



APCDE 2011

15th Asian-Pacific Congress on
Doppler Echocardiography

Strain imaging in clinical practice: case based learning

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분당 서울대학교병원
SEOUL NATIONAL UNIVERSITY BUNDANG HOSPITAL

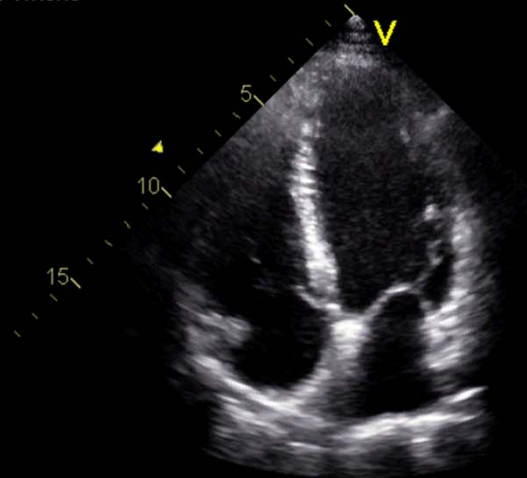


Strain imaging in clinical practice

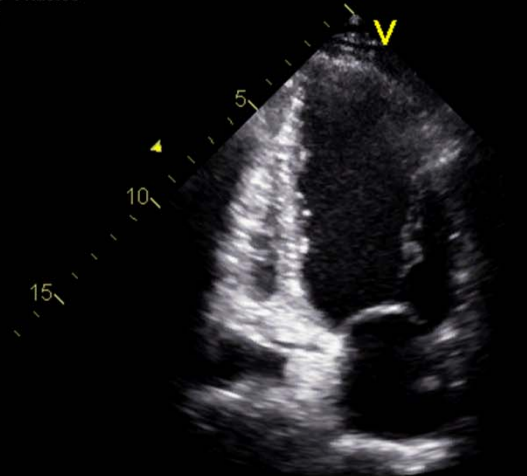
- Ischemic heart disease
- Heart failure
 - Systolic heart failure
 - Heart failure with preserved EF
- Dyssynchrony
- Subclinical myocardial dysfunction
- Cardiomyopathy

Ischemic heart disease

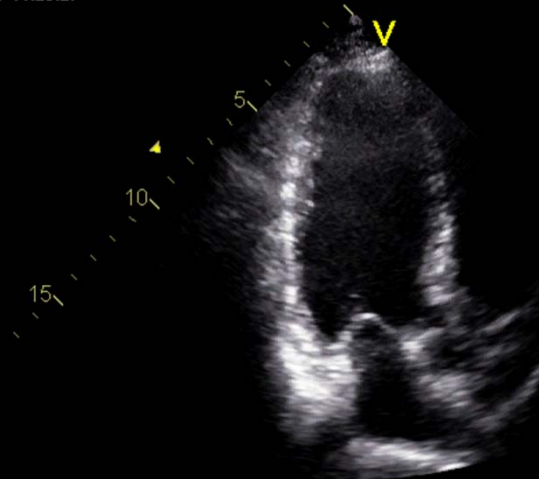
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FPS: 51.0



