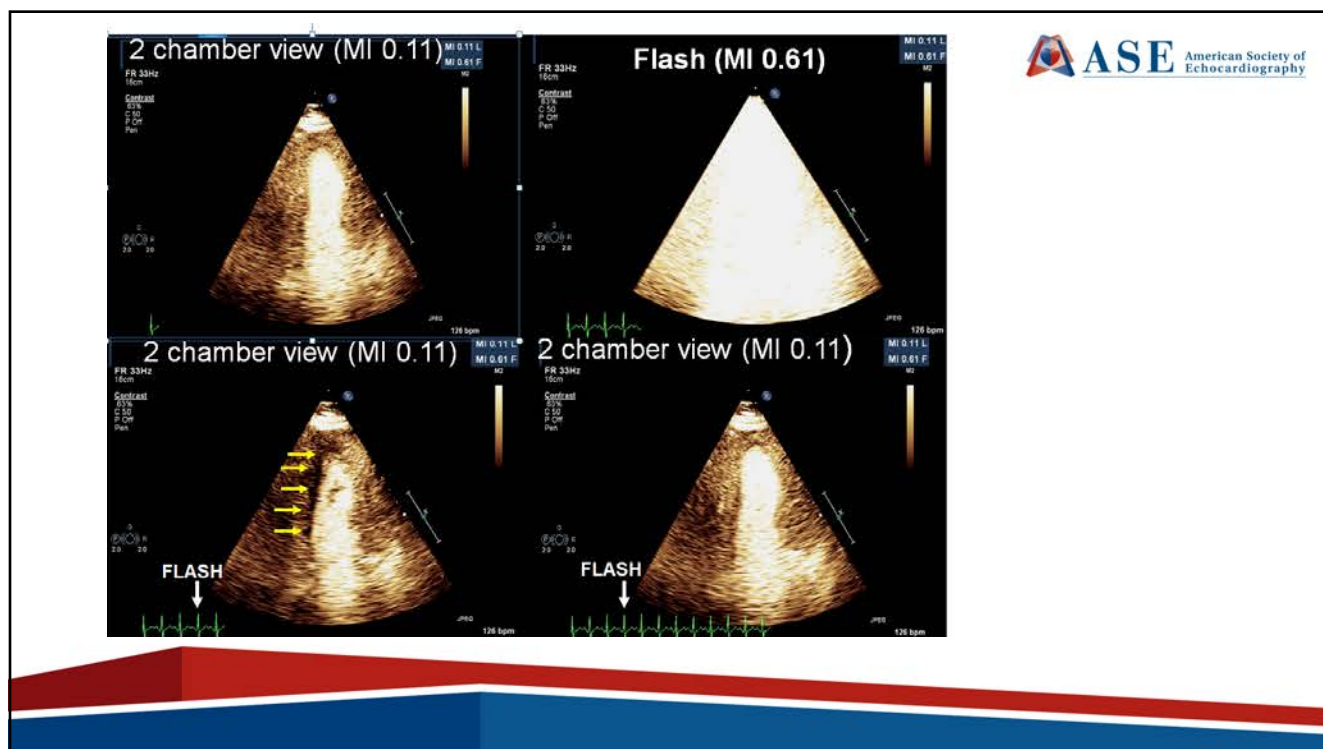
23

Normal myocardial replenishment of UEA

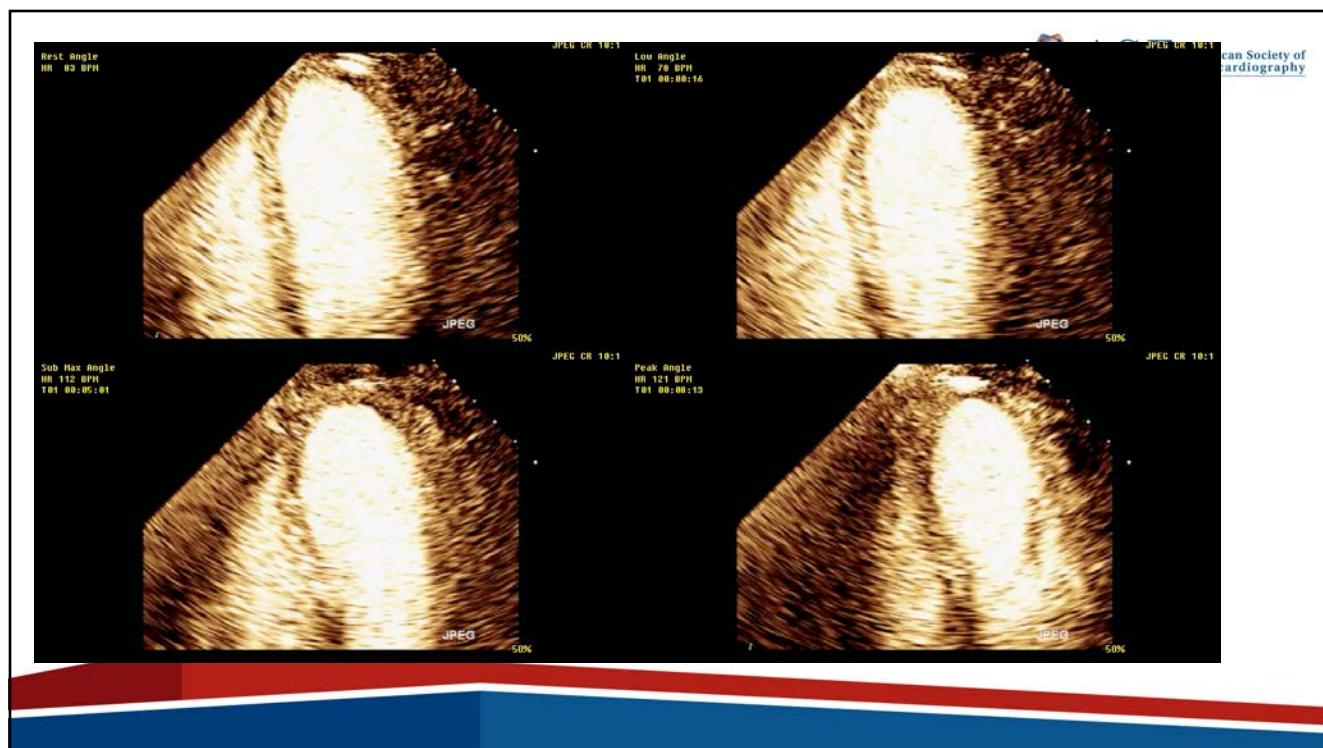


Becher H, Helfen A. Contrast Echocardiography
Compendium for Clinical Practice, Springer 2019

24



25



26

UEA for assessment of myocardial perfusion



What does it add to assessment of LV wall motion?

- increases confidence of normal findings
- more sensitive for detection of CAD
- better assessment of ischemic burden

Does it complicate the dobutamine stress protocol?

In patients with normal LV function at rest
flash replenishment only in early recovery

What is the catch?

- Not applicable in all pts/territories
- more sensitive to microvascular disease

