Role of POCUS in Diagnosing Etiology of Refractory Chest Pain

Ultrasound Scholarly Concentration
11.01.2023
Dustin Belliston-Fowkes, MS3

THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

Case Series Outline

I. Case
II. Clinical Question
III. Literature review
IV. Application of ultrasound
V. Key Points

POCUS Case Presentation

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

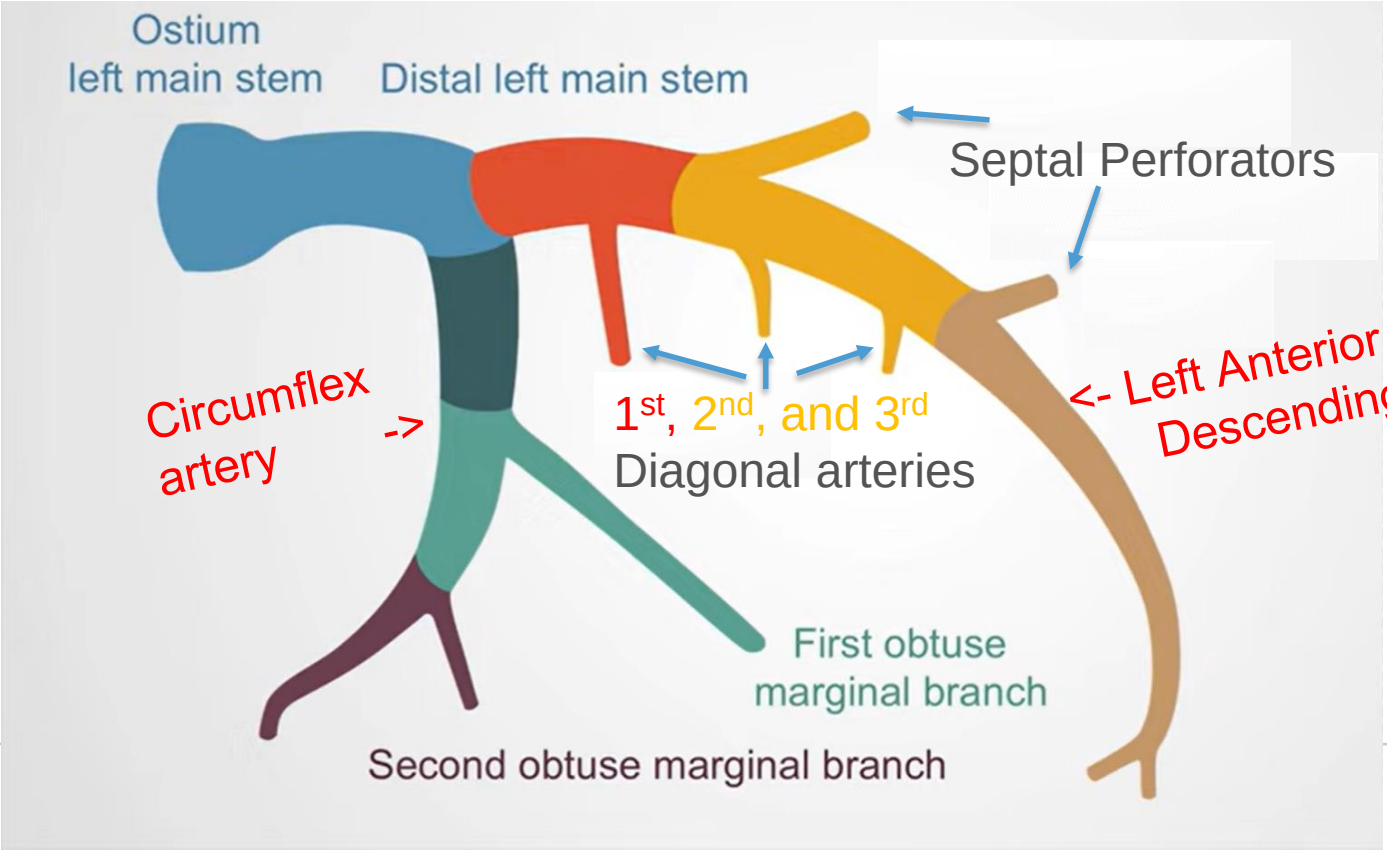
- 63-year-old female presents to the emergency department with complaint of 10/10 chest pain that has been present a couple hours prior to arrival.
- The describes feeling like "a little elephant" is sitting on her chest, with associated shortness of breath.
- She denies radiating pain, nausea, vomiting, extremity swelling, orthopnea.