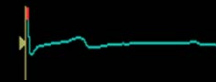
17/08/2009 14:20:06
FPS: 53.7



17/08/2009 14:20:27
FPS: 53.7



70
2:48 HR



56
2:59 HR

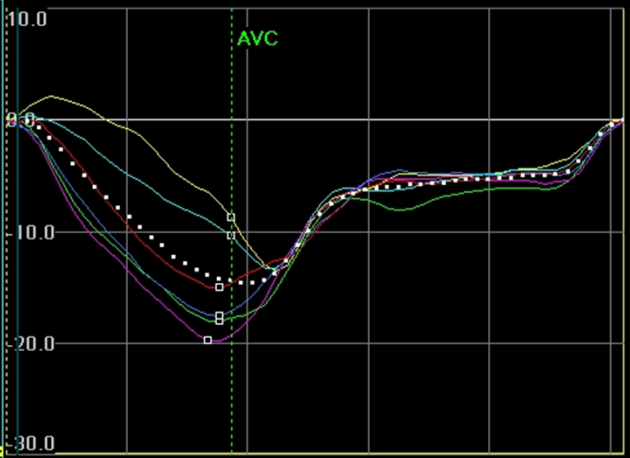
55
2:59 HR



2009/08/17-14:20:27

APLAX

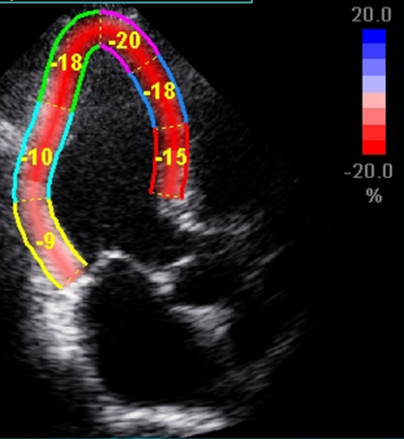
SL
20.0
-20.0
%



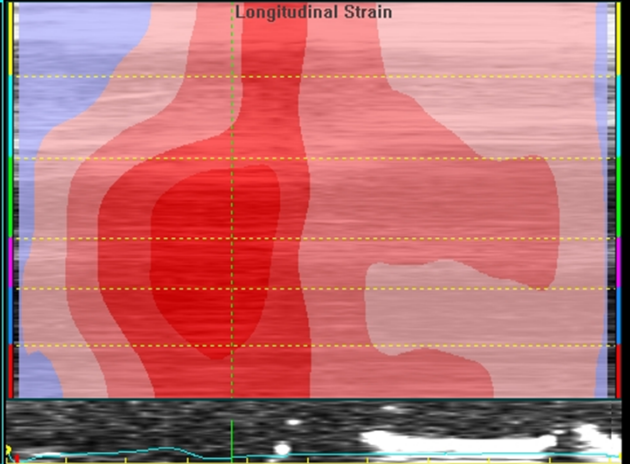
GS=-14.7%

Peak Systolic Strain

20.0
-20.0
%

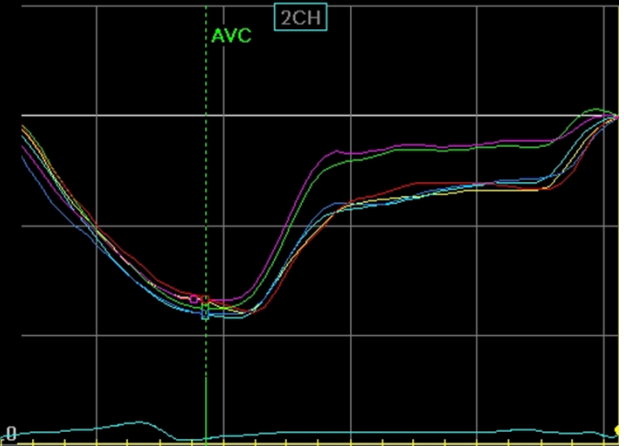


Longitudinal Strain



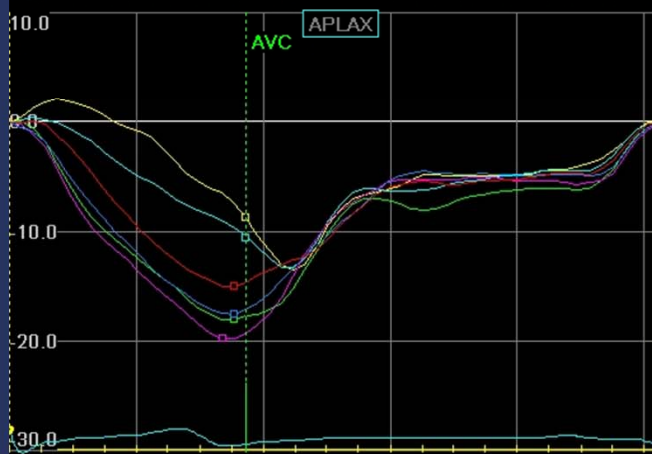
AVC

2CH

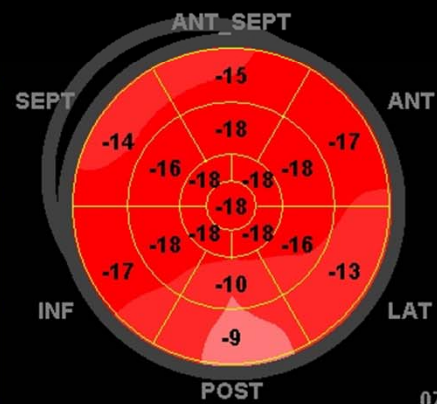


AVC

APLAX



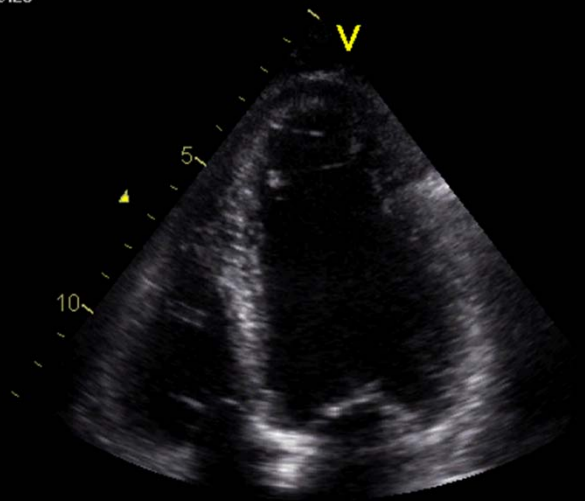
Peak Systolic Strain



20.0
-20.0
%

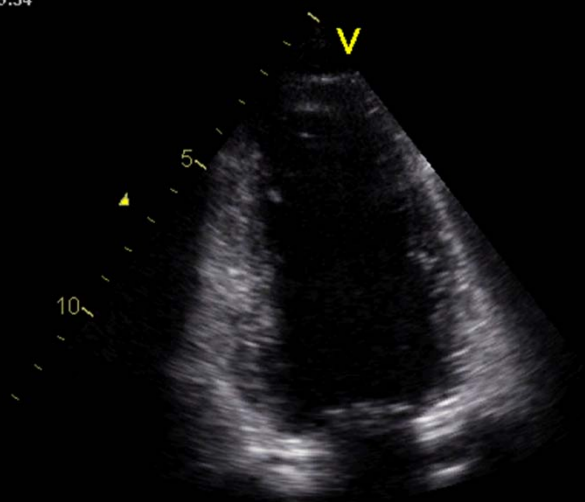
07/10/2009-19:03:31

19/11/2005 09:39:23
FPS: 70.2



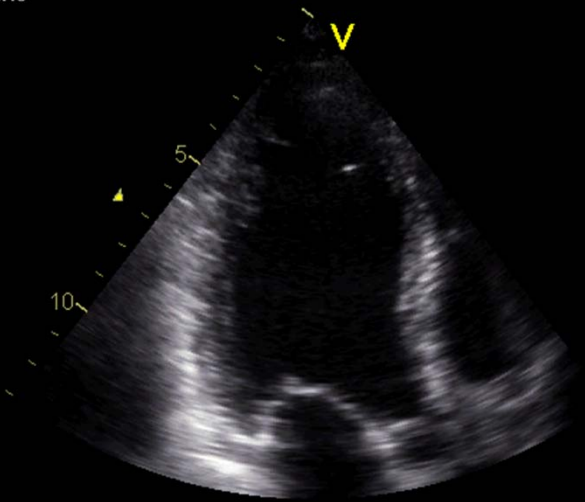
79
3:57 HR

19/11/2005 09:39:54
FPS: 70.2



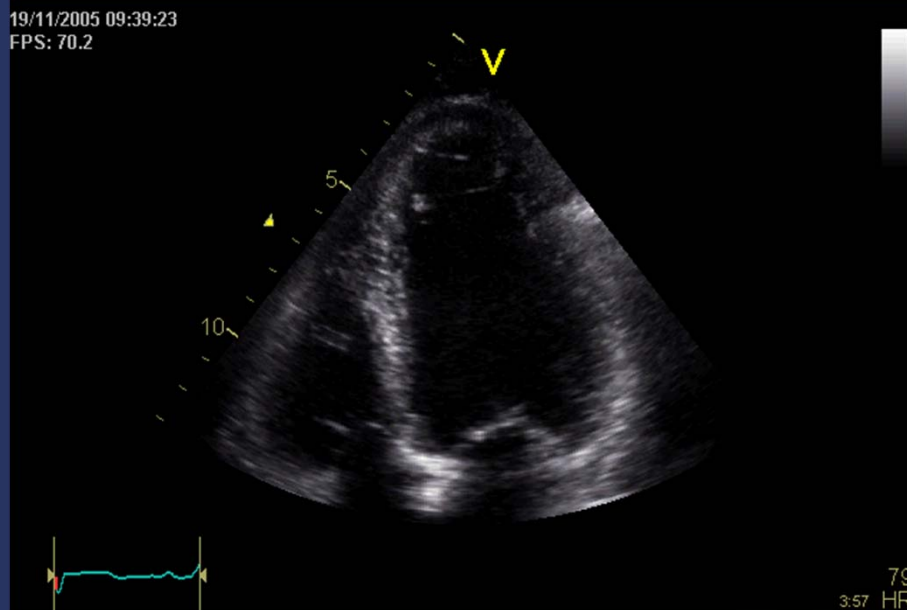
81
3:56 HR

19/11/2005 09:42:45
FPS: 103.8

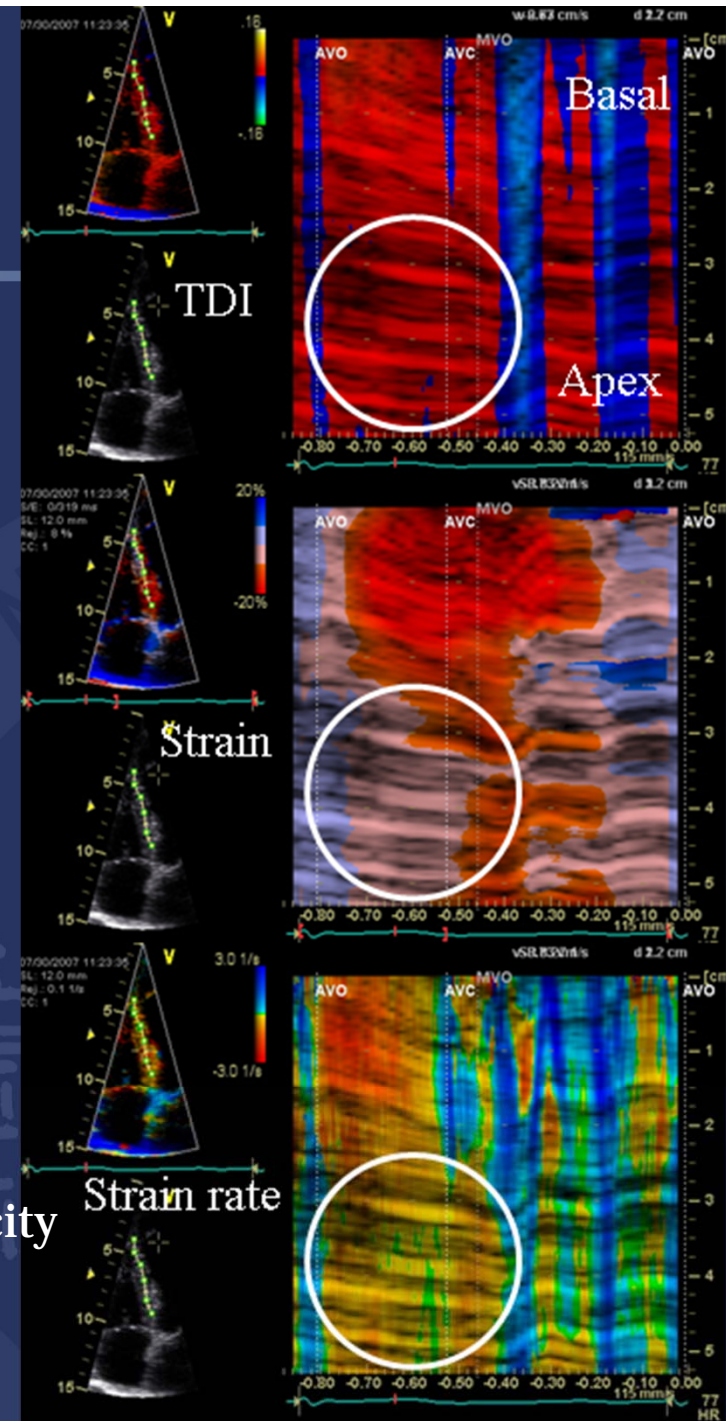


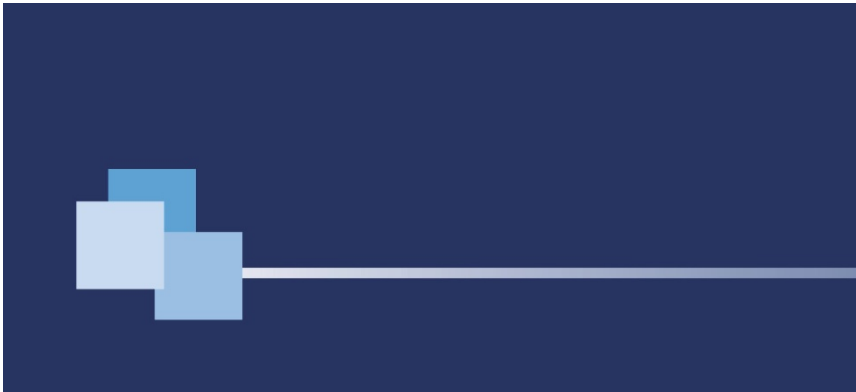
83
3:80 HR

LAD territory

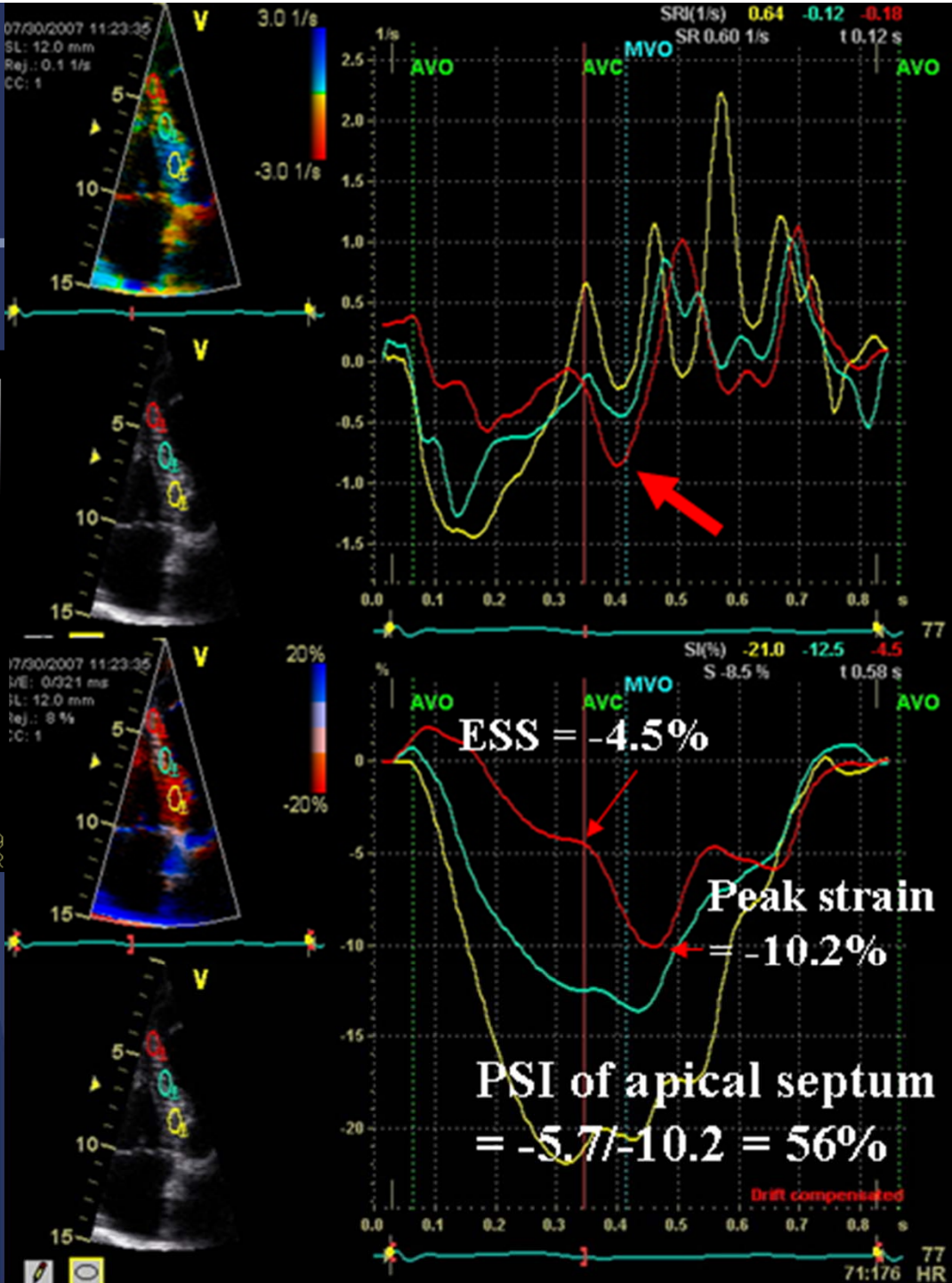
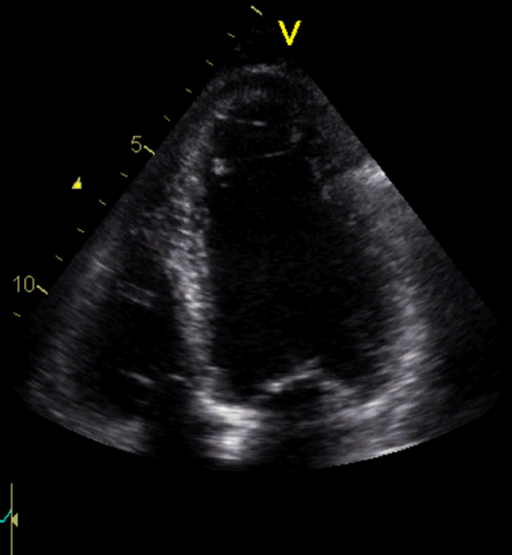


SRI curved M-mode: 86% sensitivity, 89% specificity

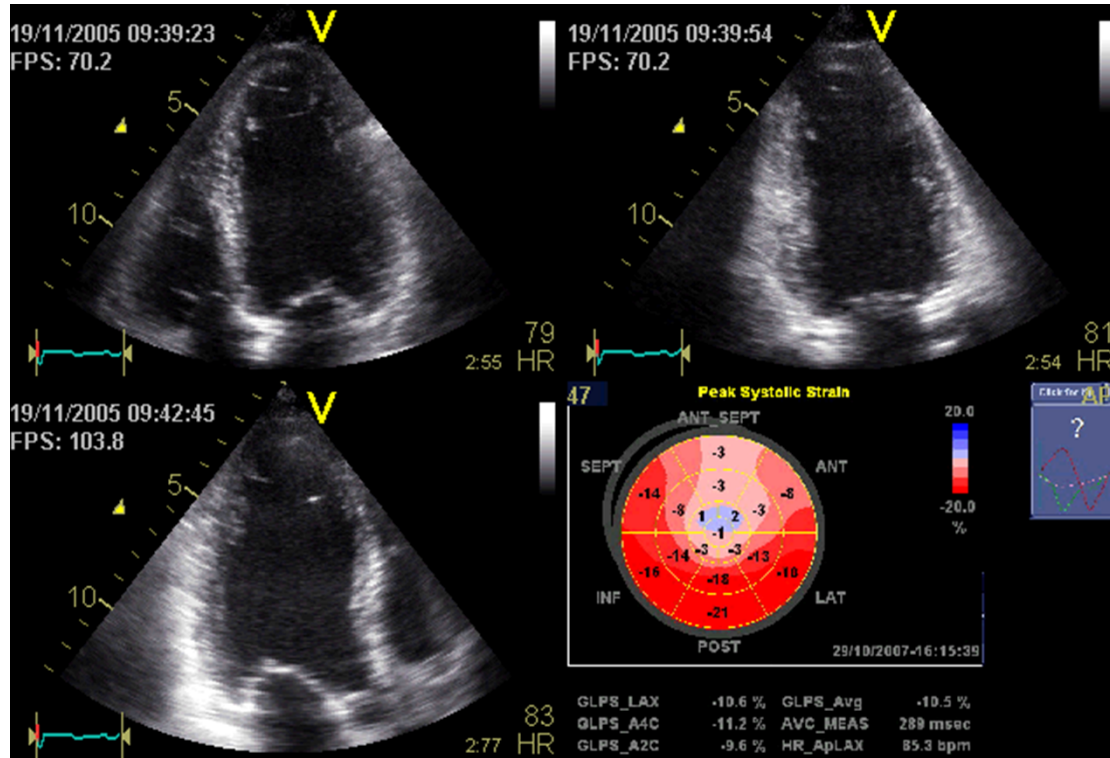




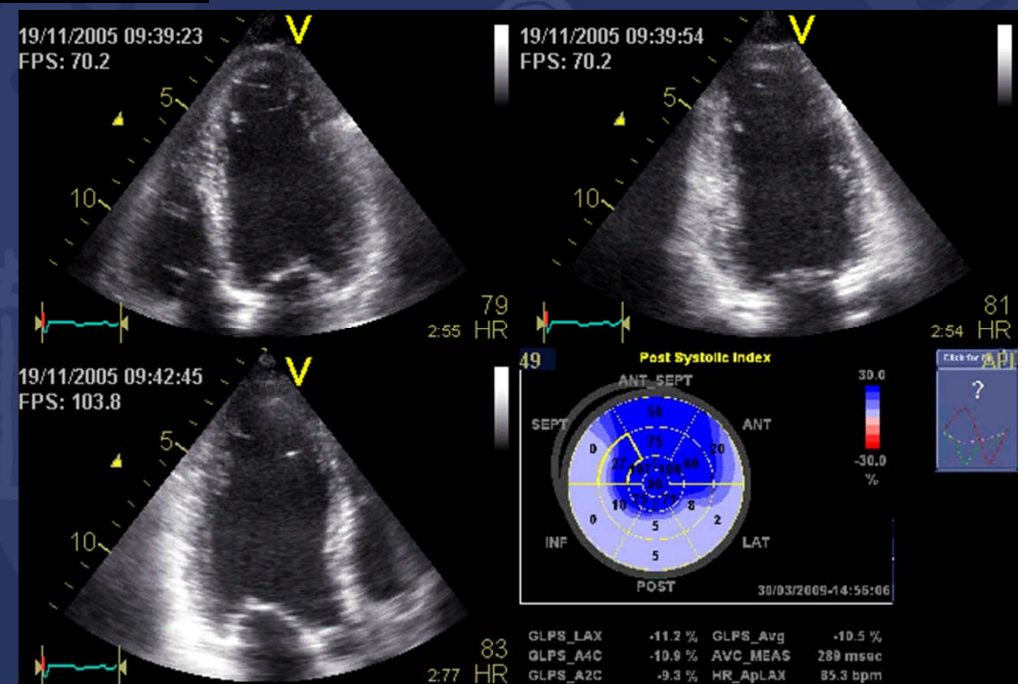
19/11/2005 09:39:23
FPS: 70.2



Peak strain



Post-systolic strain

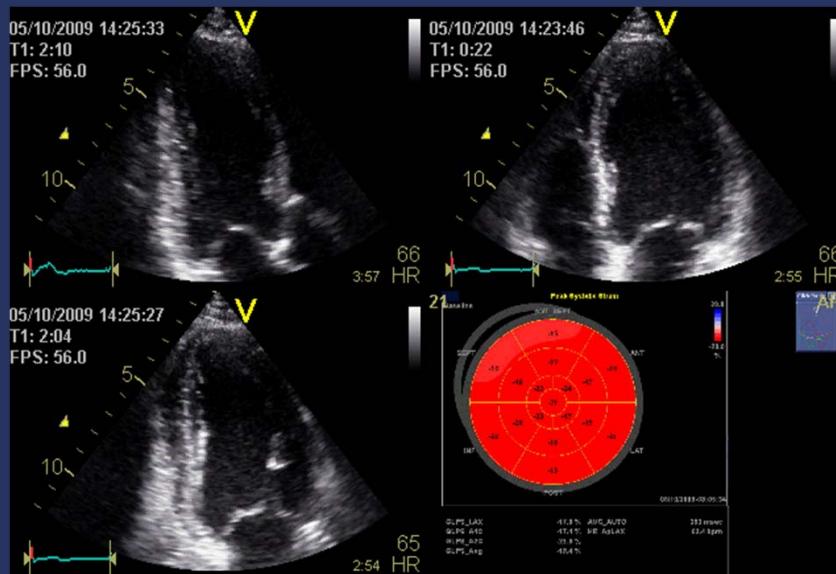




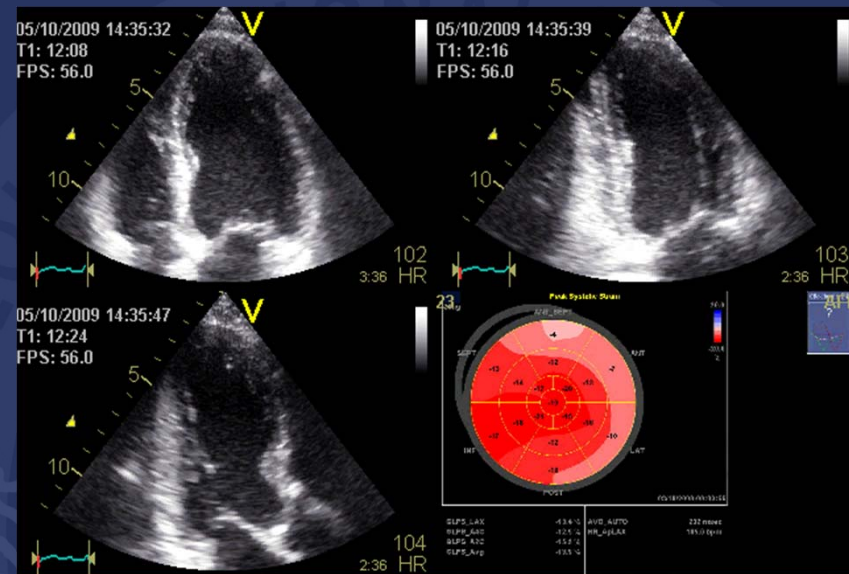
- Strain imaging can quantify regional wall motion abnormality
- However,



