Complications of Acute MI Cases

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Disclosures

- **Director of Academic Echo Core Lab with Grant Support from:**
  - Medtronic, St. Jude, Edwards, Abbott, Sorin, MitraAlign, Sunshine Heart, Boston Scientific, Direct Flow, Symetis

Acute MI: Mechanical Complications

- Free-wall Rupture
- Ventricular Septal Rupture
- Ruptured Papillary Muscle
- Aneurysm/Pseudoaneurysm
- RV Infarct
- Mural thrombus

Case 1

AL - 63 year-old man

Alleged hx MV prolapse

Around X-mas → chest pain
followed by sob

Admitted to OSH → dx CHF (early January)

Transferred to MWHC for ?MV repair +/- CABG

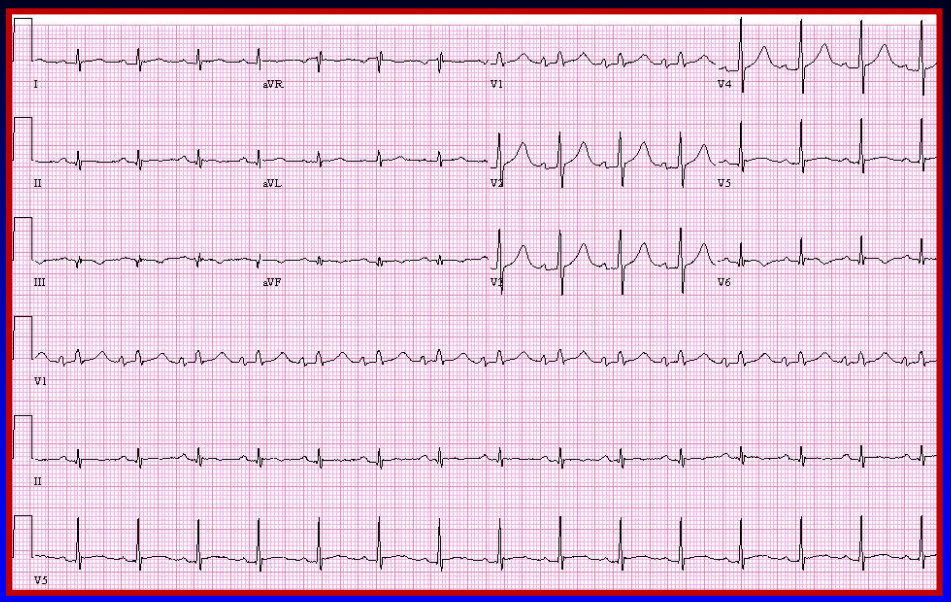
Cath: 80 – 90% proximal LAD

Total occlusion proximal OM1

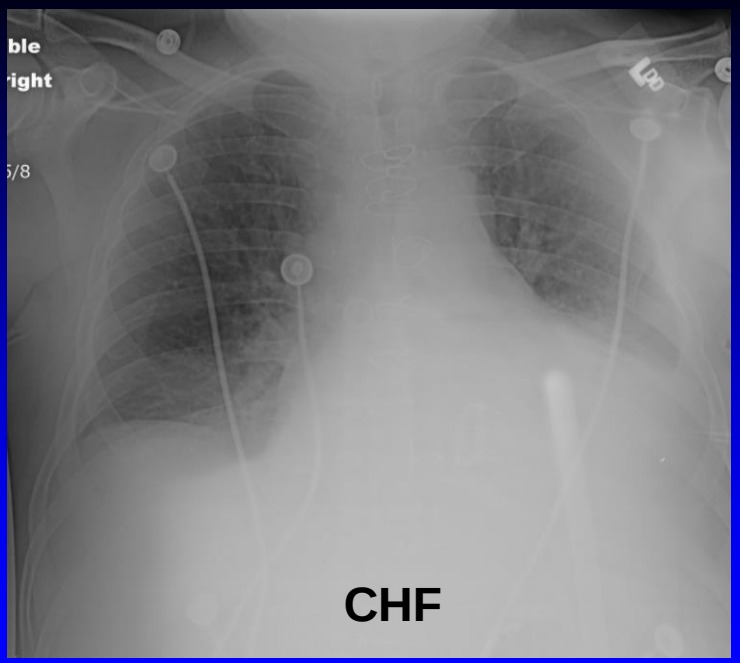
RCA → minor luminal irregularities

LV-gram → LVF lower limits of normal
severe MR
LVEDP 15 mm Hg

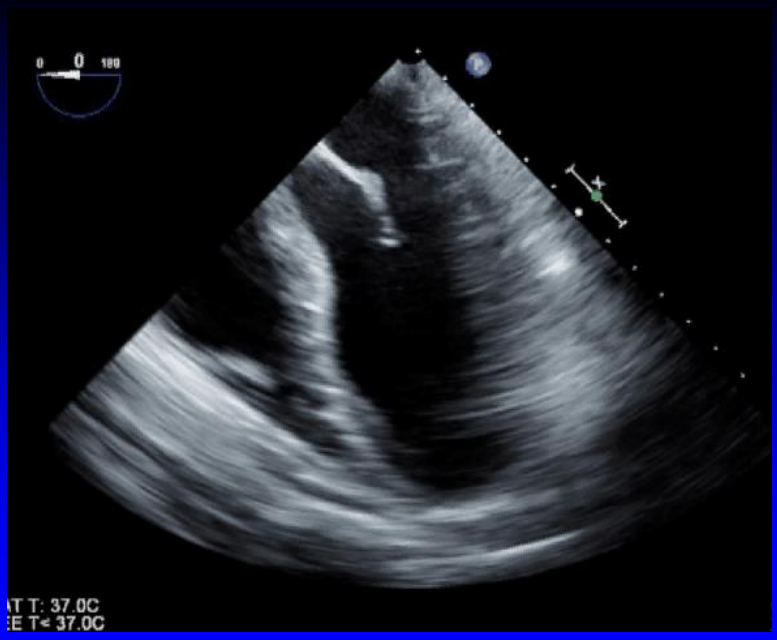
BP 85-95/60 HR 100



Infero-posterior MI



CHF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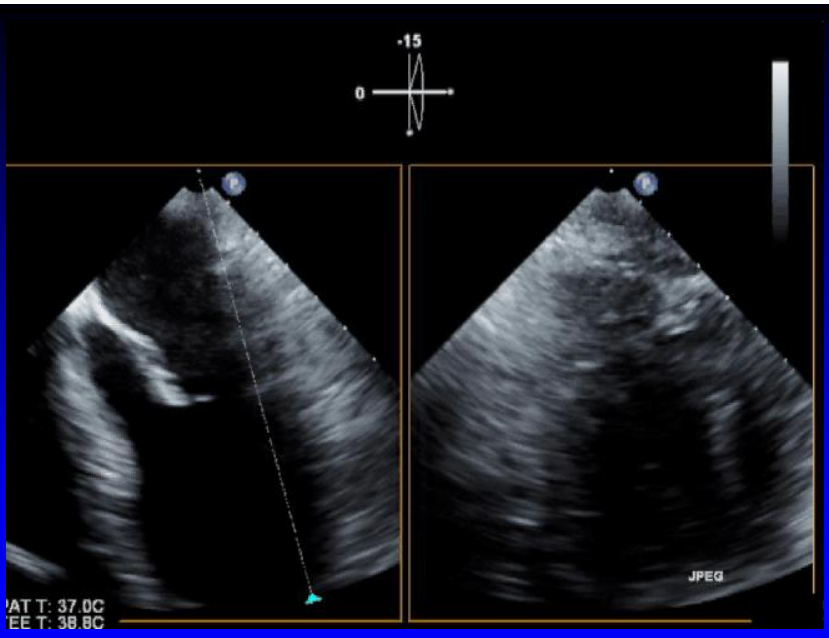
T T: 37.0C
E T< 37.0C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JPEG
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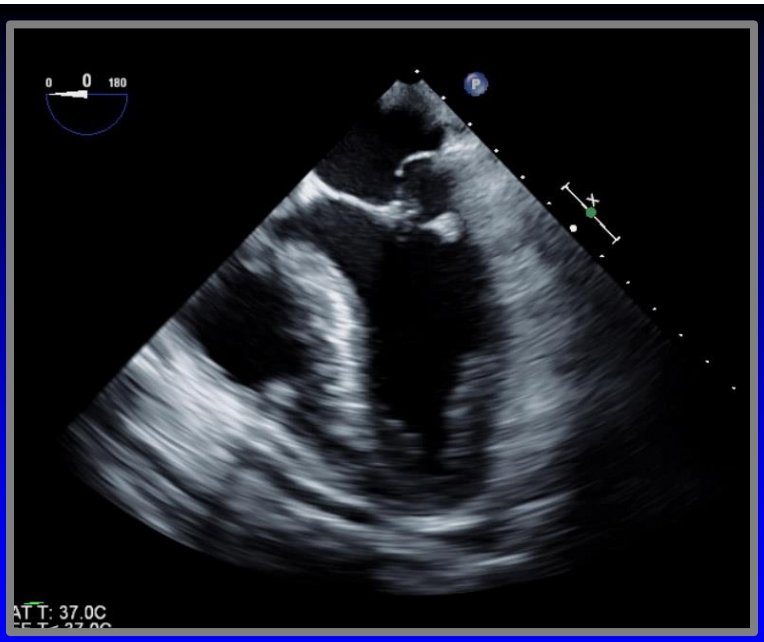
EE T: 38.8C


