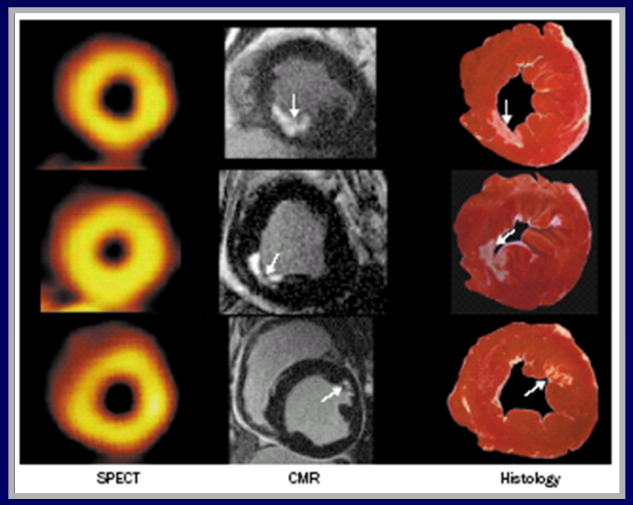
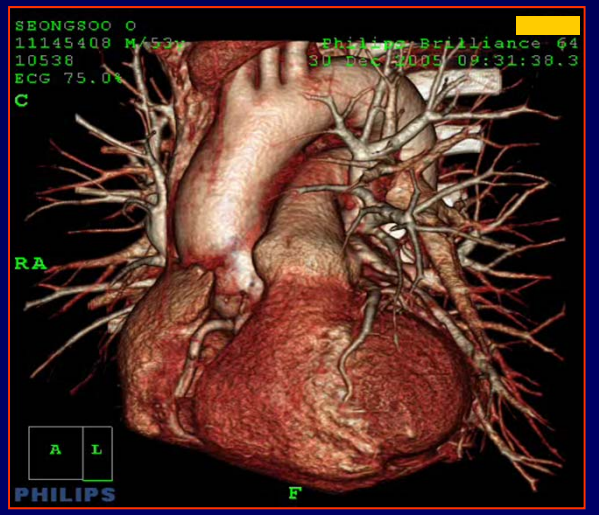
Future Role of Echocardiography in the Era of Multimodality Imaging

Yong-Jin Kim, MD

Seoul National University Hospital

Multimodality Cardiac Imaging





If you are left on a desert island….

What do you want to have for your patients?

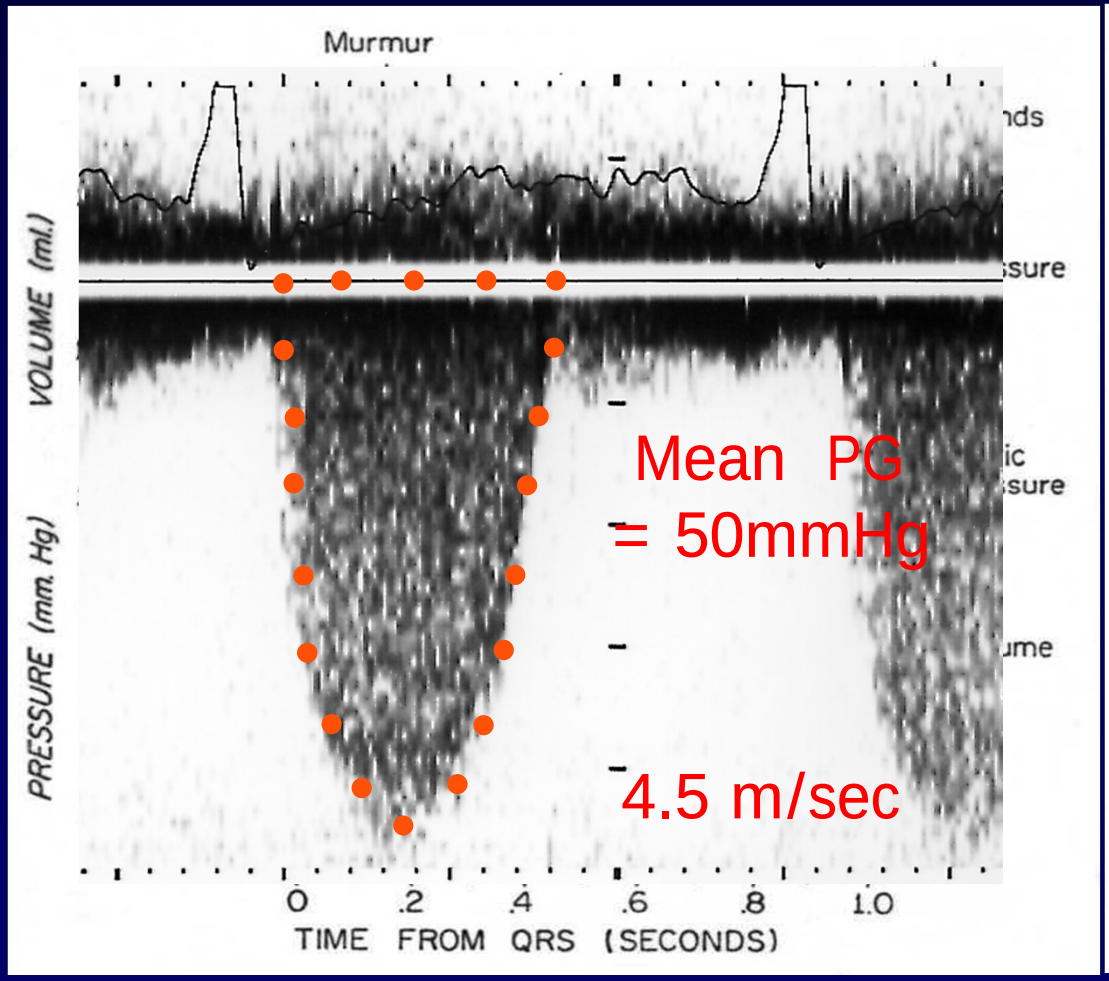
Strength and Current Role of Echo

- Hemodynamic evaluation
  - Diagnosis and therapeutic guidance for valve stenosis, HF, HFNEF, and more…

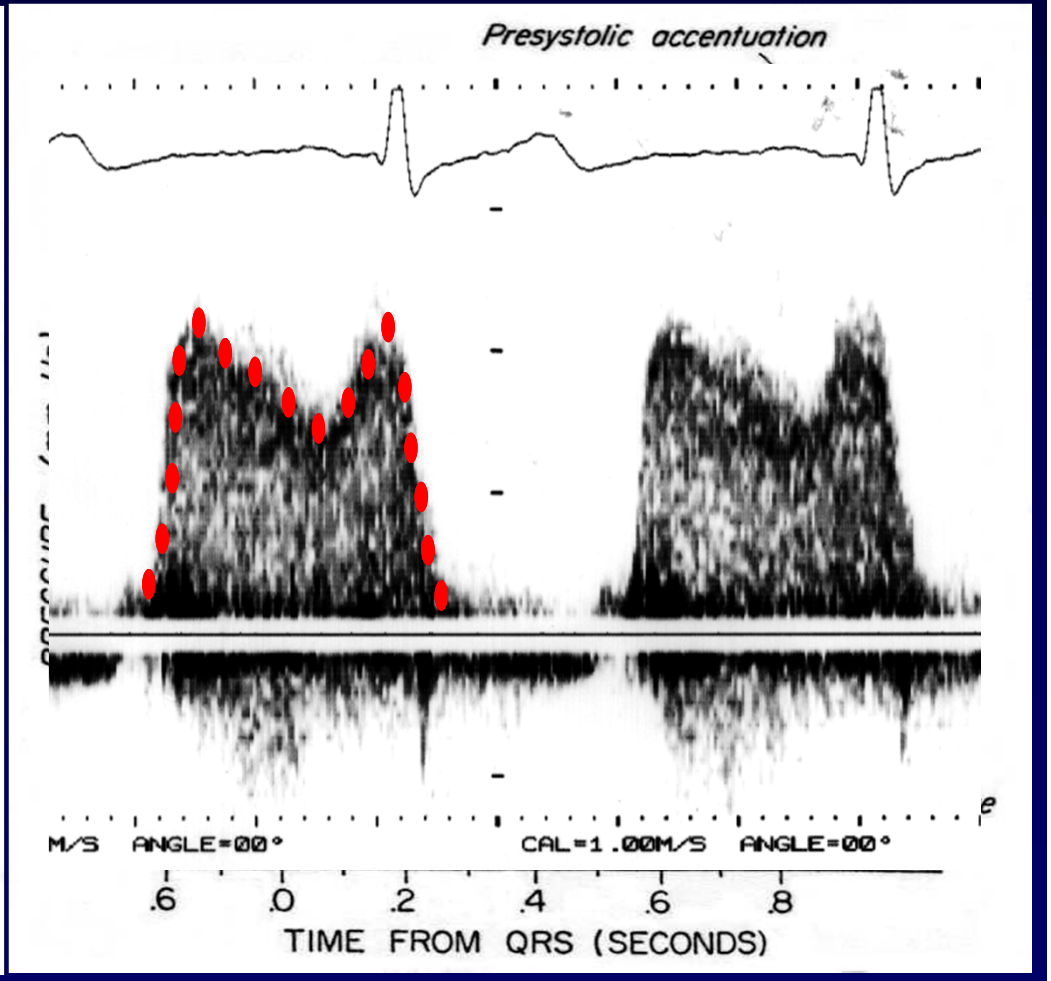
Hemodynamic Evaluation

Valve Stenosis

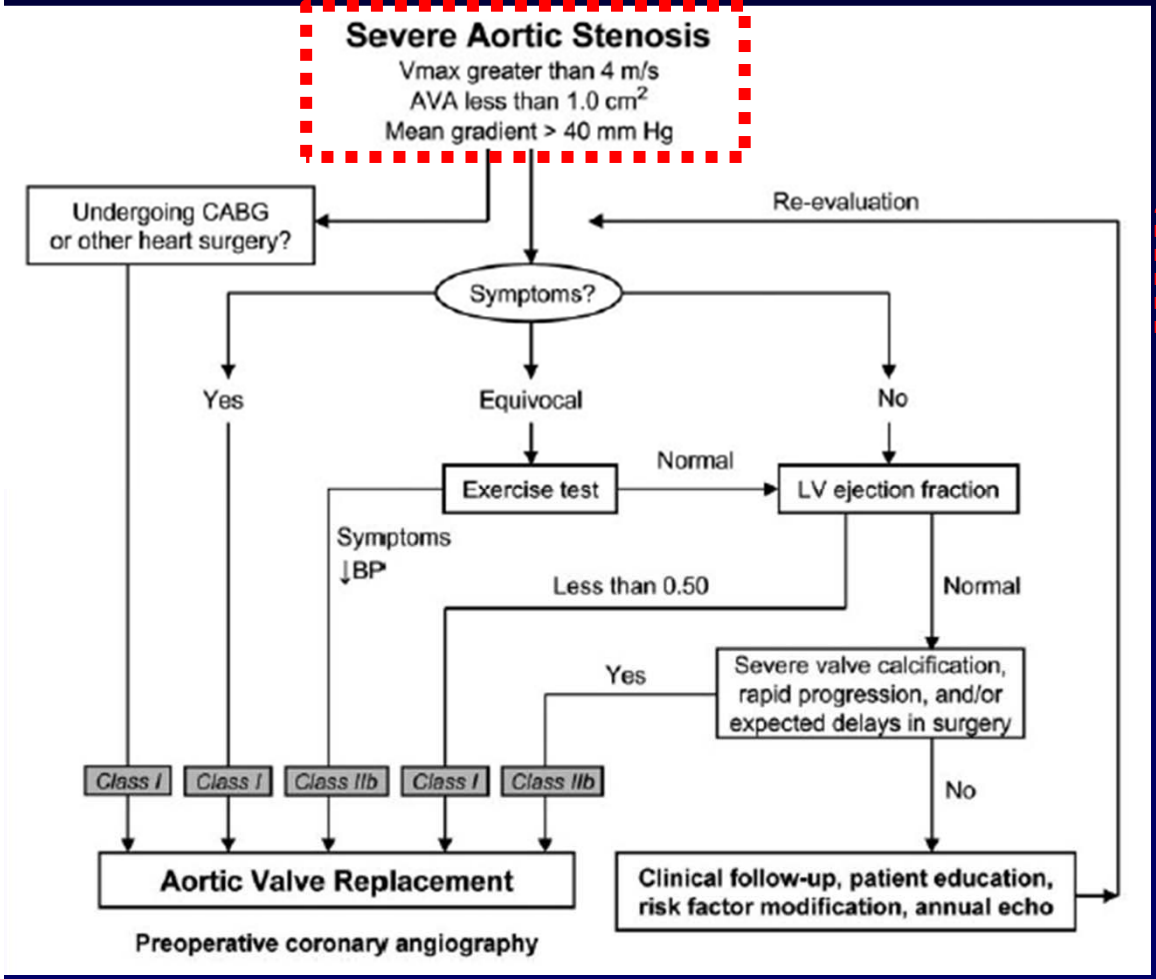
Aortic Stenosis

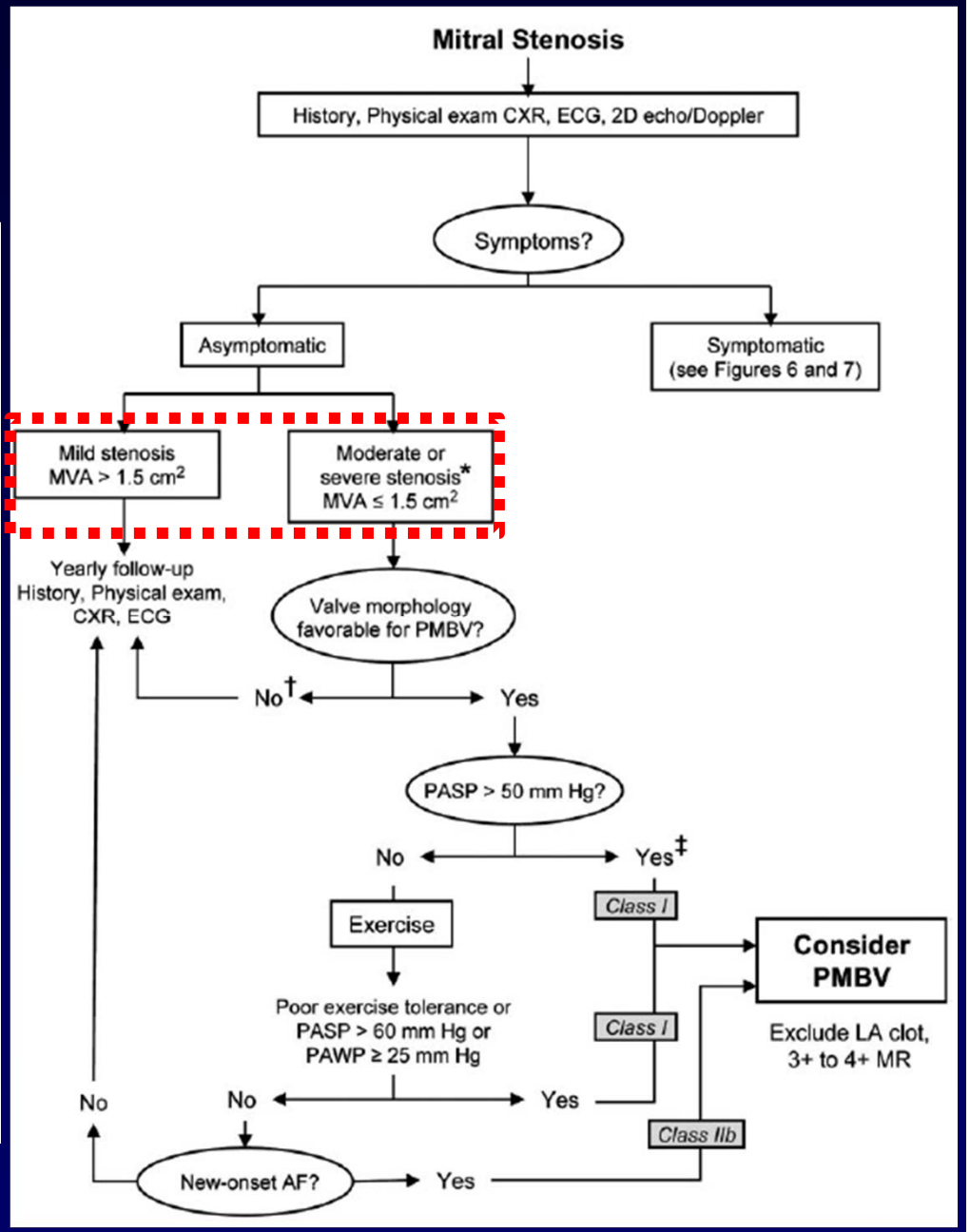


Mitral Stenosis



Guidelines for Valve Stenosis





Hemodynamic Evaluation

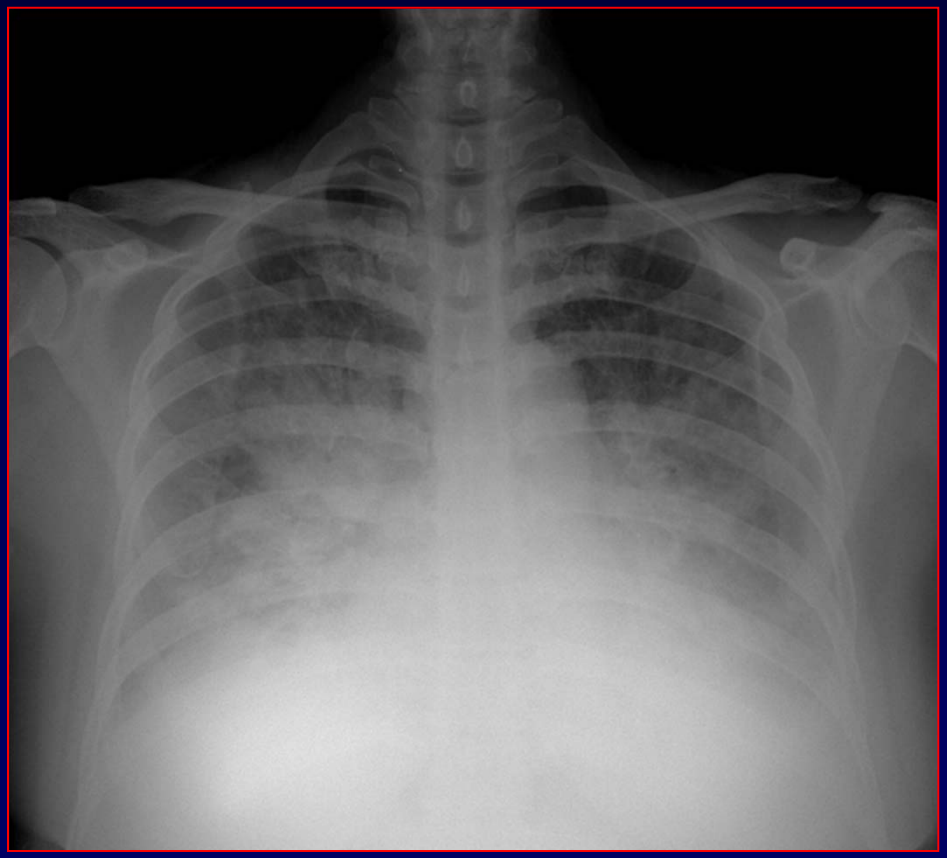
Noninvasive Swan-Ganz Catheter

Editorial

Echocardiography as a Noninvasive Swan-Ganz Catheter

Jae K. Oh, MD

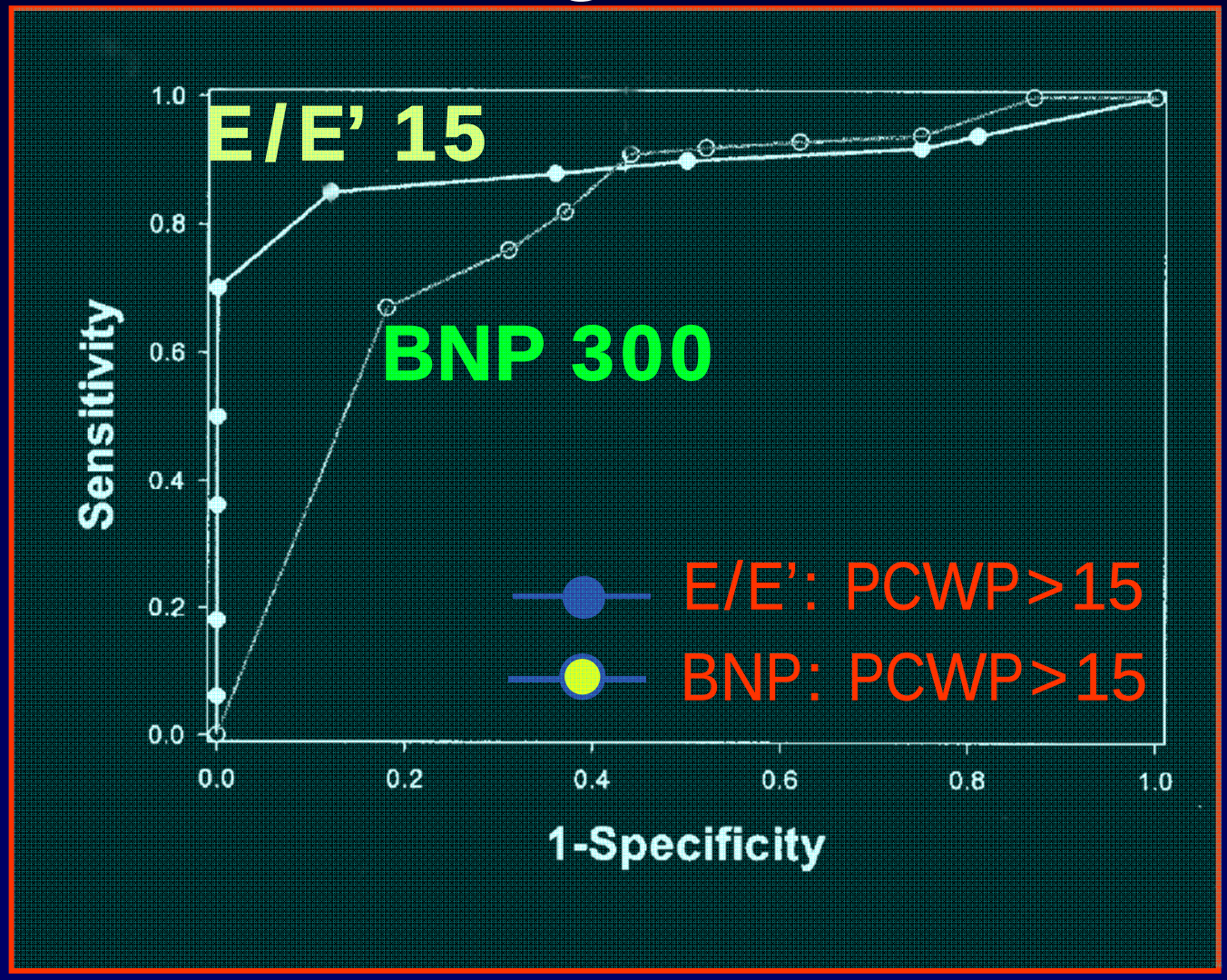
Sudden Dyspnea
in pt with Cardiomyopathy



What is the most important information for you?