Dobutamine stress echocG

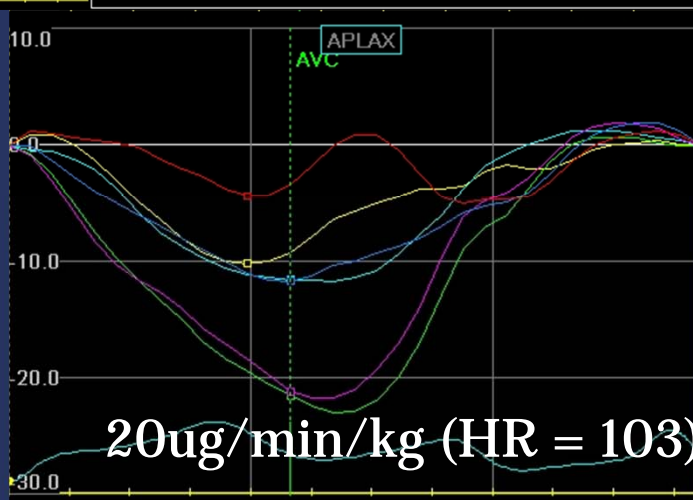
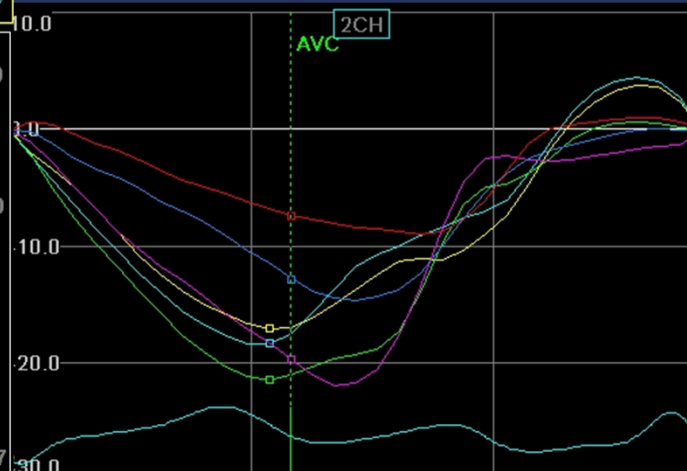
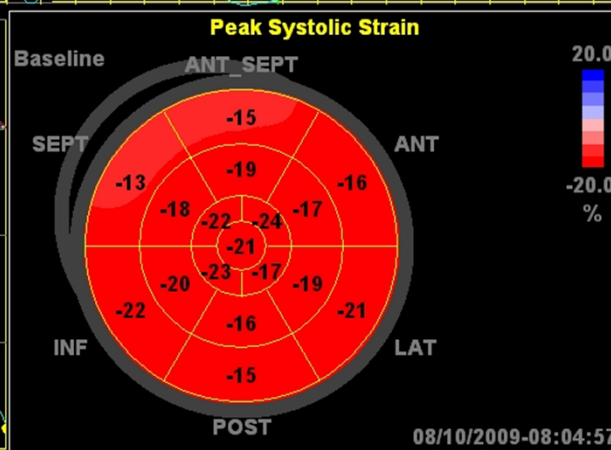
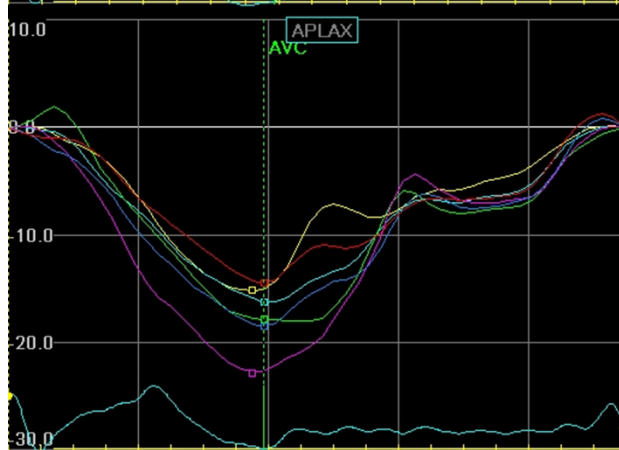
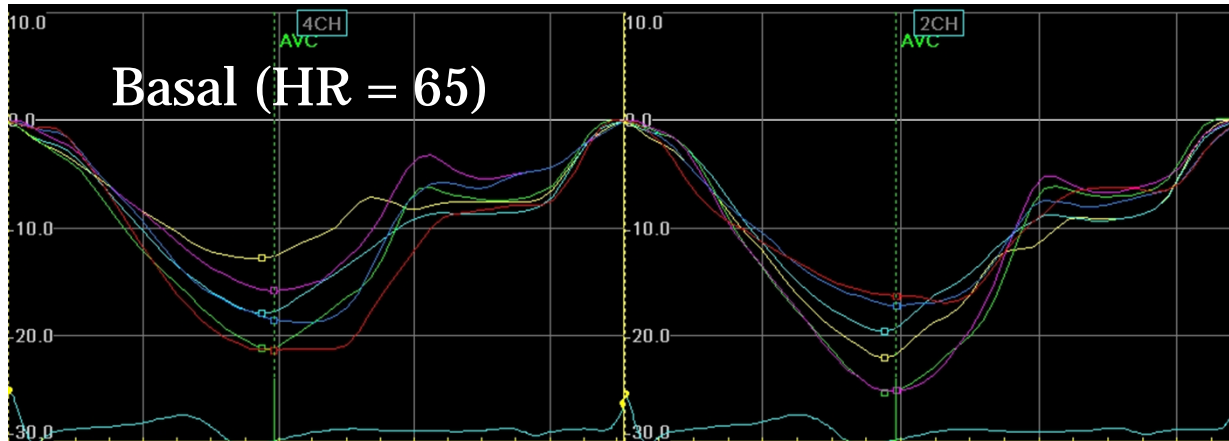


Basal (HR = 65)

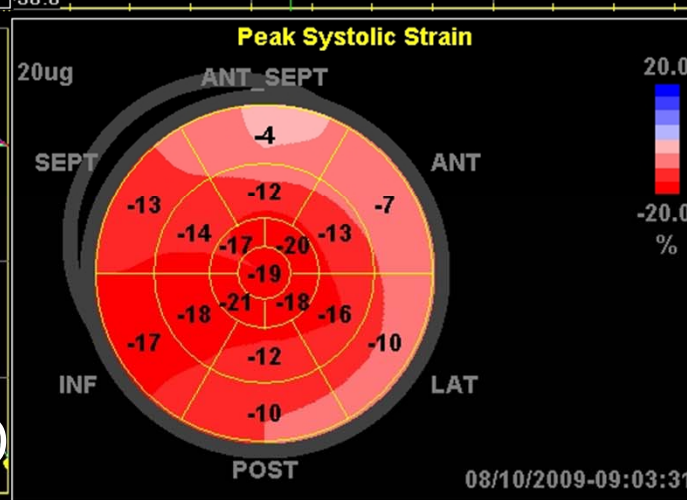


20ug/min/kg (HR = 103)

Basal (HR = 65)



20ug/min/kg (HR = 103)

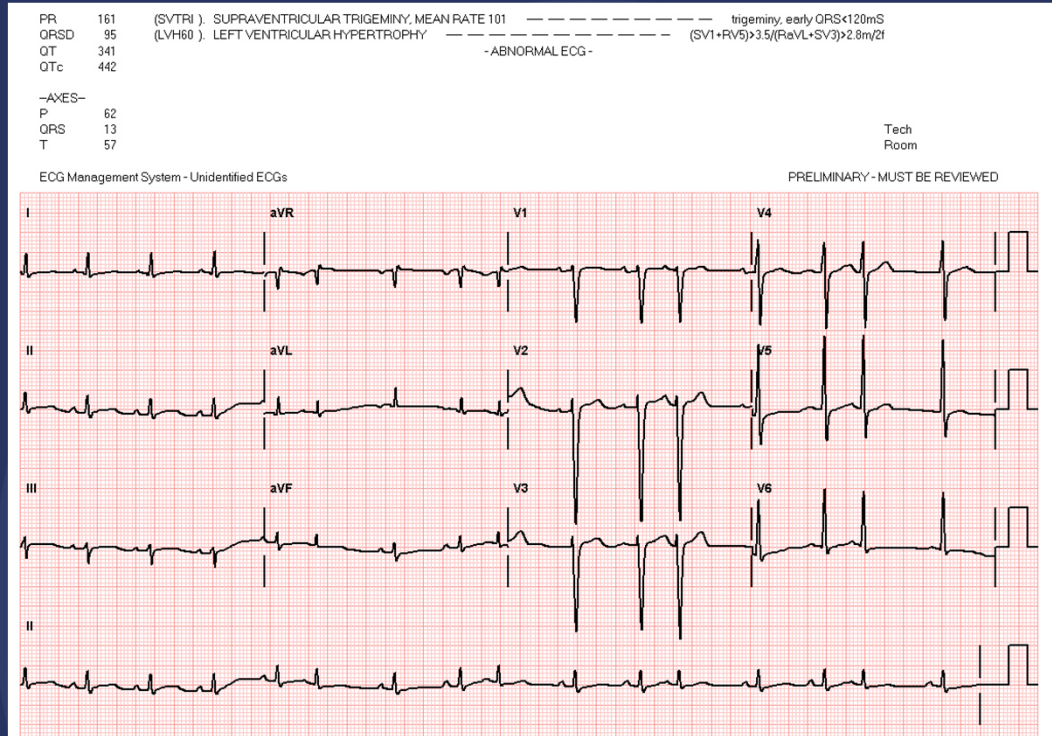
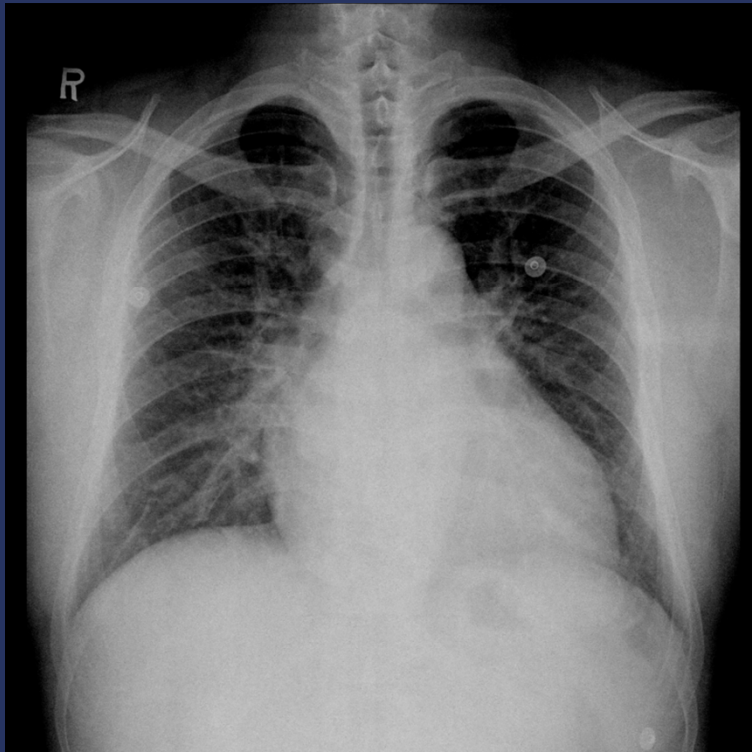


Heart failure

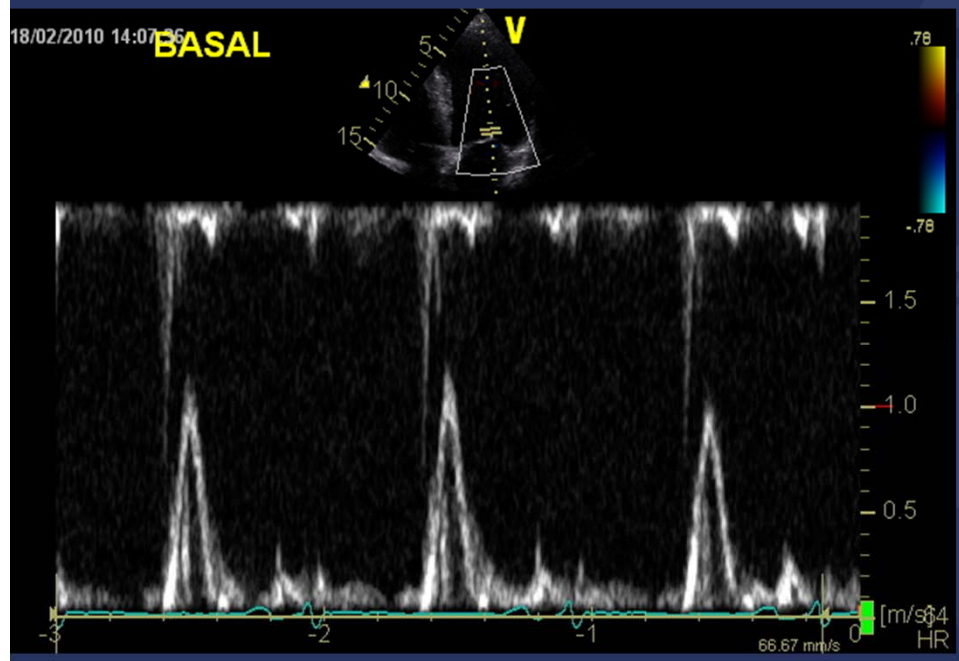
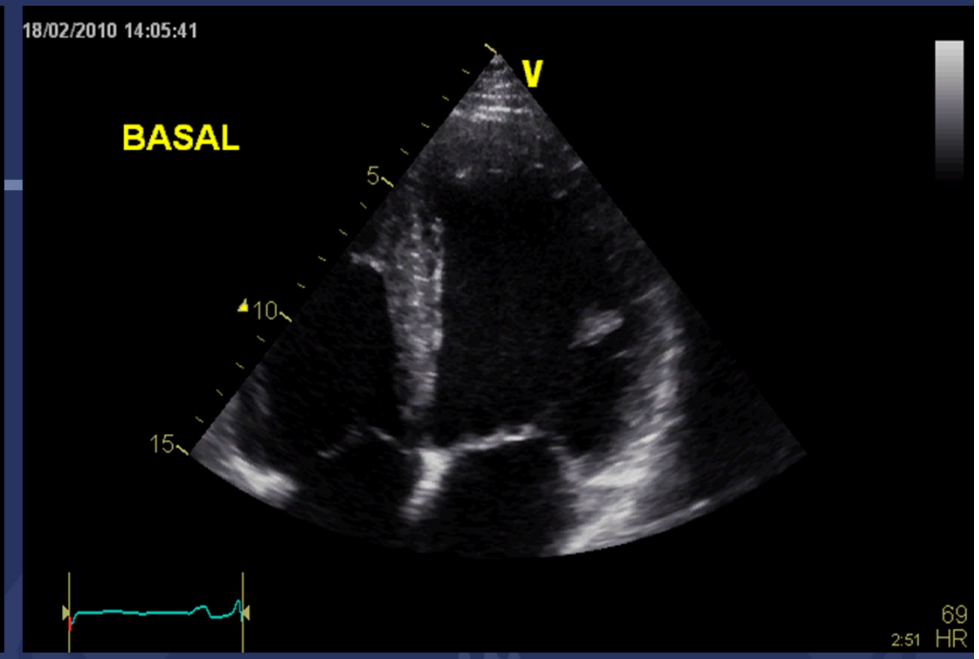
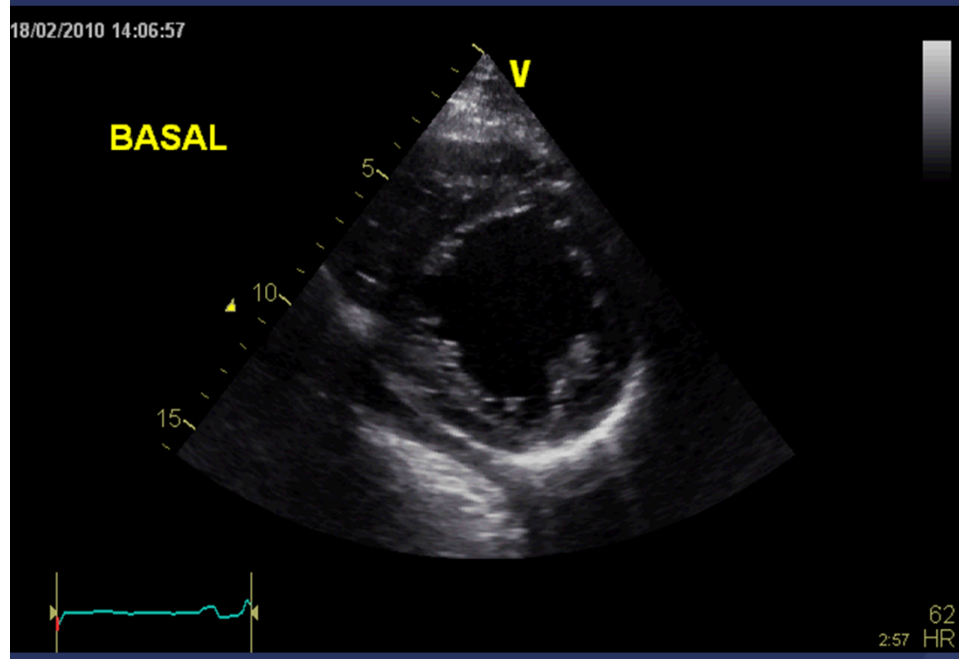