0 0 180
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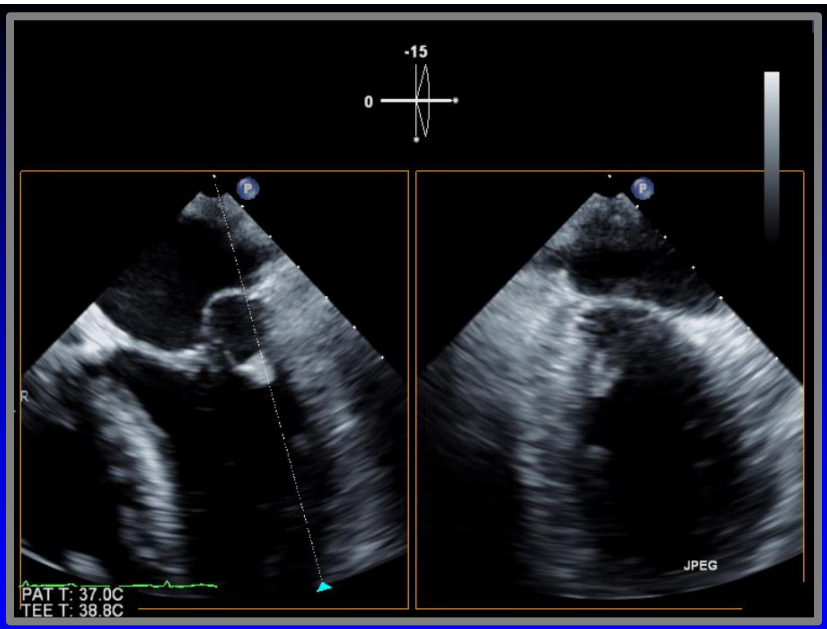
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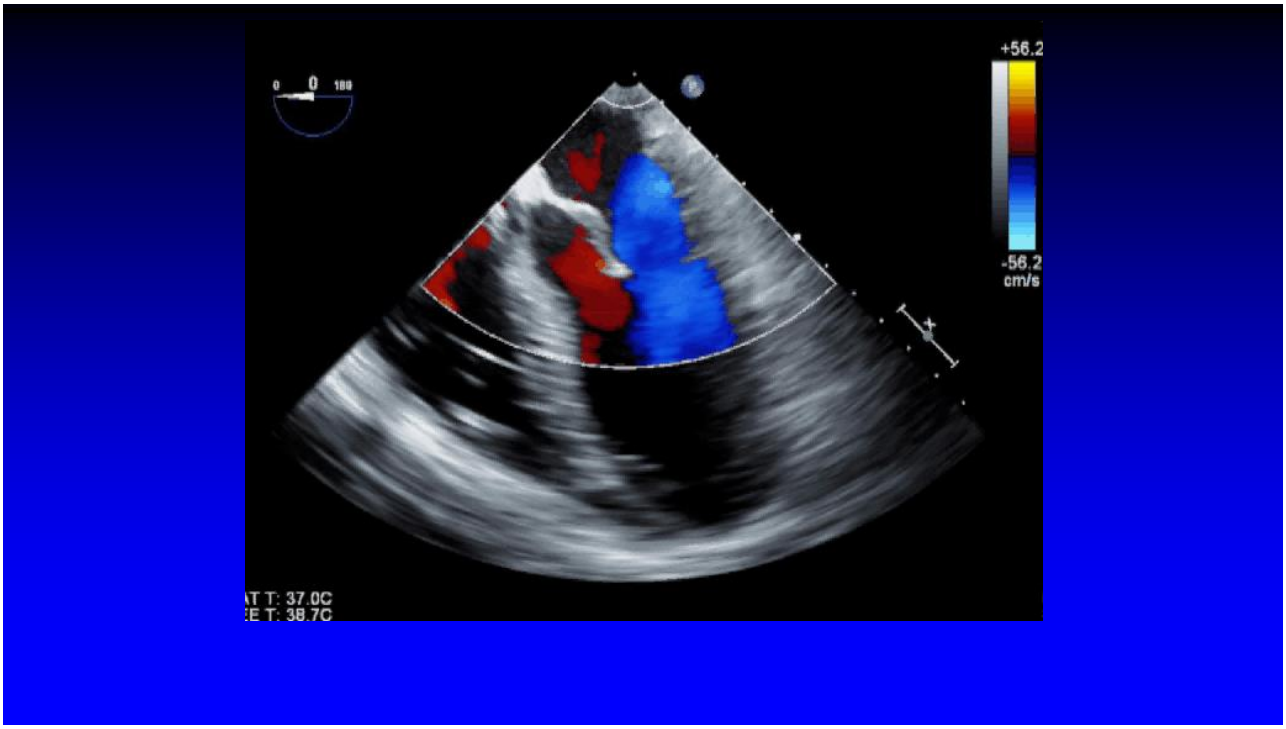
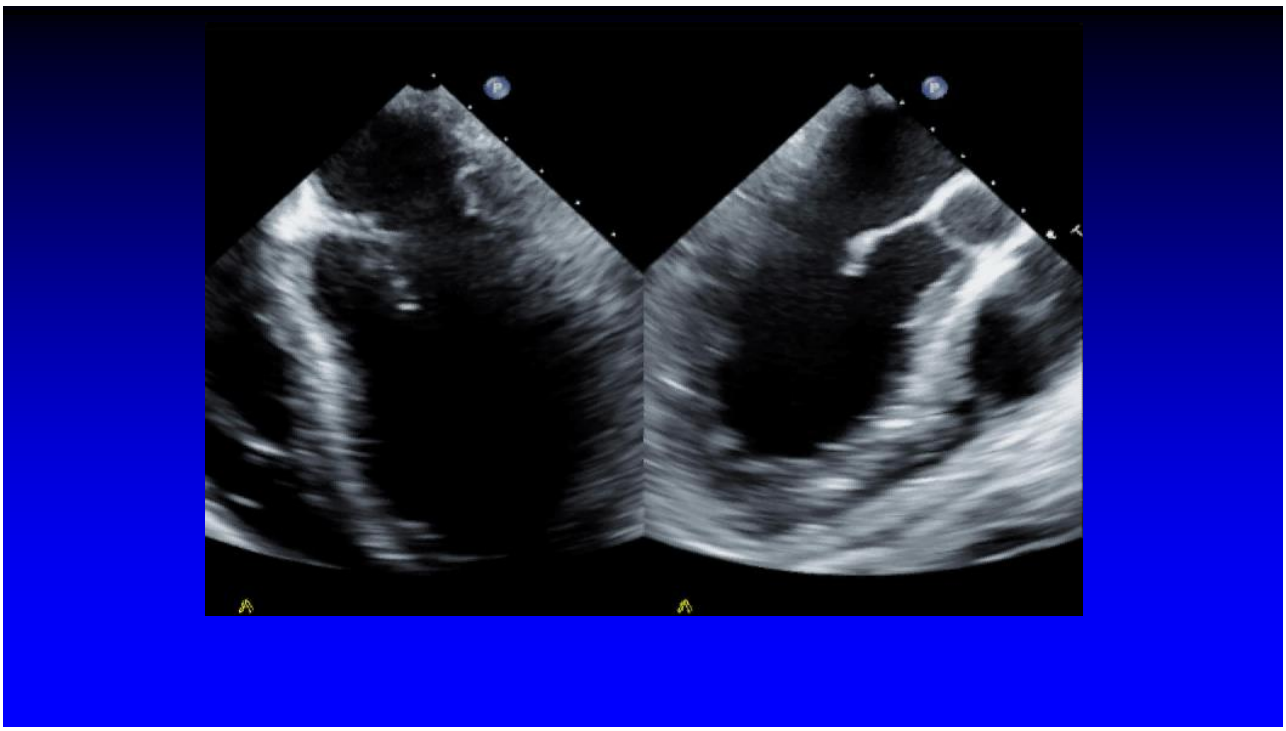
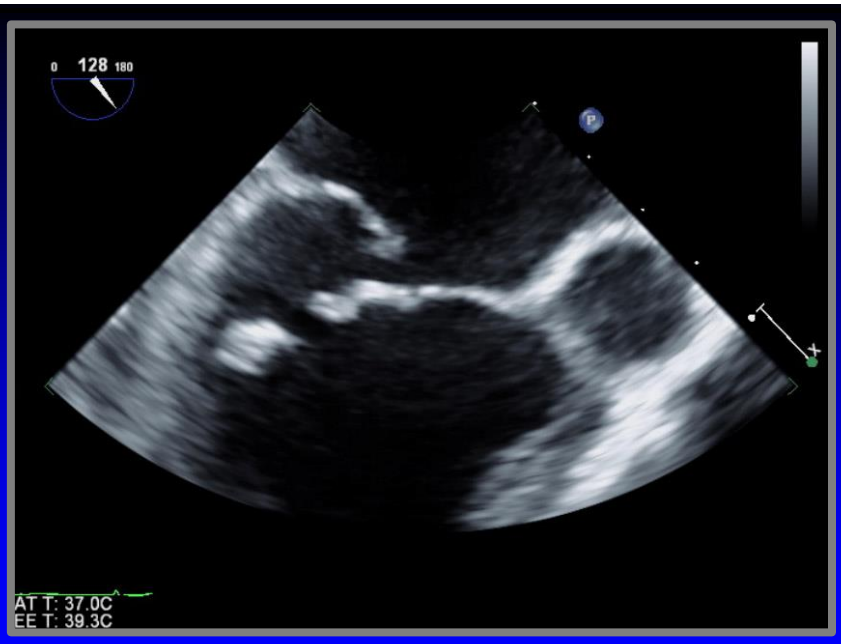
PAT T: 37.0C
TEE T: 38.8C


