

# 2025 SDMS Annual Conference

## Complications of Myocardial infarction

Kymberly Glyde BSAS, RDCS, FASE

September 20, 2025



University Hospitals Cleveland Medical Center

1

### **SPEAKER PRESENTATION DISCLAIMER**

The content and views presented are made available for educational purposes only. The information presented are the opinions of the presenter and do not necessarily represent the views of the Society of Diagnostic Medical Sonography (SDMS) or its affiliated organizations, officers, Boards of Directors, or staff members.

The presenter is responsible for ensuring balance, independence, objectivity, scientific rigor, and avoiding commercial bias in their presentation. Before making the presentation, the presenter is required to disclose to the audience any relevant financial interests or relationships with manufacturers or providers of medical products, services, technologies, and programs.

The SDMS and its affiliated organizations, officers, Board of Directors, and staff members disclaim any and all liability for all claims that may arise out of the use of this educational activity.

2

# 2025 SDMS Annual Conference

## Disclosure

- GE Healthcare

3

## Objectives

Define myocardial infarction (MI)

Discuss the ischemic cascade

Discuss complications of myocardial infarction (MI)

Image enhancement and how it aids in these patient populations

Scanning tips for image acquisition

4

# 2025 SDMS Annual Conference

## What is an MI

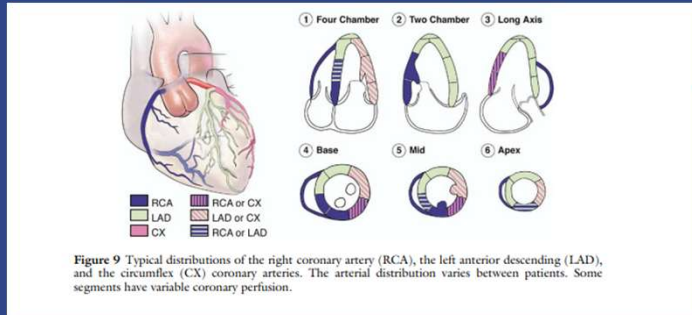
A deadly medical emergency where the heart muscle begins to die because of lack of blood flow to the cardiac muscle.

NSTEMI (Non ST segment Elevation Myocardial Infarction)- Elevated cardiac biomarkers in absence of ECG ST Elevation elevation and partial obstruction, transient occlusion, or micro embolism of thrombus in an artery

STEMI (ST segment Elevation Myocardial Infarction)- Elevated biomarkers with ruptured plaque or complete and prolonged blockage of a major artery

UA (unstable Angina) absence of cardiac enzymes

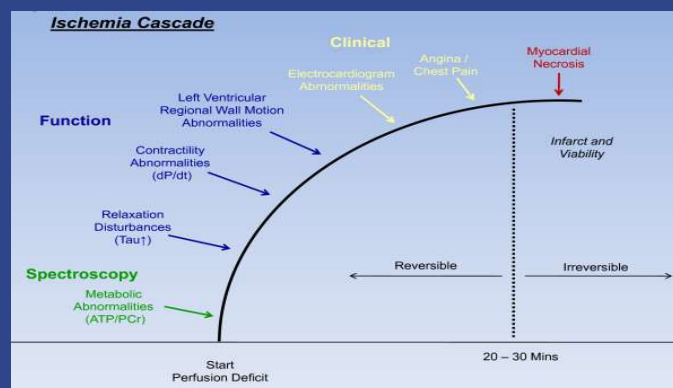
Relies on rapid assessment, history, physical exam, biomarkers( cardiac enzymes), ECG and echocardiogram for appropriate diagnosis.



