



*Clinica Cardiologica  
Università degli Studi di Padova  
Direttore: Prof. Sabino Iliceto*

# MECHANICAL COMPLICATIONS OF ACUTE MYOCARDIAL INFARCTION

Luigi P. Badano\*\*, MD, FESC

**\*\*Dr. Badano has received honoraries and research grants from GE Healthcare, Sorin cardio S.p.A., Actelion, Edwards Lifesciences**

**\*No off-label use of device**

# COMPLICATIONS OF ACUTE MYOCARDIAL INFARCTION

- **ISCHEMIC COMPLICATIONS**
  - extension of infarction area
  - reinfarction
- **HAEMODYNAMIC COMPLICATIONS**
  - left ventricular failure
  - mitral regurgitation
- **MECHANICAL COMPLICATIONS**
  - free wall rupture
  - interventricular septum rupture
  - papillary muscle rupture
- **ARRHYTHMIC COMPLICATIONS**
  - tachyarrhythmias
  - bradyarrhythmias
- **EMBOLIC COMPLICATIONS**
  - left ventricular thrombosis
  - right ventricular thrombosis
- **PERICARDIAL COMPLICATIONS**
  - pericardial effusion
  - pericarditis
  - Dressler's syndrome
- **OTHER COMPLICATIONS**
  - ventricular aneurysm
  - ventricular pseudoaneurysm
  - right ventricular infarction



# MECHANICAL COMPLICATIONS IN AMI

## Clinical Suspicion

### LV WALL RUPTURE

Hemodynamic collapse

Tamponade

Asymptomatic

### INTERVENTRICULAR SEPTUM RUPTURE

Hemodynamic collapse

Systolic murmur

### PAPILLARY MUSCLE RUPTURE

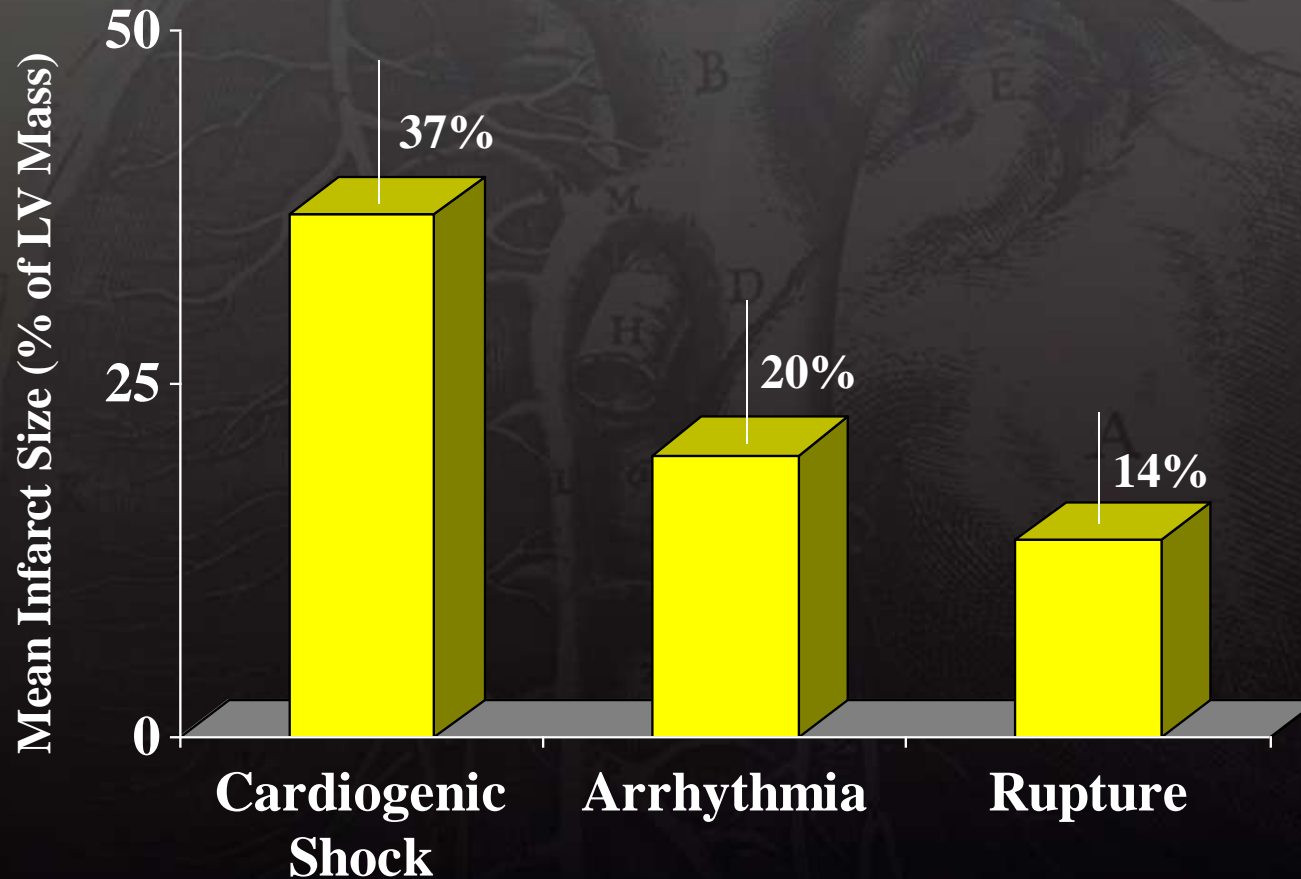
No murmur

Sudden pulmonary edema



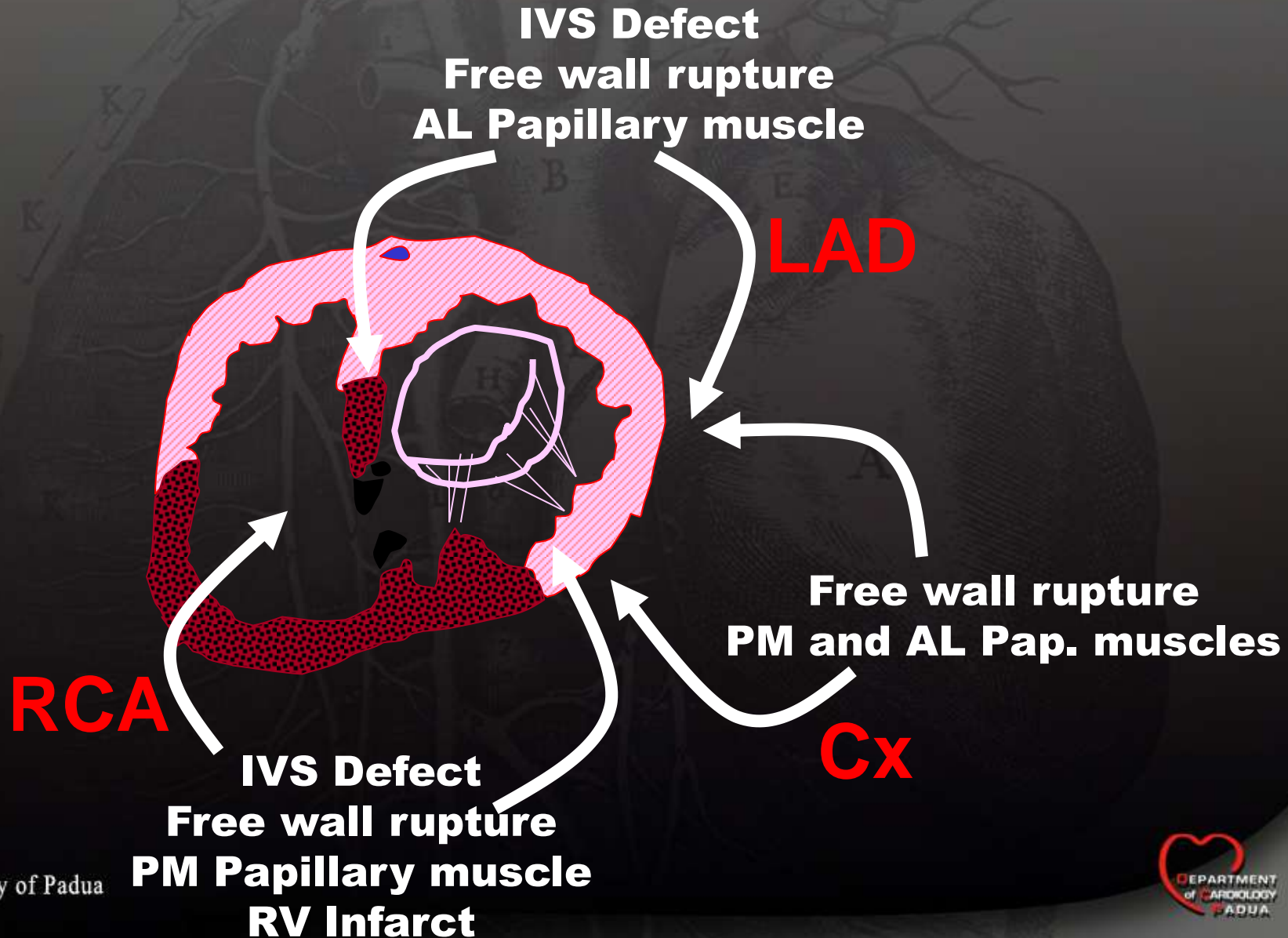
# MECHANICAL COMPLICATIONS IN AMI

## Mode of Death in Relation to Infarct Size



# MECHANICAL COMPLICATIONS IN AMI

## Relation to Coronary Anatomy



# MECHANICAL COMPLICATIONS IN AMI

## Interventricular Septum Rupture

- Acute rupture in 0.5-2% of patients with AMI
- 1-5% of hospitalized patients dying of AMI
- Occurs between 24 hours and 2 weeks, but most commonly 3 to 4 days, following AMI
- Mortality: 24% within 24 hours  
46% within 1 week  
67-82% within 2 months } in patients managed medically
- Mortality <25% in patients undergoing surgical treatment