0 0 180
+56.2
-56.2
cm/s
T: 37.0C
E T: 38.7C

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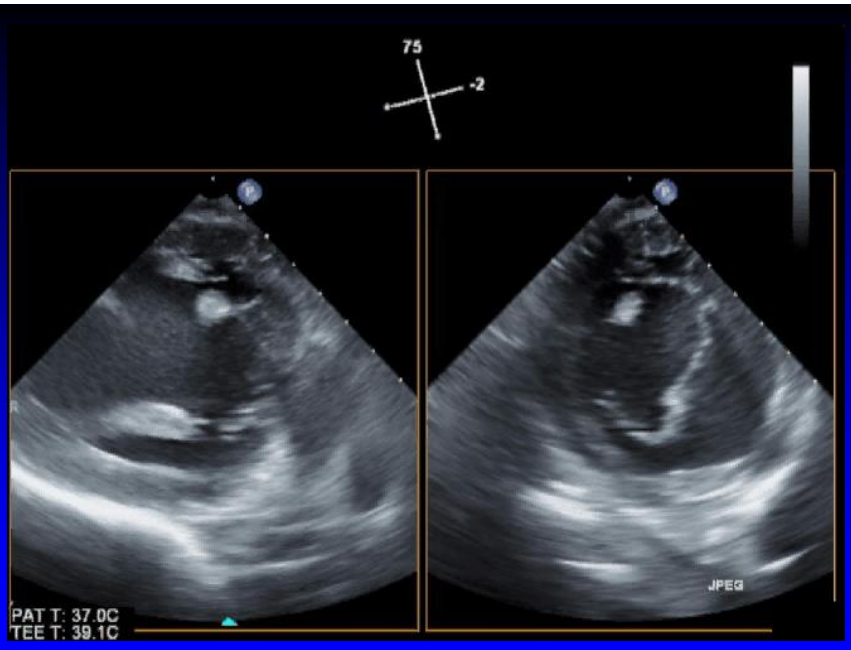
75
-2
JPEG
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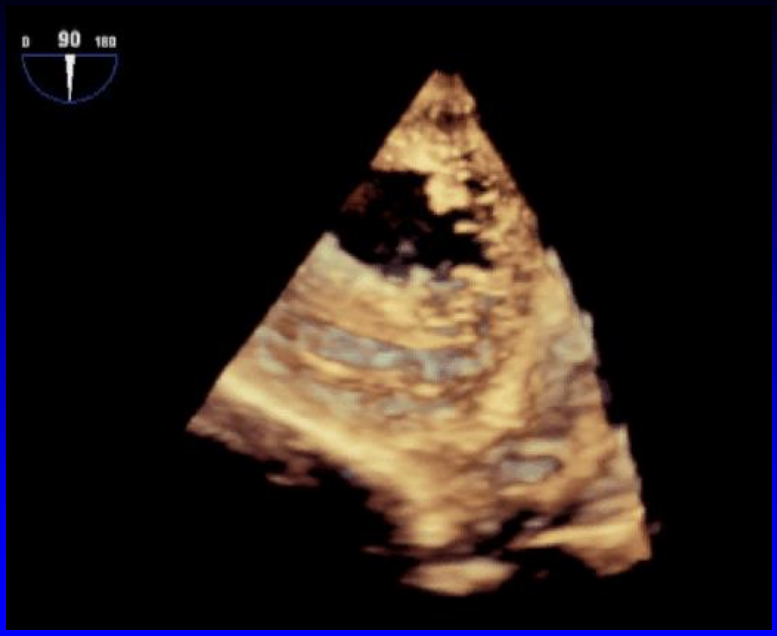
TEE T: 39.1C



Acute MI: Mechanical Complications

- Free-wall Rupture
- Ventricular Septal Rupture
- Ruptured Papillary Muscle
- Aneurysm/Pseudoaneurysm
- RV Infarct
- Mural thrombus

Papillary Muscle Rupture

- Occurs in up to 1% acute MIs
- Accounts for 5% deaths
- Postero-medial 6-12 x more common
- Relatively small myocardial MI (50%)
- Surgical emergency
  (50% mortality within 1st 24 hours if not operated)

Papillary Muscle Rupture
Clinical Risk Factors

- Older age
- Female sex
- Inferoposterior myocardial infarction
- Single-vessel disease
- No diabetes

Papillary Muscle Rupture
Clinical Picture

- Sudden, severe pulmonary edema
- Loud systolic murmur (50%)
- Often progresses to cardiogenic shock
- Typically inferior wall MI

Papillary Muscles
Blood Supply

Postero-medial	←	Post desc'g br of RCA
Antero-lateral	←	Diagonal br of LAD Marginal br of LCx

Postero-Medial Pap	Antero-Lateral Pap
	
Poorer, less reliable perfusion from PDB Rupture is 6-12X more common	Relatively generous blood supply: LAD LCx

Papillary Muscle Rupture: TTE vs TEE

"Meta-Analysis" of Published Cases

	TTE	TEE
Erbel	1/1	
Mintz		
Nishimura	1/4	
Come	2/3	
Koenig	2/2	1/1
Patel		1/1
Stoddard	1/1	1/1
Goldman	1/2	1/1
Sakai	1/1	1/1
Maeta	0/1	1/1
Smyllie	2/5	1/1
Zotz	2/5	4/5
TOTALS	12/25 **48%**	12/13 **92%**

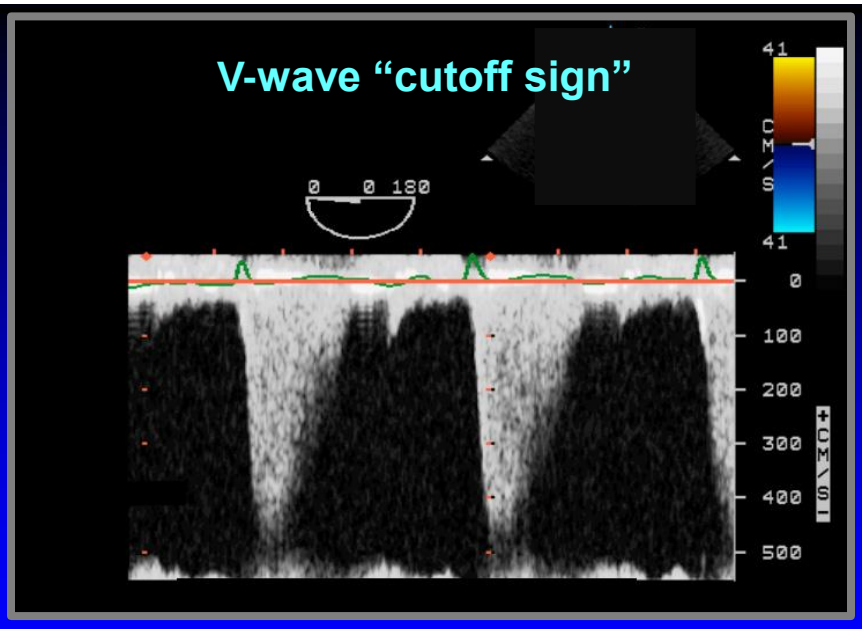
Papillary Muscle Rupture
Pitfalls in Diagnosis

- Dx may not be apparent at presentation
- Shock may be attributed to global LV dysfunction
- ECG may not show MI (if small)
- MR murmur may not be appreciated
- TTE may not establish diagnosis
- Ruptured head may not prolapse into LA
- Cath hemodynamics do not necessarily establish dx

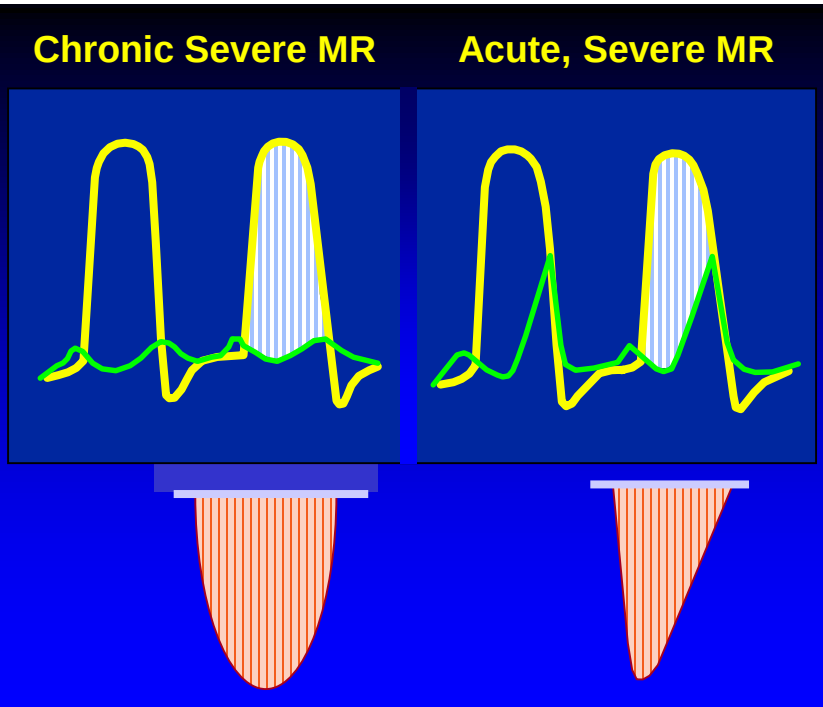
Papillary Muscle Rupture
Echo Assessment

7/20 (35%) ruptured head was not seen to prolapse into the LA

Moursi, Bhatnagar, Nanda, et al Circ 94:10003(1996)



MR jet from deep transgastric view



Papillary Muscle Rupture - Prognosis

- Complete rupture of papillary muscle usually rapidly fatal (both leaflets affected)
- Incomplete rupture of a single head has mortality of 30-60%
- In SHOCK trial, mortality was 40% in operated patients, 71% in unoperated patients