Significant Events Leading up to Arrival

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

- Pt reported to outpatient cardiology roughly a month prior to this ED visit with complaints of chest pain on exertion, and was subsequently scheduled for a catheterization and angiogram a few days after that
- Pt was found to have:
    - 70-80% occlusion of the Left Anterior Descending (LAD) artery
    - 80-90% occlusion of the LCX
    - 85-95% occlusion of the Posterior Left Ventricular (PLV) artery
- Prior to that, Pt had a stent placed an obtuse marginal (OM1) artery in 2017 and balloon angioplasty to the left circumflex (LCX) in 2019

Coronary Anatomy



Significant Events Leading up to Arrival

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

- Pt then underwent triple vessel Coronary Artery Bypass Graft (CABG)
- Post Operation Day (POD) two, the patient had a sudden and severe episode of chest pain with new st-segment elevations on EKG and was taken back to the cath-lab
- She was subsequently found to have a failed graft to the Right Posterior Descending Artery (RPDA) at the ostium as well as Obtuse Marginal (OM) at the anastomosis site.
- Revascularization attempts were unsuccessful, and the decision was made to medically manage the patients coronary artery disease.
- Pt was discharged to a skilled nursing facility on POD11

Back to this presentation….

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

- ROS: Negative except previously mentioned symptoms
- Family Hx: unknown
- Vitals
- Temp: 98.3
- HR: 79
- RR: 20
- BP: 105/57
- SpO2: 94

Labs:

Troponin 0.095, repeat 0.090

Pro BNP: 3,120

D-dimer 600 (age-adjusted normal)

CRP 12.21 (normal <0.5)

ESR (Normal)

Imaging:

CTA negative for PE, showed small pericardial and pleural effusions

EKG did not show any acute changes

- Differential? Which are most likely? What are the MUST NOT MISS diagnosis?

Differential? Which are most likely? What are the MUST NOT MISSES?

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Critical

- Acute coronary syndromes (ACS)
  - STEMI
  - Non-STEMI
  - Unstable angina
- Aortic dissection
- Cardiac tamponade
- Coronary artery dissection
- Esophageal perforation (Boerhhaave's syndrc
- Pulmonary embolism
- Tension pneumothorax

Emergent

- Cholecystitis
- Cocaine-associated chest pain
- Mediastinitis
- Myocardial rupture
- Myocarditis
- Pancreatitis
- Pericarditis
- Pneumothorax

Nonemergent

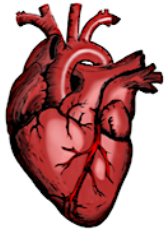
- Aortic stenosis
- Arthritis
- Asthma exacerbation
- Biliary colic
- Costochondritis
- Esophageal spasm
- Gastroesophageal reflux disease
- Herpes zoster / Postherpetic Neuralgia
- Hypertrophic cardiomyopathy
- Hyperventilation
- Mitral valve prolapse
- Panic attack
- Peptic ulcer disease
- Pleuritis
- Pneumomediastinum
- Pneumonia
- Rib fracture
- Stable angina
- Thoracic outlet syndrome
- Valvular heart disease

*List borrowed from WikEM.org

Acute chest pain. WikEM. (2018). https://wikem.org/wiki/Acute_chest_pain

Emergent Causes of Chest Pain

4-2-1 Rule

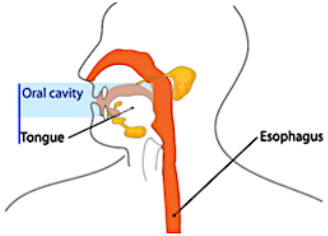


4 Heart Related Causes

1. Acute Coronary Syndrome (ACS)
2. Aortic Dissection
3. Pericarditis/Myocarditis
4. Pericardial Effusion/Cardiac Tamponade

