




Mechanical complications of MI

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HH, HMC




No disclosures

- 
- ❑ Electrical Complications
 - ❑ Mechanical Complications
 - ❑ Heart failure
 - ❑ Pericarditis
 - ❑ Post infarction angina or Reinfarction

➤ The major mechanical complications after acute myocardial infarction (AMI) include;

- Rupture of the left ventricular free wall,
- Acute severe MR
 - papillary muscle displacement
 - papillary muscle rupture
- Ventricular septal rupture.
- Pseudo aneurysm formation
- RV infarction
- Dynamic LV outflow obstruction
- LV thrombus

- 
- ❑ Primary percutaneous coronary intervention has significantly reduced major mechanical complications since its introduction as a treatment strategy in AMI.
 - ❑ Echocardiography with color-flow Doppler is the investigation of choice in the diagnosis and differentiation of the conditions.

Free wall rupture



Most common least recognized complication:

- ✓ < 1% to 6.2% patients with acute MI
- ✓ Accounts for 14 to 26% of Infarct related mortality
- ✓ 7% in hospital deaths

Time Course :

- ✓ First 5 days post MI in 50%
- ✓ 90% occur within 2 weeks

Free wall rupture

Mid ventricle and lateral wall are most common sites

May affect any wall

- ✓ Can involve RV
- ✓ Atria may be affected rarely

Adjacent to junction of normal with infarcted tissue

Presentation

- Acute free wall rupture
 - ✓ Rapid PEA /death
- Sub acute free wall rupture 30%
 - ✓ Slow ooze with warning signs and symptoms

Free wall rupture

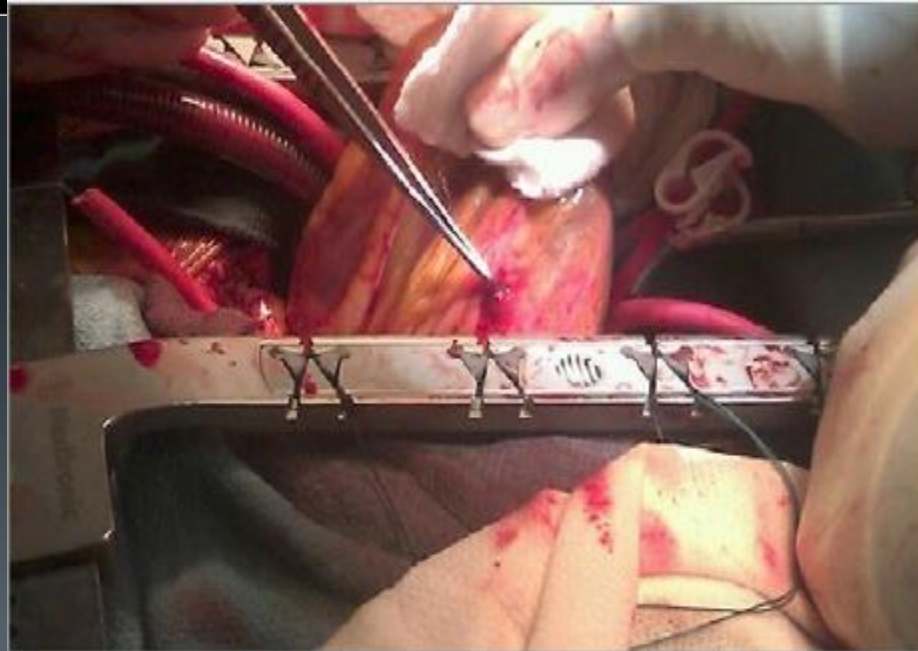
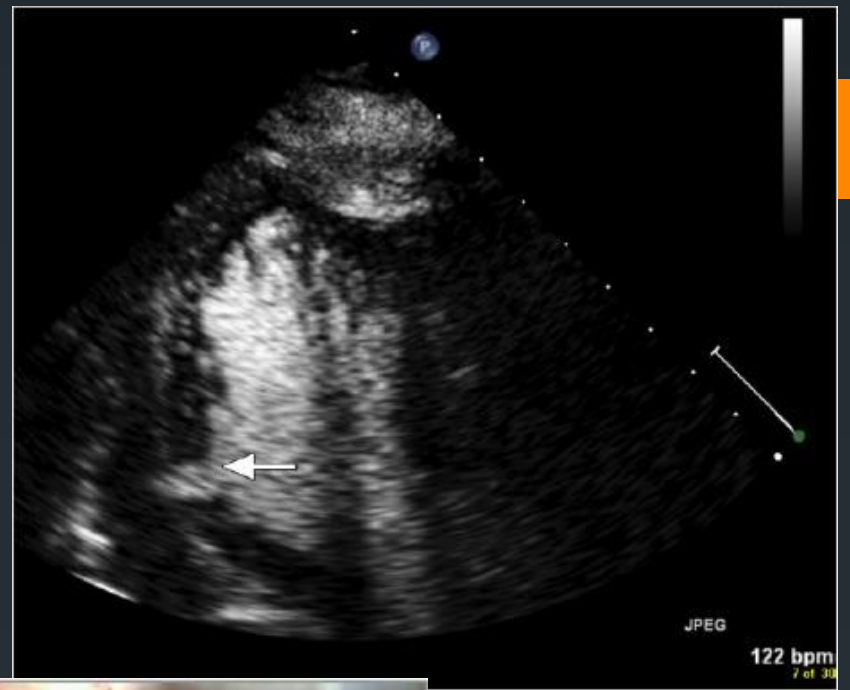
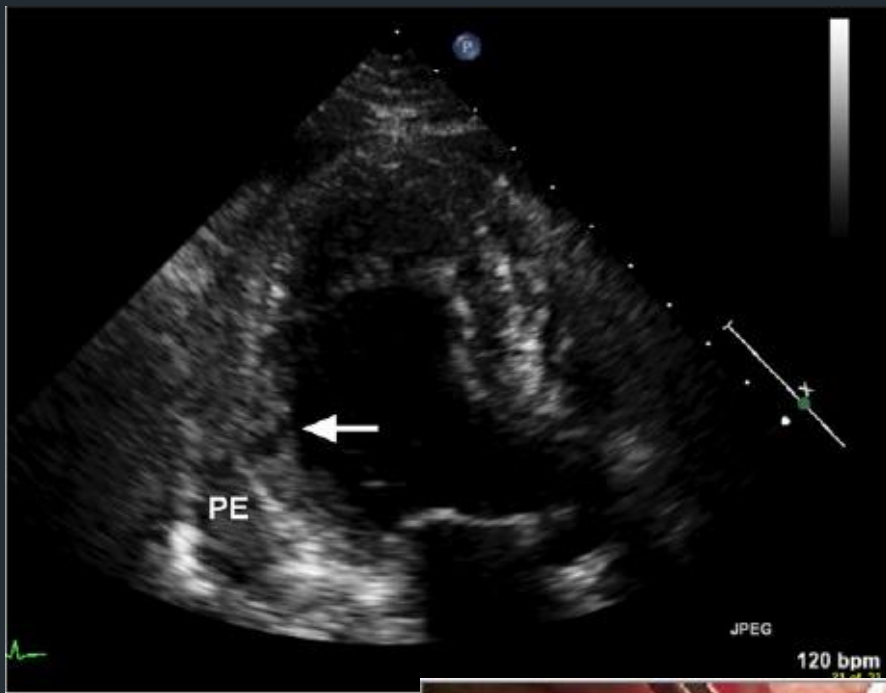
Clinical signs :

- ✓ Pericarditis , emesis and agitation
- ✓ Recurrent chest pain
- ✓ Transient hypotension and bradycardia
- ✓ Deviation from expected T-wave evolution

Free wall rupture

Echocardiographic features include;

- ✓ Pericardial effusion in end –diastole > 5mm
- ✓ High density intrapericardial echoes (thrombus)
- ✓ RV/RA compression (Tamponade)
- ✓ Direct 2D identification of tear is unusual
 - Contrast may be helpful