Case . M/34

Recent onset DOE, NYHA IV



BUNDANG

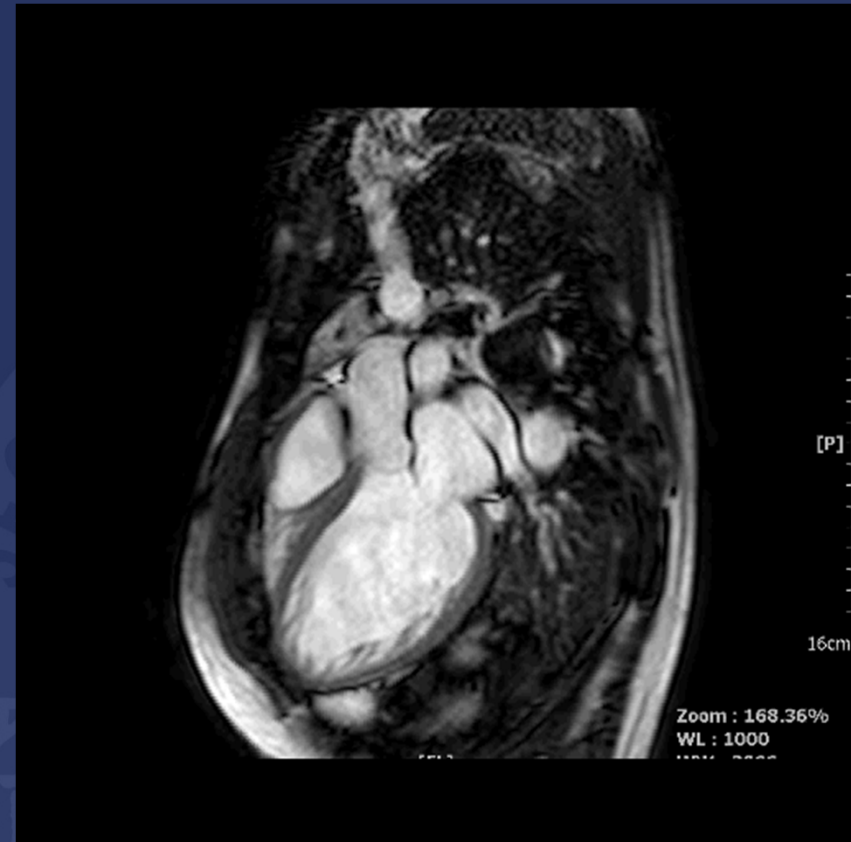
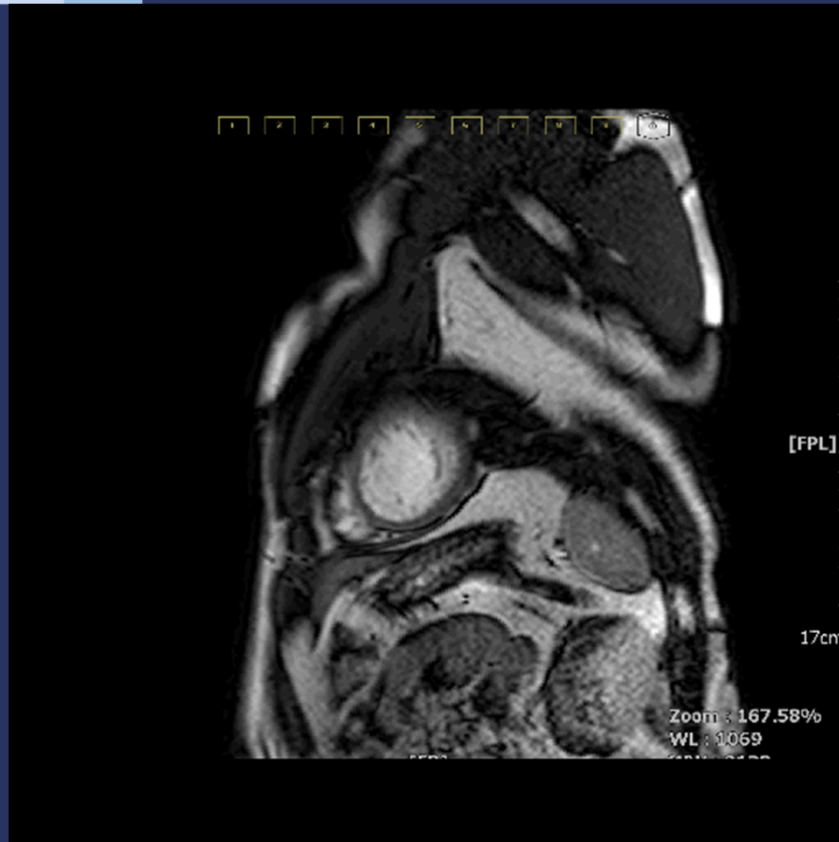


ESV/EDV = 159/160 ml
 EF (biplane Simpson method) = 16.3%

Transmitral flow: restrictive pattern
 E/A > 2.0, DT = 130 msec
 E/e' = 15.0

BUNDANG

Cardiac MRI



Basal state: $ESV/EDV = 213/277$ ml, $EF = 23.1\%$

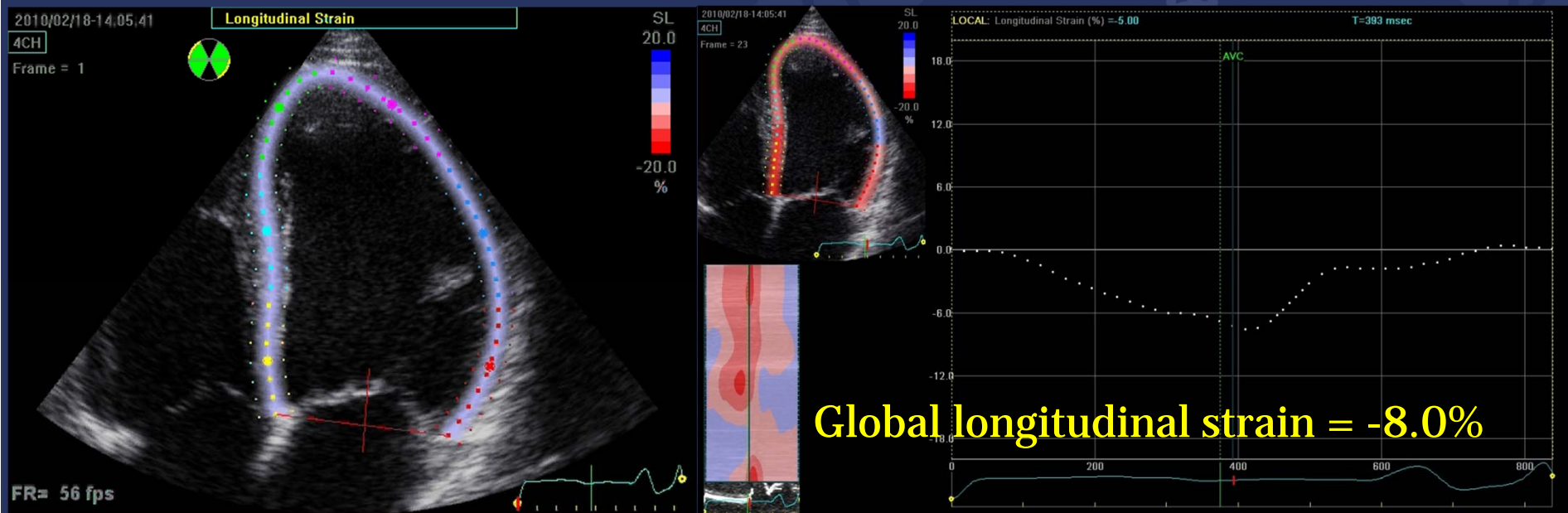
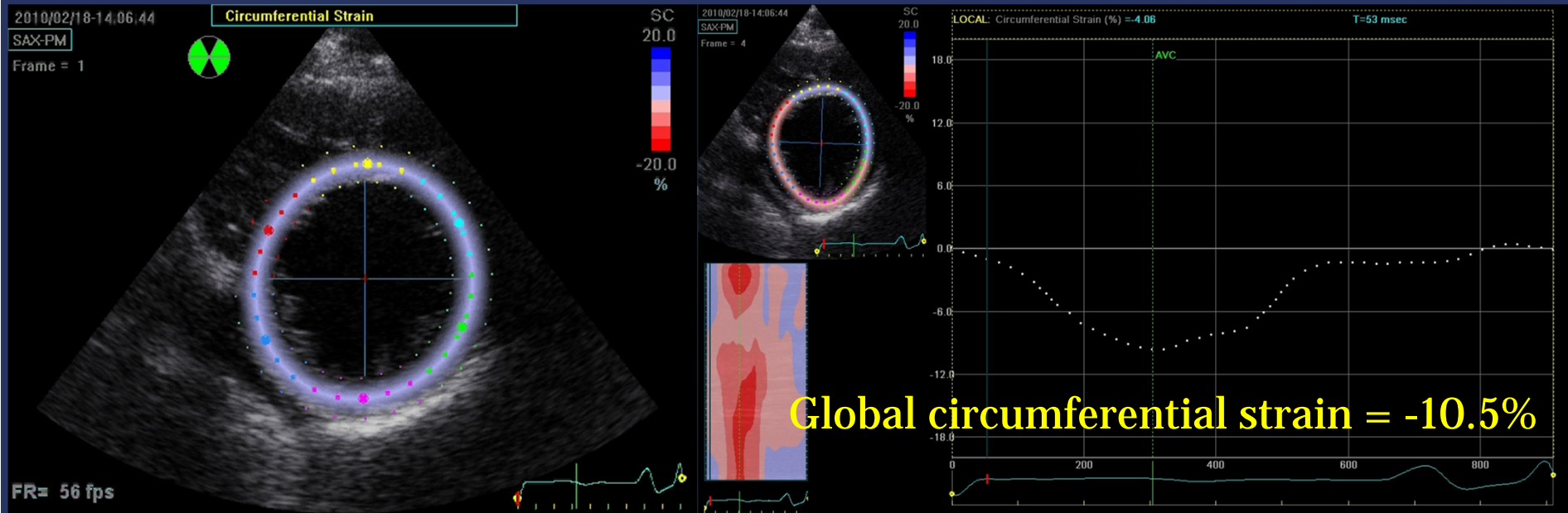
Dobutamine (10 ug/min/kg): $EDV/ESV = 220/289$, $EF = 23.7\%$



1. Cardiopulmonary exercise after volume controlled

- ✓ $V_{\max O_2} = 16.3 \text{ ml/min/kg}$
 - a. 5.9 ml/min/kg at anaerobic threshold
- ✓ $VE/VCO_2 = 22$







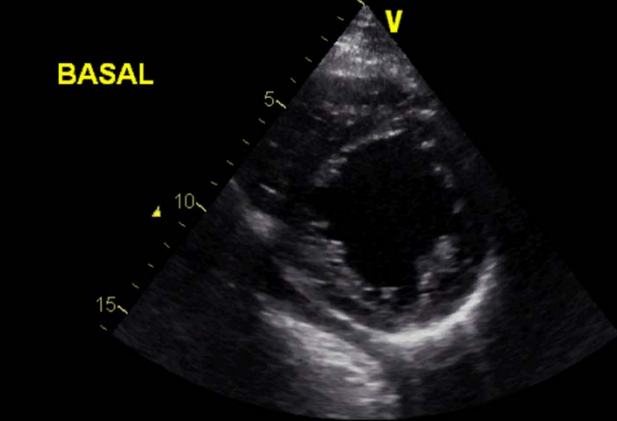
Prognosis?

