

# ECOCARDIOGRAFIA NELLA SINDROME CORONARICA ACUTA E CRONICA

*Le Evidenze Scientifiche*

Dott. Rodolfo Citro

*AOU San Giovanni di Dio e Ruggi d'Aragona*

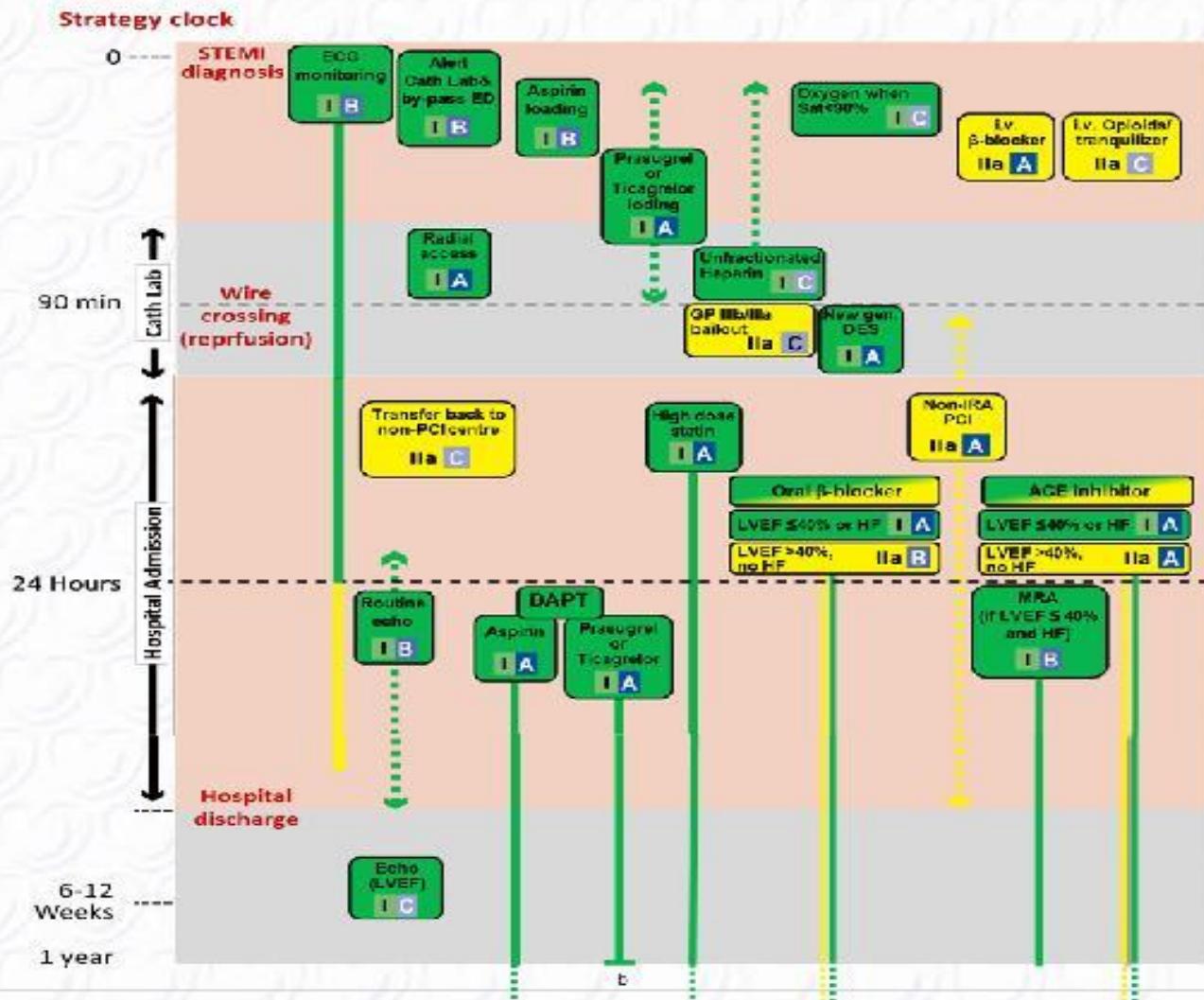
10° CONGRESSO NAZIONALE



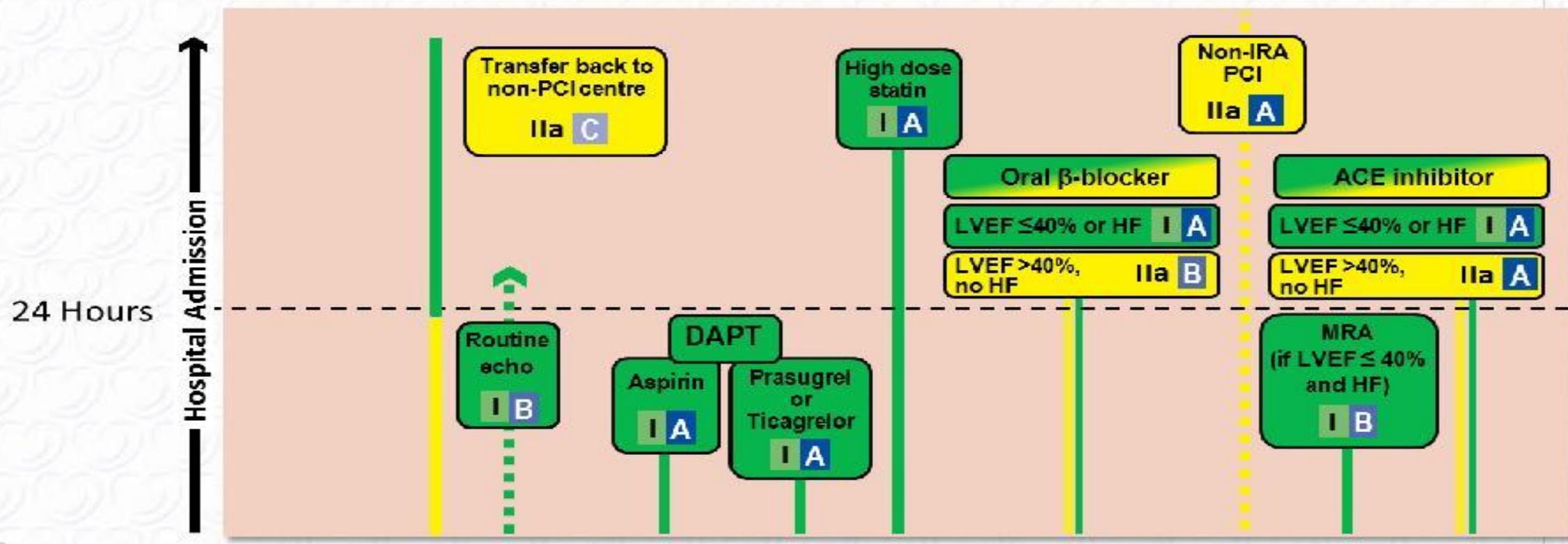
*Quello che le Linee Guida Non Dicono*  
Napoli, Hotel Excelsior, 14-15 aprile 2023



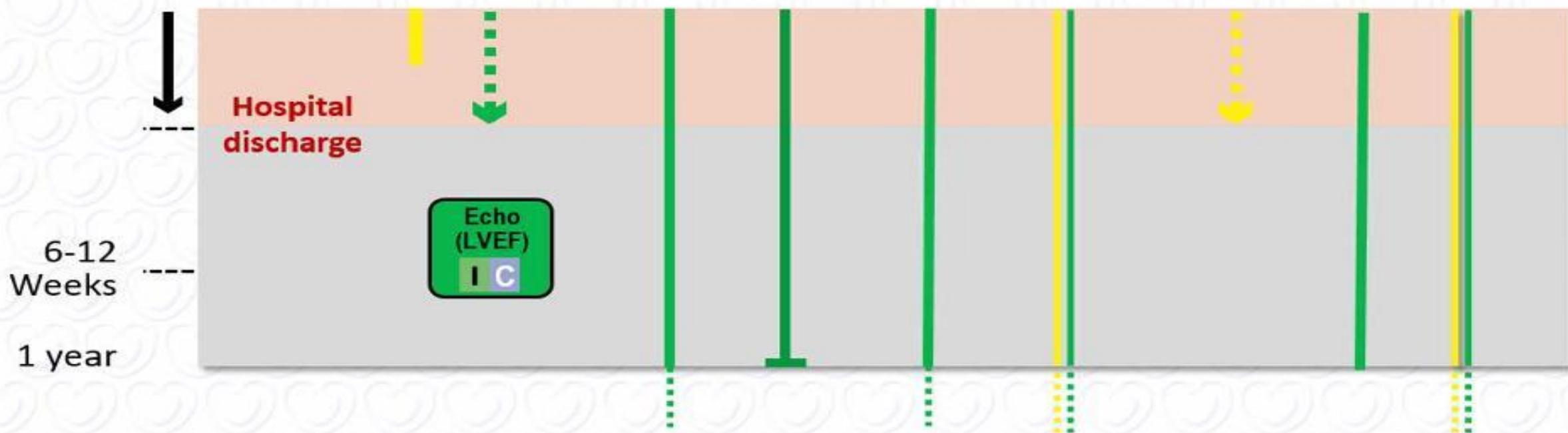
# "Do not forget" interventions in STEMI patients undergoing a primary PCI strategy

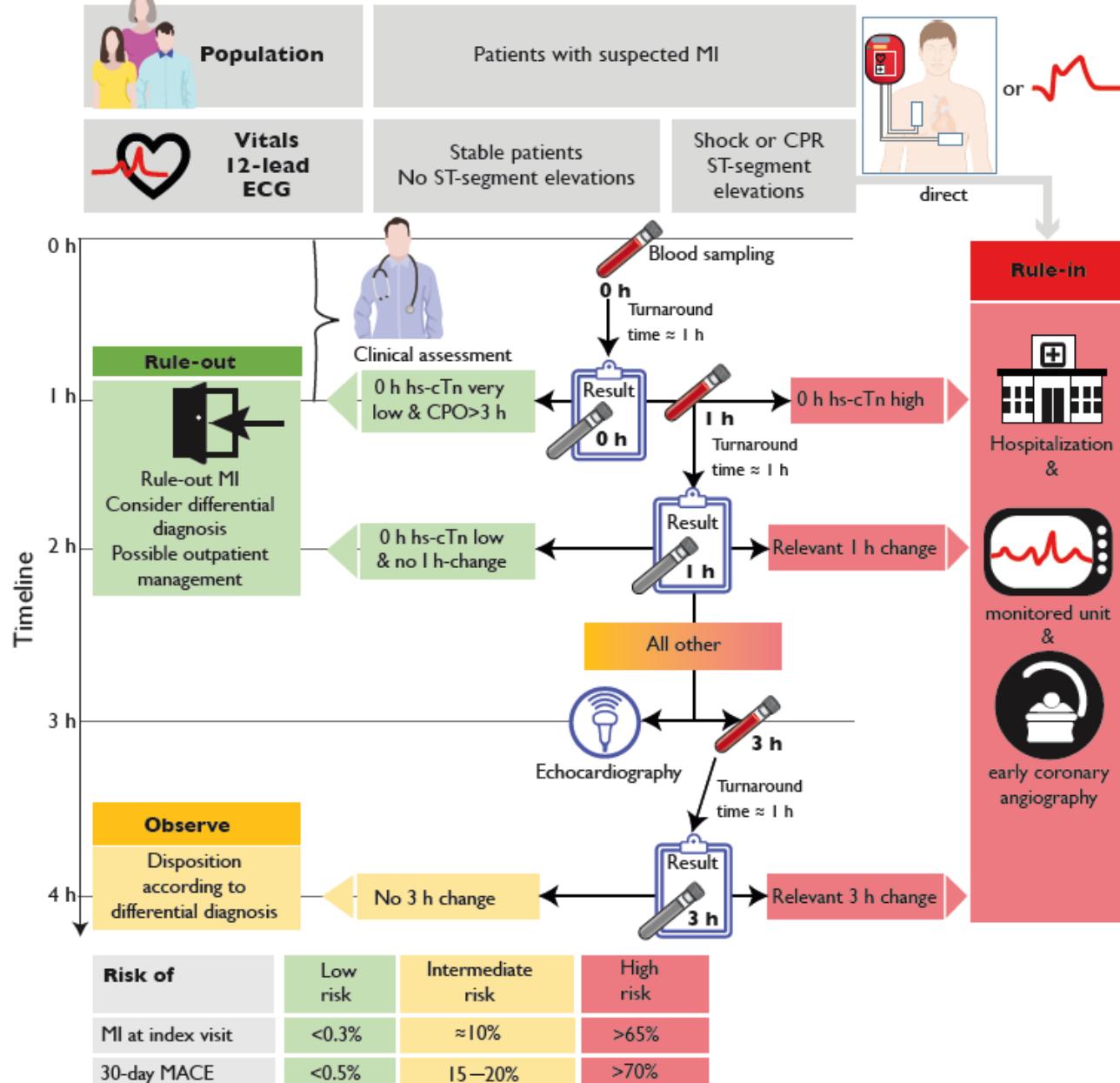


## "Do not forget" interventions in STEMI patients undergoing a primary PCI strategy

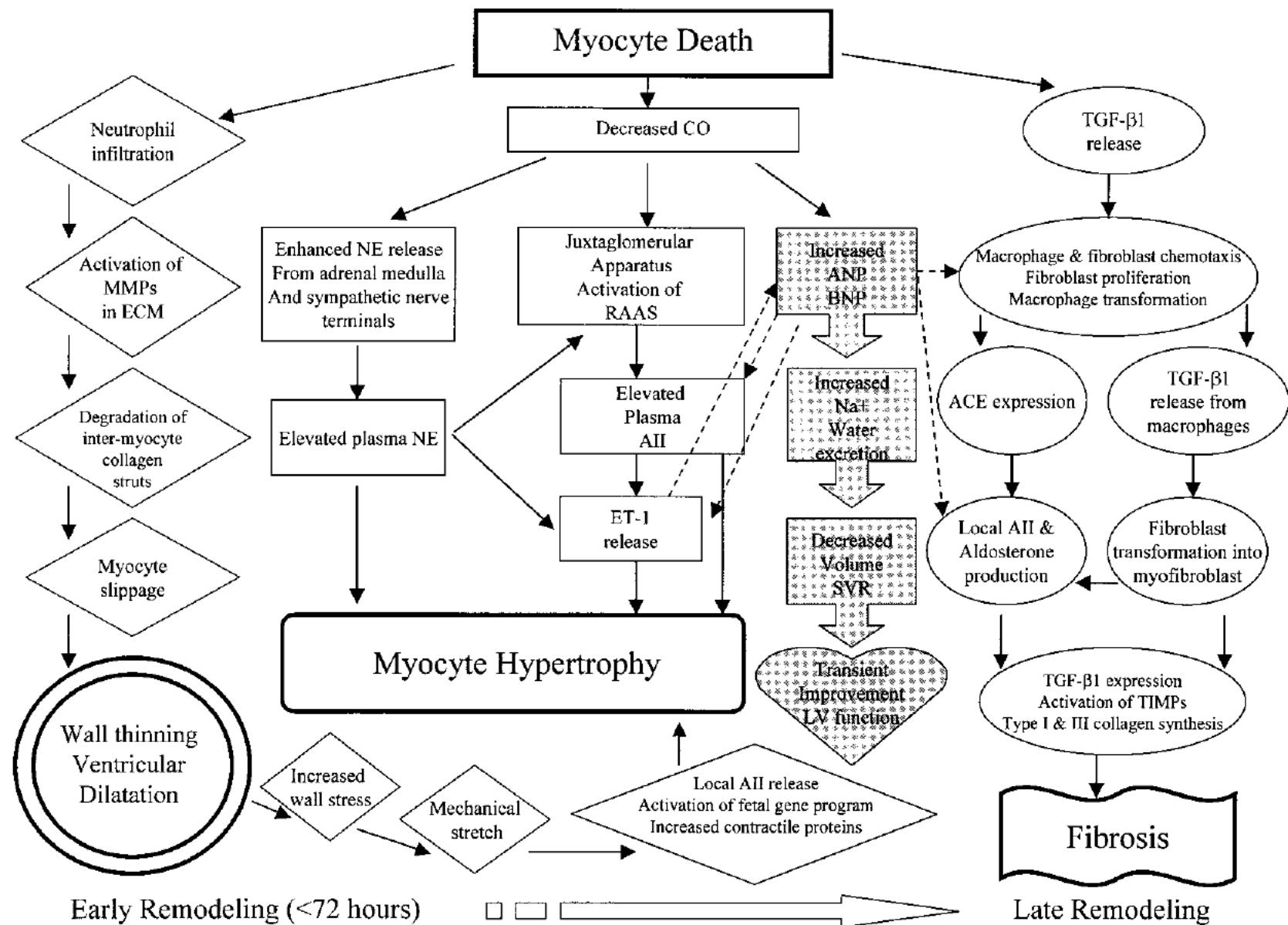


## **“Do not forget” interventions in STEMI patients undergoing a primary PCI strategy**

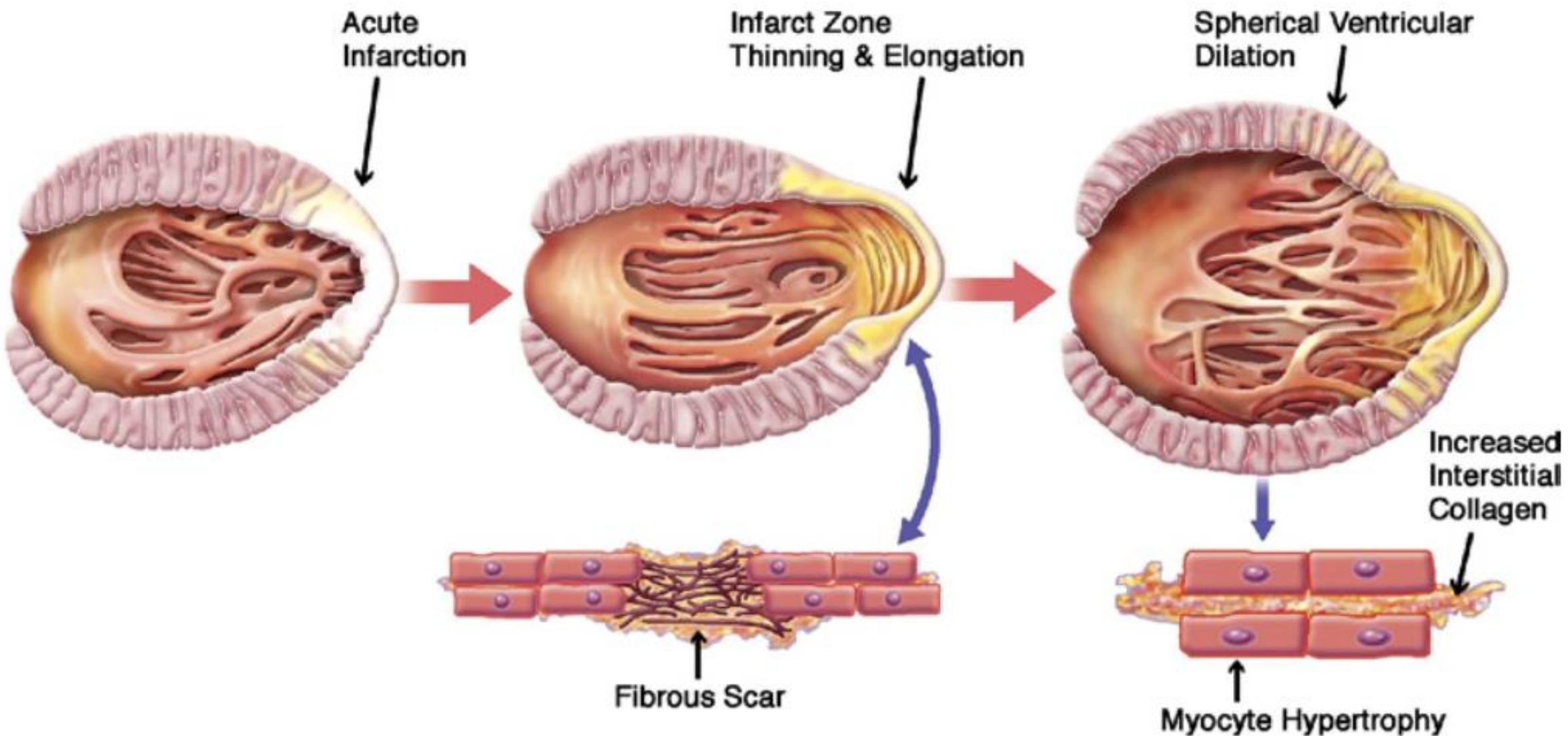




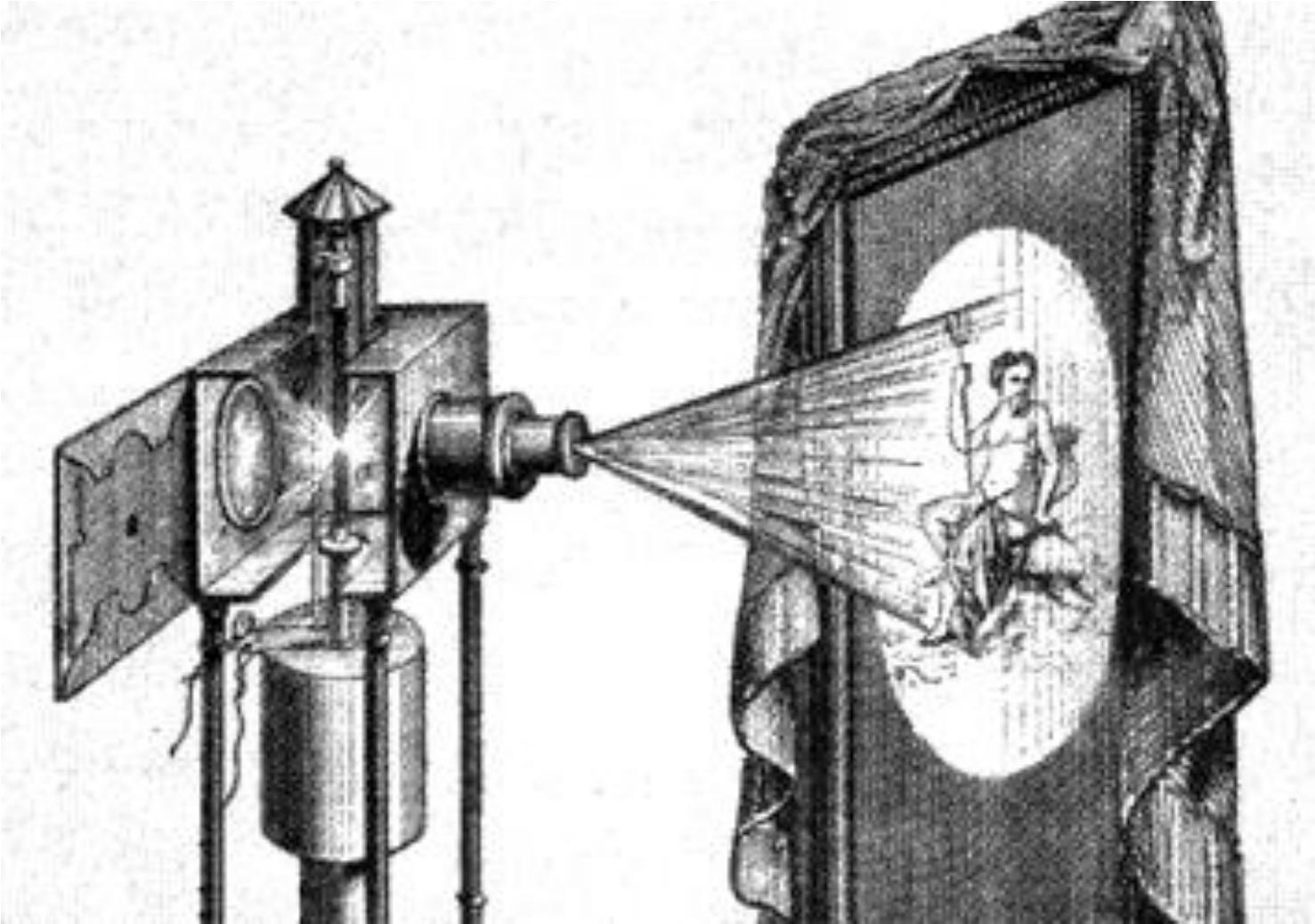
**Figure 4 (1) Timing of the blood draws and clinical decisions when using the European Society of Cardiology 0 h/1 h algorithm.**