Suspected LVFWR



Echo confirmation



**Hypotension
No EMD**



**IV fluids, Inotropes, IABP,
Pericardiocentesis(?)**



Emergency Surgery

LV pseudo aneurysm

❑ Incomplete rupture

- ✓ Sealed by pericardium and hematoma
- ✓ Lacks elements of myocardial wall

❑ Echo-lucent space external to LV

❑ Narrow neck

- ✓ Ratio of the diameter of the entry point to the maximal diameter is <40 -50%

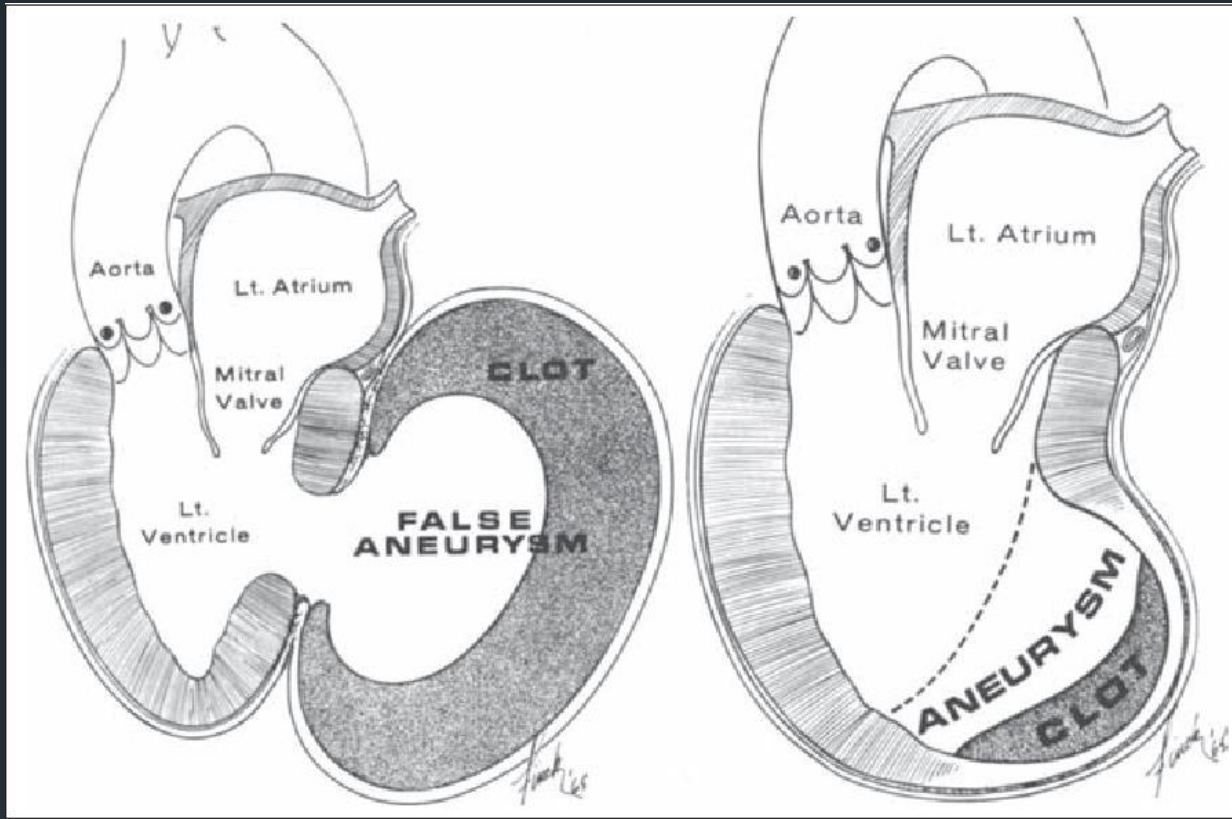
❑ May contain thrombus

❑ Characteristic Doppler Profile

- ✓ Bidirectional (“to- and –fro”) flow pattern

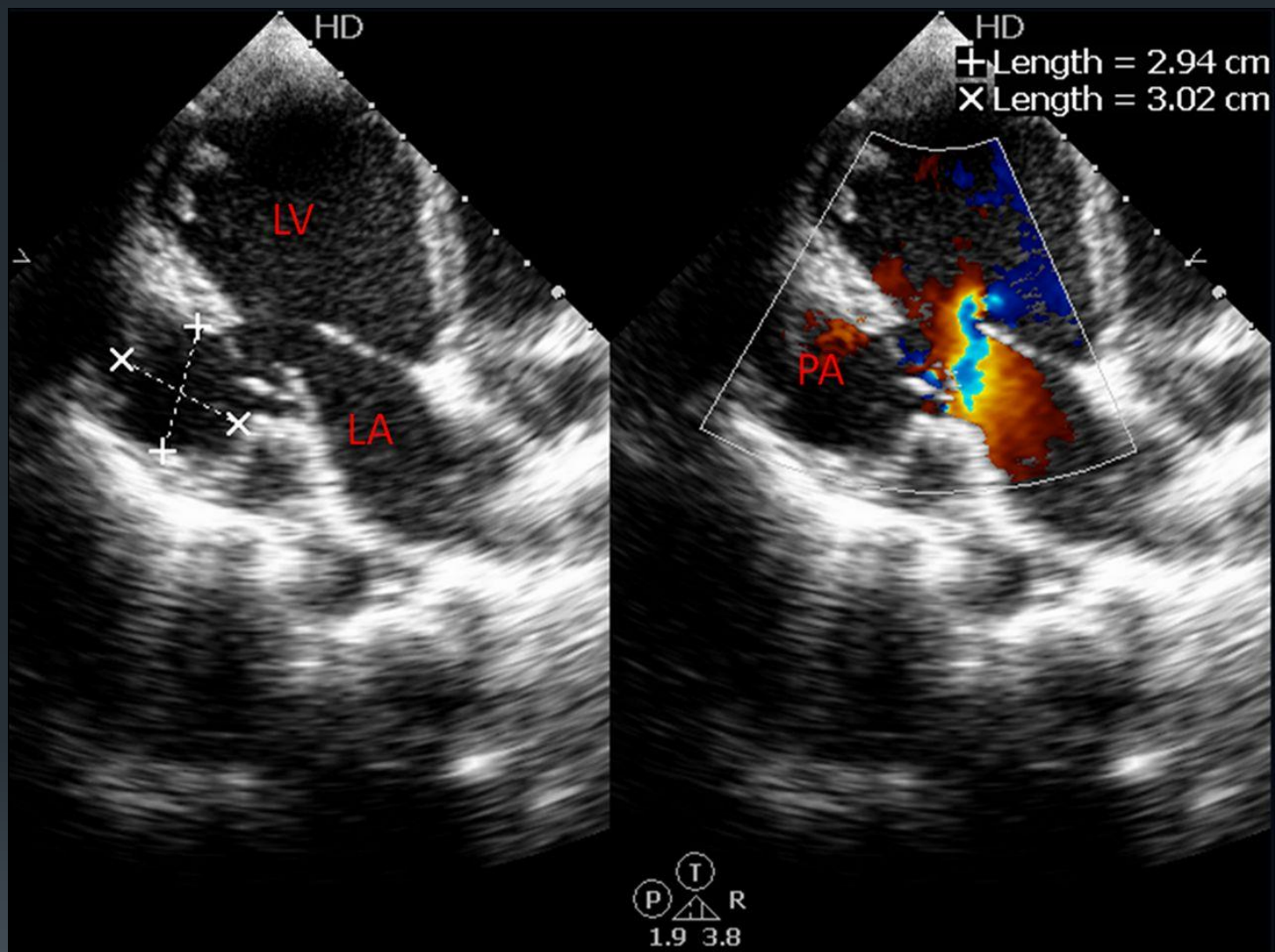
Pseudo-aneurysms

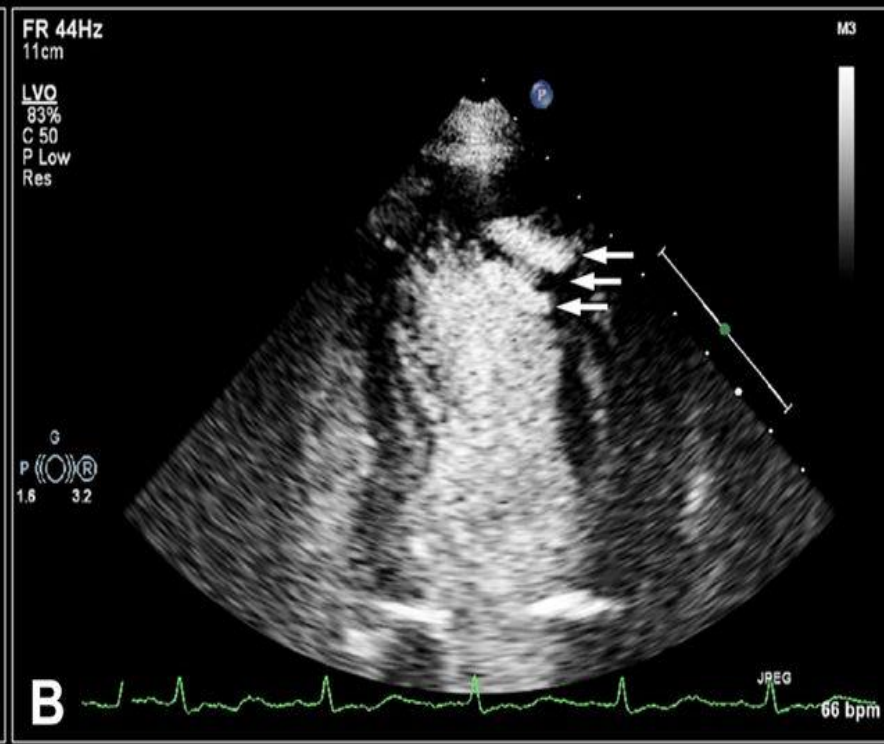
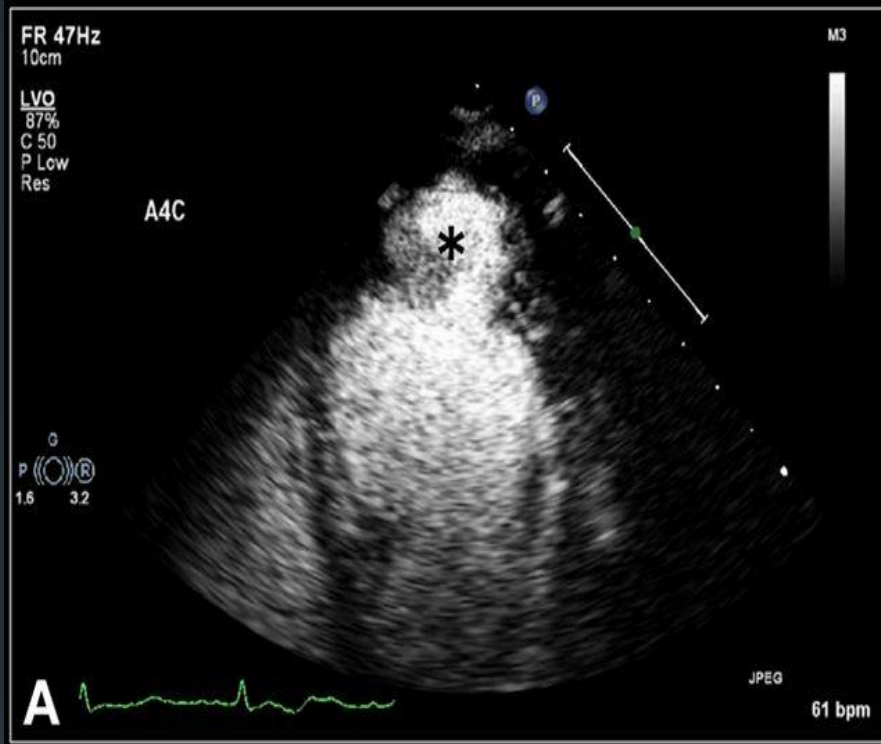
Aneurysms