# MECHANICAL COMPLICATIONS IN AMI

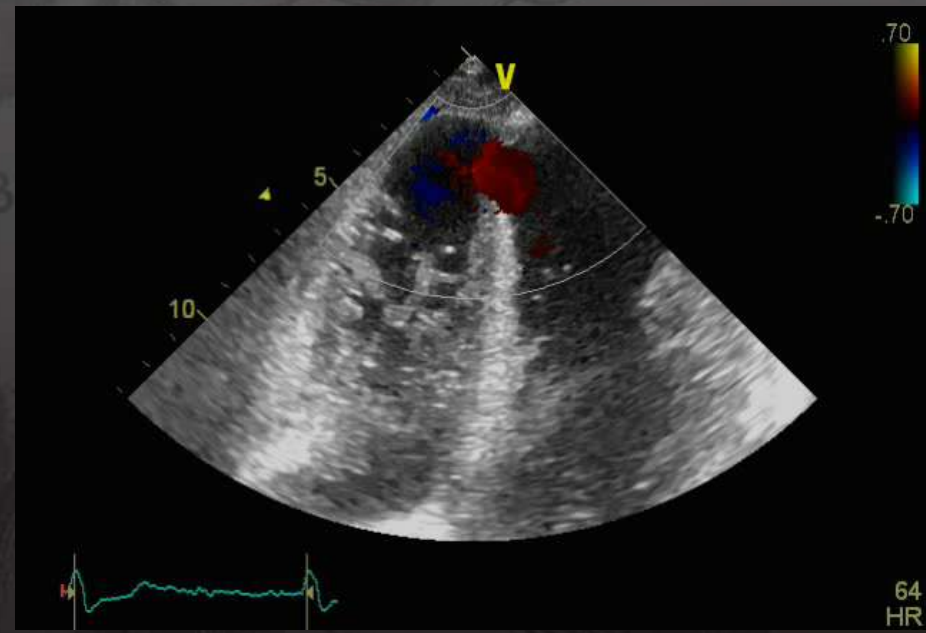
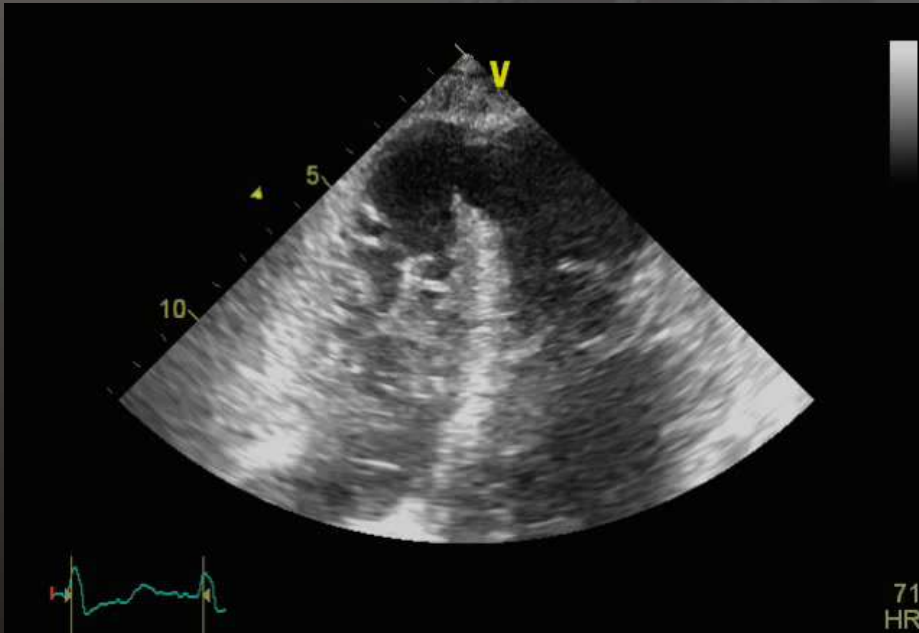
## Interventricular Septum Rupture

- Occurs with the same incidence in anterior, lateral and inferior MI
- More frequent in patients with first infarction
- Anterior AMI associated with rupture of the apical septum,
- Inferior AMIs with rupture of the inferior basal septum (worse prognosis)



# MECHANICAL COMPLICATIONS IN AMI

## Apical Interventricular Septum Rupture

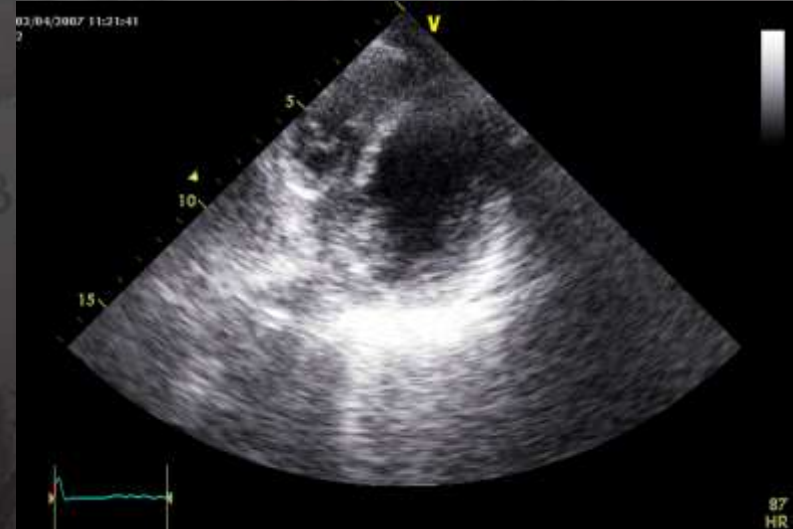


- Usually located postero-inferior or at the apex
  - ✓ Scan to find
- Right ventricular dilatation (left to right shunt)
- Abrupt posterior I.V. septum motion in diastole



