ECHO Alex Conference 2010

Emergency Echo, Emergency Setting, “ABCD“ Approach

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Emergency Echocardiography

- Why ECHO in cardiac emergencies?
- Emergency setting
- Emergency clinical presentations
- Simple and comprehensive answers
- Medicolegal issues
- “ABCD” approach

Why Echo in Cardiac Emergencies?

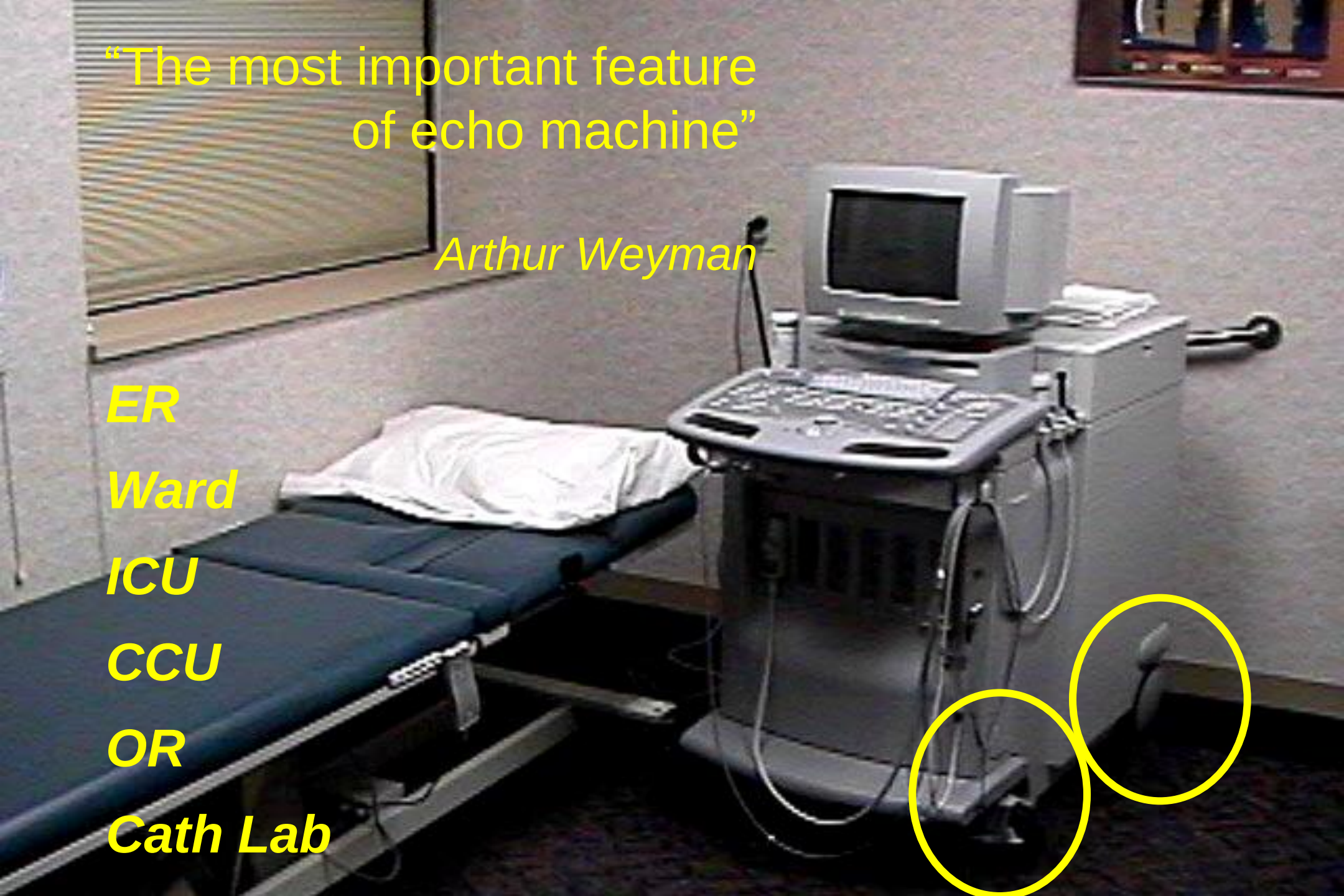
- Cardiologists consider ECHO as the single most valuable technique to assess unstable CV patient

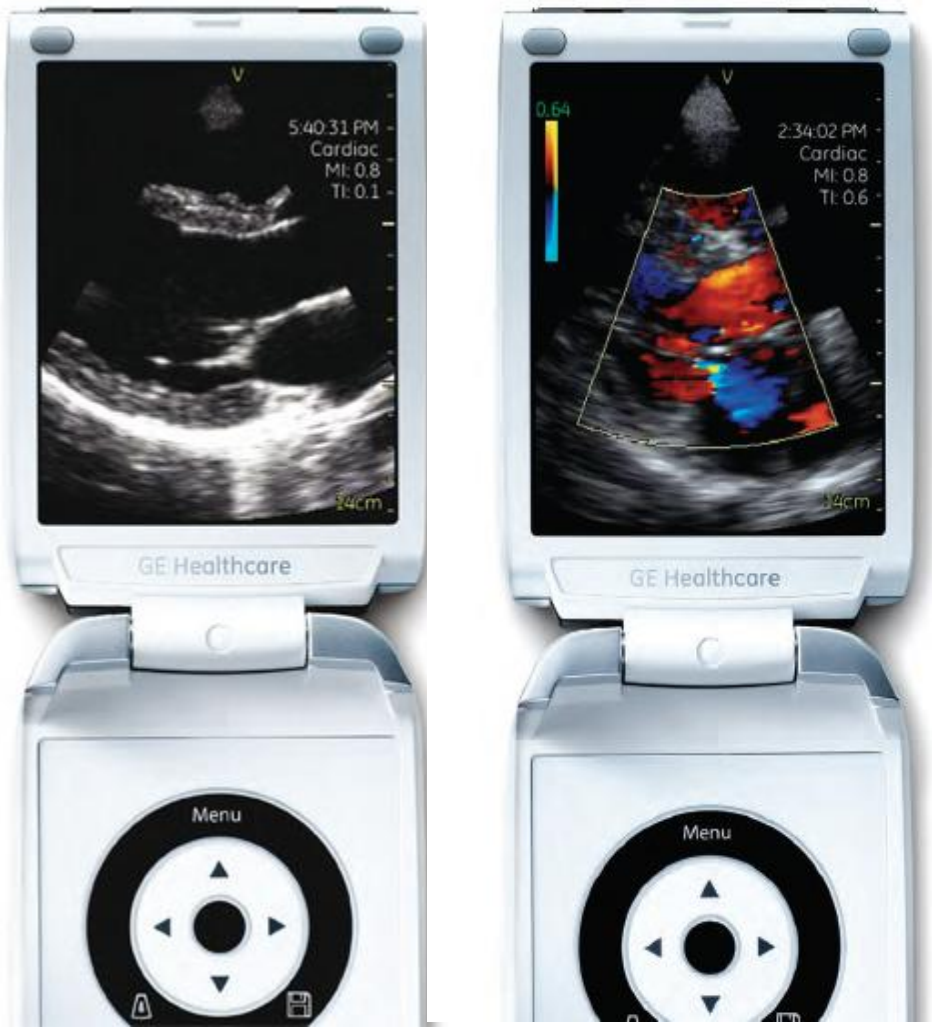
Availability

- noninvasive
- harmless
- portable
- inexpensive

Accuracy

- structure
- function
- hemodynamics

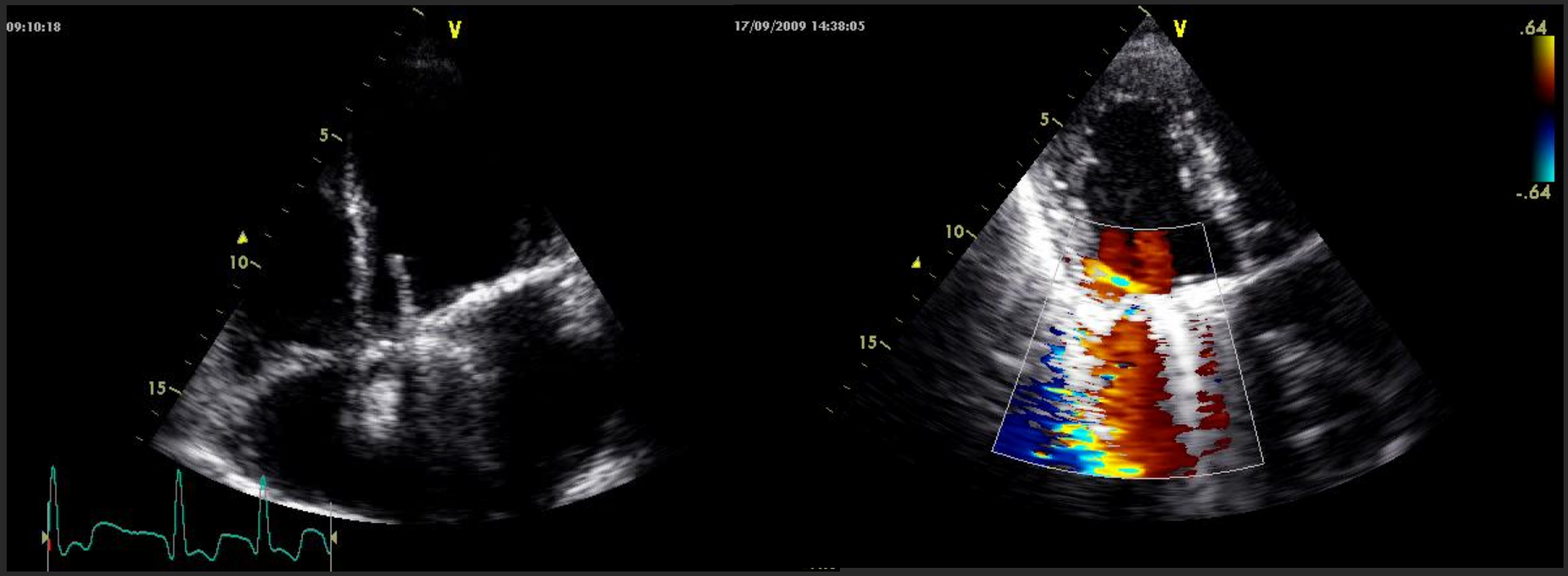

"The most important feature of echo machine"
Arthur Weyman
ER
Ward
ICU
CCU
OR
Cath Lab


5:40:31 PM
Cardiac
MI: 0.8
TI: 0.1
GE Healthcare
Menu
0.64
2:34:02 PM
Cardiac
MI: 0.8
TI: 0.6
GE Healthcare
Menu