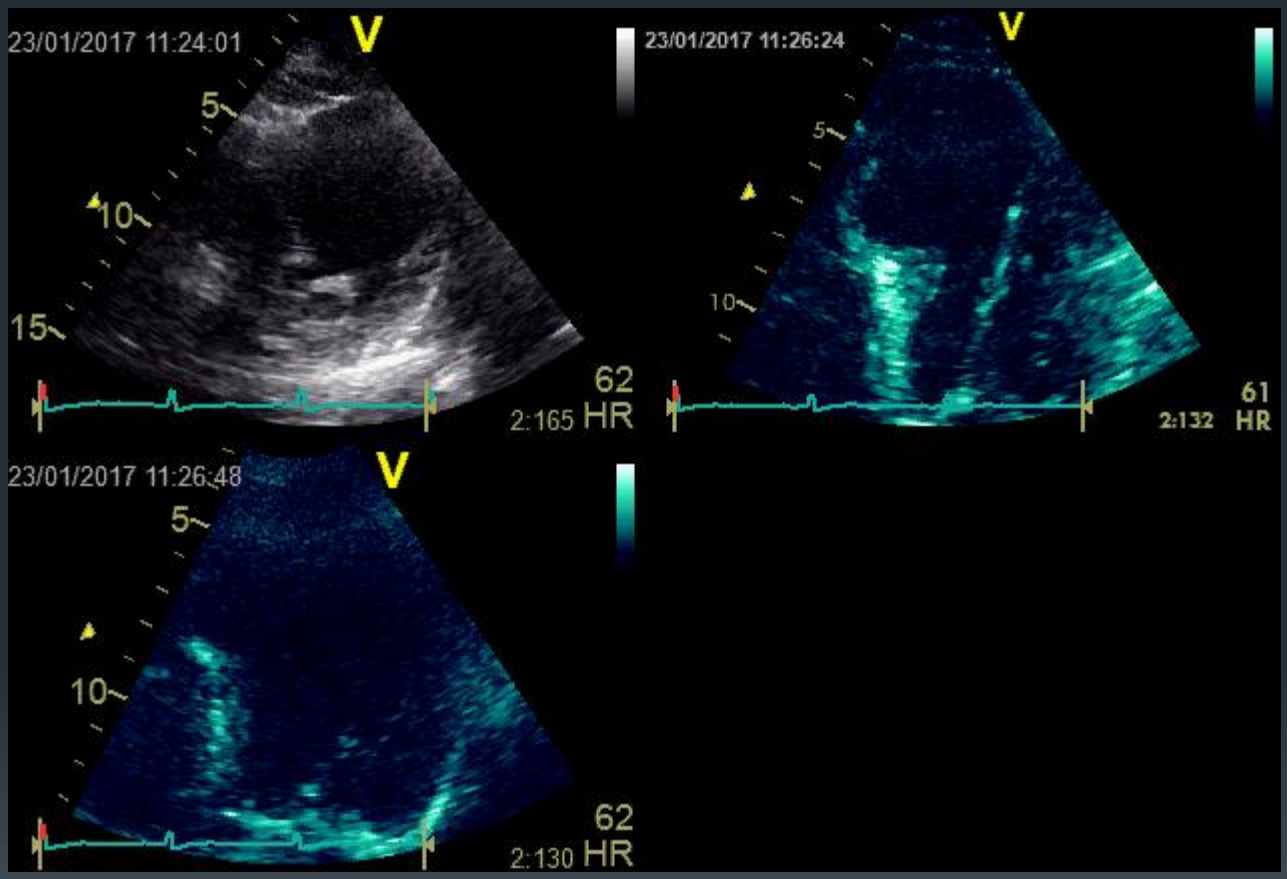


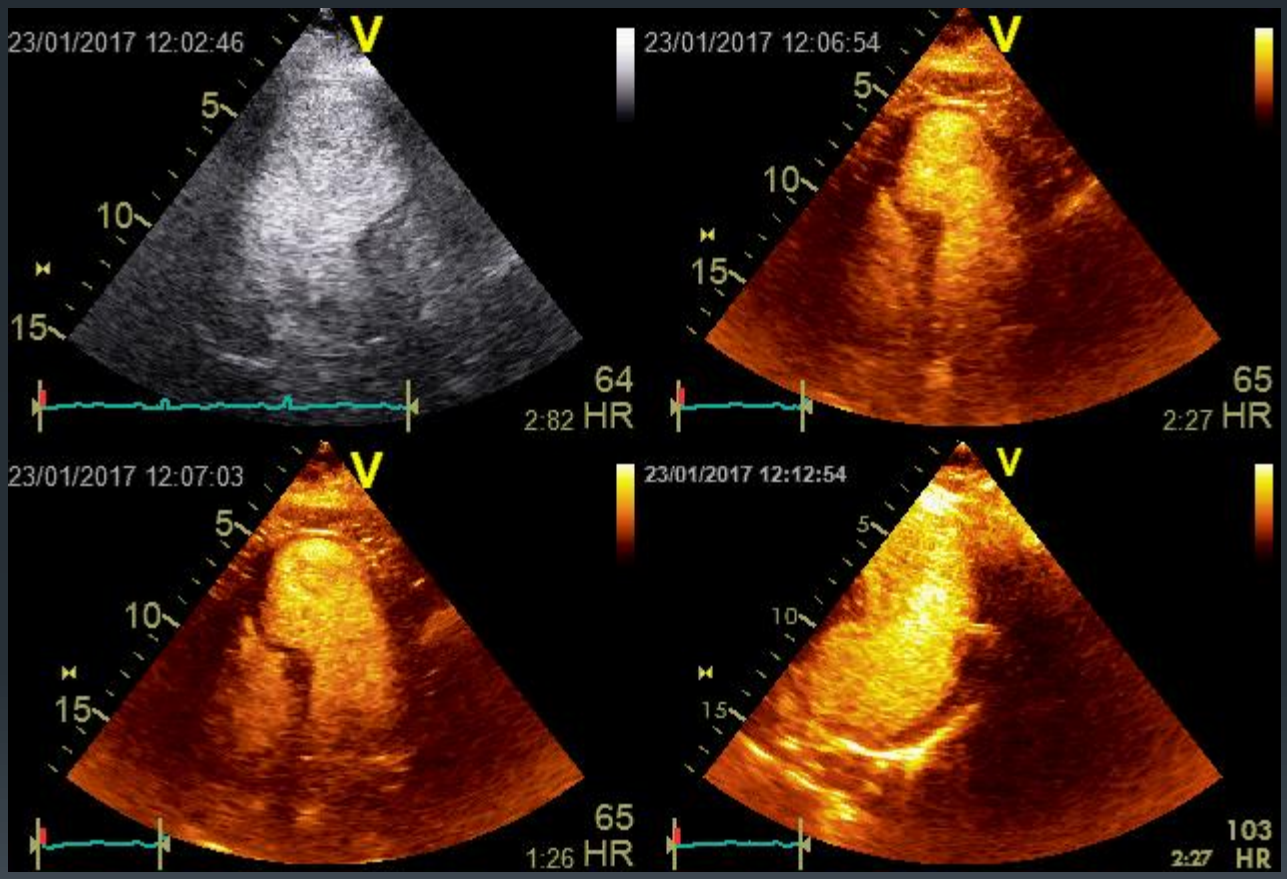
- Narrow base
- Walls composed of pericardium and thrombus
- High risk of rupture

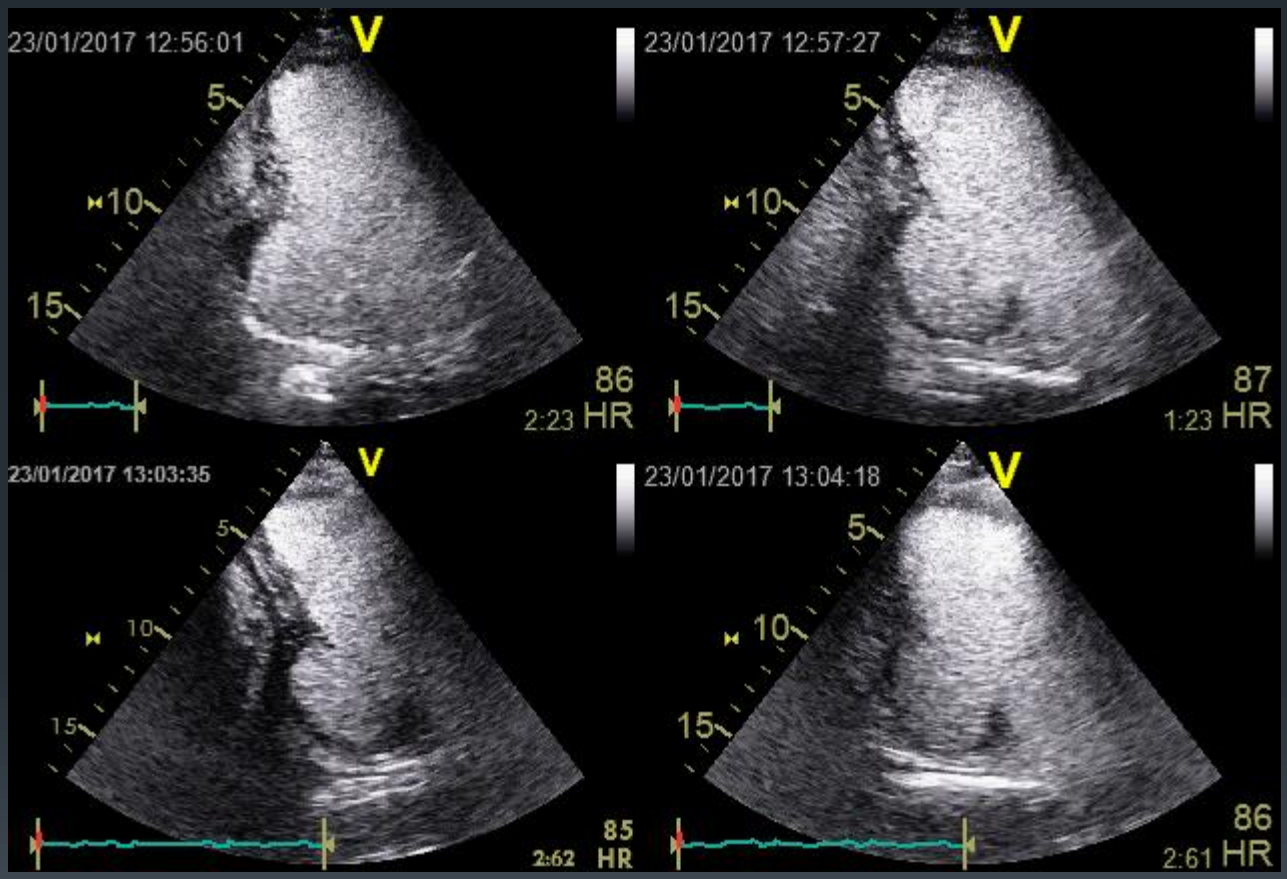
- Wide base
- Walls composed of myocardium
- Low risk of rupture