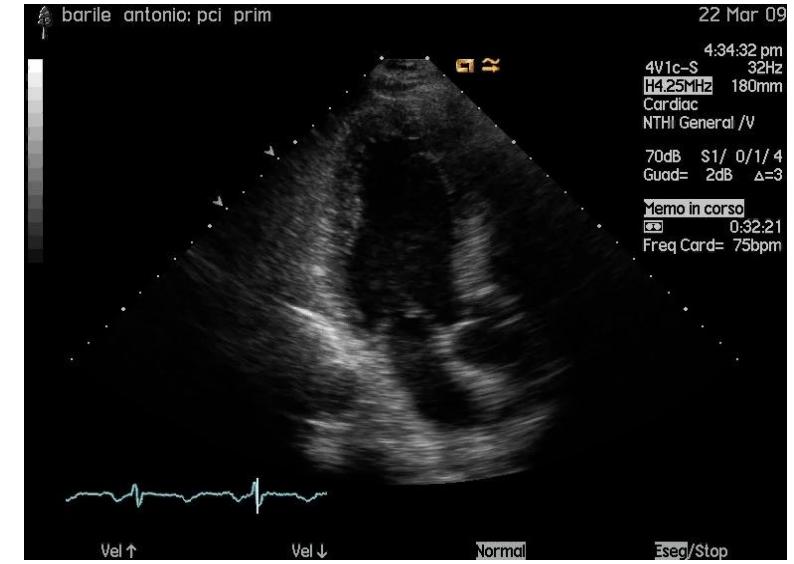
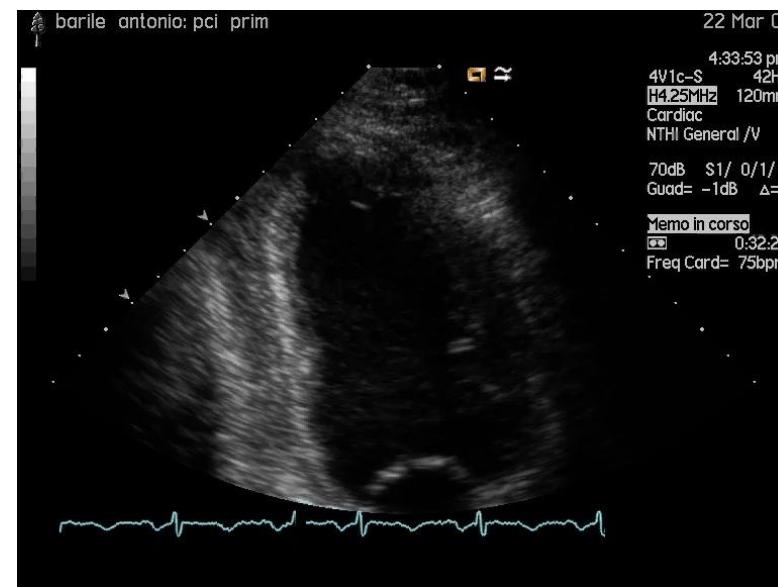
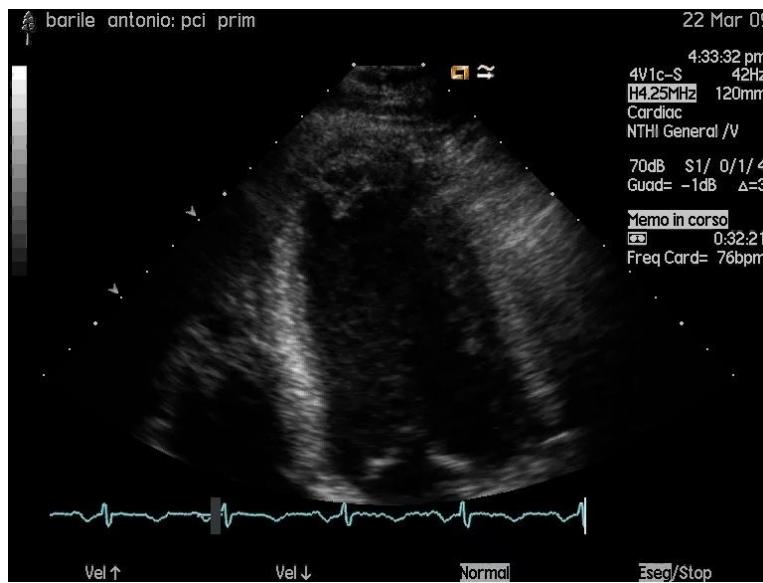
## POST-MI REMODELING



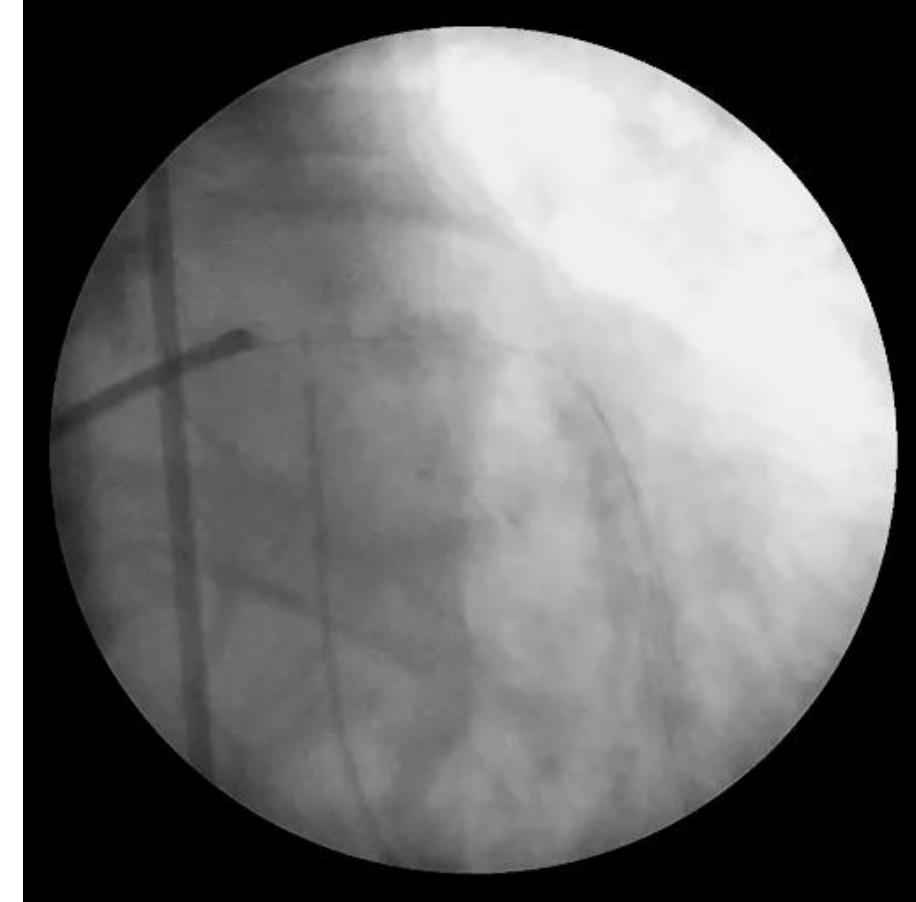
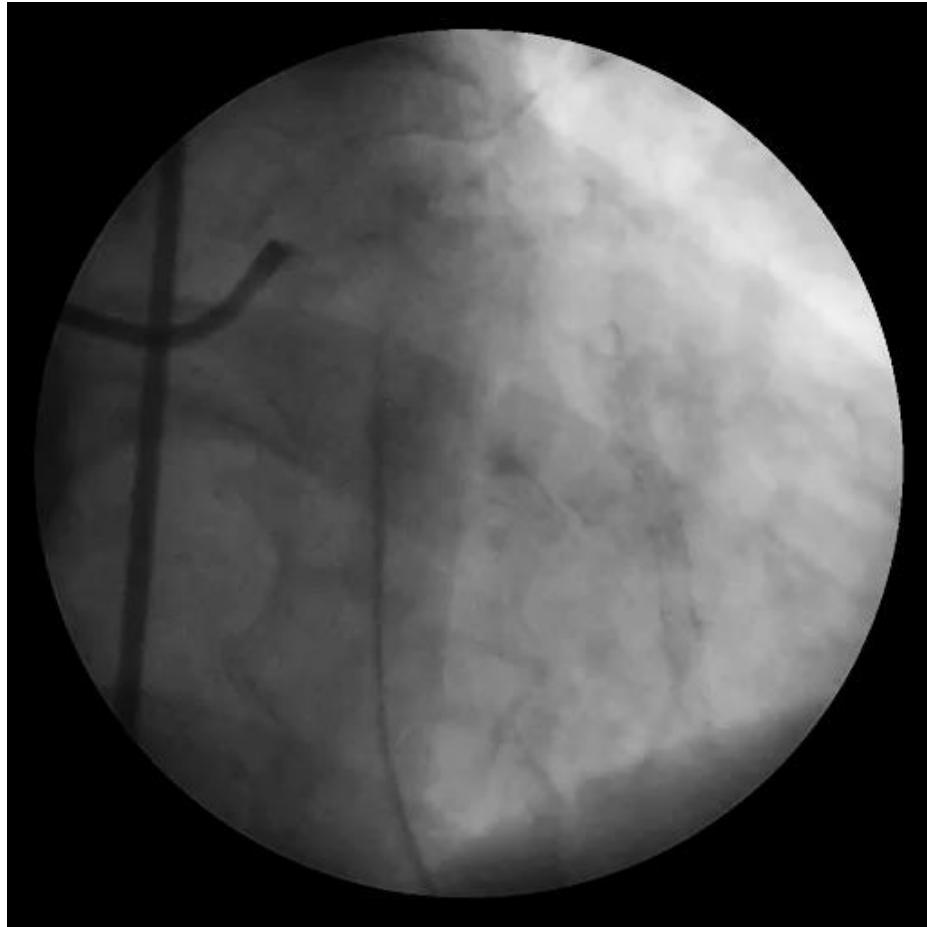
Echocardiography  
and HF.....*Le  
magique lanterne*