GE Healthcare
Menu
Vscan

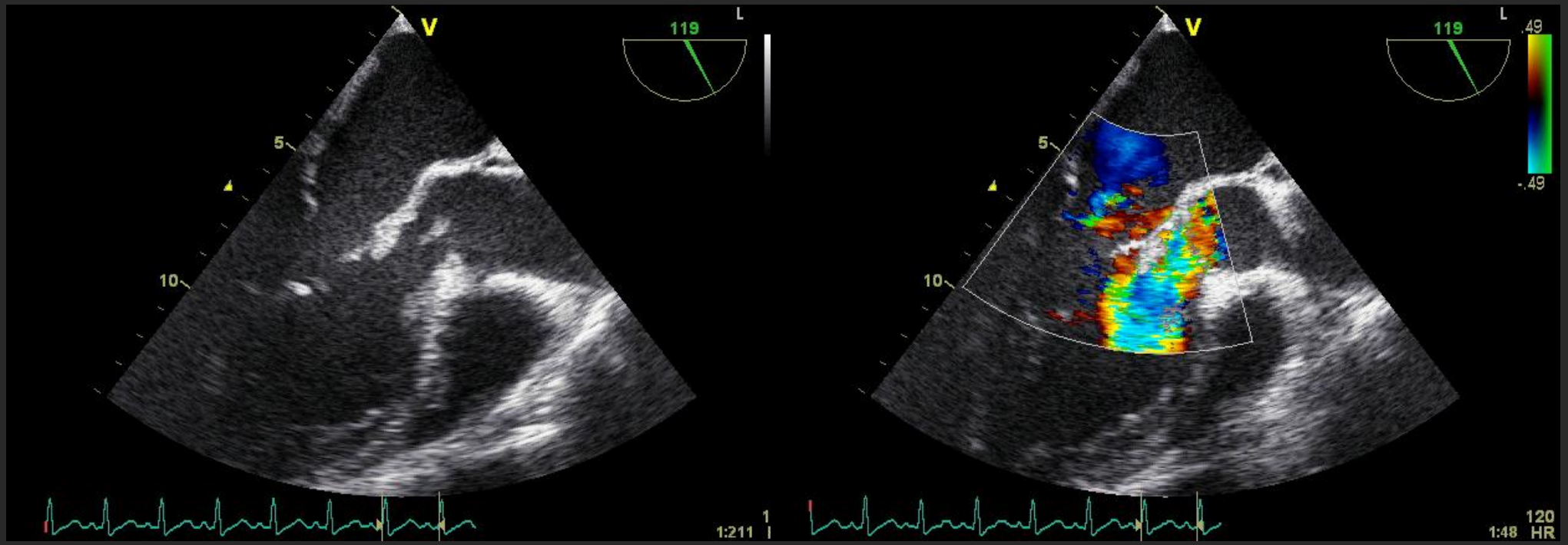
TTE

New murmur, fever



TEE

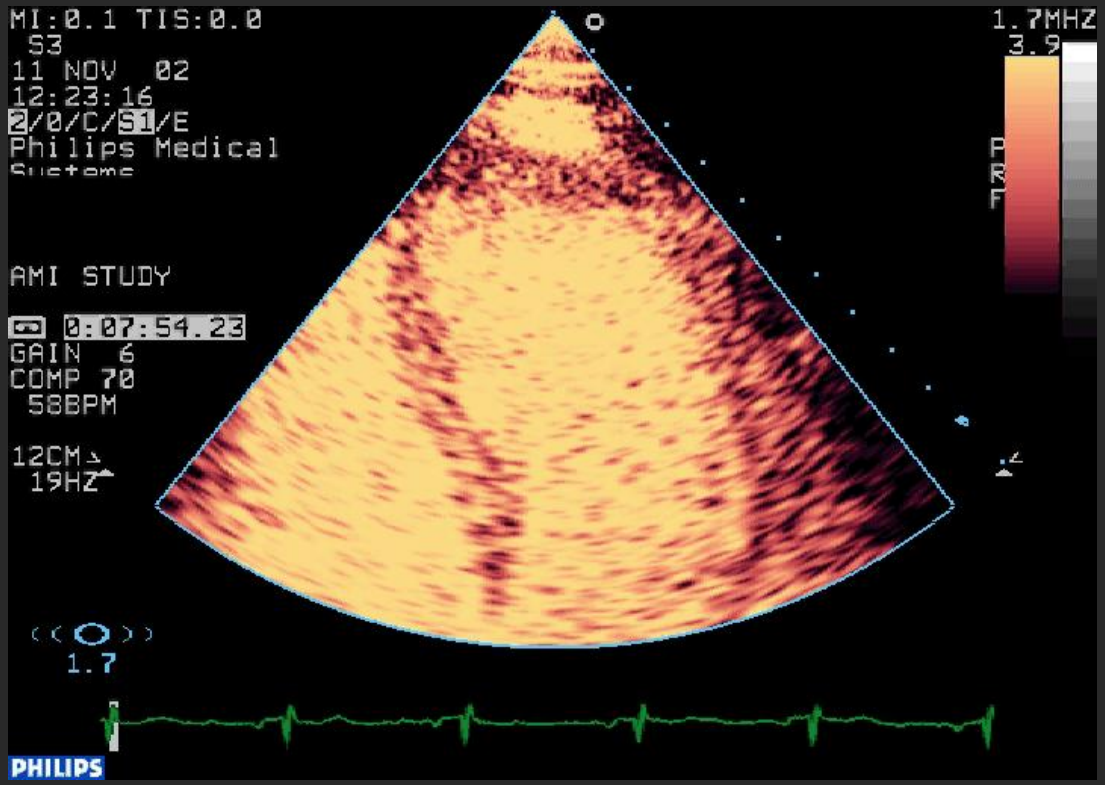
Acute Severe Dyspnea



Contrast Echo

LV Opacification

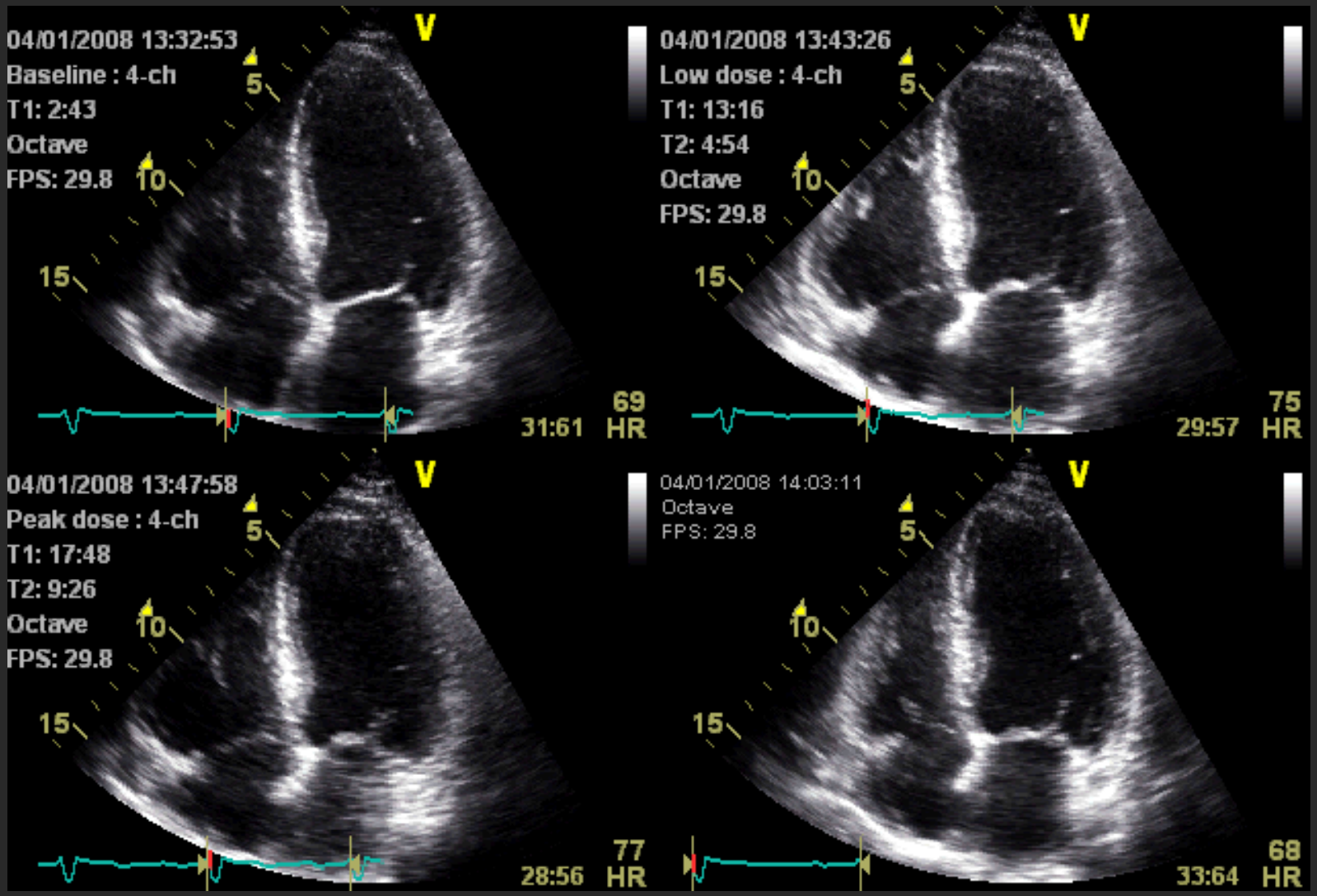
Myocardial perfusion



Courtesy of R. Senior

Stress Echo

Dip-Echo



Courtesy of MJ Andrade

Emergency Echocardiography

- Why ECHO in cardiac emergencies?
- Emergency setting
- Emergency clinical presentations
- Simple and comprehensive answers
- Medicolegal issues
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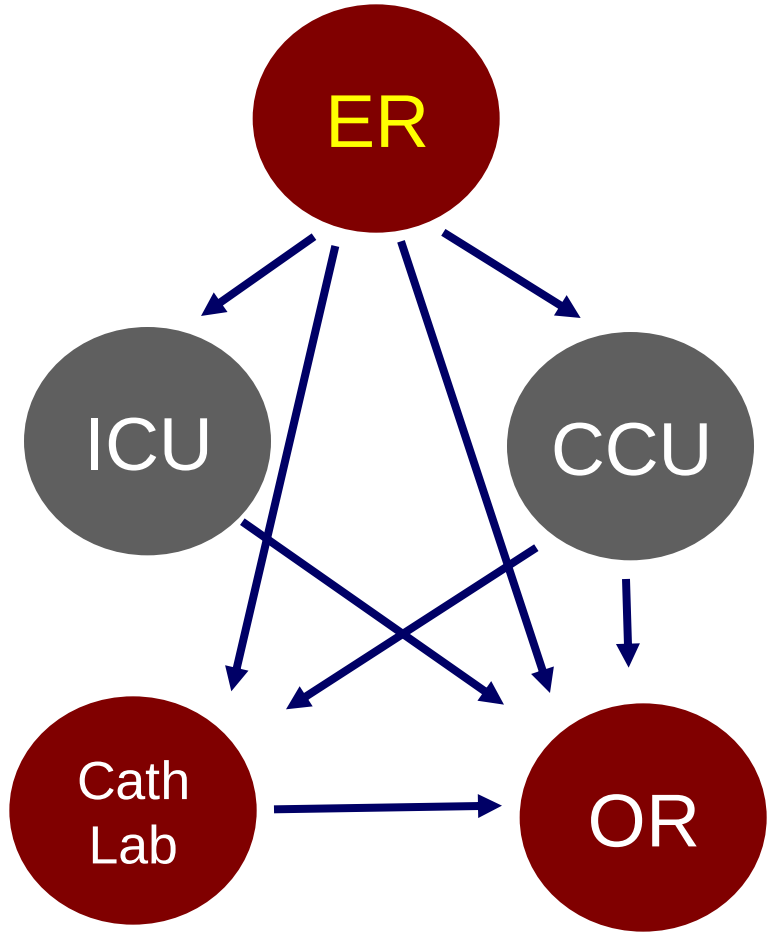
Emergency Echo Setting