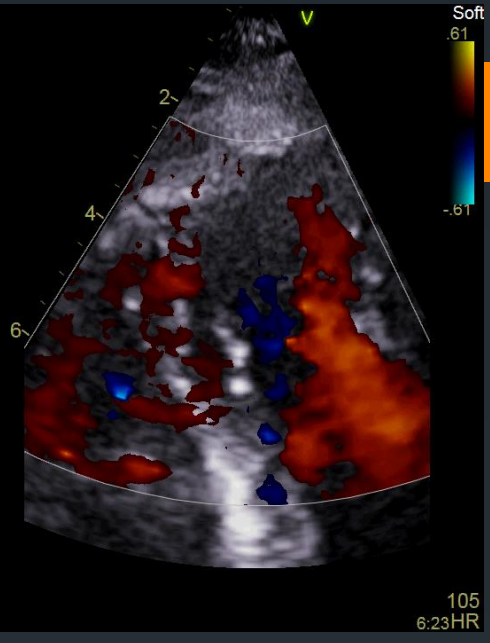
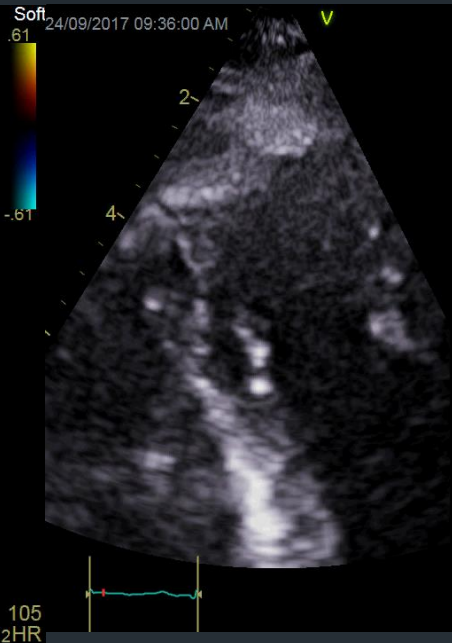
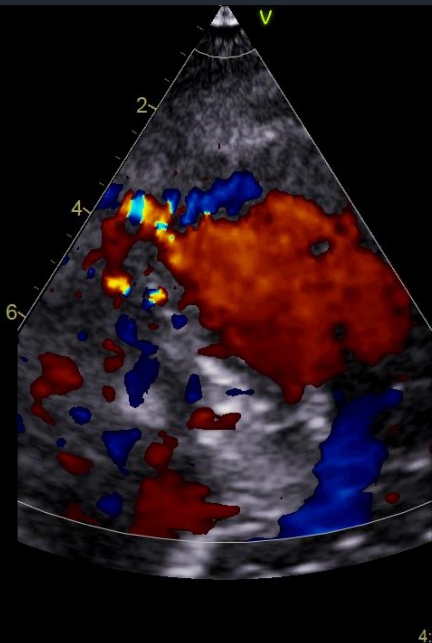




	Aneurysms	Pseudo-aneurysms
Location	3% posterior	Posterior or inferior
Echocardiography		
Anatomy	Thinned myocardium	Ruptures
Contractility	Non contractile	Dyskinesia
Consequences/Complications	Congestive heart failure Embolic events Ventricular arrhythmias	Congestive heart failure Embolic events Ventricular arrhythmias
Therapy	Medical or Surgical therapy	Surgery
Surgical risk	Dubious	Lower than medical therapy

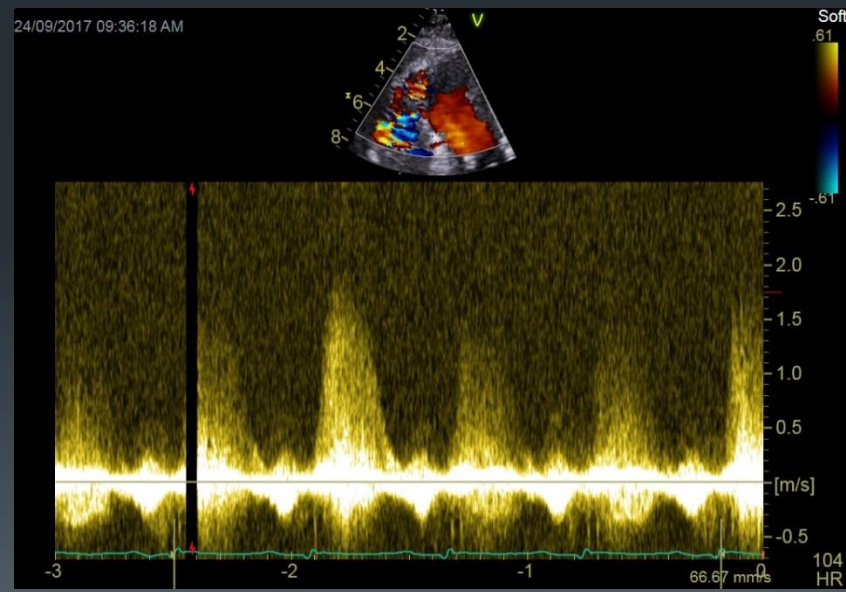
Ventricular septal rupture

- ❑ Occurs in 0.2 to 1% patients with MI
 - Bimodal distribution – 24 hrs. and days 3-5
- ❑ Any portions of the septum may be involved margin between necrotic and non necrotic myocardium
- ❑ Anterior VSR s tend to located distally with defects that perforate the septum at the same level - “simple”
- ❑ Inferior VSRs located more toward the base and follows a serpingenious course - “complex”



105
4:12HR

105
6:23HR



Ventricular septal rupture



Presentation

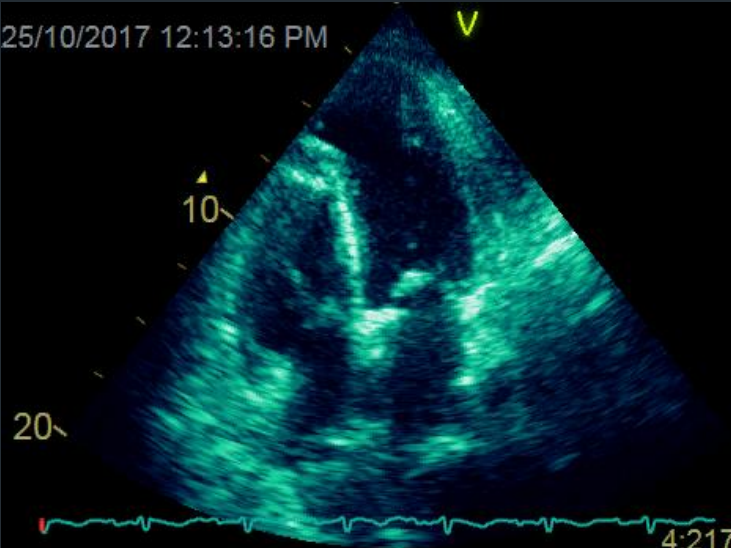
- ✓ Holosystolic murmur (often loud)
- ✓ Thrill
- ✓ Heart failure

Ventricular septal rupture

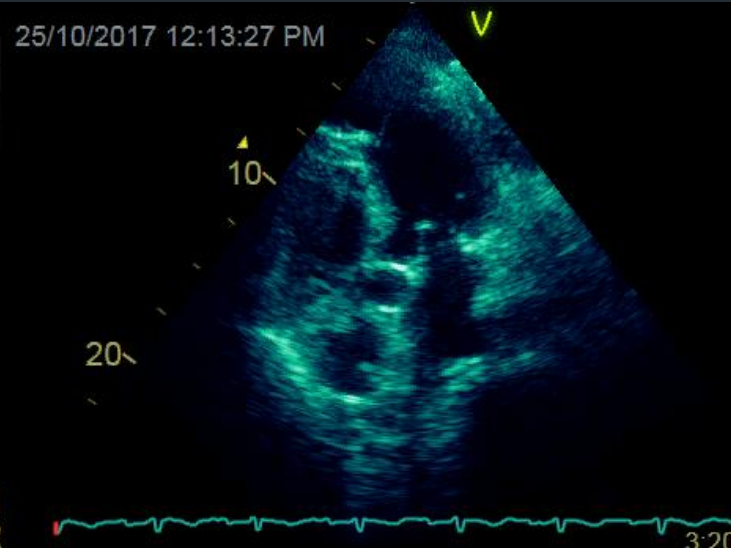
Treatment

- ❑ Medical Therapy
 - ✓ Diuretics
 - ✓ Inotropes
 - ✓ Vasodilators
 - ✓ IABP
- ❑ Surgery
- ❑ Percutaneous Closure