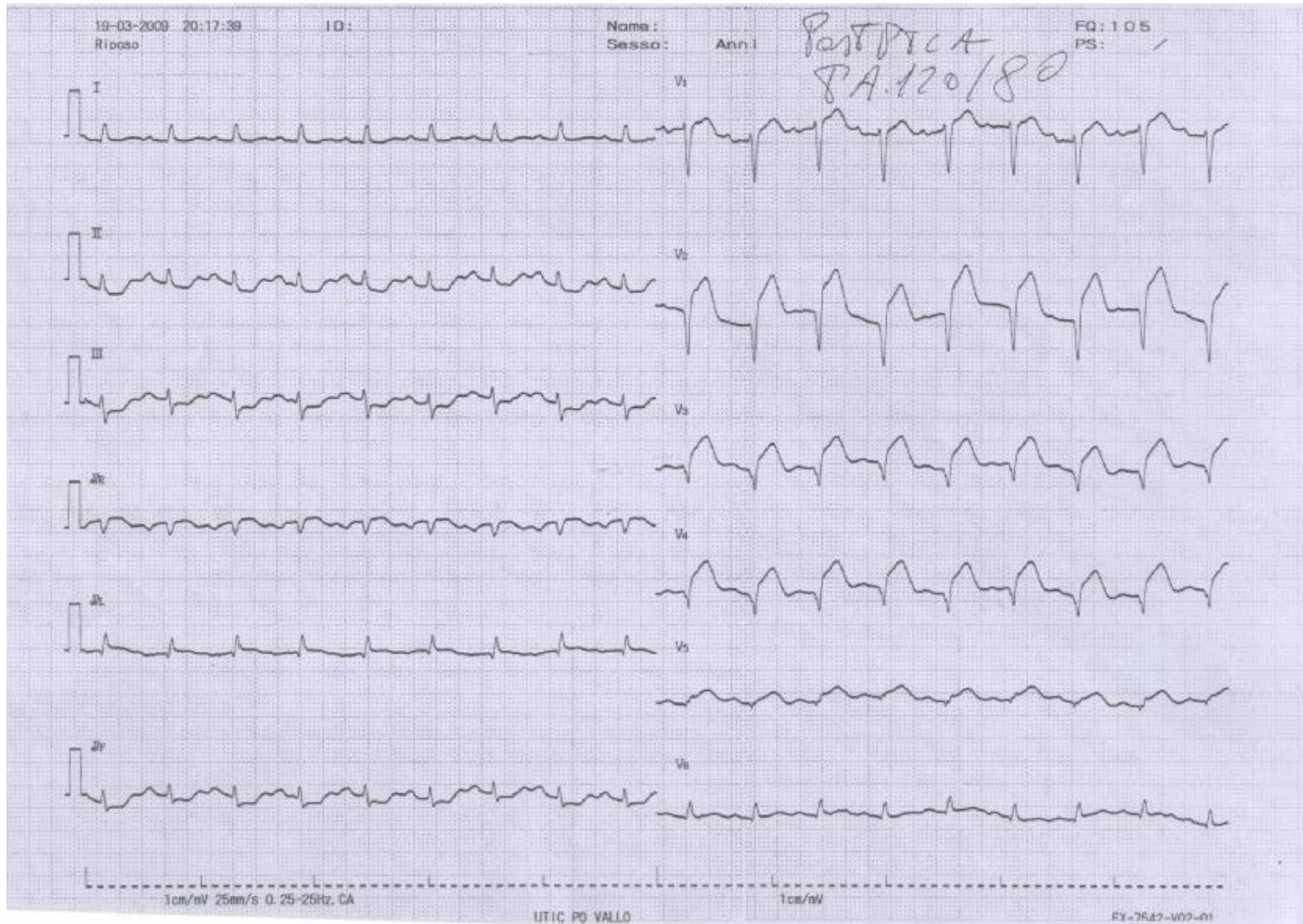
# STEMI Anteriore



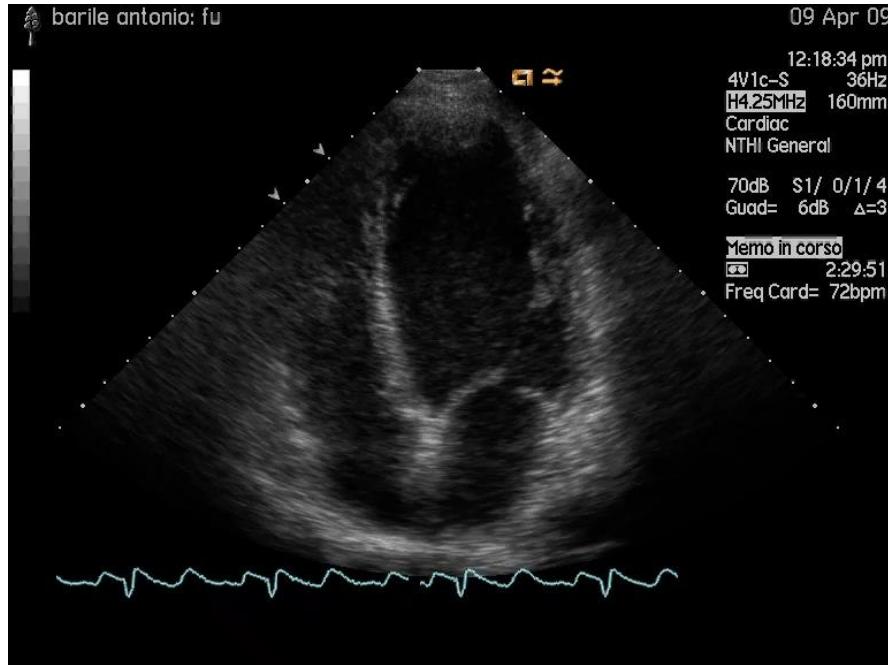
# *Coronarografia*



# **ECG post-procedura**

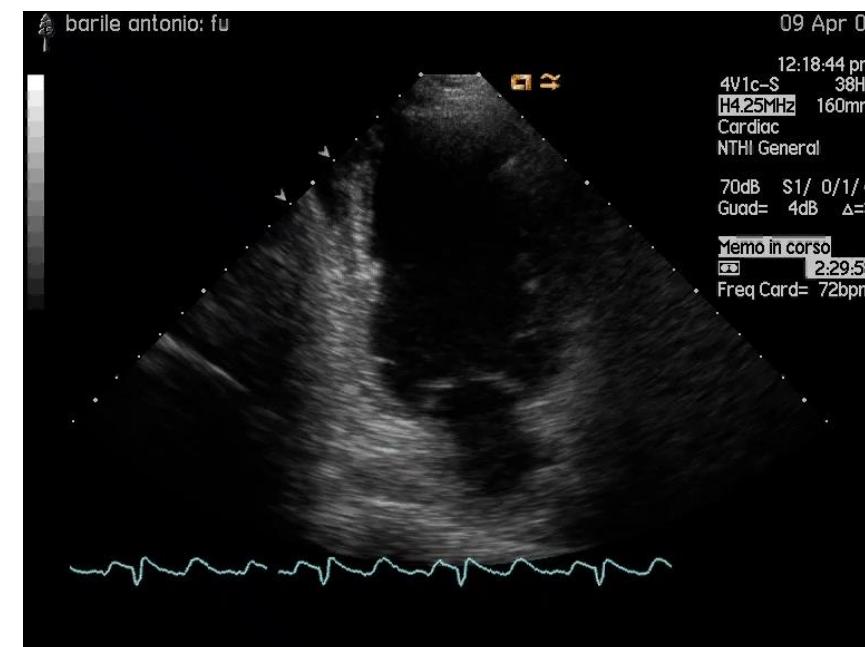


# **Ecocardiografia pre-dimissione**



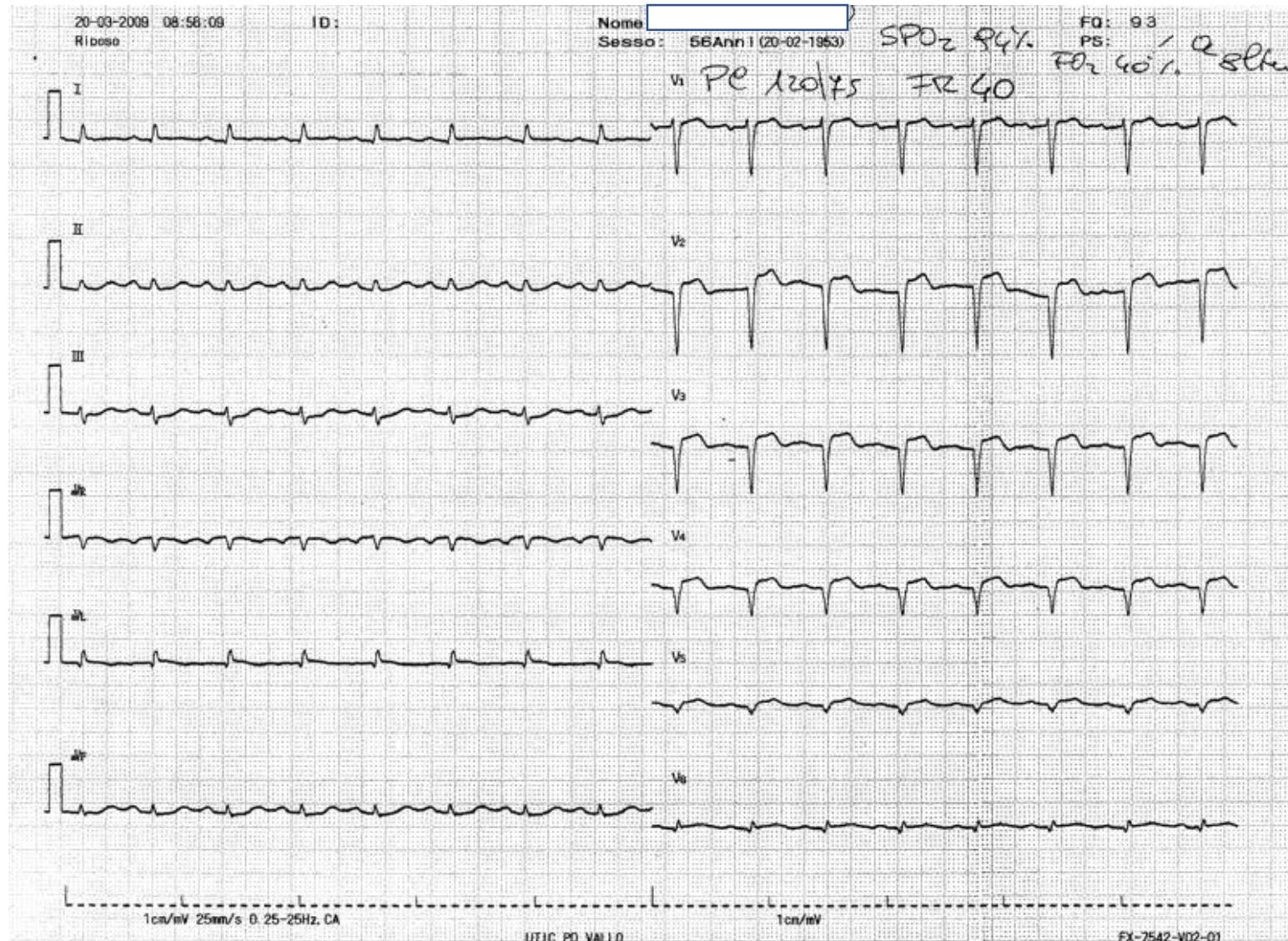
**4 camere**

**EDV = 129 ml**  
**ESV = 80 ml**  
**LV EF = 37%**



**2 camere**

# **ECG pre-dimissione**



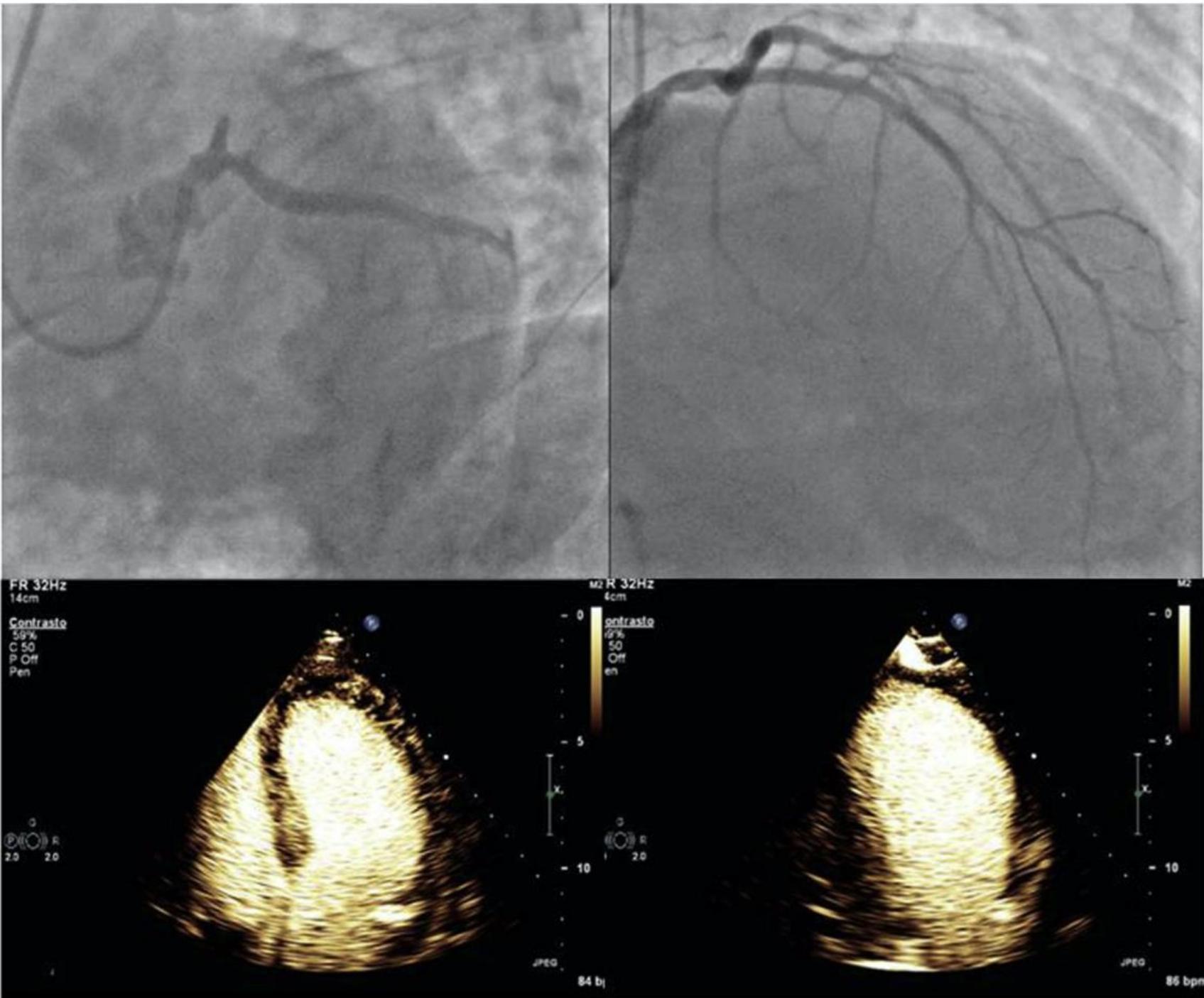
# **Cosa non ha funzionato?**

## **Fenomeno del no-reflow**

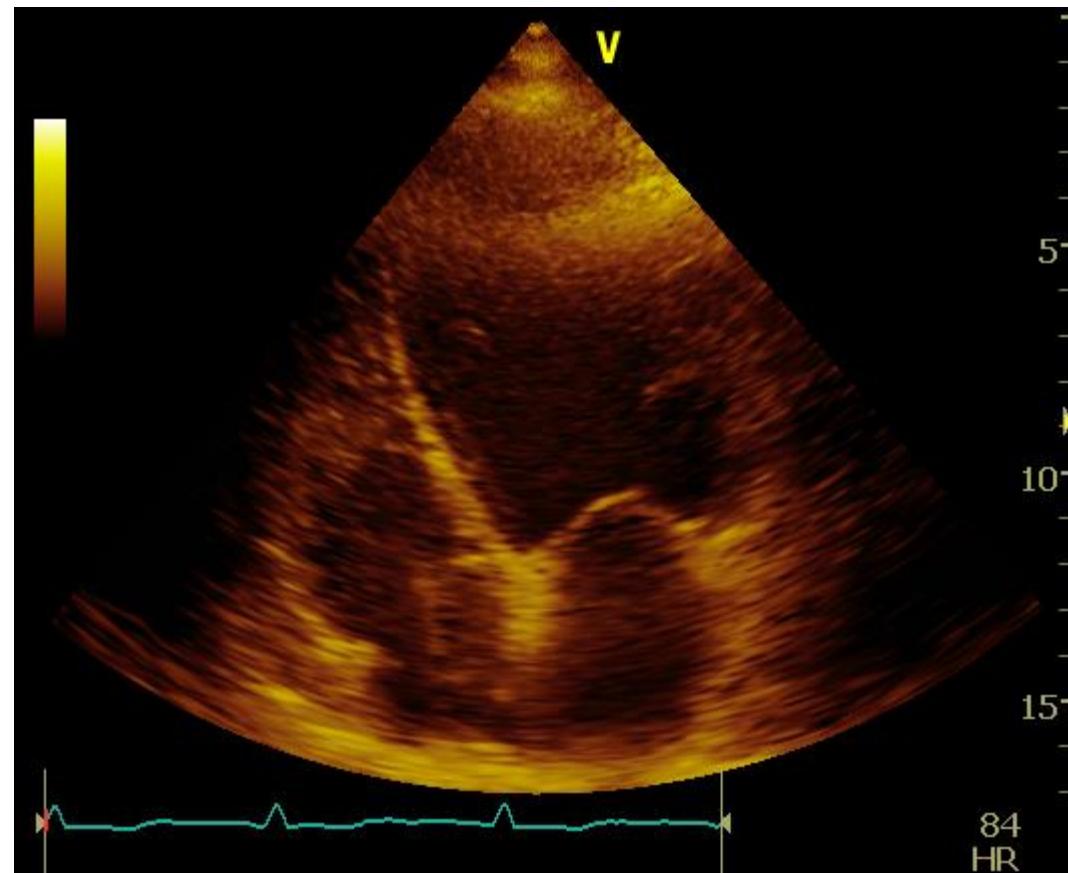
***“...Inadeguata perfusione miocardica nonostante un dato segmento della circolazione coronarica sia senza evidenza angiografica di ostruzione meccanica del vaso...”***

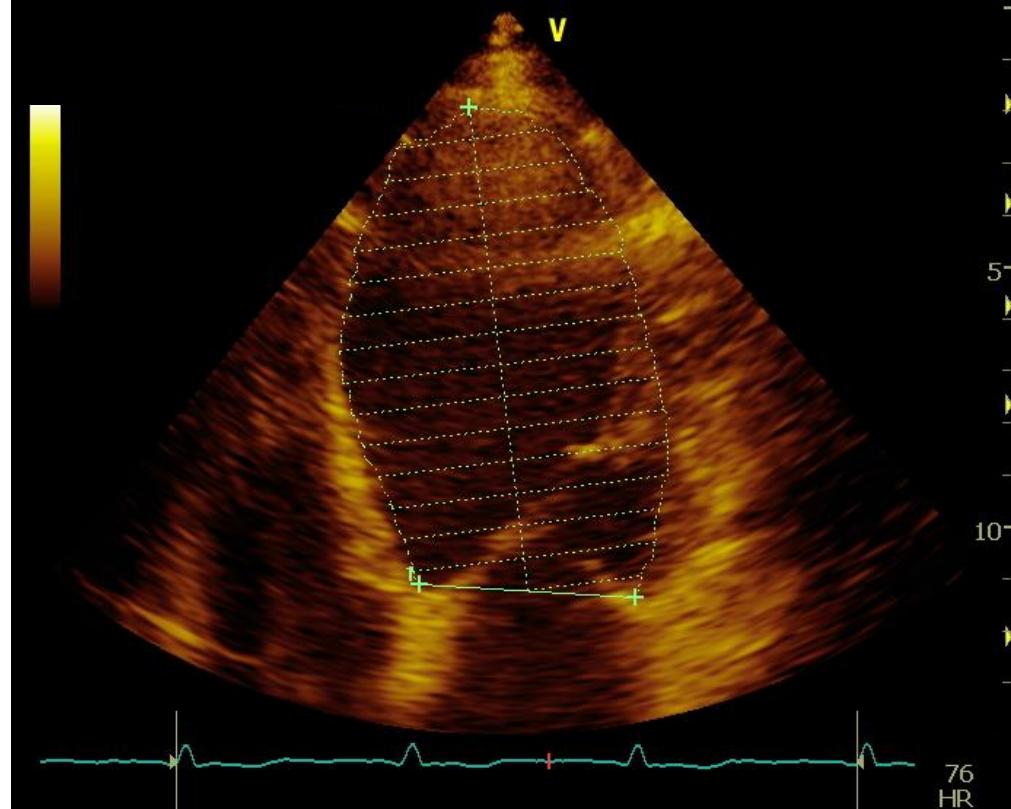
**(Kloner et al. J Clin Invest 1974)**



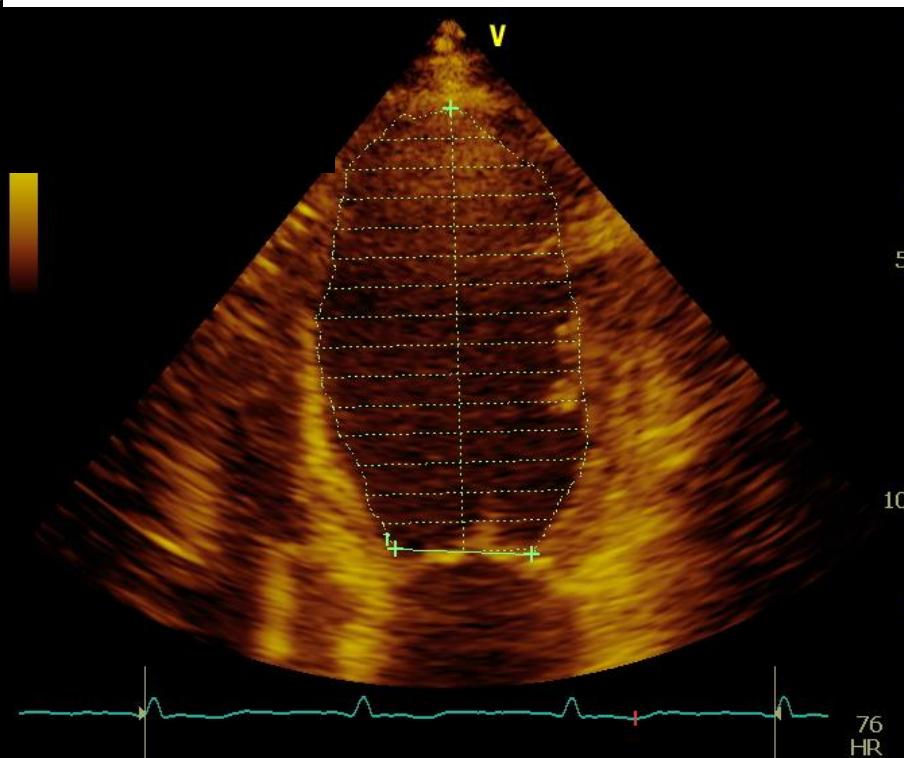


Due anni dopo.....

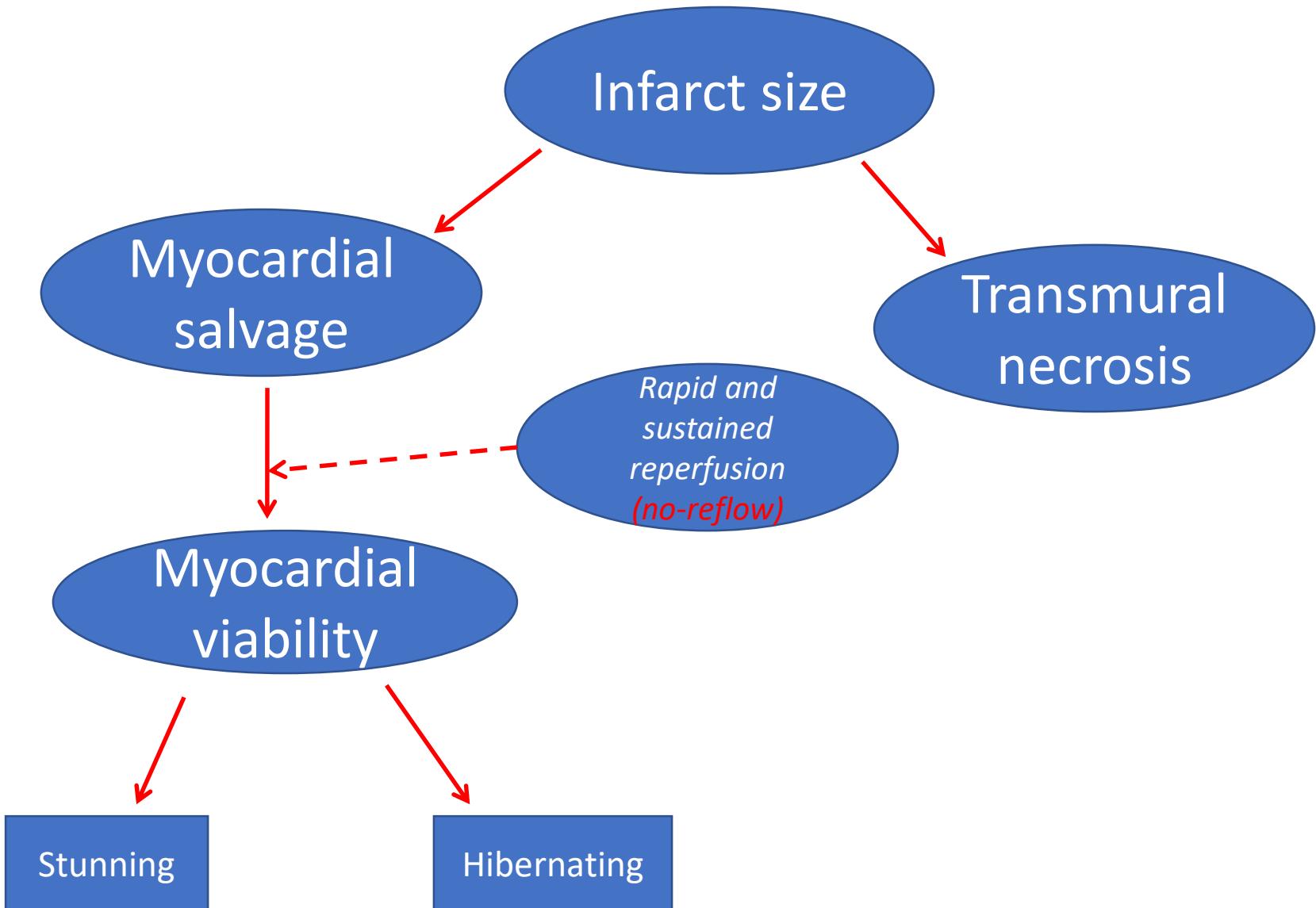




**EDV = 198 ml**  
**ESV = 146 ml**  
**LV EF = 26%**



# Prognosis after AMI



# Prognosis after AMI

Transmural  
necrosis

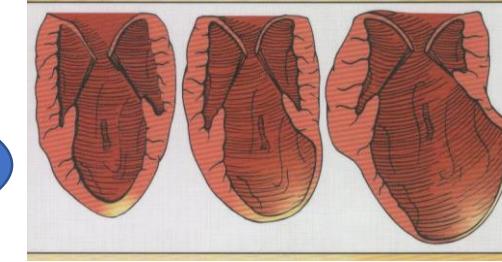
Infarct  
expansion

LV remodelling

LV dysfunction

Secondary  
mitral reg.

Worse  
outcome



# Echocardiographic parameters related to prognosis after myocardial infarction

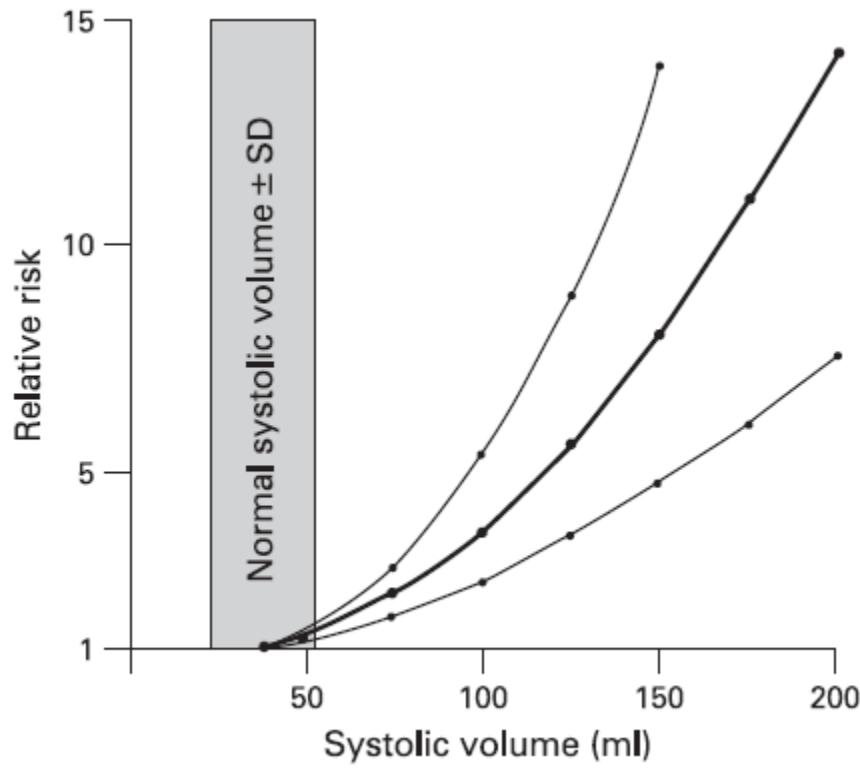
## Traditional parameters

- LV volumes,
- LV ejection fraction (LVEF),
- Wall motion score index (WMSI),
- mitral regurgitation,
- E/e' = ratio,
- Left atrial size,
- right ventricular function

## Novel parameters

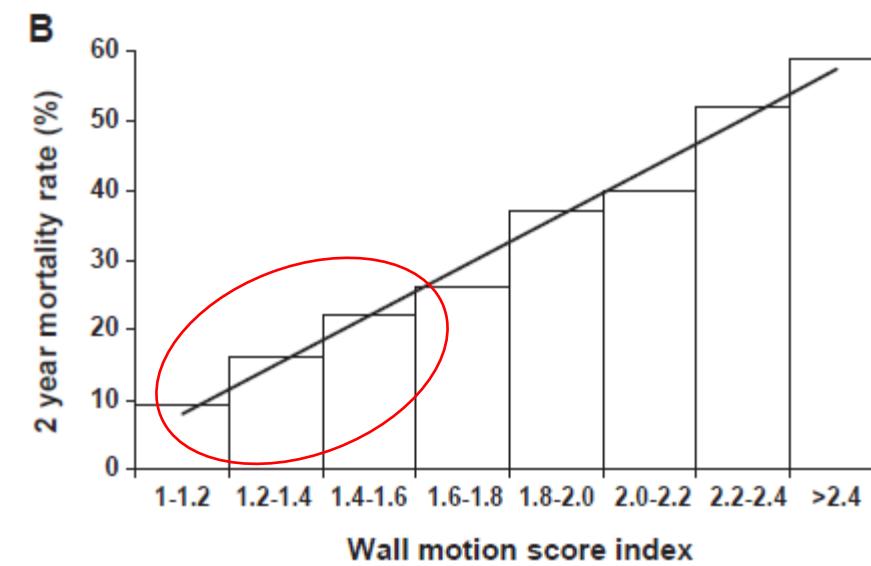
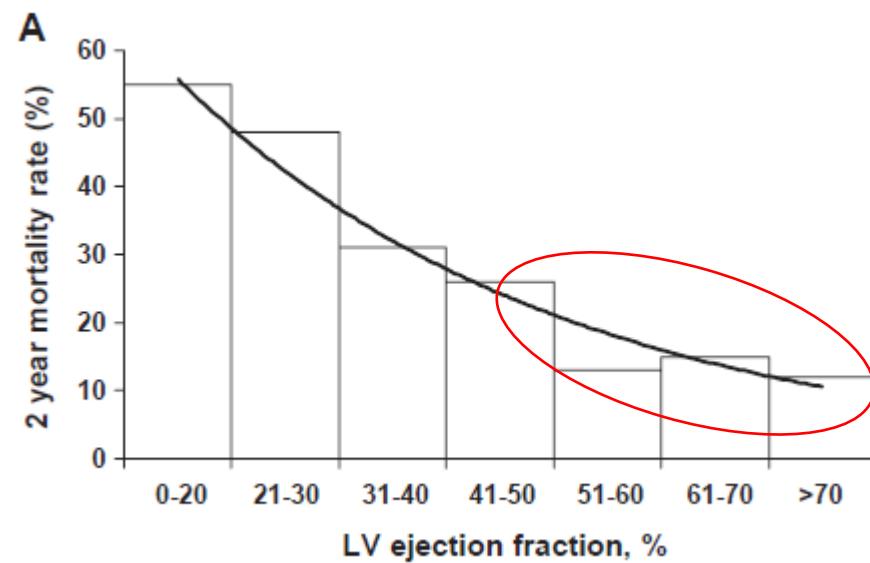
- 2D Strain (speckle tracking)
- LV dyssynchrony
- Intravenous contrast
- 3D echocardiography
- *Assessment of perfusion/viability*
- *Stress echocardiography*
- *Contractile reserve*
- *Coronary flow reserve*

# Left ventricular end-systolic volume as the major determinant of survival after recovery from myocardial infarction.



White HD et al. Circulation 1987;76:44–51

# Influence on mortality rate of LVEF and WMSI



Moller et al AHJ 2006

LVEF <40%

Strength: Large availability, Large evidence in AMI Guidelines  
Weakness: Geometric assumption, Poor reproducibility

Increased risk of short-  
and long-term mortality  
and SCD<sup>11-14</sup>

•Add to therapy inhibitors of RAAS (ACEI, ARB,MRA)<sup>3,4</sup>;  
•Reevaluate LVEF 40 days or more after AMI for ICD  
implantation<sup>4</sup>.