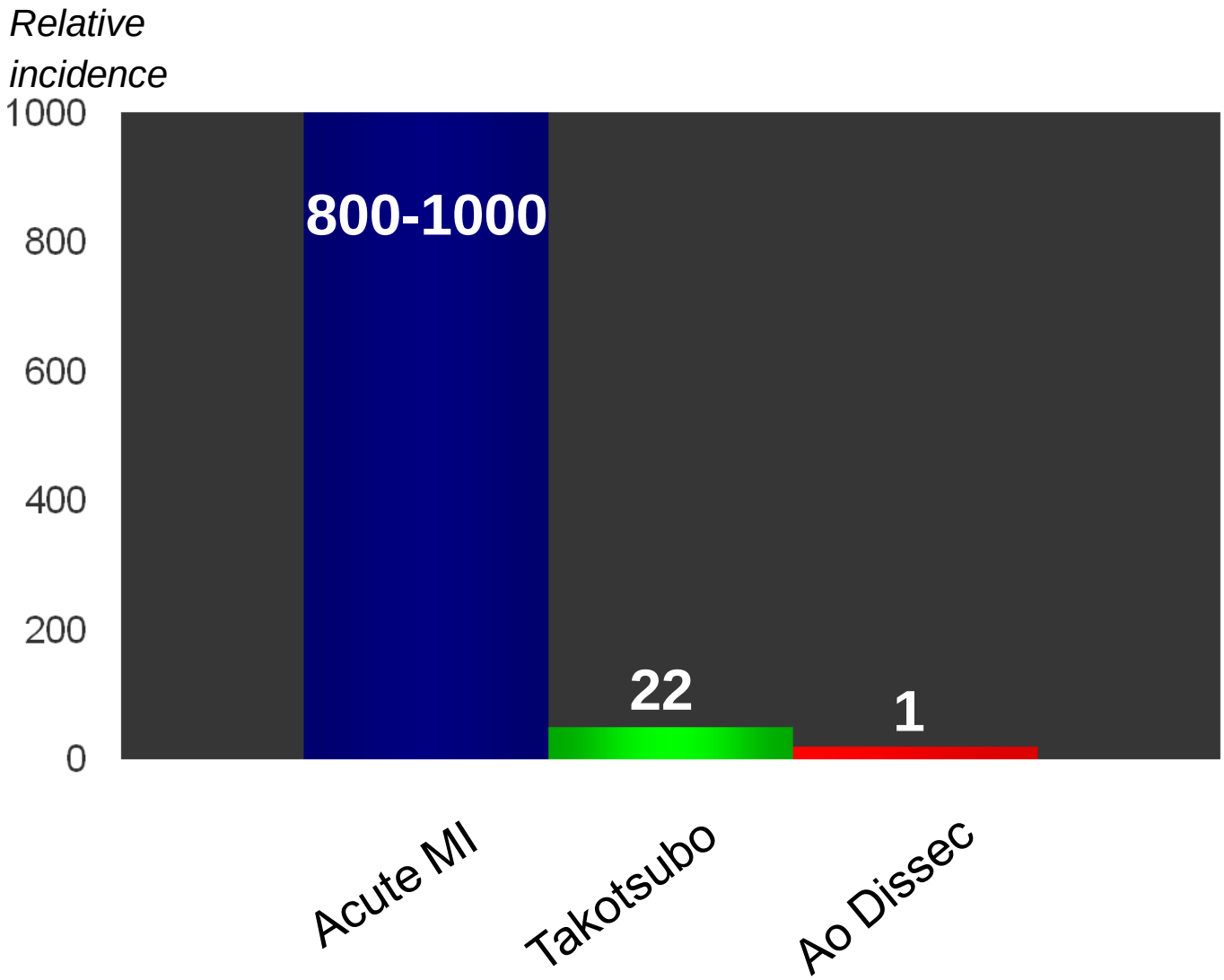
- Stressful environment
- Critically ill
- Time constrain
- Poor images (often)
- Limited consultation time with others
- Critical decisions (surgery, Th)
- Medical errors are likely to occur !

Referrals for Immediate Interventions

- Acute coronary syndromes
- Cardiogenic shock
- Ao dissection
- Acute AR
- Cardiac tamponade
- Acute MR
- Post MI PM rupture
- Post MI LV free wall rupture
- Post MI VSD
- Prosthetic valve thrombosis



Relative Incidence



Impact of pretest likelihood of the disease

(Bayesian Theory)

↓

Different results in:

- ER
- CCU

Emergency Echocardiography

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Emergency Clinical Presentations

Referrals for the Emergency Echo

1. Acute chest pain
2. Acute dyspnea
3. Hemodynamic instability (acute HF, shock)
4. New murmur
5. Syncope (CVI), source of emboli
6. Chest trauma
7. Cardiac arrest/CPR

Major Causes of Cardiac/Cardiac-like Emergencies and their Common Initial Clinical Presentations

	ACS	AoD	PE	P	Ptx	ADHF	T	AVR/ PVD
A								
A								
H in								
N								
C e								
C								
Cardiac arrest/CPR	++++	+	+++	+	+	+	+++	+

- Serious
- Lifethretening if untreated
- Prompt echo detection/assessment

Major Causes of Cardiac/Cardiac-like Emergencies and their Common Initial Clinical Presentations

	ACS	AoD	PE	P	Ptx	ADHF	T	AVR/ PVD
Acute chest pain	++++	++++	++	++	+++	+	+	+
Acute dyspnea	++	+	++++	0	++	++++	++++	++++
Hemodynamic instability/Shock	++	++	+++	+	+	++++	++++	++++
New murmur	+	+	+	+	0	+	0	++++
Cardiac sources of embolism/Syncope	+	+	+	0	0	+	0	+
Chest trauma	+	+++	0	+	++	0	+++	+
Cardiac arrest/CPR	++++	+	+++	+	+	+	+++	+

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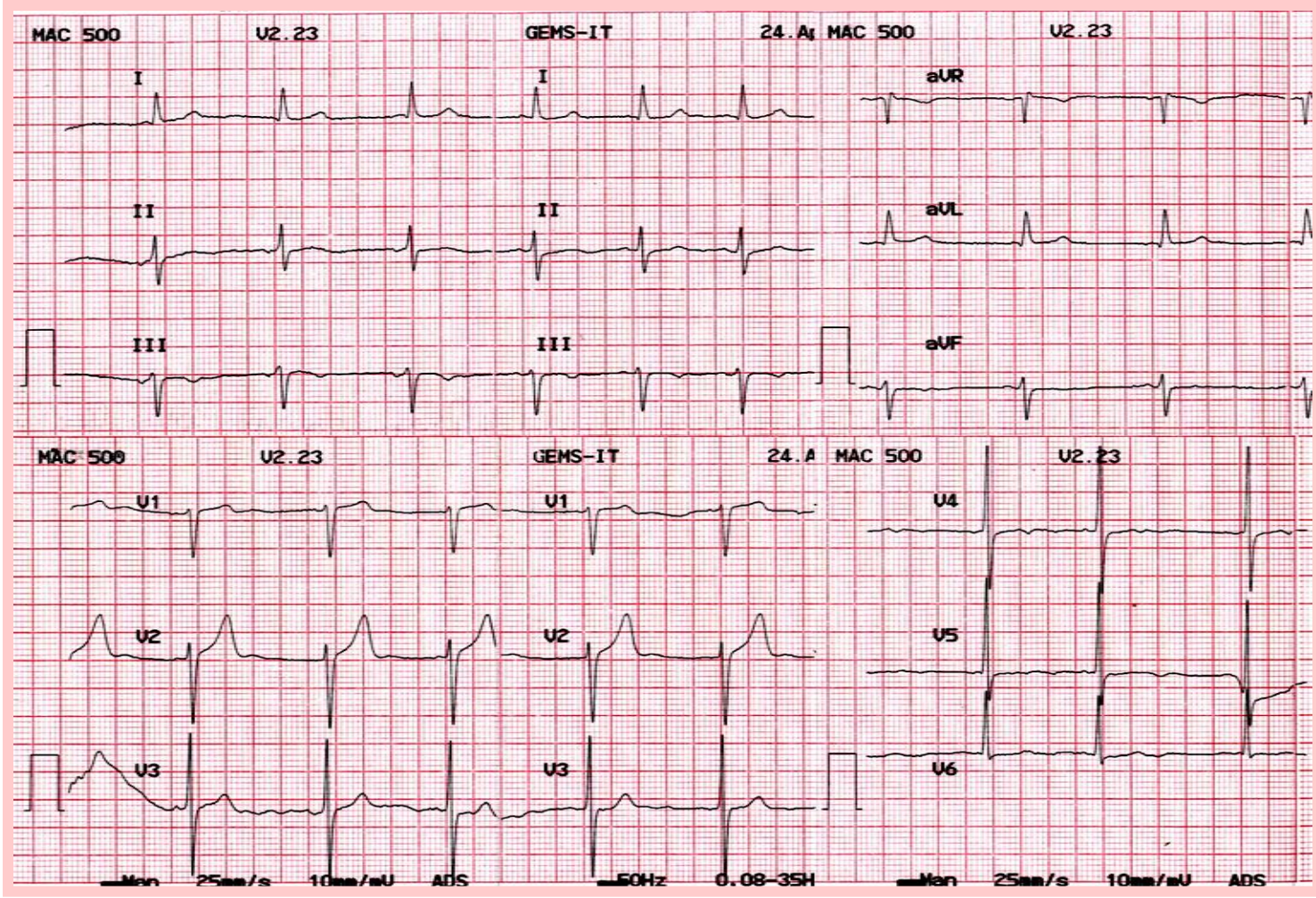
Simple