<https://www.asecho.org/wp-content/uploads/2013/05/Chamber-Quantification.pdf>

5

## Ischemic Cascade

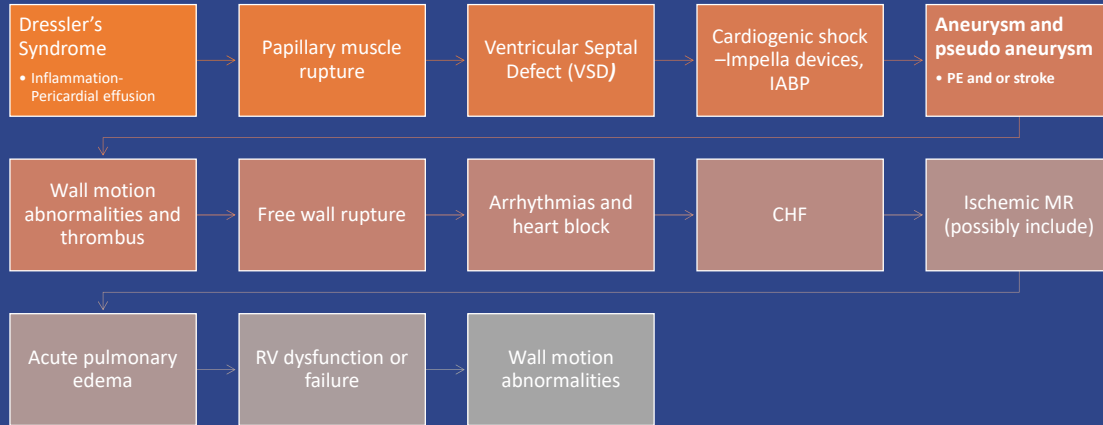


<http://www.jcmr-online.com/content/12/1/59>

6

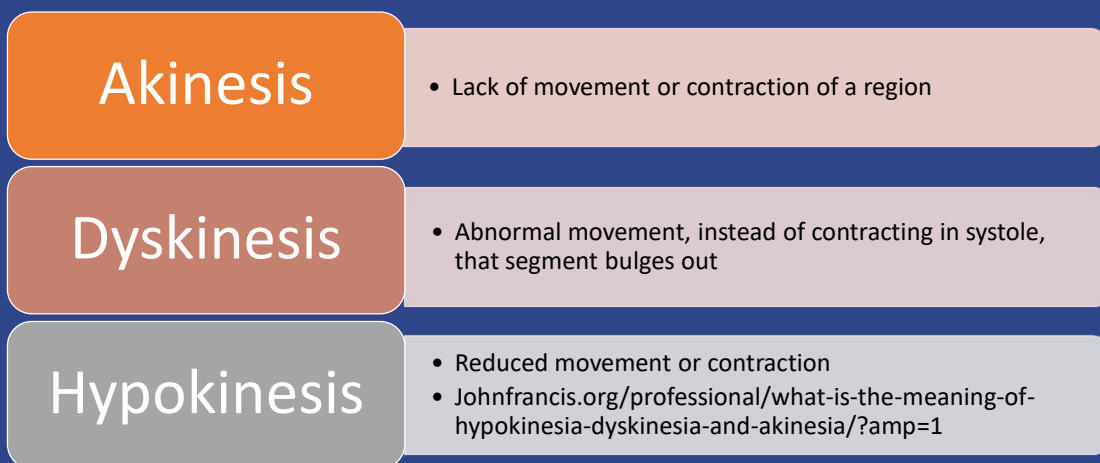
# 2025 SDMS Annual Conference

## Complications of Myocardial Infarction



7

## Wall motion



8

# 2025 SDMS Annual Conference

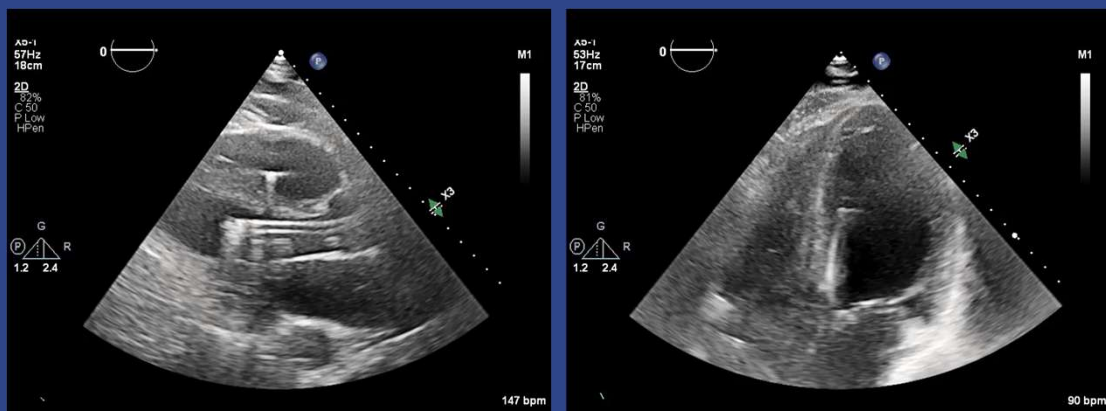
## Impella Device

- FDA approved heart pump
- Supports heart during percutaneous revascularization
  - Hemodynamic stability during balloon / stent placement
- Reduces afterload by aiding in unloading the left ventricle during ejection
- Continuously pumps blood from the LV into the aorta
- Hemodynamic support for heart recovery
- May allow for a more complete revascularization in a single session
- Decreases rate of major cardiac and cerebrovascular events



9

## Impella Device



10

# 2025 SDMS Annual Conference

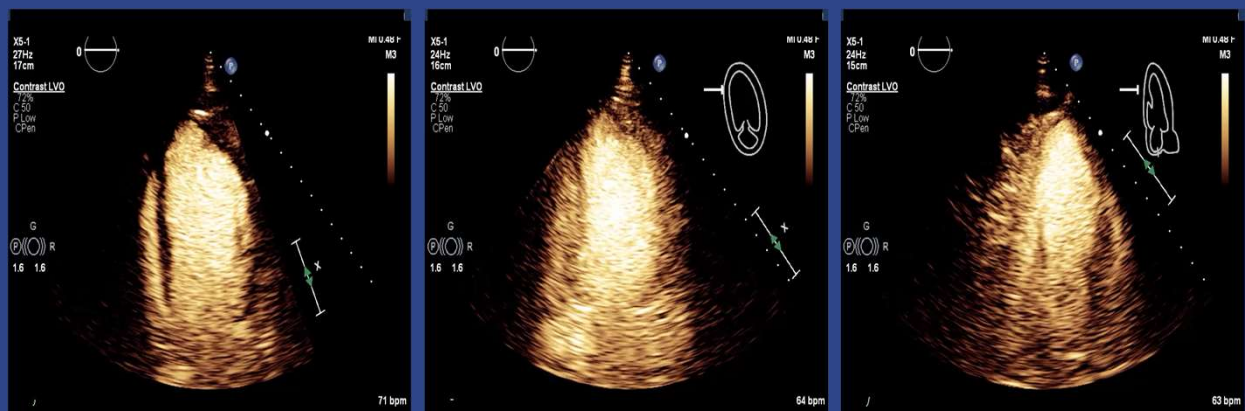
## Wall Motion Abnormality?



Technically challenging – up from 2 to 3 beats. Apical hypertrophy? Contrast?

11

## Wall Motion Abnormality- Contrast



Small Apical Aneurysm

12

# 2025 SDMS Annual Conference

## Contrast

- ASE Guidelines suggest 2 or more contiguous segments
- To opacify and delineate
- Sonographer driven
- Scope of practice
- Expectation for excellence

### AMERICAN SOCIETY OF ECHOCARDIOGRAPHY POSITION PAPER

#### Guidelines for the Cardiac Sonographer in the Performance of Contrast Echocardiography: Recommendations of the American Society of Echocardiography Council on Cardiac Sonography

Alan D. Waggoner, MHS, RDCS, Donna Ehler, BS, RDCS, David Adams, RDCS, Sally Moos, RDCS, Judy Rosenbloom, RDCS, Cris Gresser, RN, RDCS, Julio E. Perez, MD, FACC, and Pamela S. Douglas, MD, FACC, St Louis and Kansas City, Missouri; Durham, North Carolina; Charlottesville, Virginia; Reseda, California; Toronto, Ontario, Canada; and Madison, Wisconsin

13

## Dressler's Syndrome

- Inflammation of the pericardial sac
- Heart attack or other cardiac trauma which sets off a series of biochemical responses which result in inflammation and pericarditis
- Usually occurs within 1-3 days to several weeks post injury, but may be as prolonged as several months.
- 1%
- Chest pain, dyspnea, palpitations, fever are most frequent symptoms
- Pericardial effusion – electrical alternans
  - Becks Triad
    - Hypotension
    - Quiet heart sounds
    - JVD

<https://ufhealth.org/conditions-and-treatments/pericarditis-after-heart-attack>

14

# 2025 SDMS Annual Conference

## Papillary Muscle Rupture

Acute –severe mitral regurgitation- cardiogenic shock- flash pulmonary edema

82% with a first myocardial infarction

.07-.26% of infarcts and 5% of post MI mortalities

Most common with STEMI as opposed to NSTEMI

Immediate medical intervention or high mortality rates

- 50% mortality rates at 24 hours without surgical intervention
- Randomized trials are lacking; multiple retrospective studies show significant in hospital mortality rates with timely surgical intervention compared to medical therapies alone. (Pahuja M, et. EI, 2021)