## LV Remodeling Post Anteroseptal MI

1 week



EDV 137ml ESV 80ml  
EF 41%

3 months



EDV 189ml ESV 146ml  
EF 23%

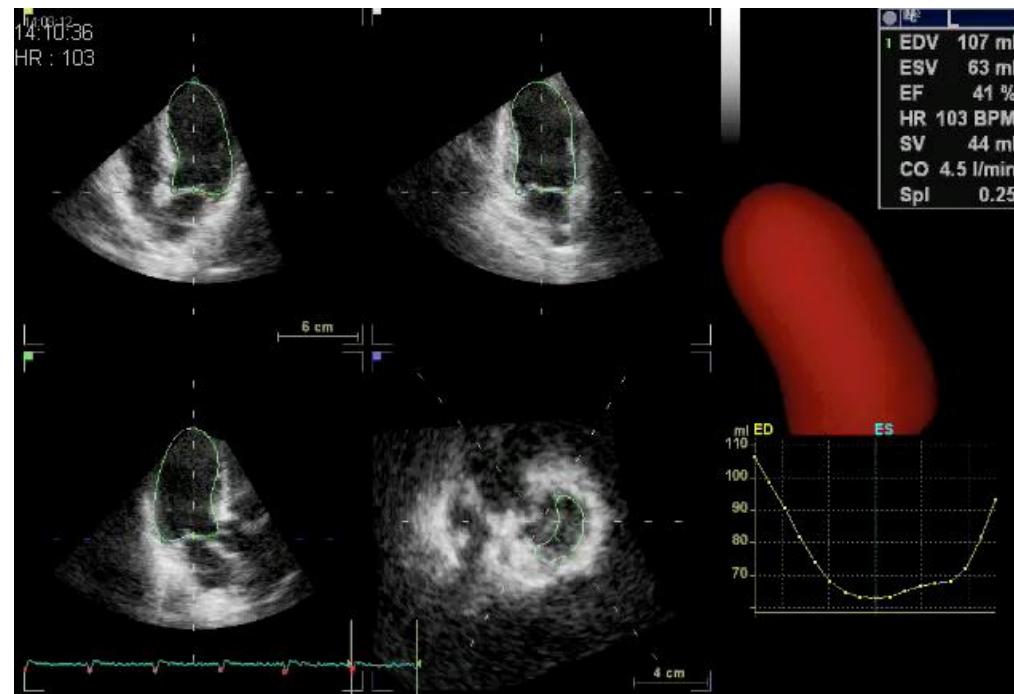
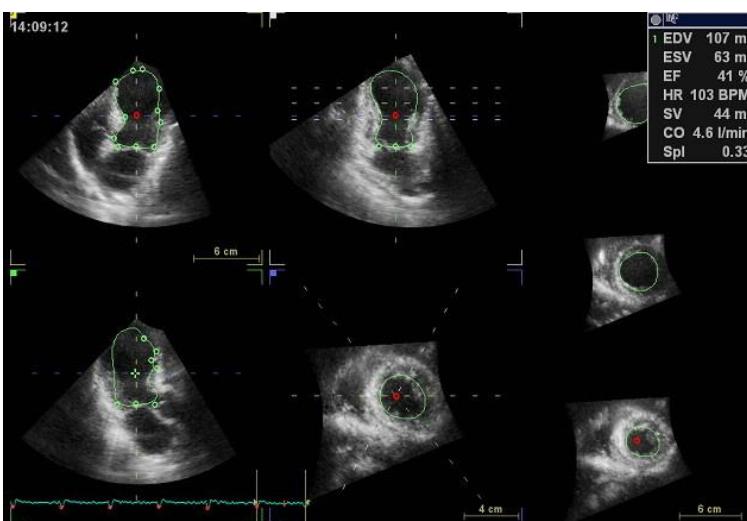
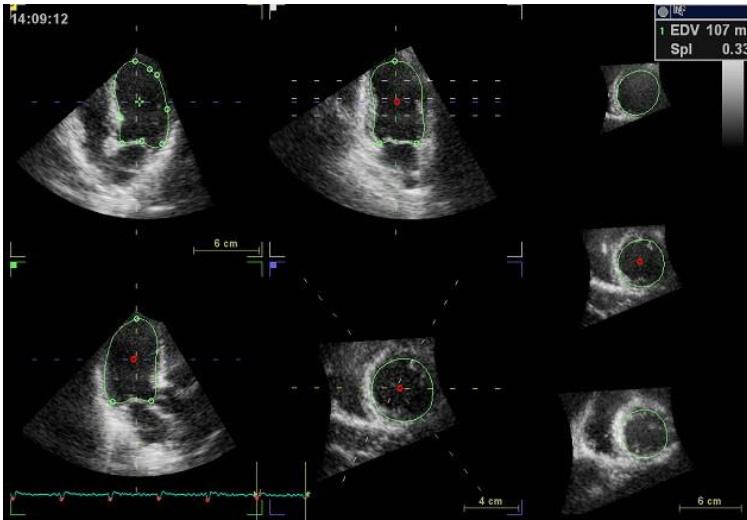
Apical 4 Chamber View  
End-diastole

### LVEF <40%

Strength: Large availability, Large evidence in AMI Guidelines  
Weakness: Geometric assumption, Poor reproducibility

Increased risk of short-  
and long-term mortality  
and SCD<sup>11-14</sup>

- Add to therapy inhibitors of RAAS (ACEI, ARB,MRA)<sup>3,4</sup>;
- Reevaluate LVEF 40 days or more after AMI for ICD implantation<sup>4</sup>.

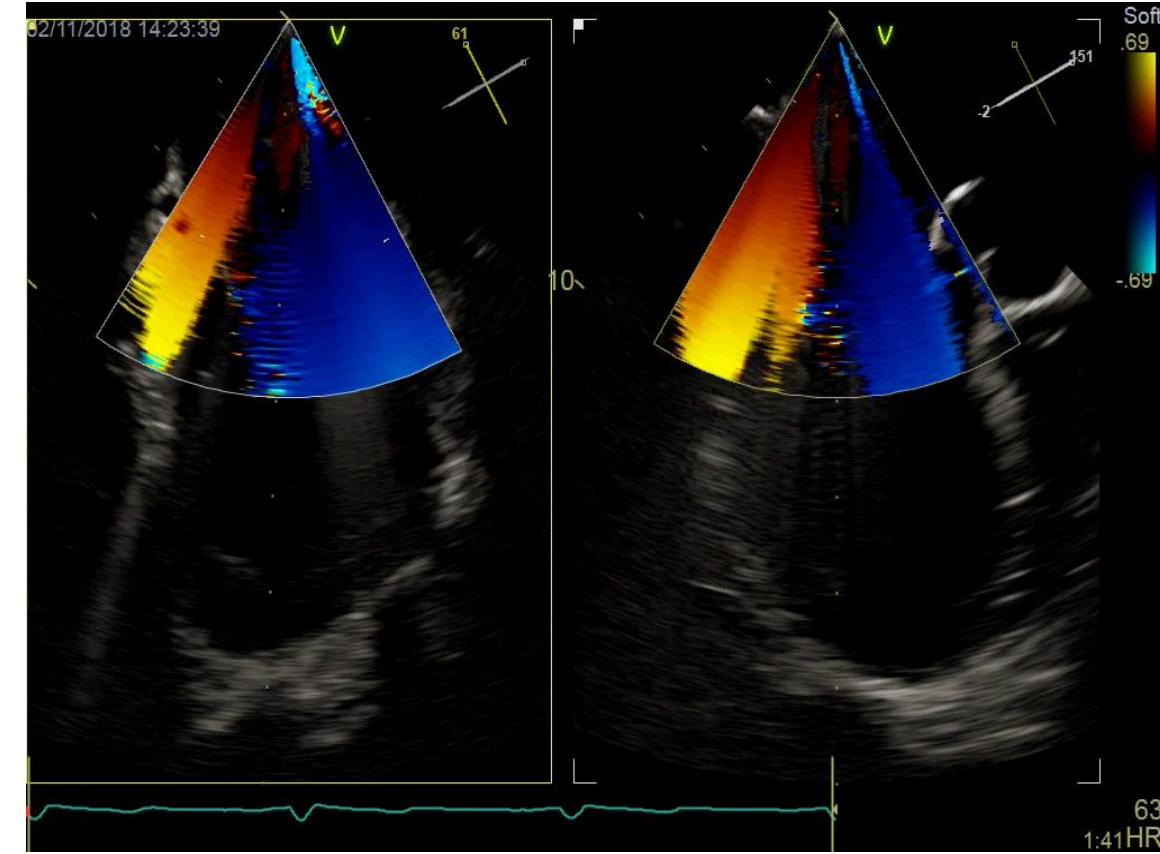
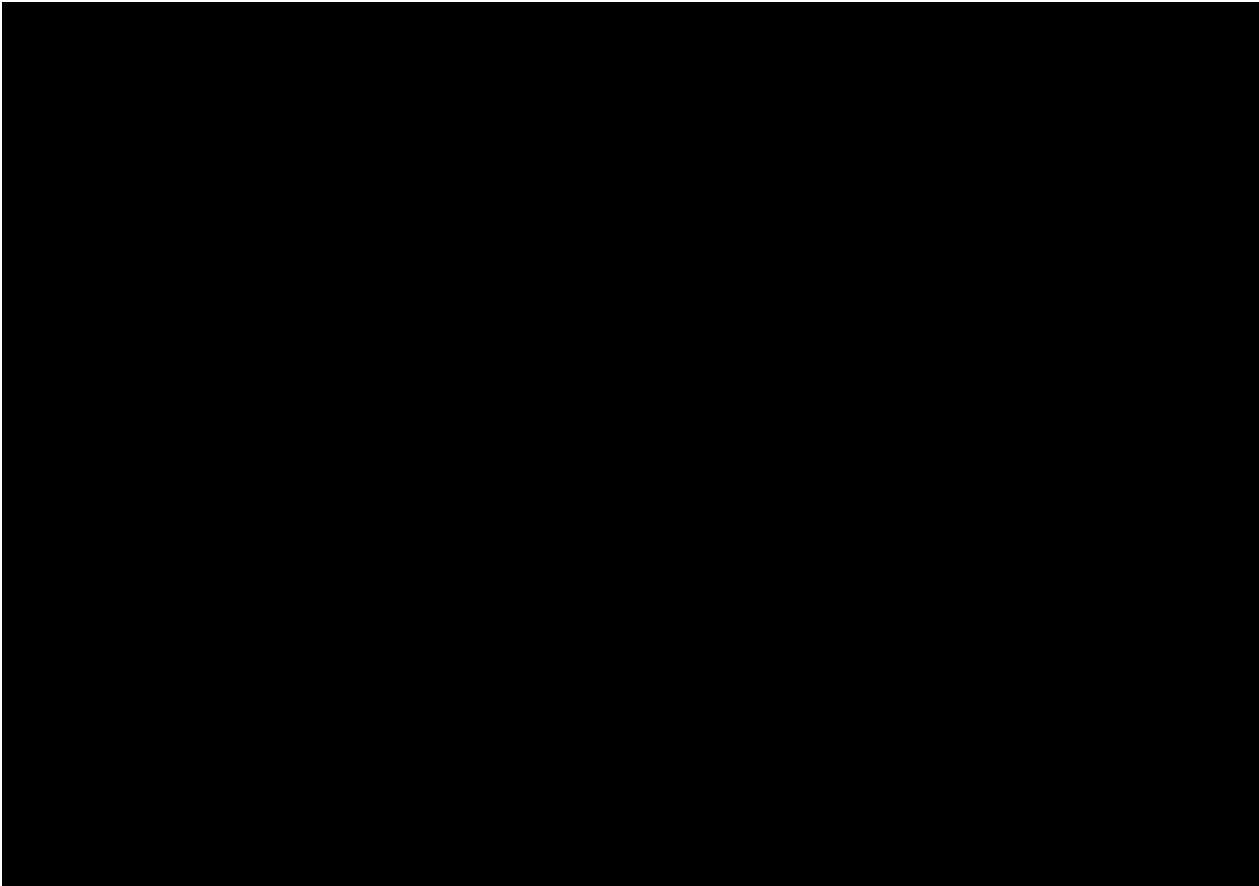


## Moderate or severe MR

Strength: Feasibility, Evidence in Guidelines on NSTEMI  
Weakness: Heterogeneity of grading (visual or quantitative)

## Increased risk of long-term mortality and HF<sup>27,28</sup>

- Increased attention to fluid overload and HF symptoms
- Consider more aggressive diuretic therapy;
- In case of new or worsening MR immediate invasive (within 2 h) strategy for NSTEMI<sup>3</sup>.

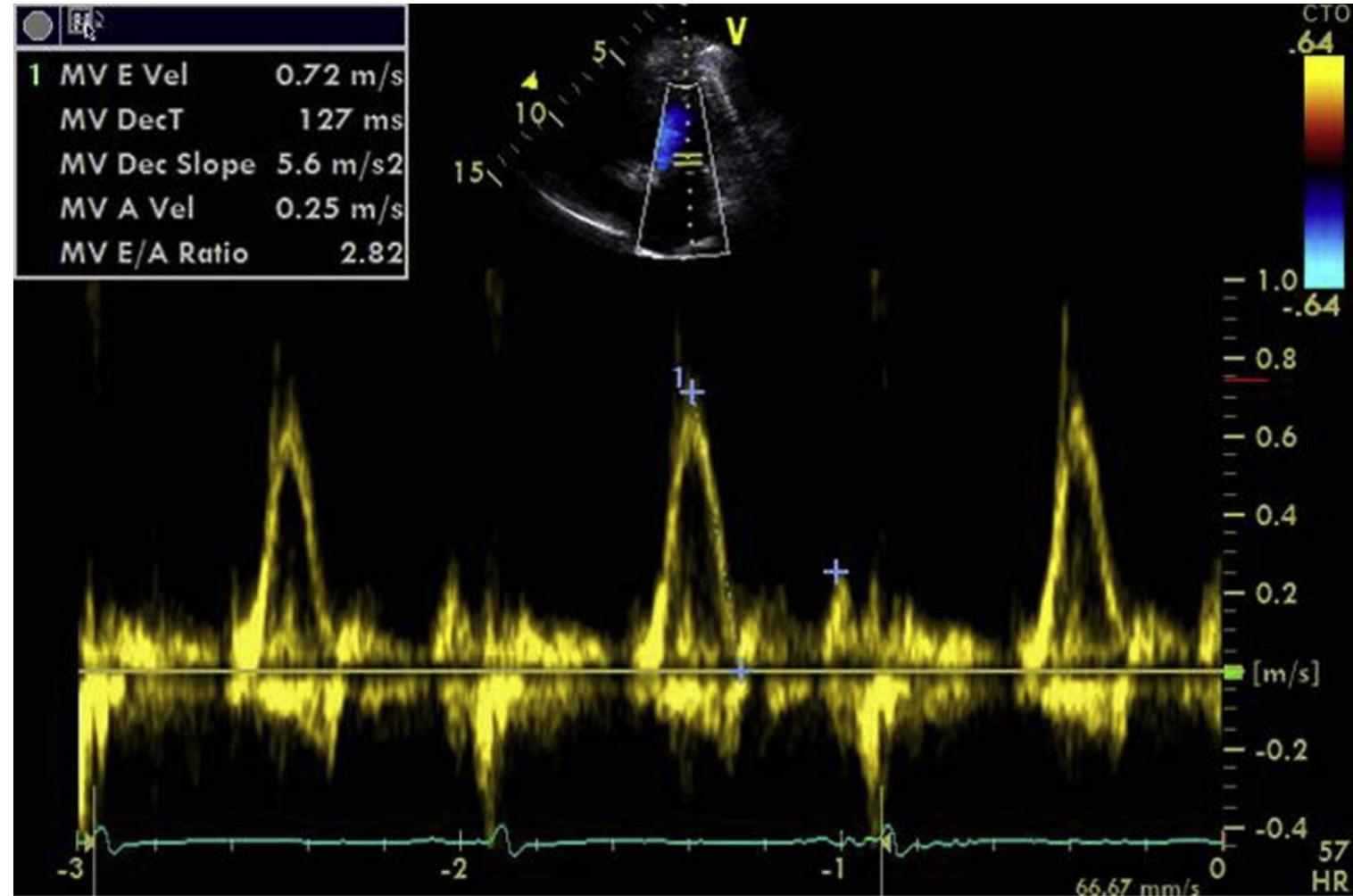


## RFP and DT < 130 msec

**Strength:** Feasibility, Acceptable reproducibility, Validation of LVFP with cath lab in pts with reduced LVEF  
**Weakness:** Angle dependency (Doppler), No relation with invasive LVFP in pts with normal LVEF, Age dependency

## Increased risk of long-term mortality and HF<sup>17</sup>

- Increased attention to fluid overload and HF symptoms;
- Consider more aggressive diuretic therapy.



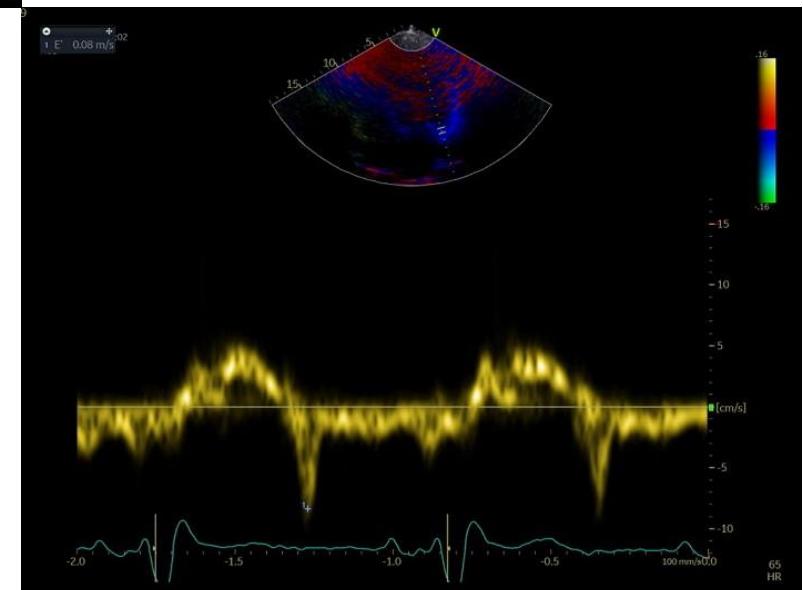
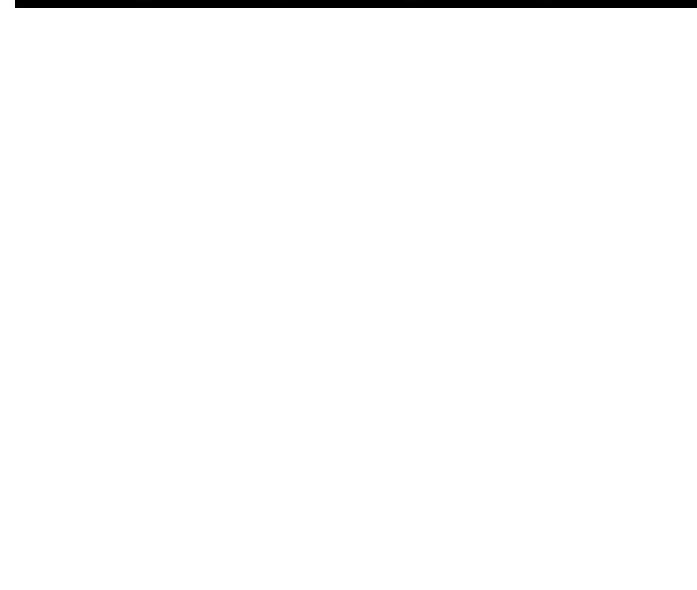
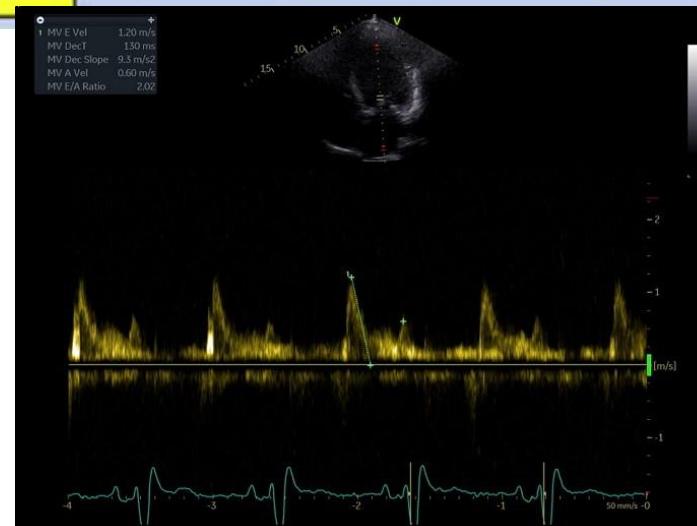
## E/e' ratio >15

Strength: Feasibility, Good reproducibility, Validation of LVFP with cath lab

Weakness: Angle dependency (Doppler), Age dependency

## Increased risk of long-term mortality<sup>32</sup>

- Increased attention to fluid overload and HF symptoms;
- Consider more aggressive diuretic therapy.