- Dilated LV with severe LV dysfunction
- Severe diastolic dysfunction
- Dobutamine stress CMR

- Cardiopulmonary exercise test
- Global strain

18/02/2010 14:06:57

BASAL



62
HR

MI:1.6
S3
01 JUNE 10
14:18:02
2/0/C/H5
SNUBH

ECHO
YIL SEON
KO
18342426

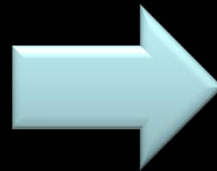
GAIN 62
COMP 60
57BPM

16CM
60HZ

P T R
1.6 3.2



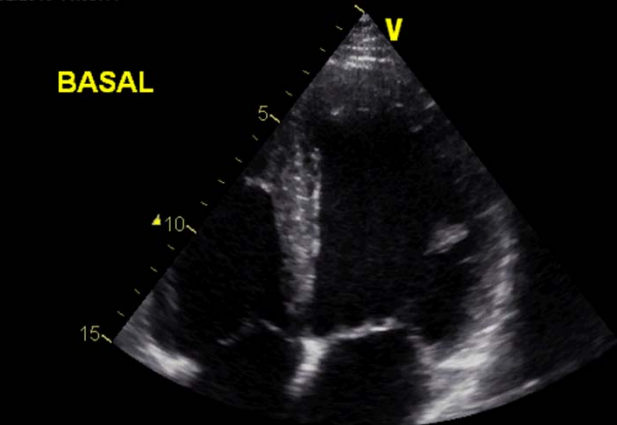
After medical therapy for 3 months



3 Mo later

18/02/2010 14:05:41

BASAL



69
HR

MI:1.6
S3
01 JUNE 10
14:17:11
2/0/C/H5
SNUBH

ECHO
YIL SEON
KO
18342426

GAIN 62
COMP 60
57BPM

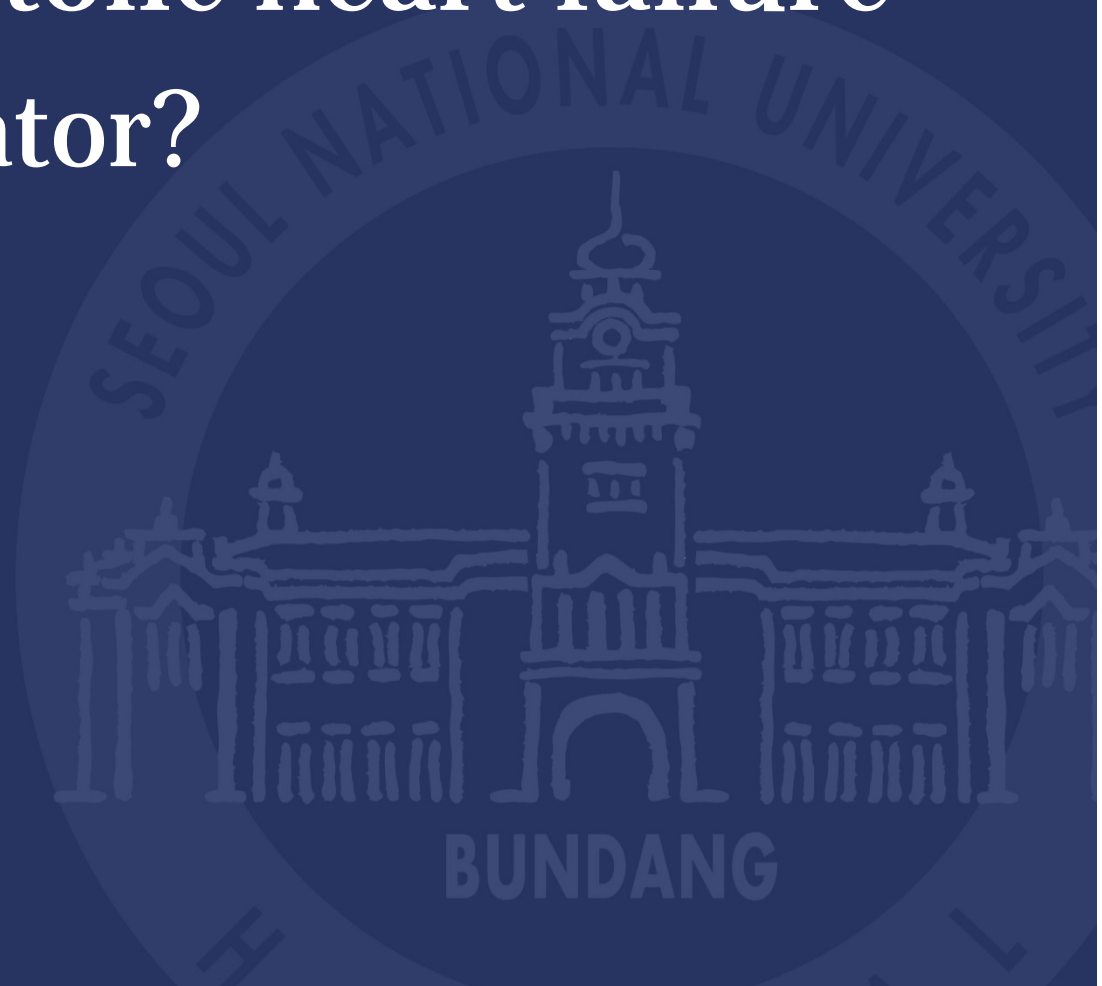
16CM
60HZ

P T R
1.6 3.2



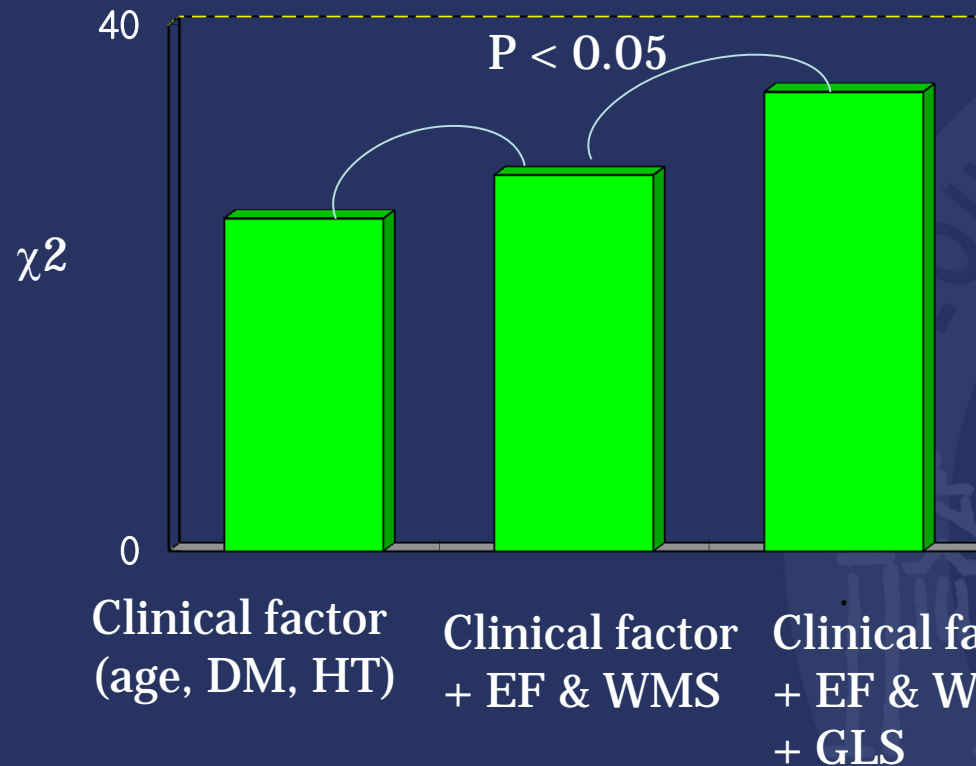


- Strain in systolic heart failure
– Prognosticator?



Prediction of all-cause mortality from GLS: Comparison with EF and WMS

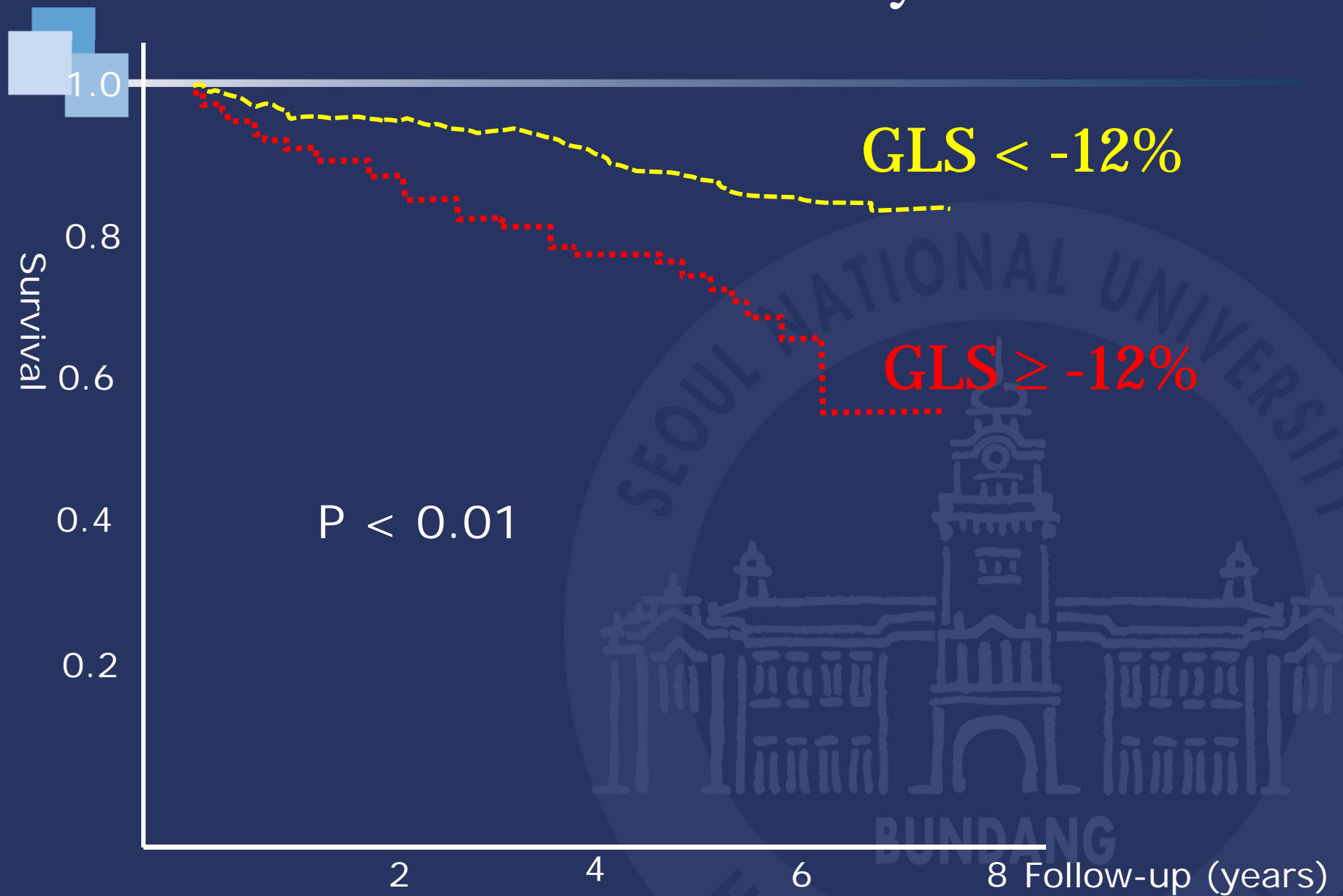
- 546 patients with 5.2 ± 1.6 yr follow-up



GLS is a superior predictor of outcome to either EF or WMSI and may become the optimal method for assessment of global LV systolic fx.

* GLS -12% = EF 35%*

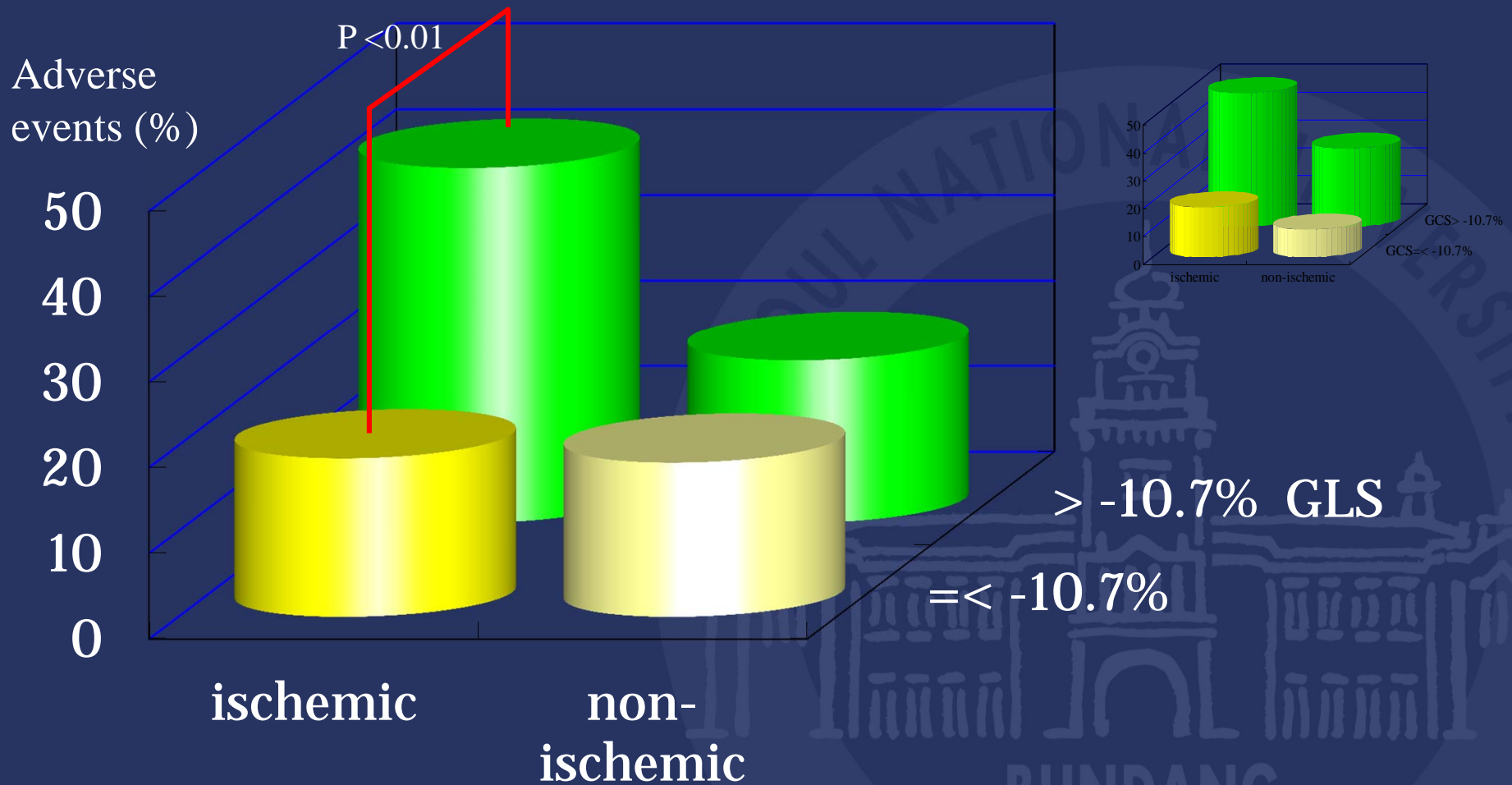
Prediction of all-cause mortality from GLS:



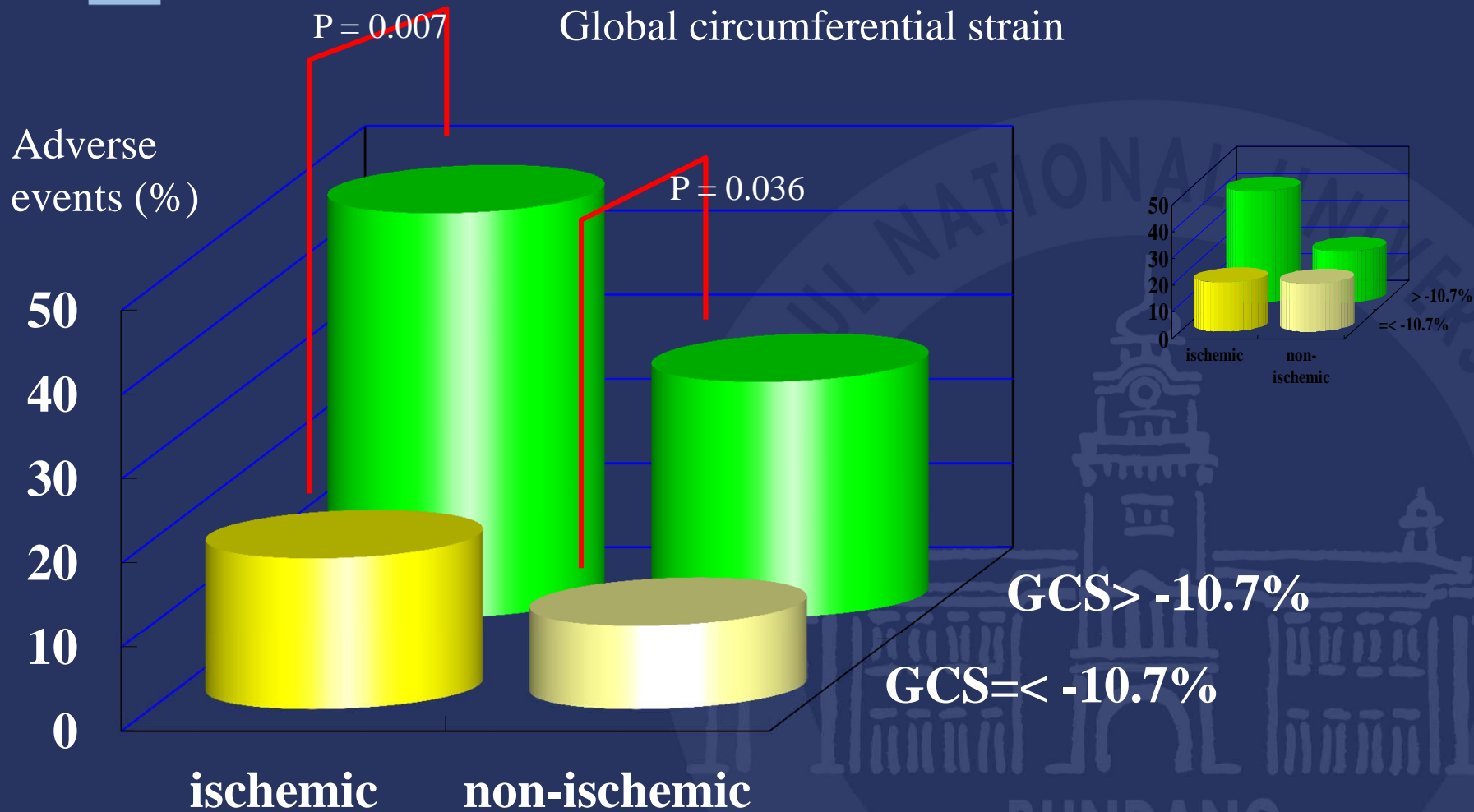
2-D strain as a prognosticator in HF



Global longitudinal strain

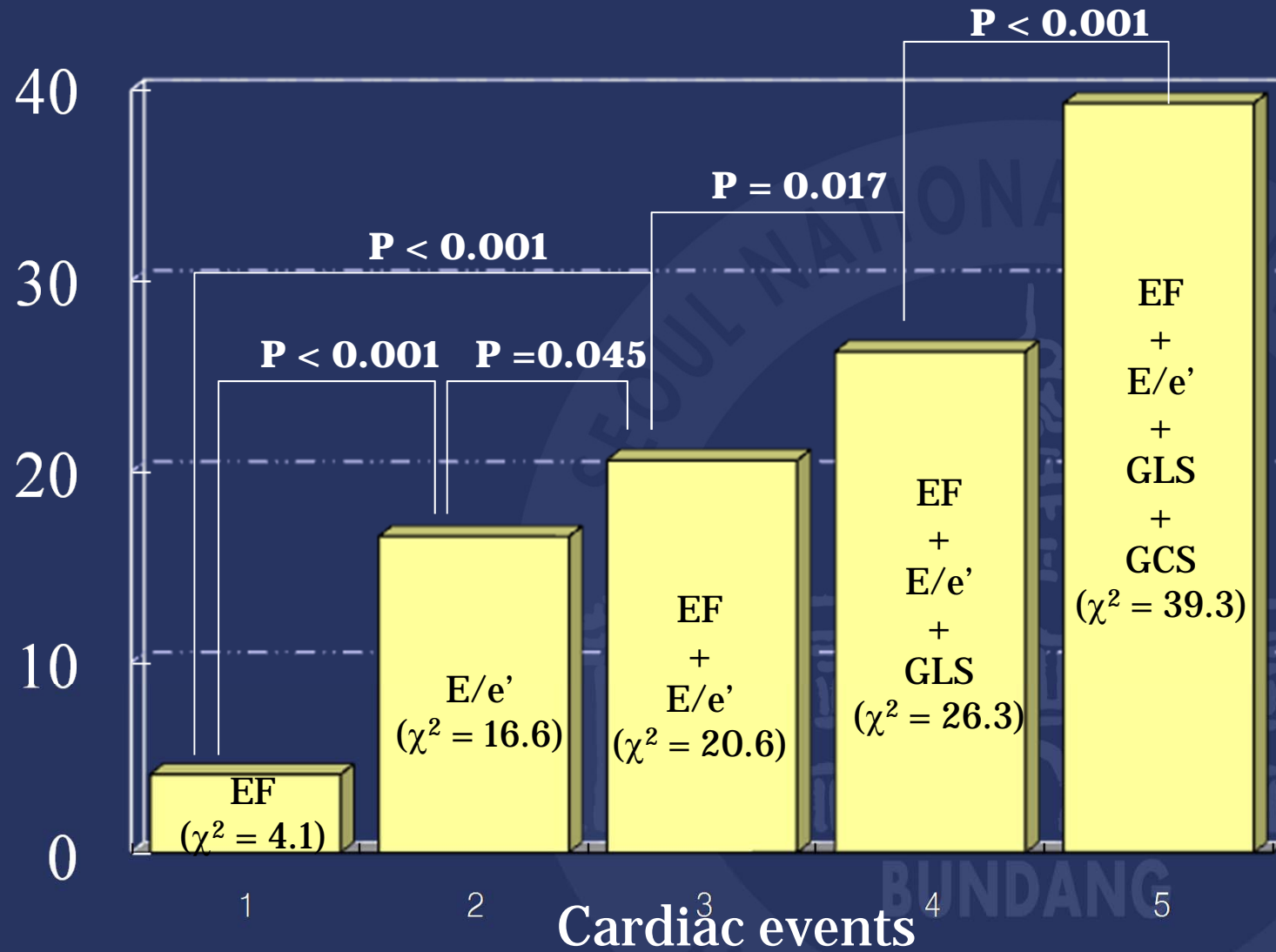


2-D strain as a new prognosticator in HF





Chi-square





Diastolic heart failure

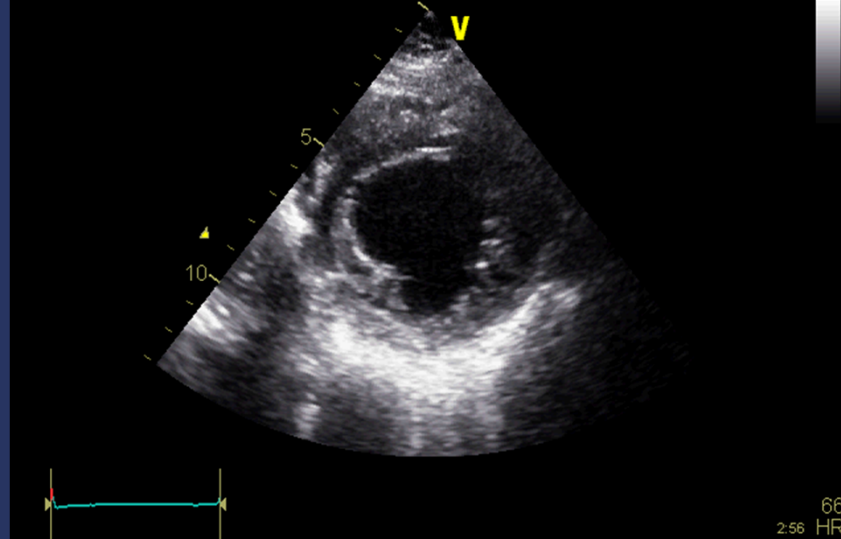
- Longitudinal and radial strains: ↓
- Circumferential strain: normal

In patients with SHF

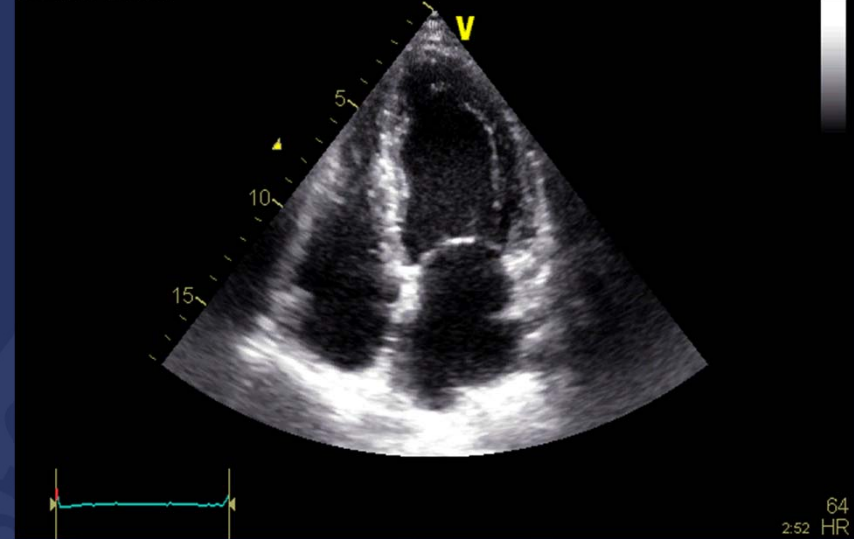
- All 3 directional strain: ↓
- *The preserved circumferential strain appear to contribute to the normal EF in patients with diastolic heart failure.*

Case, F/54, DOE (YNHA Fc II)

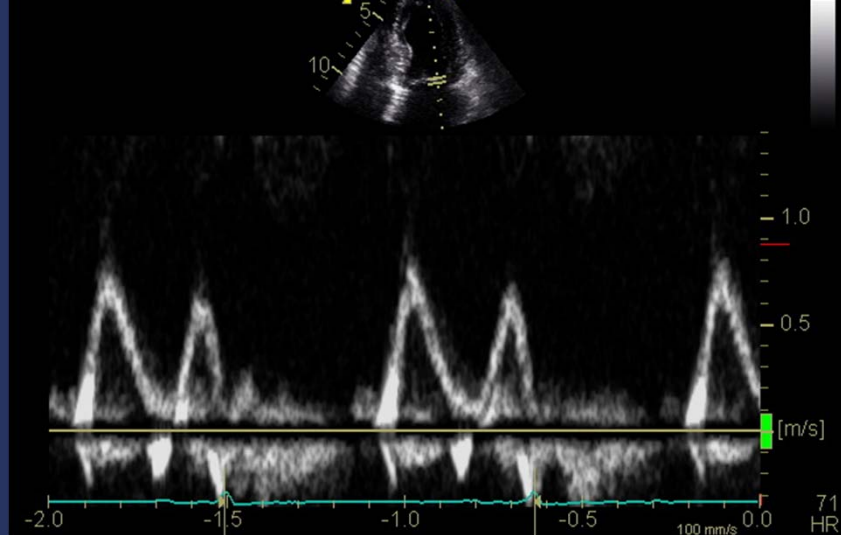
05/09/2009 09:09:36



05/09/2009 09:10:50



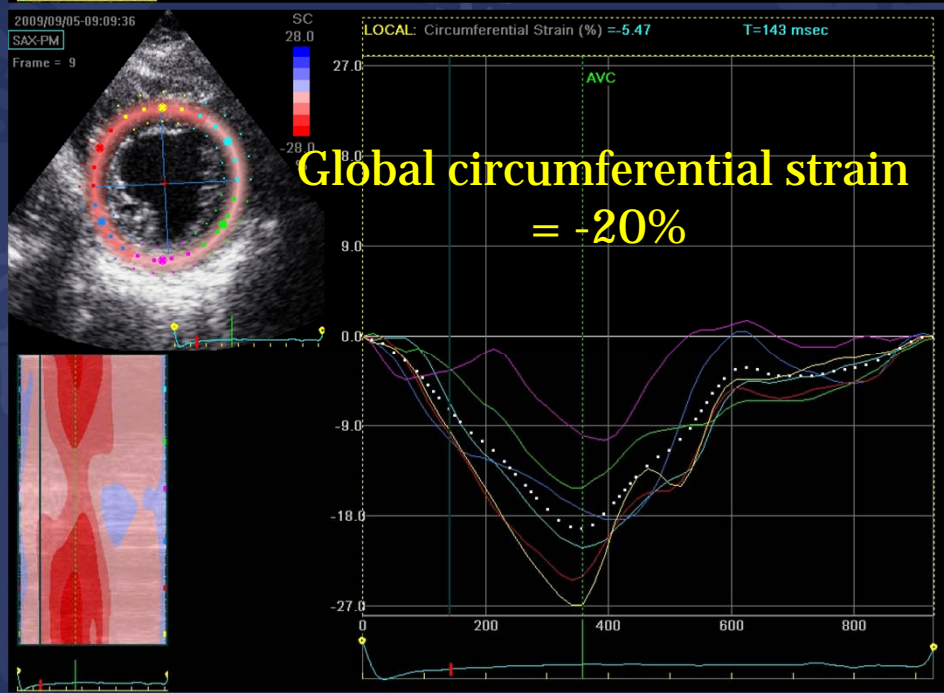
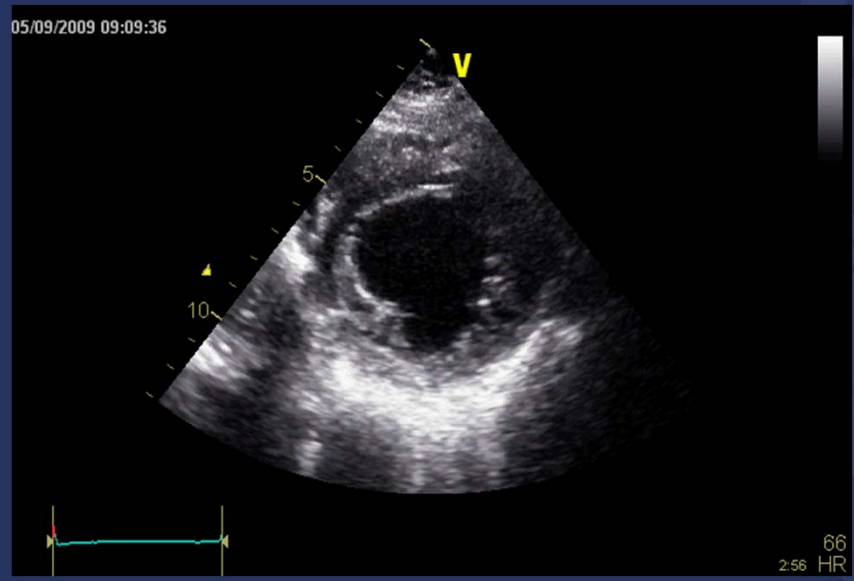
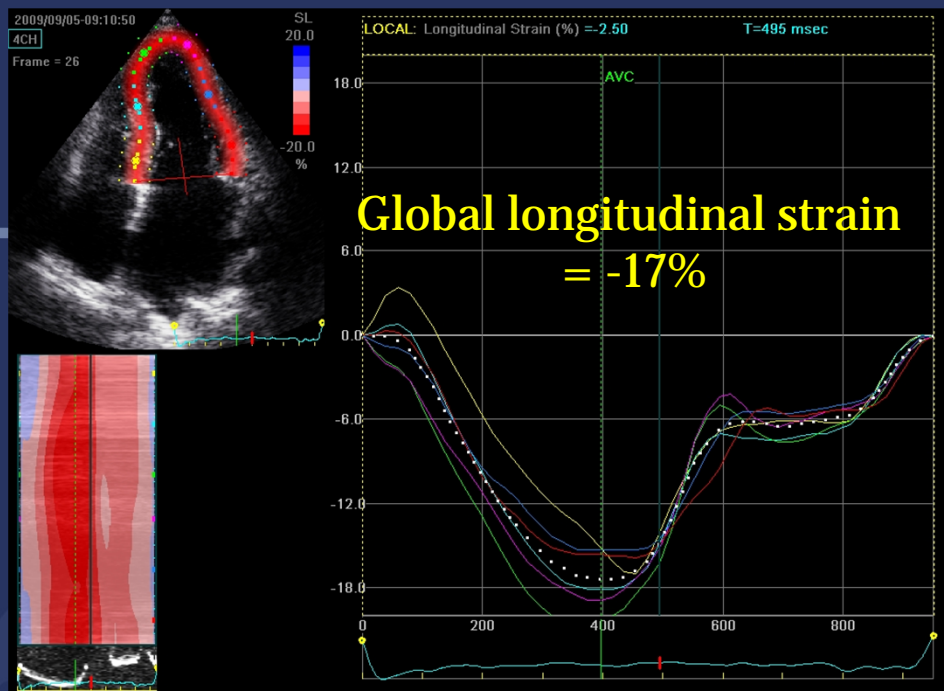
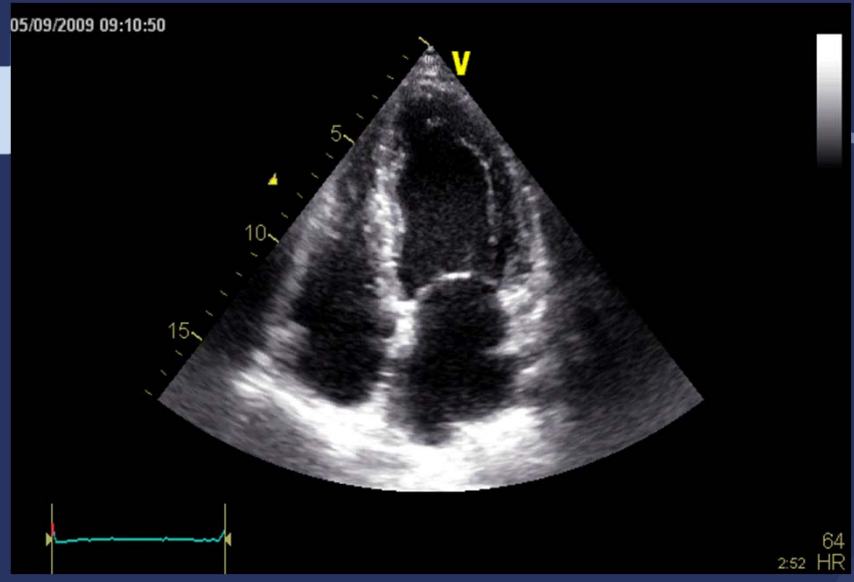
05/09/2009 09:11:41