Hemodynamic Evaluation

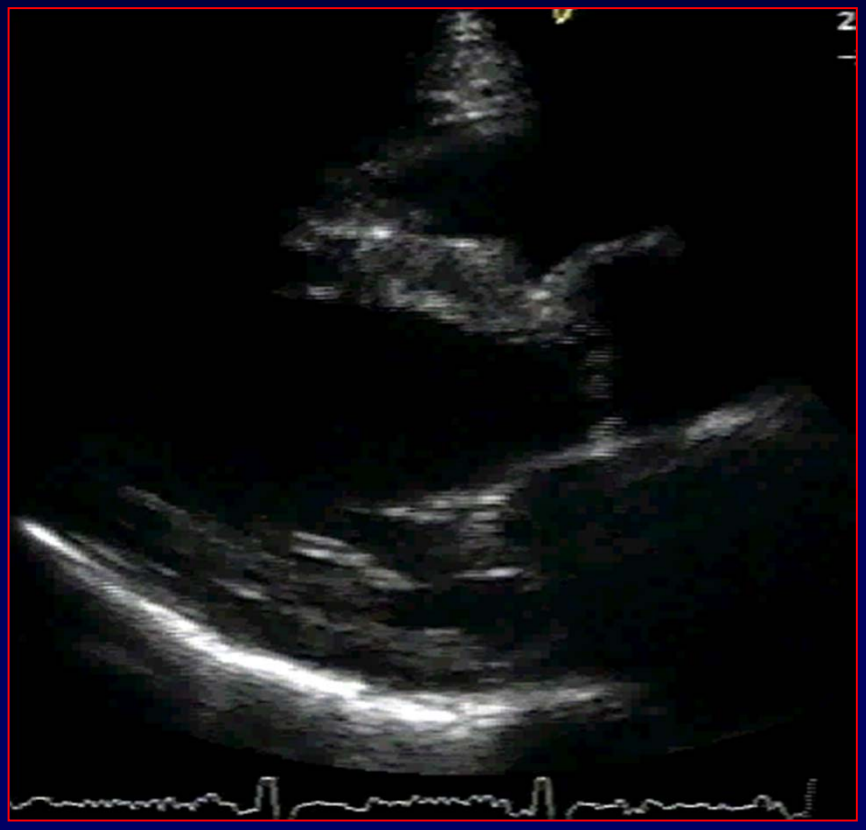
LV Filling Pressure

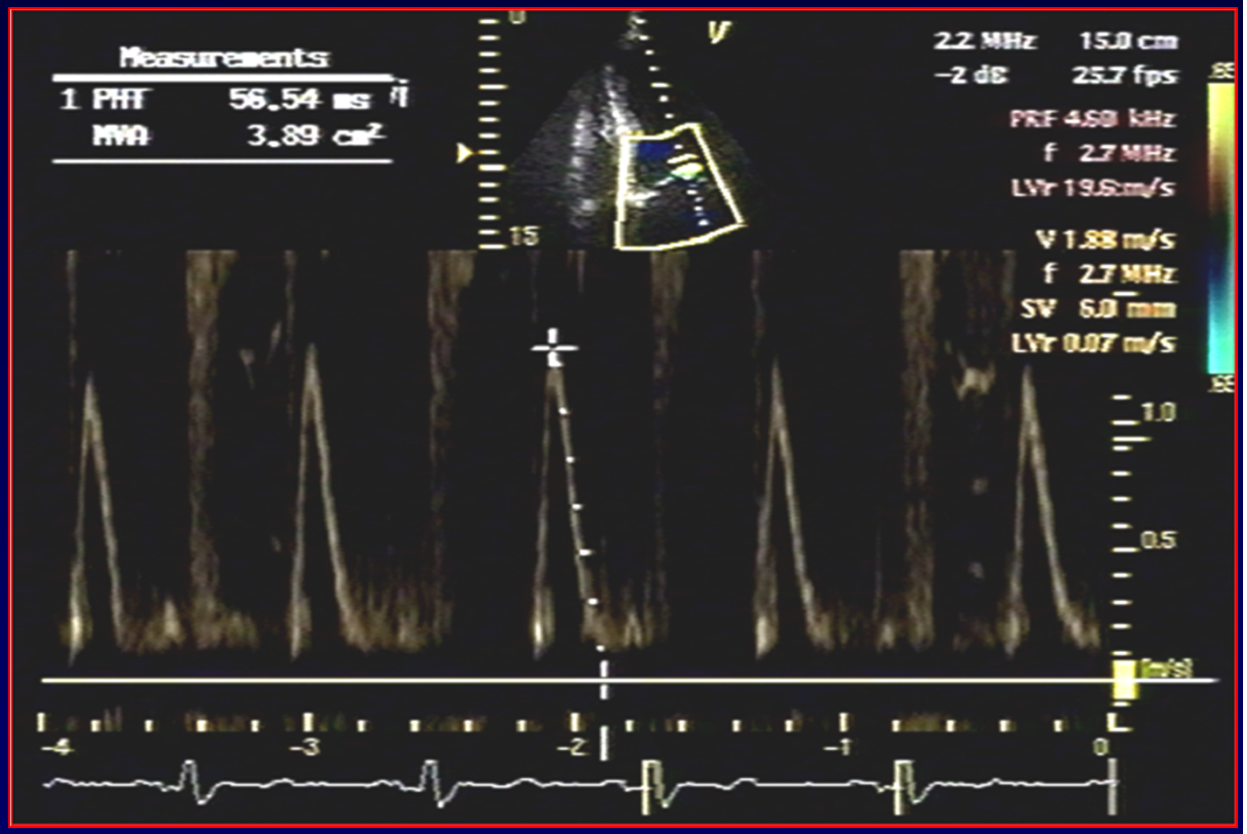


Dokainish H, Circulation 2004

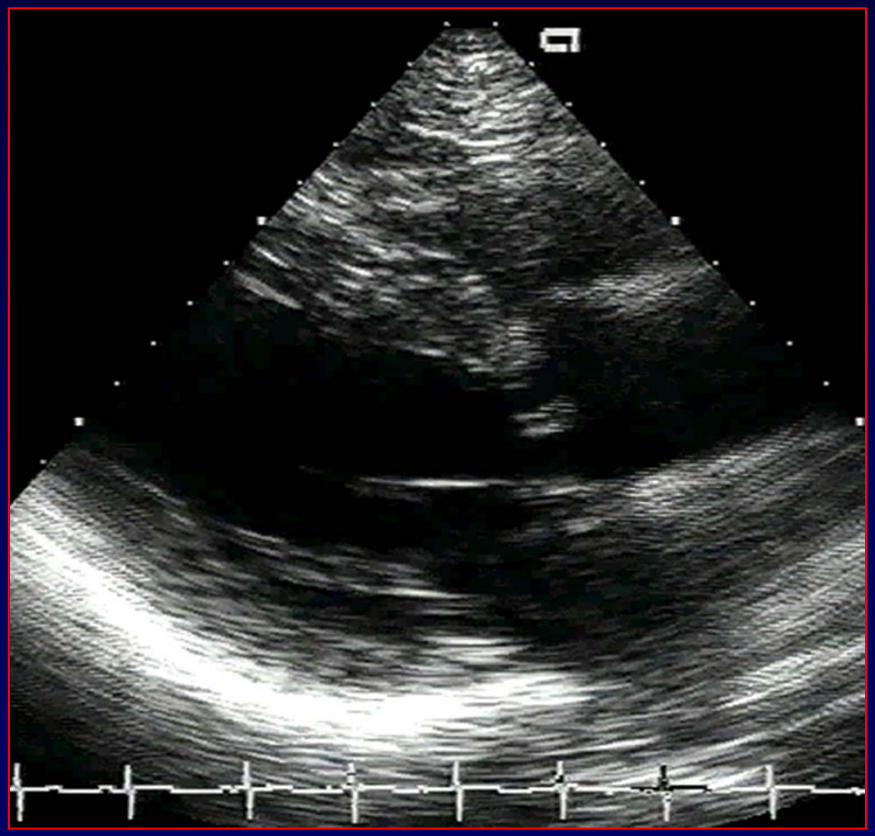
Case 1: 65 yo gentleman

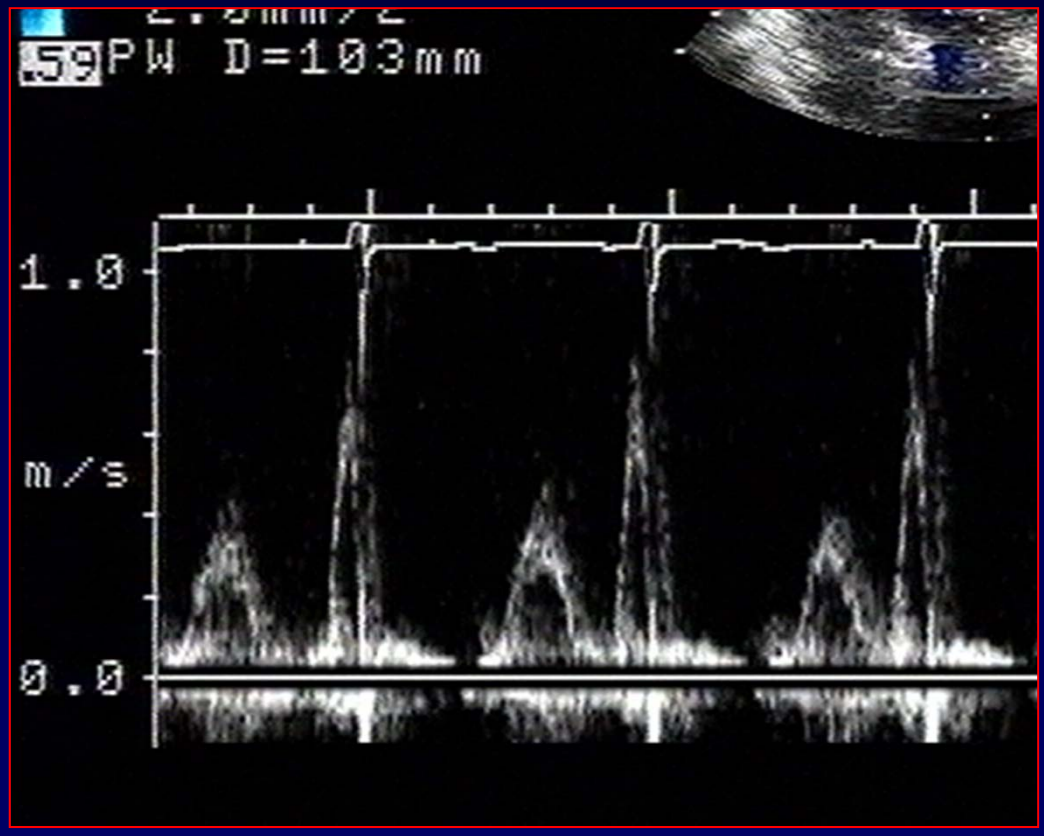
known COPD: ER due to dyspnea



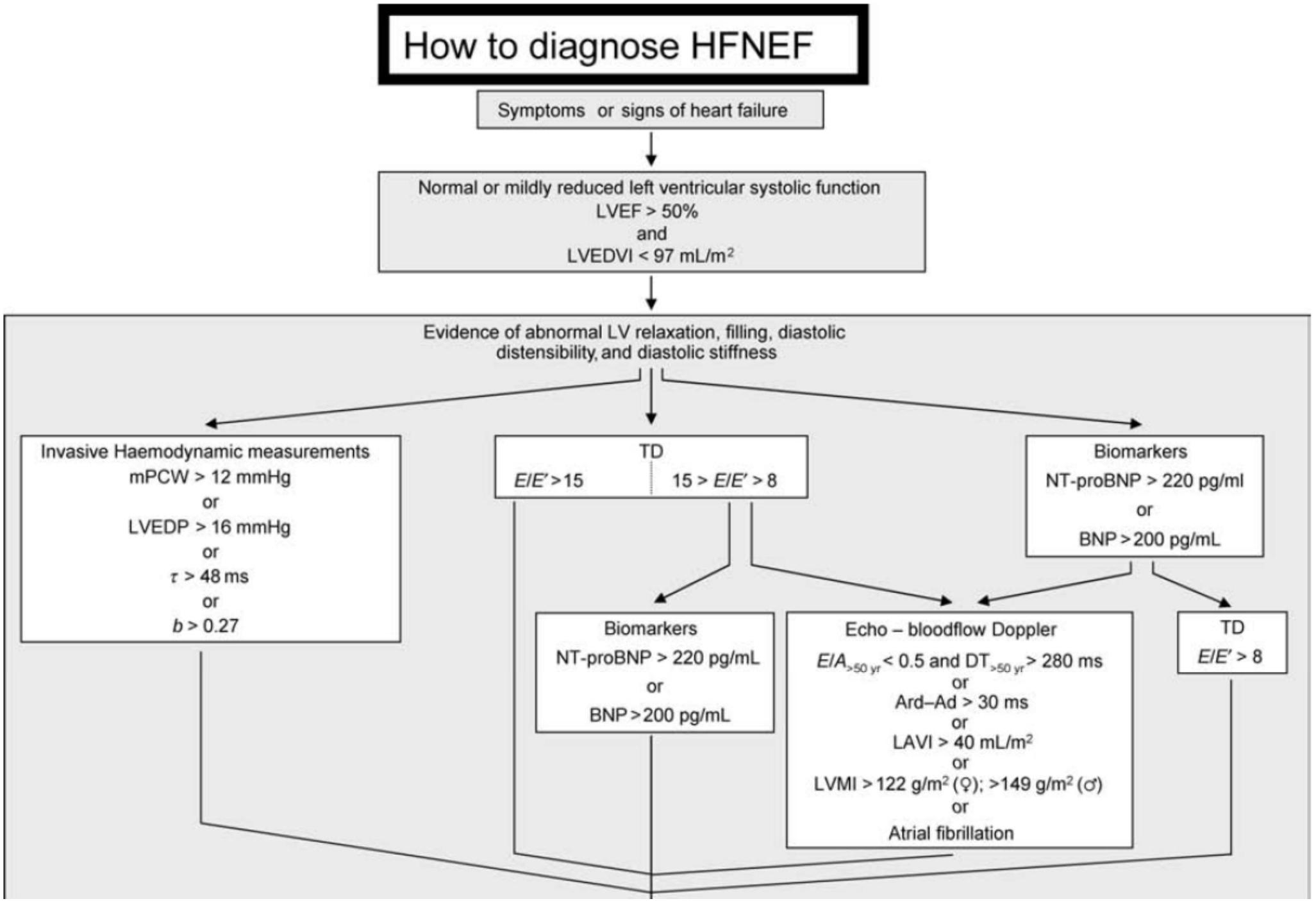


Case 1: 2 months later

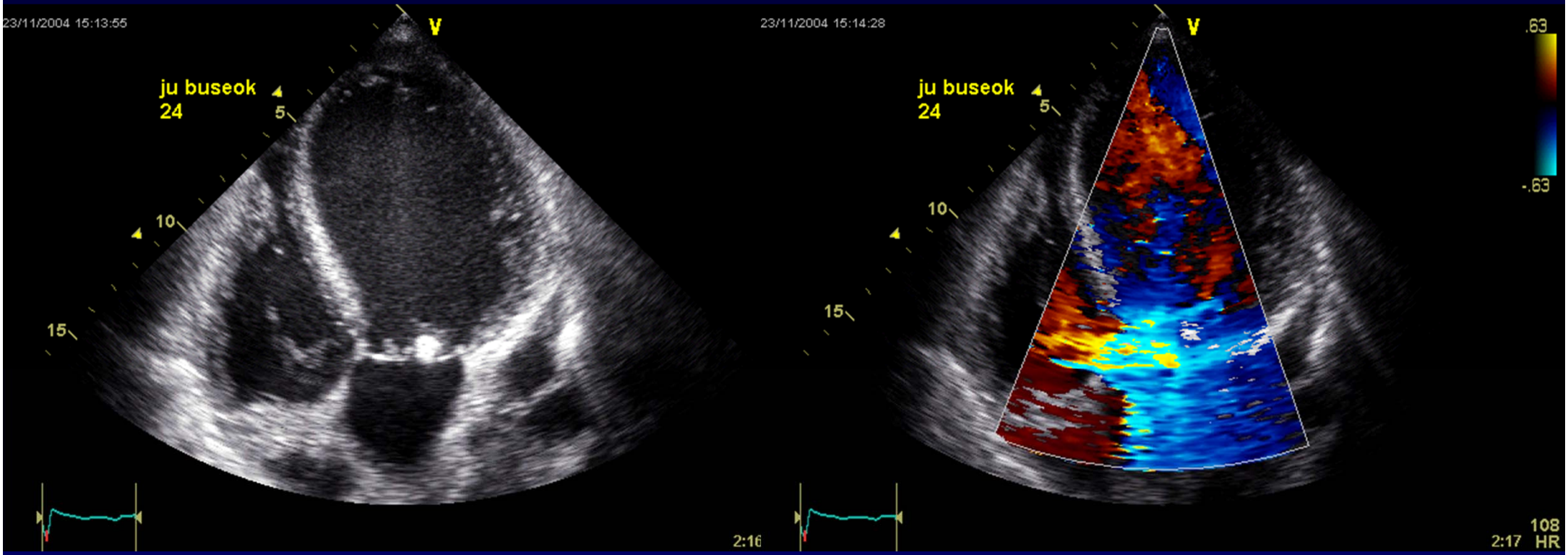




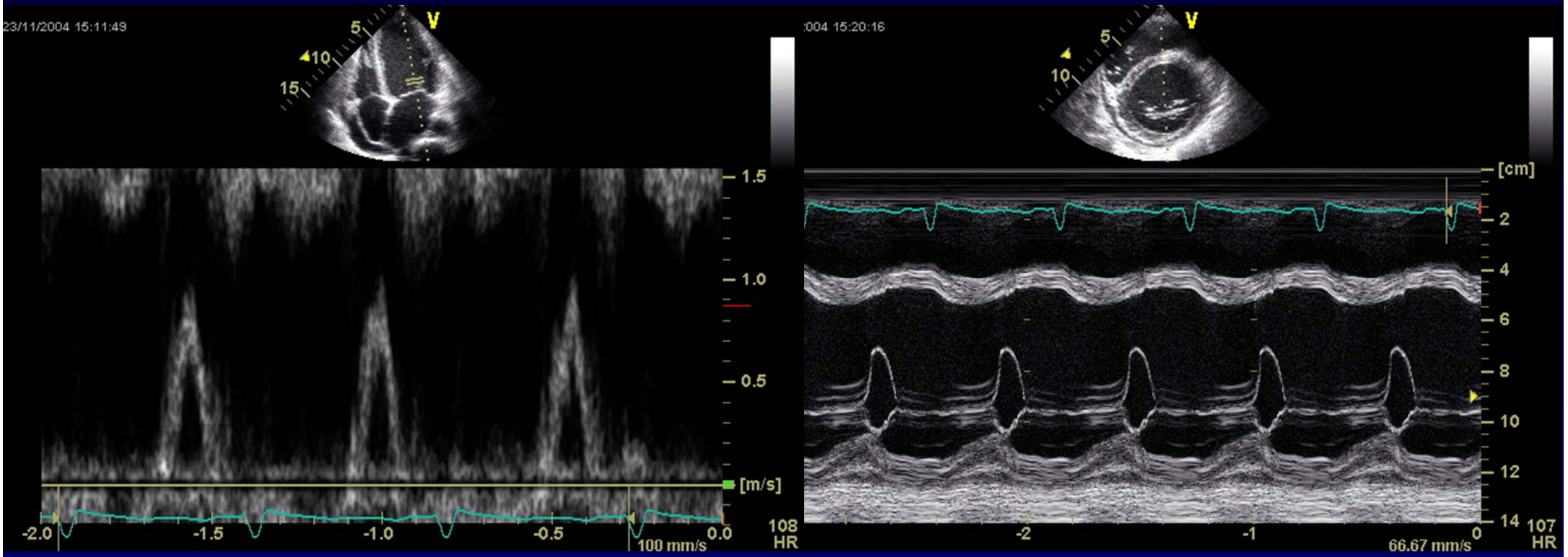
How to diagnose HFNEF



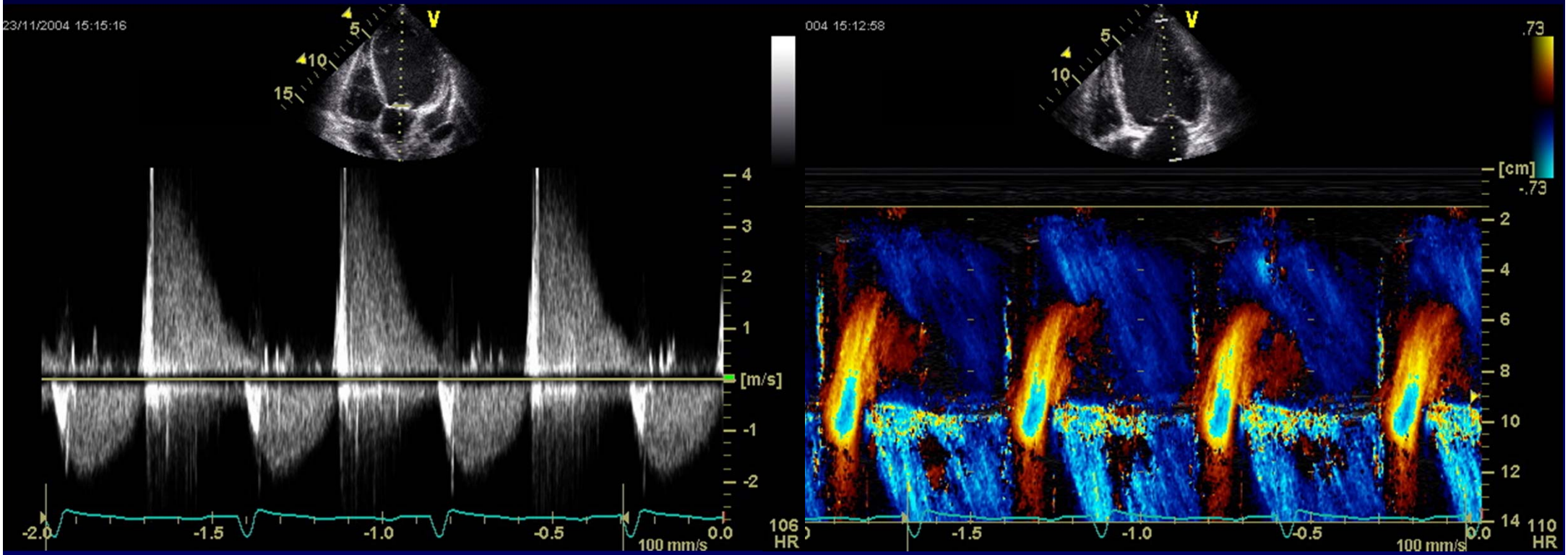
Case 2. Aggravated Dyspnea in pt with Endocarditis