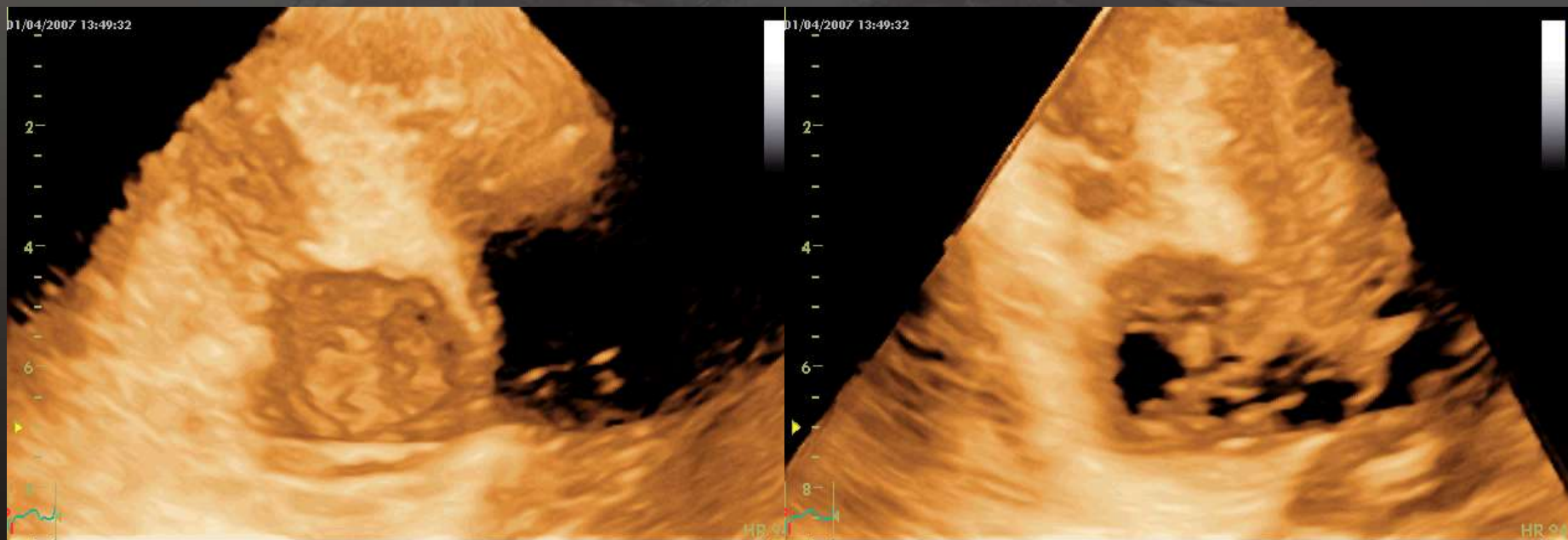
# MECHANICAL COMPLICATIONS IN AMI

## Posterior Interventricular Septum Rupture



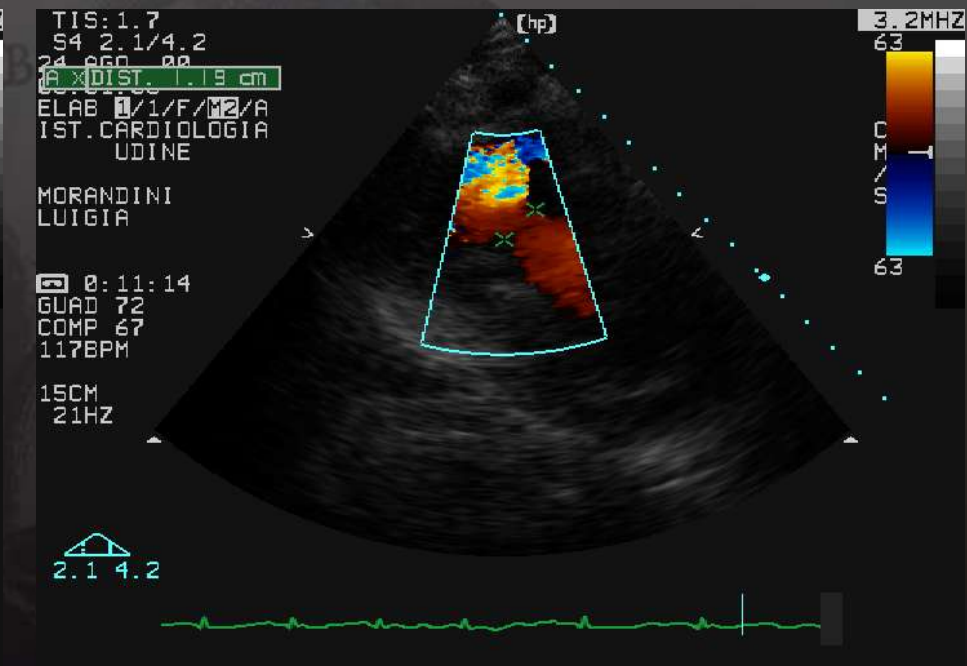
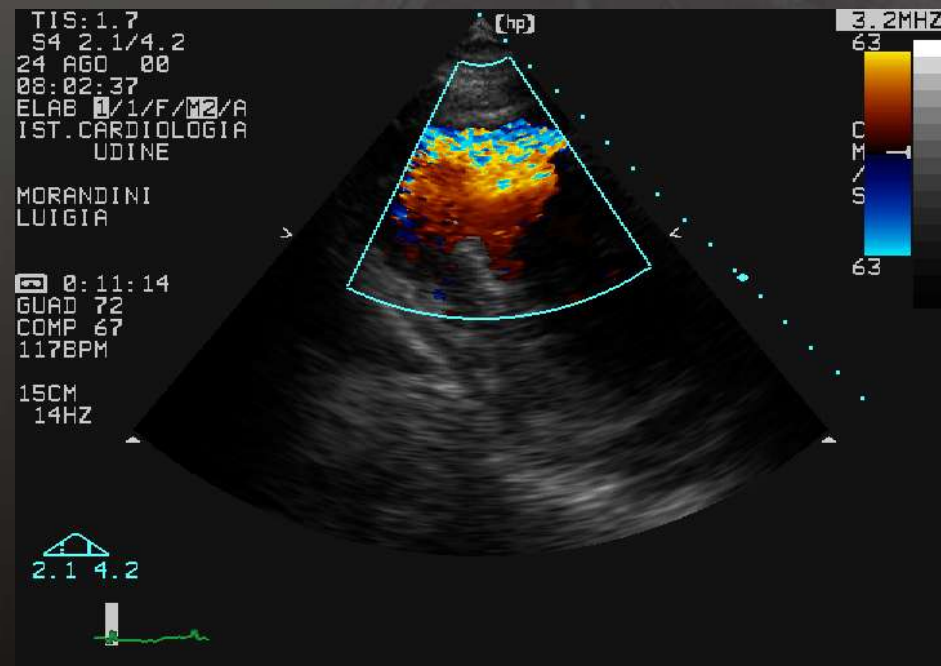
# MECHANICAL COMPLICATIONS IN AMI

## Posterior Septum Rupture: Role of 3DE



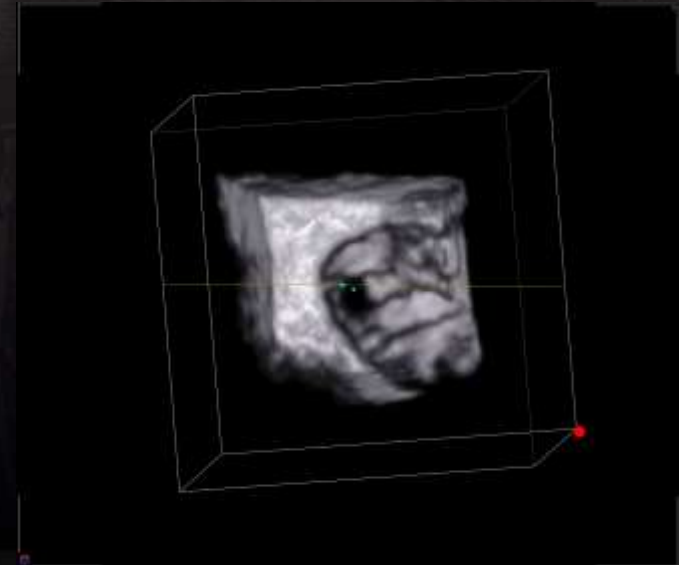
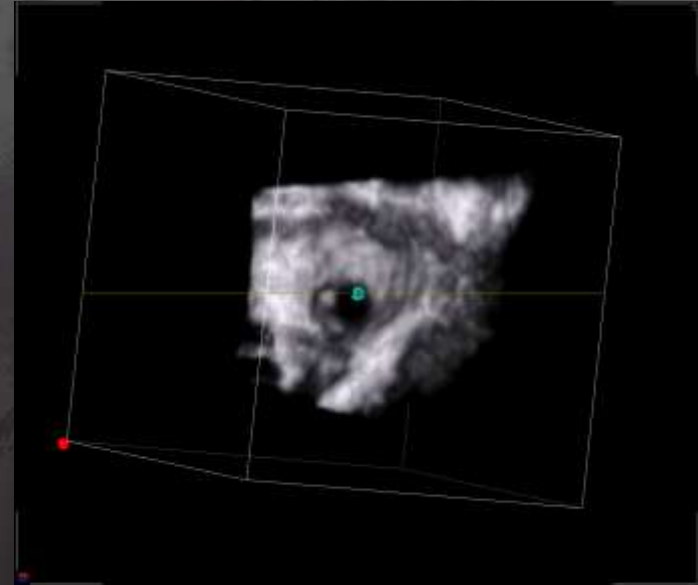
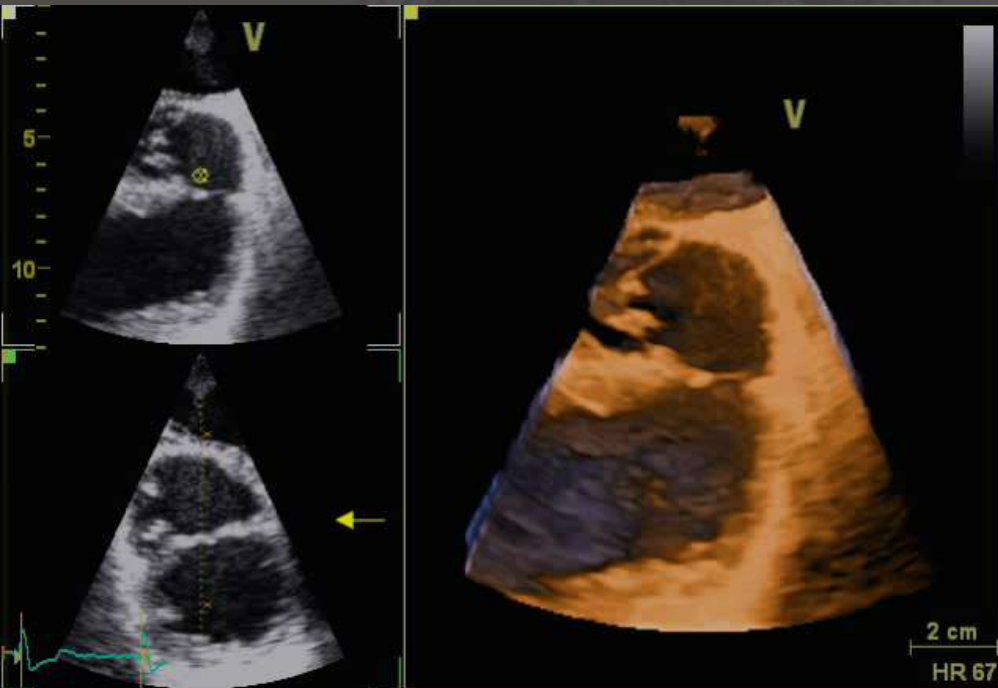
# MECHANICAL COMPLICATIONS IN AMI