Papillary Muscle Rupture - Treatment

- Hemodynamic compromise requires invasive hemodynamic monitoring (PA catheter)
- Reduce afterload with nitroprusside (unless hypotensive)
- Use inotrope to increase cardiac output
- Diuretics for pulmonary congestion
- IABP very helpful

Papillary Muscle Rupture - Treatment

- Patients with hemodynamic compromise should have urgent surgical repair (usually in combination with CABG)

Case 2

RE - 74 year-old woman

Presented to ER with 2 hour history of midsternal chest pain → nonradiating

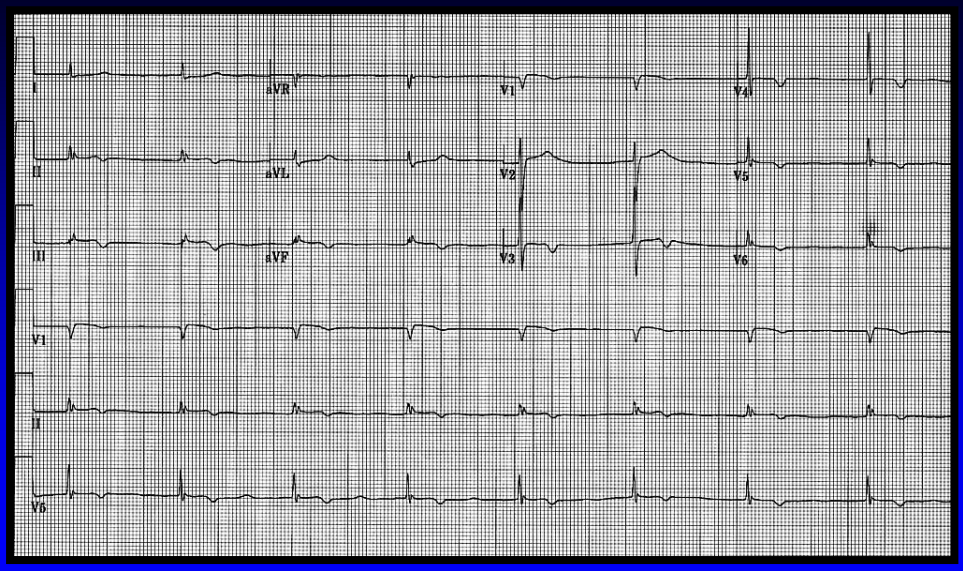
→ associated with shortness of breath

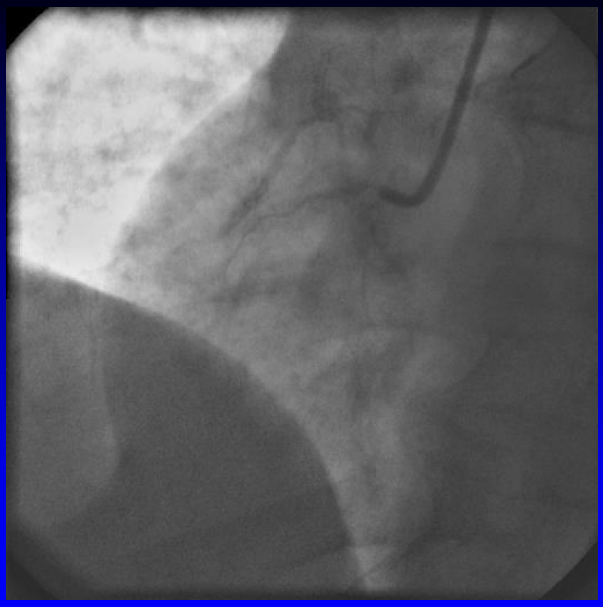
→ diaphoresis and nausea

Taken quickly to Cath Lab

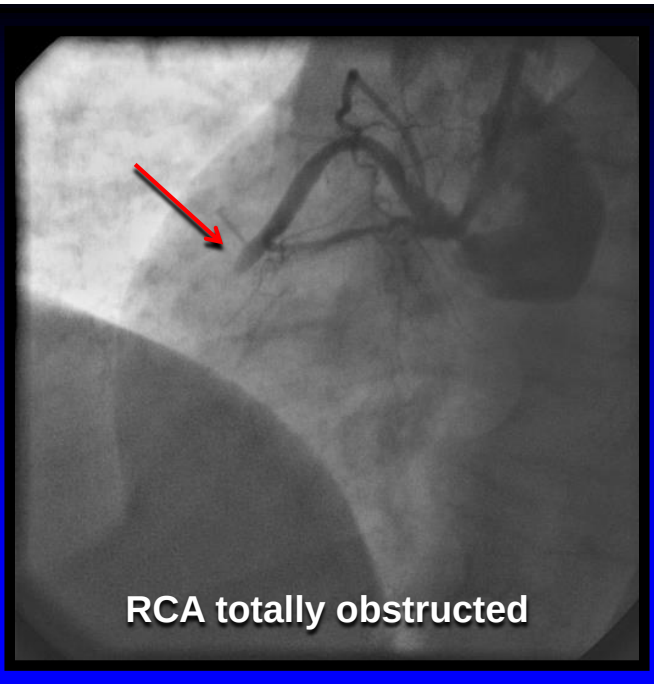
- RCA totally occluded
- 3 stents placed

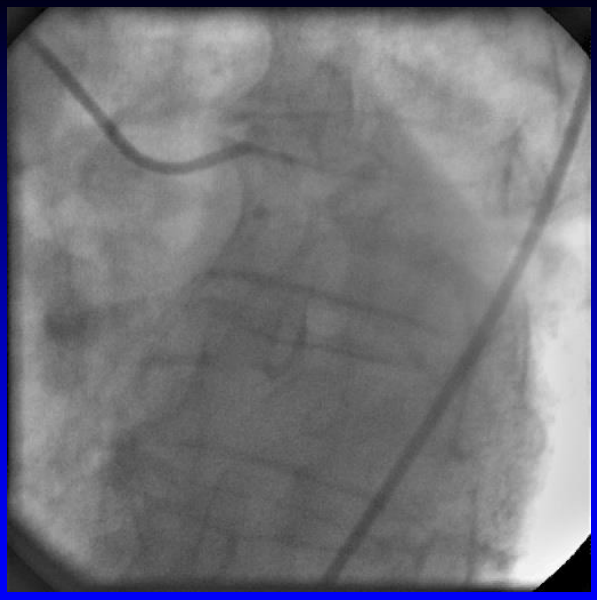
(proximal, mid, and distal RCA)



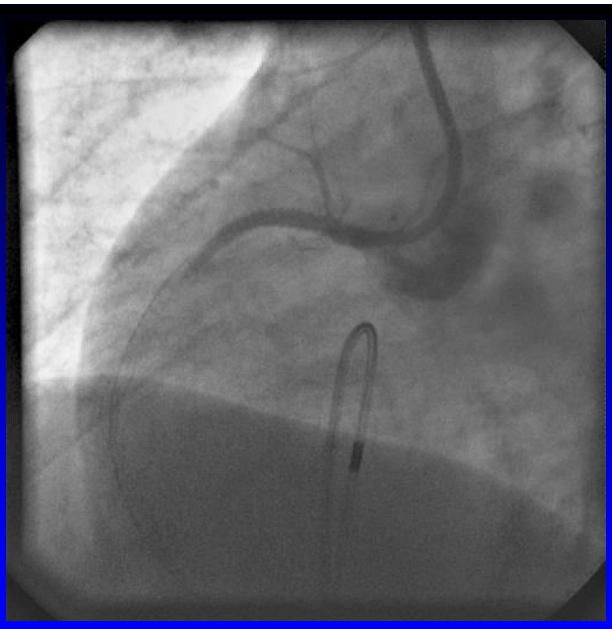


RCA - pre





Left - pre

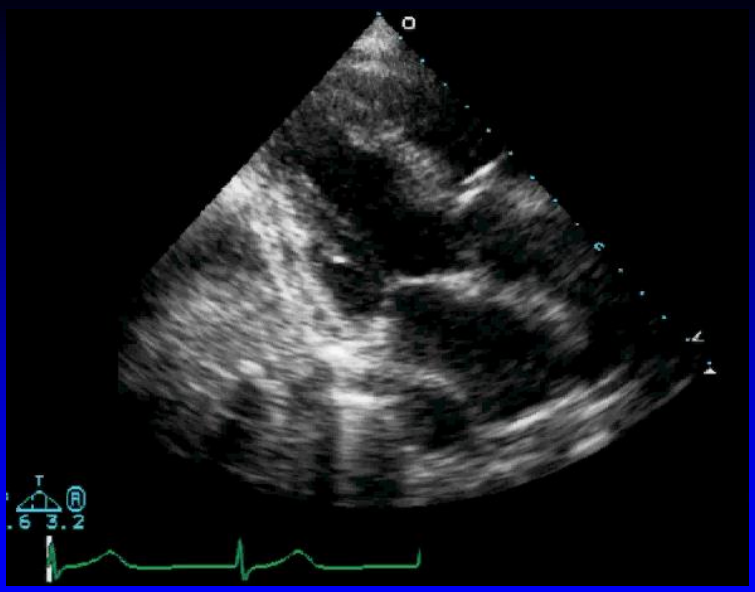


RCA - post

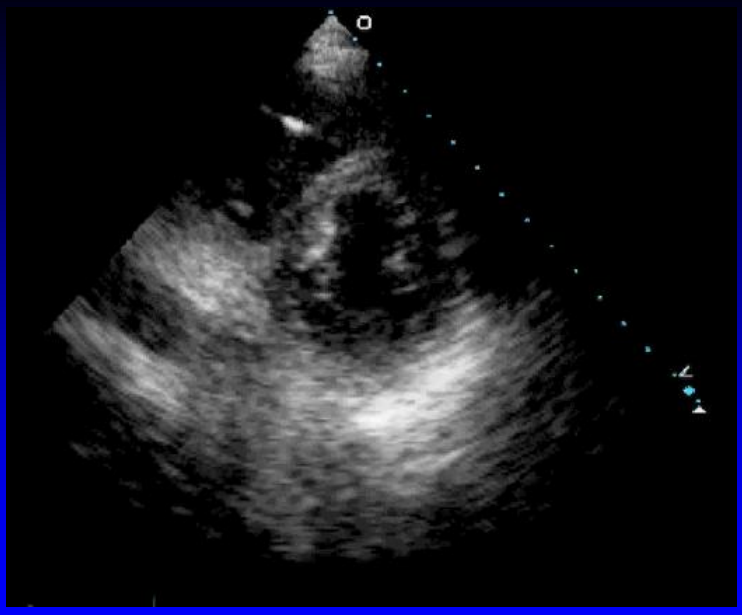
While in Cath Lab, intubated and IABP inserted