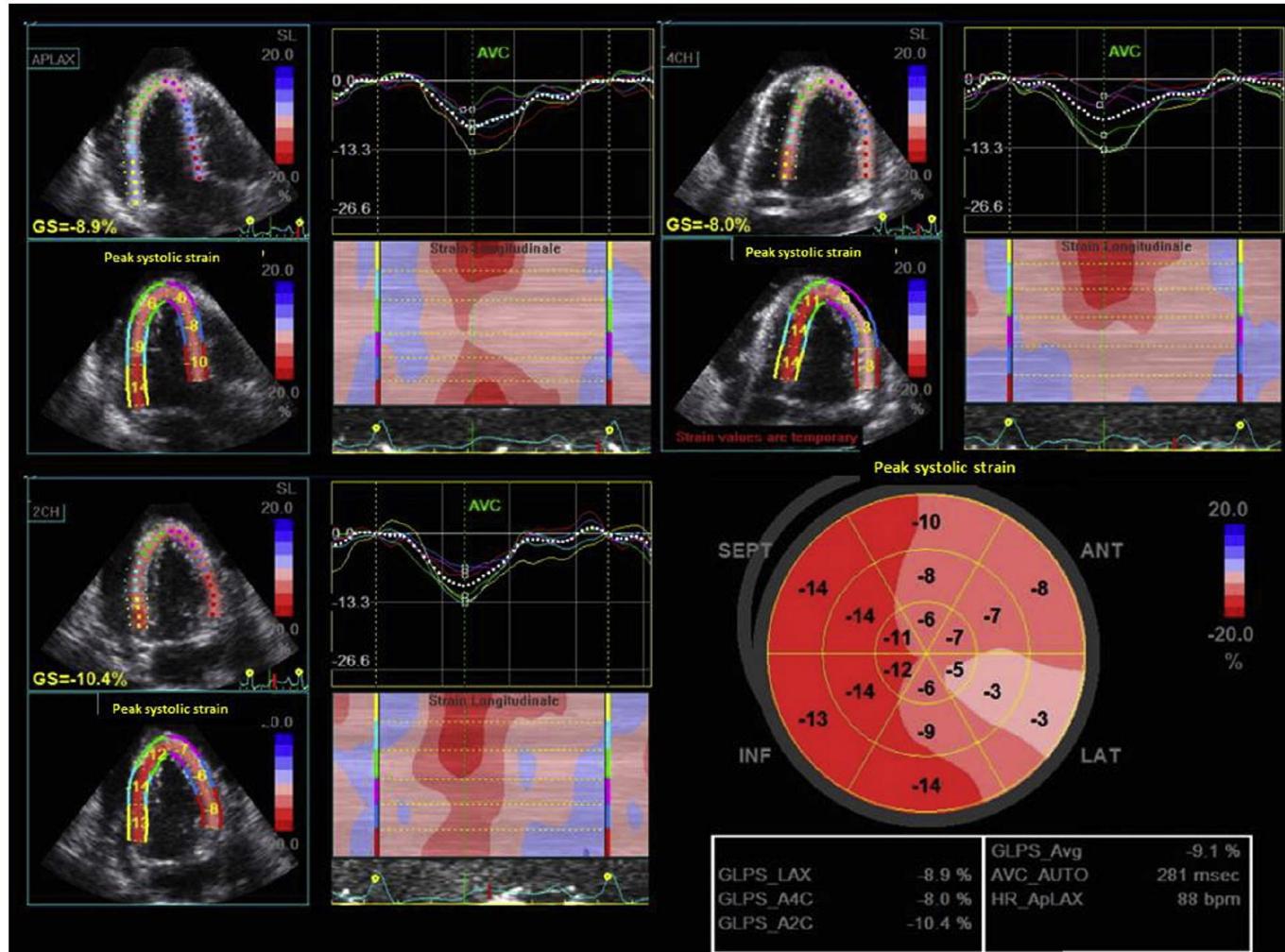


## GLS>-14%

**Strength:** Relatively operator independency, Feasibility, Good reproducibility  
**Weakness:** Vendor dependency, Limited availability

## Increased risk of long-term mortality and HF<sup>43</sup>

- Consider inhibitors of RAAS (ACEI, ARB) also if VEF>40%;
- Consider ECG monitoring until discharge and WCD after discharge till evaluation for ICD implantation;
- Increased attention to HF symptoms;
- Consider more aggressive in-hospital diuretic therapy

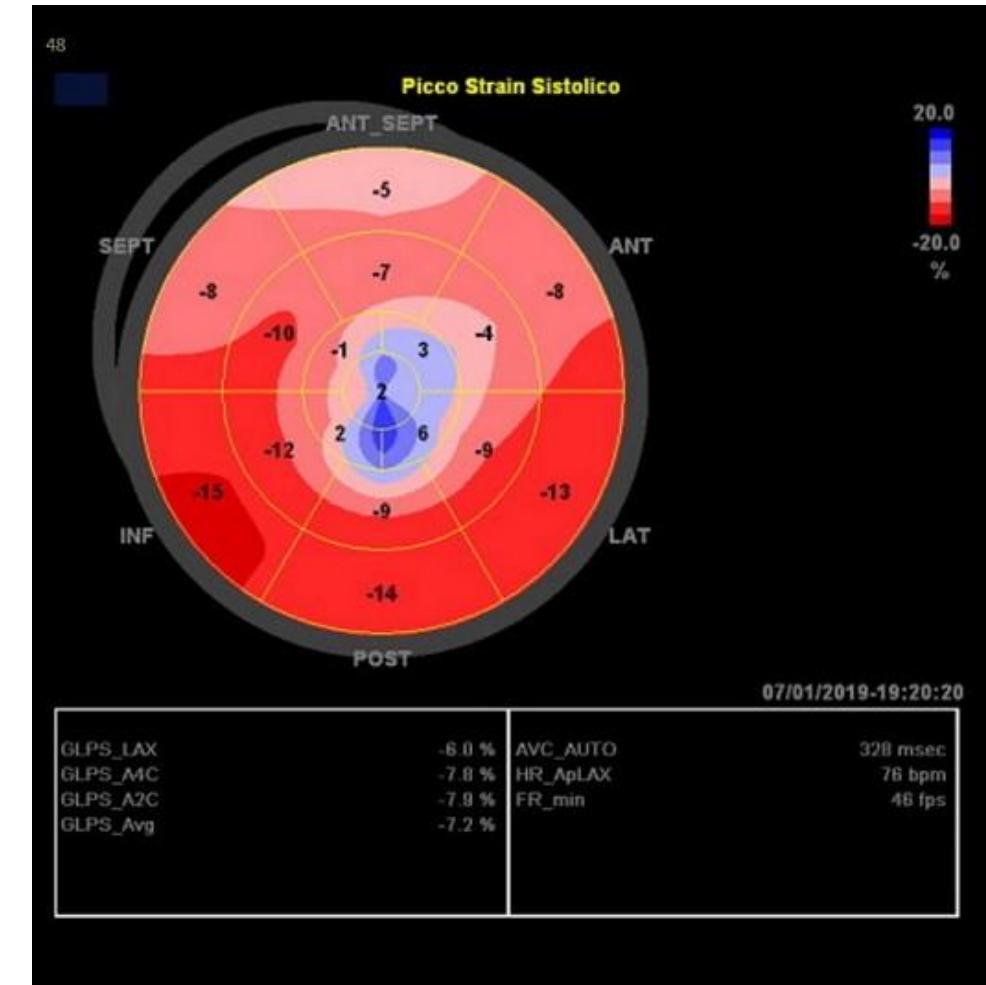
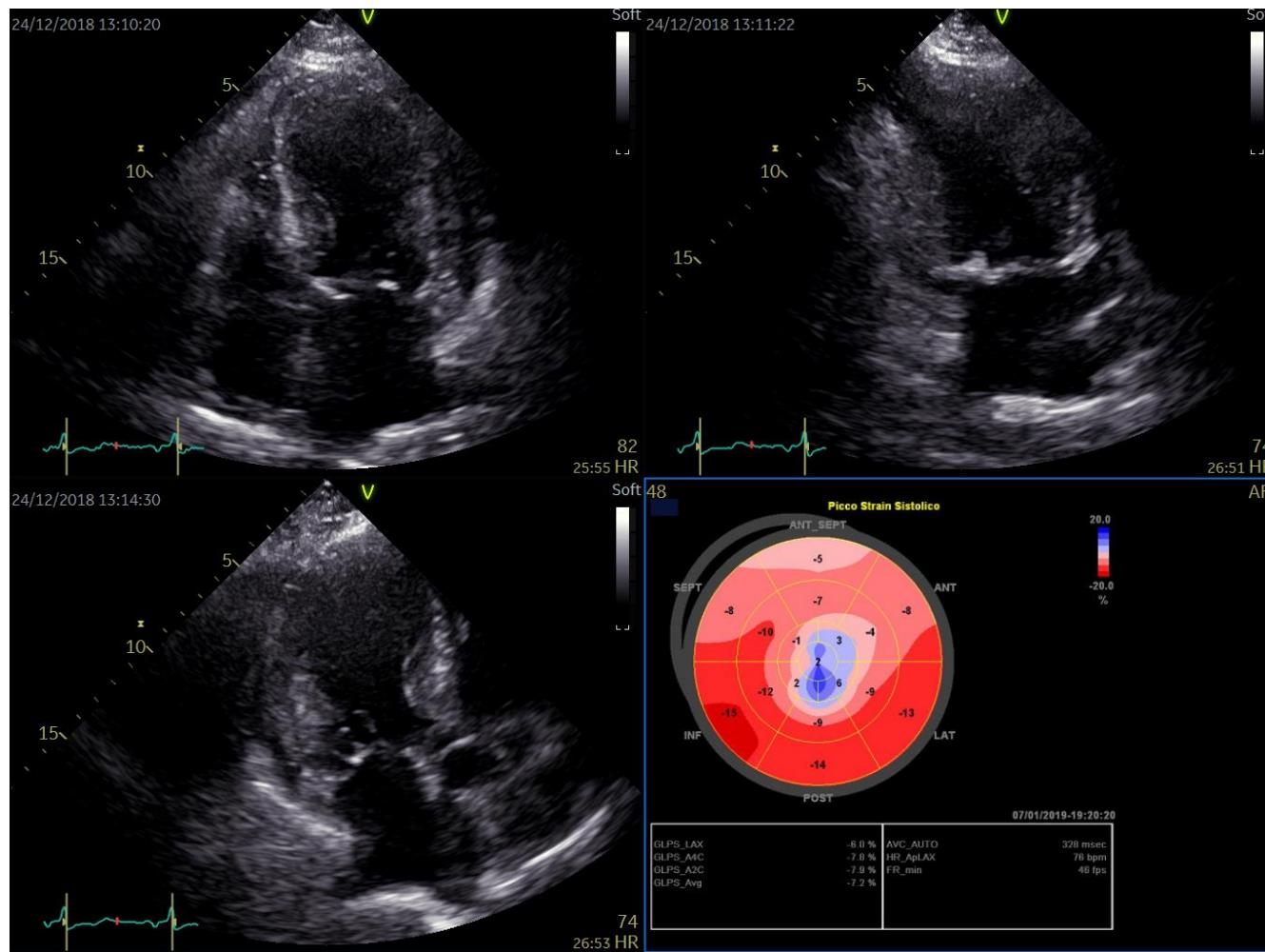


**GLS>-14%**

**Strength:** Relatively operator independency, Feasibility, Good reproducibility  
**Weakness:** Vendor dependency, Limited availability

**Increased risk of long-term mortality and HF<sup>43</sup>**

- Consider inhibitors of RAAS (ACEI, ARB) also if VEF>40%;
- Consider ECG monitoring until discharge and WCD after discharge till evaluation for ICD implantation;
- Increased attention to HF symptoms;
- Consider more aggressive in-hospital diuretic therapy



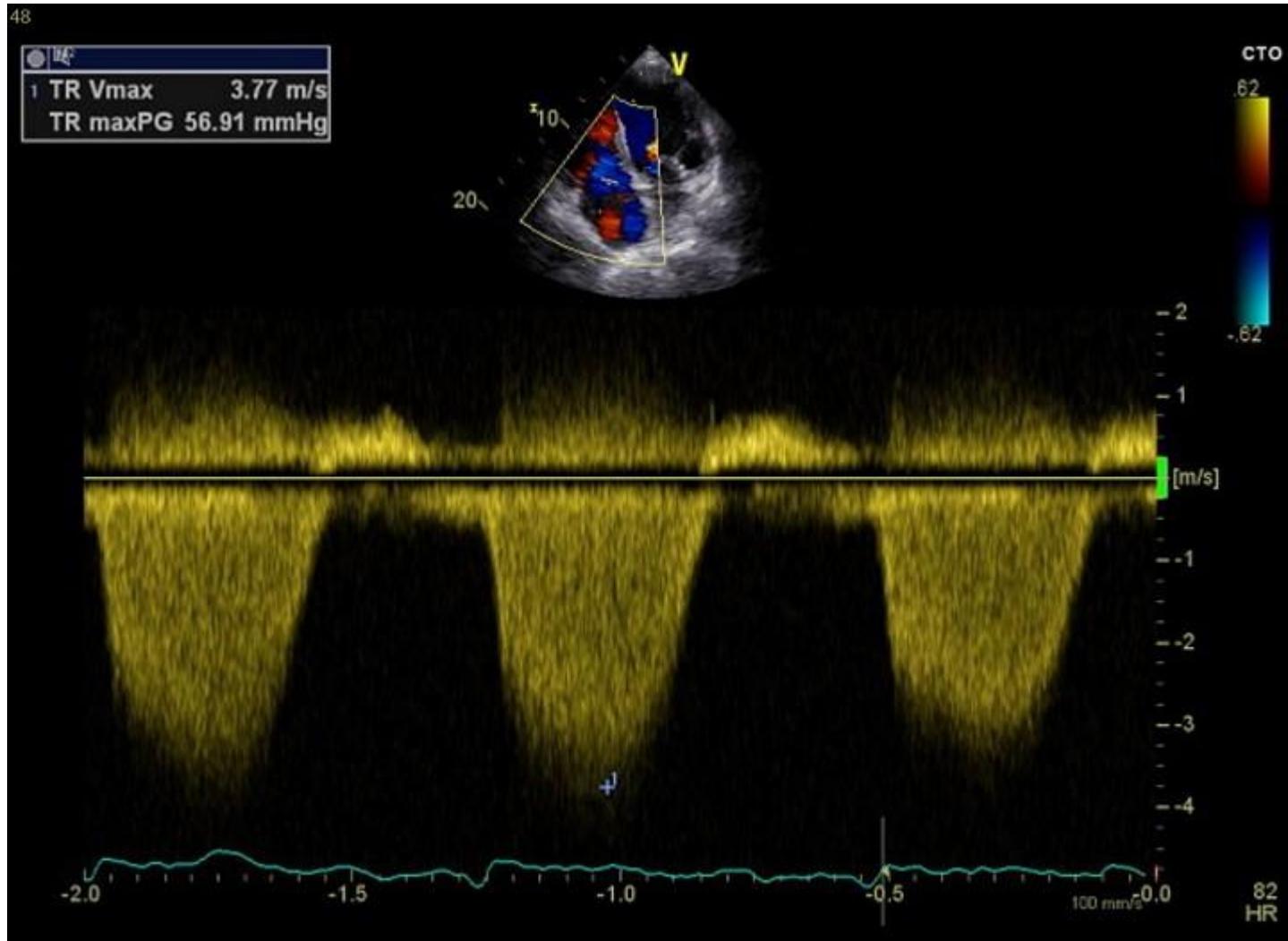
## PASP >35 mmHg

Strength: Validation with cath lab

Weakness: Angle dependency (Doppler), Poor reproducibility

## Increased risk of long-term mortality and HF<sup>31</sup>

- Increased attention to fluid overload and HF symptoms;
- Consider more aggressive diuretic therapy.

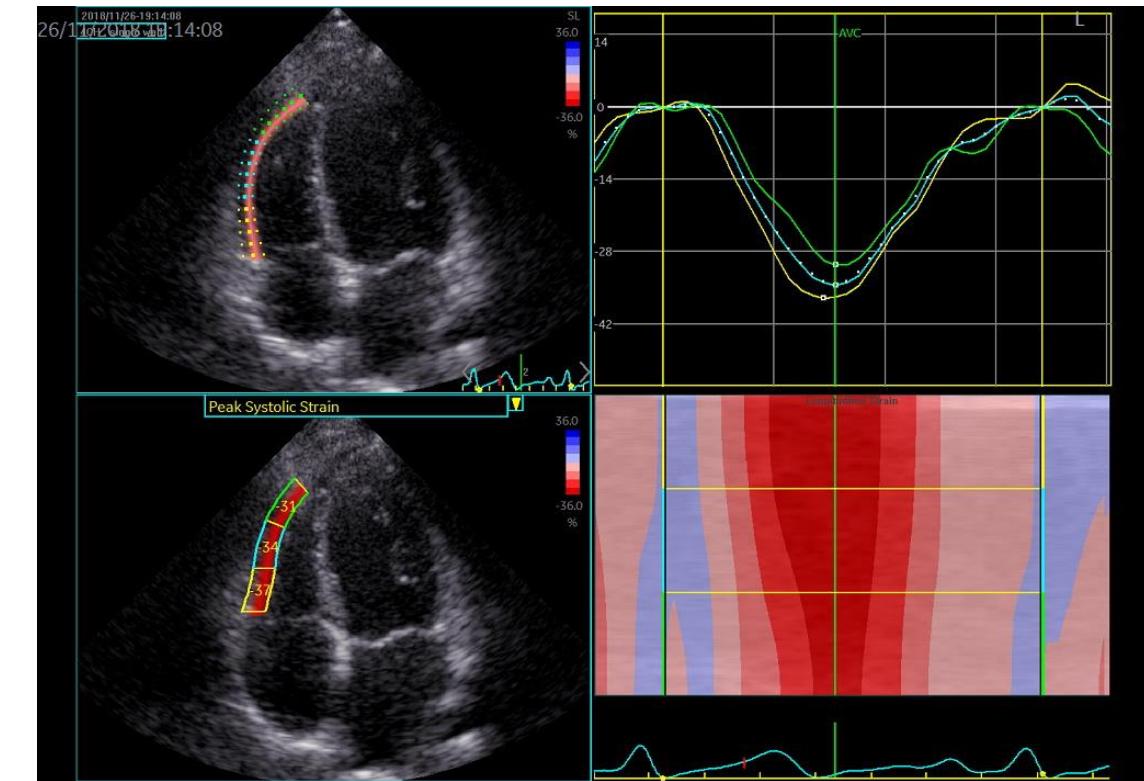
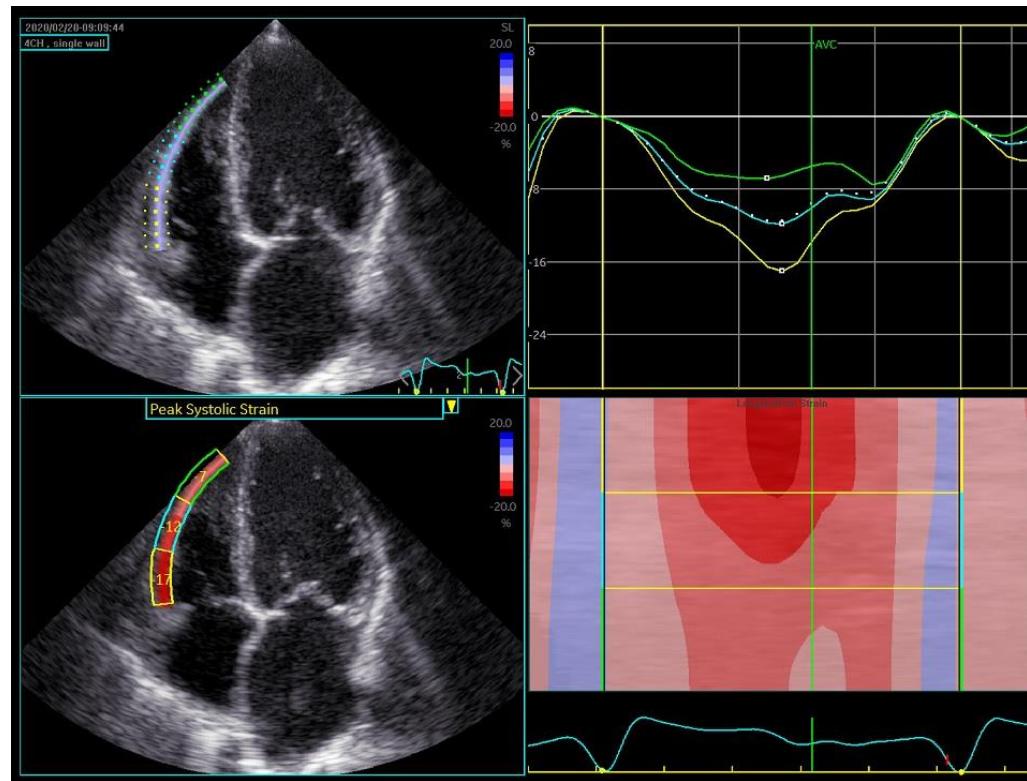


## RV LS $\geq$ 22%

Strength: Relatively operator independency, Good reproducibility  
Weakness: Vendor dependency, Limited availability

## Increased risk of long-term mortality and HF<sup>17</sup>

- Increased attention to fluid overload and HF symptoms;
- Consider more aggressive diuretic therapy.



# ECOCARDIOGRAFIA: FE

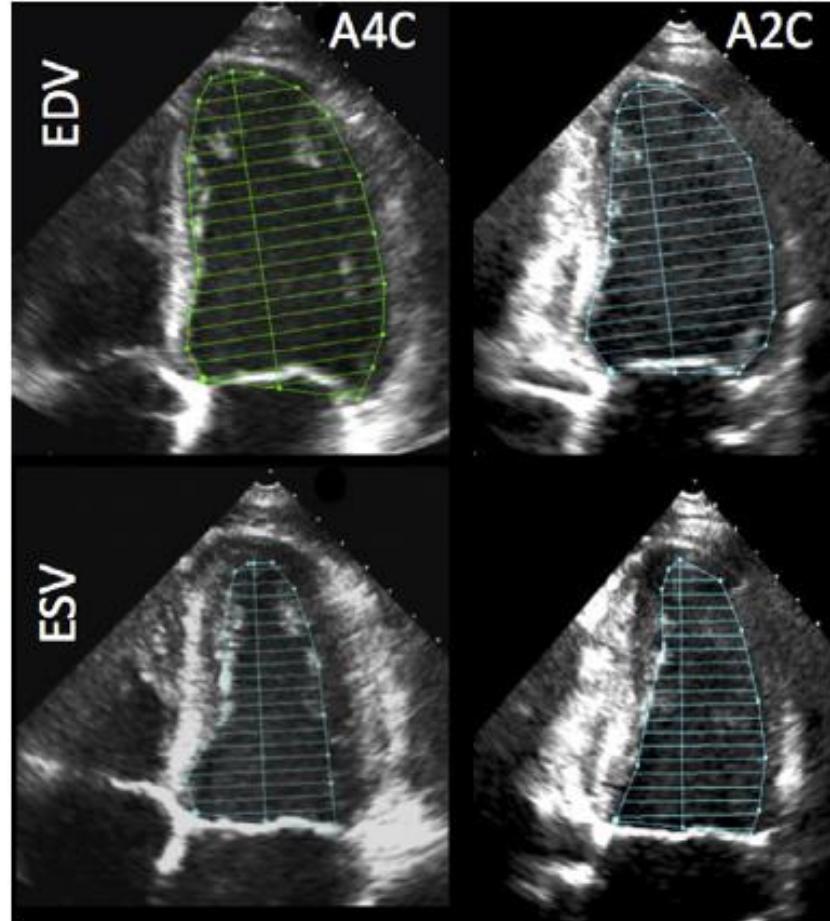


## LIMITI della FEVS

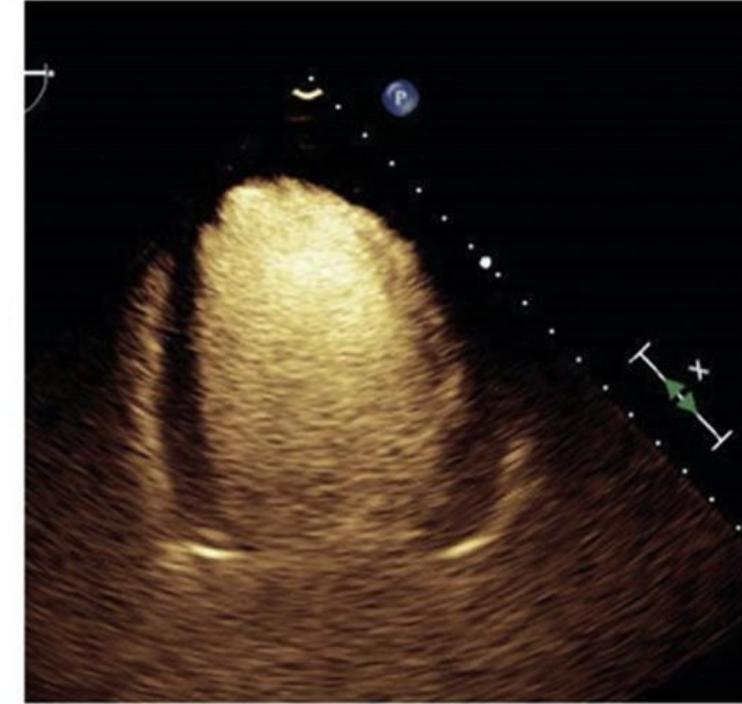
- Variabilità inter/intra-osservatore nella stima della cinetica segmentaria;
- Scarsa affidabilità in pazienti con ipertrofia ventricolare sinistra e ridotti volumi;
- Riduzione *solo* in fasi avanzate della malattia;
- Scarso potere predittivo verso gli eventi aritmici.