2 Lung Related Causes

1. Pulmonary Embolism (PE)
2. Pneumothorax



1 Esophageal Related Cause

1. Esophageal Perforation

Course After Admission

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

- Pt was admitted to the cardiology step-down unit
- Cardiology and CT Surgery were consulted
- Providers did not feel she needed an urgent catheterization that night, and would reassess the next day
- Pt was started on Heparin and Nitro drip, as well as colchicine and Ibuprofen for suspected pericarditis

Course After Admission

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

- Pt was taken to the cath-lab the day after admission and was found to have no changes from previous PCI, but re-stenting of the previously occluded LAD was successful and appeared to be flowing well after PCI
- Pt reported initial reduction in chest pain
- Overnight after PCI, cardiology was called with Pt having systolic blood pressures in the 60's. Was improved with Levophed, Lasix and increased Oxygen support

Next morning….

- Next morning, Cardiology was called w/Pt reporting 10/10 chest pain

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

What Role Does POCUS Play in the Diagnosis of Chest Pain?

What Role Does POCUS Play in the Diagnosis of Chest Pain?

Literature review

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Potentially useful in rapid discovery of:

- Aortic dissection, pericardial effusion (2)
- Ventricular free wall rupture (1)
- Pneumothorax, pleural effusion, pneumonia, pulmonary edema and diaphragm dysfunction (3)

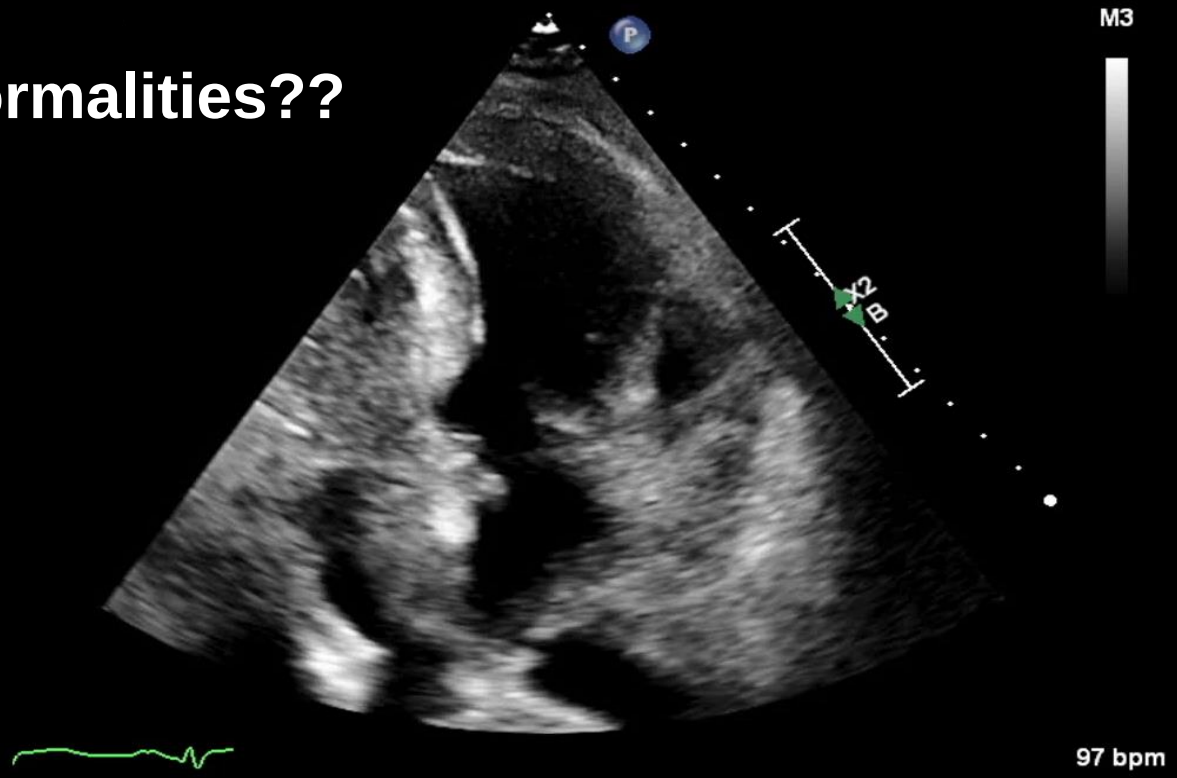
(1)Lancellotti P, Price S, Edvardsen T, et al. The use of echocardiography in acute cardiovascular care: Recommendations of the European Association of Cardiovascular Imaging and the Acute Cardiovascular Care Association. *Eur Heart J Acute Cardiovasc Care* 2015; 4: 3–5