15

## Papillary Muscle Rupture

Partial rupture - Up to 3 months post MI

better tolerated, less chords impacted



Complete rupture of the papillary trunk – within 2-7 days post infarct

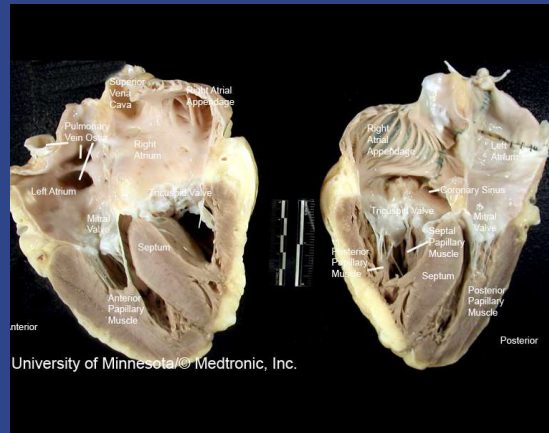
Rapid clinical decline

16

# 2025 SDMS Annual Conference

## Mitral Valve Papillary Muscle

- Anterolateral-dual artery blood supply
- Posteromedial-single artery supply
  - Posterior descending coronary artery arises from the right or circumflex coronary artery
  - Produces inferior ischemia
  - 6-12 x more frequent than anterolateral



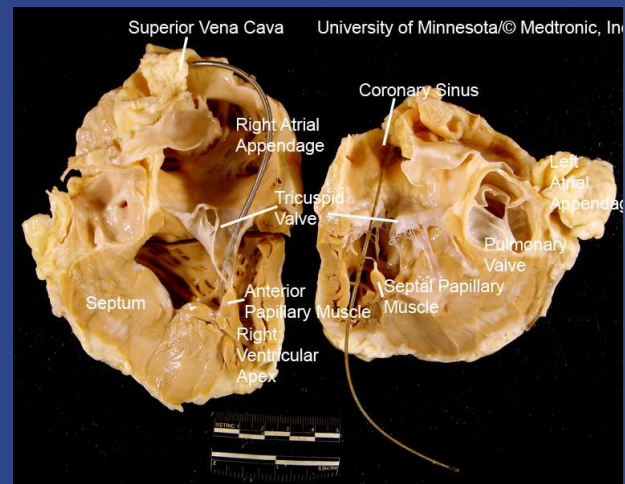
University of Minnesota© Medtronic, Inc.

<https://www.vhlab.umn.edu/atlas/sectioned/Heart0058-Sectioned-Int-Ant-Post.jpg>

17

## Tricuspid valve papillary anatomy

Anterior, posterior, and septal  
Extremely rare complication of inferior MI.  
50% involve RV  
A handful of published case studies  
Severe tricuspid regurgitation



University of Minnesota© Medtronic, Inc.

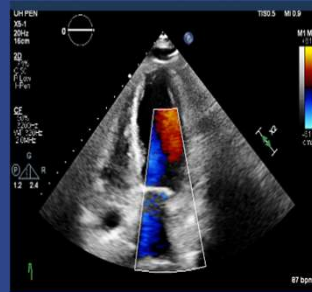
<https://www.vhlab.umn.edu/atlas/sectioned/Heart0032-Sectioned-Int-Ant-Post.jpg>

18

# 2025 SDMS Annual Conference

## Post Infarct Papillary Muscle Rupture 3/9

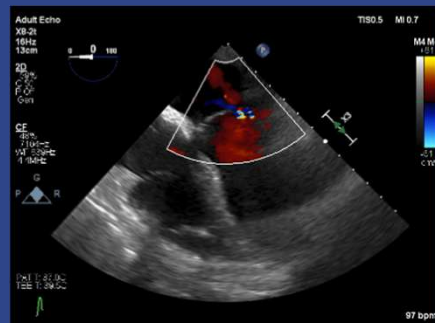
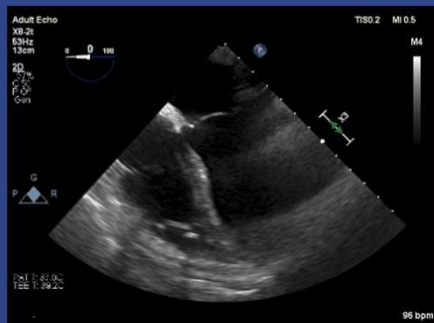
- Ordered for NSTEMI-
  - 25-30%
  - “There is a very large regional wall motion abnormality suggestive of a wrap around LAD vs. multivessel vs. Takotsubo cardiomyopathy. Basal segments work best”
  - Mild MR



19

## Pre-op TEE for CABG 3/15

- Ordered for atherosclerosis and pre-op
  - Severely decreased EF
  - Severe MR
  - Tethered posterior MV leaflet with overriding anterior leaflet



20

# 2025 SDMS Annual Conference

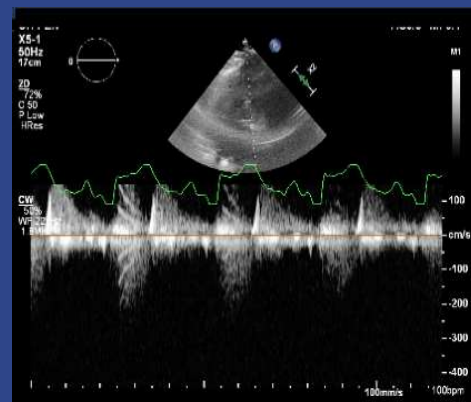
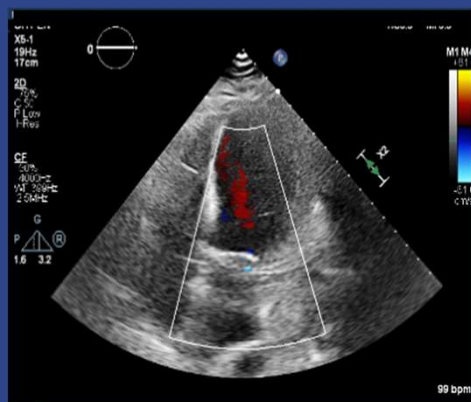
## Post CABG echo 3/17