# *Systolic dysfunction assessment*

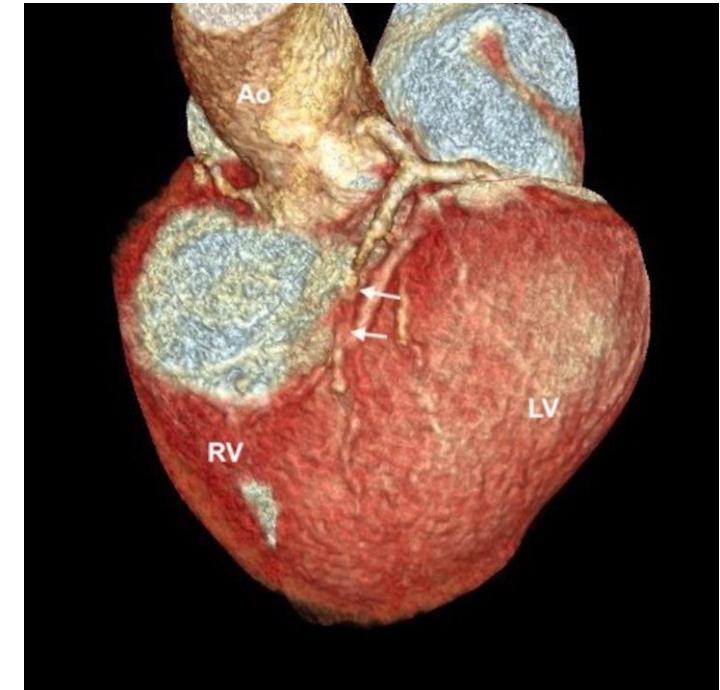
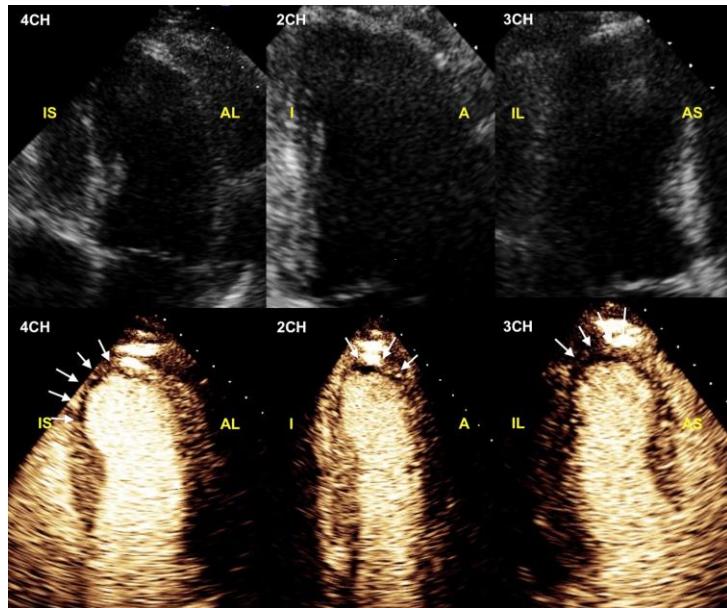
Two-dimensional LV ejection fraction



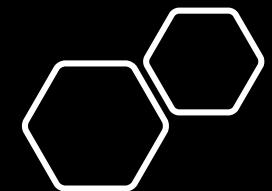
Biplane disk summation

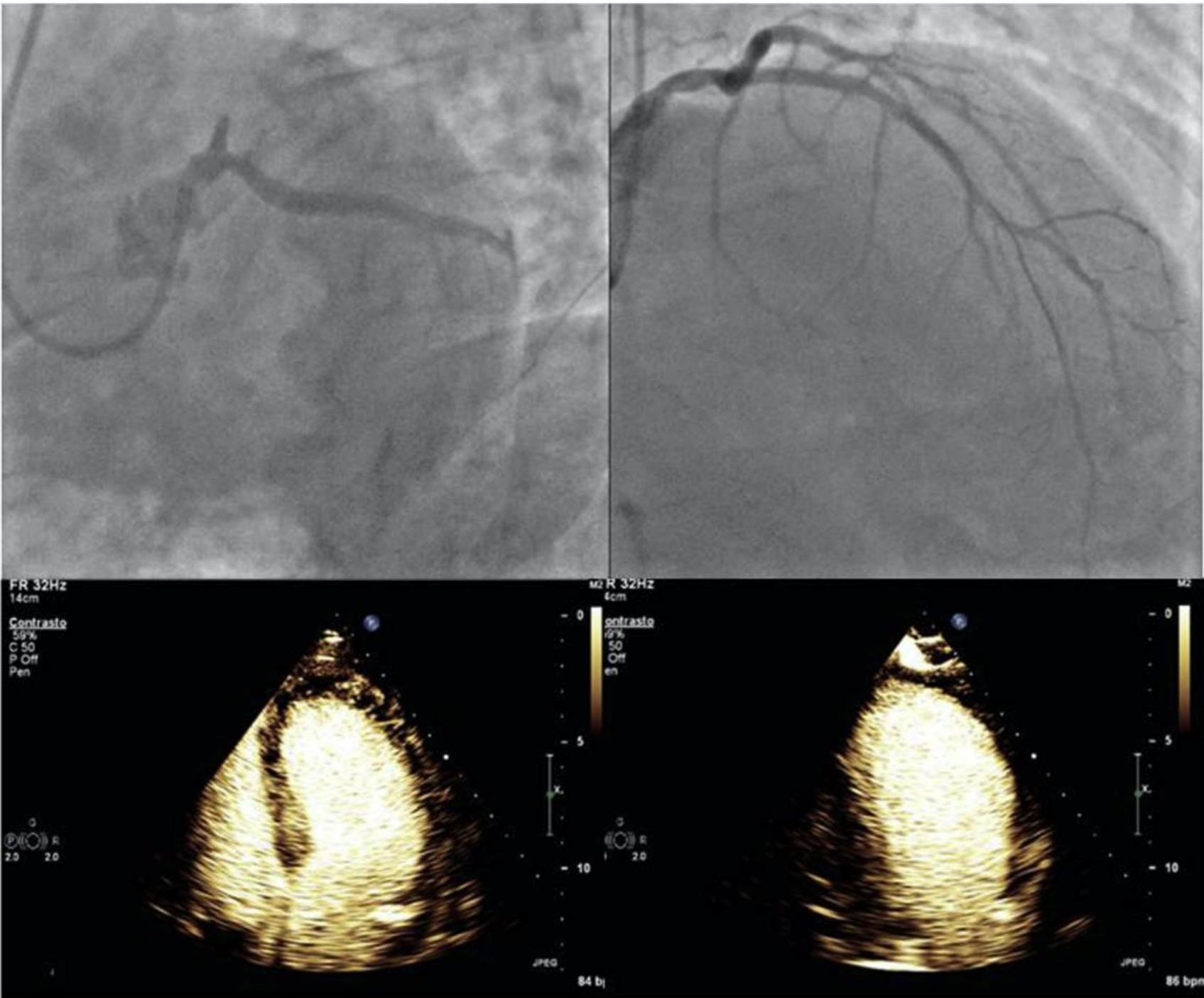


Enhanced biplane planimetry



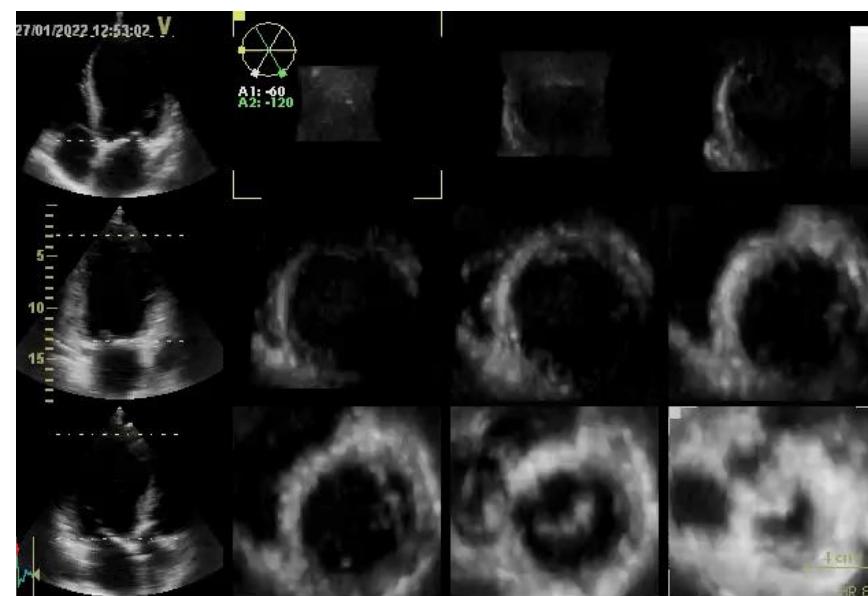
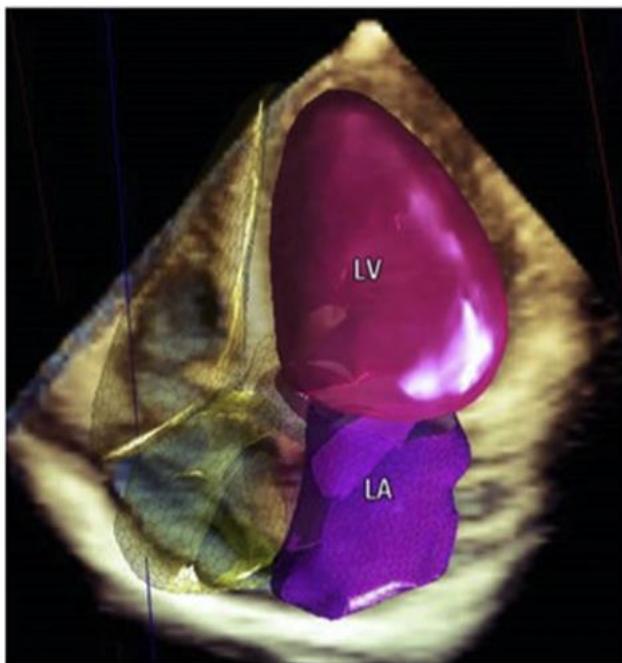
Rest contrast Echocardiography in  
patients with chest pain



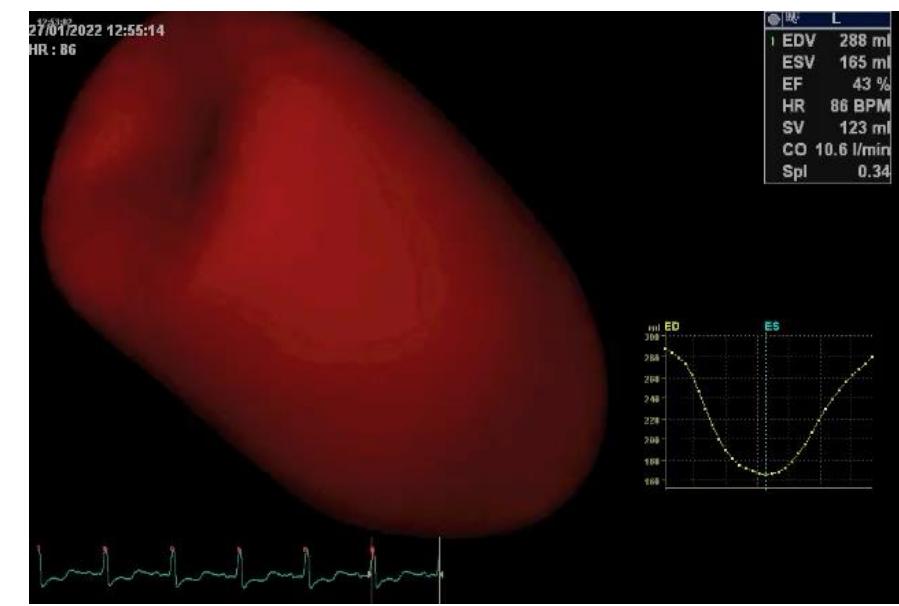


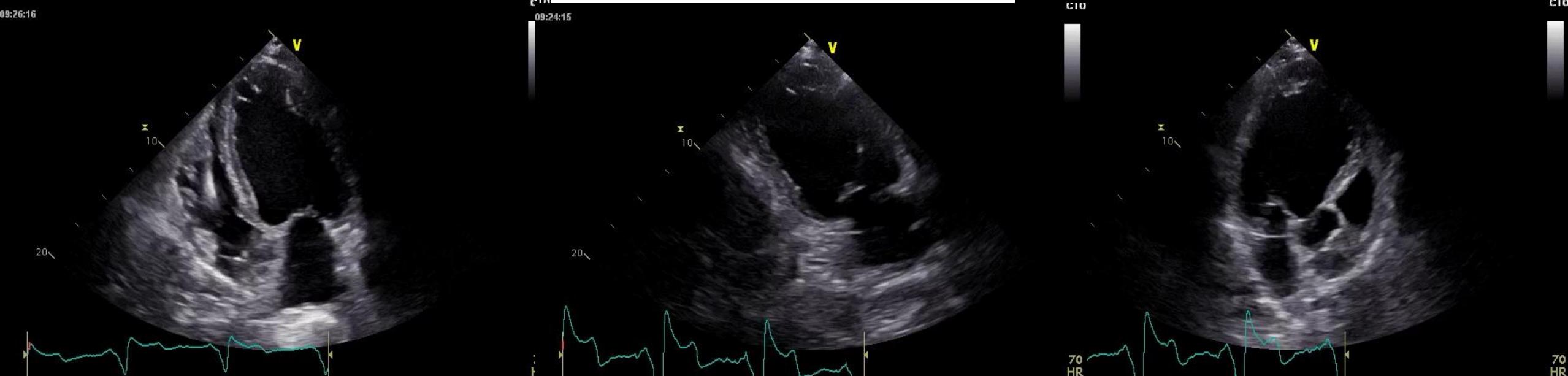
# *Systolic dysfunction assessment*

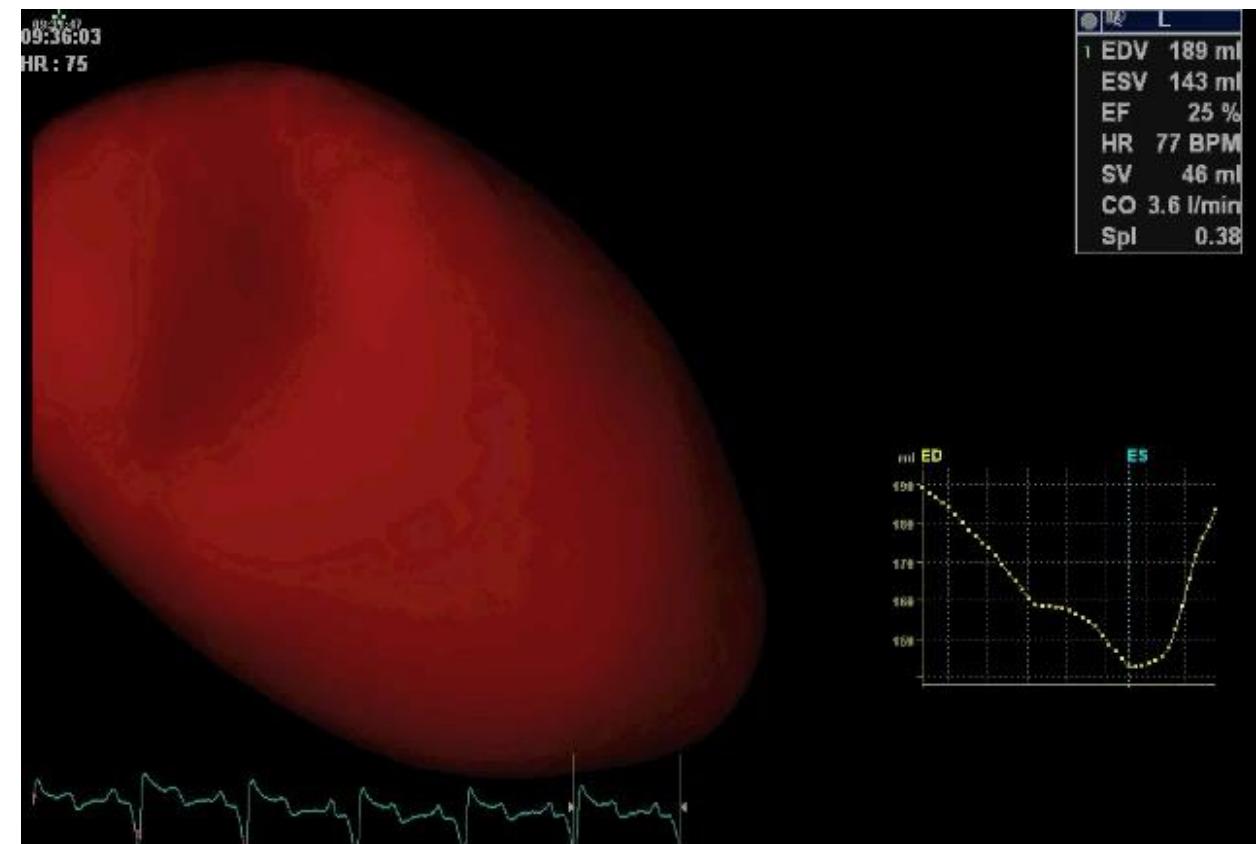
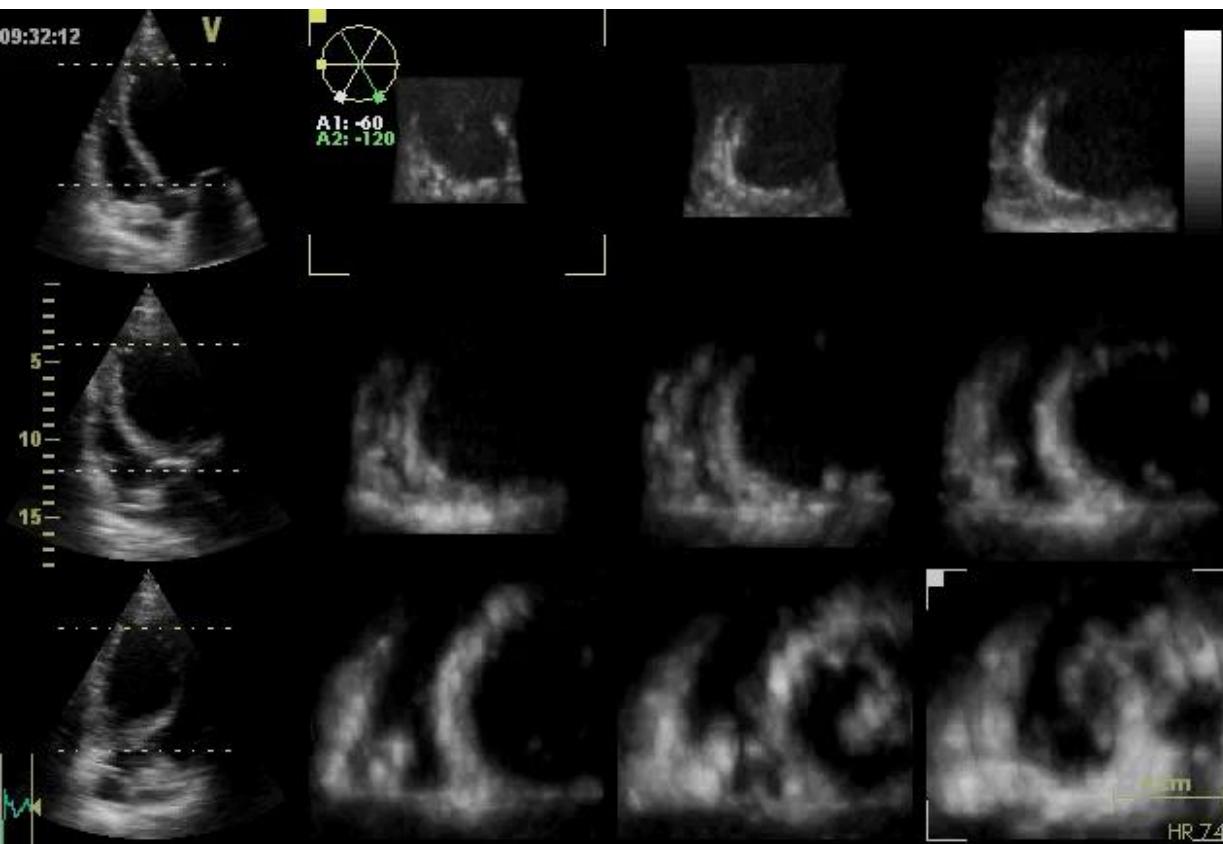
Three-dimensional LV ejection fraction



**LV full volume**

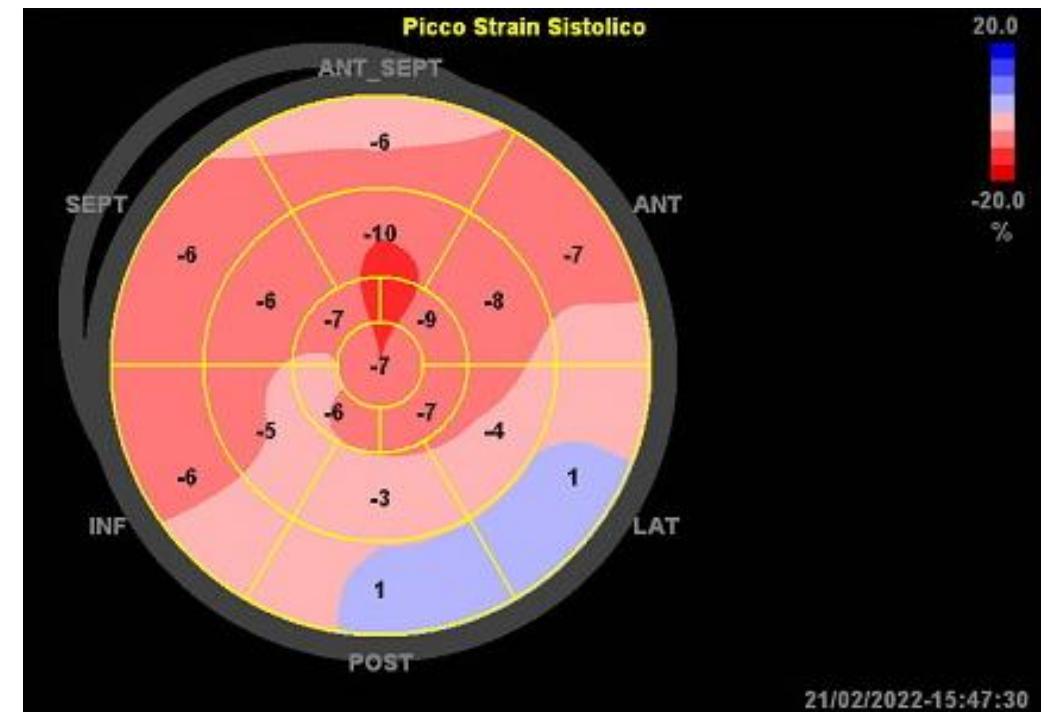
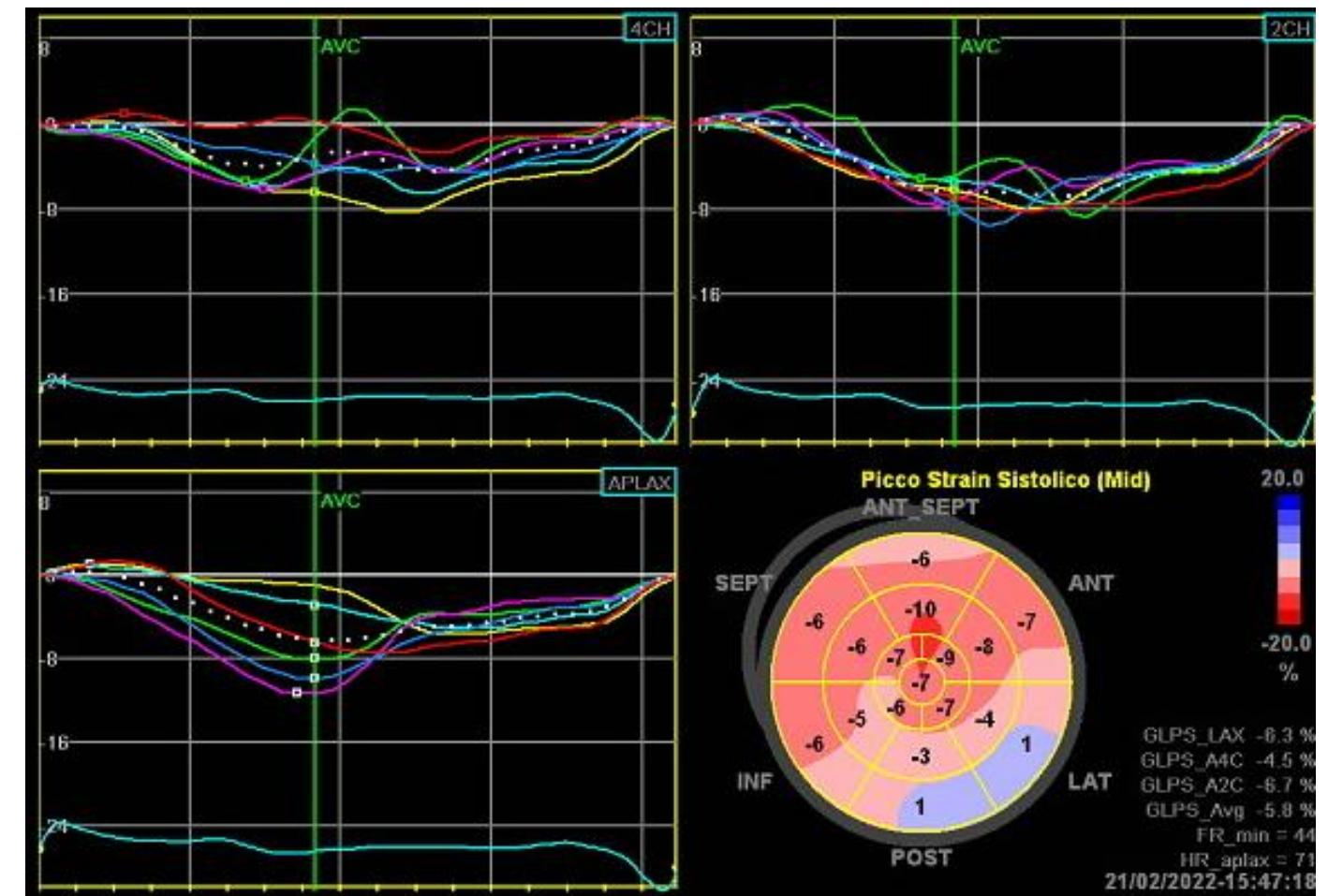