(2) Colony M.D., Edwards F., Kellogg D. Ultrasound assisted evaluation of chest pain in the emergency department. Am. J. Emerg. Med. 2018;36:533–539. doi: 10.1016/j.ajem.2017.09.003

(3) Wallbridge P., Steinfort D., Tay T.R., Irving L., Hew M. Diagnostic chest ultrasound for acute respiratory failure. Respir. Med. 2018;141:26–36. doi: 10.1016/j.rmed.2018.06.018

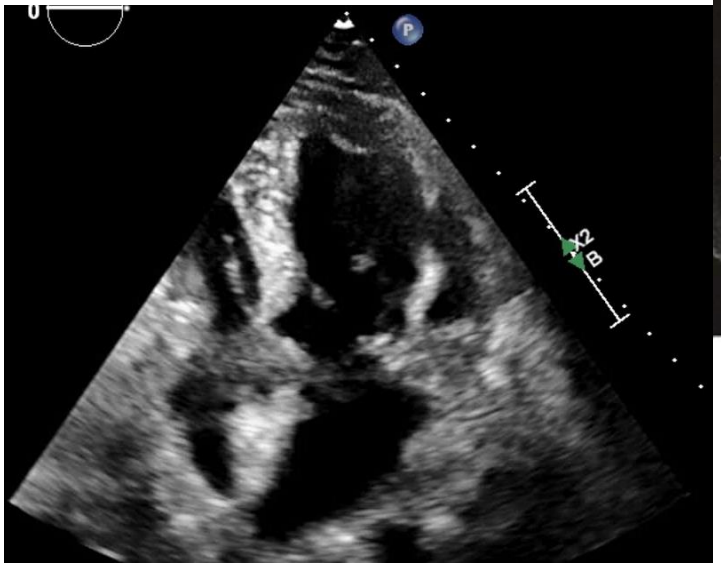
WHAT VIEW IS THIS??

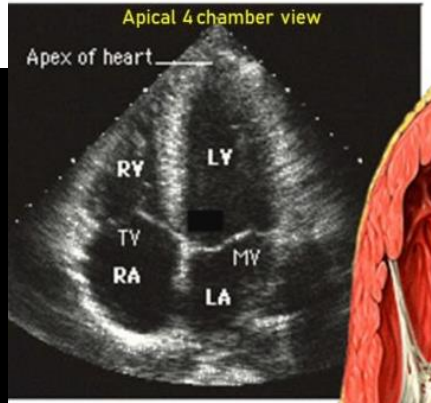
Any abnormalities??