Acute AR Hemodynamics



Acute AR Hemodynamics

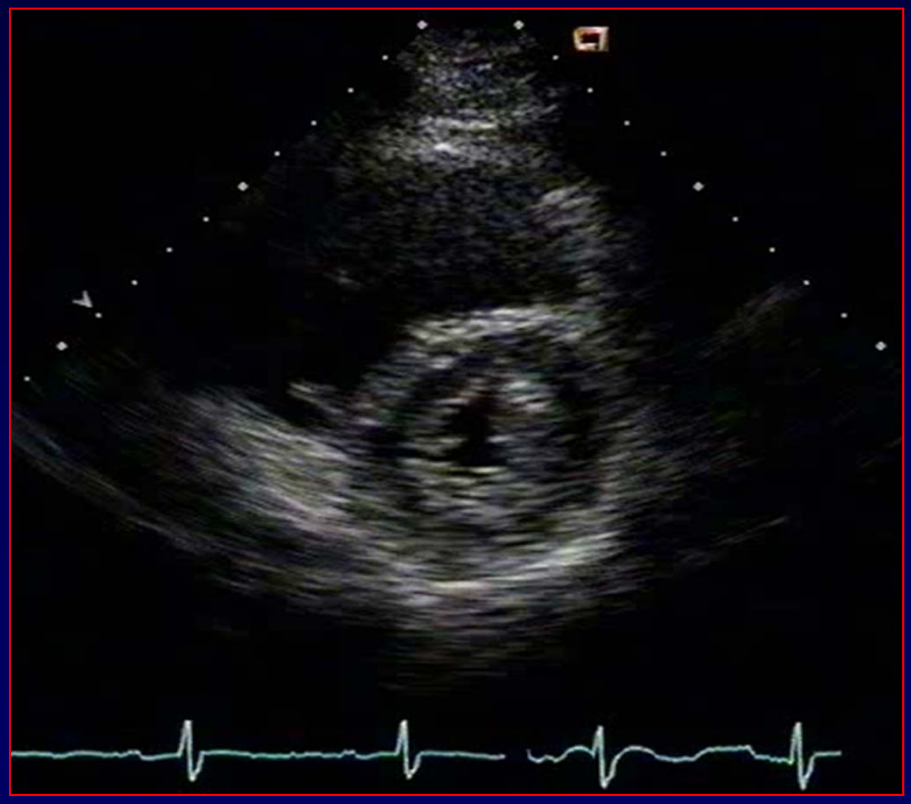


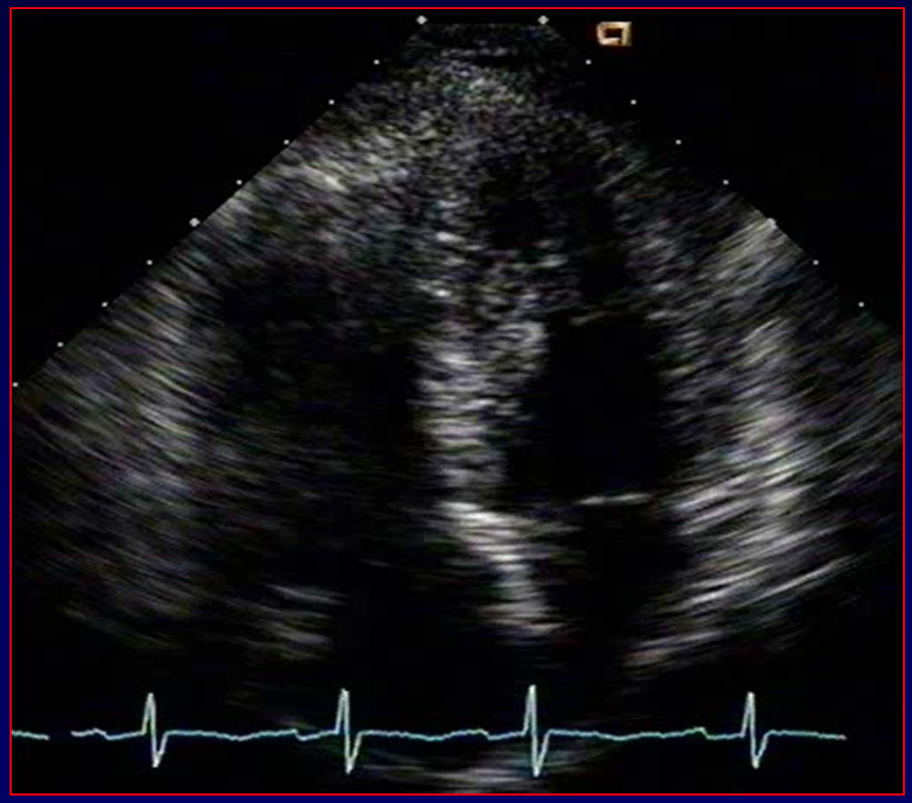
Strength and Current Role of Echo

- Hemodynamic evaluation
  - Valve stenosis, HF
- Portability
  - The best imaging modality for critical pts

Case 3: 55 yo woman

Sudden Collapse at Psychiatric Ward



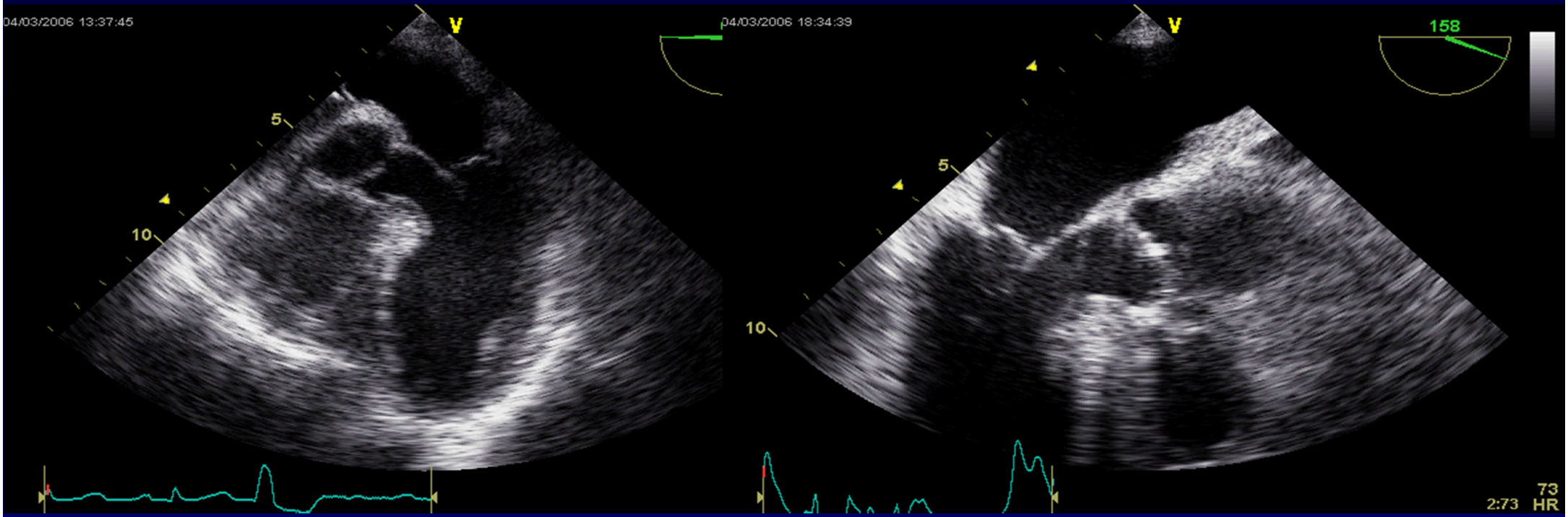


Strength and Current Role of Echo

- Hemodynamic evaluation
  - Valve stenosis, HF
- Portability
  - The best imaging modality for critical pts
- Versatility
  - intraOp TEE, intracardiac,
  - Therapeutic echo: ASD closure, pericardiocentesis, PMV, biopsy, alcohol ablation