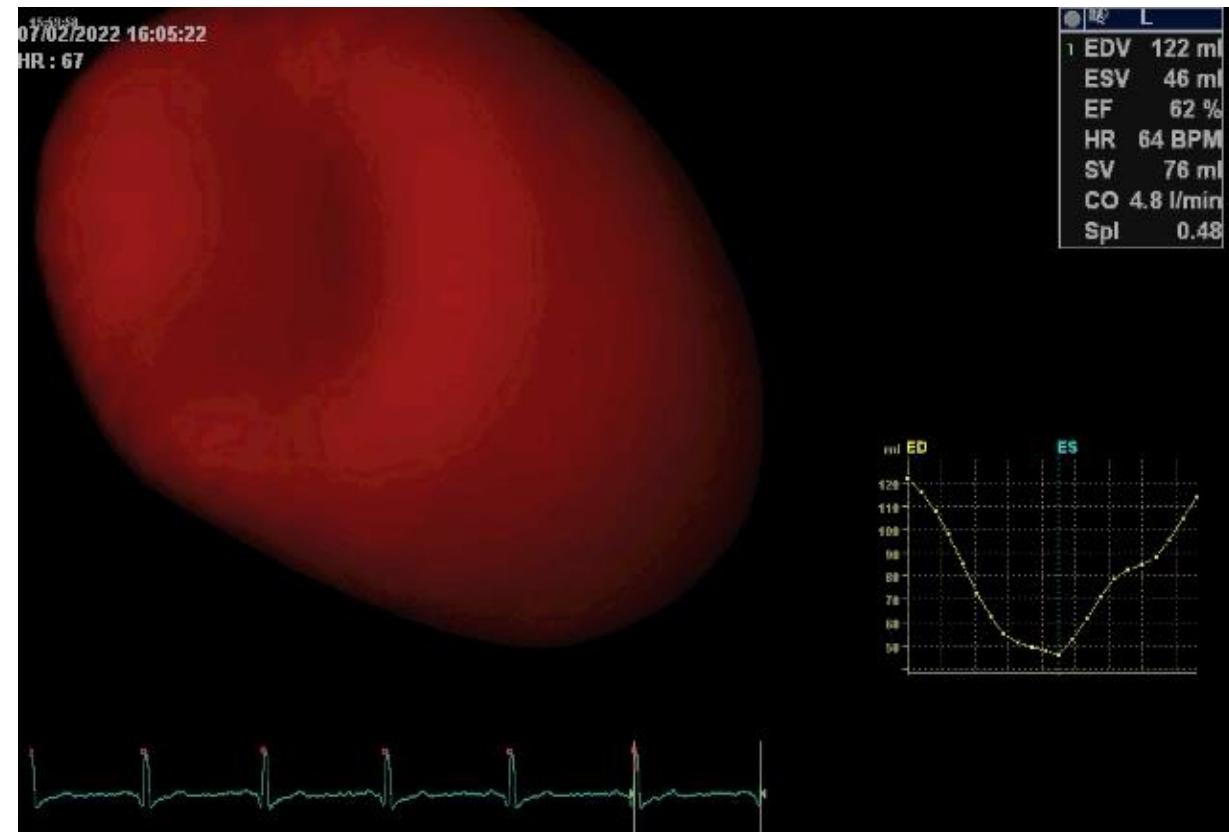
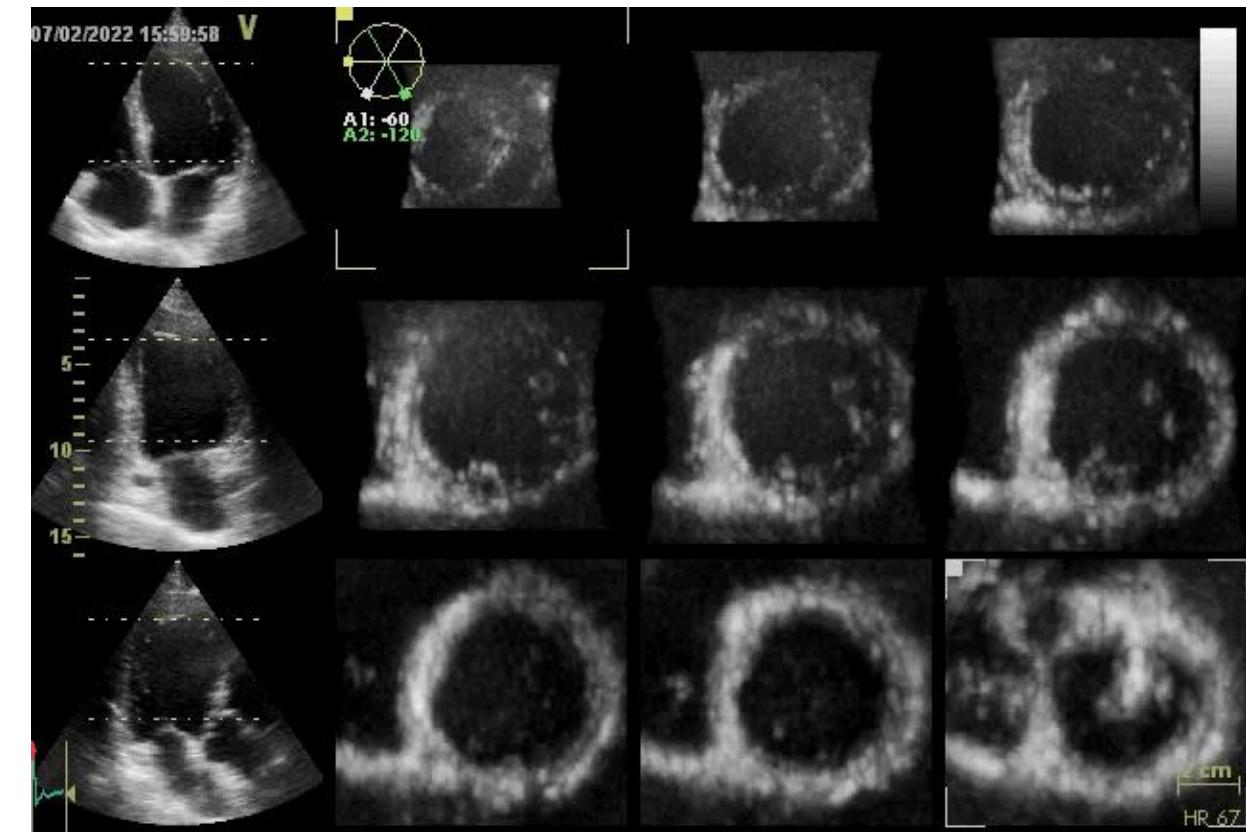




EF RT 3D 25%

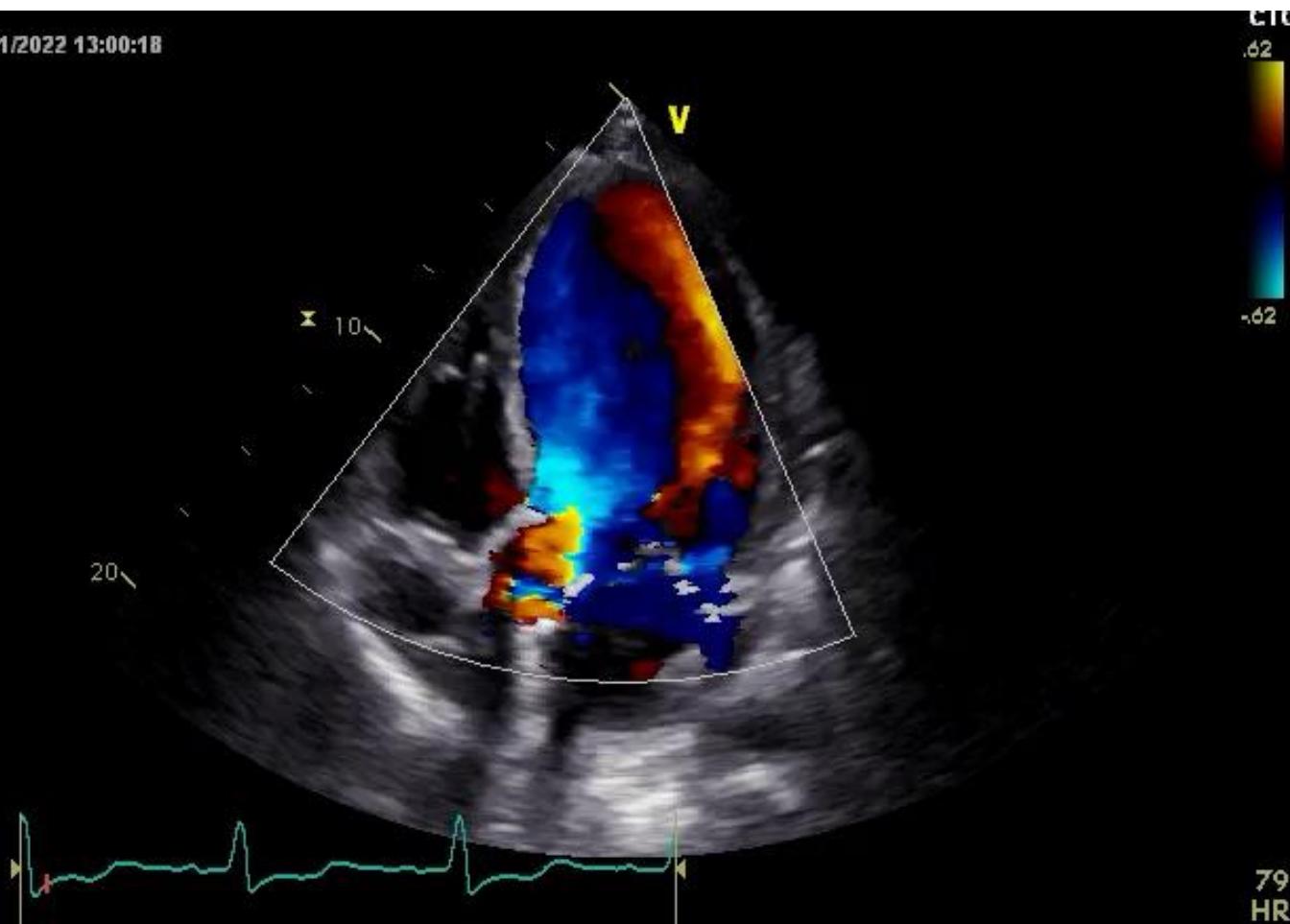
GLS Avg -5.8%



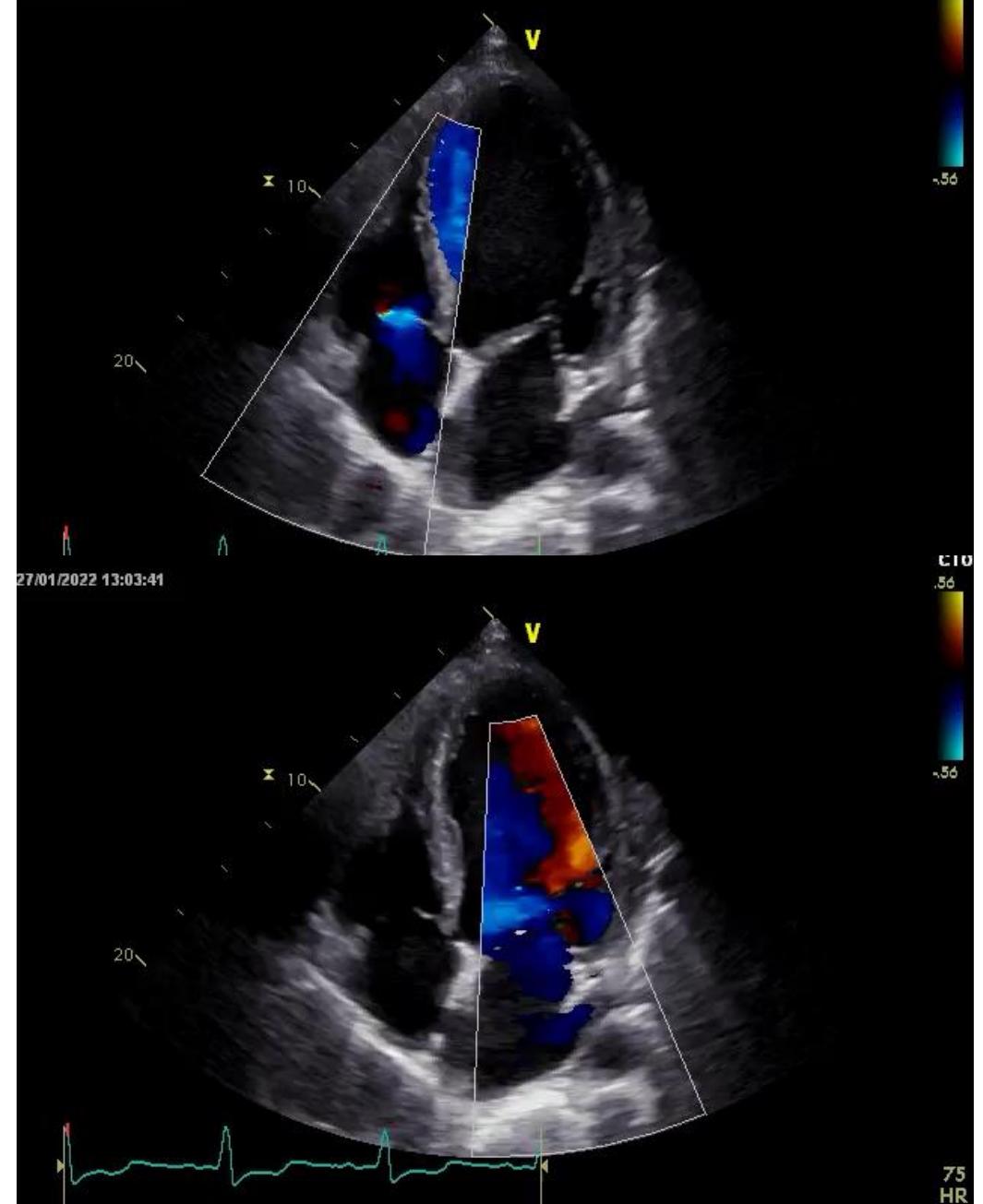


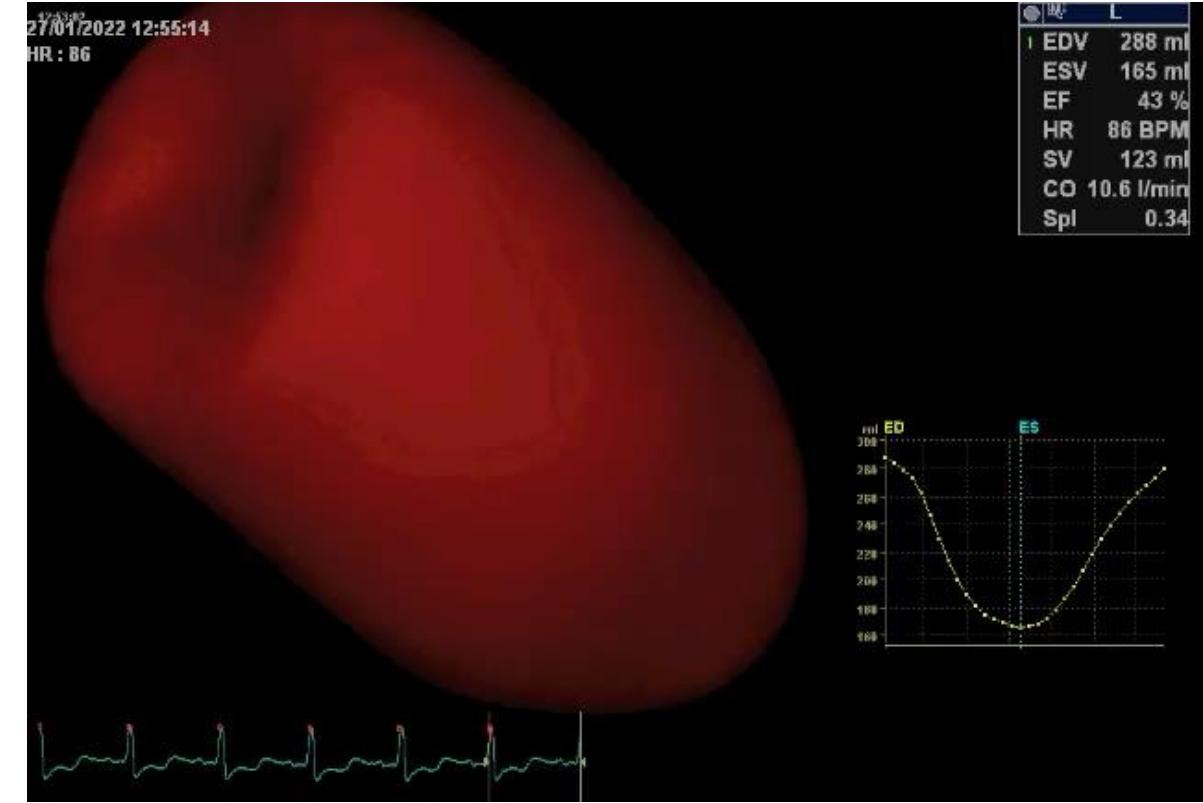
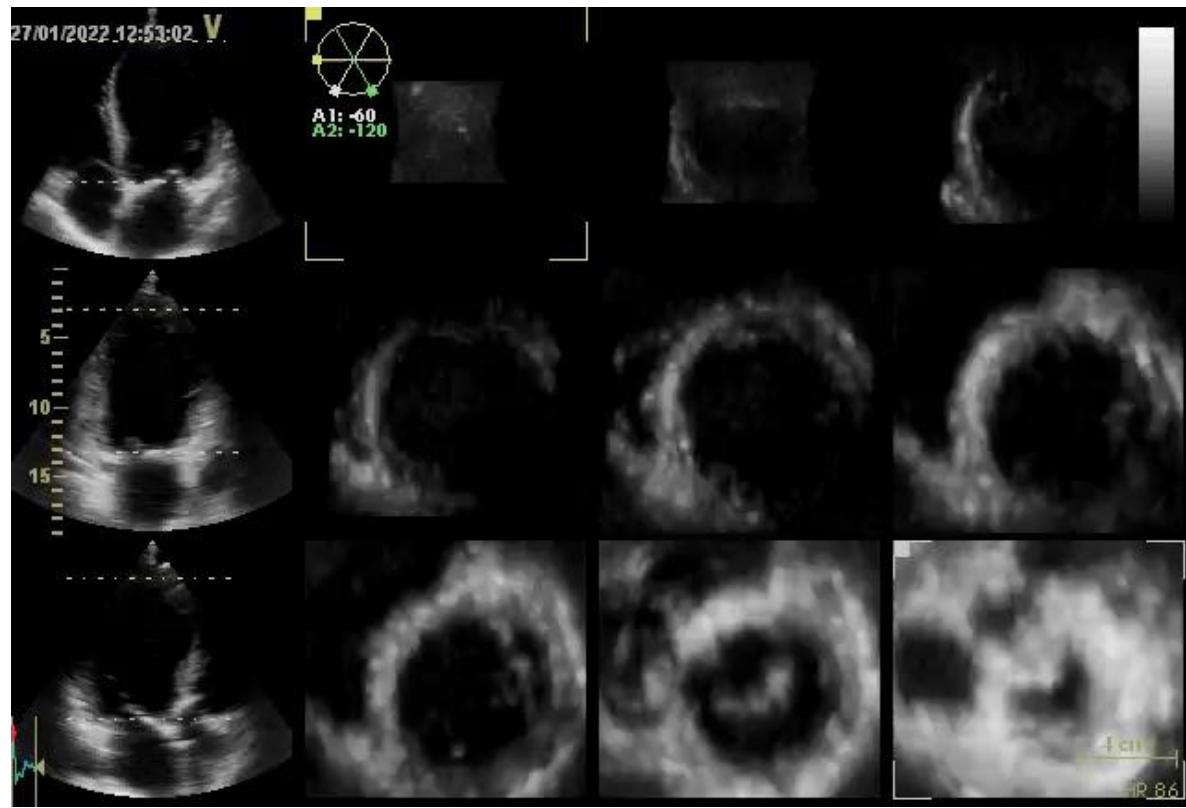
EF RT 3D 62 %