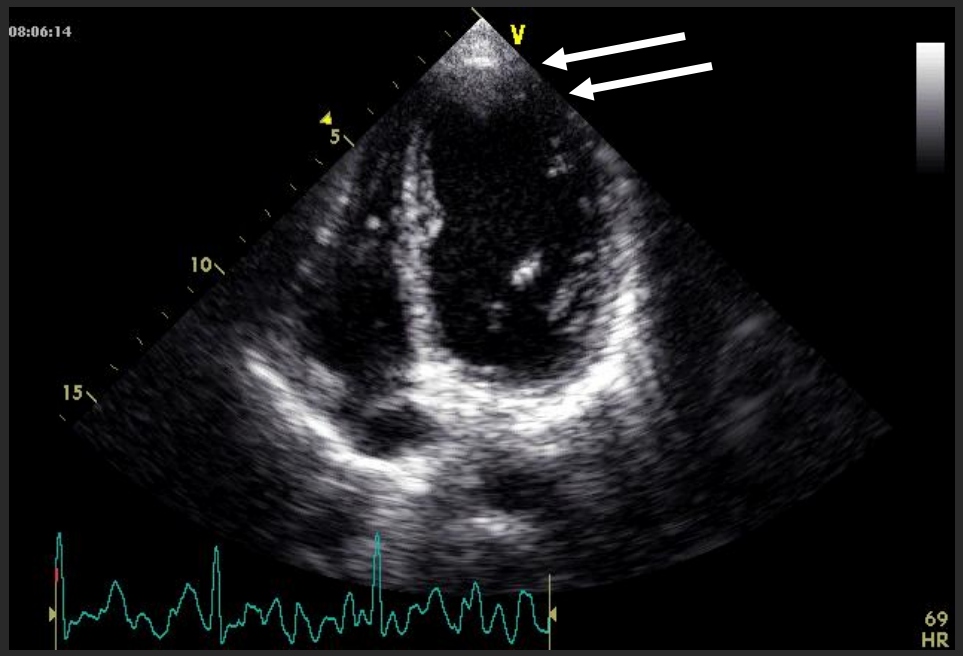
Chest Pain

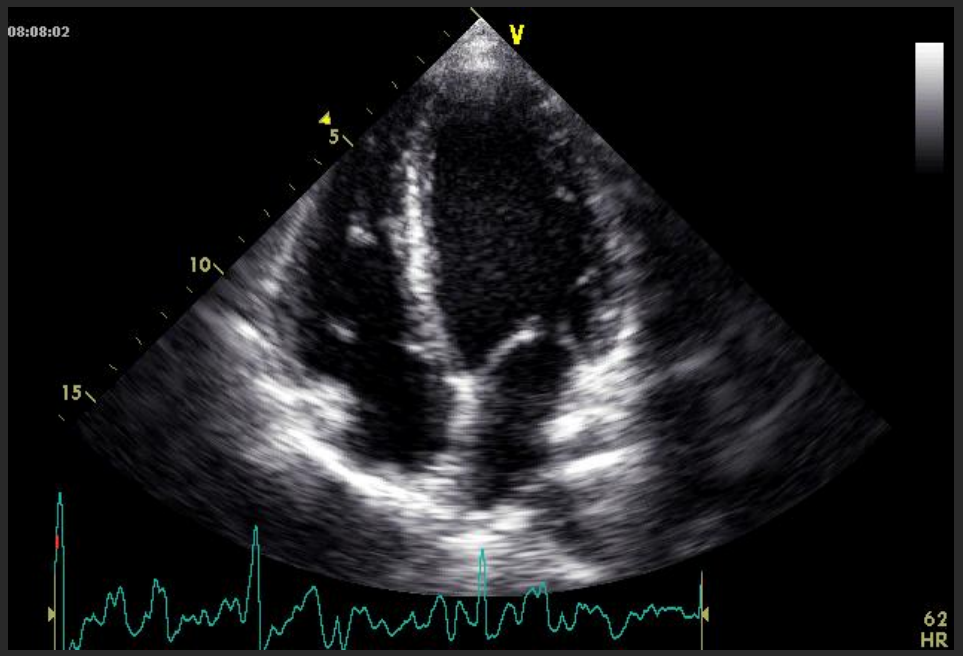
Nondiagnostic ECG in the ER



Chest pain

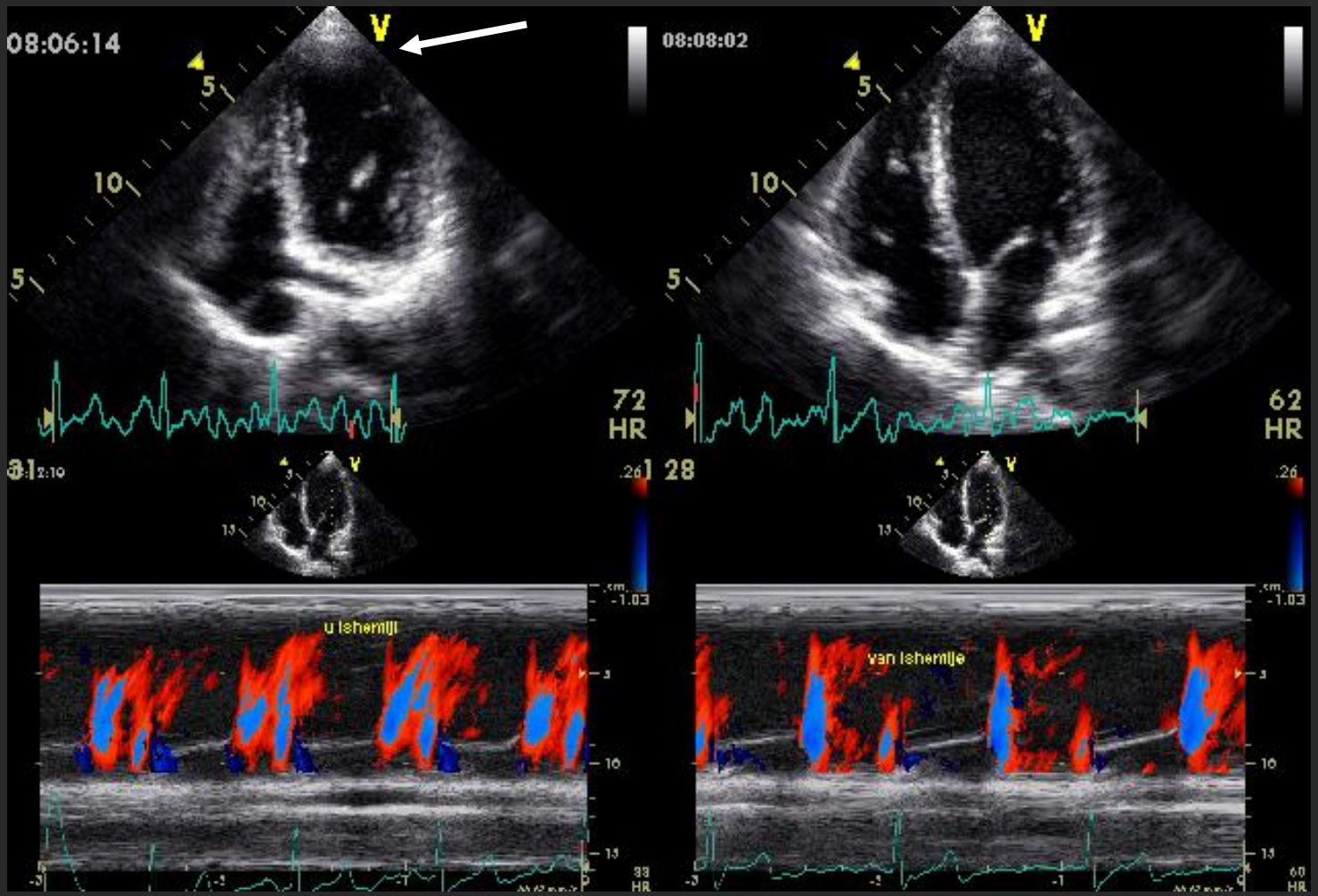
... 2 min after !





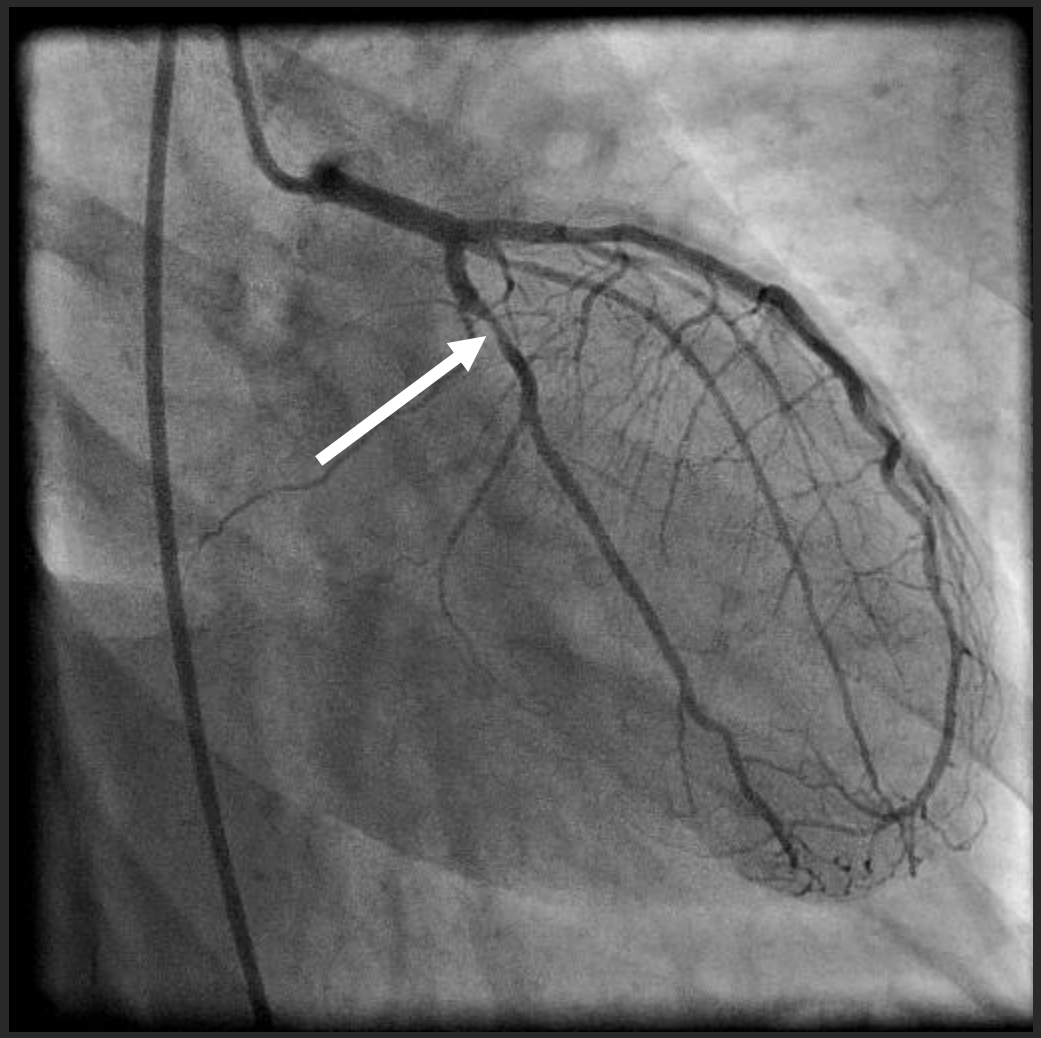
Chest pain

... 2 min after !