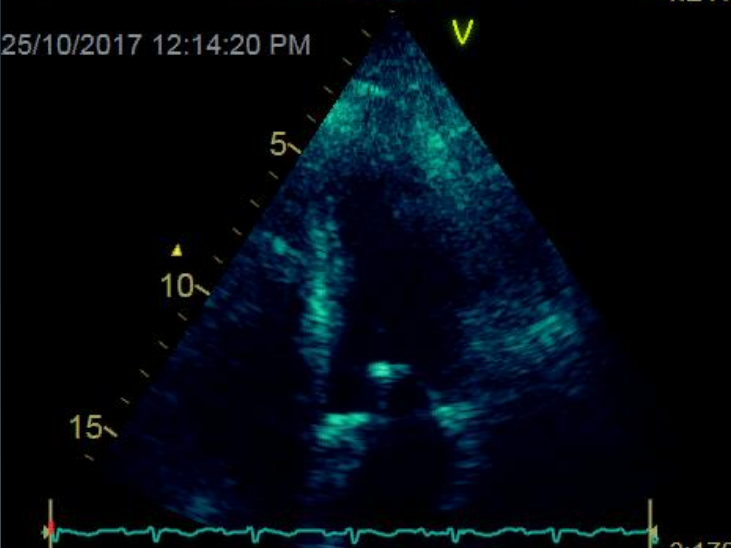
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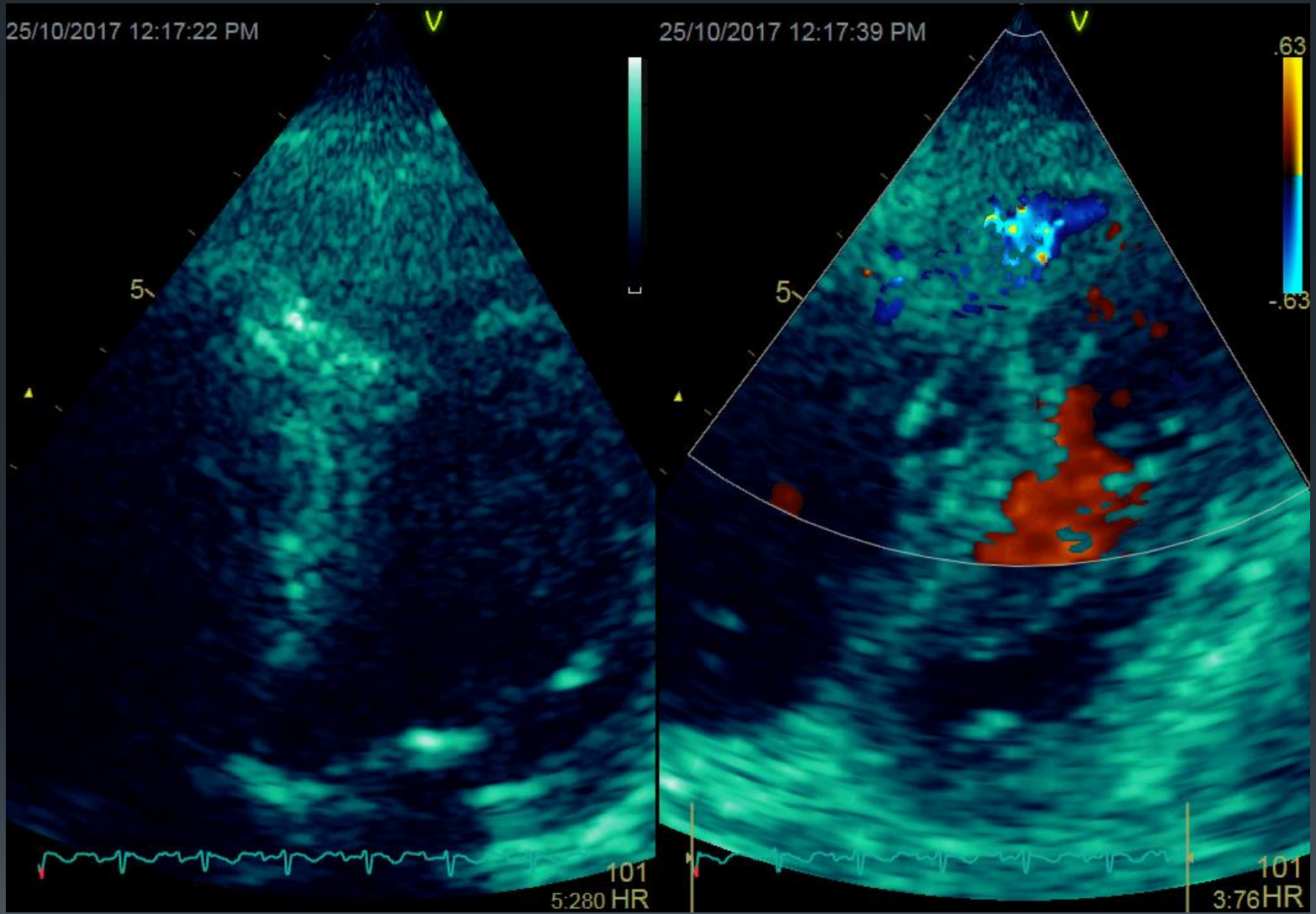


101
4:217HR

101
3:209HR

102
3:170HR

101
3:280HR



Papillary Muscle Rupture

- ❑ **Least common mechanical complication**
- ❑ **Pathology**
 - ✓ Complete
 - ✓ Partial – muscle heads/tips
- ❑ **Posteromedial papillary muscle more often involved (single blood supply)**
- ❑ **Often occurs with relatively small infarcts (poor collaterals)**

Papillary Muscle Rupture

□ Presentation

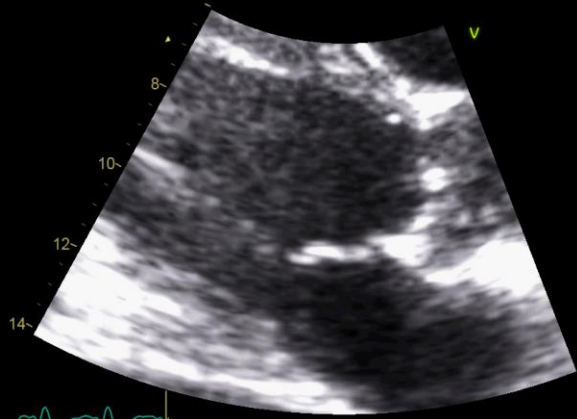
- ✓ 1 to 7 days after MI
- ✓ Heart failure
- ✓ Shock
- ✓ MR murmur
 - may be soft/indistinct
 - often no thrill present

Papillary Muscle Rupture

Echocardiographic features

- ❑ Flail mitral leaflet with systolic cusp prolapse to LA
- ❑ Mobile echogenic mass attached to the chordae tendinae and to the mitral valve
- ❑ No prolapse of papillary head to LA is observed in 35%
- ❑ Abnormal cutoff of one papillary muscle
- ❑ Severe MR
 - Color –flow disturbance area can be small
 - Cut-off sign in CW spectral profile
- ❑ Hyper dynamic LV function

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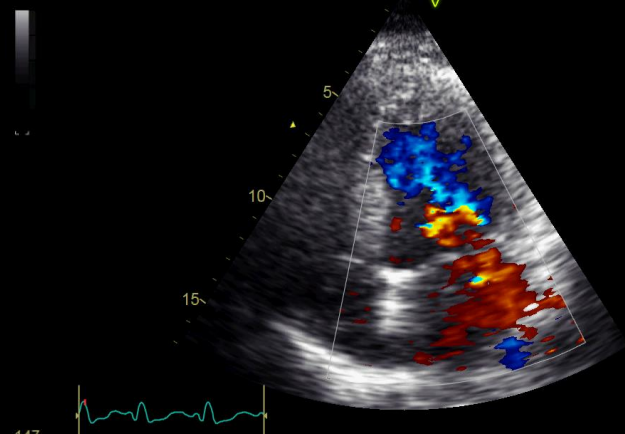
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HR: 146



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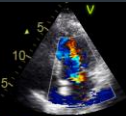


63
-63

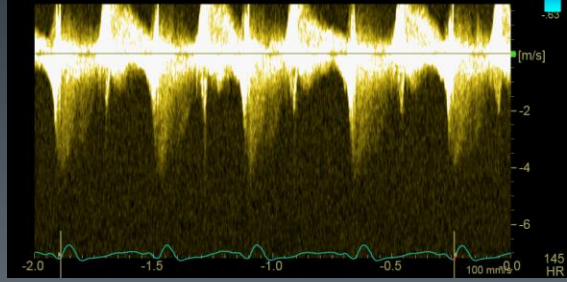
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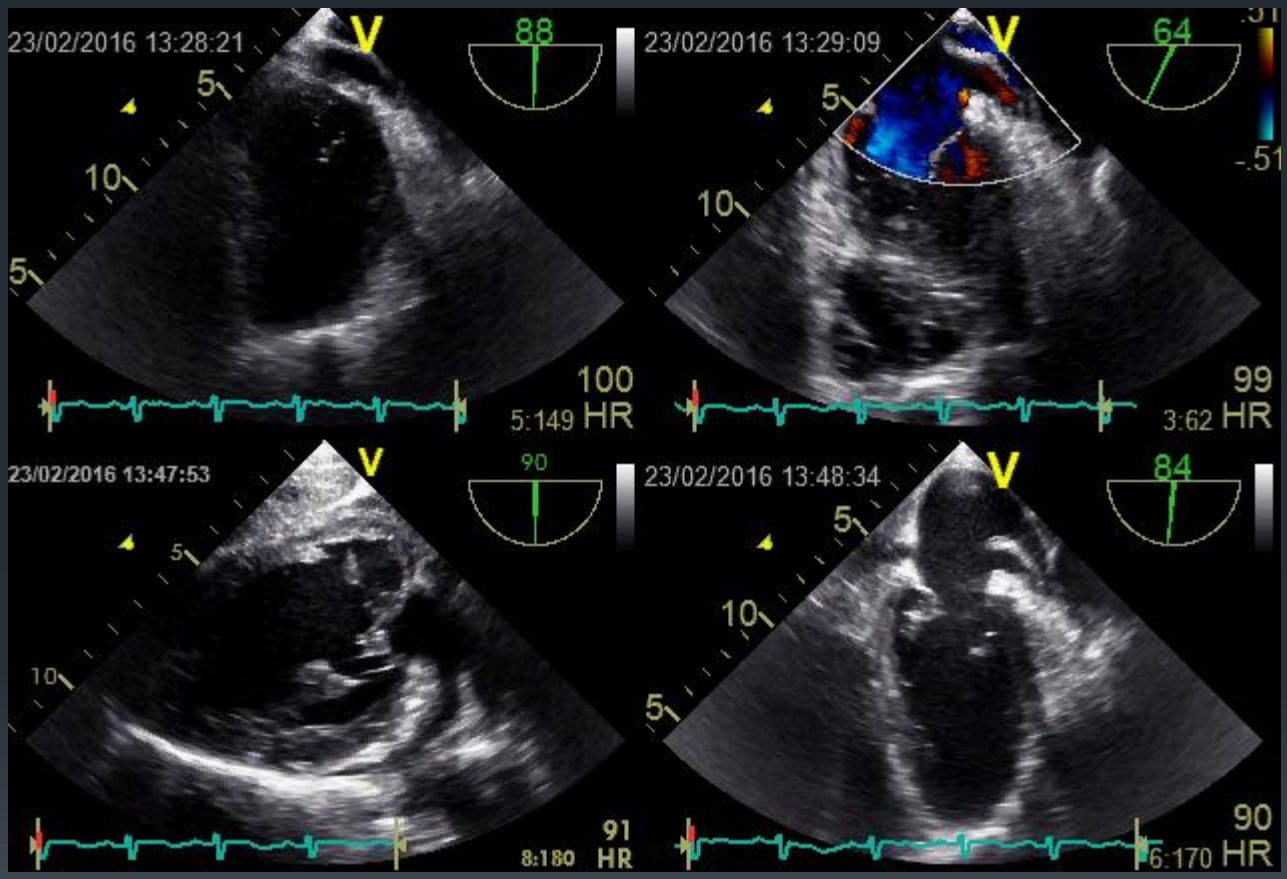
141
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63
-63