## Anterior Interventricular Septum Rupture



# MECHANICAL COMPLICATIONS IN AMI

## Sizing Interventricular Septum Rupture



# MECHANICAL COMPLICATIONS IN AMI

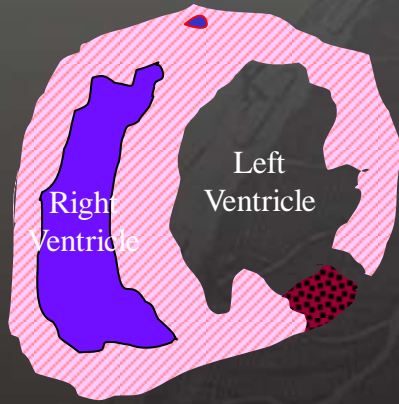
## Free Wall Rupture

- Occurs more frequently in the elderly and in women with infarction
- Most often in patients without previous infarction and in hypertensive patients
- More frequently (>90%) in the left ventricle, anterior or lateral walls, in patients with a large transmural infarction
- Usually occurs near the junction of the infarct and the normal muscle
- Generally occurs within the first 2 weeks of the infarction and may occur within the first 24 hours

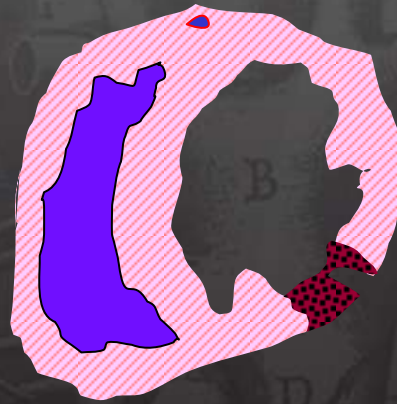


# MECHANICAL COMPLICATIONS IN AMI

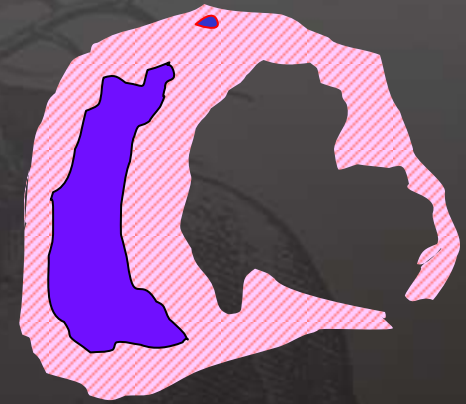
## Anatomopathological Types of Free Wall Rupture