Hypotensive

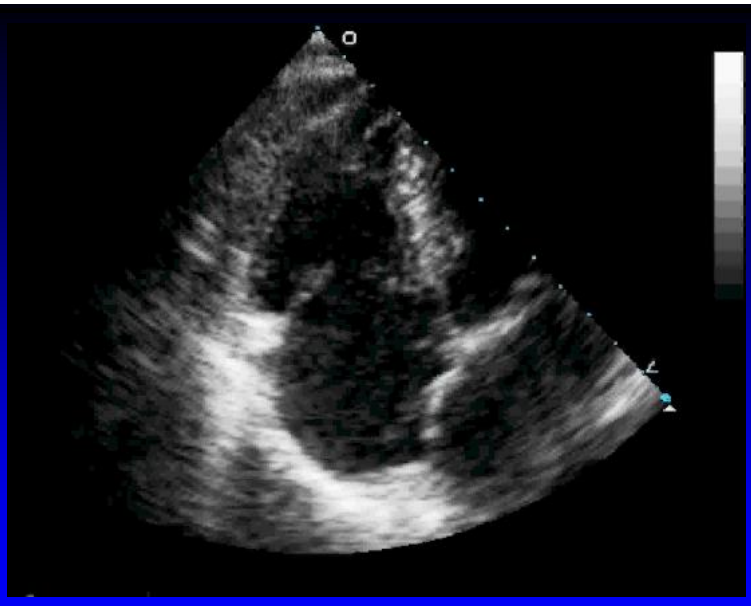
Transferred to CCU



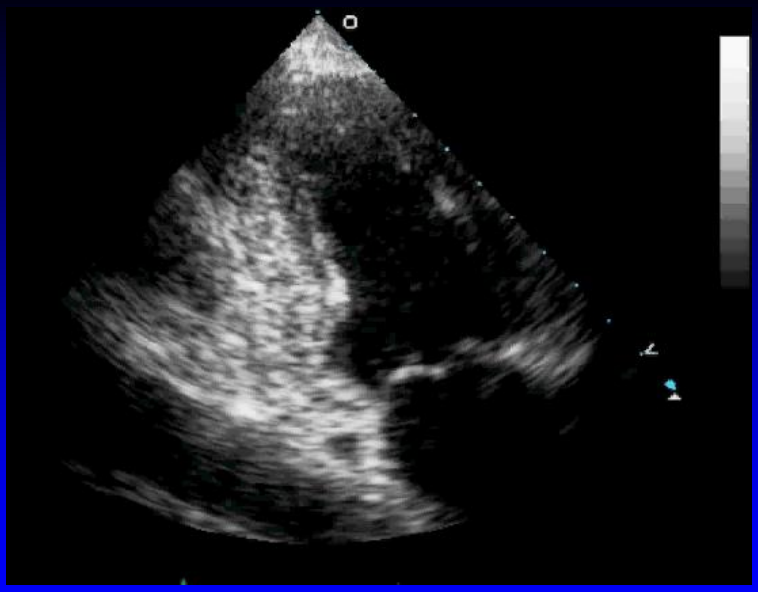
Parasternal long-axis view
(slightly off-axis → tilted up)



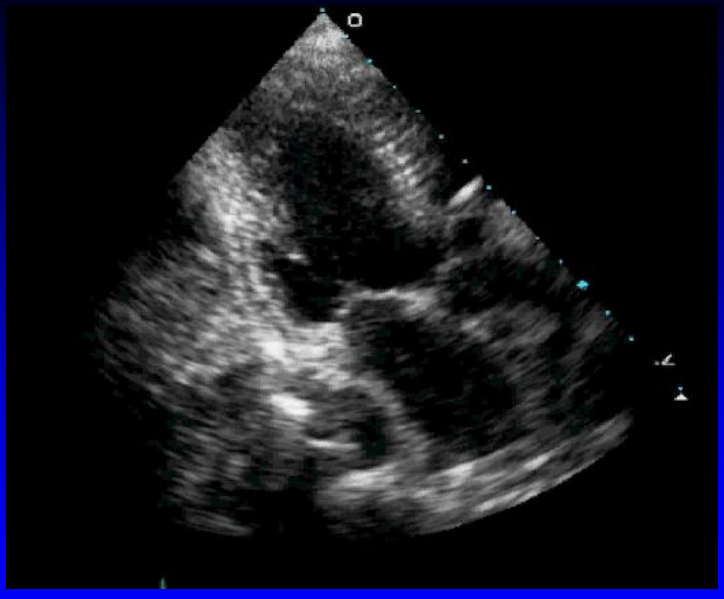
Short-axis



Apical 4-Chamber view (centered on RV)

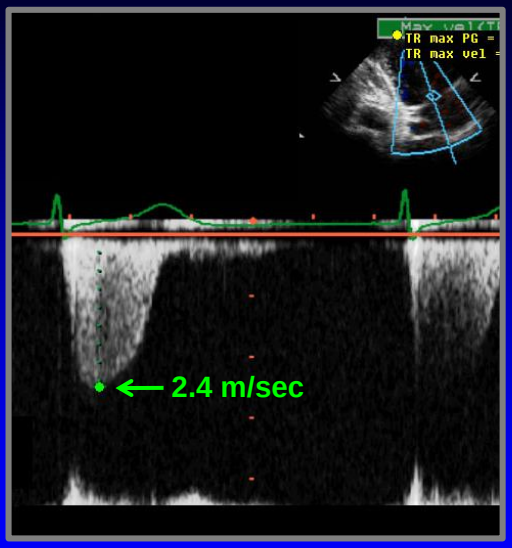


Apical 2-Chamber view

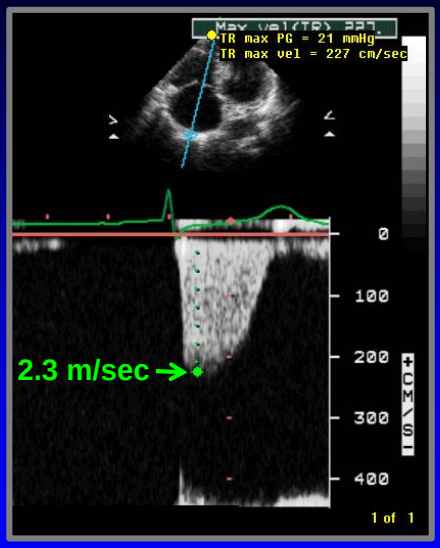


Apical 3-Chamber view

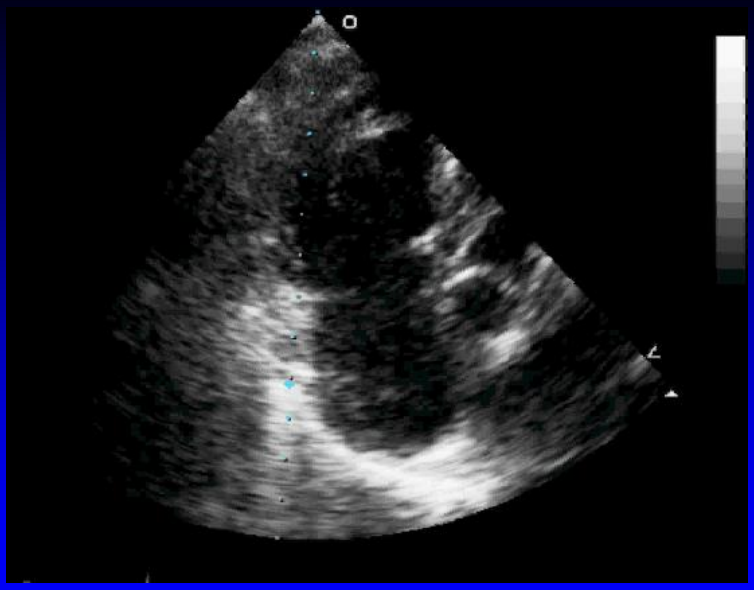
TR Jet Velocity → Normal Pulm Artery Pressure