Acute Mitral Regurgitation

Treatment

- ❑ Medical therapy
 - ✓ Inotropic support
 - ✓ Diuretics
 - ✓ Afterload reduction
- ❑ IABP
- ❑ Surgery

Right ventricular MI

□ Common association with inferior MI

- ✓ RV apical segments may be involved in LAD occlusion
- ✓ ST segment elevation in V1 and or V4R- V6R
- ✓ Mortality high vs inferior MI

□ Clinical presentation

- ✓ Hypotension (preload sensitive)
- ✓ Clear lung fields
- ✓ Increased JVP (Kussmaul sign may be present)
- ✓ Lack of pulmonary congestion

□ Hypoxemia

- ✓ Right to left shunting via PFO

Echocardiographic features

- ✓ Focal RV wall motion abnormalities – McConnell's sign
- ✓ Paradoxical septal motion due to acute volume overload
- ✓ Dilation of RV (RA)
- ✓ Small LV
- ✓ Bowing of interatrial septum from right to left
- ✓ RV thrombus
- ✓ Tricuspid regurgitation
- ✓ TAPSE and RVS' reduced
- ✓ IVC plethora
- ✓ Right to left shunting via PFO

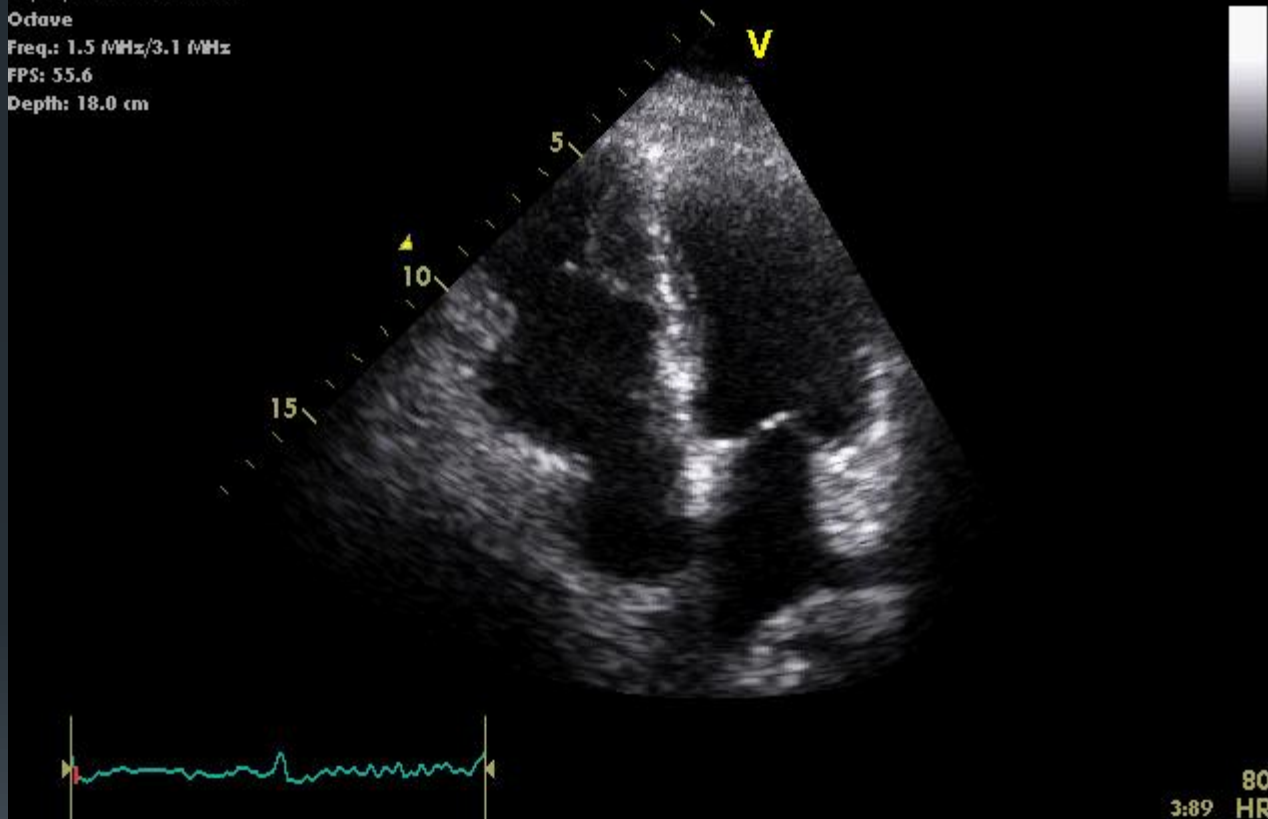
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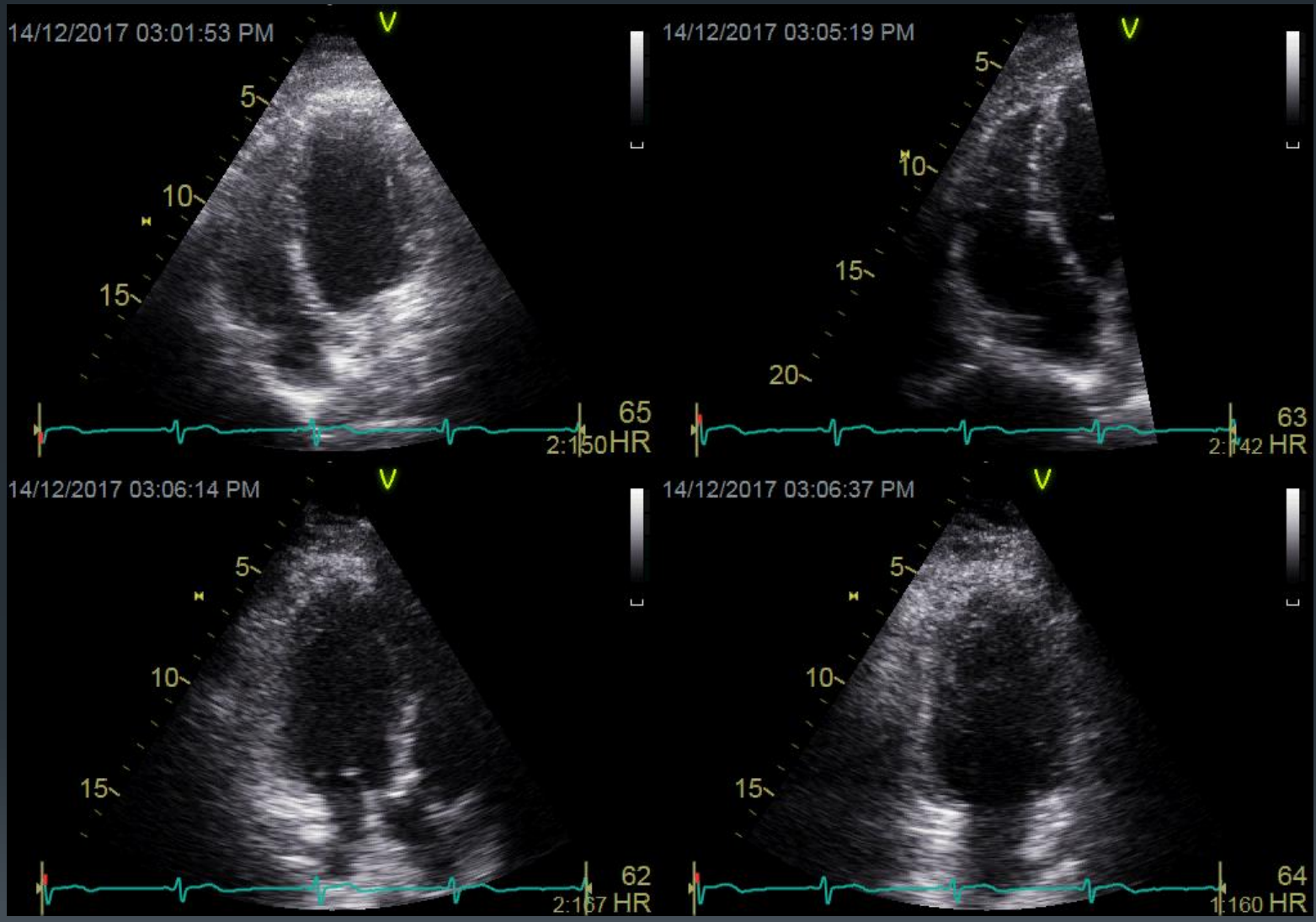
Odave