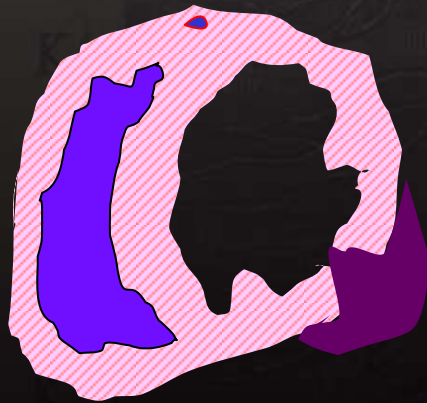
Complete Rupture



Partial Rupture



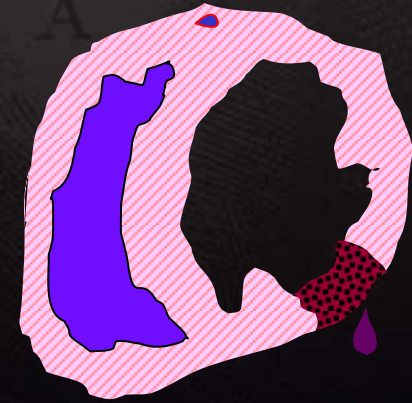
Infarct Expansion



Epicardial Hematoma



Multicanalicular Rupture



Bleeding Infarct

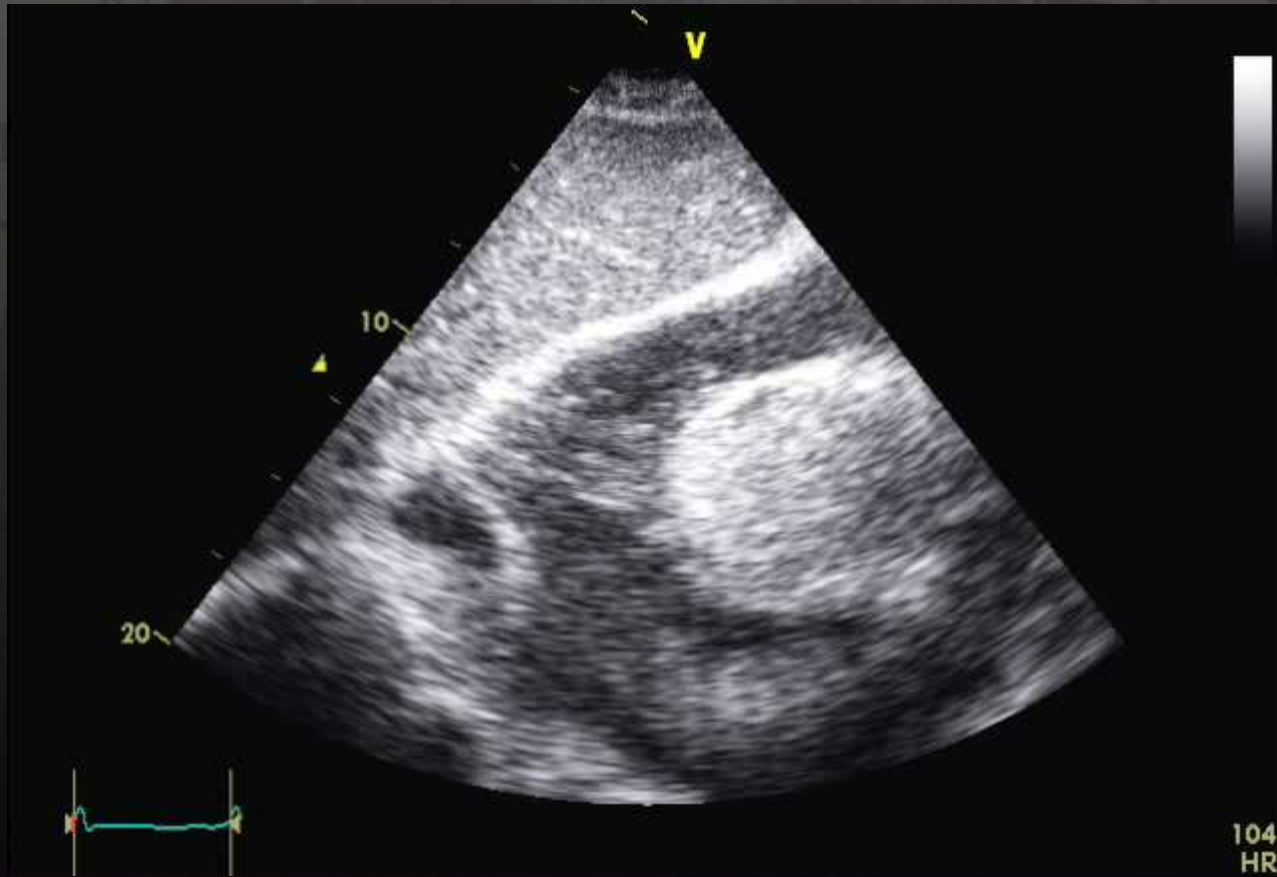
# MECHANICAL COMPLICATIONS IN AMI

## Left Ventricular Free Wall Rupture



# MECHANICAL COMPLICATIONS IN AMI

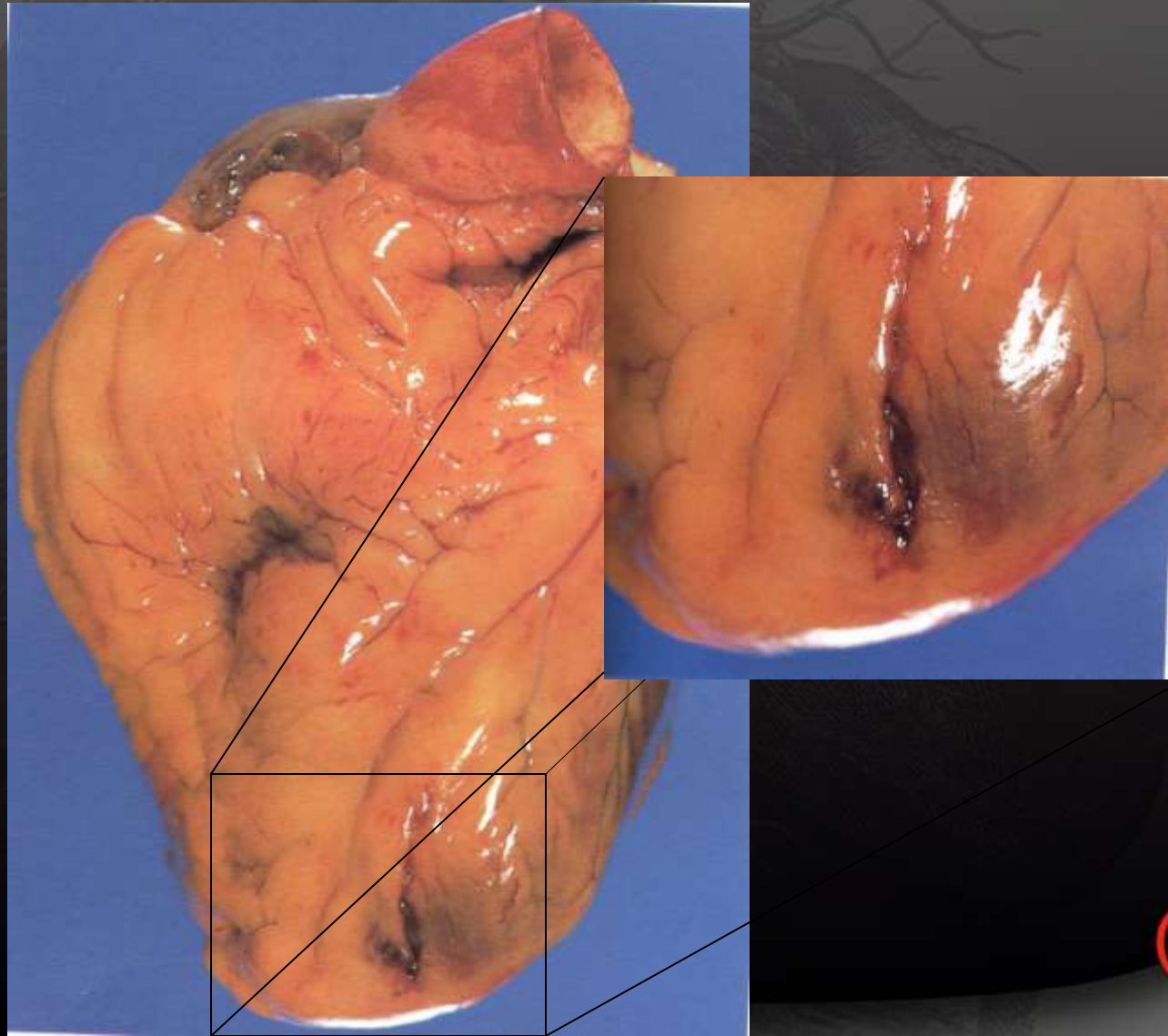
## Left Ventricular Free Wall Rupture





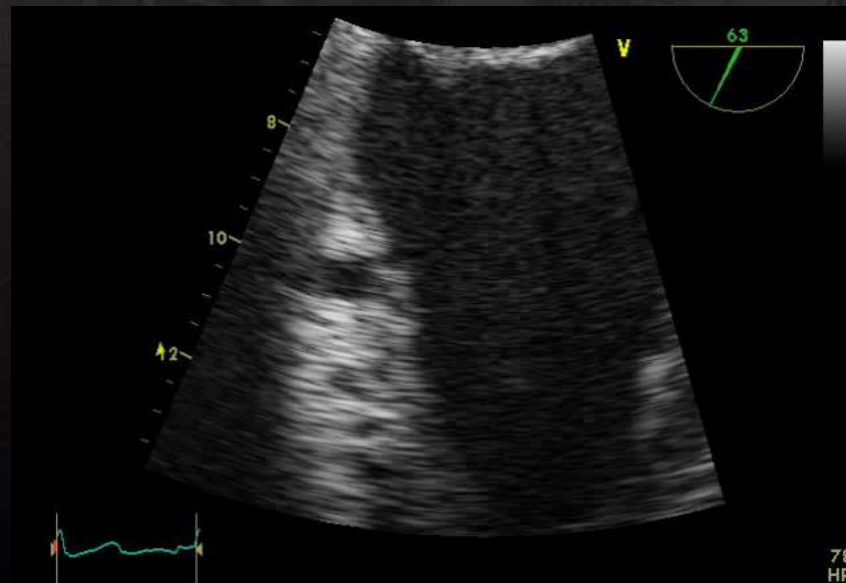
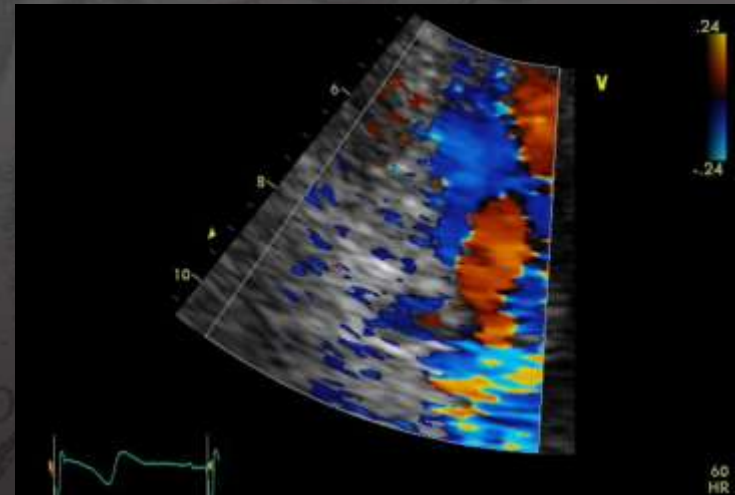
# MECHANICAL COMPLICATIONS IN AMI