RV Inflow view

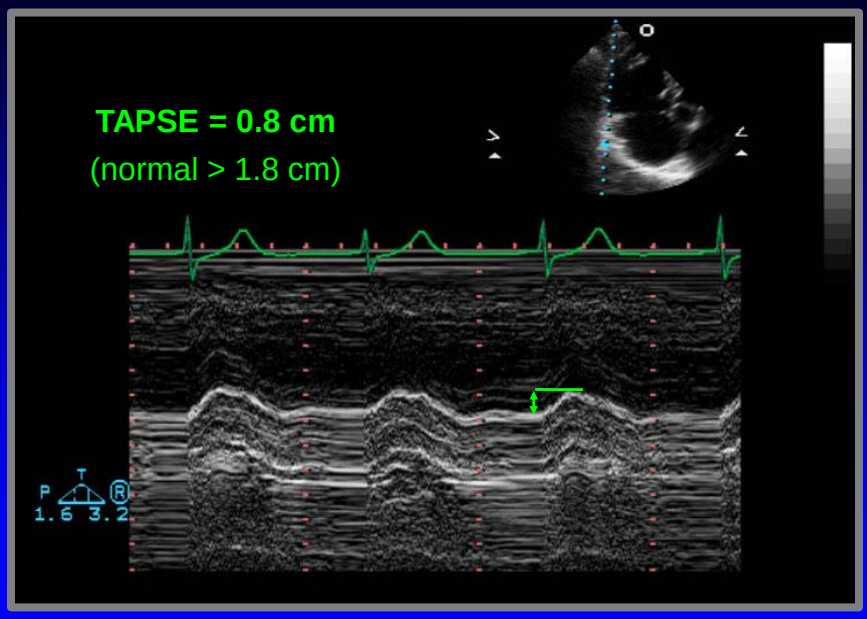


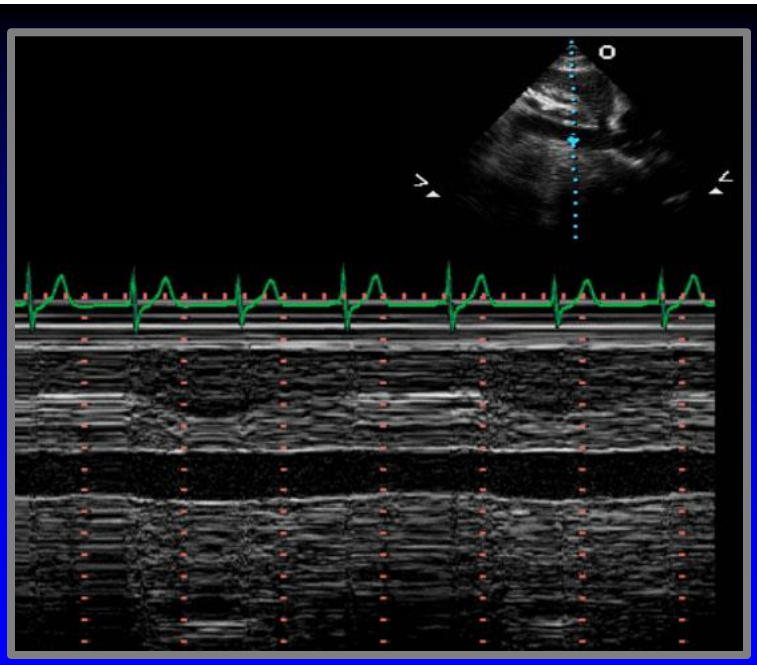
Ap-4 chamber



Placing M-Mode cursor for TAPSE

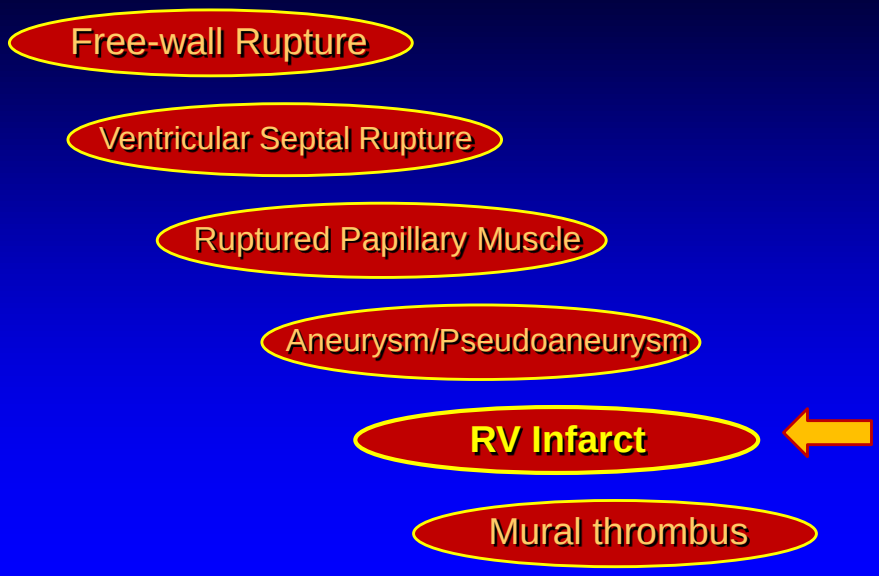
Tricuspid Annular Plane Systolic Excursion (TAPSE)





IVC dilated and minimal respiratory variation

Acute MI: Mechanical Complications



Right Ventricular Infarction

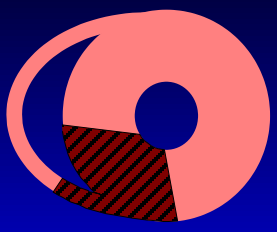
- **Isolated** RV infarct **rare**
- Almost exclusively in setting of inferior MI
- Incidence varies depending on criteria

Autopsy:	25-75% inferior MIs
Echo:	20-50% inferior MIs
Clinical:	3-10% inferior MIs

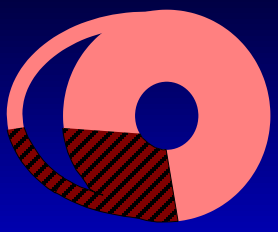
Right Ventricular Infarction

Scarred inferior wall infarction of the LV extends onto the posterior ventricular septum and the inferior wall of the RV

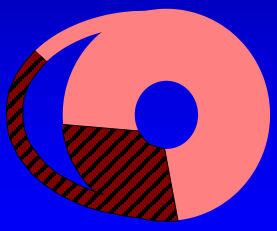
Grading System for Extent of RV Infarction



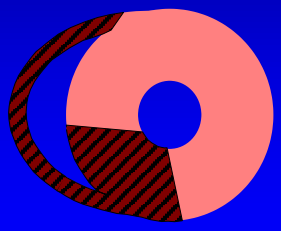
Grade I <50% PW



Grade II >50% PW



Grade III All PW + <50% AW



Grade IV All of PW and AW

Isner, Roberts (NIH) Am J Cardiol 42:885(1978)

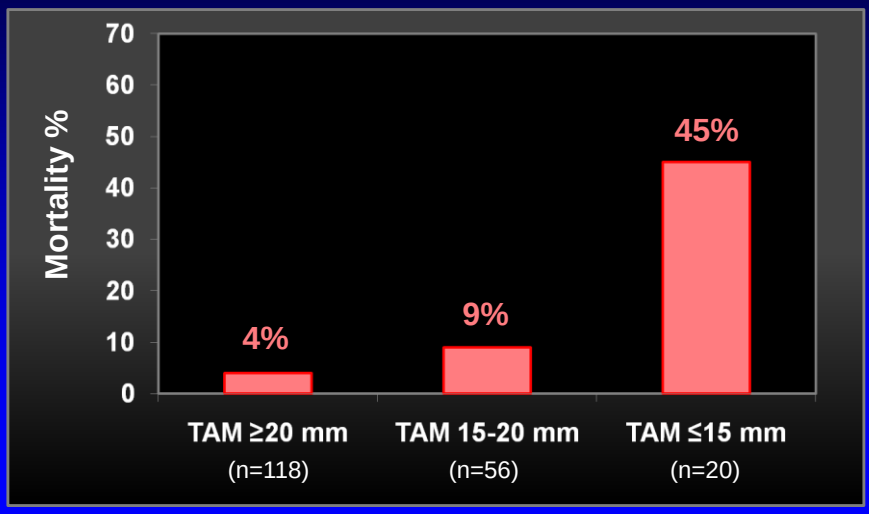
RV Infarction
When to Suspect

- Any inferior MI
- Inferior MI with low output state
- Increased JVP in inferior MI
- RV dilatation
- Cardiogenic shock
- Hypoxemia

RV Infarction
Echo Findings

- Abnormal RV wall motion
- RV dilatation
- Tricuspid regurgitation
- Abnormal septal motion
- Atrial septum may bow toward LA
- Opening of patent foramen ovale
- Premature opening of pulmonic valve