Courtesy of V. Cvorovic

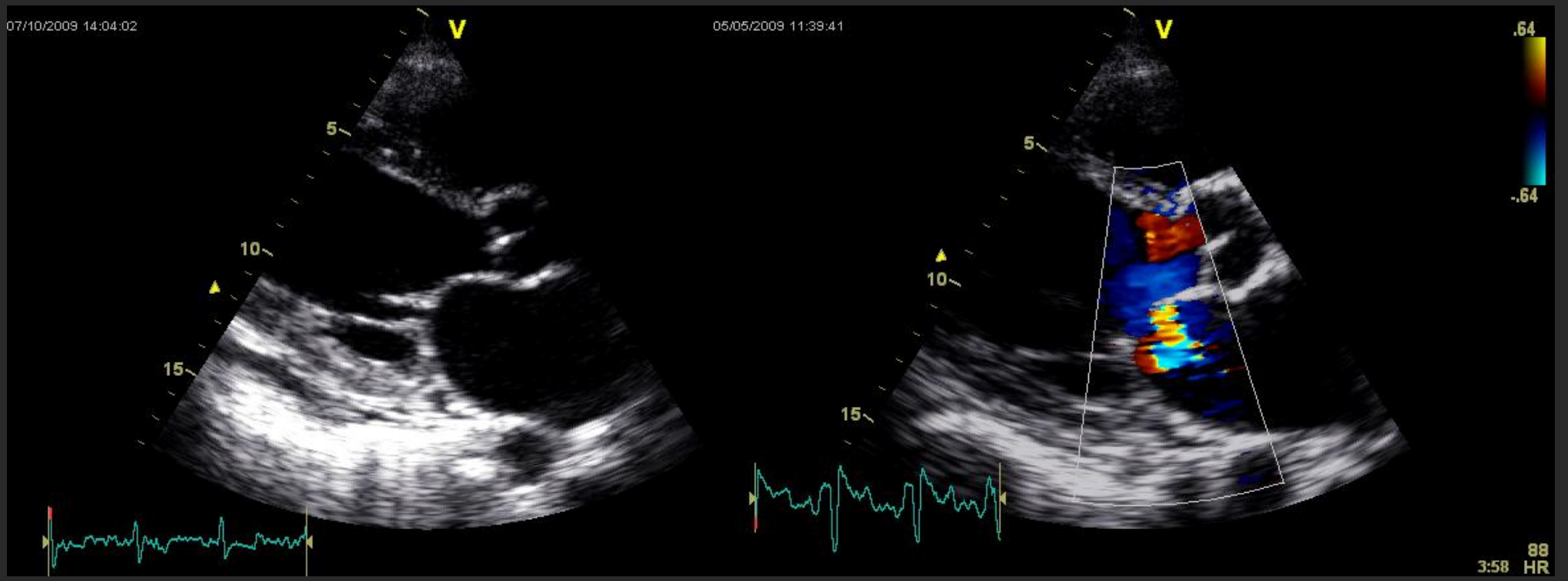
Cath



Comprehensive

Severe Acute Dyspnea

Acutely Decompensated HF

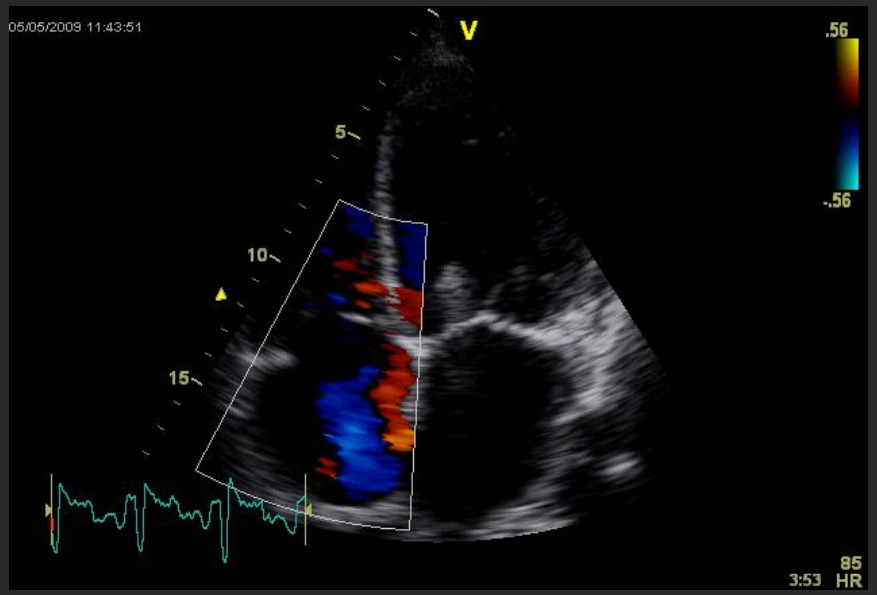


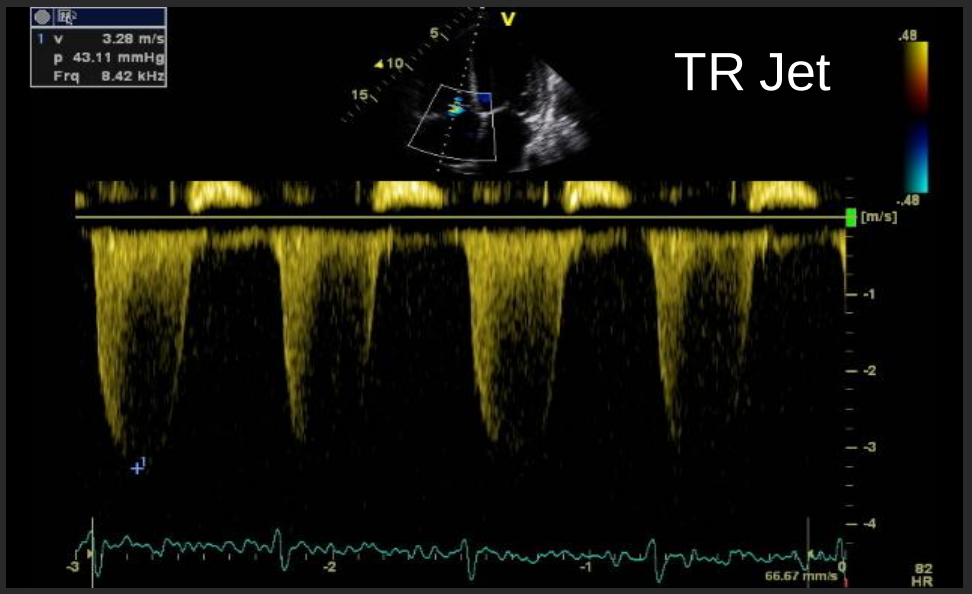
ADHF:

Comprenhensive Echo Evaluation

1. LV systolic function
2. **Estimation of RV systolic pressure**

Estimation of RV Systolic Pressure





TR jet velocity 3.38 m/s

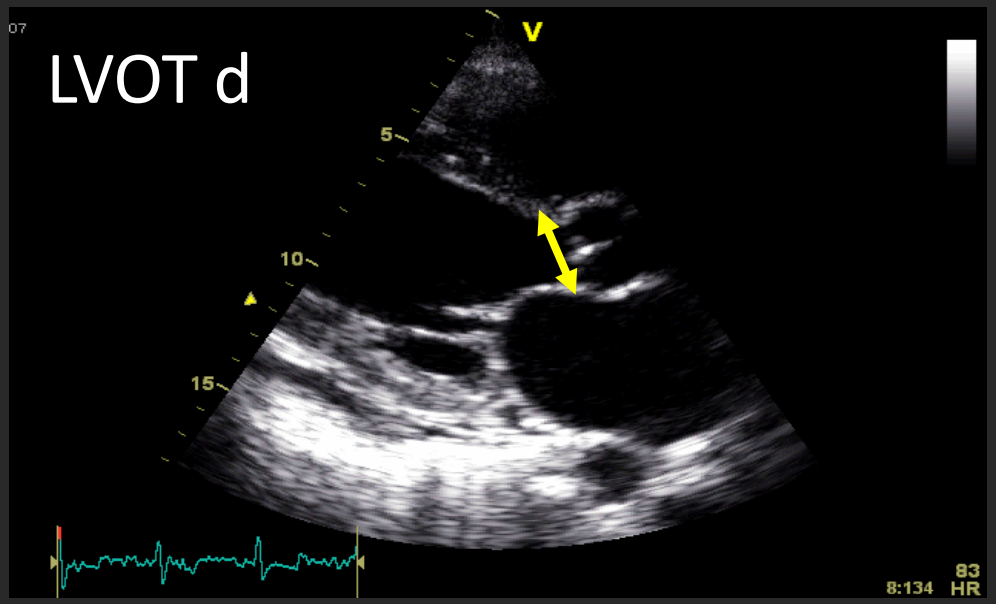
Estimated RVSP 53 mmHg

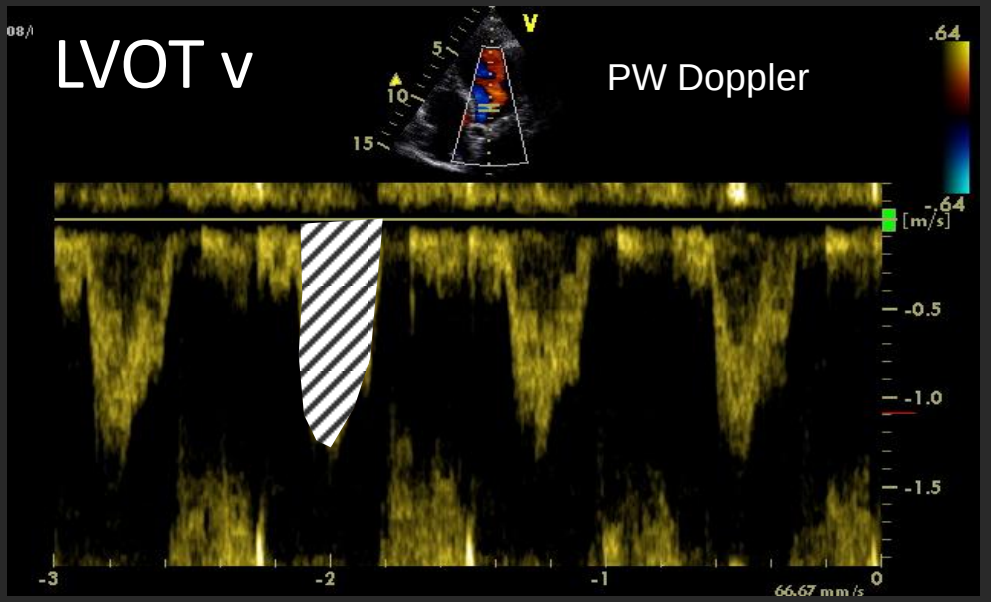
ADHF:

Comprenhensive Echo Evaluation

1. LV systolic function
2. Estimation of RV systolic pressure
3. **Cardiac output**

Estimation of Cardiac Output





$$SV = CSA_{LVOT} \times VTI_{LVOT}$$

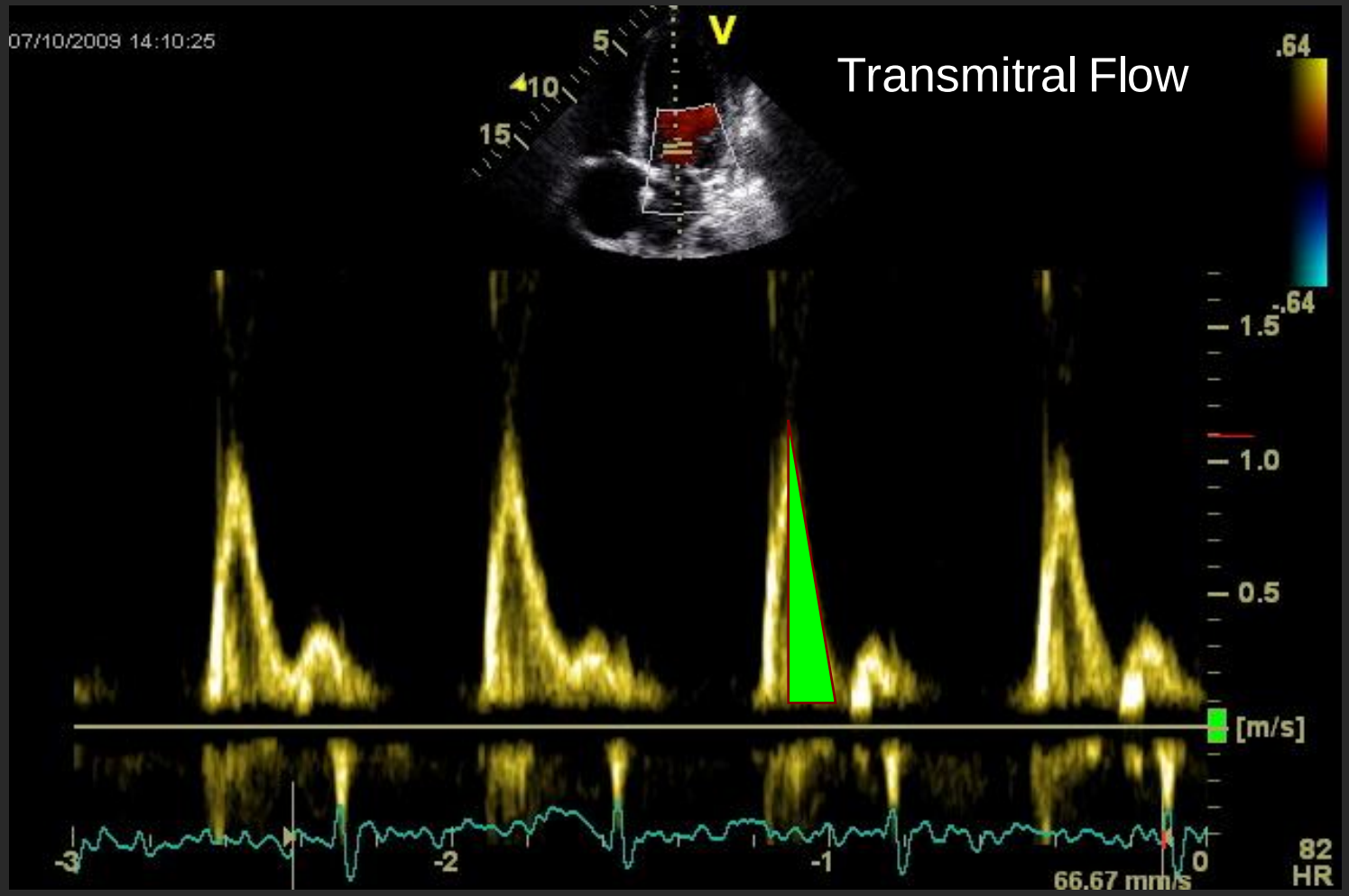
$$CO = SV \times HR$$

ADHF:

Comprenhensive Echo Evaluation

1. LV systolic function
2. Estimation of RV systolic pressure
3. Cardiac output
4. **Estimation of LV filling pressure**

Restrictive LV Filling Pattern

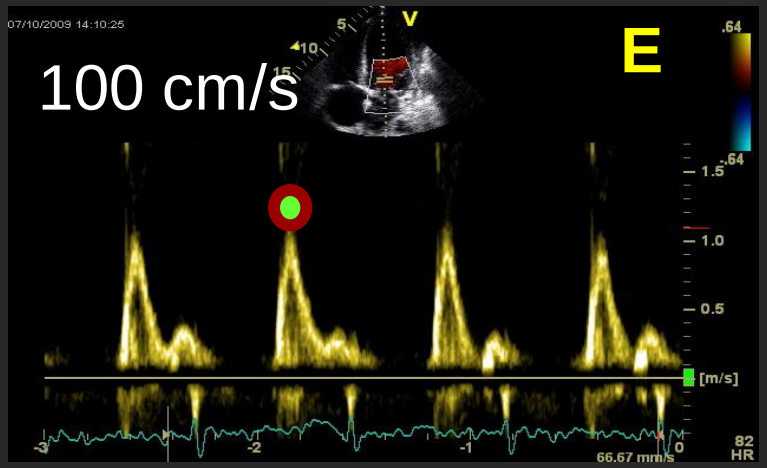


E/A = 2.5

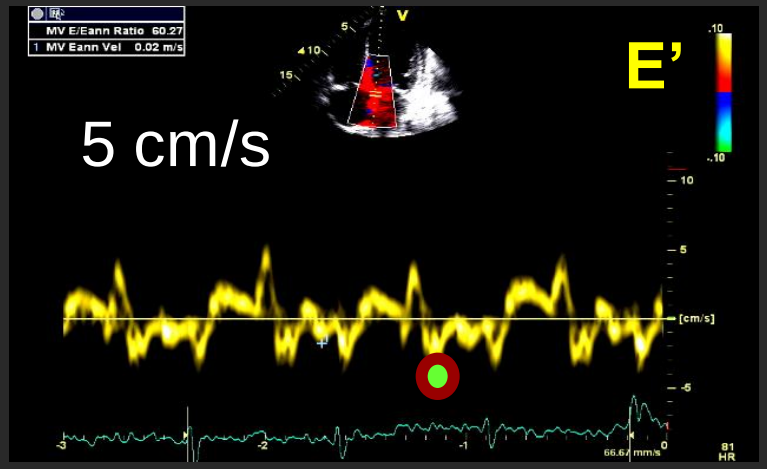
DT = 140 ms

Estimation of LV Filling Pressure

Transmitral Flow



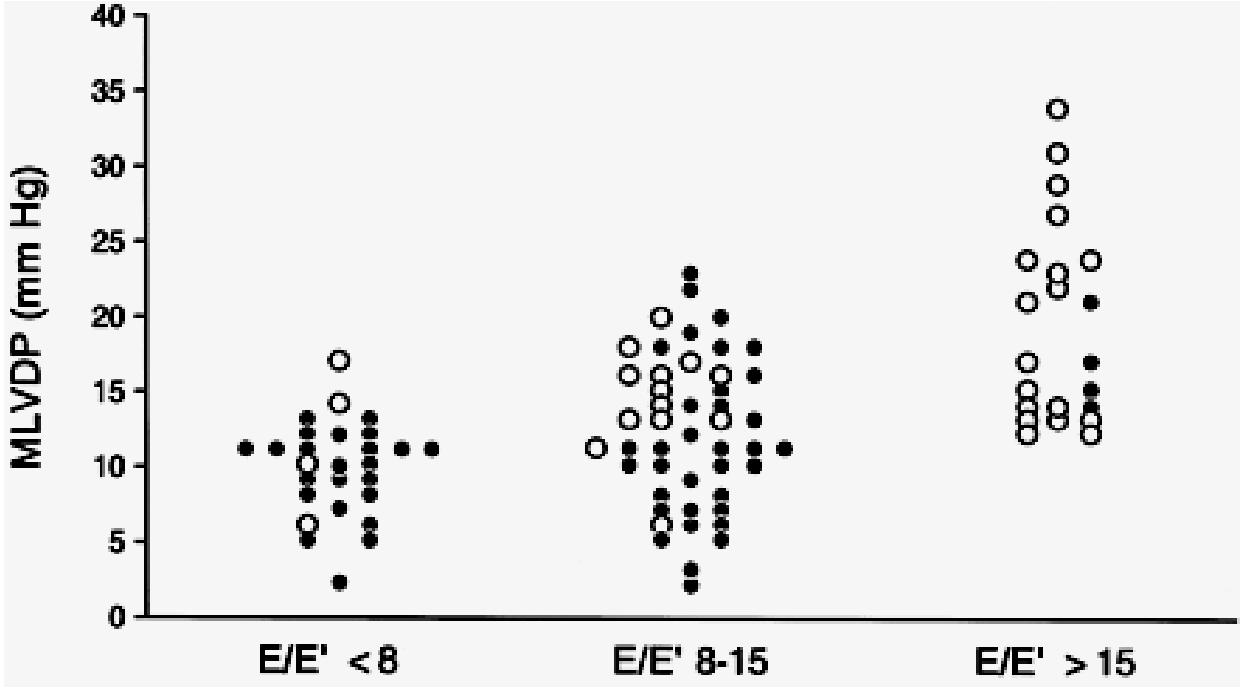
Mitral annular velocity (DTI)