- CTICU –Pericardial effusion and S/P CABG
  - 35% EF
  - Mild MR



21

## 3/17 CICU

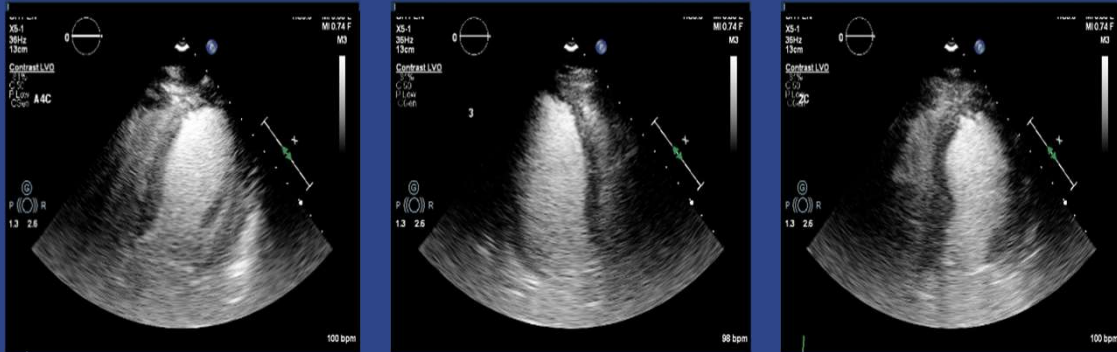


Mild MR

22

# 2025 SDMS Annual Conference

3/17 CICU



23

TTE 3/22

Stat echo for cardiogenic shock  
45% EF

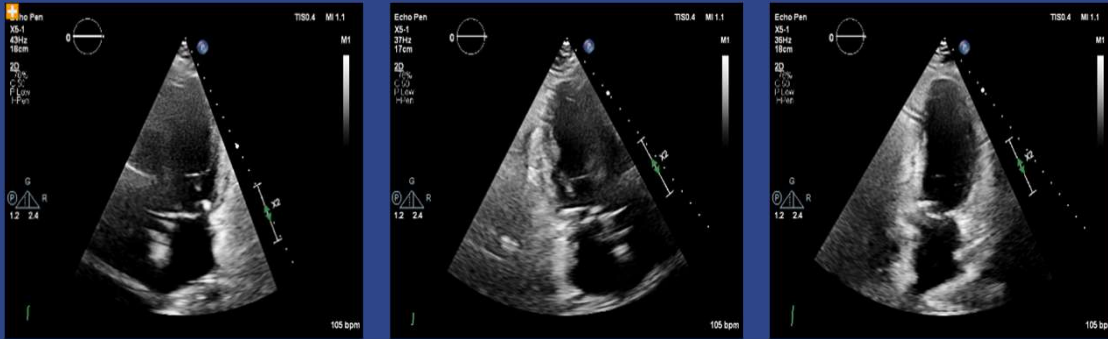
"There is mild to moderate mitral regurgitation. There is a suggestion of a partially ruptured papillary muscle with an eccentric posteriorly directed jet of mitral regurgitation which appears mild to moderate, however cannot appreciate well due eccentricity. Consider TEE"



24

# 2025 SDMS Annual Conference

TTE 3/22



25

TTE 3/22

Very eccentric regurgitant jet most likely underestimated due to imaging limitations on TTE.

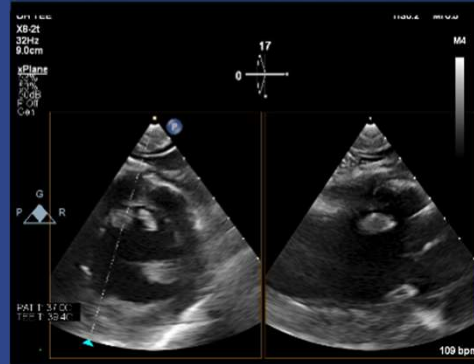
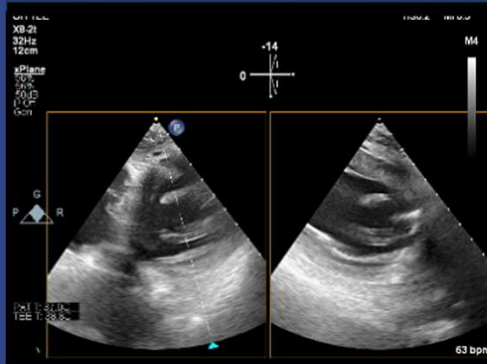


26

# 2025 SDMS Annual Conference

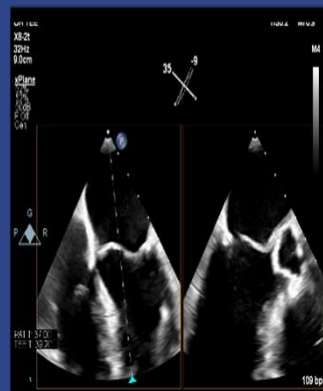
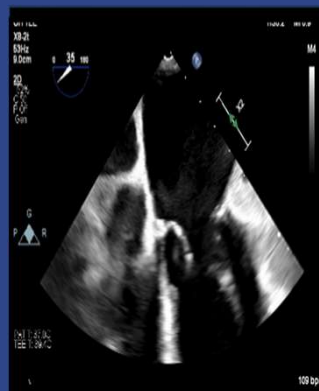
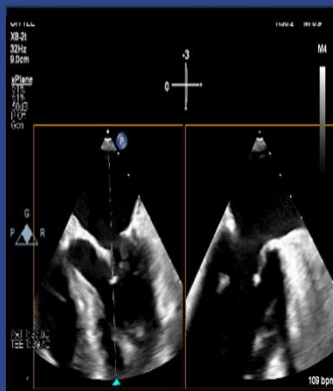
## TEE 3/24

- Order for ruptured papillary muscle
  - Bi-plane imaging shows the ruptured papillary muscle in two different views



27

## TEE 3/24

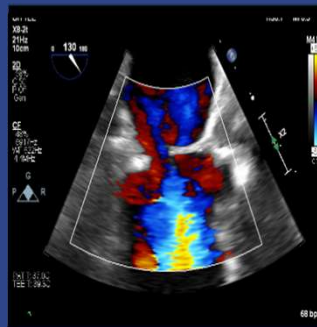
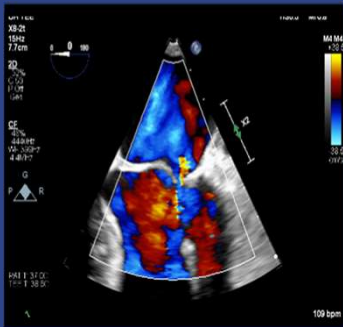


28

# 2025 SDMS Annual Conference

## TEE 3/24

- TEE much better assessment
  - “There is severe mitral valve regurgitation which is posteriorly directed. The postero-medial papillary muscle is likely bifid with one head of the muscle completely ruptured causing holosystolic prolapse of the anterior leaflet and severe eccentric posteriorly directed MR jet.”

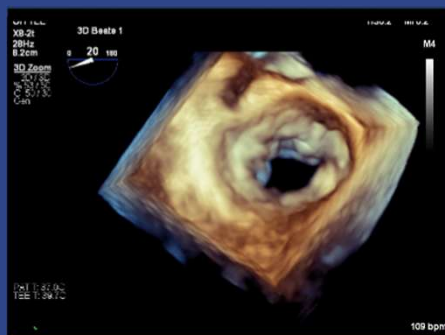


29

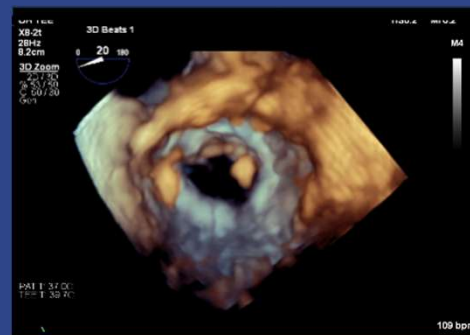
## TEE 3/24

3D imaging shows the rupture.