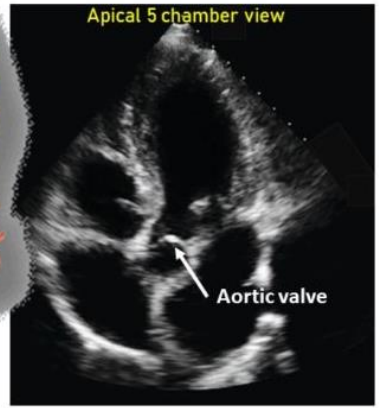


Apical 4-chamber View

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL



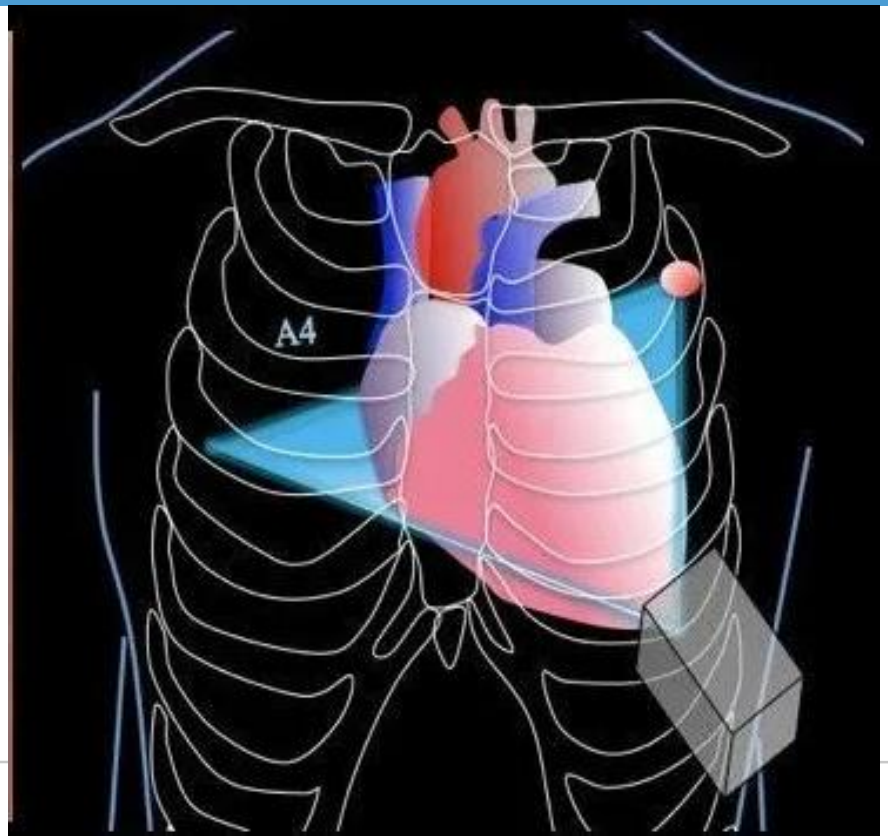


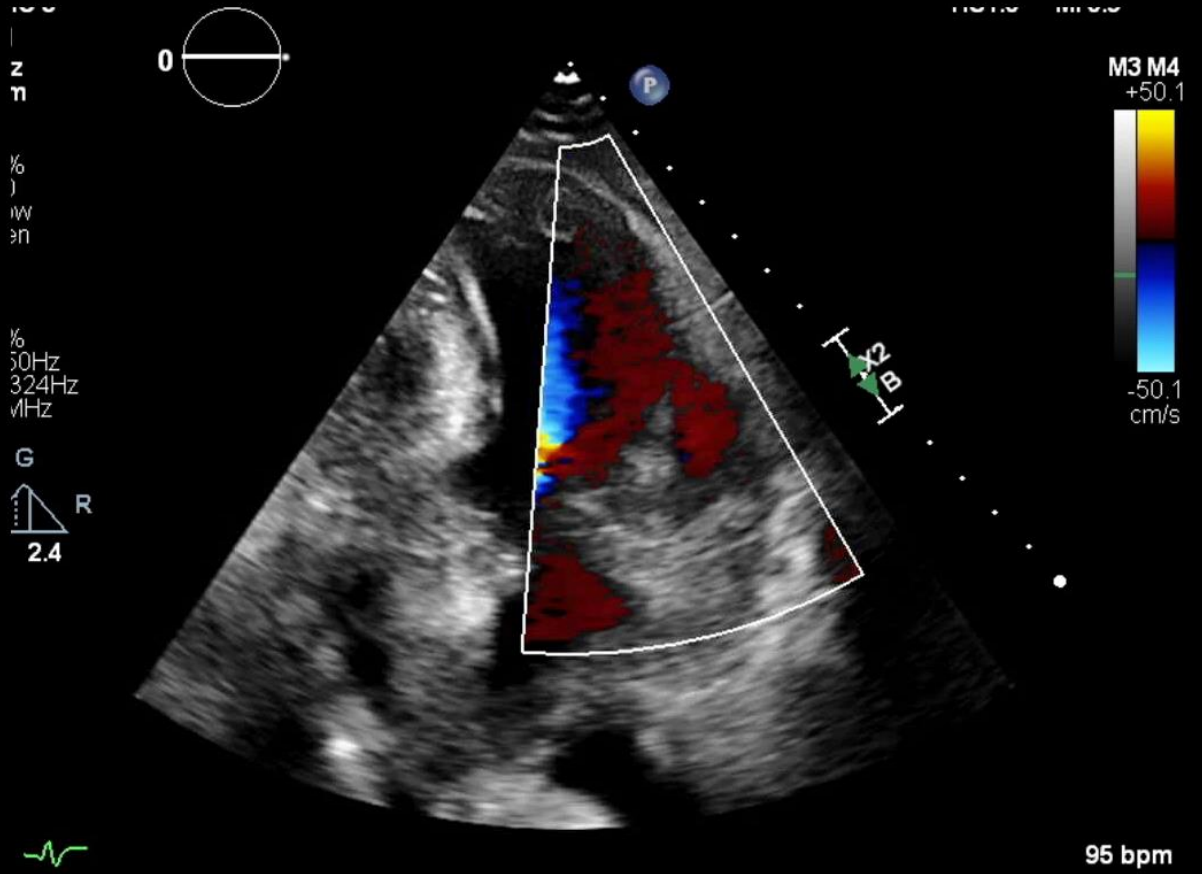


Apical 4-chamber Probe Placement

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