Case 5: BP Drop after Induction for CABG

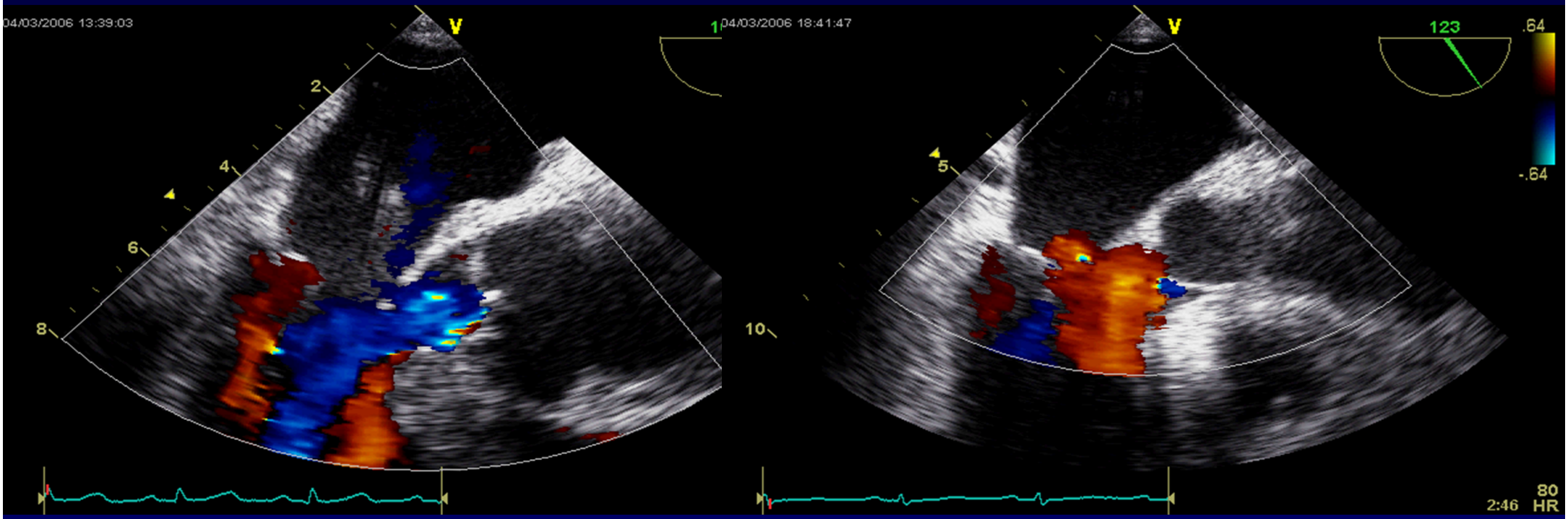
Under intensive inotropics



SAM during coronary bypass Op

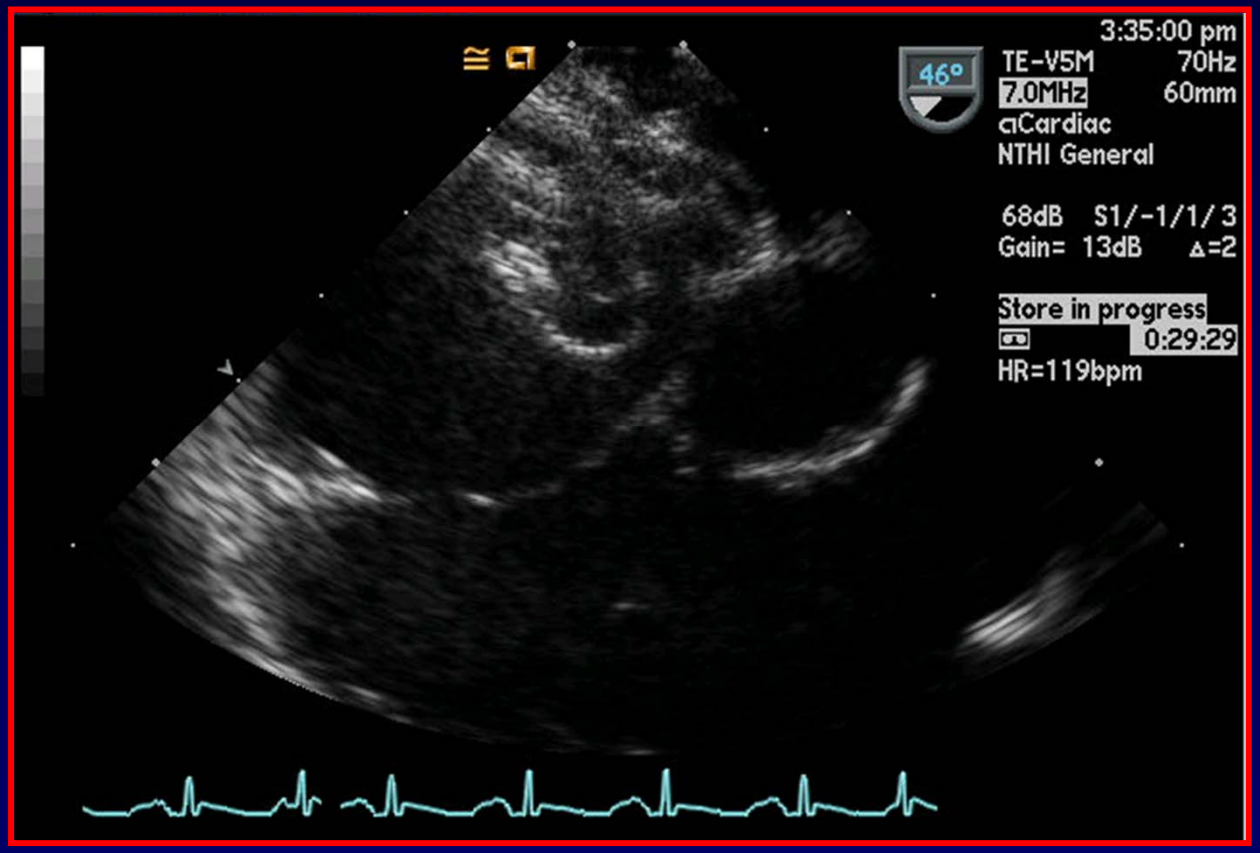
Intensive inotropics

Stop inotropics Hydration

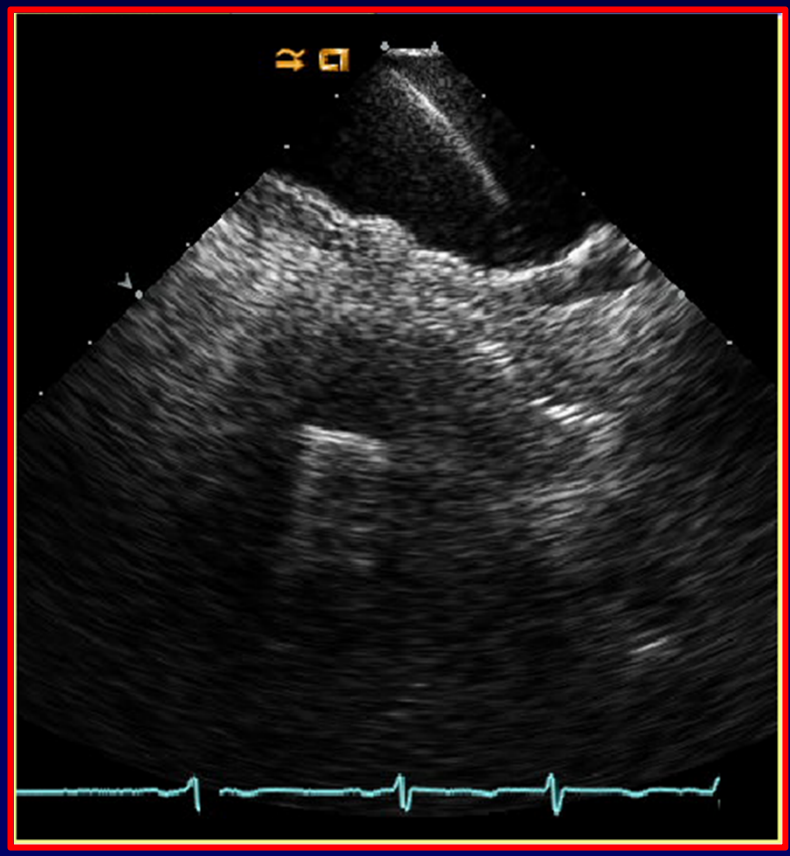


Echo for ASD Device Closure

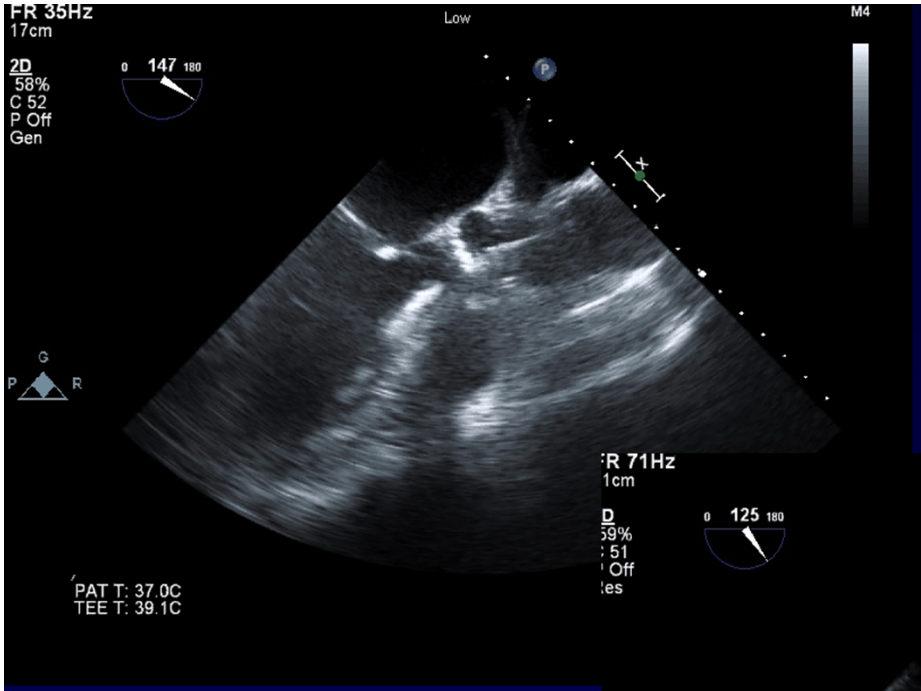
Transesophageal

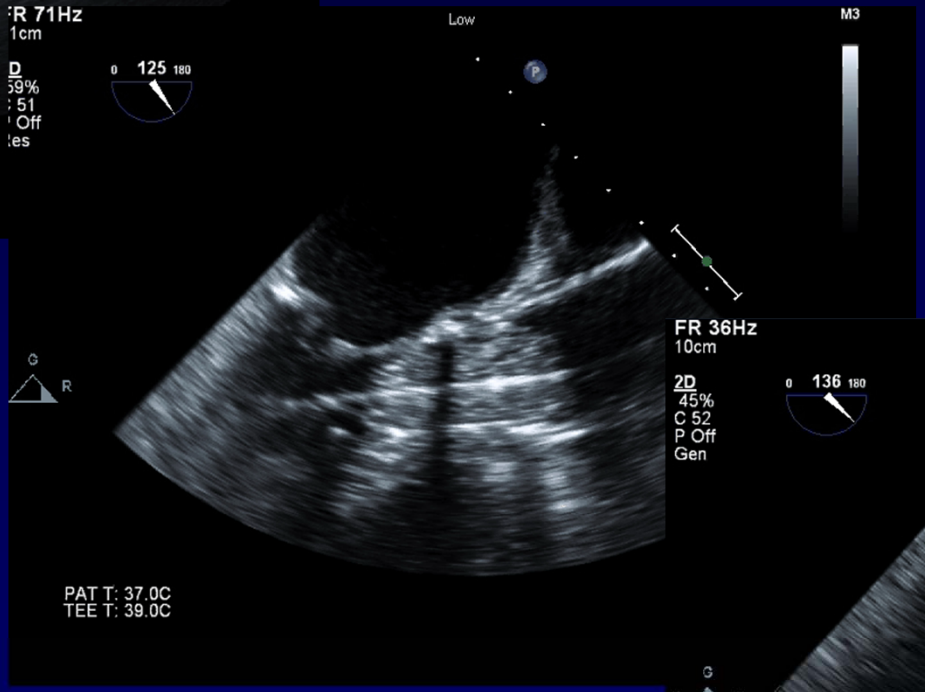


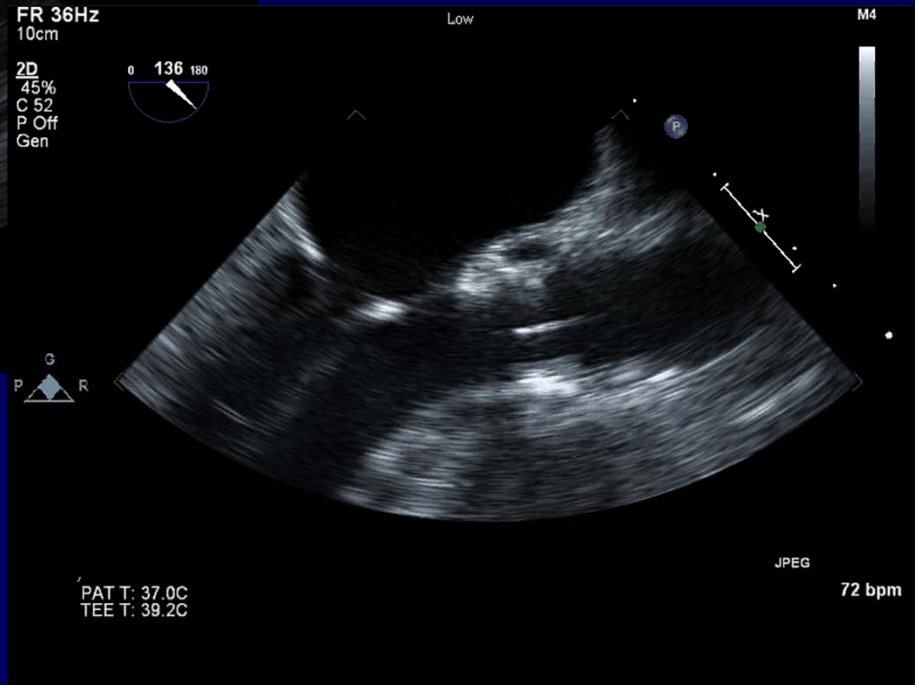
Intracardiac



Echo for TAVI





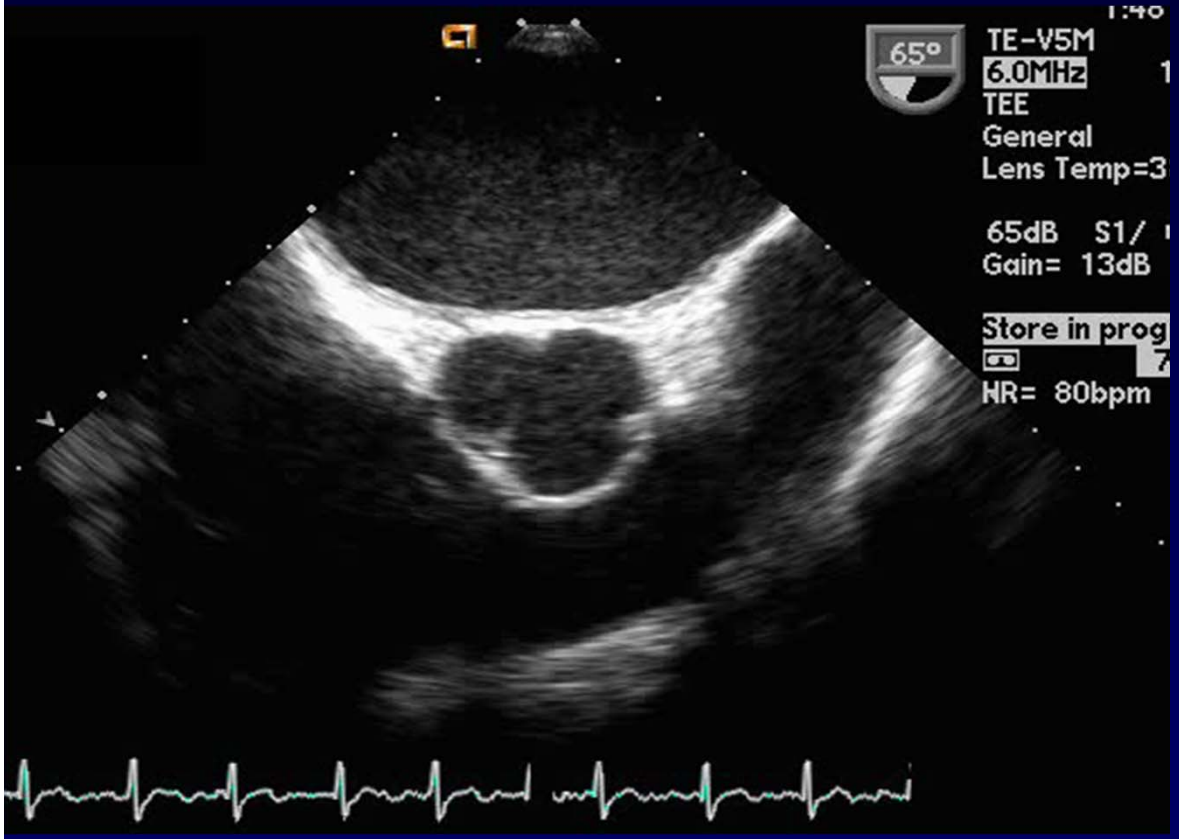


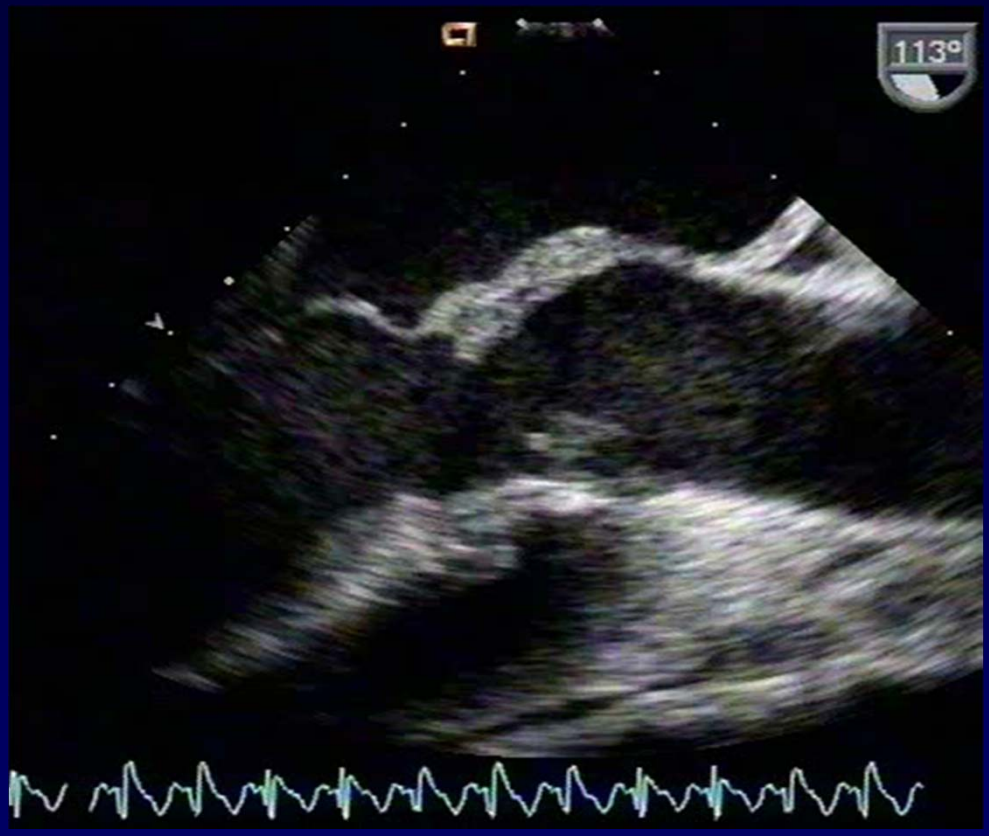
Courtesy of Prof. SJ Park

Strength and Current Role of Echo

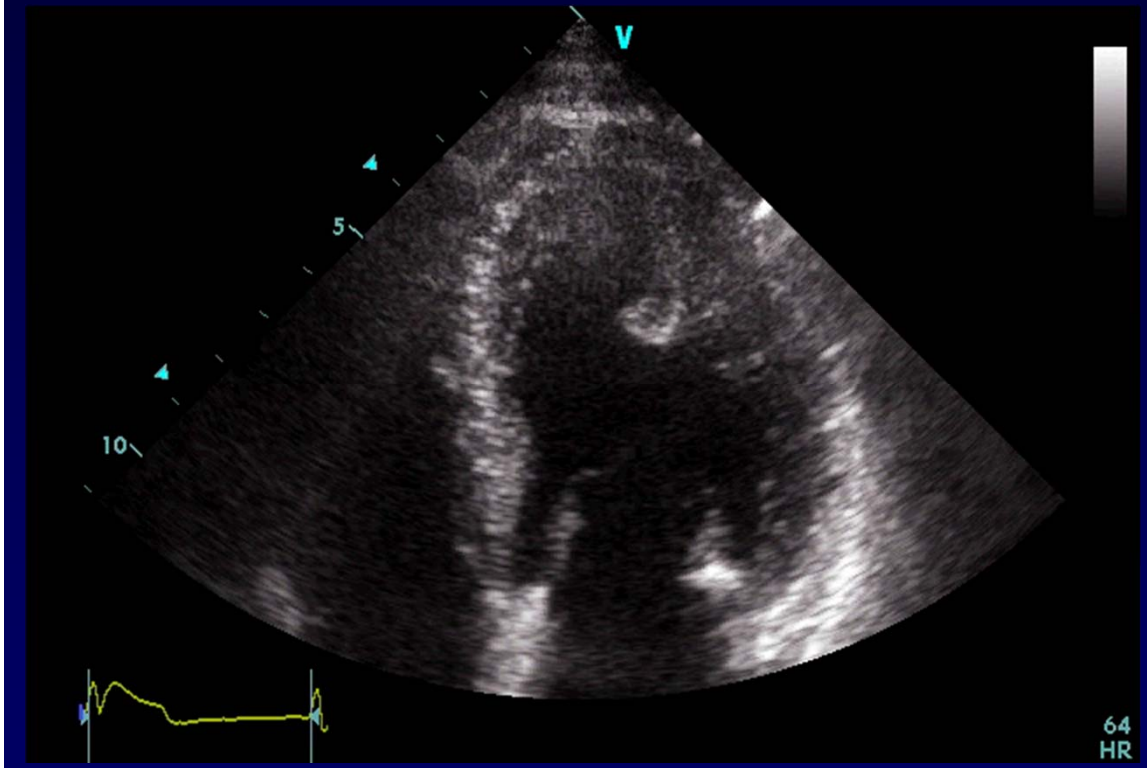
- Hemodynamic evaluation
  - Valve stenosis, HF
- Portability
  - The best imaging modality for critical pts
- Versatility
  - IntraOp TEE, ICE, Therapeutic echo
- High temporal, spatial resolution
  - Detection of intracardiac mass

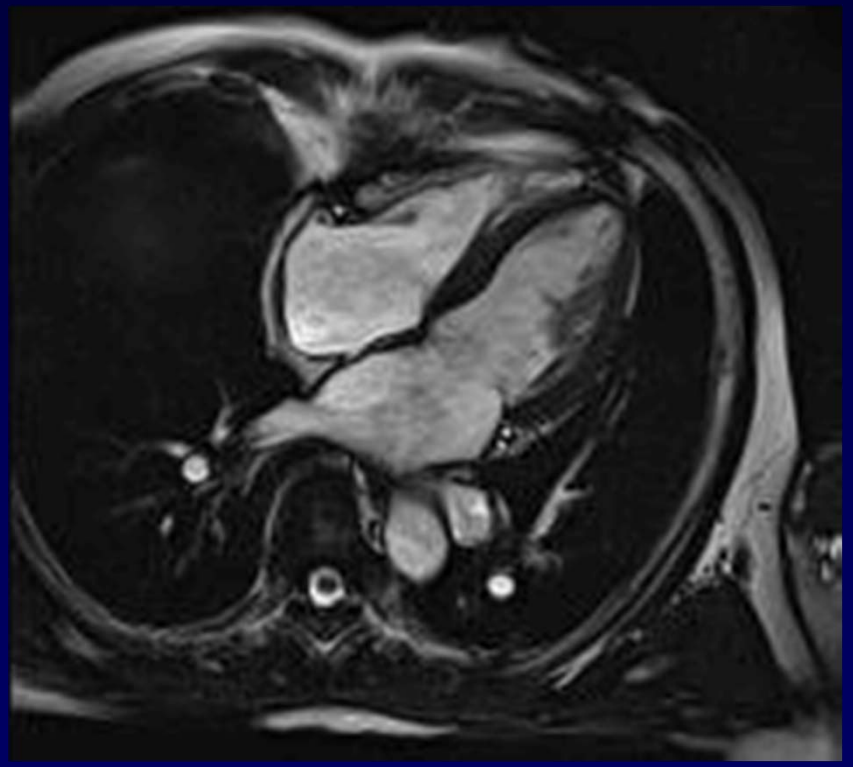
Case: Endocarditis



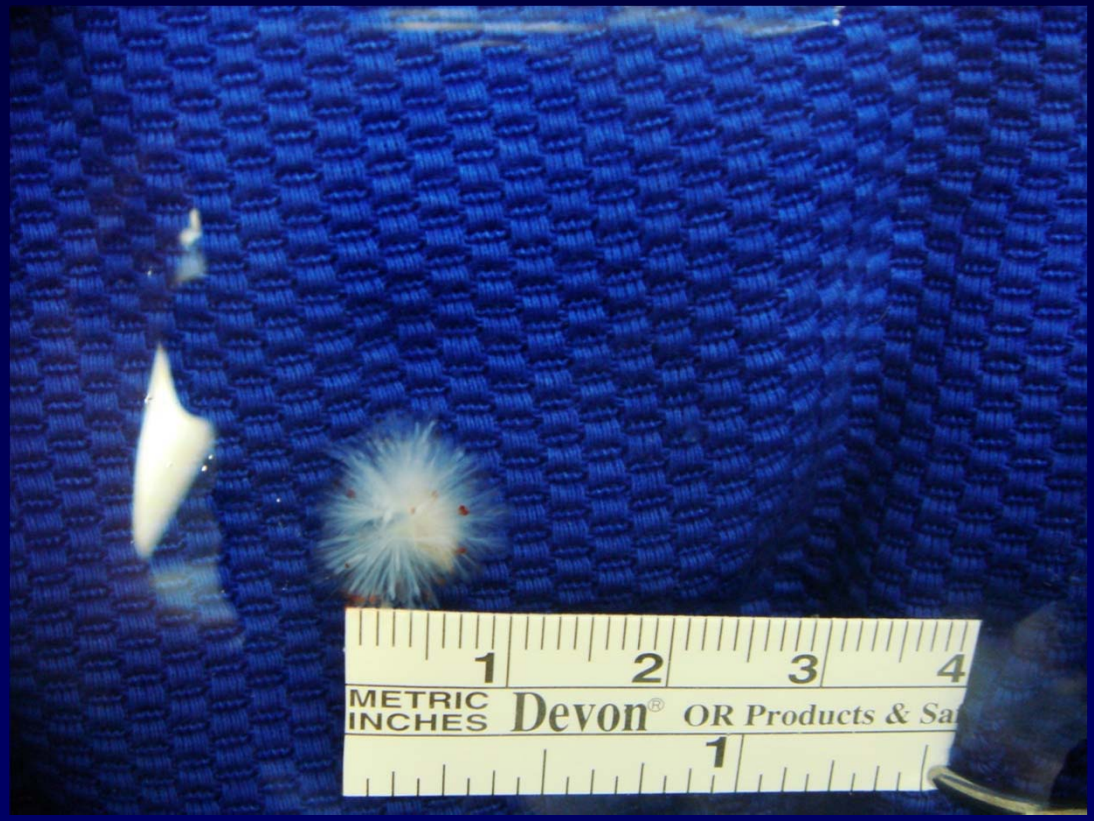


LV Mass





LV Papillary Fibroelastoma



Strength and Current Role of Echo

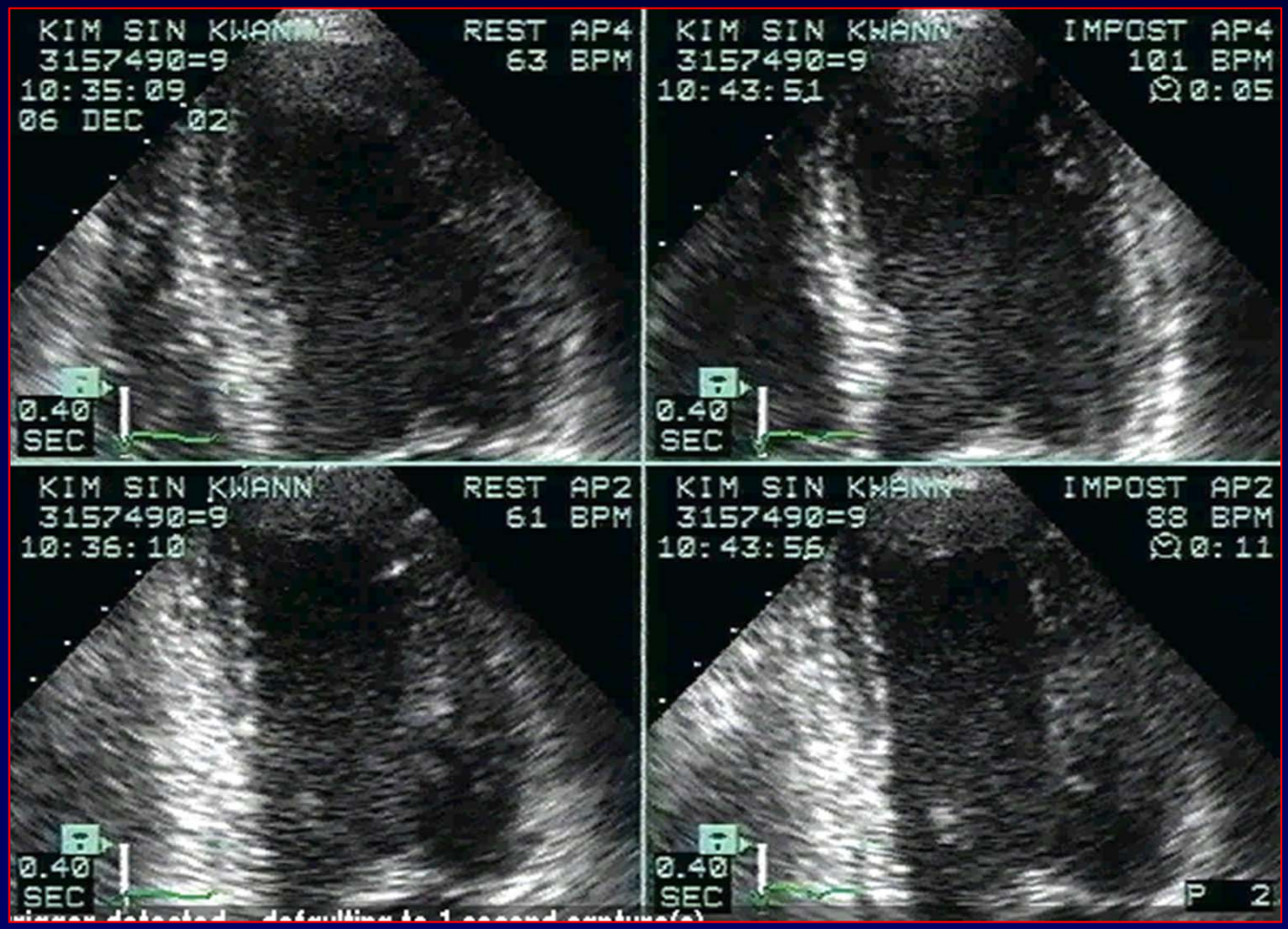
- Hemodynamic evaluation
  - Valve stenosis, HF
- Portability
  - The best imaging modality for critical pts
- Versatility
  - IntraOp TEE, ICE, Therapeutic echo
- High temporal, spatial resolution
  - Detection of intracardiac mass
- Exercise physiology: CAD, Valve ds, Diastolic stress