$$E/E' = \frac{100}{5} = 20$$

Predicting LV Filling Pressure by **E/E'**

- *Simple*
- *Doable*
- *Essential information*



E/E`ratio > 15

↑ LA pressure

E/E` ratio < 8

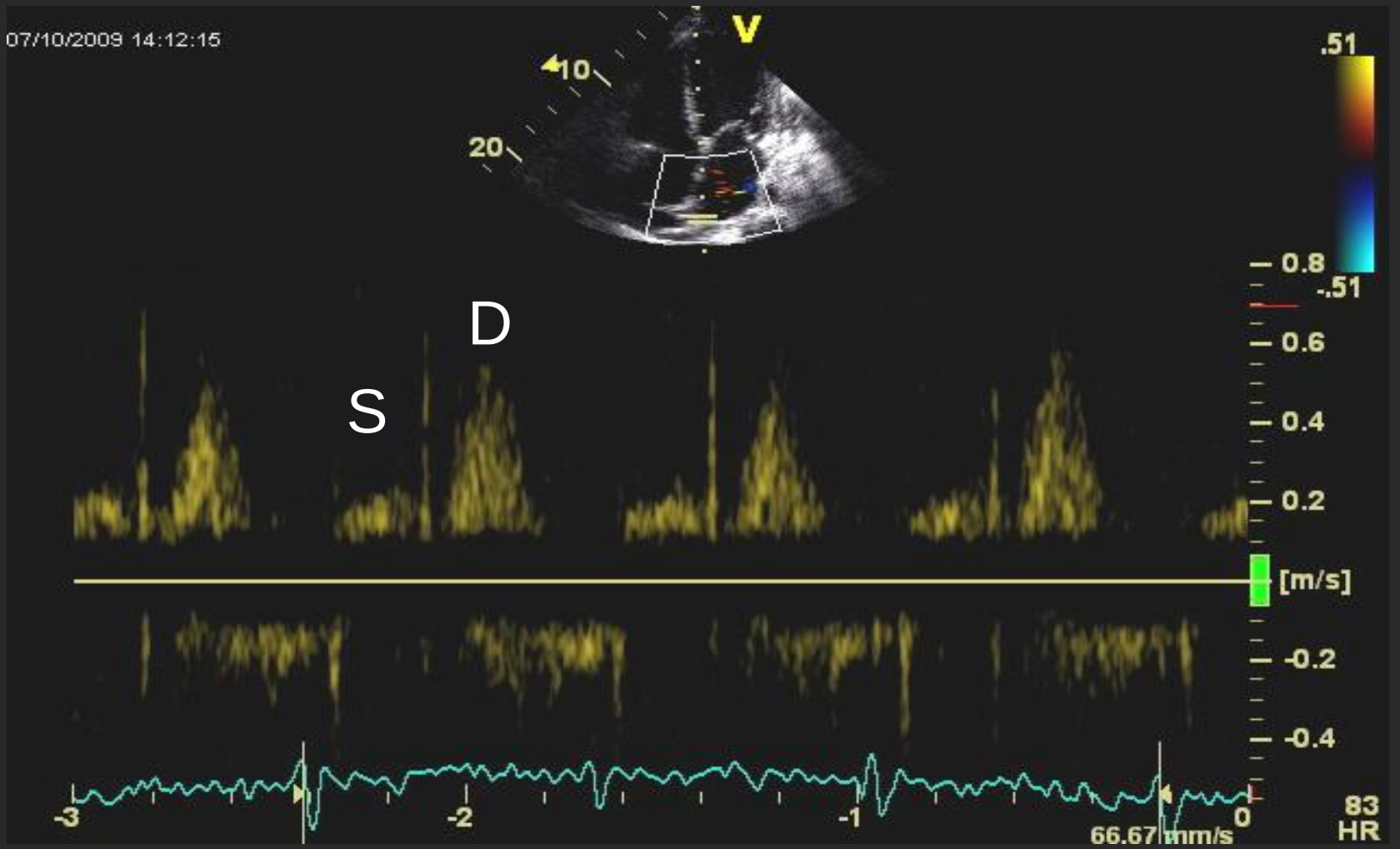
↓ LA pressure

E/E`ratio 8-15

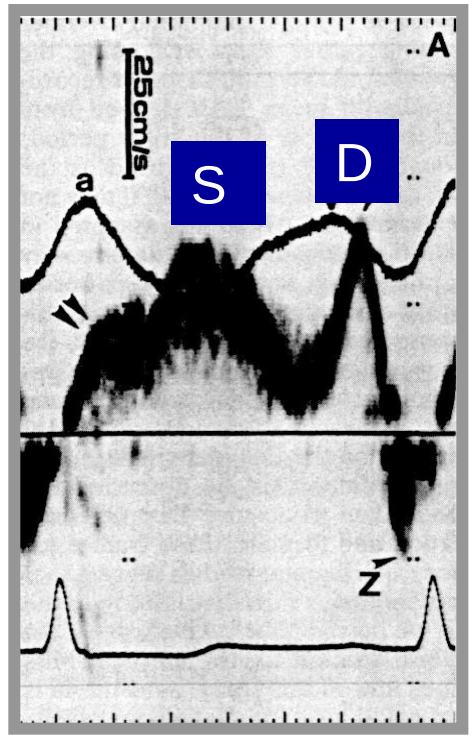
useless

Ommen SR et al, Circ 2000

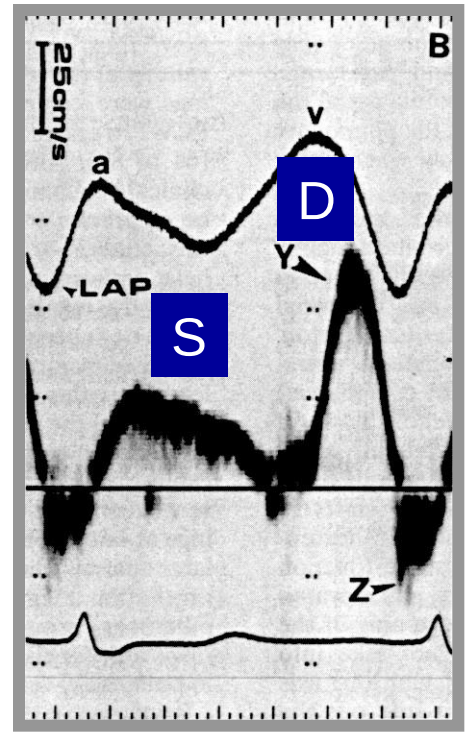
Systolic Fraction of the Pulmonary Venous Flow