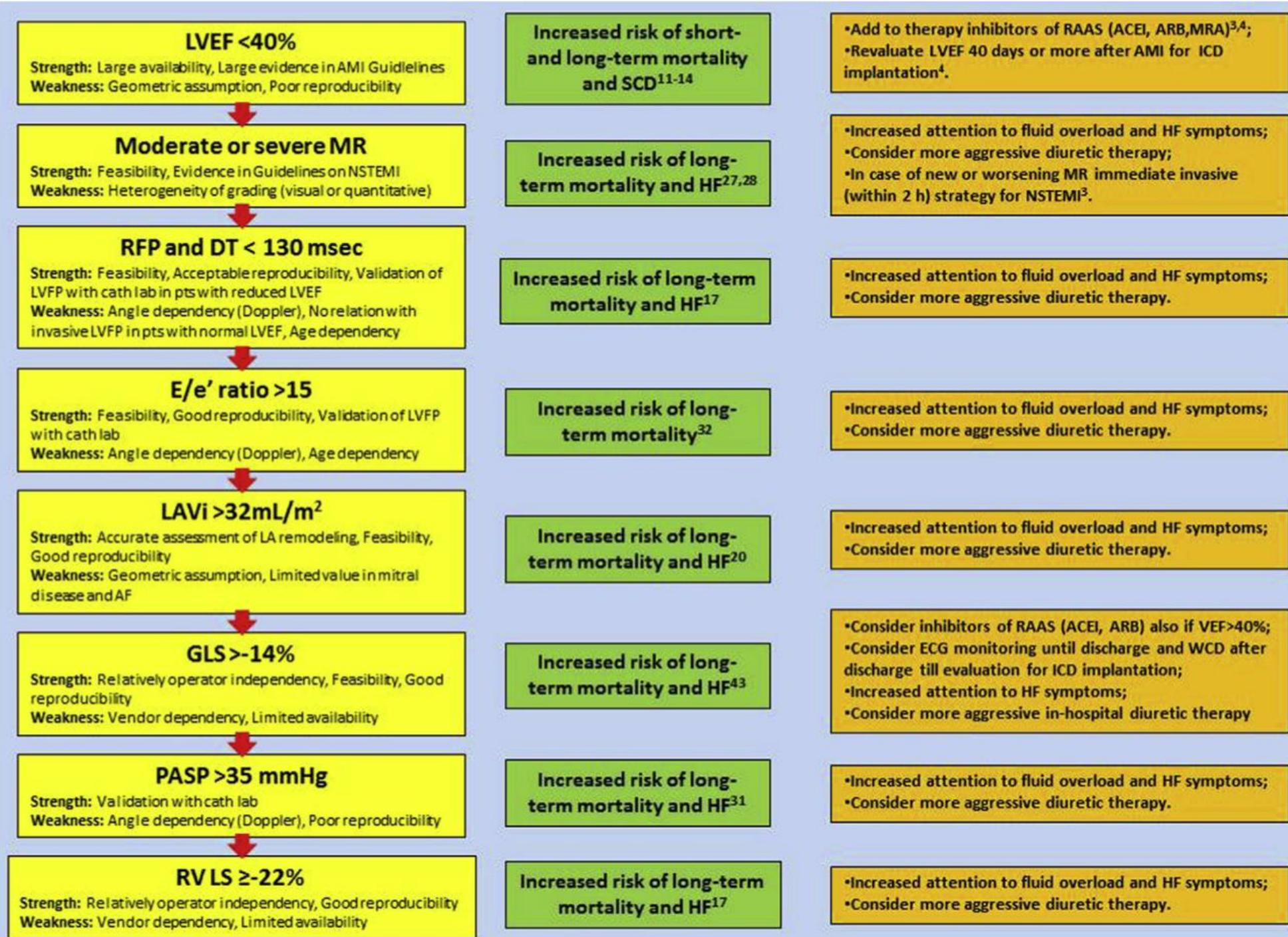
27/01/2022 13:00:18



27/01/2022 13:01:40







LVEF <40%

Strength: Large availability, Large evidence in AMI Guidelines  
Weakness: Geometric assumption, Poor reproducibility

Increased risk of short-  
and long-term mortality  
and SCD<sup>11-14</sup>

•Add to therapy inhibitors of RAAS (ACEI, ARB,MRA)<sup>3,4</sup>;  
•Reevaluate LVEF 40 days or more after AMI for ICD  
implantation<sup>4</sup>.

## LV Remodeling Post Anteroseptal MI

1 week



EDV 137ml ESV 80ml  
EF 41%

3 months



EDV 189ml ESV 146ml  
EF 23%

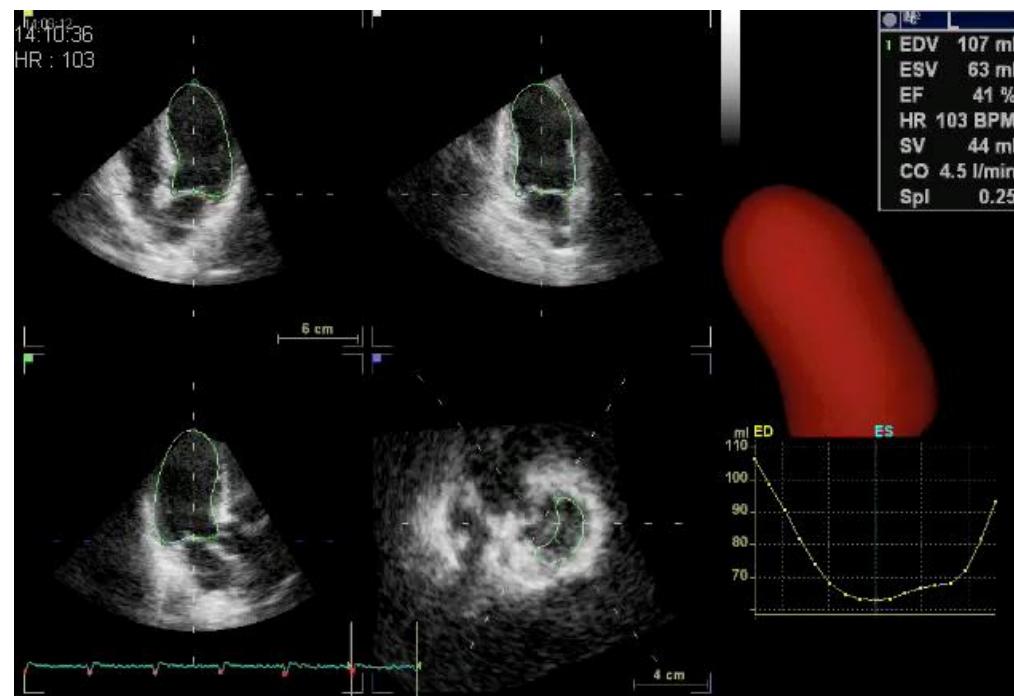
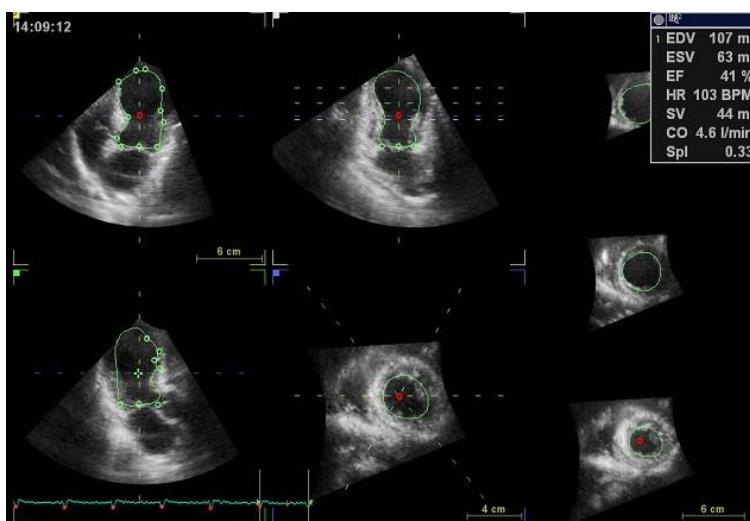
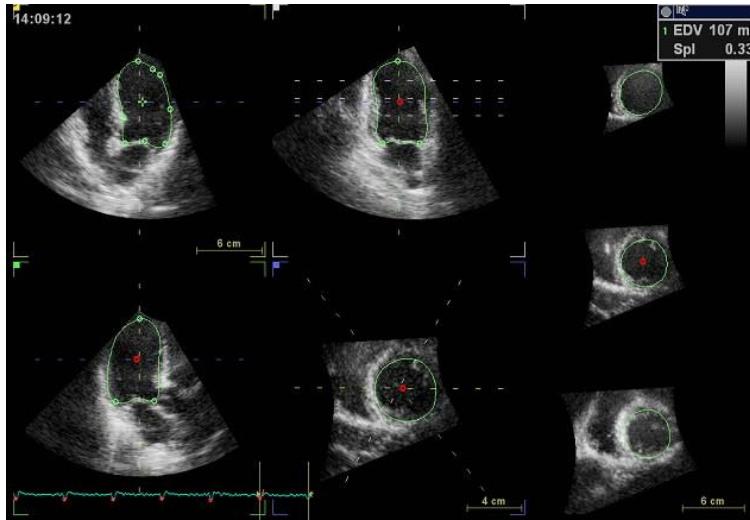
Apical 4 Chamber View  
End-diastole

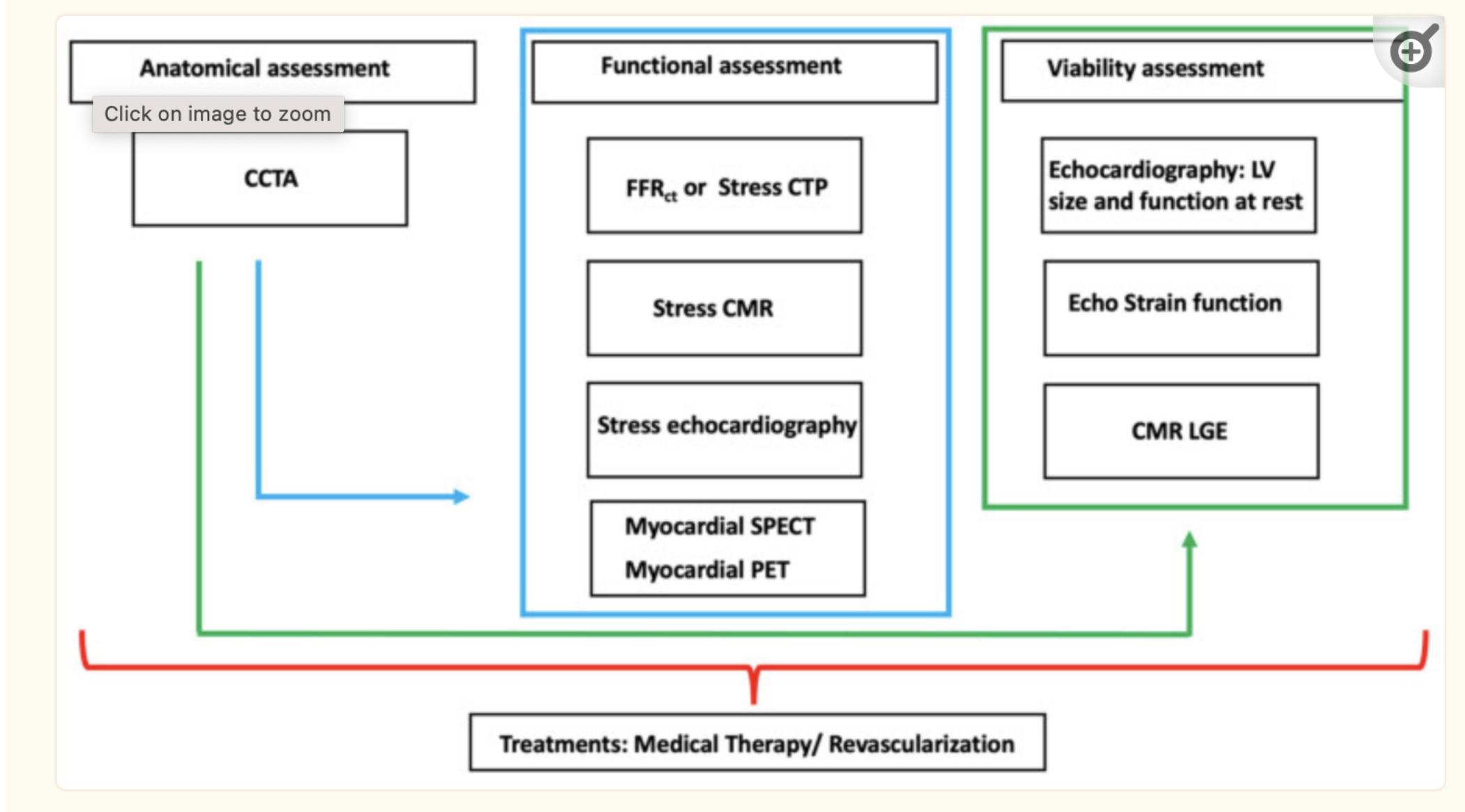
### LVEF <40%

Strength: Large availability, Large evidence in AMI Guidelines  
Weakness: Geometric assumption, Poor reproducibility

Increased risk of short-  
and long-term mortality  
and SCD<sup>11-14</sup>

- Add to therapy inhibitors of RAAS (ACEI, ARB,MRA)<sup>3,4</sup>;
- Reevaluate LVEF 40 days or more after AMI for ICD implantation<sup>4</sup>.





# Multimodality imaging in takotsubo syndrome: a joint consensus document of the European Association of Cardiovascular Imaging (EACVI) and the Japanese Society of Echocardiography (JSE)

Rodolfo Citro (Chair)<sup>1\*</sup>, Hiroyuki Okura (Co-Chair)<sup>2</sup>, Jelena R. Ghadri<sup>3</sup>,  
Chisato Izumi<sup>4</sup>, Patrick Meimoun<sup>5</sup>, Masaki Izumo<sup>6</sup>, Dana Dawson<sup>7</sup>, Shuichiro Kaji<sup>8</sup>,  
Ingo Eitel<sup>9,10</sup>, Nobuyuki Kagiyama<sup>11</sup>, Yukari Kobayashi<sup>12</sup>, Christian Templin<sup>3</sup>,  
Victoria Delgado<sup>13</sup>, Satoshi Nakatani<sup>14</sup>, and Bogdan A. Popescu<sup>15,16</sup>

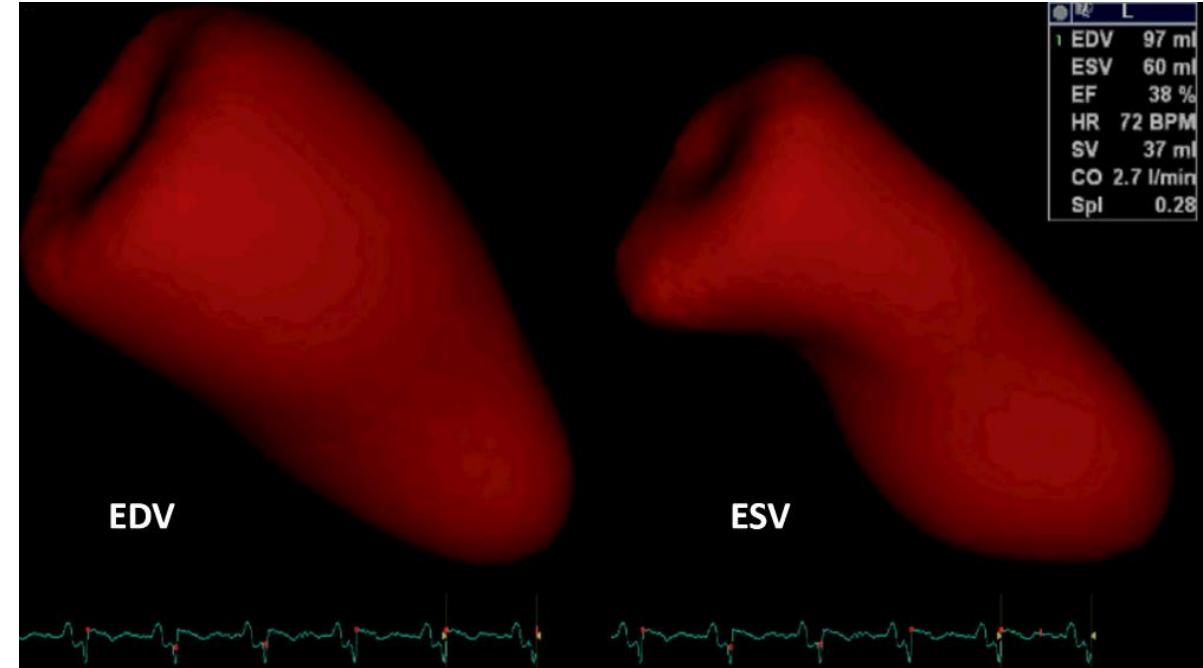
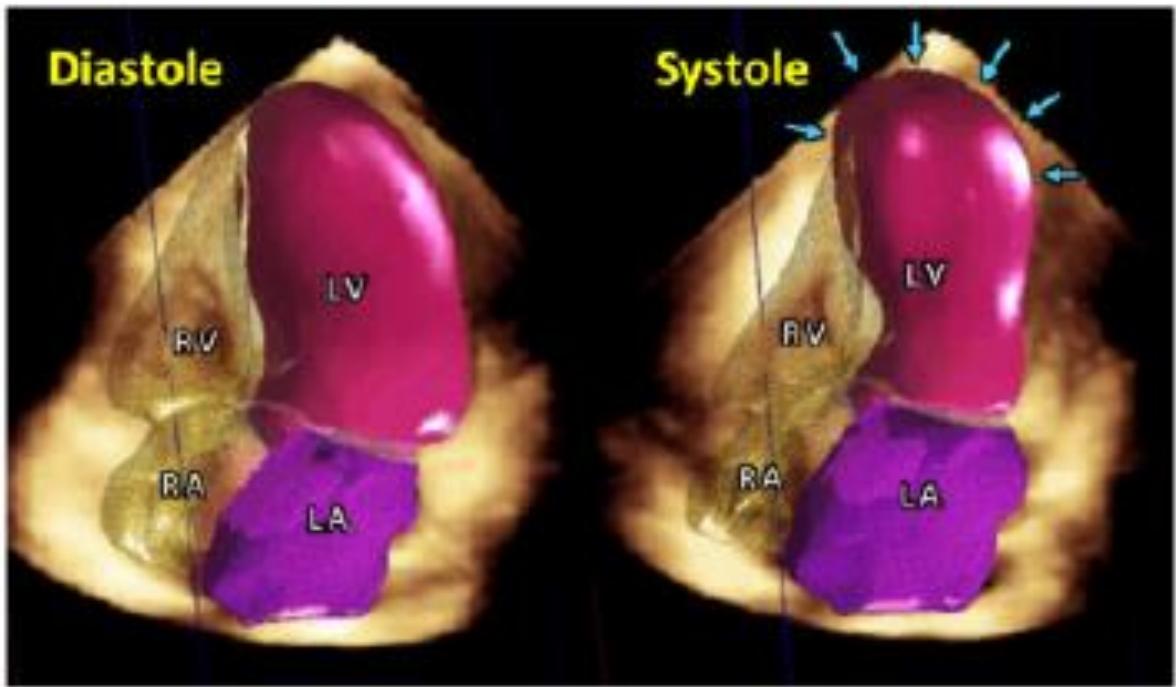


Dr. Hiroyuki Okura

Dr. Rodolfo Citro

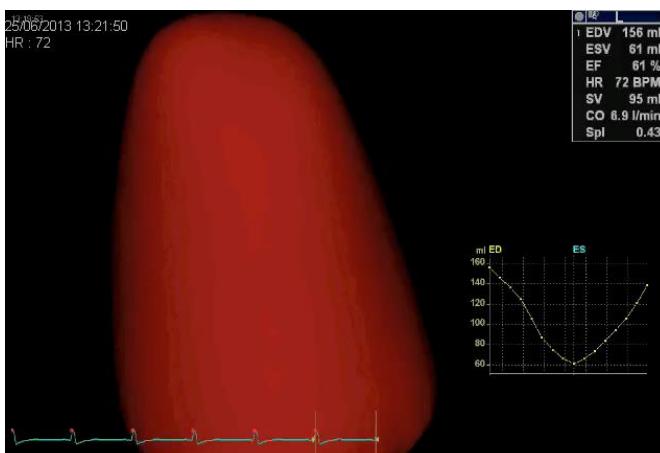
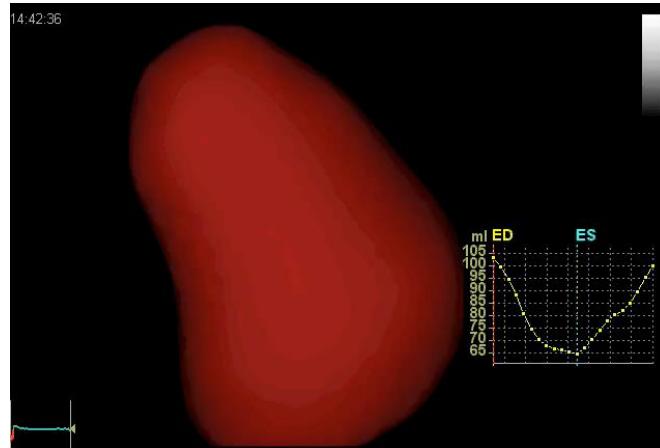
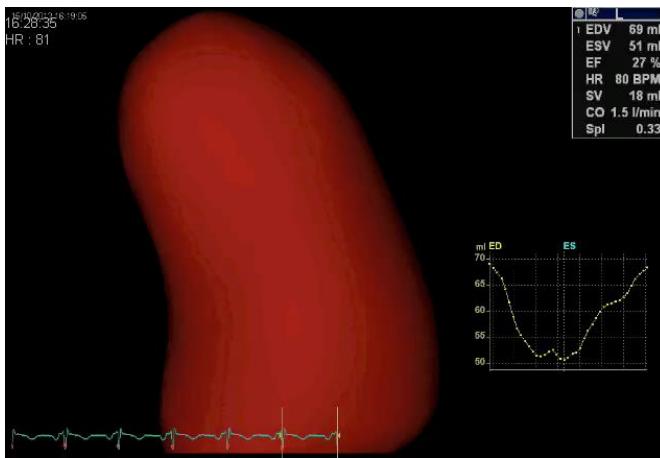


## ADVANCED ECHOCARDIOGRAPHY



3D echocardiography





**Table 2 Anatomical variants of Takotsubo syndrome**

Variant	Estimated prevalence
Apical with or without MLV variant (typical)	75–80%
MLV	~10–15%
Inverted or basal	~5%
Biventricular	Clinical <0.5%; CMR 33%
Right ventricular	Unknown
Apical tip sparing	Unknown
Possible atypical variants	
Global	Unknown
Focal	Unknown

CMR, cardiac magnetic resonance; MLV, mid-left ventricular;



**9° CONGRESSO NAZIONALE**



*Quello che le Linee  
Guida Non Dicono*

Napoli  
Hotel Excelsior  
1-2 aprile 2022



**PROGRAMMA**

# **Nuove tecnologie ecocardiografiche nella valutazione della cardiopatia ischemica acuta e cronica**

**Rodolfo Citro** MD, PhD, FESC

Dipartimento Cardio-Toraco-Vascolare

U.O.S.D. Ecocardiografia

A.O.U. San Giovanni di Dio Ruggi d'Aragona - Salerno

[rodcitro@unisa.it](mailto:rodcitro@unisa.it)