Freq.: 1.5 MHz/3.1 MHz

FPS: 55.6

Depth: 18.0 cm



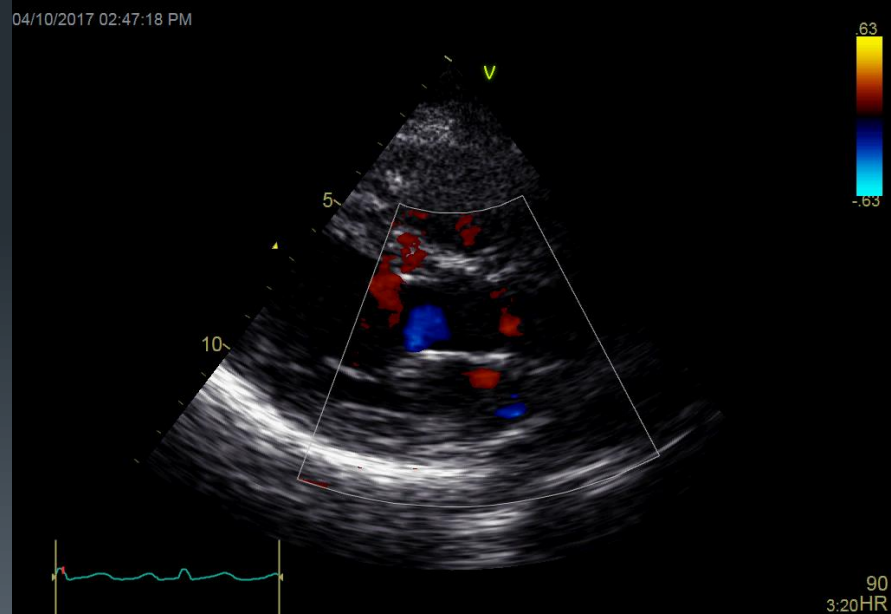
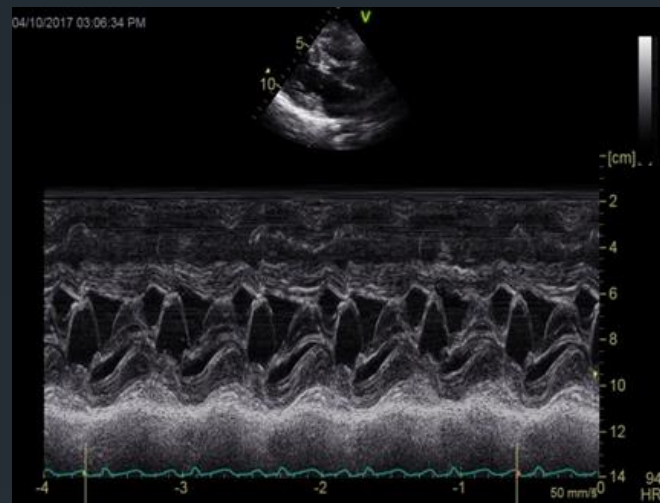
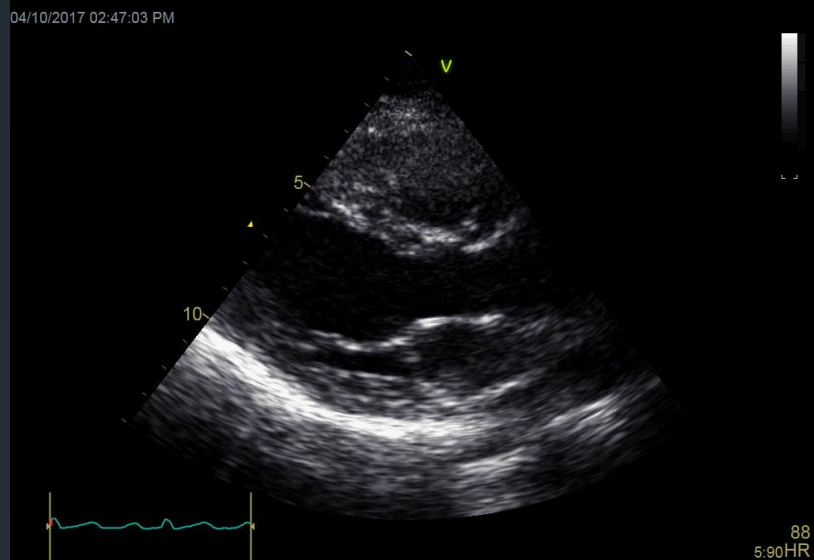


Dynamic LV outflow obstruction

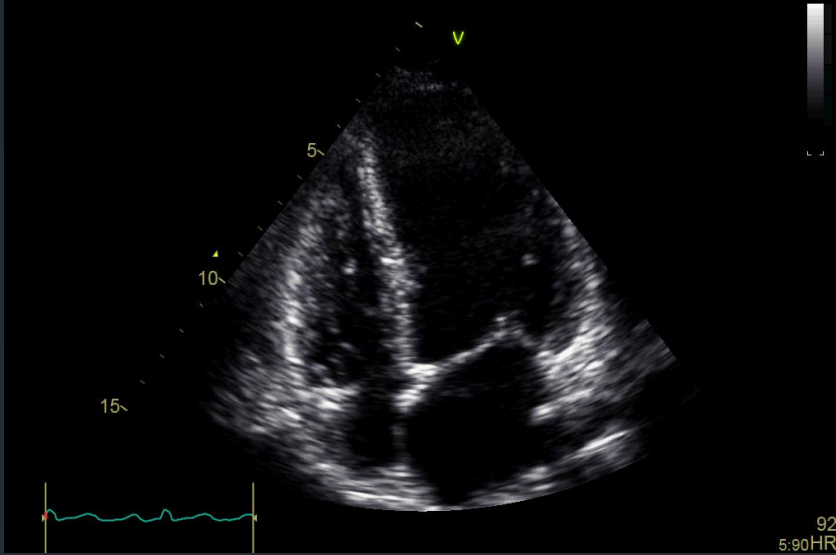
- ❑ In setting of apical infarction sparing the base

- ❑ Basal hyper kinesis
 - ✓ Systolic anterior motion of mitral leaflet
 - ✓ Dynamic LVOT obstruction
 - ✓ Hypotension
 - ✓ Systolic murmur

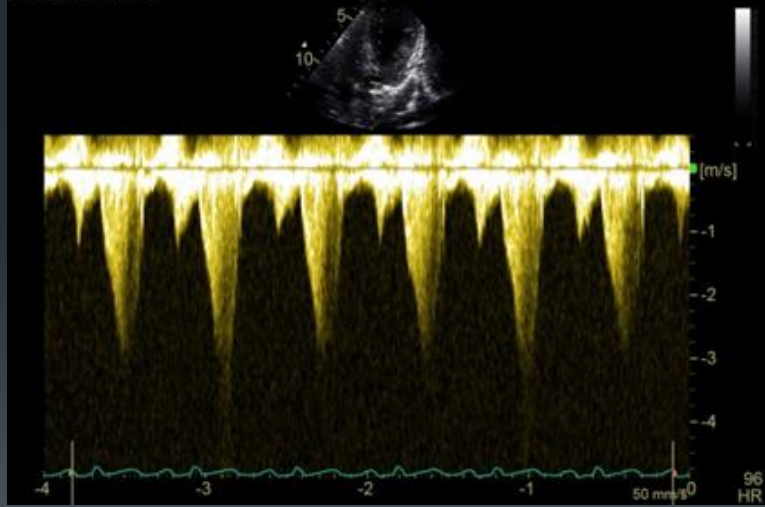
- ❑ Exacerbation by inotropic agents and IABP



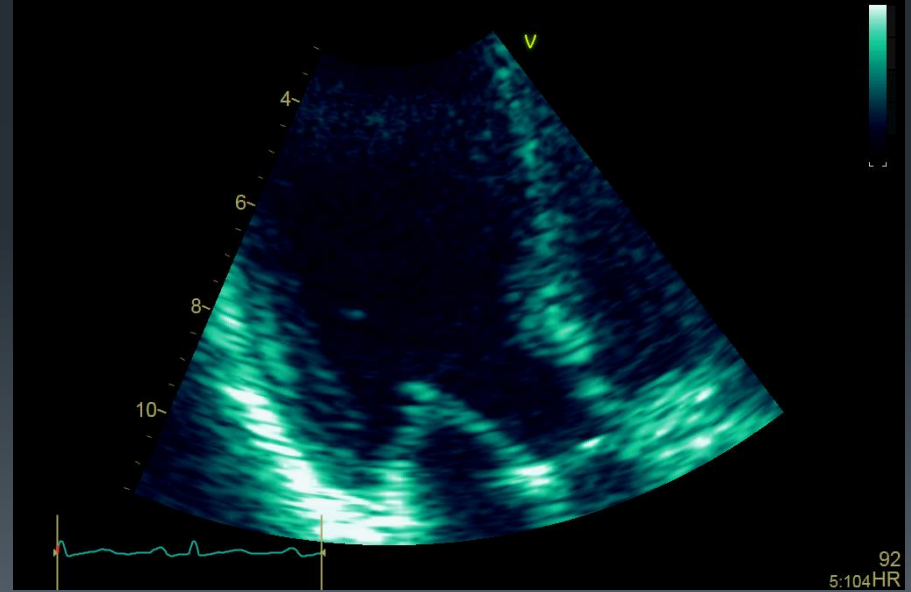
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Left ventricular thrombus