From the LA - Enface- surgeons view



From the ventricle

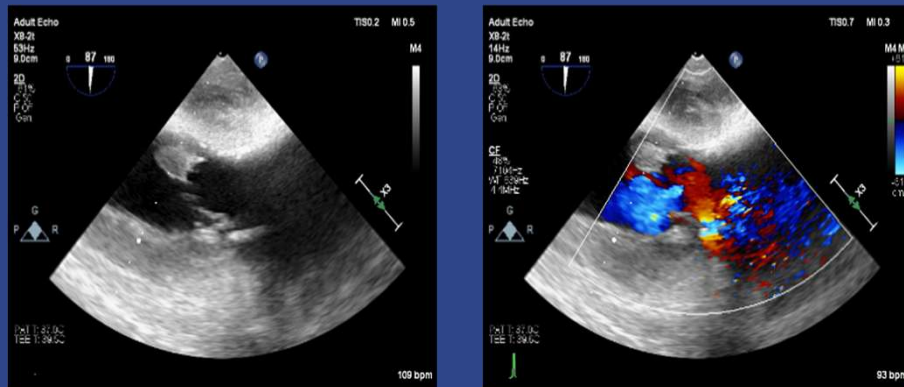


30

# 2025 SDMS Annual Conference

## Intra-op TEE 3/25

Confirm papillary rupture



31

## Intra-op TEE 3/25

MVR



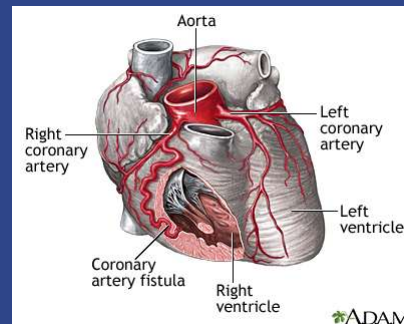
32

# 2025 SDMS Annual Conference

## Coronary Artery Fistula

### Extremely rare

- Usually congenital, but possibly post MI
- Abnormal connection between a coronary artery and a heart chamber
- Chest pain, dyspnea, heart failure
  - Must close fistulas- cath with coil or surgery



[Medlineplus.gov/ency/imagepages/19878.htm](https://medlineplus.gov/ency/imagepages/19878.htm)

33

## Ventricular Septal Defect /Rupture (VSD or VSR)

01

Extremely rare post MI complication of transmural MI

- Apical septum with anterior MI
- Basal posterior septum with inferior MI – more likely to have multiple fenestrations

02

1-3% of STEMI pt.'s in the absence of reperfusion therapy and 0.2% -0.34% of pt.'s receiving fibrinolytic therapy

03

Usually within 24 hours to 3-5 days post MI but may develop up to 14 days post STEMI.

04

### Signs and symptoms

- New holosystolic murmur
- Severe heart failure, pulmonary edema, cardiogenic shock, ventricular overload

34

# 2025 SDMS Annual Conference

## VSD Mortality

Medically treated - 24% at 72 hours increasing to 75% at 3 weeks

surgical mortality:

- 70% inferior infarcts

basal septum-complex often involves MV, coexisting MR

- 30% anterior infarcts

Conservative treatment - 94%

Collectively all surgical treatment have 47% mortality

Difficult surgical procedure

Preoperative medical instability –acute infarct phase

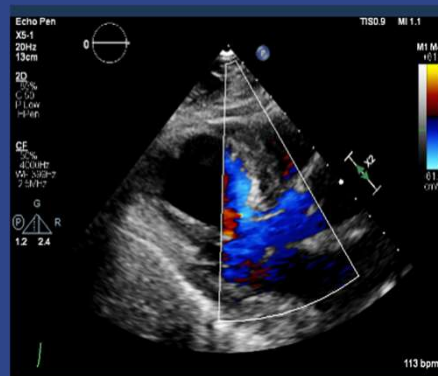
Necrotic tissue is fragile- lack solid support for patches and sutures

Delaying surgery short term may improve outcomes- difficult balance

35

## Post STEMI VSD

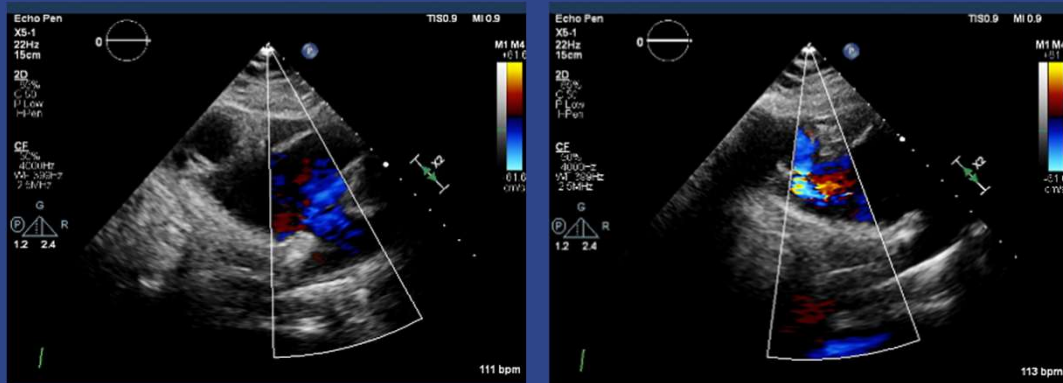
- Anterior STEMI complicated by VSD
  - EF 45-50%
  - “There is septal-apical akinesis and an ~ 8 mm apical VSD with apical-and basilar-directed jets”



36

# 2025 SDMS Annual Conference

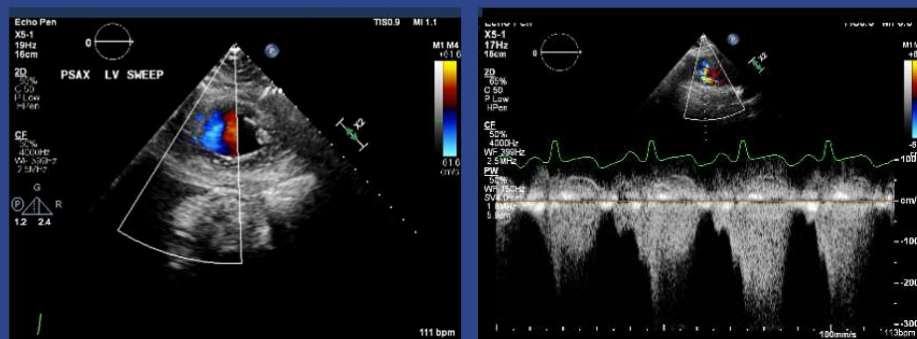
## Post STEMI VSD



37

## Post STEMI VSD

## Long sweep acquisition



38

## Post STEMI VSD

## Tall color boxes



### Subcostals - perpendicular



# 2025 SDMS Annual Conference

## Pseudoaneurysm

Full rupture of the ventricular wall and is contained by the surrounding pericardium