- Apical four-chamber view is obtained by placing the transducer in the 4th or 5th intercostal space, with the probe pointed at the patients right shoulder




0
M3 M4
+50.1
-50.1
cm/s
95 bpm
2.4
G
R

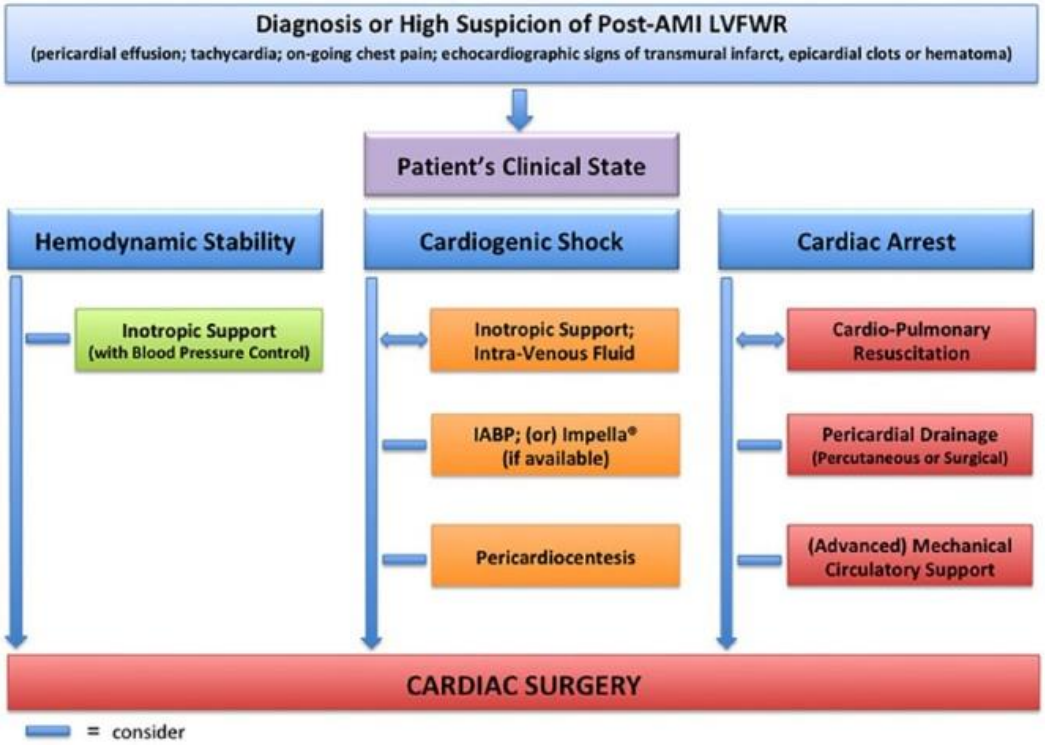
Left Ventricular Free Wall Rupture (LV Pseudoaneurysm)