Exercise Echo

Courtesy of Prof. WS Kim

Courtesy of Prof. JW Ha

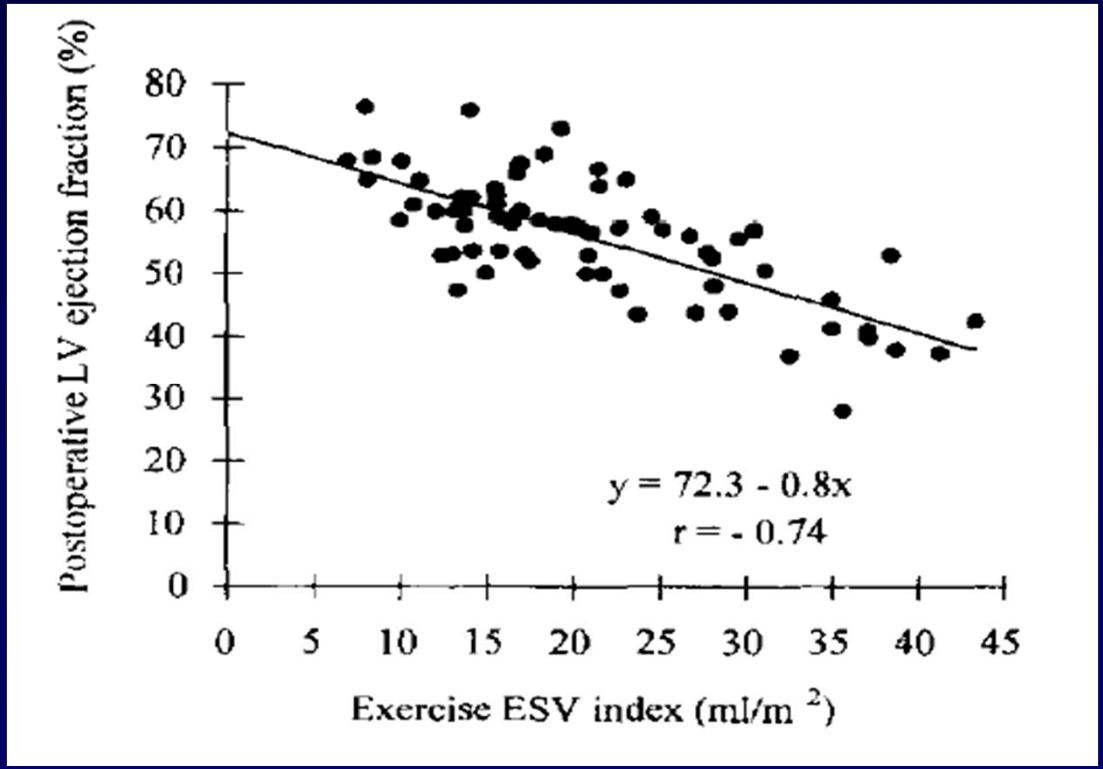
Exercise Echo for CAD



Exercise Echo in MR

latent LV dysfunction

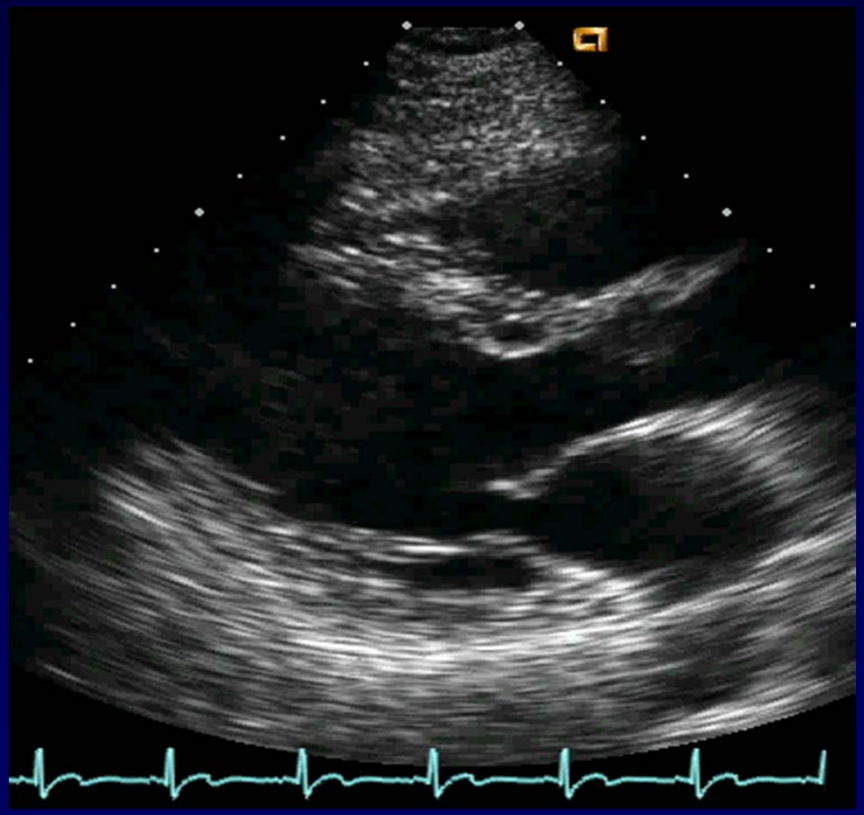
139 pt with chronic MR

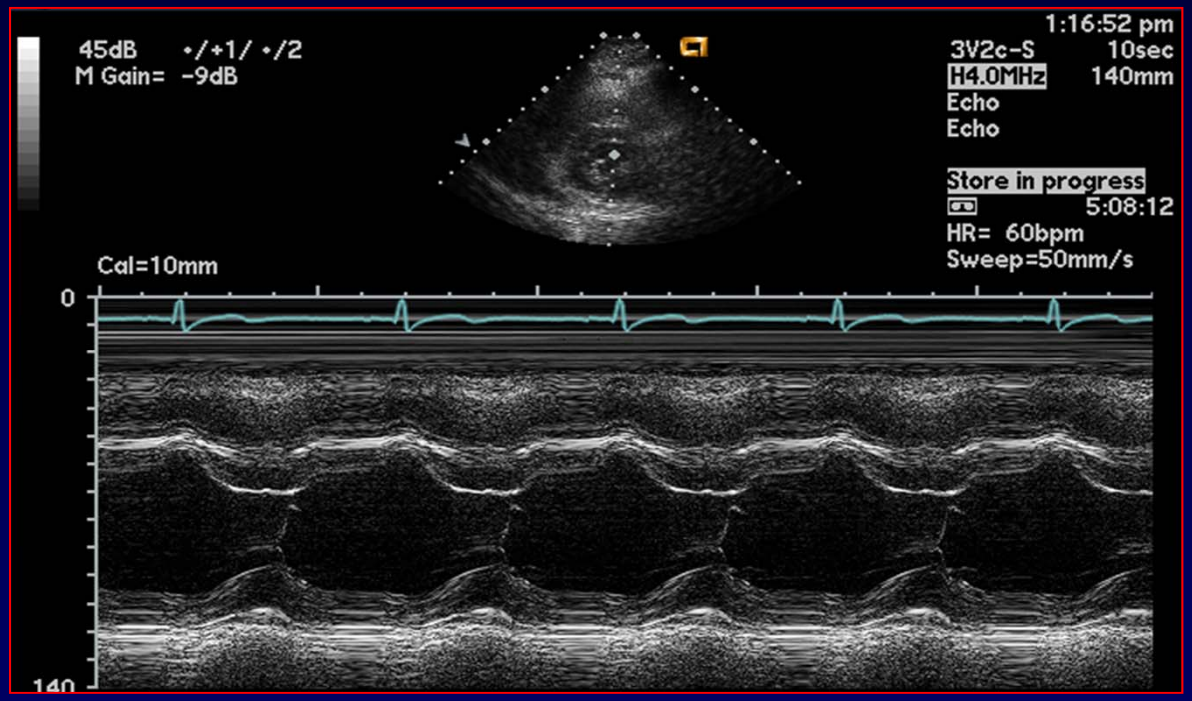


Leung et al, JACC 1996

Exercise Echo in MR

Source of symptoms





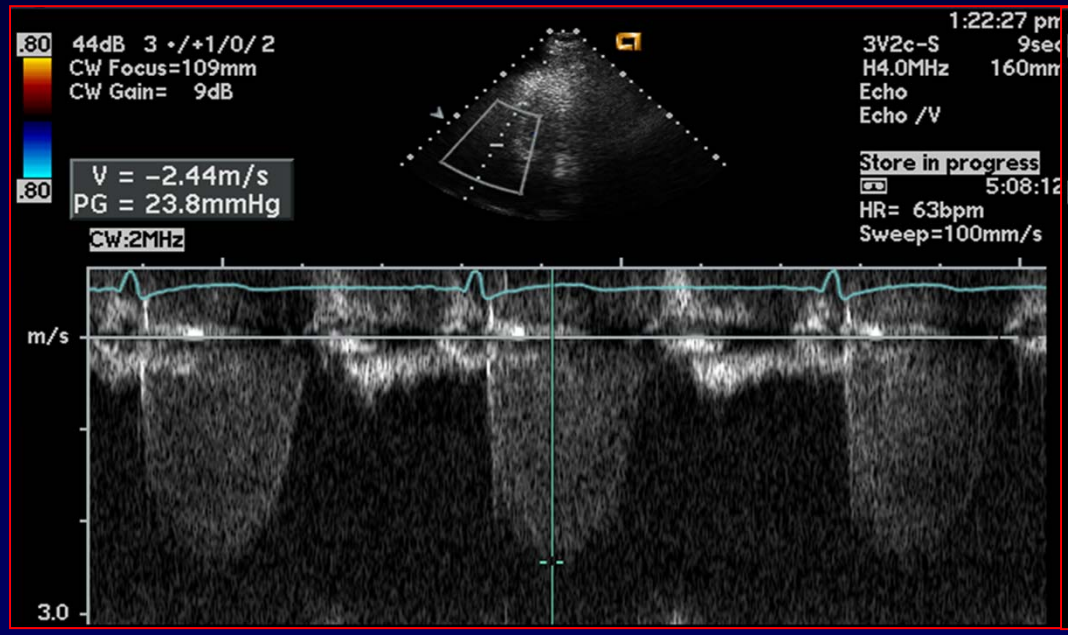
LVEDD = 53mm

LVESD = 27mm

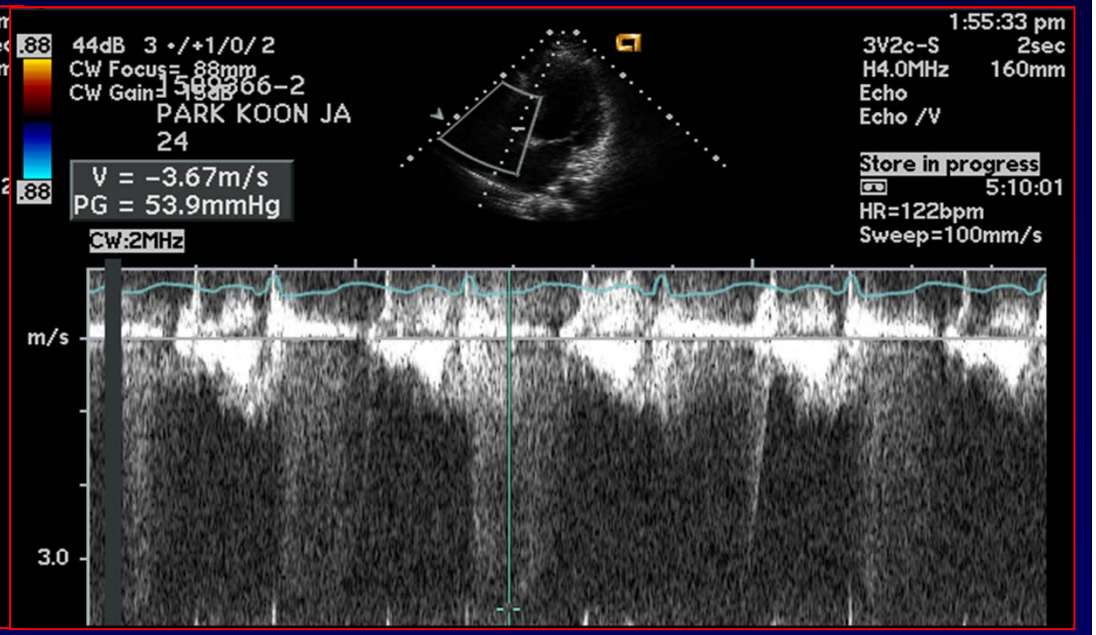
EF = 74 %

Exercise Echo in MR

Source of symptoms



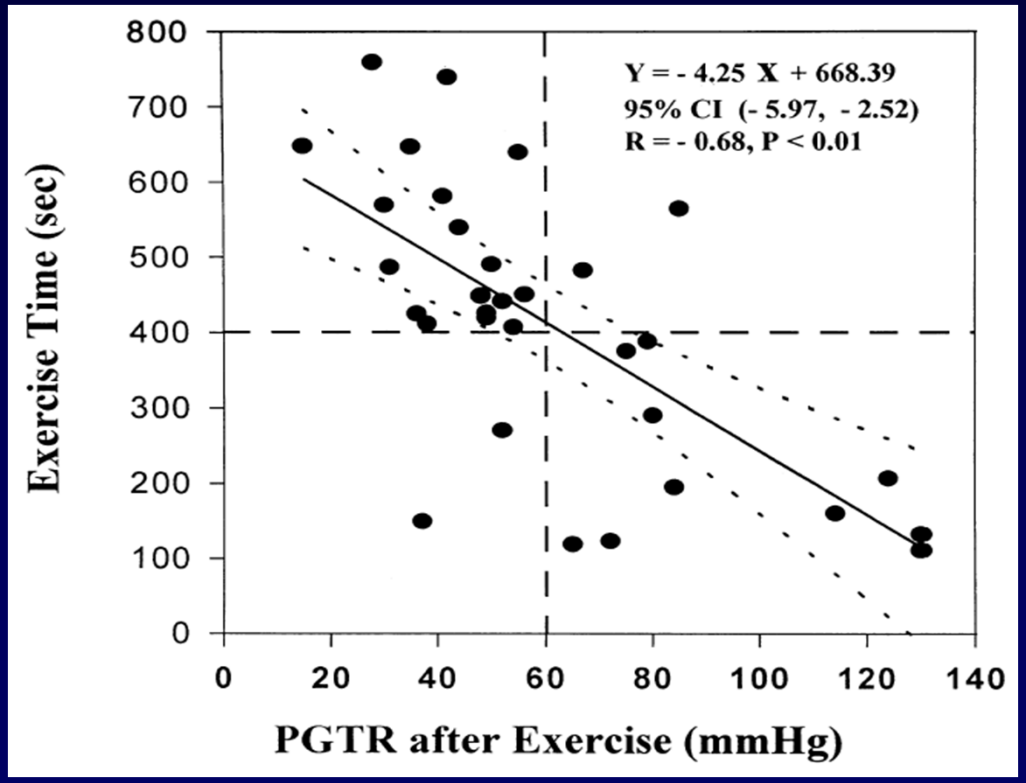
PA systolic pr = 34mmHg

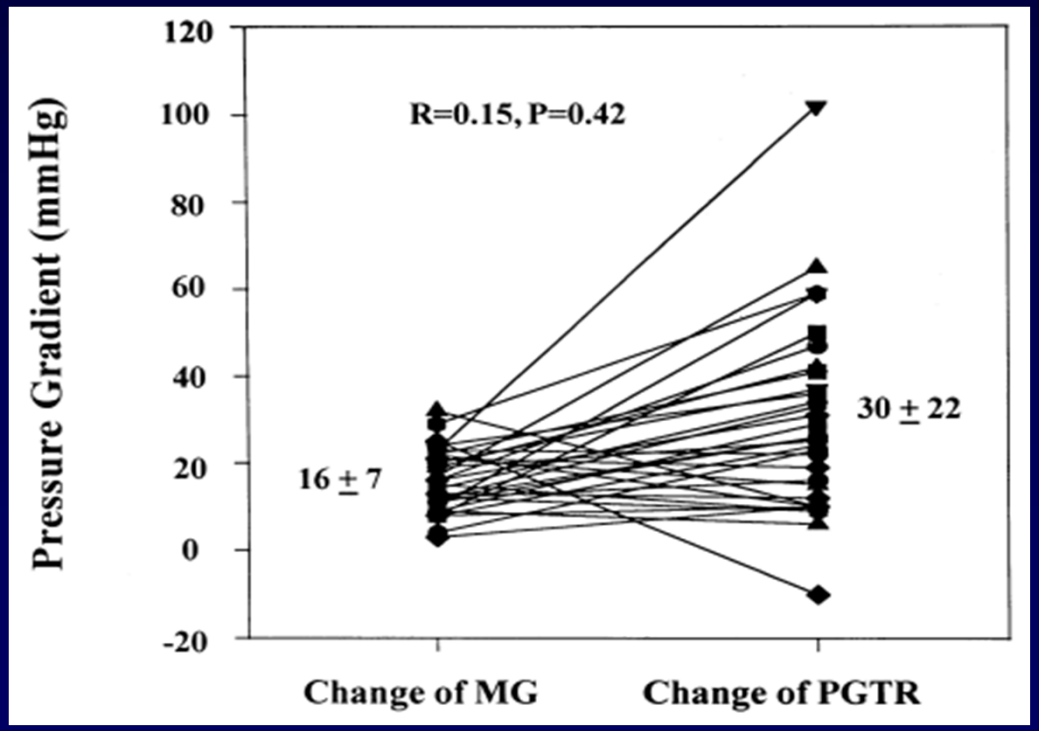


PA systolic pr = 64mmHg

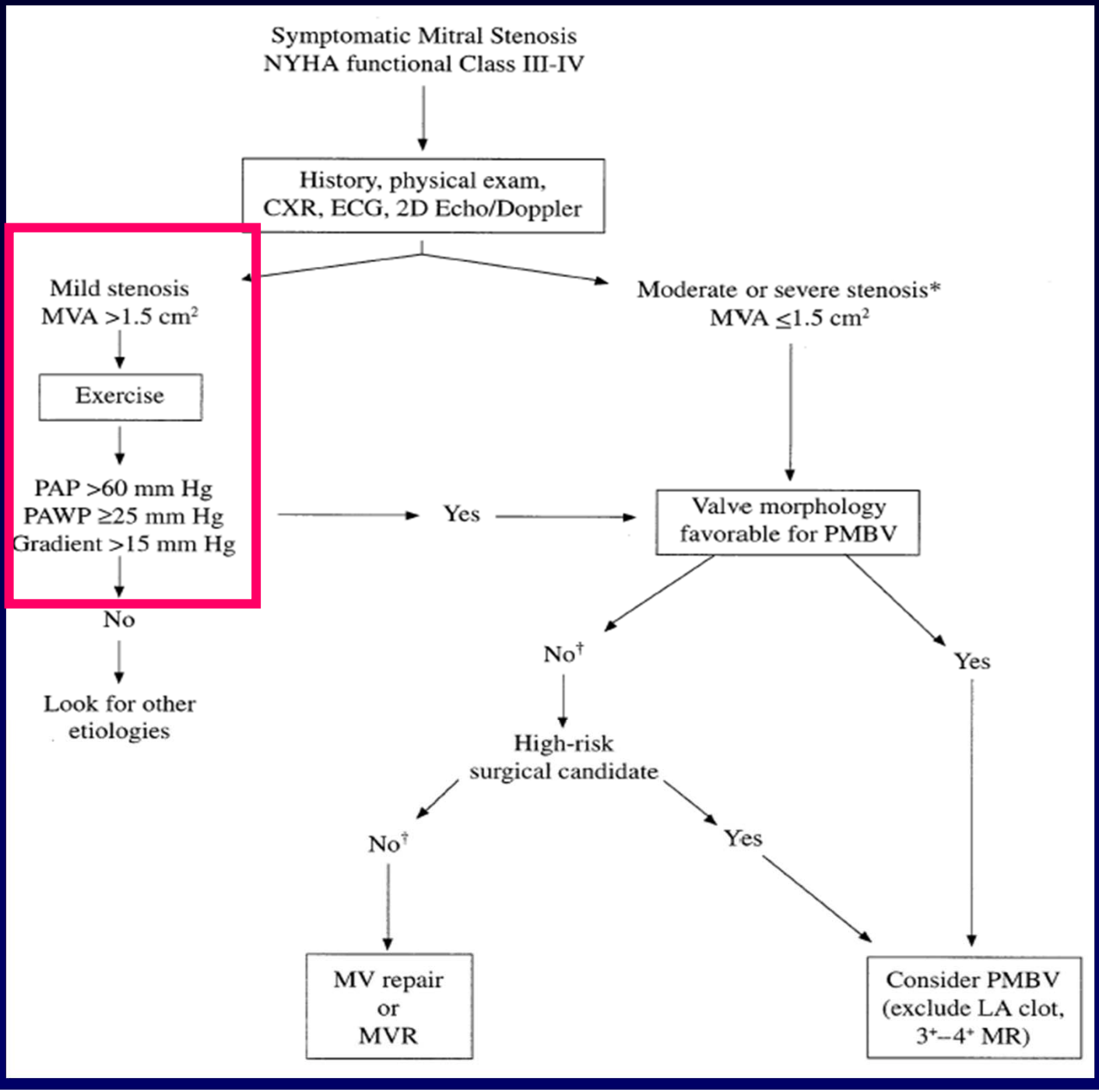
Exercise Echo in MS

Determinants of exercise capacity





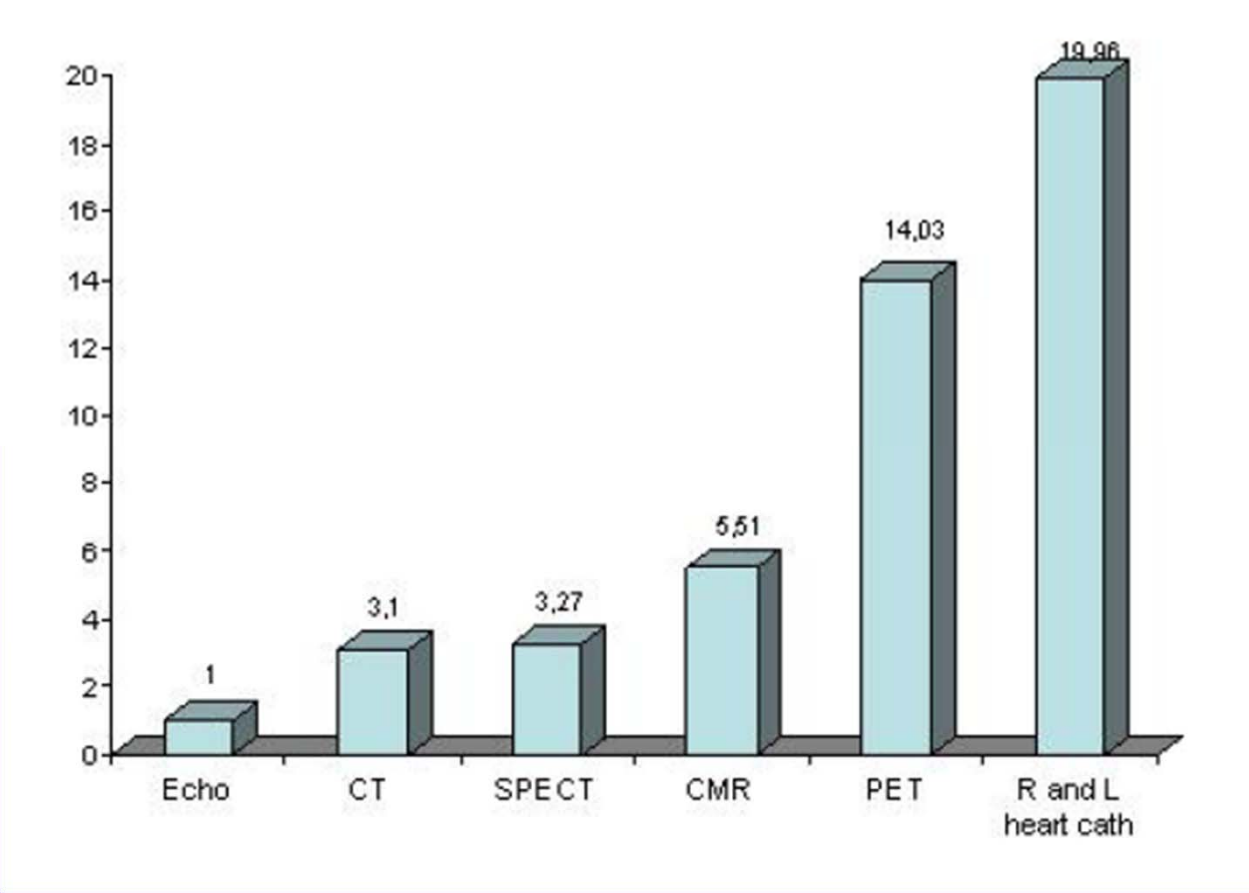
Song et al, AJC 1996


Symptomatic Mitral Stenosis
NYHA functional Class III-IV
History, physical exam,
CXR, ECG, 2D Echo/Doppler
Mild stenosis
MVA >1.5 cm²
Exercise
PAP >60 mm Hg
PAWP ≥25 mm Hg
Gradient >15 mm Hg
No
Look for other
etiologies
Moderate or severe stenosis*
MVA ≤1.5 cm²
Yes
Valve morphology
favorable for PMBV
No†
Yes
High-risk
surgical candidate
No†
Yes
MV repair
or
MVR
Consider PMBV
(exclude LA clot,
3+–4+ MR)

Strength and Current Role of Echo

- Hemodynamic evaluation: Valve stenosis, HF
- Portability: The best imaging modality for critical pts
- Versatility: IntraOp TEE, ICE, Therapeutic echo
- High temporal, spatial resolution
  - Detection of intracardiac mass
- Exercise physiology: CAD, Valve ds, Diastolic stress
- Lower cost
  - Regular F/U, screening, developing country