Most common involve posterior or inferior wall segments

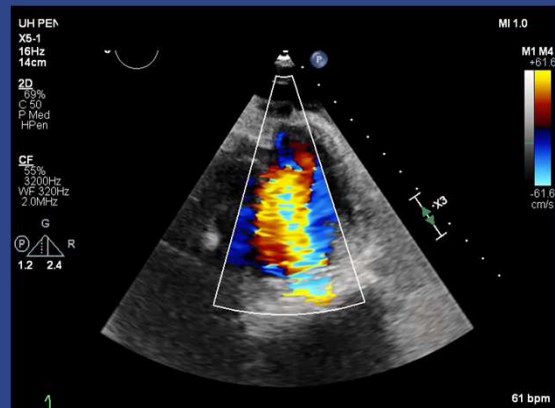
Large symptomatic can cause v-tach, heart failure and sudden death

Managed by anticoagulation therapies and may require surgical resection.

Potential medical emergency

41

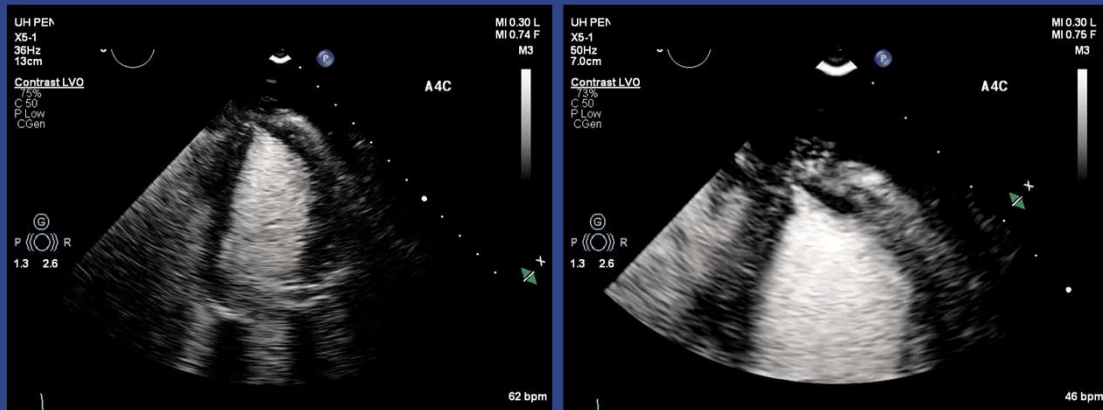
## Pseudoaneurysm



42

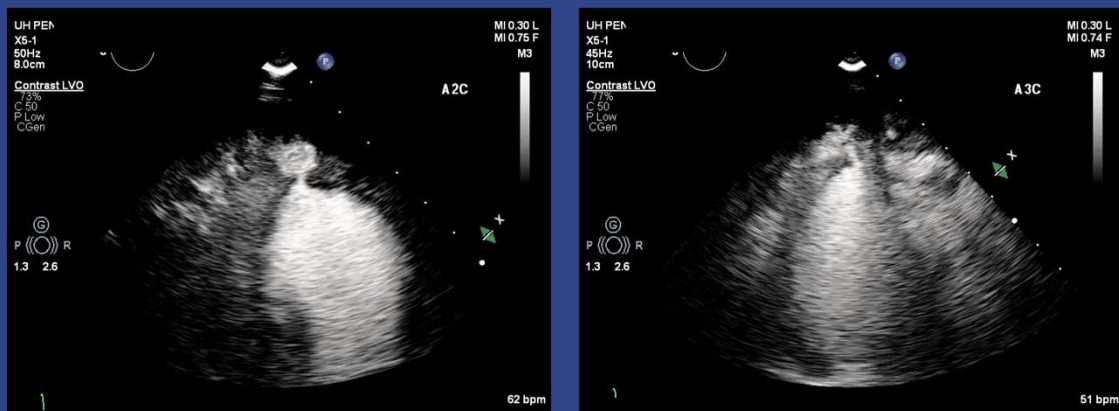
# 2025 SDMS Annual Conference

## Pseudoaneurysm



43

## Pseudoaneurysm



44

# 2025 SDMS Annual Conference

## Aneurysm

- As early as 48 hours – 14 days post infarct
- Gross thinning of the infarct zone
- Necrotic myocytes lead to decreased diastolic and systolic function
- Influenced by:
  - Within 6-8 weeks the loss of myocytes decreases wall thickness myocardium becomes replaced by fibrous tissue which decreases and
    - Preserved contractility of surrounding myocardium
    - Lack of collaterals and reperfusion
    - Hypertension
    - Transmural infarction

45

## Aneurysm

- Damaged myocardial tissue is replaced by fibrous tissue and cannot participate in contraction.
- Tissue is displaced outward during systole.
- Most often asymptomatic and found in follow up echocardiography
- A significant aneurysm occurs in 30-35% of acute transmural MI's
- Most common in the apex and anteroapical wall (85%)
- Inferior posterior or lateral wall is very low incidence (5%-10%)
- Large symptomatic can cause v-tach, heart failure and sudden death
- Managed by anticoagulation therapies and may require surgical resection.
- Potential medical emergency

46

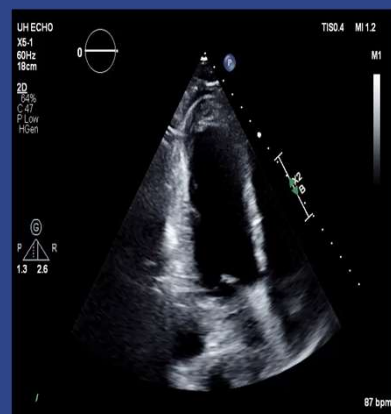
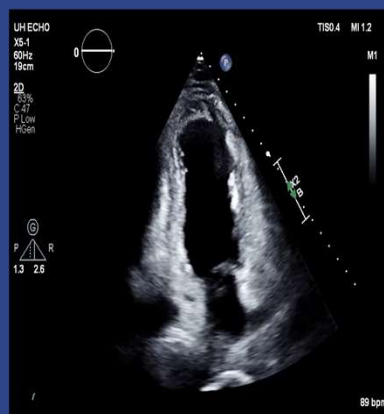
# 2025 SDMS Annual Conference