27

Dobutamine stress: perfusion defect without regional wall motion abnormality



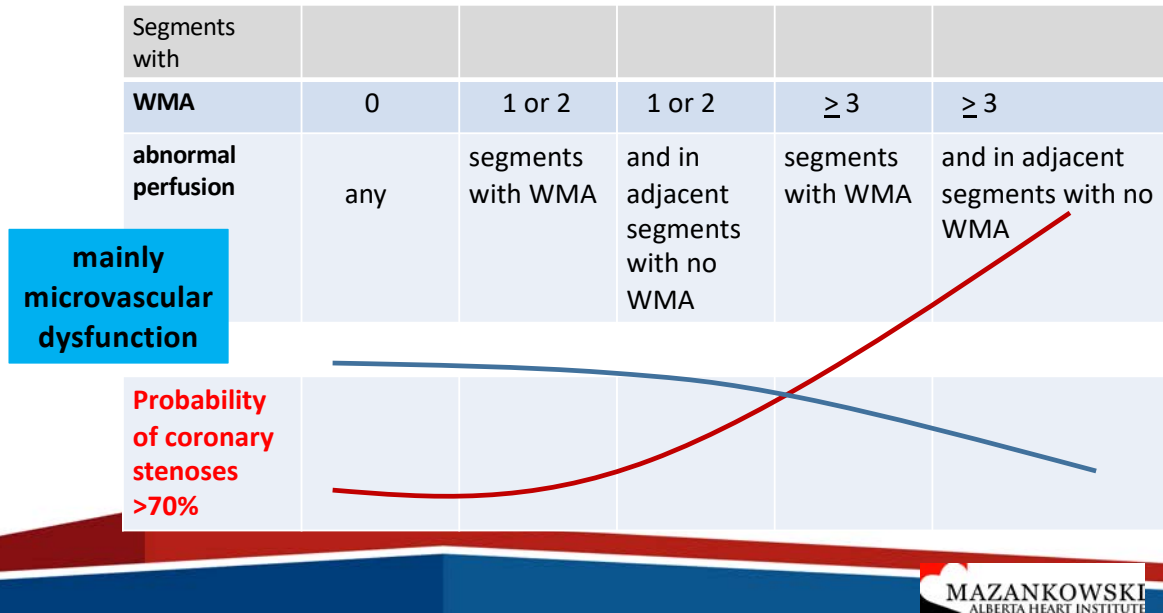
peak stress 4 chamber view



early recovery 2 chamber view

28

Assessment of myocardial perfusion in addition to LV wall motion



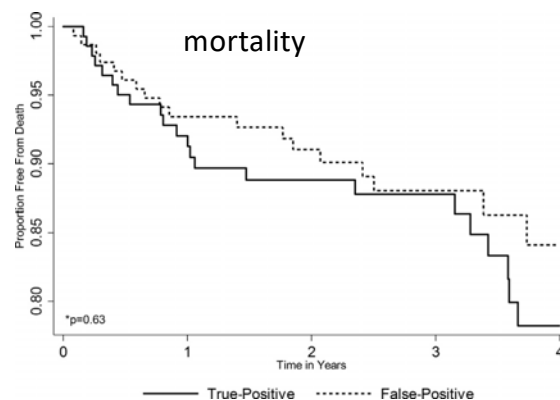
29

Poor prognosis of patients with 'false positive' stress echocardiogram



A total of 305 patients had positive SE results; of which 162 (53%) were false positive

Patients with FP results on SE could benefit from aggressive risk factor control and careful clinical follow-up.



Rachwan RJ et al. International J Cardiol 2019

30

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Take home messages

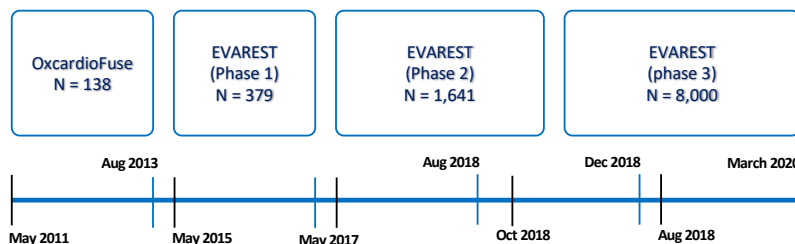
1. Consider the pre-test probability – in patients with low pretest probability stress echo is not good to rule in CAD
2. Use UEAs for wall motion analysis in exercise and dobutamine stress
3. Assess perfusion in dobutamine stress – it is also helpful to confirm normal wall motion
4. Patients with abnormal stress echocardiograms but without significant epicardial stenoses ('false positive studies') have a similar prognosis as pts with 'true positive' studies

31

The Future?