## Left Ventricular Free Wall Rupture



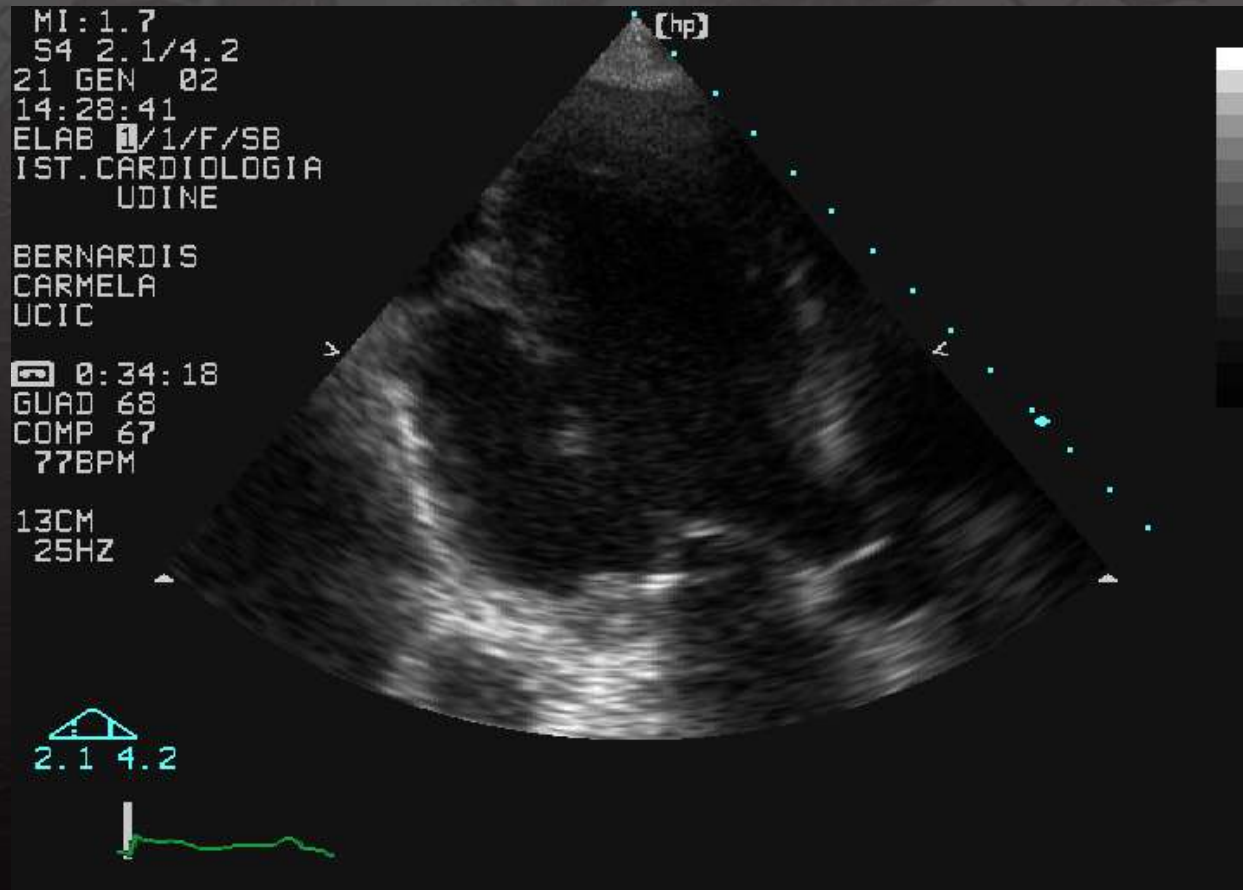
# MECHANICAL COMPLICATIONS IN AMI

## Left Ventricular Partial Free Wall Rupture



# MECHANICAL COMPLICATIONS IN AMI

## Left Ventricular Pseudoaneurysm



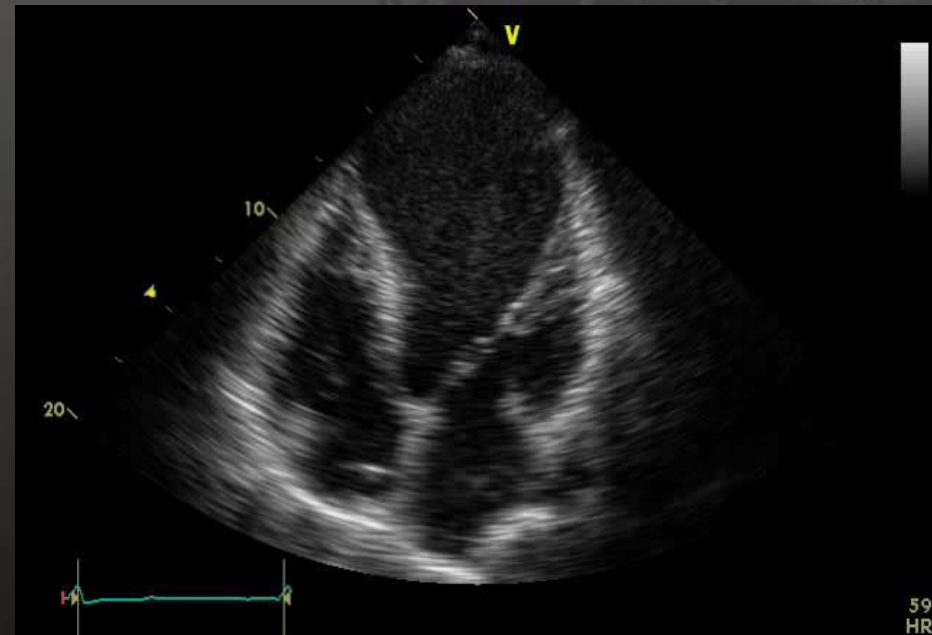
# MECHANICAL COMPLICATIONS IN AMI

## Pseudoaneurysm: Differential Diagnosis

	ANEURYSM	PSEUDOANEURYSM
Orifice	Wide	Narrow
Endocardium	Uninterrupted	Sudden drop
Cavity	Unexpandable	Expands in systole
Doppler	No flow	Bidirectional flow

# MECHANICAL COMPLICATIONS IN AMI

## Left Ventricular Aneurysm vs Pseudoaneurysm



Aneurysm



Pseudo - aneurysm

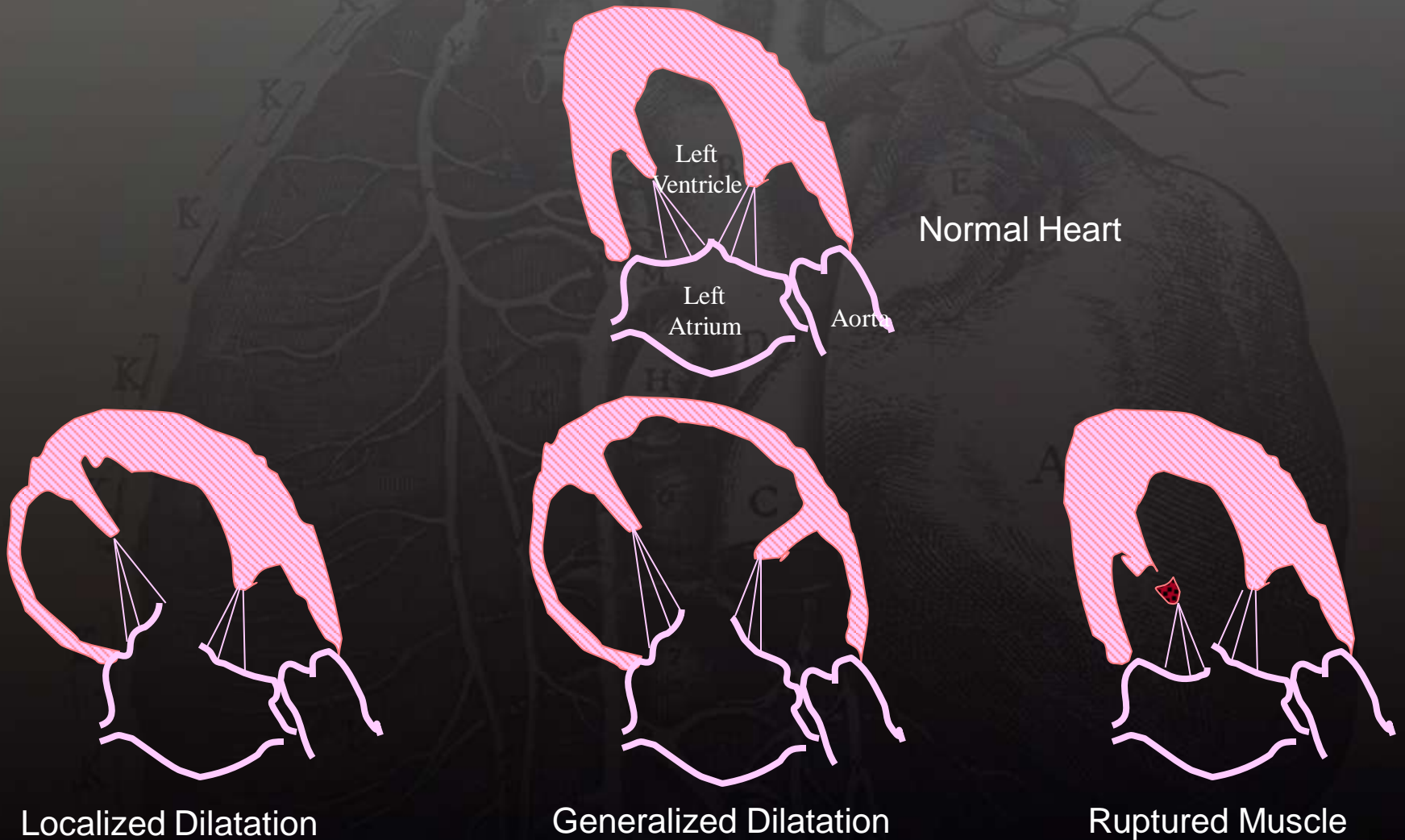
# MECHANICAL COMPLICATIONS IN AMI

## Papillary Muscle Dysfunction

- Papillary muscle dysfunction is a rare complication of transmural MI
- Anterolateral infarctions can lead to dysfunction of the anterolateral papillary muscle; while inferior infarctions to dysfunction of the posteromedial papillary muscle (more common)
- The dysfunction is associated with mild mitral regurgitation