Echo 11/2020



47

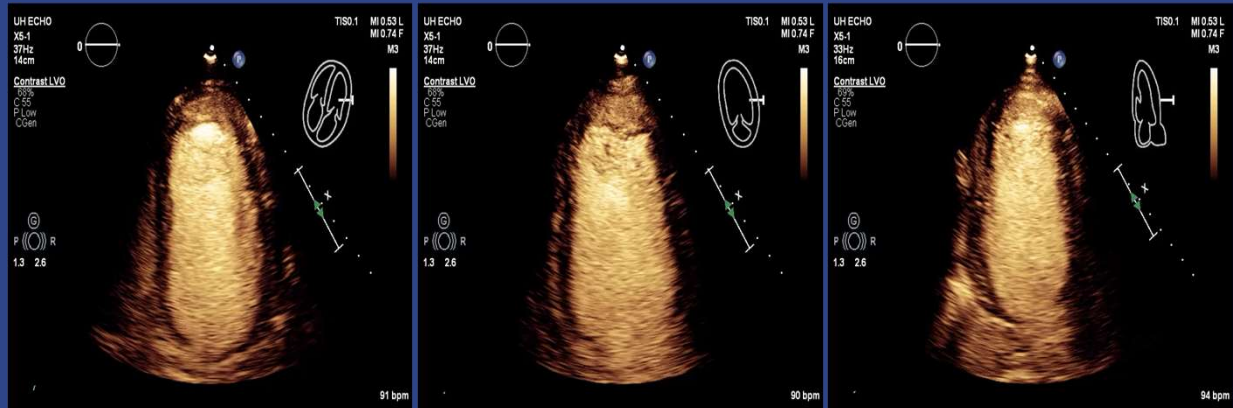
11/2020



48

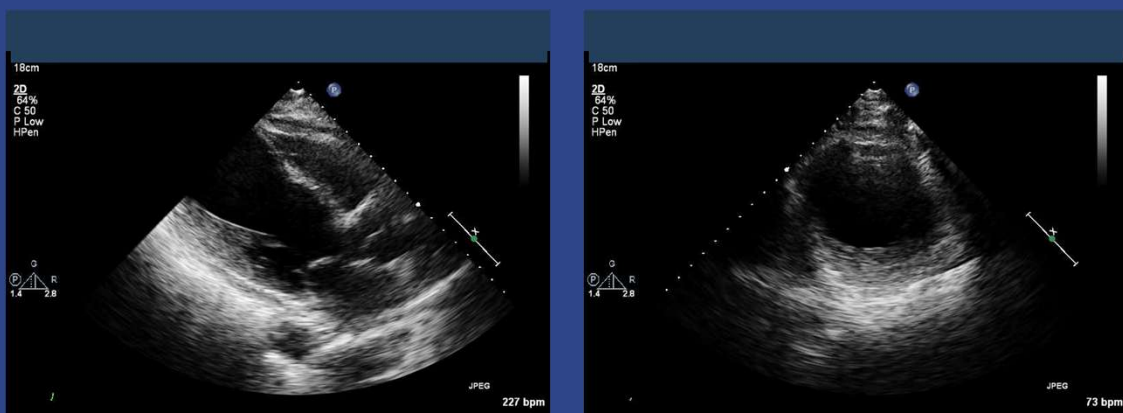
# 2025 SDMS Annual Conference

11/2020



49

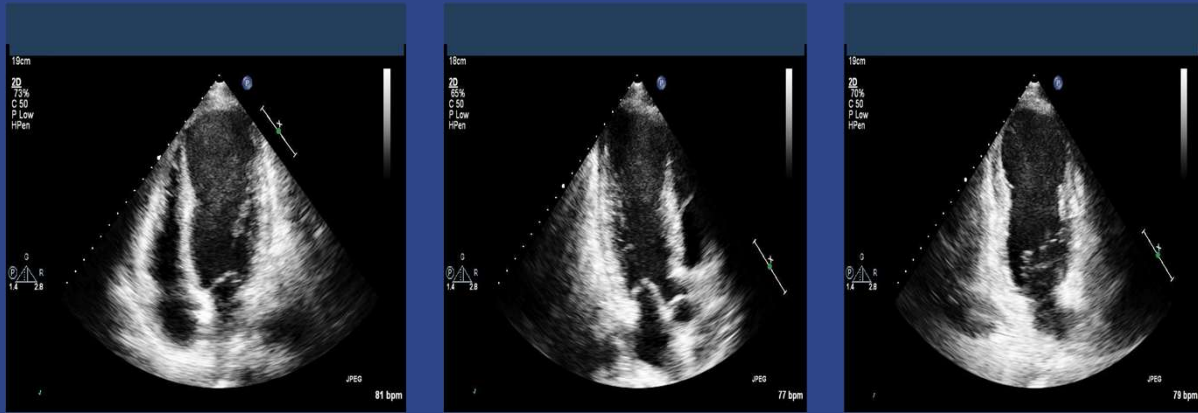
12/2020



50

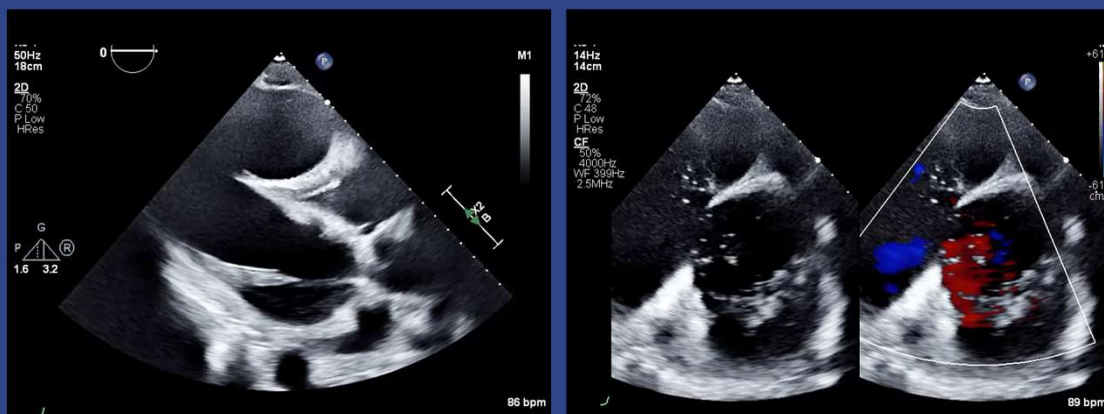
# 2025 SDMS Annual Conference

12/2020



51

3/2021



52

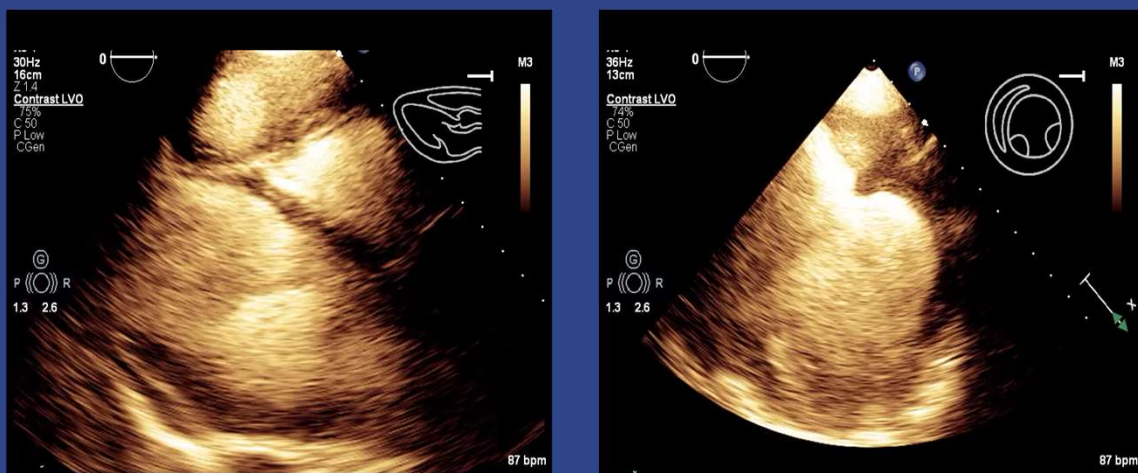
# 2025 SDMS Annual Conference

3/2021



53

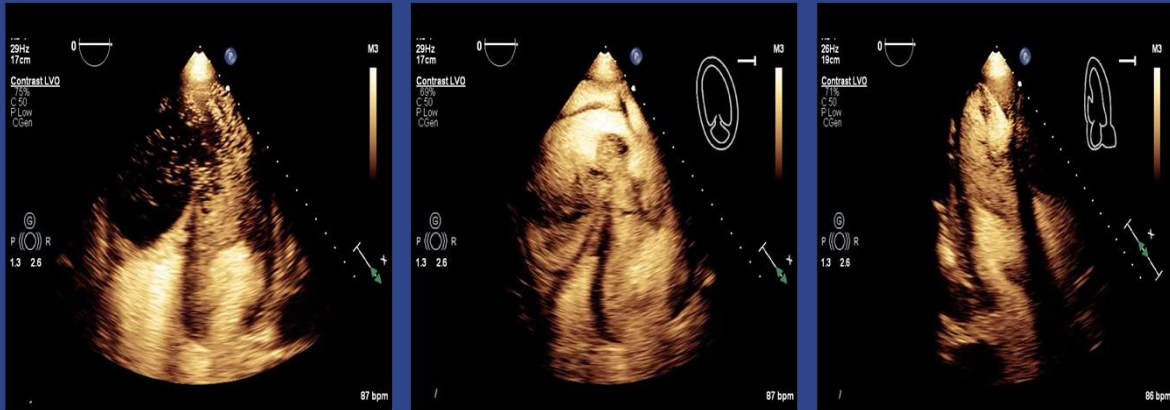
3/2021



54

# 2025 SDMS Annual Conference

3/2021



55

2/2025



56

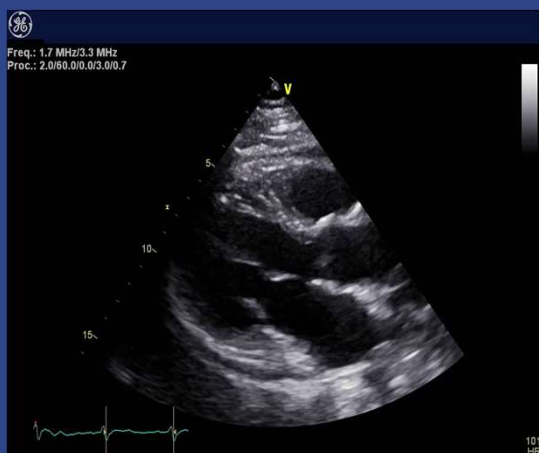
# 2025 SDMS Annual Conference

2/2025



57

## Complicated Aneurysm 10/26



In patient echo ordered for acute heart failure

58

# 2025 SDMS Annual Conference

## Complicated Aneurysm 10/26



In patient echo ordered for acute heart failure

59

## Complicated Aneurysm TEE 11/5 VSD



Emergent overnight TEE for murmur and shock

60

# 2025 SDMS Annual Conference

## References

- [Ncbi.nlm.nih.gov/books/NBK555955/](https://www.ncbi.nlm.nih.gov/books/NBK555955/)
  - Nguyen S, Umana-Pizano JB, Donepudi R, Dhoble A, Nguyen TC. Minimally Invasive Mitral Valve Repair for Acute Papillary Muscle Rupture During Pregnancy. Ann Thorac Surg. 2019 Feb;107(2):e93-e95. [PubMed] [Reference list]
  - Burton LV, Beier K. Papillary Muscle Rupture. [Updated 2022 Jul 7]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499976/>