$$E/e' = 14$$

$$LAVI = 45 \text{ ml/m}^2$$

$$E/V(p) = 2.1$$



Case. F/50



Problem list

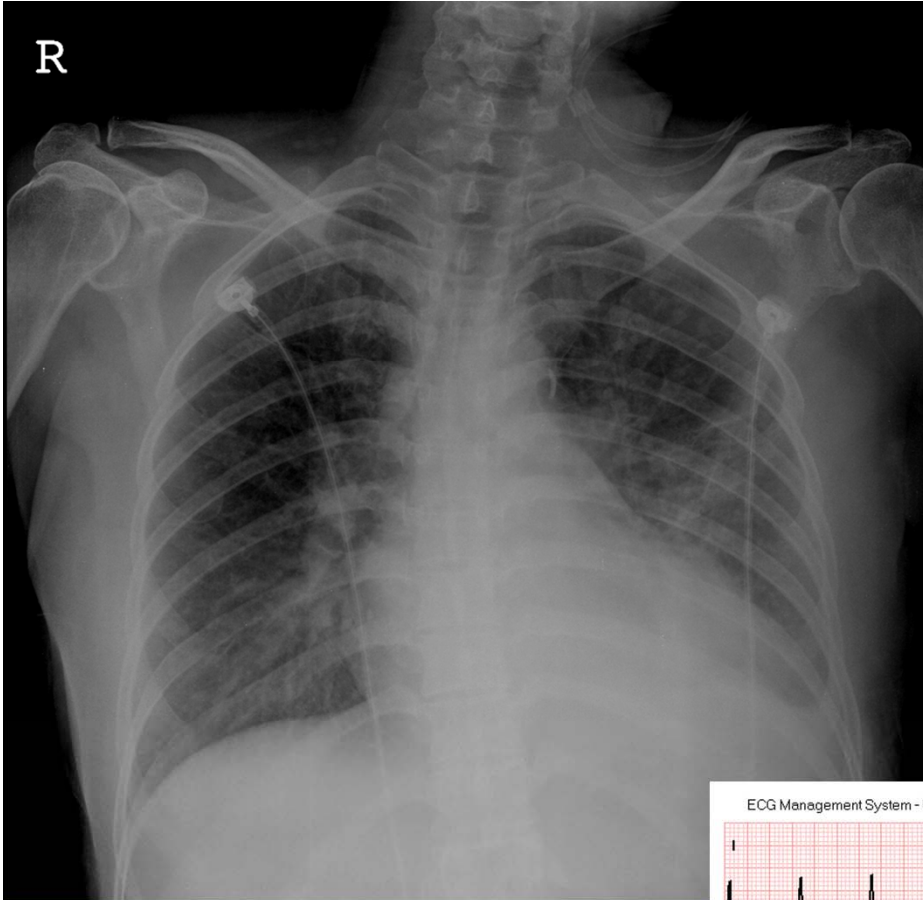
#1. admission for recurrent heart failure
('08.1, '08.10, '09.9, '09.11, -----)

#2. HTN

#3. DM with triopathy

: proteinuria, azotemia (Cr 1.4)

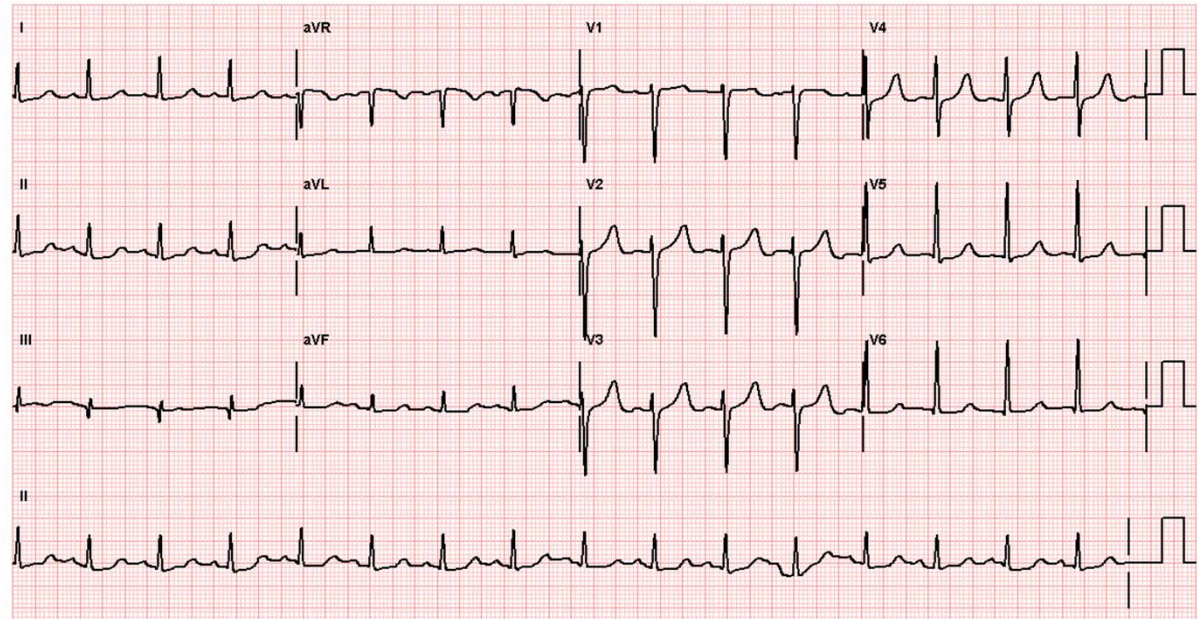
R



Both lung: crackle
RHR with S3 gallop

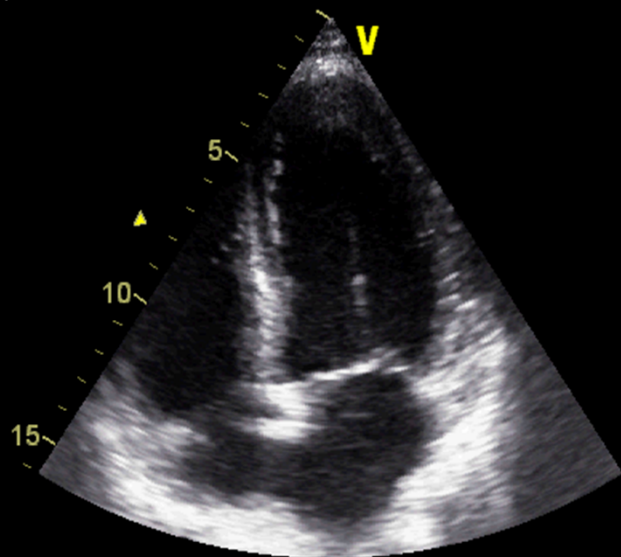
ECG Management System - Unidentified ECGs

PRELIMINARY - MUST BE REVIEWED

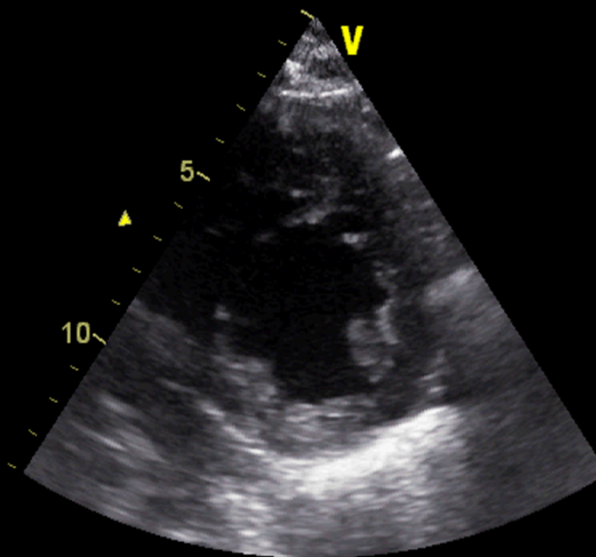




01/10/2009 12:11:54
FPS: 62.8

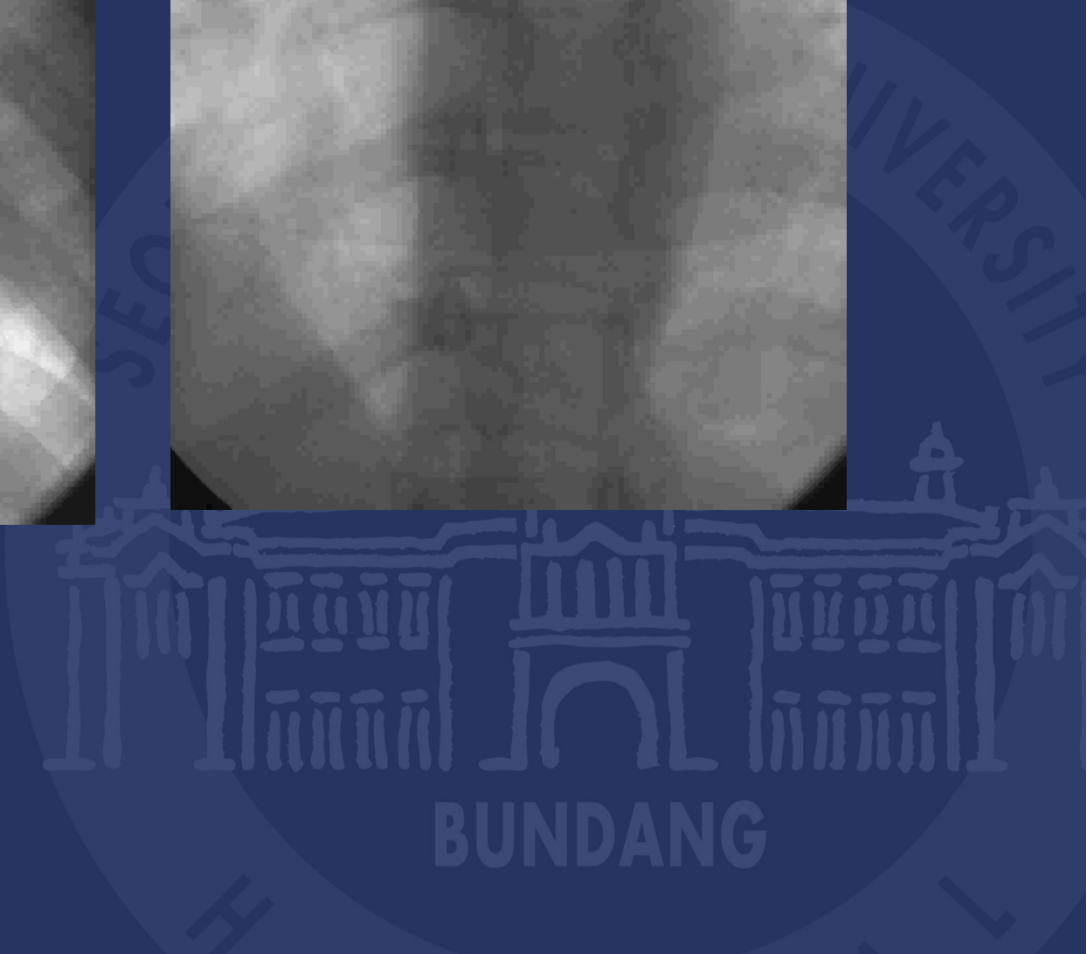
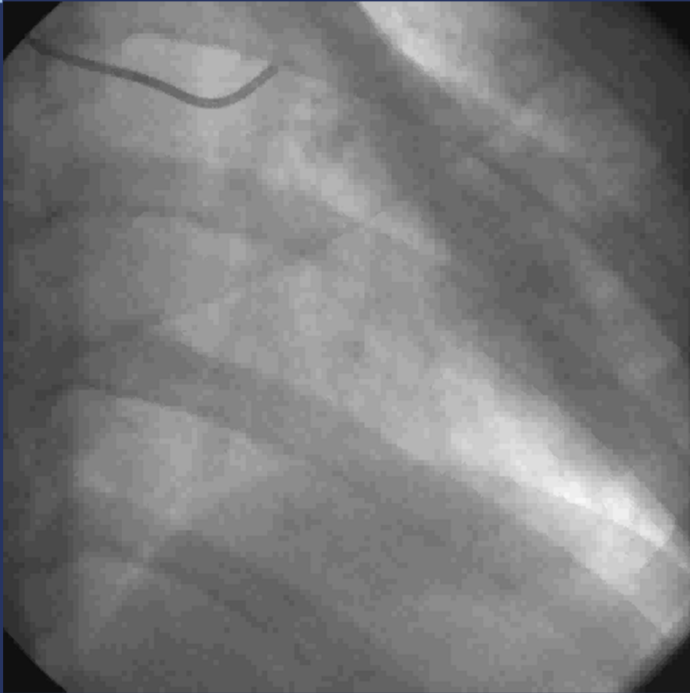