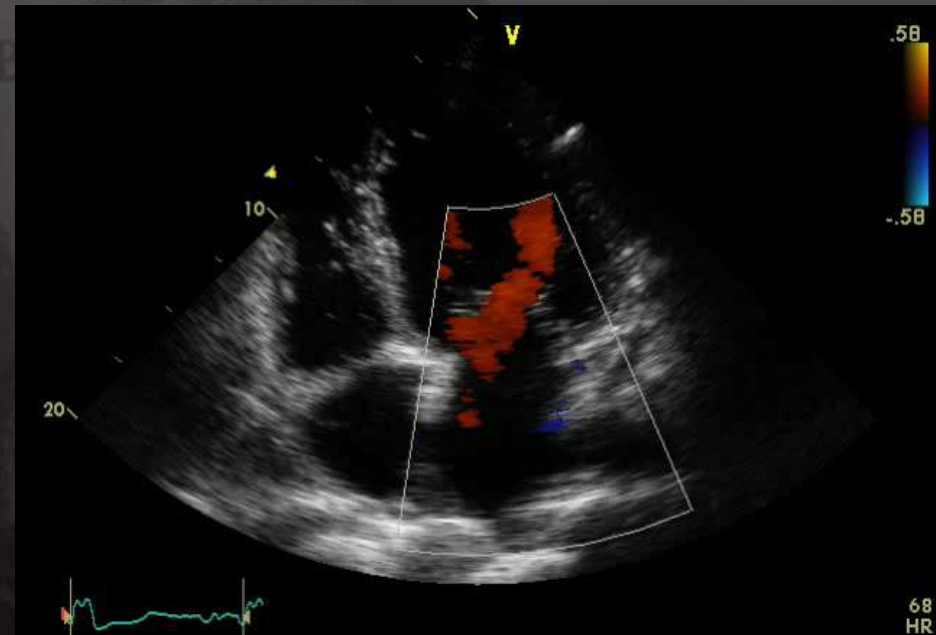
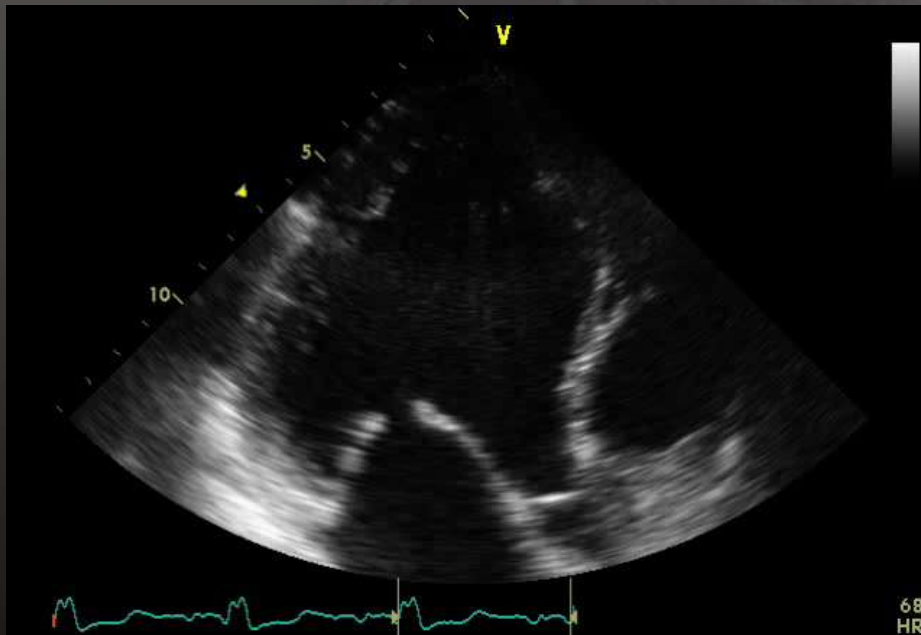
# MECHANICAL COMPLICATIONS IN AMI

## Mechanisms of Papillary Muscle Dysfunction



# MECHANICAL COMPLICATIONS IN AMI

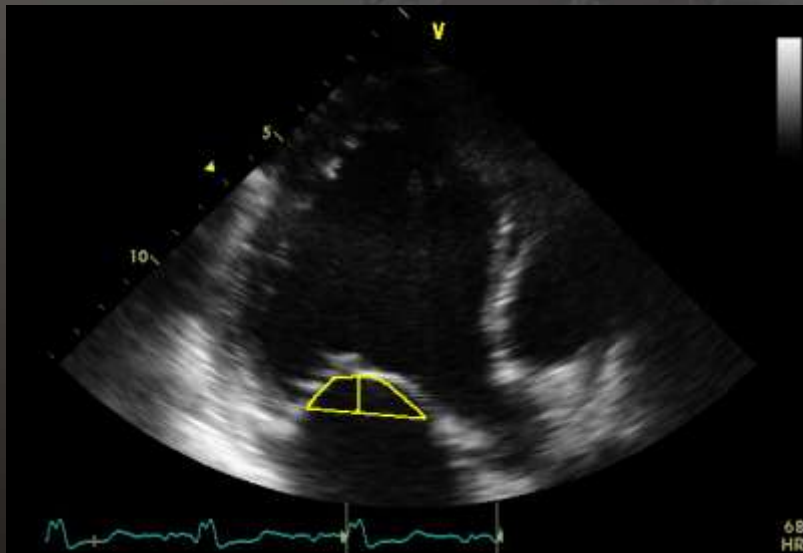
## Generalized LV Dilation



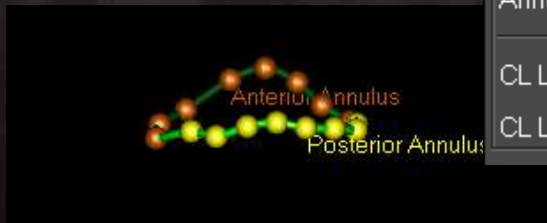
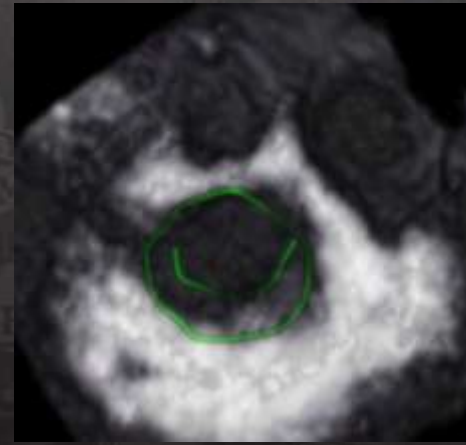


# MECHANICAL COMPLICATIONS IN AMI

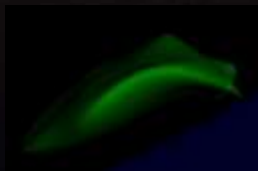
## Assessing Ischemic Mitral Regurgitation



**Tenting Area = 1.4 cm<sup>2</sup>**  
**Coaptation Depth = 1.0 cm**



Automatic Measurements	
AP Diameter:	4.5 cm
AL-PM Diameter:	4.9 cm
Sphericity Index:	0.9
Commissural Diameter:	4.7 cm
Non-planar Angle:	143.0°
Anterior Annulus Length:	6.4 cm
Posterior Annulus Length:	8.8 cm
Annulus Circumference:	15.2 cm
Annulus Area (2D):	16.4 cm <sup>2</sup>
CL Length (2D):	5.1 cm
CL Length:	5.6 cm