The computer reads the stress echocardiogram

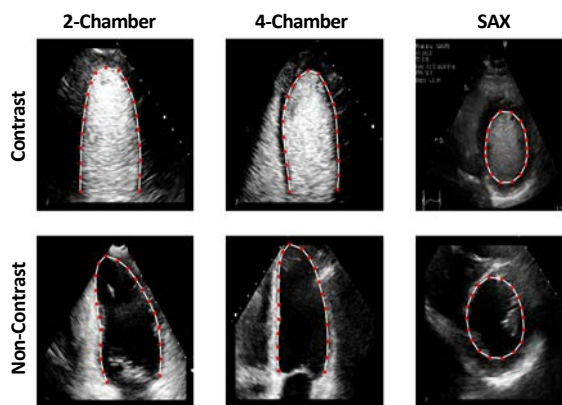
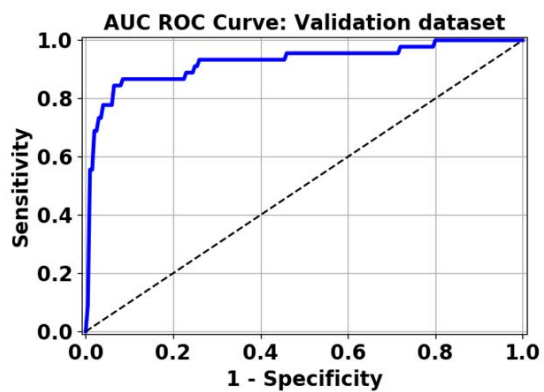
- Comparison with visual assessment
- UK multicenter study



Courtesy of Ultramics

32

Auto-Contouring and Analysis To predict outcome



FDA approval 12/2019

33



34

LAD coronary velocity reserve



What does it add to assessment of LV wall motion?

Confirms normal or abnormal wall motion findings in the LAD territory

Does it complicate the stress protocol?

Yes, but no prolongation of the test

What is the catch?

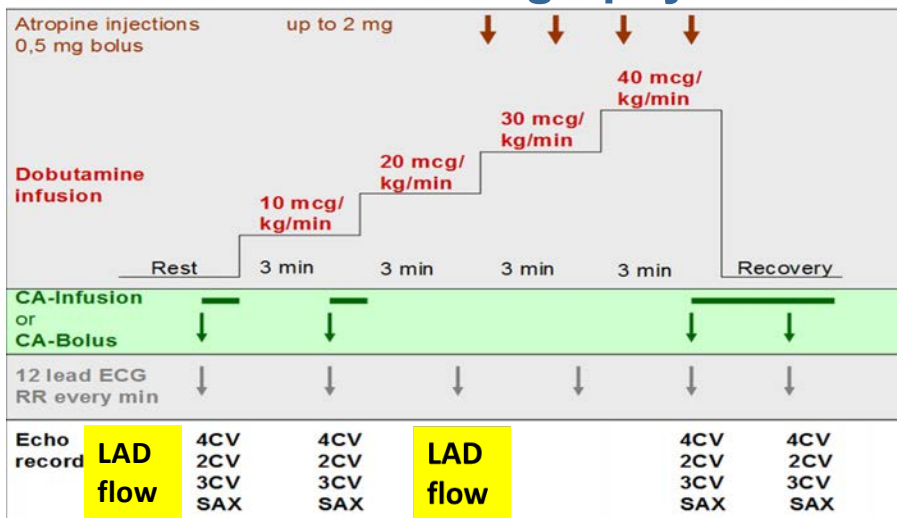
Often not applicable in RCA or LCX

more sensitive to microvascular disease than stress echo assessing only wall motion

EACV stress echo guideline

35

Stress 2D Echocardiography with UEA



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36