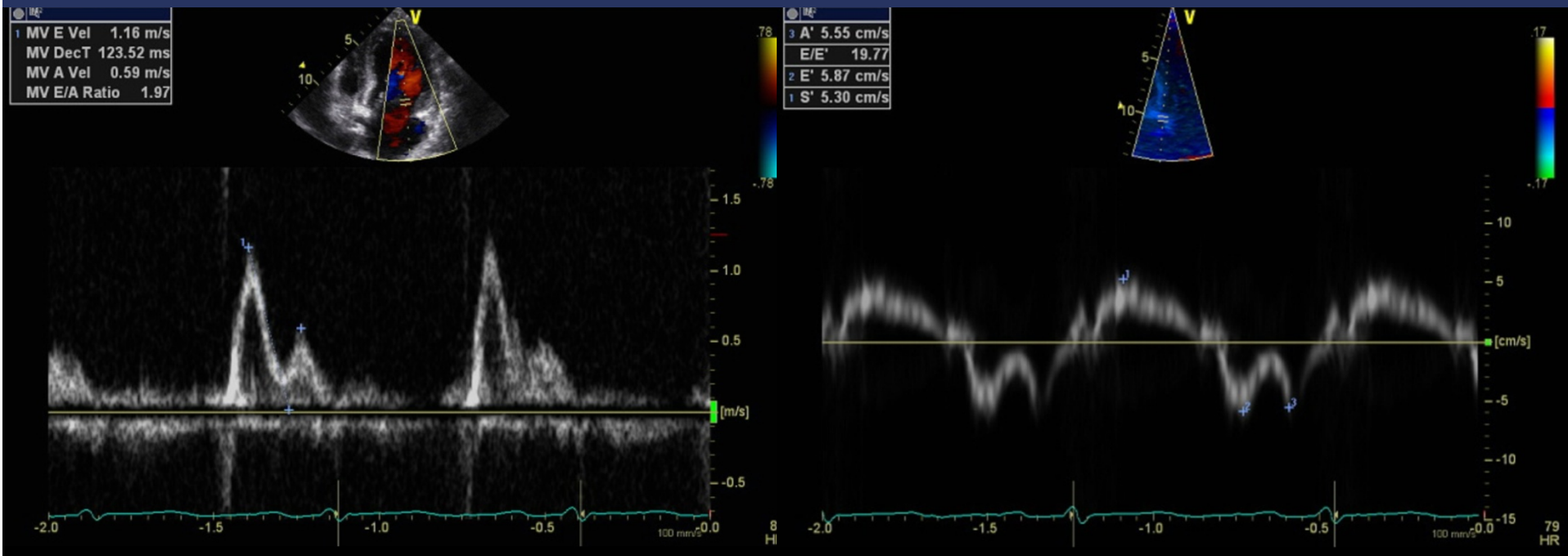
01/10/2009 12:10:42
FPS: 62.8



82
3:50 HR







$E/A = 116/59 \text{ cm/sec}$
 $DT = 123 \text{ msec}$

$s'/e'/a' = 5.3/5.9/5.5 \text{ cm/sec}$

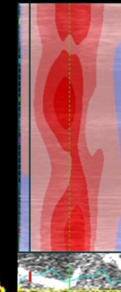
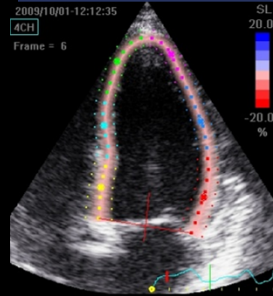
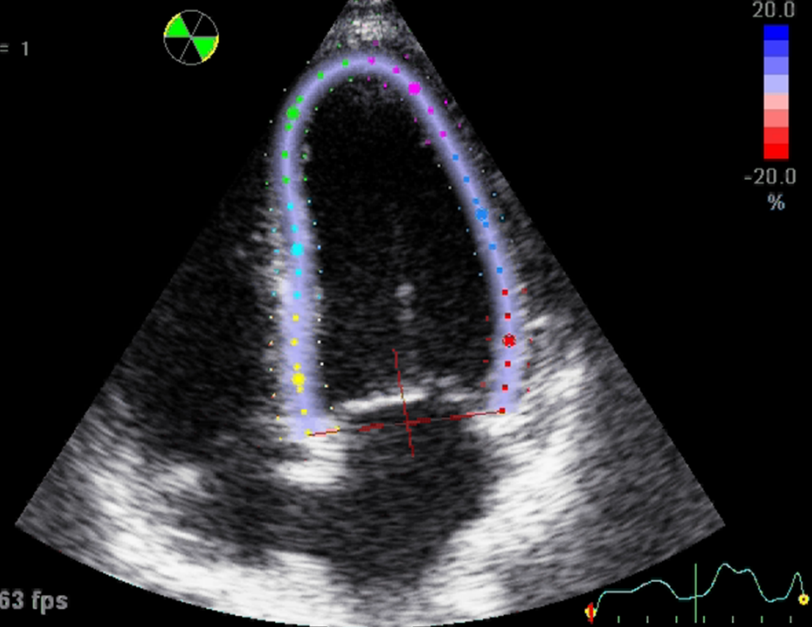
1. Concentric LVH with $EF = 51\%$
2. Grade 2 diastolic dysfunction (high LV filling pressure, $E/e' = 19.7$)
 : LA volume index = 45 ml/m^2

2009/10/01-12:11:54

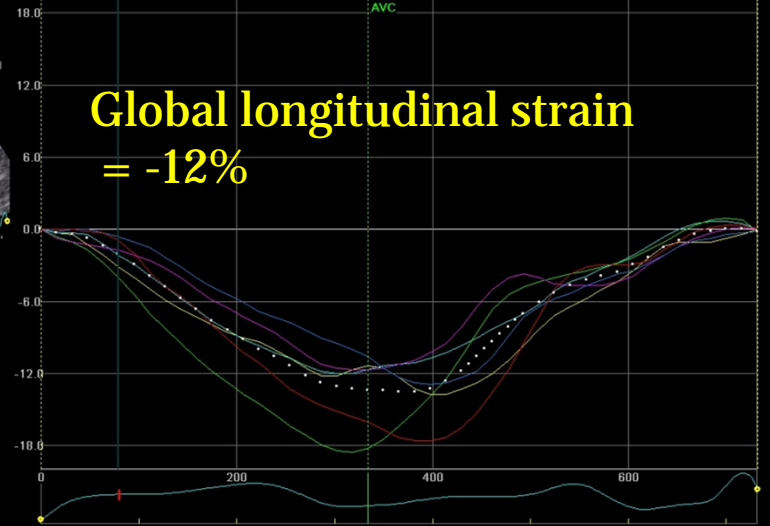
4CH

Frame = 1

Longitudinal Strain



LOCAL: Longitudinal Strain (%)

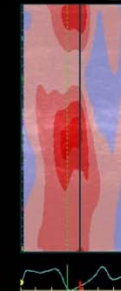
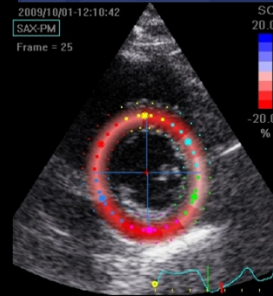
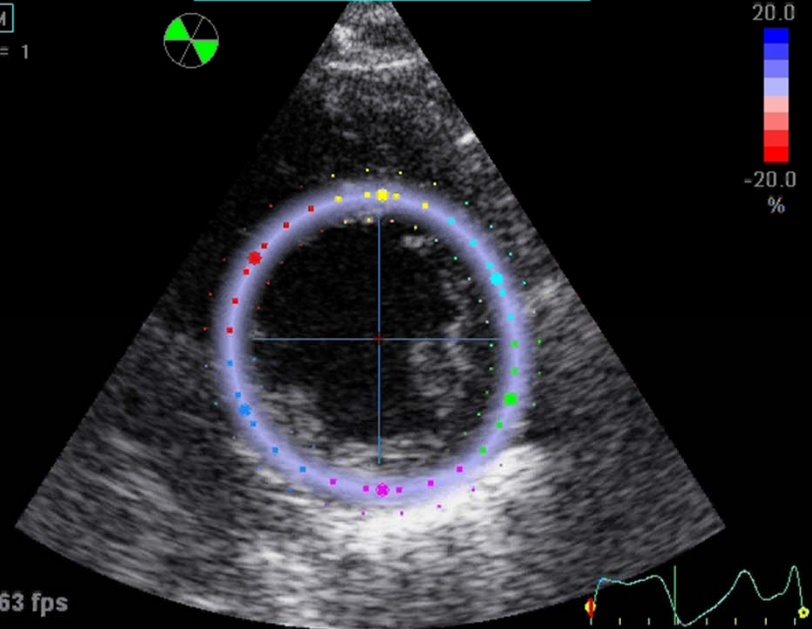


2009/10/01-12:10:42

SAX-PM

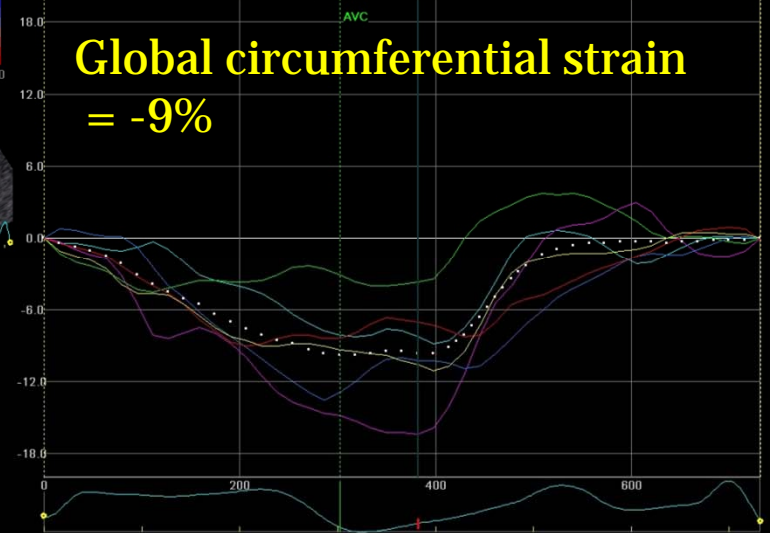
Frame = 1

Circumferential Strain



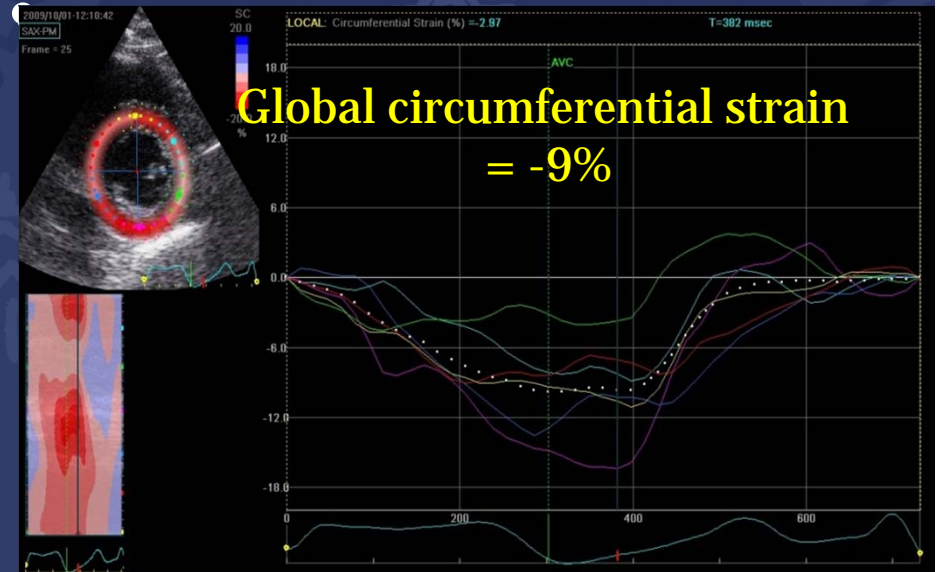
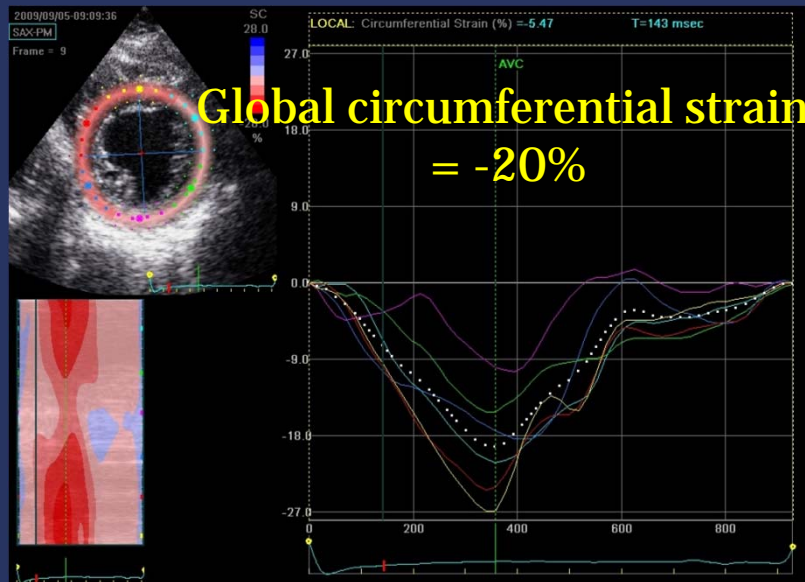
LOCAL: Circumferential Strain (%) = -2.97

T=382 msec



What's the difference?

- F/54, NYHA II
- EF = 60%
- E/e' = 14
- LAVI = 45 ml/m²
- F/50, recurrent adm.
- EF = 51%
- E/e' = 19.6
- LAVI = 45 ml/m²



Global circumferential (GCS)

vs. longitudinal strain (GLS)

1. The superiority of GCS over GLS
 - a. GCS applies to myocardial fibers with a transverse orientation associated with circumferential and radial ventricular deformation.
 - b. Those abnormalities develop later in the progression of heart failure than the usually less-severe deformation of longitudinal myocardial fibers that GLS measures.



Conclusion

Strain imaging can be used as for
diagnosis, understanding mechanism, and
*prognosticator in cardiac
disease*

Thank you very much.

감사합니다.



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