Relation between Mortality and TV Annulus Motion in RV Infarction

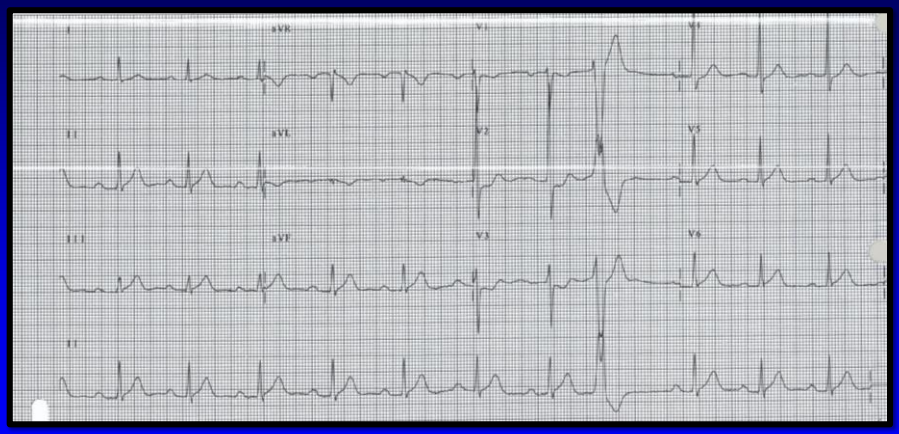


Samad *Am J Cardiol* 2002;90:778

Case 3

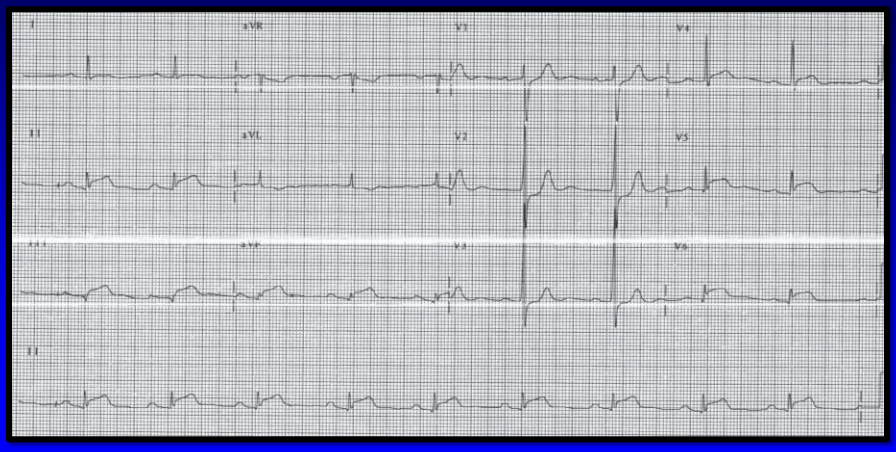
- 59 yo M HTN, HLP, DM and asthma.
- h/o psychiatric disorder
- No prior heart disease
- 8:30 pm – chest tightness, goes promptly to ER still with pain.

21:13



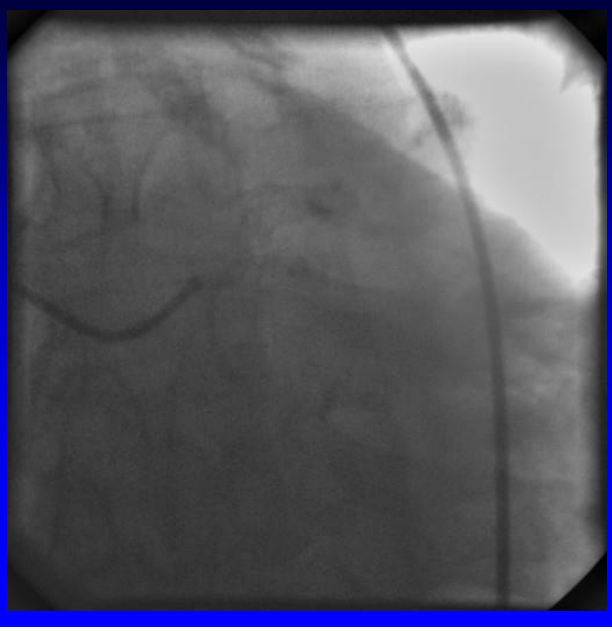
- Nitro sl x3 given with no resolution.
- Sedatives and antipsychotics given overnight
- Hours later biomarkers came back elevated, so ECG is repeated

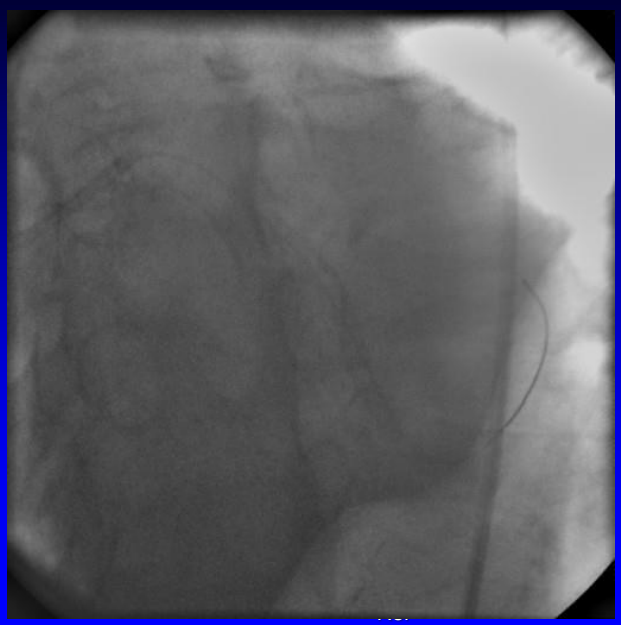
7:41 AM (10 hs later)



- Now he gets ASA 325 and IV heparin
- Transferred to cath lab

BP 90/60, HR 110, RR 20x' sats 96%
Agitated
2/4 SEM LUSB, no CHF
Lungs clear





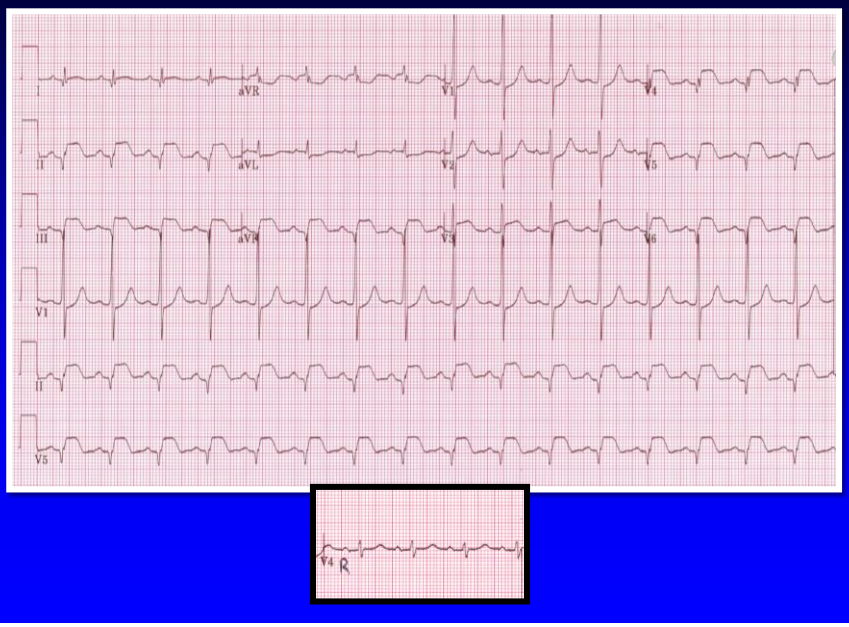
Cath lab

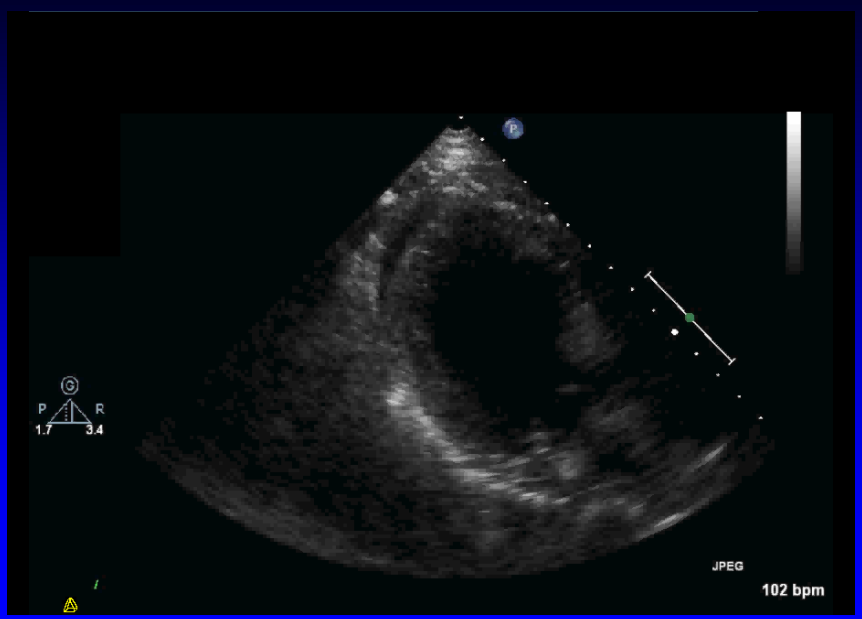
LCX
- prox 100% ➔ POBA
- Mid and distal 95% ➔ stents

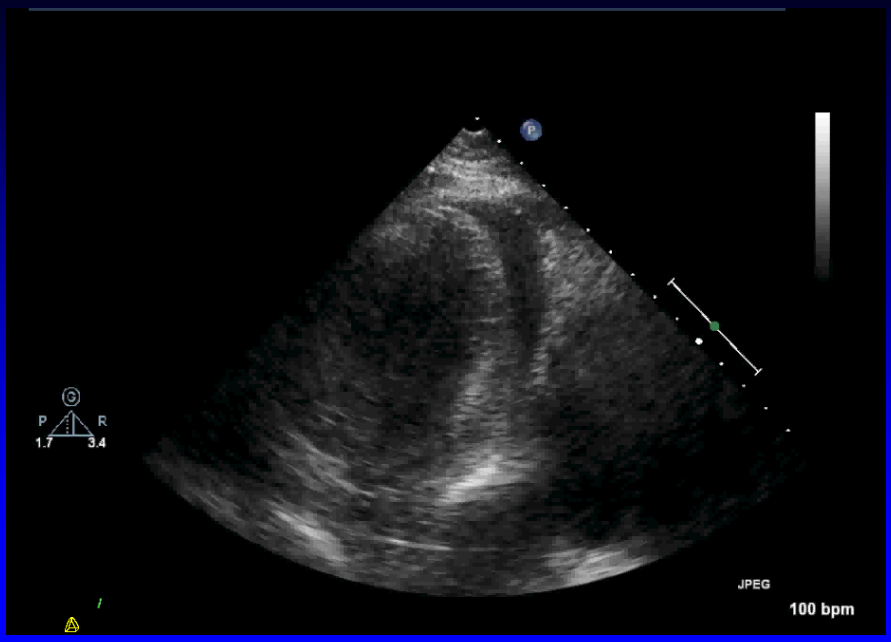
LAD - non significant irregularities
Ramus - 80%
RCA - multiple irregularities