Average Costs



Epidemics of Imaging

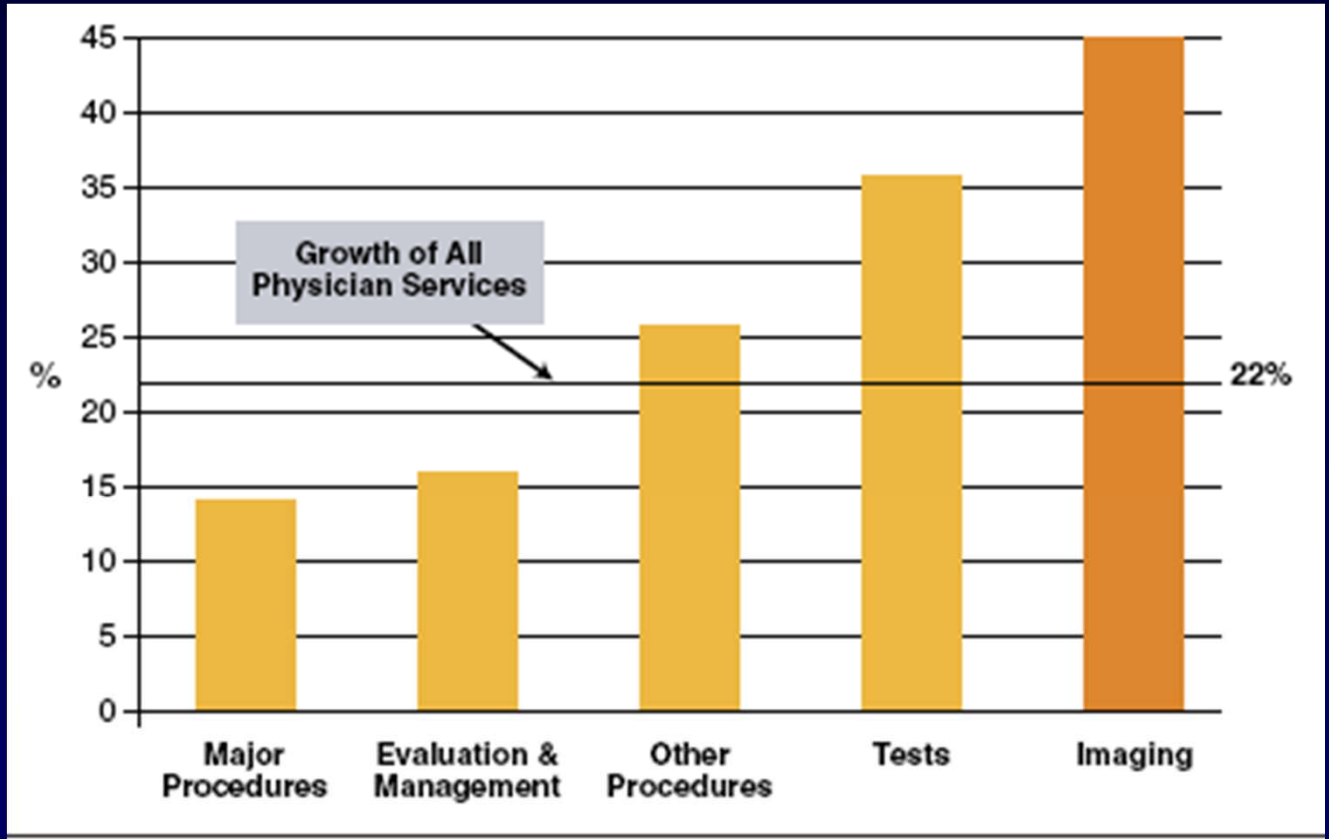
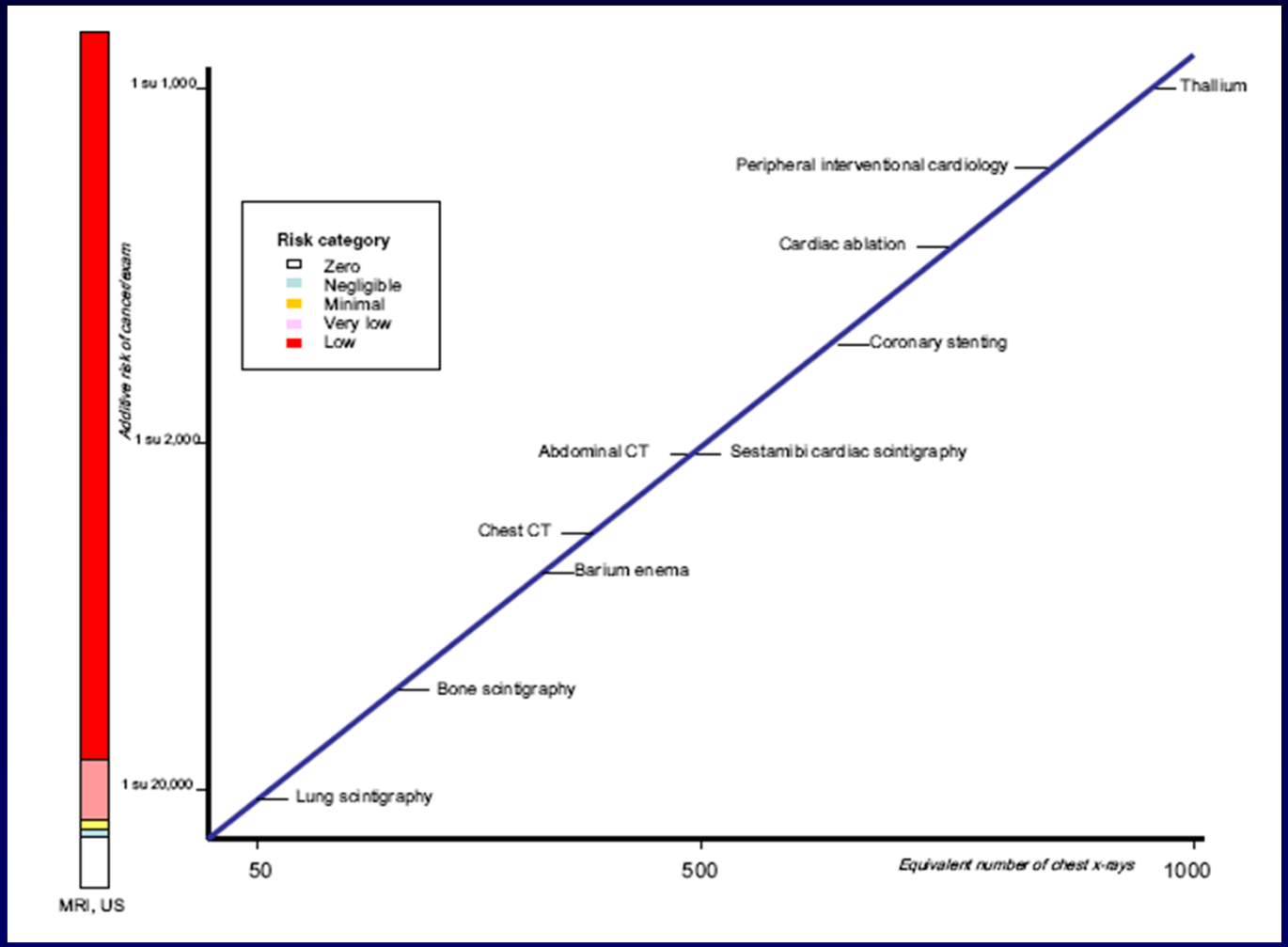
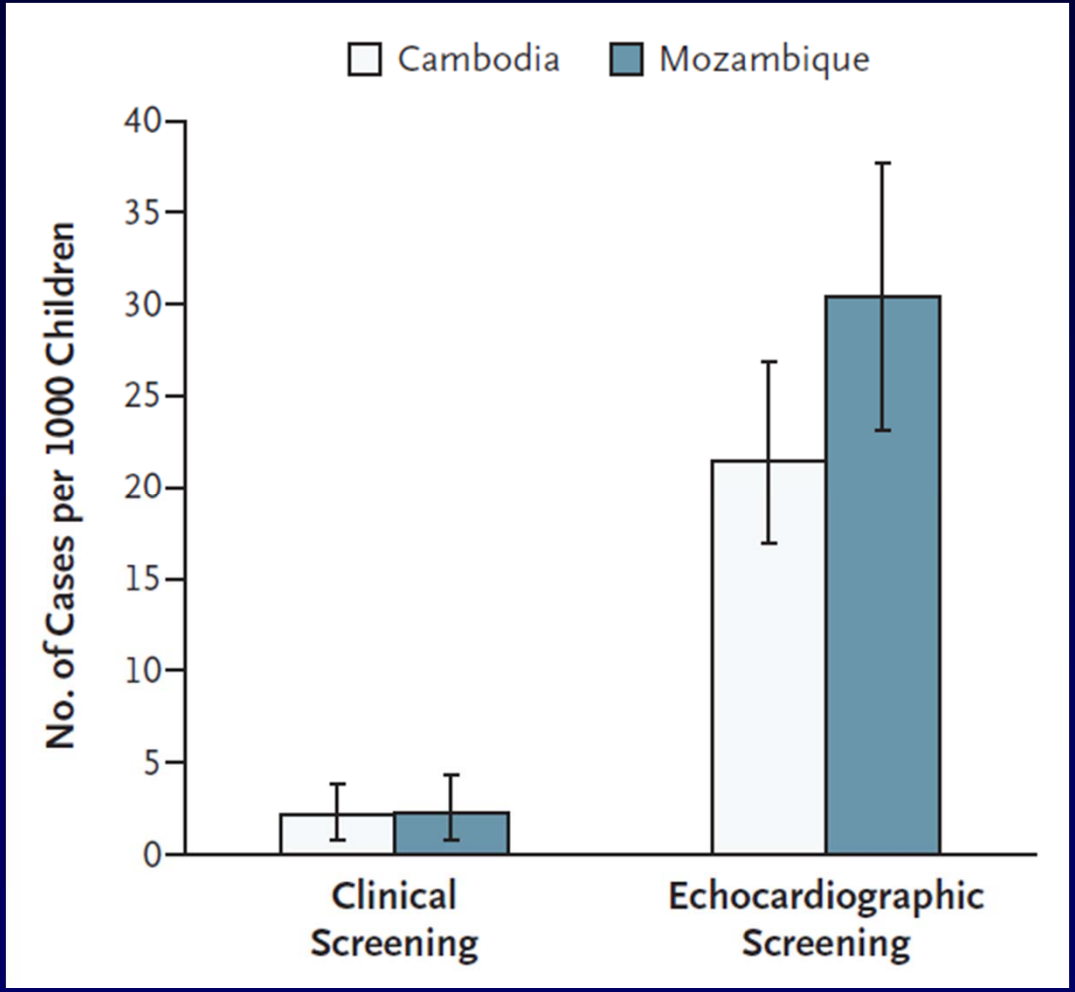


Figure 1. MedPAC Evaluation of Growth in Physician Services From 1999 to 2000

Cancer Risk and Radiation



Echo Screening for Rheumatic Valve

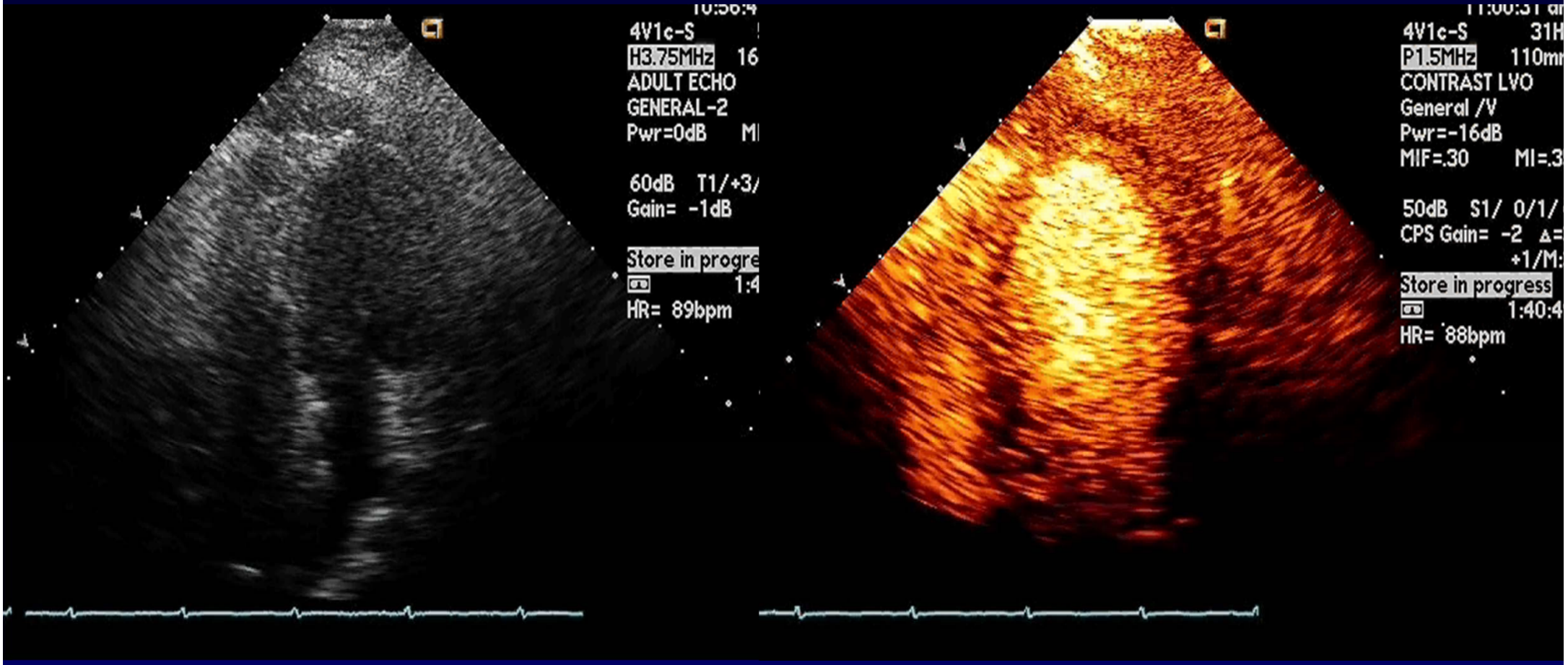


Marijon E, et al. NEJM 2007

Weakness and Recent Development

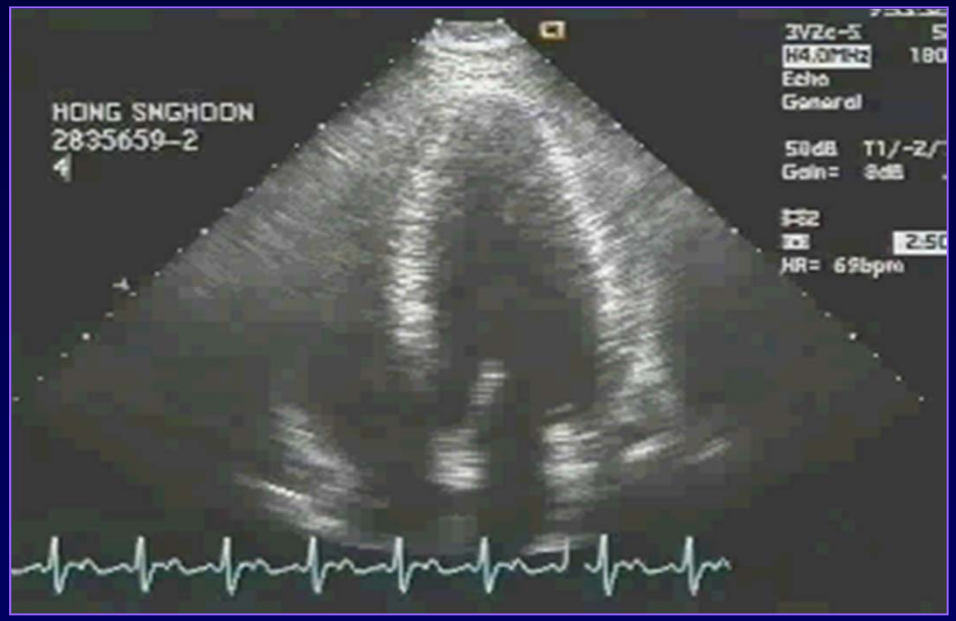
- Poor image quality
  - Contrast echocardiography

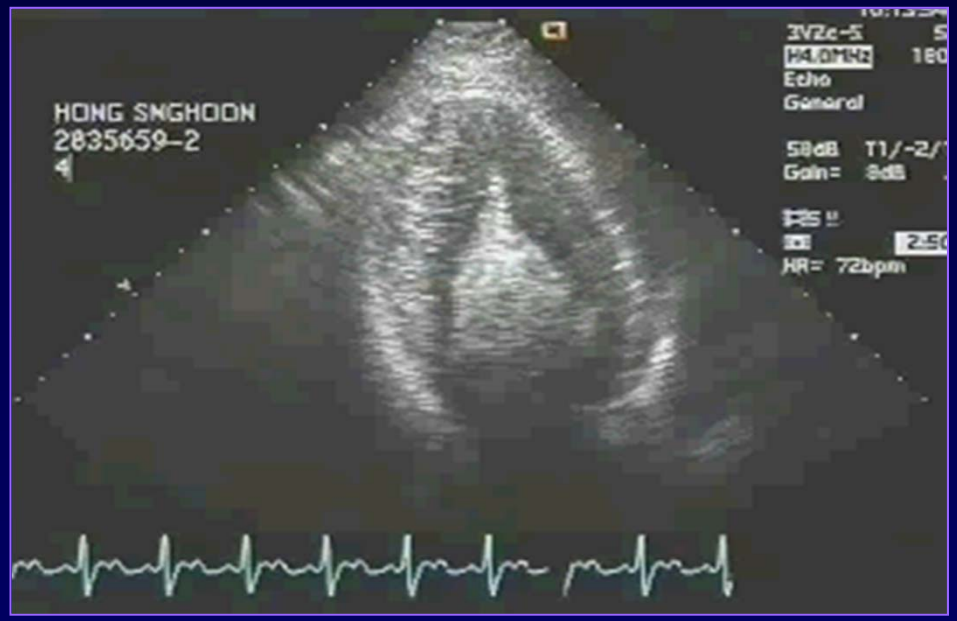
LV Opacification with Contrast Echo



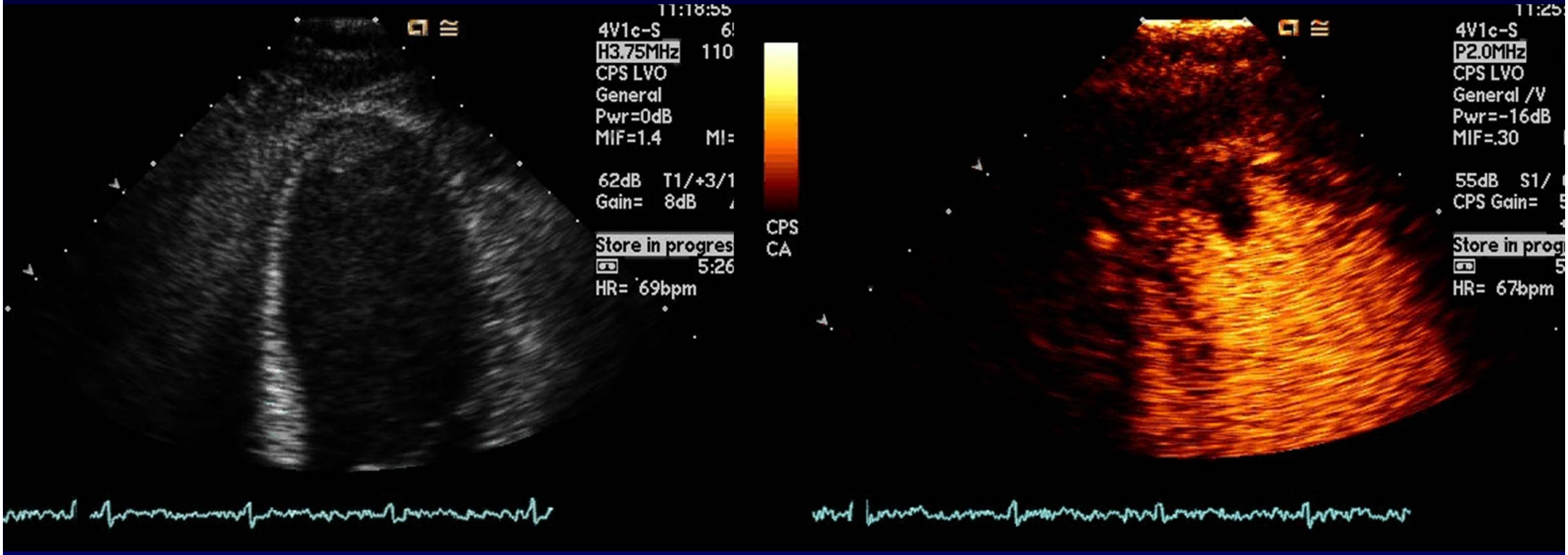
Courtesy of Prof. GR Hong

Apical HCM: Pitfalls in Diagnosis





Apical Thrombus



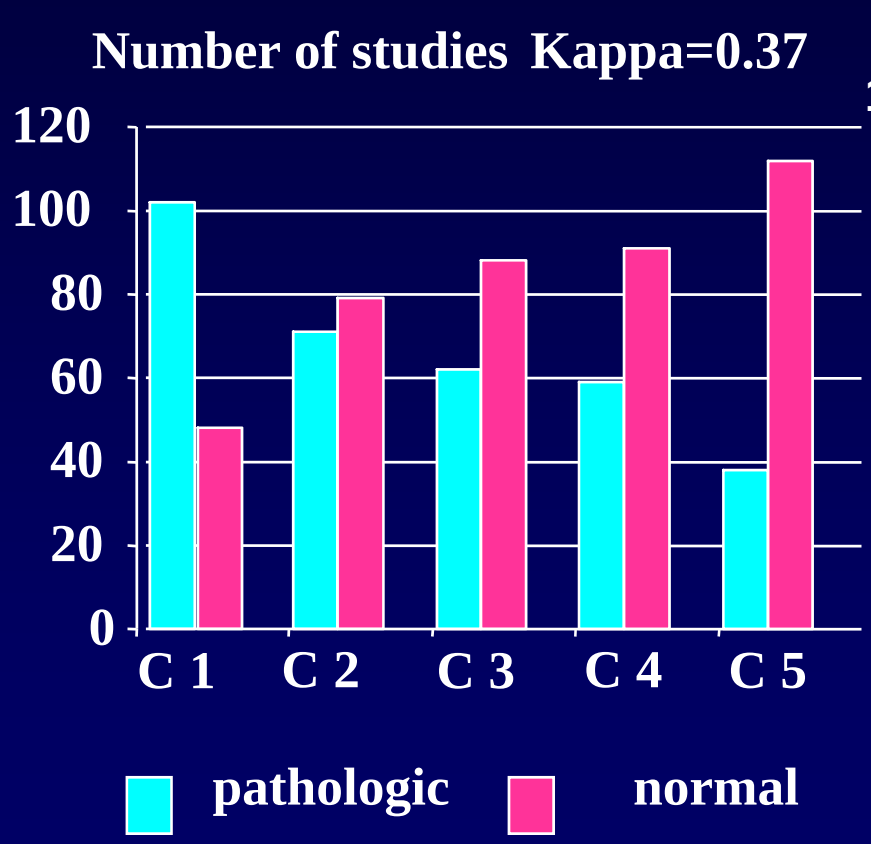
Courtesy of Prof. GR Hong

Weakness and Recent Development

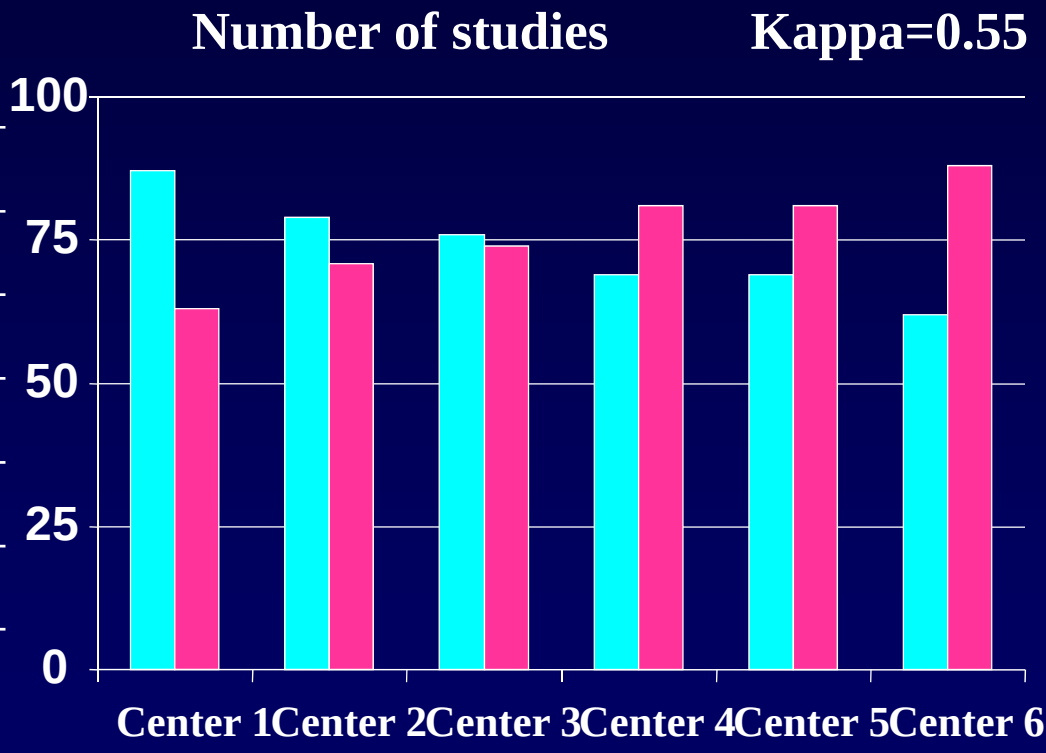
- Poor image quality
  - Contrast echocardiography
- Large variability
  - Automation