The most important diagnostic method for LVFWR is transthoracic echocardiography: the presence of reduced myocardial wall thickness, hemopericardium or epicardial clots and cardiac tamponade are the most relevant findings

Lancellotti P, Price S, Edvardsen T, et al. The use of echocardiography in acute cardiovascular care: Recommendations of the European Association of Cardiovascular Imaging and the Acute Cardiovascular Care Association. *Eur Heart J Acute Cardiovasc Care* 2015; 4: 3–5

Peri-operative Approach to post AMI LVFWR

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL



Matteucci M, Fina D, Jiritano F, Meani P, Blankesteijn WM, Raffa GM, Kowaleski M, Heuts S, Beghi C, Maessen J, Lorusso R. Treatment strategies for post-infarction left ventricular free-wall rupture. Eur Heart J Acute Cardiovasc Care. 2019 Jun;8(4):379-387. doi: 10.1177/2048872619840876. Epub 2019 Apr 1. PMID: 30932689; PMCID: PMC6572585.

Free wall Rupture: Initial Management

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Surgical *vs.* Conservative

Immediate Surgical

- If hemodynamically unstable/concern for destabilization

Conservative

- If hemodynamically stable/not worsening
- Fluids, Inotropic support, vasopressors
- Allows tissue to heal prior to surgical intervention

Pericardiocentesis??

Pericardiocentesis

- Relatively contraindicated w/effusion associated with aortic dissection or myocardial rupture due to the potential risk of aggravating the dissection or rupture via rapid pericardial decompression and restoration of systemic arterial pressure

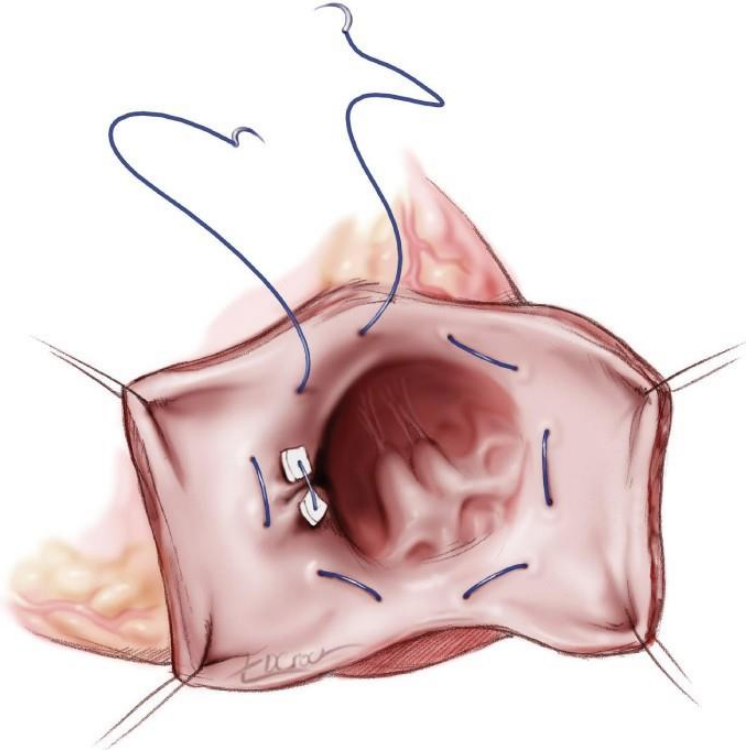
Continued admission course…

- CT Surgery initially elected to manage the Pt conservatively
- That night, Pt experienced hypotension requiring vasopressors, tachycardia and increased oxygen requirements
- The treatment plan was reconsidered, and the Pt underwent urgent surgery for LVFW repair the day after her LVFWR was discovered

Modified Dor procedure (Modified Endoventricular Circular Plasty)

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

- Pt underwent Modified Dor procedure
- Pt recovered well and was eventually discharged 7 days after surgery



Thank you!

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Questions/Comments?