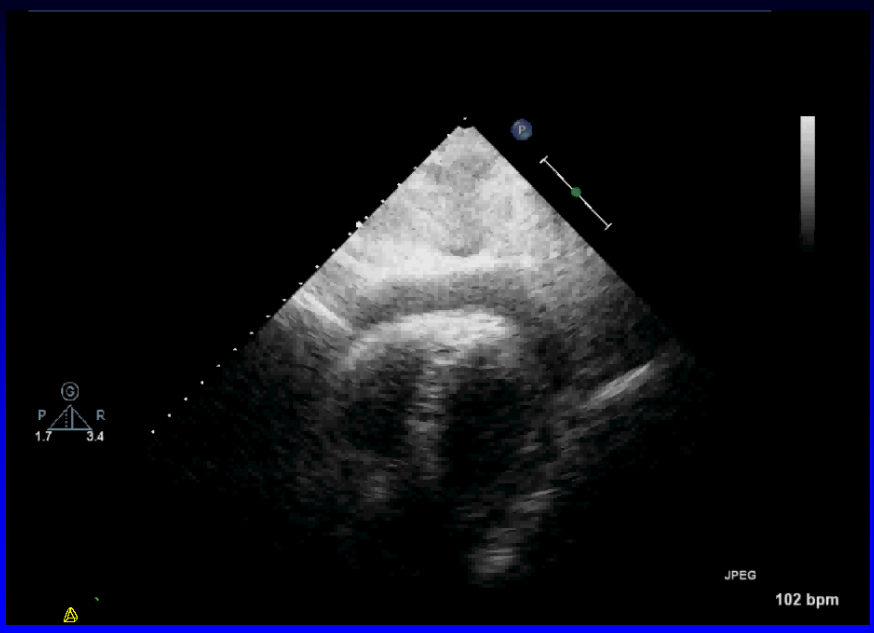
IABP placed. MAP 65-70, Augm 95
Received fluids but no pressors required.

Admission to CCU






P
G
P
R
1.7
3.4
JPEG
100 bpm


P
G
P
R
1.7
3.4
JPEG
102 bpm

MI-related Pericarditis

- Affects as much as 20% of large transmural AMIs, 5% in reperfusion era.
- On day 1-2 post MI, transient
- It is almost always a benign process with none or small PE.
- Small PE post MI may grow over the next few days to moderate size.
- When moderate/large most are hemorragic and 5-10% develop tamponade

Figueras J. Am Heart J 2002;144:251

Hospital course

IABP DC after 36 hs

BiDil and metoprolol started

Asthma exacerbation treated with steroids

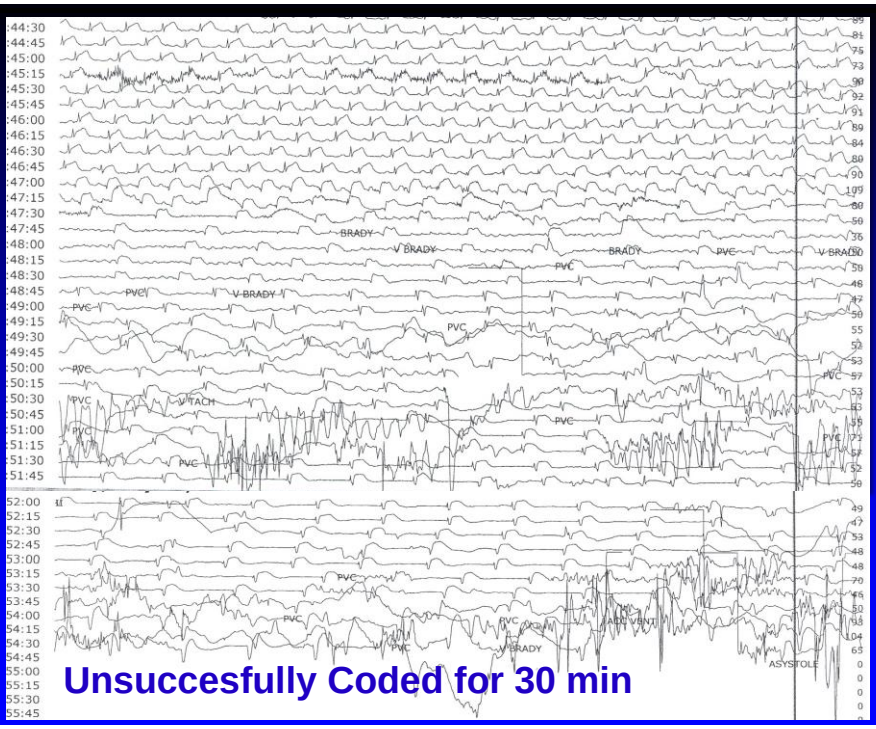
Transferred to floor on day 3
BP 145/80, HR=80's

Day 4

6:00 AM took his meds

6:40 AM Nurse exam: 150/95, 80's, 16, 98%

6:47 AM Decompensated, unresponsive and gasping



Unsuccesfully Coded for 30 min

What Happened? Audience Response

1. Free-wall Rupture
2. Ventricular Septal Rupture
3. Ruptured Papillary Muscle
4. Aneurysm/Pseudoaneurysm
5. RV Infarct
6. Mural thrombus

Acute MI: Mechanical Complications

Free-wall Rupture ←

Ventricular Septal Rupture

Ruptured Papillary Muscle

Aneurysm/Pseudoaneurysm

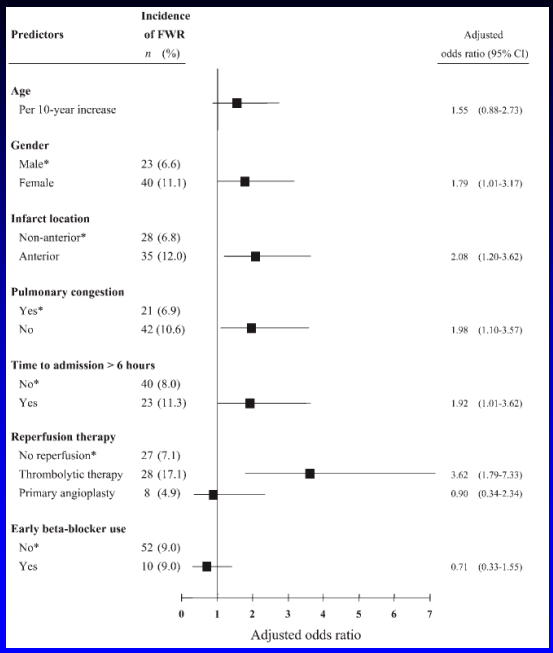
RV Infarct

Mural thrombus

Autopsy

Autopsy report I

- 450 cc of blood and clots were removed from a tense pericardium
- Large (9 x 5 cm) lateral LV MI
- 2.5 cm transmural rupture
- No aneuryism or pseudoaneurism
- Coronaries and stents were patent
- Acute and chronic fibrinous pericarditis at the ruptured site.



Bueno et al. EHJ 2005;26:1705

LVFWR vs VSD

	Free Wall Rupture (n = 97)	Septal Rupture (n = 96)
Age (yrs)	65 ± 8	66 ± 8
Men	77 (79)	71 (74)
Systemic hypertension	47 (48)	50 (52)
Diabetes mellitus	25 (26)	32 (33)
Angina >1 mo	19 (20)	18 (19)
Old infarction	4 (4)	6 (6)
Time to rupture	(n = 94)	(n = 52)
<2 d	52 (55)	26 (50)
<6 d	78 (83)	42 (81)
Site of acute myocardial infarction		
Anterior	47 (48)	44 (46)
Inferior	40 (41)	52 (54)
Lateral	10 (10)	0 (0)
Maximum ST elevation (mm)		
Anterior	5.9 ± 3.2	5.8 ± 2.6
Inferior	3.7 ± 2.5	3.0 ± 2.4
Lateral	1.0 ± 0.2	
Conduction abnormalities		
Complete atrioventricular block*	8 (8)	21 (22)
Right bundle branch block with or without hemiblock†	8 (8)	37 (39)
Atrial fibrillation†	5 (5)	25 (26)
Number of coronary arteries narrowed >70% in diameter	(n = 76)	(n = 65)
1	44 (58)	38 (59)
2	29 (38)	21 (32)
3 ± left main	3 (4)	6 (9)
Culprit artery		
Left anterior descending	31 (43)	26 (40)
Right†	14 (19)	36 (55)
Circumflex†	28 (38)	3 (5)
Total occlusion	64 (88)	58 (89)

Data are expressed as number of patients (%) or mean ± SD.
*p <0.01
†p <0.001.

Figueras et al. AJC 1998;81:495

Diagnosis – clinical characteristics

- Age > 55 yo
- HTN
- 1st transmural MI
- Persistent ST elevation in non MI-related leads(pericarditis?).
- Persistent or recurrent CP

Figueras J et al. Heart 2000;83:499
Wehrens X et al. AJC 2001;88:414