Interpretation of Stress Echo

1994



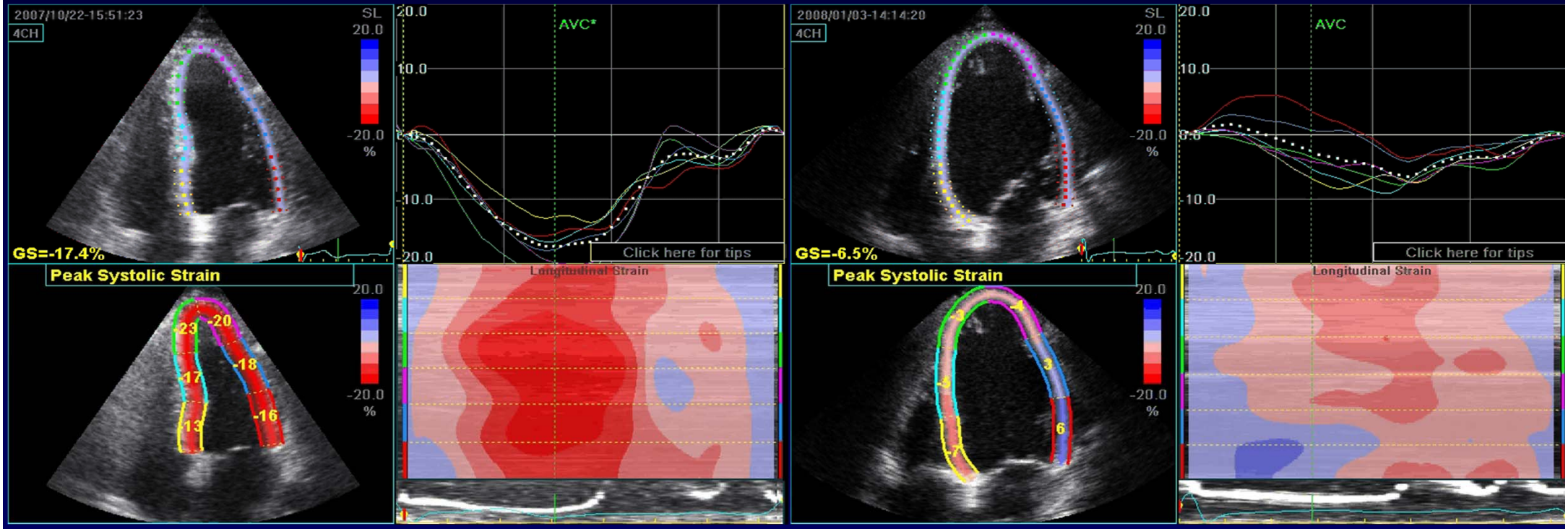
2000



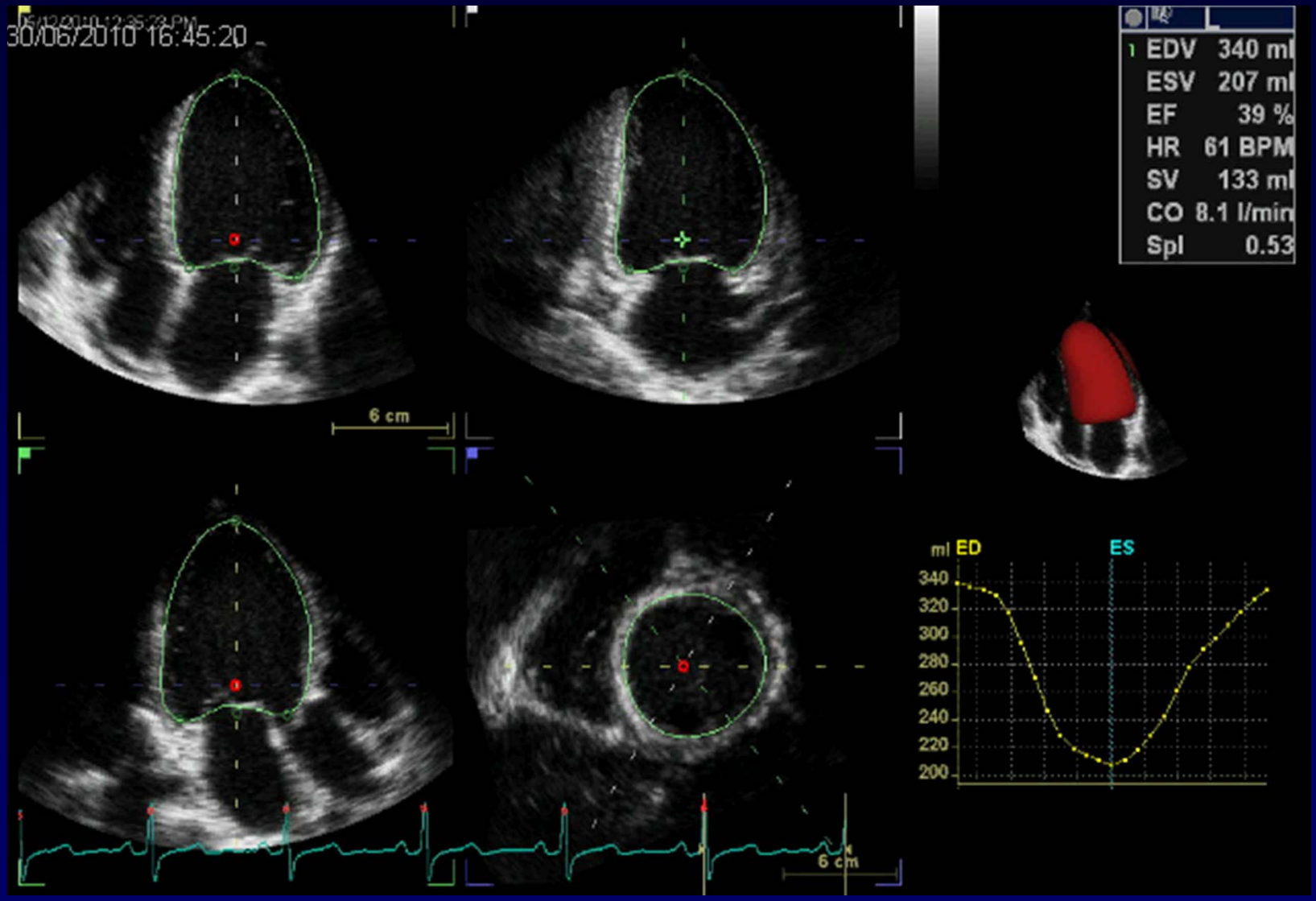
Hoffmann R, EHJ 2002

Regional Myocardial Function

2D Speckle Strain



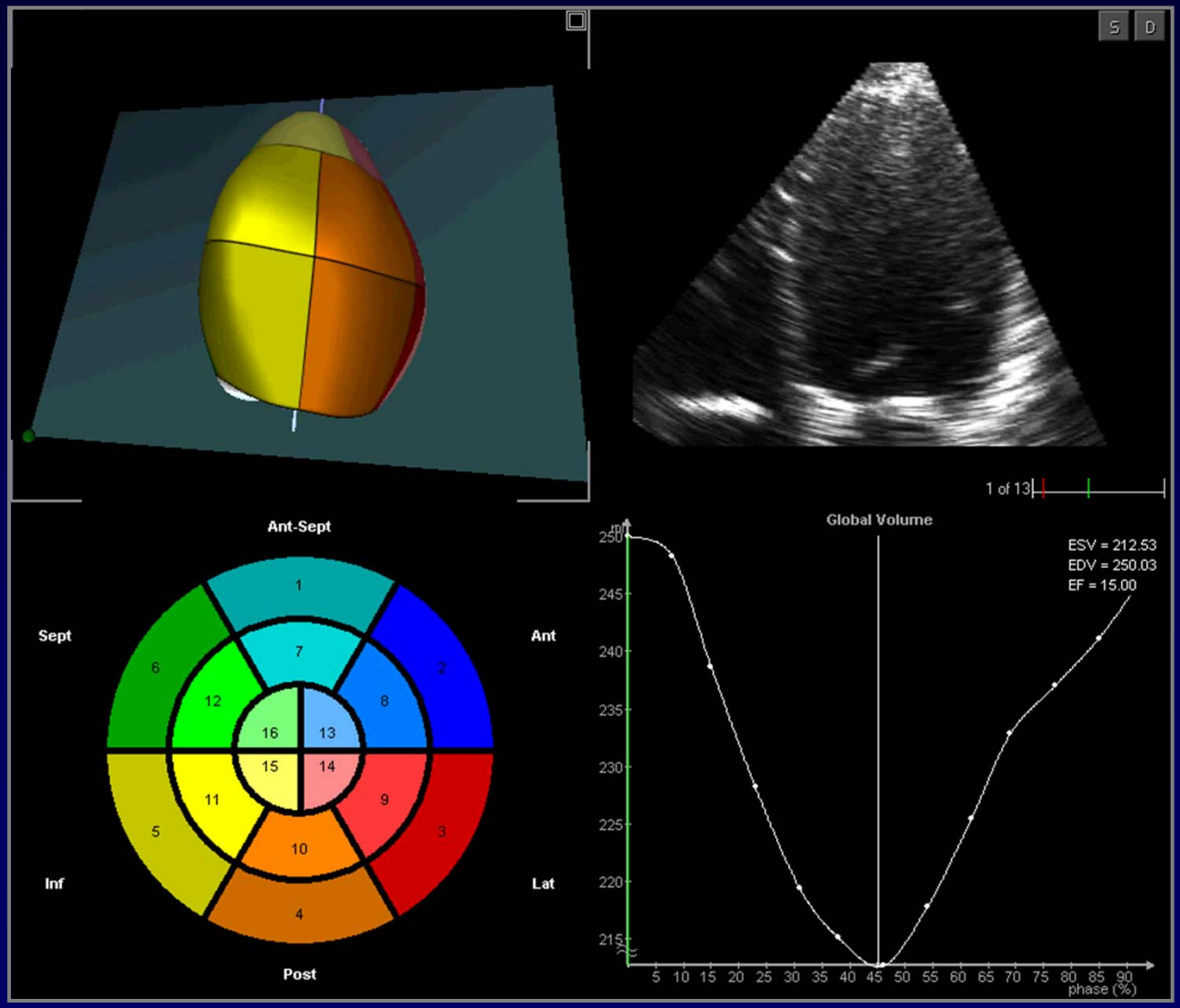
Automated Volume Measurement



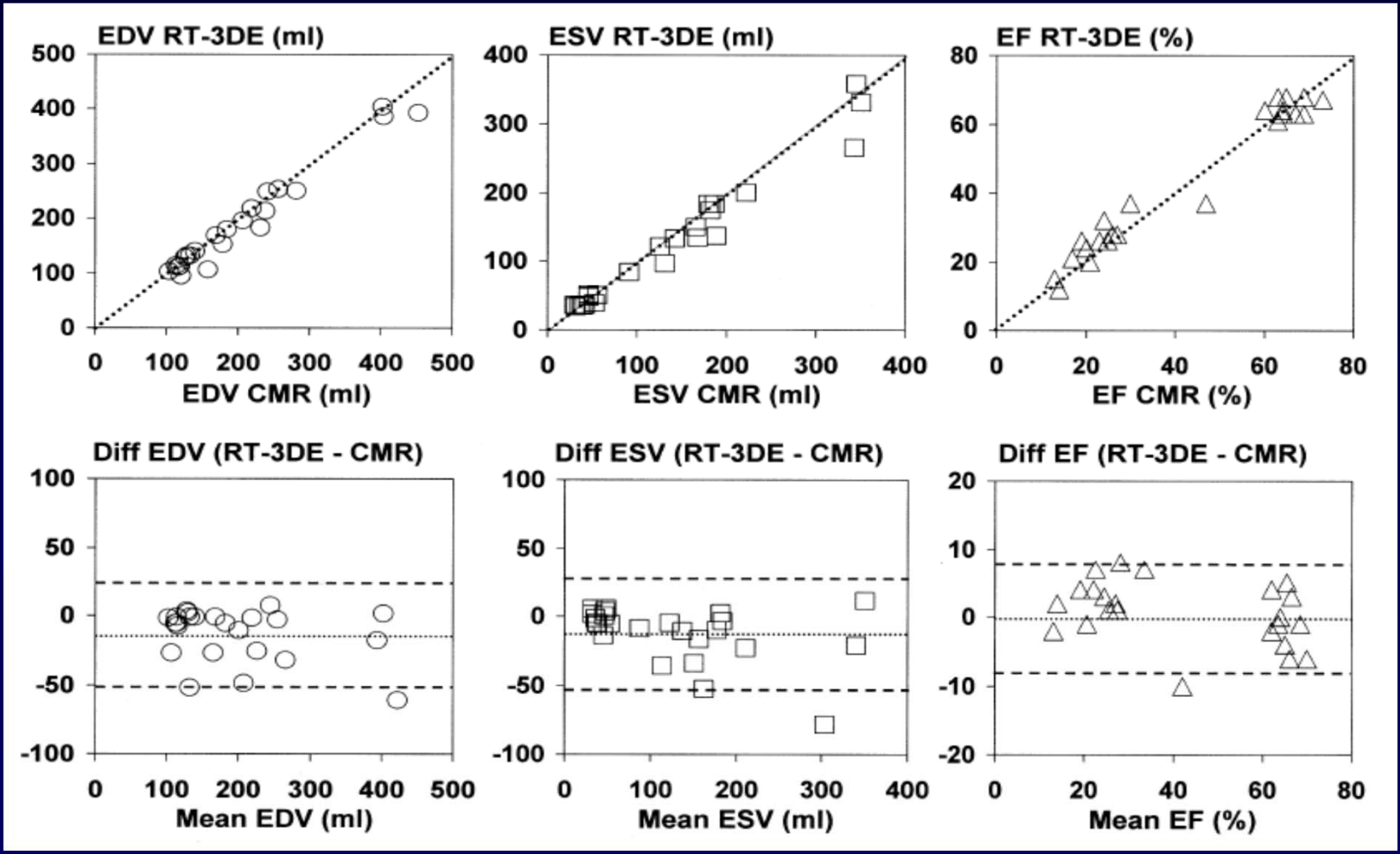
Weakness and Recent Development

- Poor image quality
  - Contrast echocardiography
- Large variability
  - Automation
- Geometric assumption
  - Real-time 3D echo

3D Echo

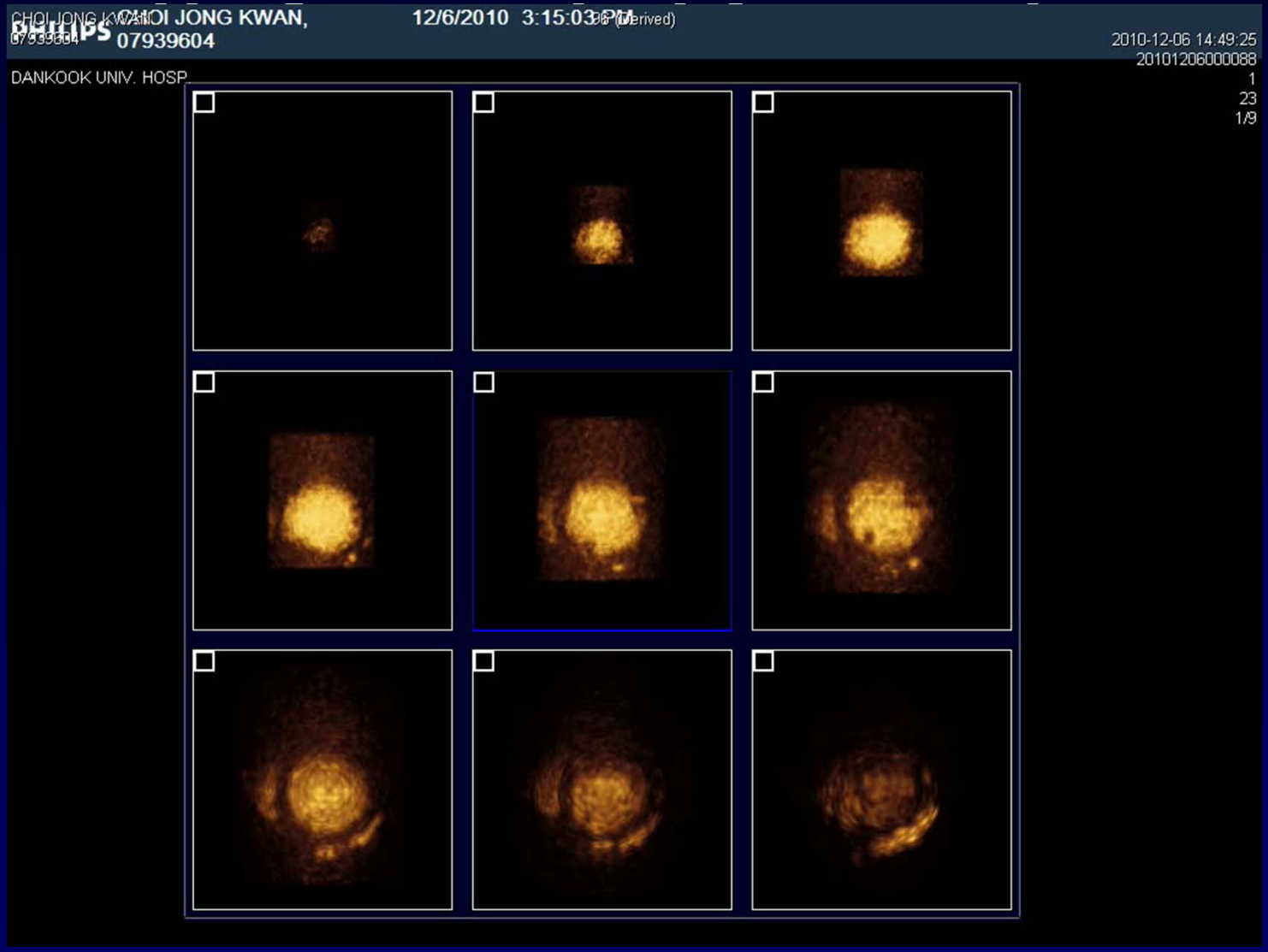

S
D
1 of 13
Ant-Sept
Sept
Ant
Inf
Lat
Post
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Global Volume
ESV = 212.53
EDV = 250.03
EF = 15.00
ml
250
245
240
235
230
225
220
215
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
phase (%)

LV Volume (RT3DE vs. MRI)