**Tenting Volume = 6 ml**

# MECHANICAL COMPLICATIONS IN AMI

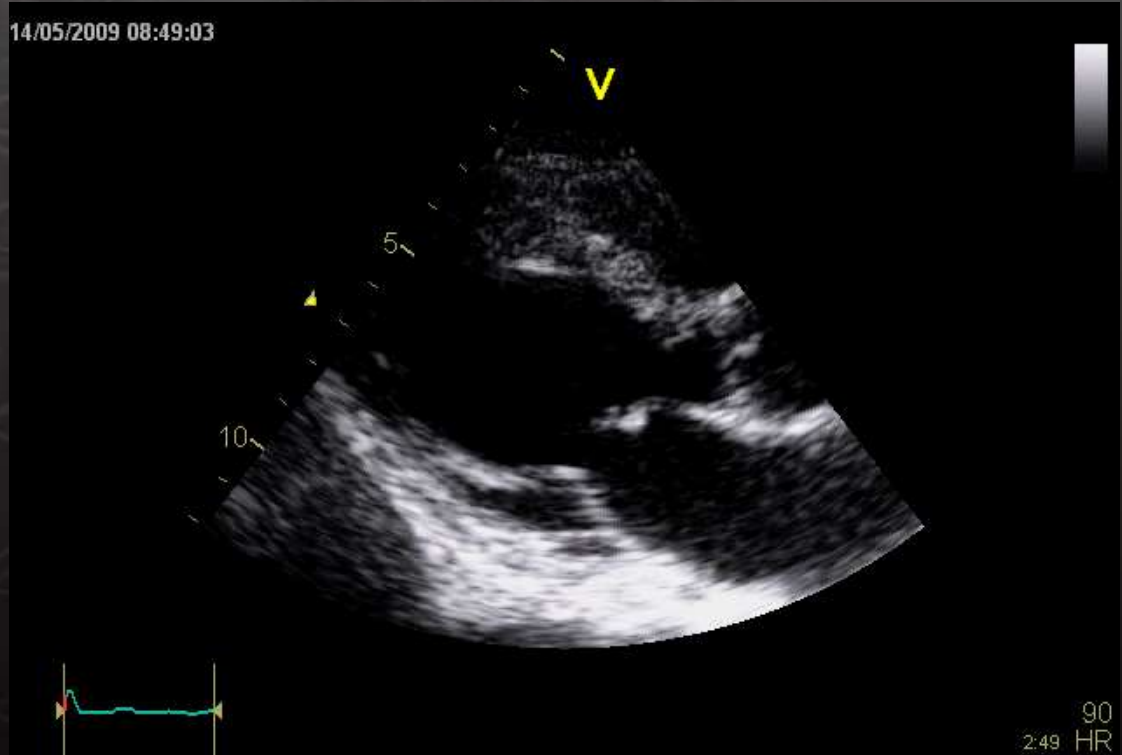
## Papillary Muscle Rupture

- Acute rupture in 1% of patients with AMI
- 5% of hospitalized patients dying of AMI
- 50% of cases are associated with small infarctions and produce severe mitral regurgitation
- Occurs most commonly 2 to 7 days following infarction (20% of cases within 24 hours)
- Mortality 50% within 24 hours  
94% within 8 weeks
- Intra-operative mortality 35% in patients subjected to a surgical treatment



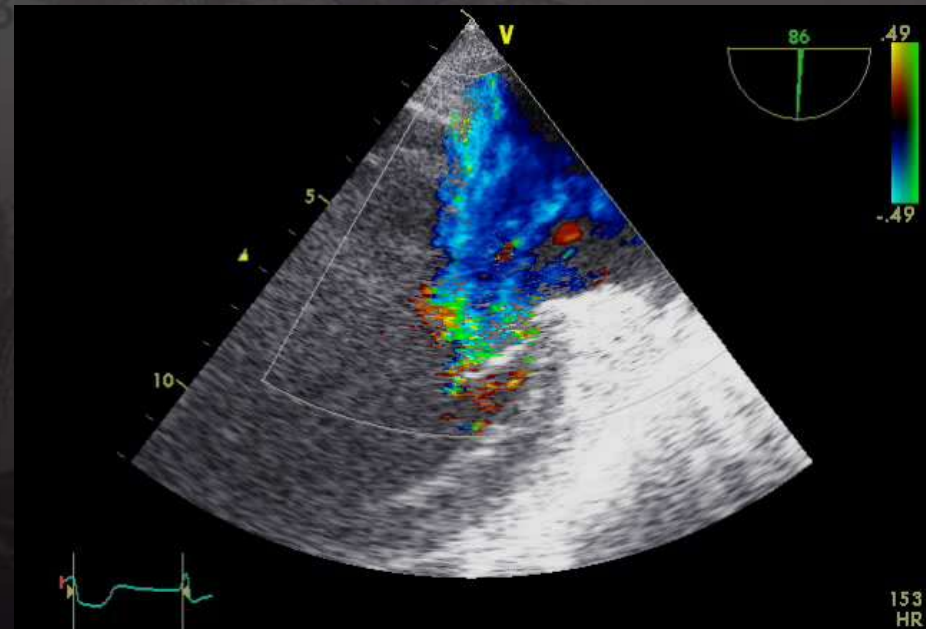
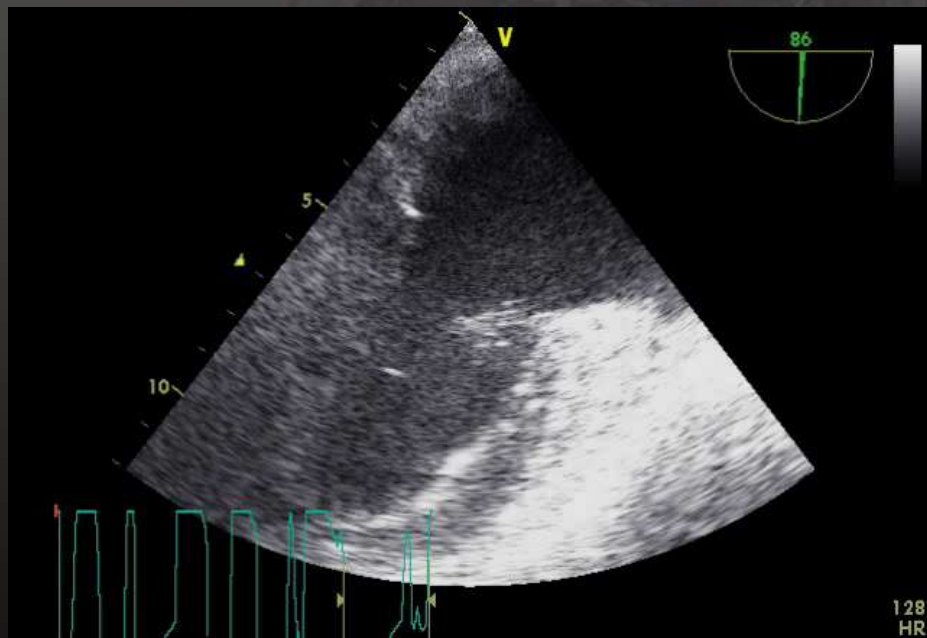
# MECHANICAL COMPLICATIONS IN AMI

## Papillary Muscle Rupture



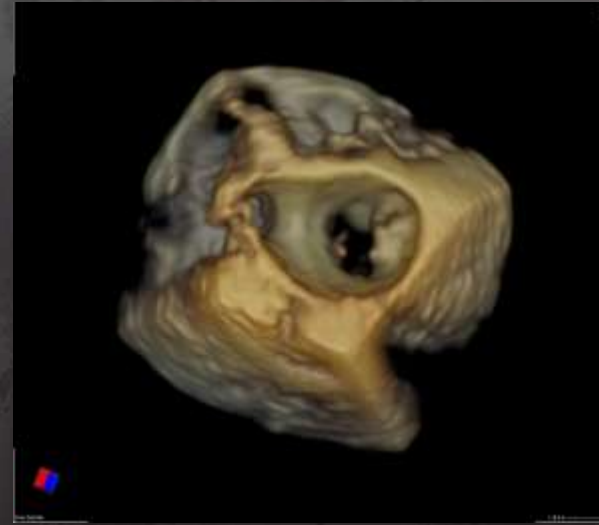
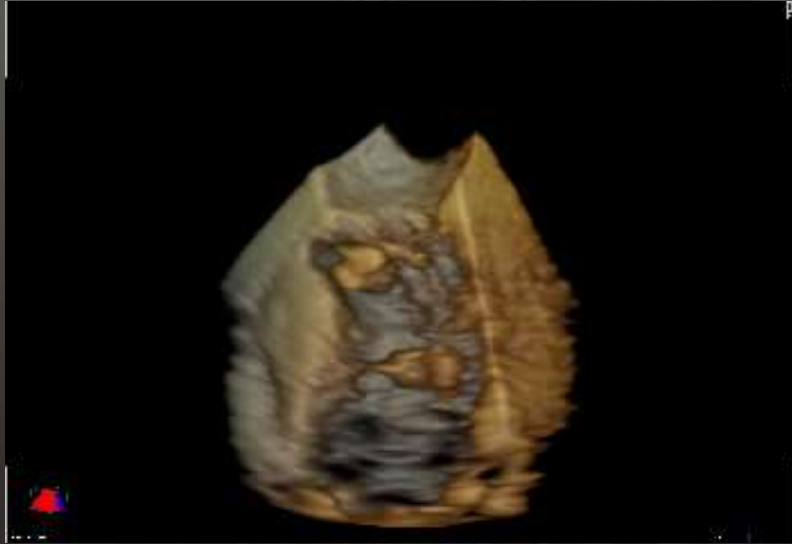
# MECHANICAL COMPLICATIONS IN AMI

## Papillary Muscle Rupture



# MECHANICAL COMPLICATIONS IN AMI

## Papillary Muscle Rupture: 3D Echo



# MECHANICAL COMPLICATIONS IN AMI

## Conclusions

- **Correct diagnosis of a mechanical complication in a patient with AMI may be challenging, but if timely it may be life saving;**
- **The first step is to have the clinical suspicion of it;**
- **Scan should be guided by knowledge of the the clinical picture in order to look for the more likely complication**
- **TOE and 3D acquisitions may help to better delineate the anatomy of the complication to address management**



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