Effects of Increased Mean LAP on Pulmonary Venous Pattern



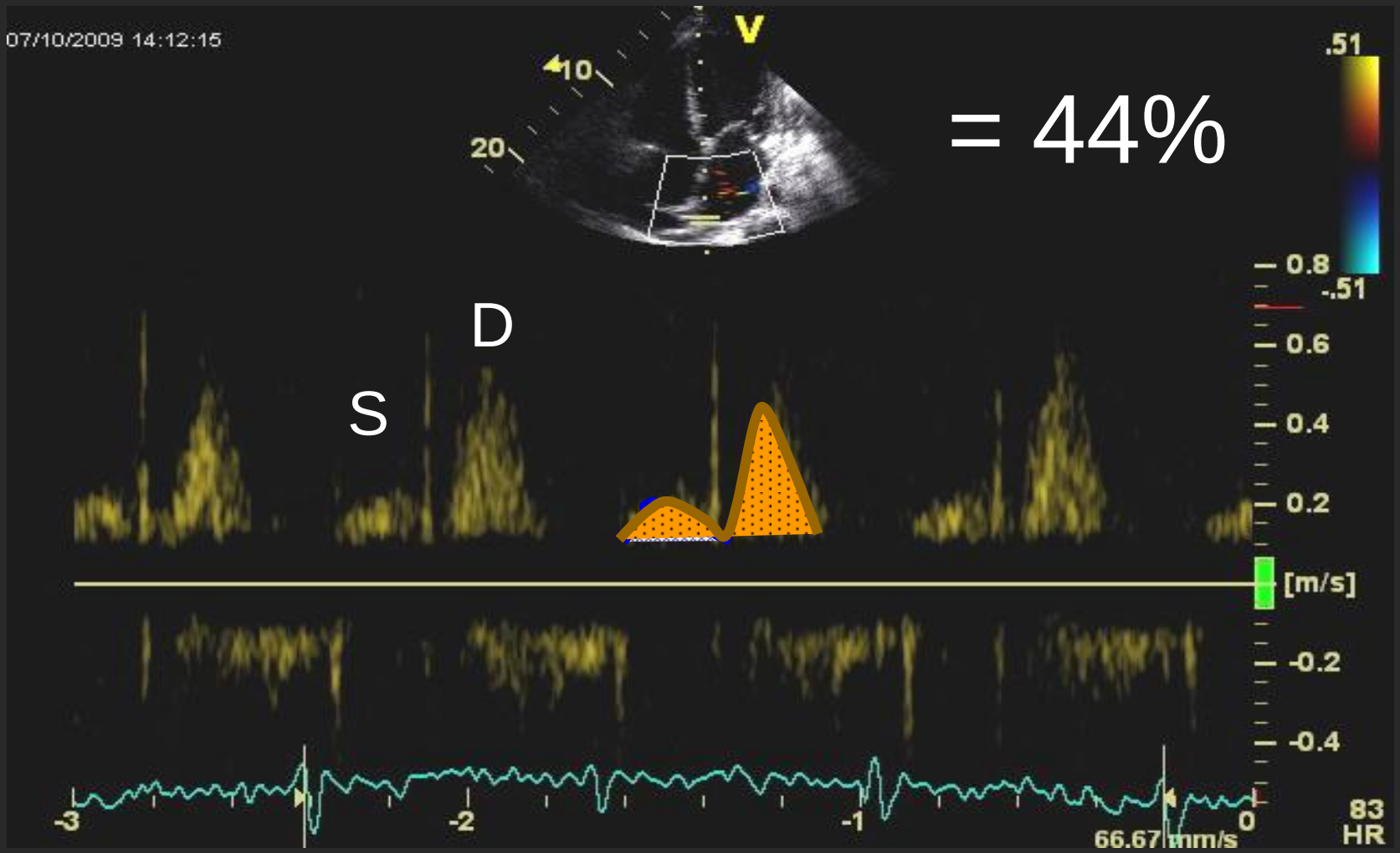
mean LAP=9 mmHg



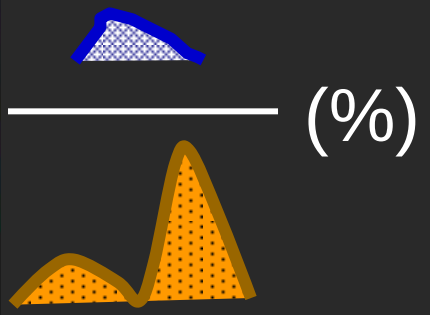
mean LAP=15 mmHg

Kuecherer HF et al, Circ 1990

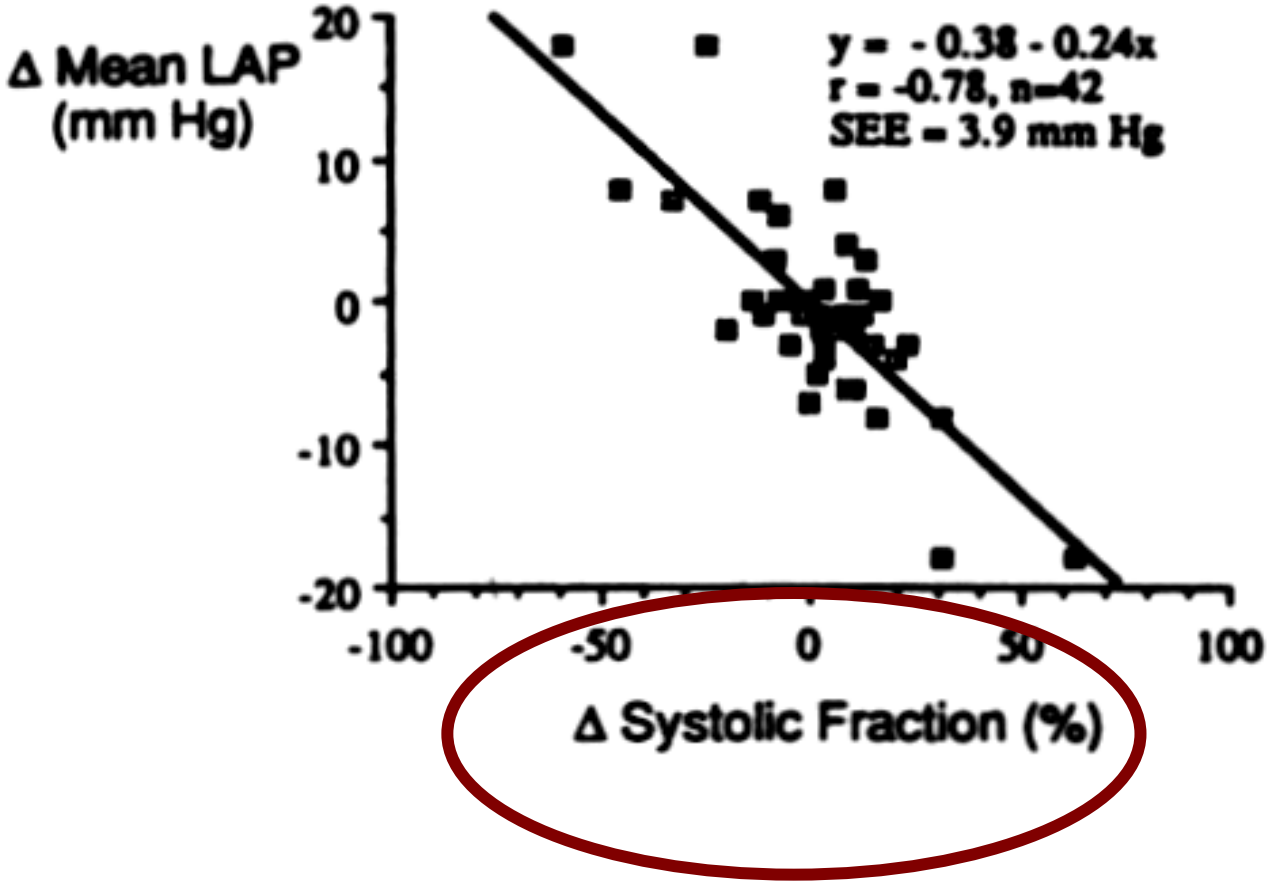
Systolic Fraction of the Pulmonary Venous Flow



= 44%



Estimation of Mean LAP by Systolic Fraction of the Pulmonary Venous Flow



< 55%

↓

Sn 91%, Sp 87%

for predicting

mean LAP ≥ 15 mmHg

Kuecherer HF et al, Circ 1990

ADHF:

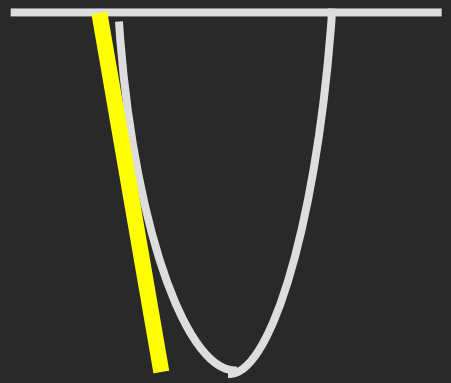
Comprenhensive Echo Evaluation

1. LV systolic function
2. Estimation of RV systolic pressure
3. Cardiac output
4. Estimation of LV filling pressure
5. **Estimation of dP/dT**

Noninvasive Estimation of dP/dT

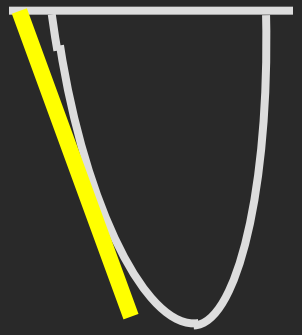
Good

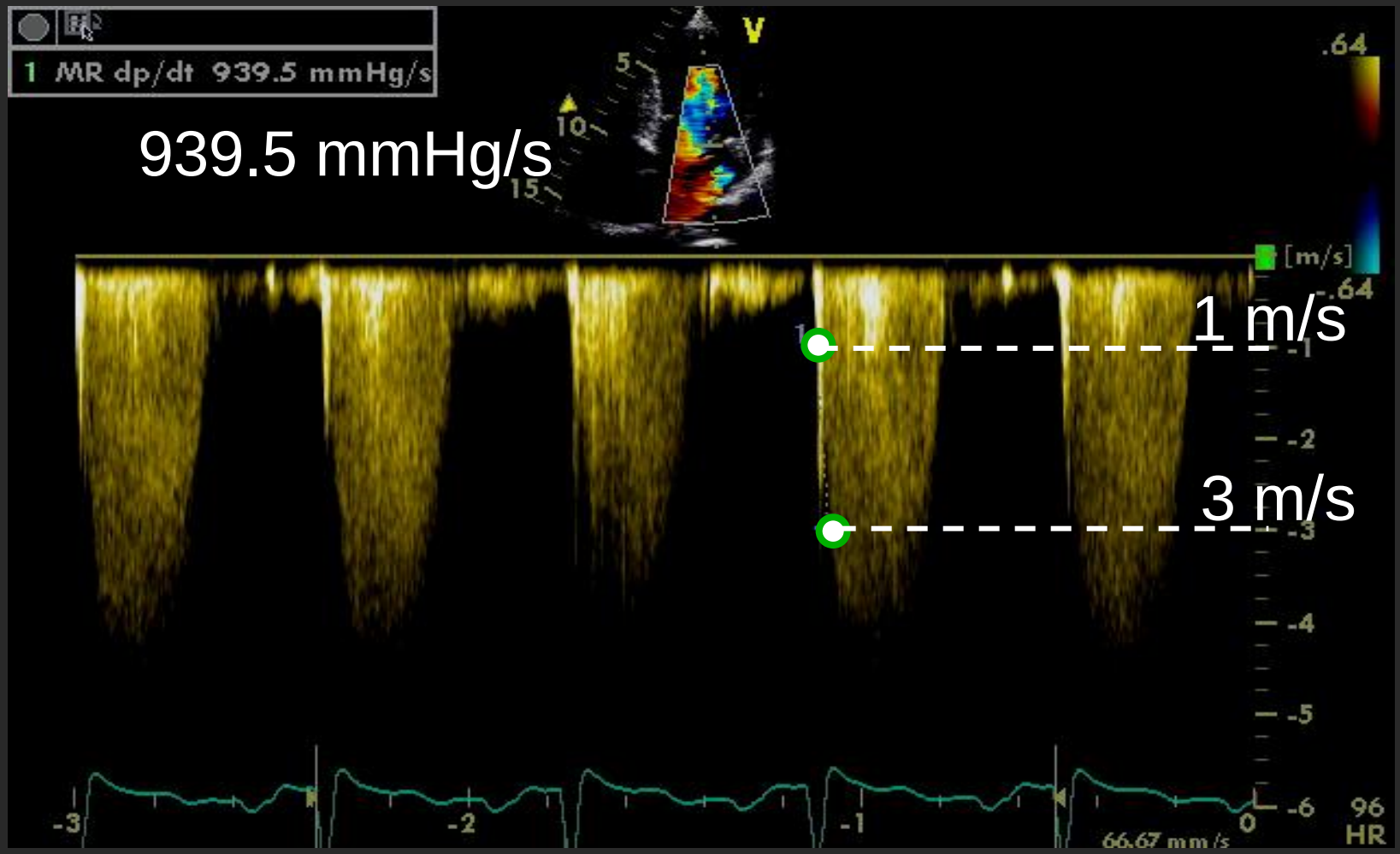
> 1200 mmHg/s



Poor

< 1000 mmHg/s





ADHF:

Comprenhensive Echo Evaluation

1. LV systolic function
2. Estimation of RV systolic pressure
3. Cardiac output
4. Estimation of LV filling pressure
5. Estimation of dP/dT
6. **Extravascular lung water**

Ultrasound “Lung Comets” in ADHF

Courtesy of L. Gargani

Emergency Echocardiography

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Important Facts

- Over 225,000 people die from medical malpractice related injuries in a single year.

- Nearly **50%** of these are from **emergency room errors**.

www.medicalmalpractice.com

Emergency Echo:

Medicolegal Issues

- Should **not** be ignored !
- Cases: documented, stored (DICOM), and retrieveable
- Adequate machine used
- **Reports:** approved/signed by the individual with adequate formal education

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Emergency Echo

How to avoid bad scenarios?

“ABCD”

approach

Emergency Echocardiography

ABCD approach

Awareness → Fight against routine

Be Suspicious →
- Think beyond apparent explanations
- Referral Dg may be misleading
- Never trust, confirm

Comprehensiveness → Do as complete exam as suitable

Double **R** * → Team work

* Record/Review

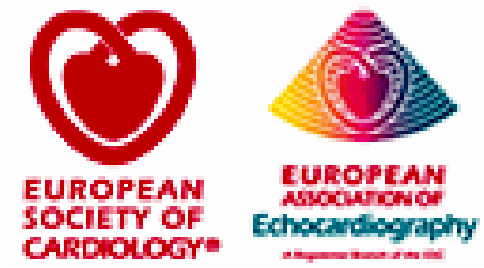
Take Home Message

Emergency Echo

ECHO in the emergency setting is highly demanding diagnostic procedure and *should not* be attempted by inexperienced *without* supervision !

Emergency Echo

- **Only simple to apply, not to perform !**
- **Perspective:** increased use of mini echo machines instead of the”**stethoscope”** by non-cardiologist or inadequately trained cardiologist
- **Saving lives *vs.* disastrous errors** in the emergency setting
- Key issue: **Education / Curriculum !**



EAE Recommendations on Emergency Echocardiography

…spring 2011 !