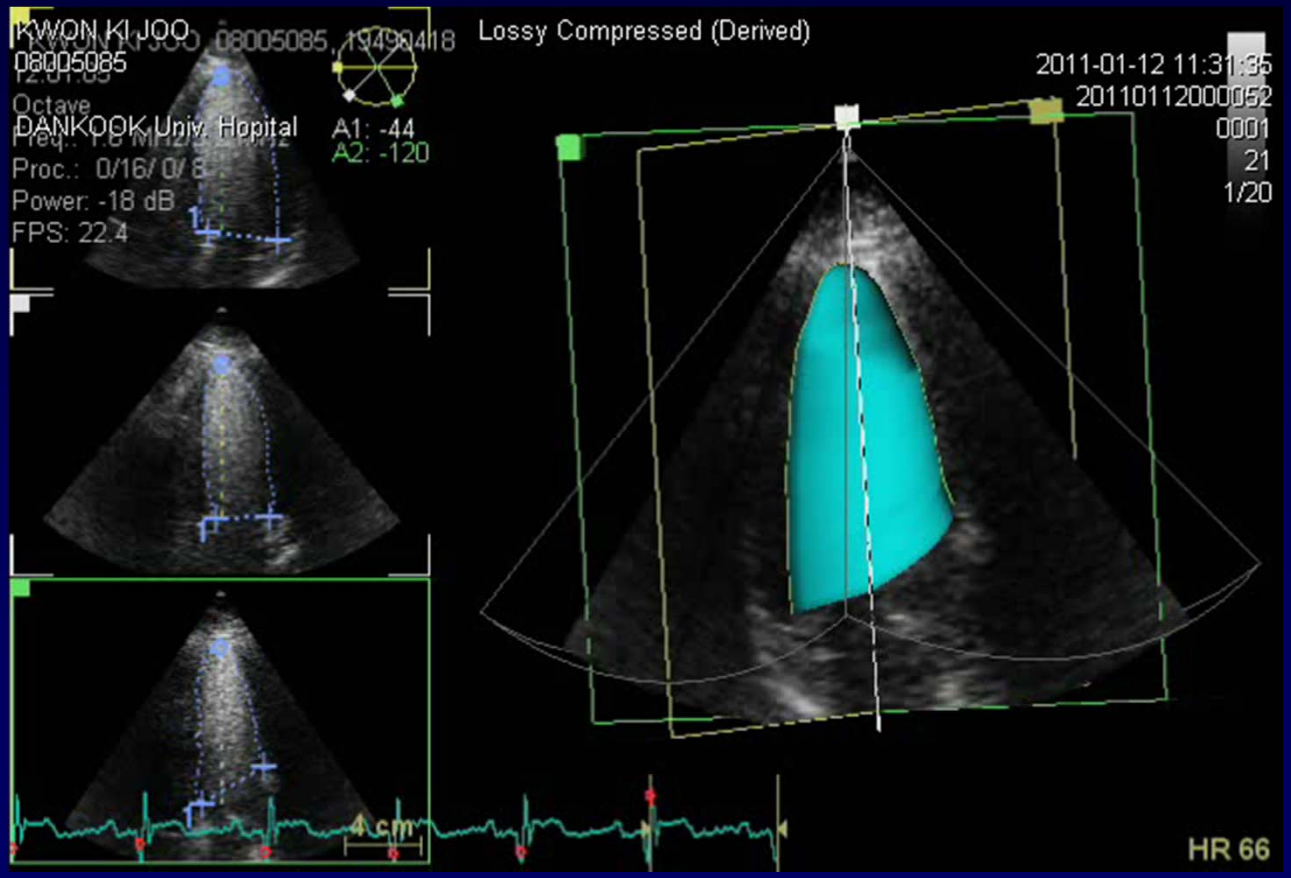
Kuhl, JACC 2004;43:2083-90

3D LV Opacification



Courtesy of Prof. JH Choi

LV Opacification with 3D Echo

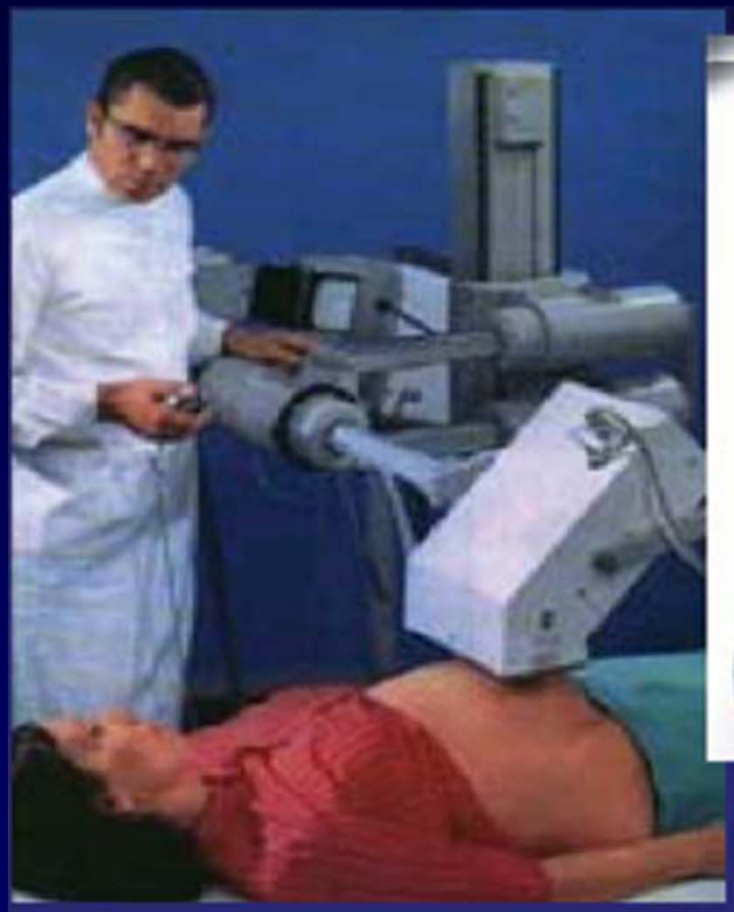


Courtesy of Prof. JH Choi

Weakness and Recent Development

- Poor image quality
  - Contrast echocardiography
- Large variability
  - Automation
- Geometric assumption
  - Real-time 3D echo
- Miniaturization: “point-of-care echo”

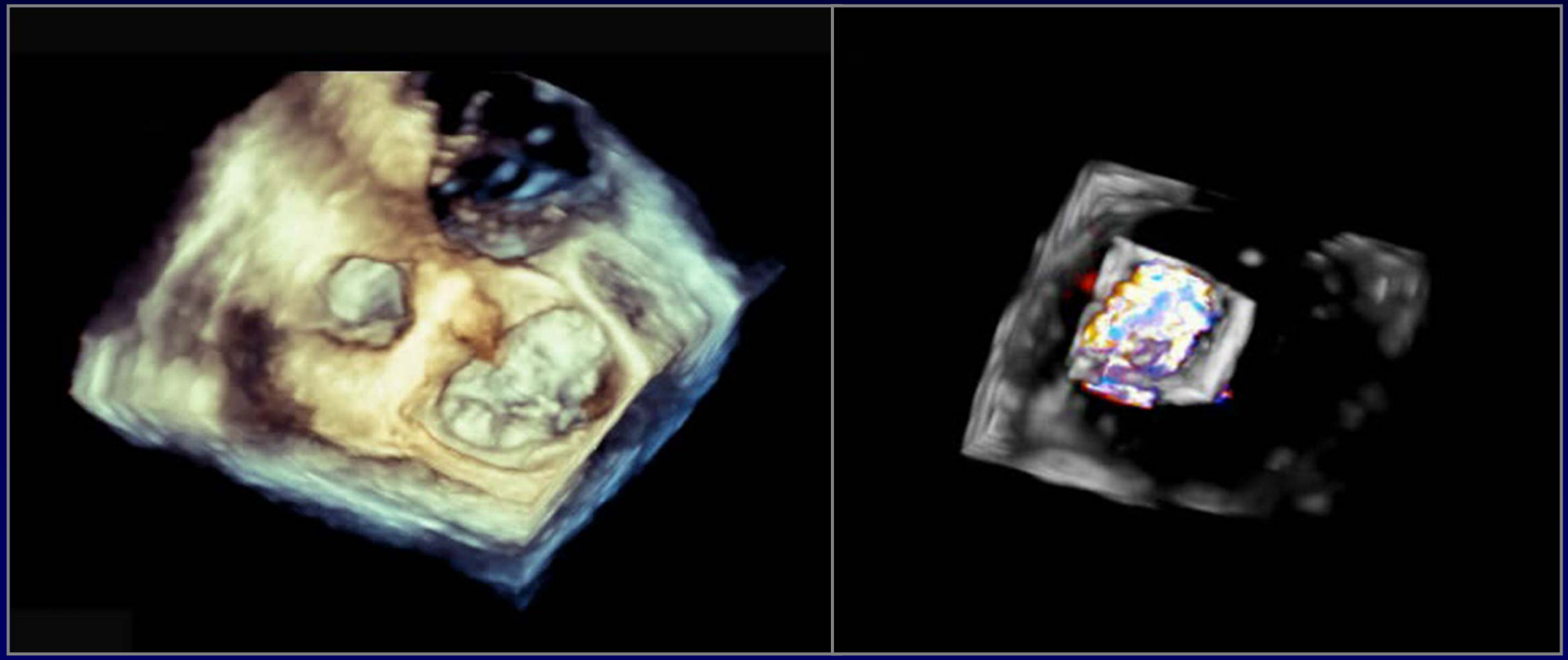
Miniaturization



Weakness and Recent Development

- Poor image quality
  - Contrast echocardiography
- Large variability
  - Automation
- Geometric assumption
  - Real-time 3D echo
- Miniaturization: “point-of-care echo”
- Rapid development of 3D echo

MV Prolapse



Courtesy of Prof. JM Song

MV Prolapse on 3D TEE

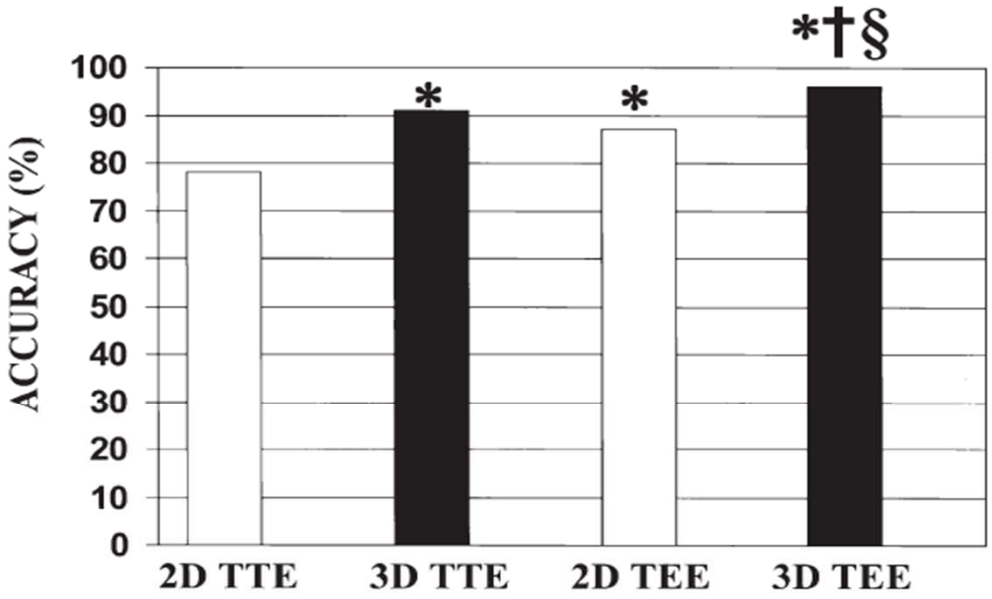
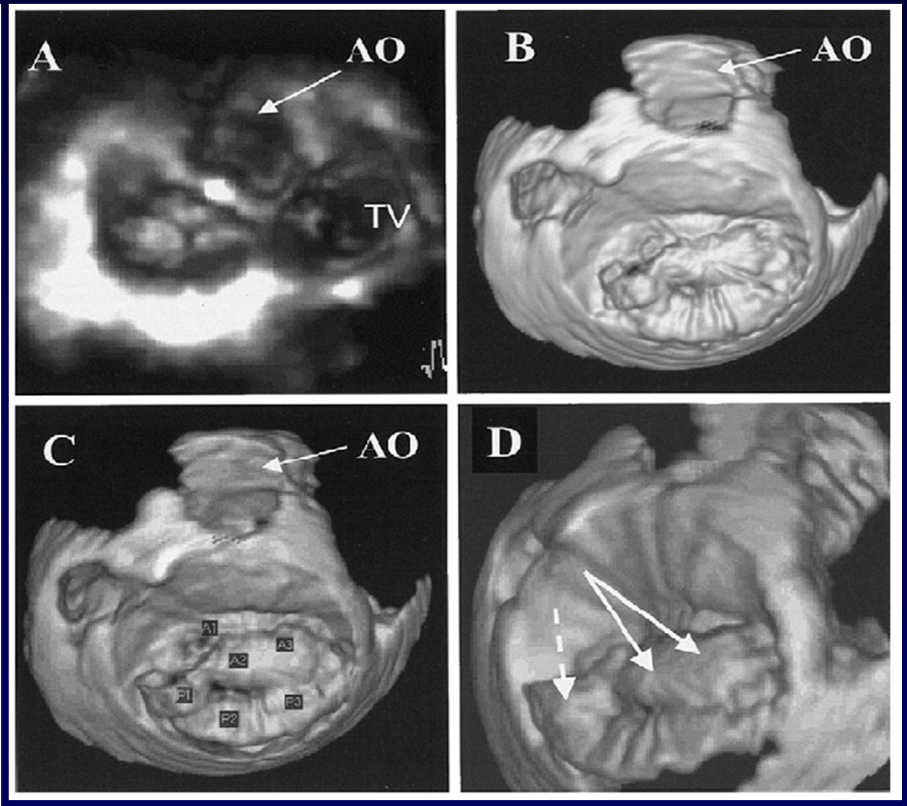
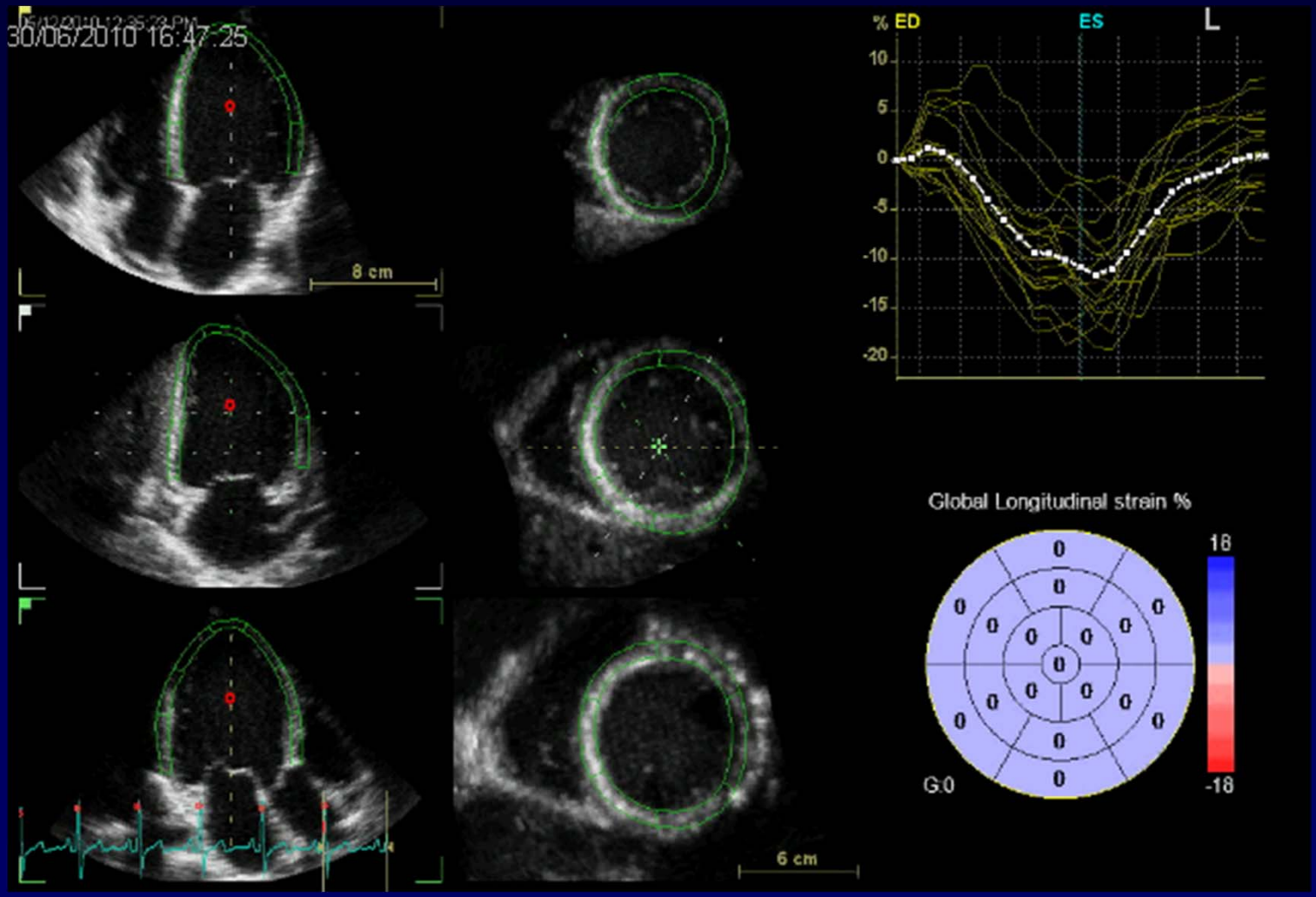


Figure 1. Overall accuracy of the 4 techniques in the identification of mitral valve pathology. *p < 0.001 versus 2D TTE; †p < 0.001 versus 3D TTE; §p < 0.001 versus 2D TEE. 2D = two-dimensional; 3D = three-dimensional; TEE = transesophageal echocardiography; TTE = transthoracic echocardiography.



Pepi M, JACC 2006;48:2524-30

3D Strain Imaging



Future Role of Echo in the Era of Multimodality Imaging

Which One Do You Prefer?

Life without Echo

Life without Cardiac CT

Life without Cardiac MR

Our Responsibility as a Echo Specialist

- Education for the quality assurance
  - Relatively easy, availability
- Communication with surgeons & interventionist
- Knowledge & experience with other imaging modalities
- Cost-effectiveness
- Outcome trials

STICH Trial

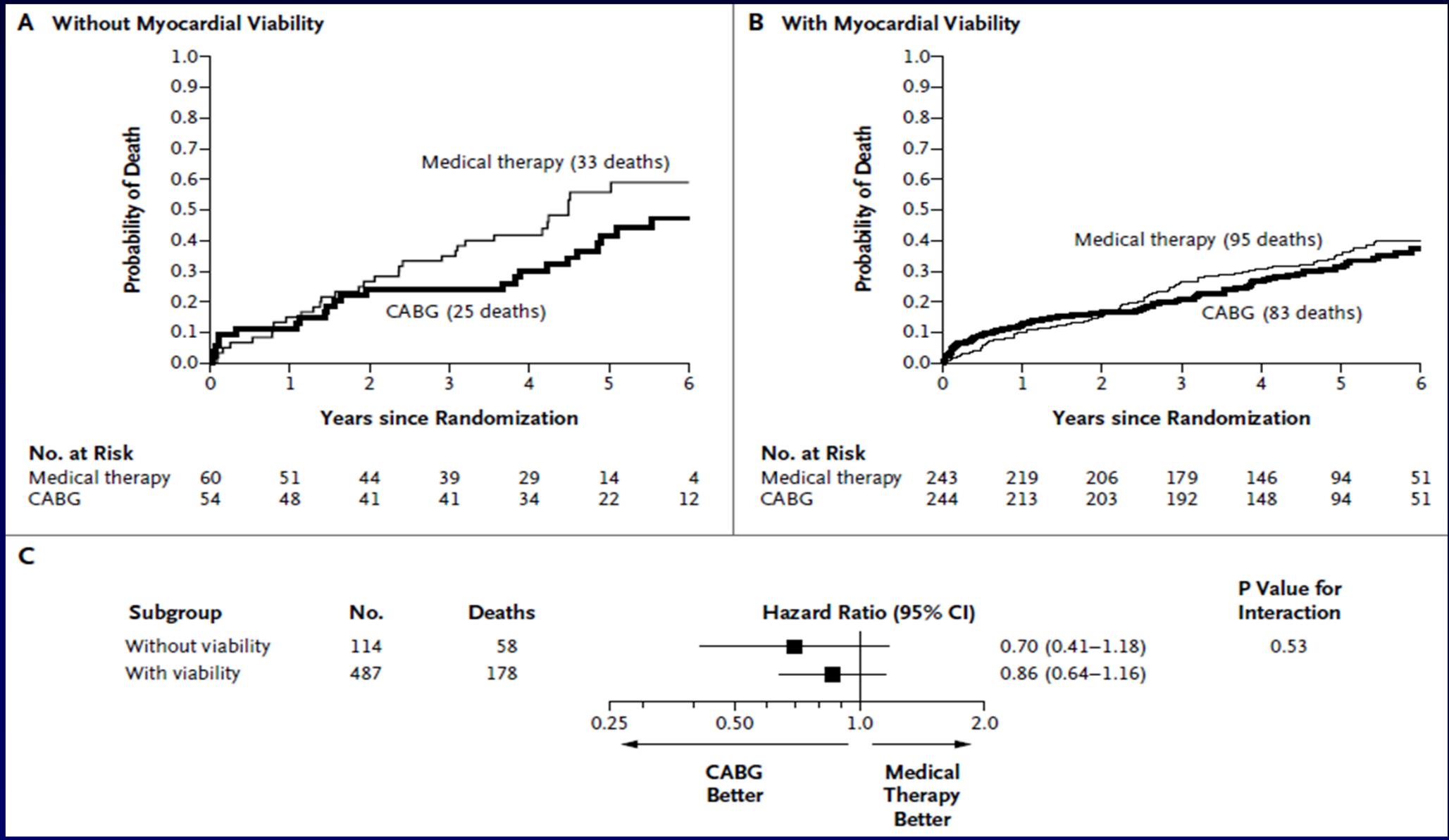
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Myocardial Viability and Survival in Ischemic Left Ventricular Dysfunction

Robert O. Bonow, M.D., Gerald Maurer, M.D., Kerry L. Lee, Ph.D., Thomas A. Holly, M.D., Philip F. Binkley, M.D., Patrice Desvigne-Nickens, M.D., Jaroslaw Drozdz, M.D., Ph.D., Pedro S. Farsky, M.D., Arthur M. Feldman, M.D., Torsten Doenst, M.D., Ph.D., Robert E. Michler, M.D., Daniel S. Berman, M.D., Jose C. Nicolau, M.D., Ph.D., Patricia A. Pellikka, M.D., Krzysztof Wrobel, M.D., Nasri Alotti, M.D., Ph.D., Federico M. Asch, M.D., Liliana E. Favaloro, M.D., Lilin She, Ph.D., Eric J. Velazquez, M.D., Robert H. Jones, M.D., and Julio A. Panza, M.D., for the STICH Trial Investigators*

Is Viability Test "Viable"?



Thank You for Your Attention!

THANK YOU