  - Daga LC, Kaul U, Mansoor A. Approach to STEMI and NSTEMI. J Assoc Physicians India. 2011 Dec;59 Suppl:19-25. PMID: 22624277.
  - Echo images courtesy of University Hospitals Cleveland Medical Center
  - [Johnfrancis.org/professional/what-is-the-meaning-of-hypokinesia-dyskinesia-and-akinesia/?amp=1](https://www.johnfrancis.org/professional/what-is-the-meaning-of-hypokinesia-dyskinesia-and-akinesia/?amp=1)
  - Burton LV, Beier K. Papillary Muscle Rupture. [Updated 2023 May 22]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499976/>
- Sharma S, Burton LV, Beier K. Papillary Muscle Rupture. 2024 Nov 25. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. PMID: 29763151.

61

## References

- Mahajan K, Shah N, Patel H. Postinfarction Ventricular Septal Rupture. [Updated 2022 Sep 19]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK534873/>
- Tricuspid Valvular Papillary Muscle Rupture With Intractable Hypoxia: A Rare Complication Post MI  
Walker, Jonathan R. et al. Journal of the American Society of Echocardiography, Volume 22, Issue 7, 863.e1 - 863.e3
- <https://mmcts.org/tutorial/1157>  
<https://ufhealth.org/conditions-and-treatments/pericarditis-after-heart-attack>  
[Medlineplus.gov/ency/imagepages/19878.htm](https://medlineplus.gov/ency/imagepages/19878.htm)

62

# 2025 SDMS Annual Conference



Thank You!

63