- ❑ Anterior wall infarcts

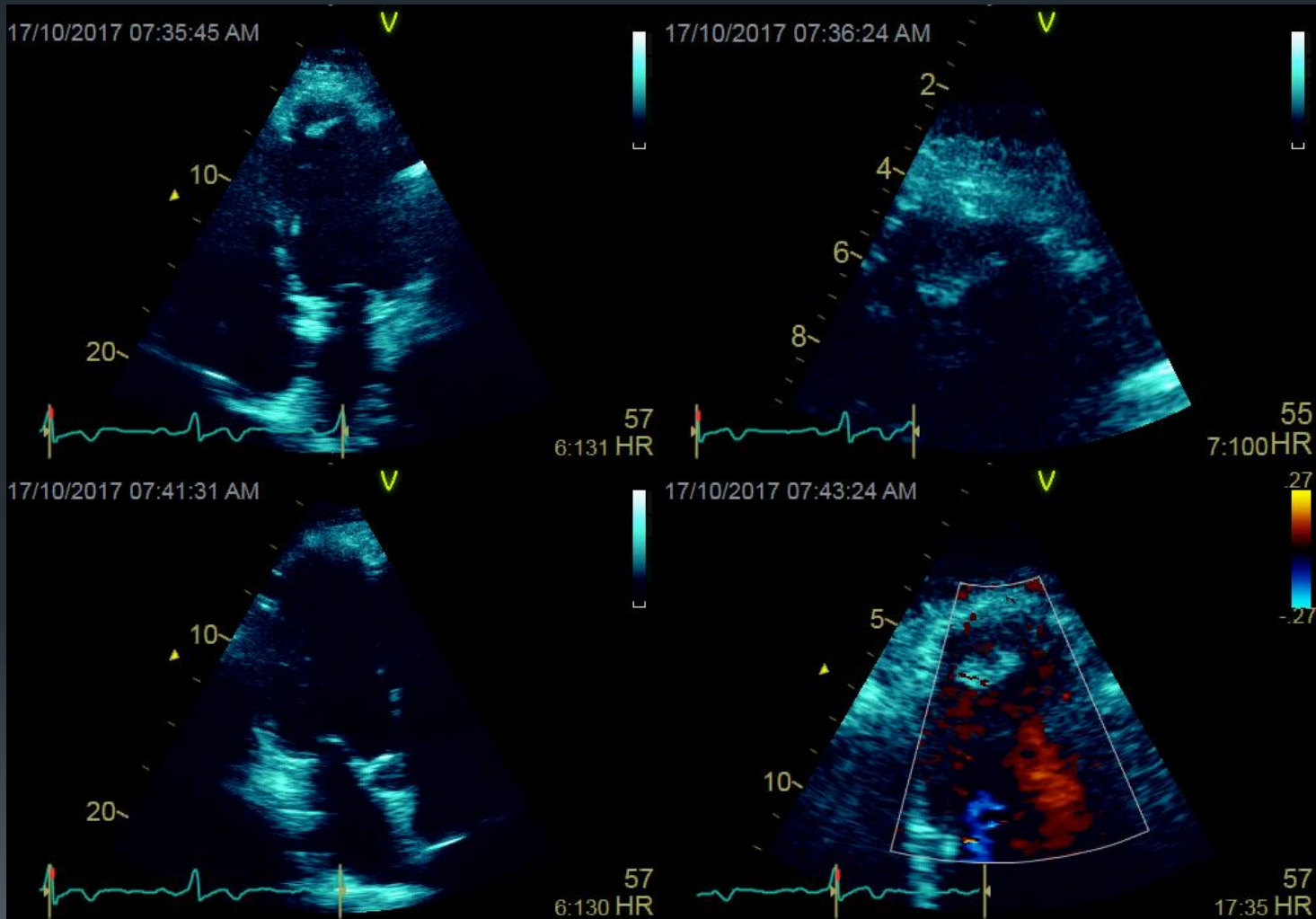
 - 20-40% (60% in large anterior-wall AMIs, not treated with anticoagulant therapy)

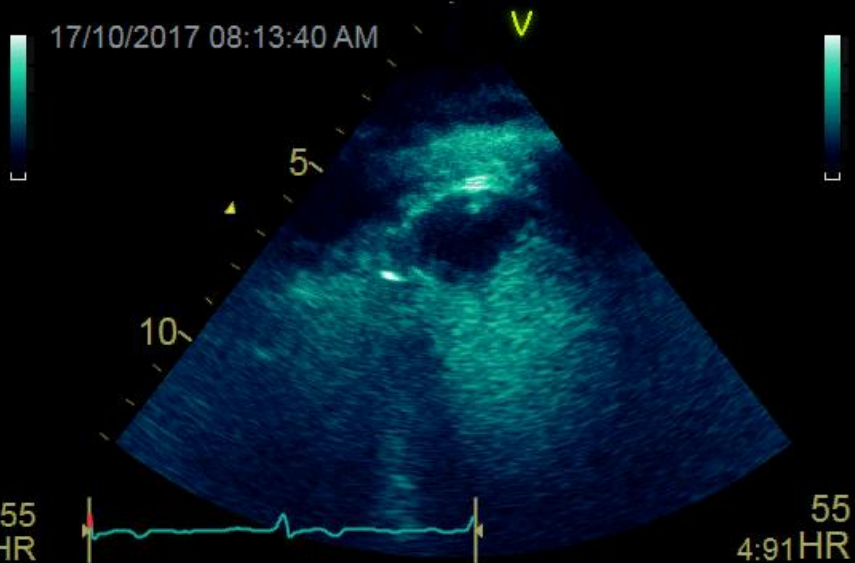
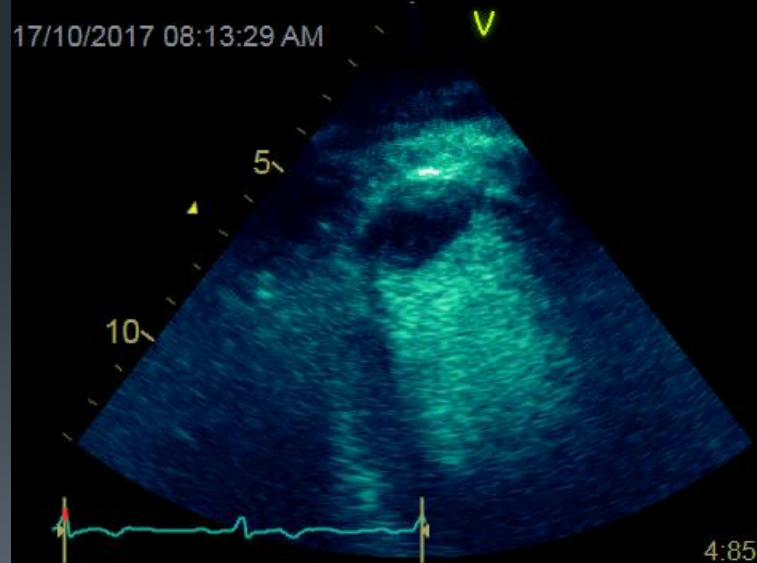
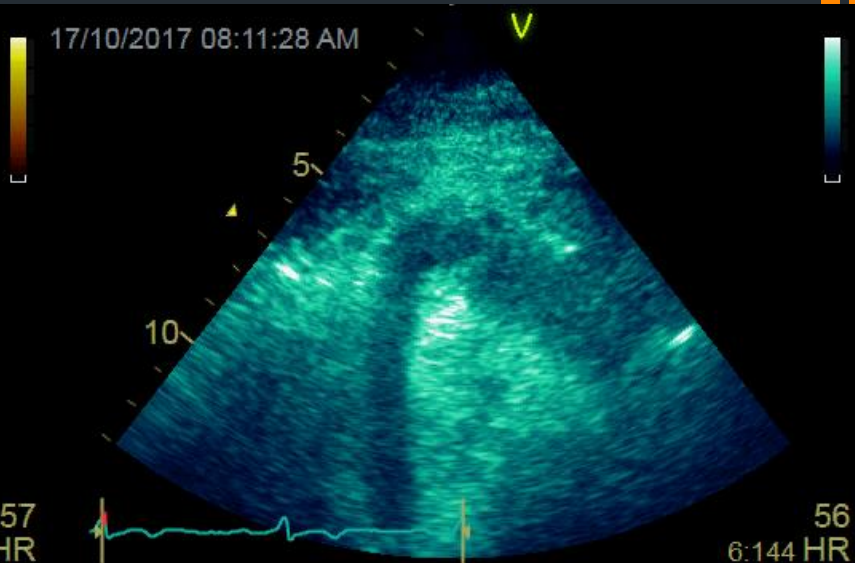
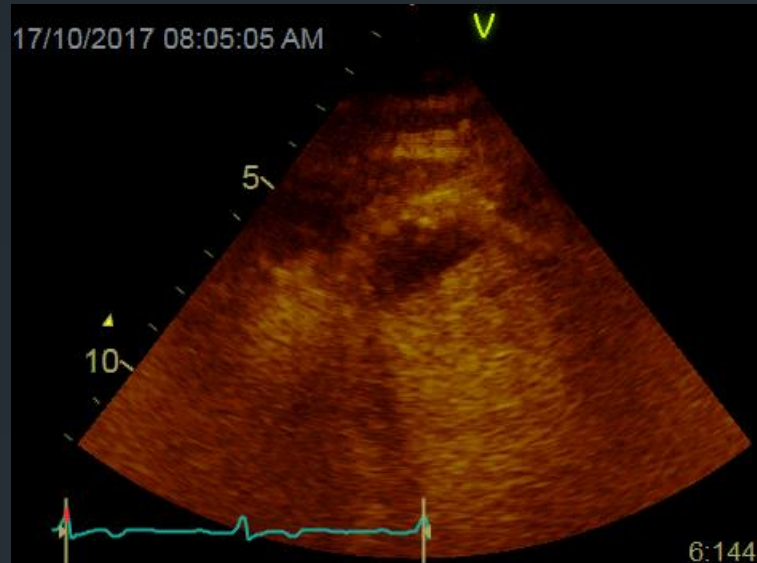
- ❑ High risk of systemic embolization (Anticoagulant therapy ↓ rate of embolic events by 33% anticoagulation)

- ❑ Most common presentation is Stroke (within the first 10 days after AMI)

Left ventricular thrombus

- ❑ Transthoracic echocardiography is modality of choice (92% sensitivity, 88% specificity)
- ❑ Management - heparin treatment followed by oral warfarin therapy for 3-6 months, lifelong anticoagulation if a clot persists.





Etiologies , Incidence and Mortality

Causes	Incidence	Mortality
Predominant left ventricular failure	78%	59%
Severe mitral regurgitation	6.9%	55%
Ventricular septal rupture	3.9%	87%
Isolated right ventricular shock	2.8%	55%
Free wall rupture and tamponade	1.4%	55%
Average		60%

*Hochman JS, Buller CE, Sleeper LA, Boland J, Dzavik V, Sanborn TA, et al. Cardiogenic shock complicating acute myocardial infarction--etiologies, management and outcome: a report from the SHOCK Trial Registry. SHould we emergently revascularize Occluded Coronaries for cardiogenic shock. J Am Coll Cardiol 2000;36(3 Suppl A):1063-70.

Summary for LAD Infarct

Left anterior descending artery

40% of LV myocardium

His-Purkinje System

Cardiogenic shock due to loss of large amount of myocardium

Advanced Heart Block
(LBBB, 3rd degree A-V block
And Mobitz II 2nd degree)

Intraventricular septum
(upper two – thirds)

Antero-apical wall

Apical LV aneurysm

Acute VSD

Ventricular arrhythmias

Apical thrombus formation

Arterial embolism originating in the LV

Summary for RCA (or Circumflex) Infarct

Right coronary artery

RV Infarct

**Hypotension due to
Decreased LV filling**

**SA –nodal infarct
A-V nodal infarct**

**Brady arrhythmias
1st degree A-V block
Mobitz 2nd degree
block
A-V dissociation**

**Posteromedial
Papillary muscle
infarct**

**Acute MR
(with or without papillary
muscle rupture)**



Thank you