AMSER Case of the Month September 2025

67-year-old with chest pain

John David Raupp
University of Michigan Medical School

Elizabeth Lee, M.D.
University of Michigan Department of Radiology

MICHIGAN MEDICINE
UNIVERSITY OF MICHIGAN

AMSER

Patient Presentation

- HPI: 67 y.o. w/ recent STEMI s/p stenting to the left anterior descending (LAD) who presented to ED with chest pressure radiating to his left arm
- Pertinent tests/labs: ECG w/ marked T wave abnormality in the anterolateral leads (noted on previous ECGs). Initial troponin was elevated to 35. As it was uncertain whether the elevated troponins were related to the current chest pain or if they were still elevated from the recent STEMI he underwent cardiac catheterization.
  - PCI of distal RCA was performed due to a 90% stenosis
- Echocardiography was notable for an ejection fraction of 44%

What Imaging Should We Order?

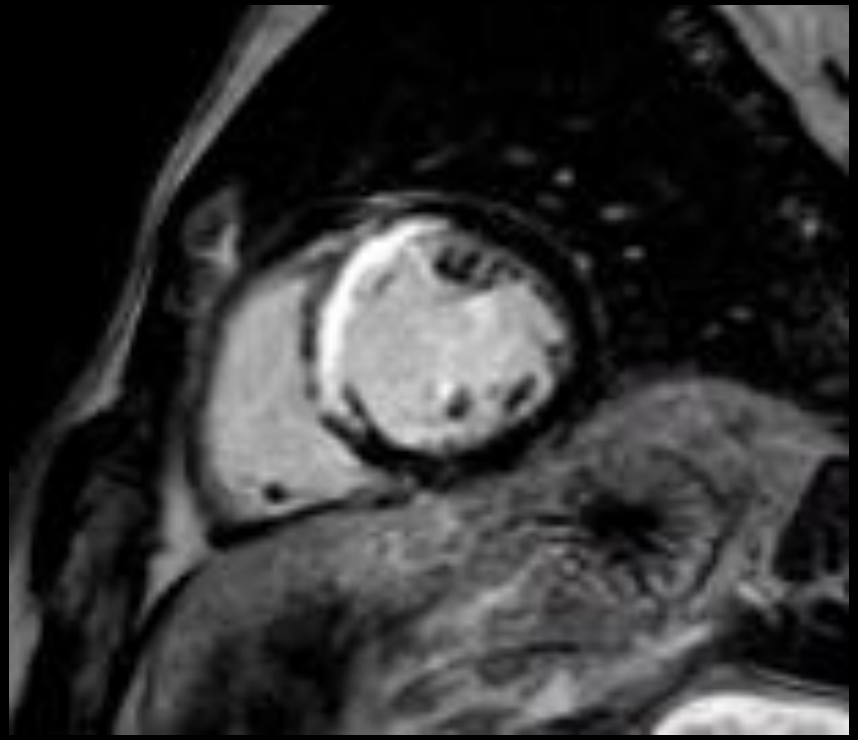
Select the applicable ACR Appropriateness Criteria

Scenario	Scenario ID	Procedure	Adult RRL	Peds RRL	Appropriateness Category
		US echocardiography transthoracic resting	0 mSv O	0 mSv [ped] O	Usually appropriate
		US echocardiography transthoracic stress	0 mSv O	0 mSv [ped] O	Usually appropriate
		MRI heart function and morphology without and with IV contrast	0 mSv O	0 mSv [ped] O	Usually appropriate
		MRI heart function and morphology without IV contrast	0 mSv O	0 mSv [ped] O	Usually appropriate
		MRI heart function with stress without and with IV contrast	0 mSv O	0 mSv [ped] O	Usually appropriate
		Radiography chest	<0.1 mSv *	<0.03 mSv [ped] *	May be appropriate
		Nuclear medicine ventriculography	1-10 mSv ***	3-10 mSv [ped] ***	May be appropriate
		CT heart function and morphology with IV contrast	10-30 mSv *****	3-10 mSv [ped] *****	May be appropriate
		FDG-PET/CT heart	10-30 mSv *****	3-10 mSv [ped] *****	May be appropriate
Heart failure, follow-up imaging	3198624	Rb-82 PET/CT MPI rest and stress	10-30 mSv *****		May be appropriate
		SPECT or SPECT/CT MPI rest and stress	10-30 mSv *****	10-30 mSv [ped] ******	May be appropriate
		US echocardiography transesophageal	0 mSv O	0 mSv [ped] O	Usually not appropriate
		Arteriography coronary	1-10 mSv ***		Usually not appropriate
		MRA coronary arteries without and with IV contrast	0 mSv O	0 mSv [ped] O	Usually not appropriate
		CT chest with IV contrast	1-10 mSv ***	3-10 mSv [ped] *****	Usually not appropriate
		CT chest without and with IV contrast	1-10 mSv ***	3-10 mSv [ped] *****	Usually not appropriate
		CT chest without IV contrast	1-10 mSv ***	3-10 mSv [ped] *****	Usually not appropriate
		CT coronary calcium	1-10 mSv ***		Usually not appropriate
		CTA coronary arteries with IV contrast	1-10 mSv ***	3-10 mSv [ped] *****	Usually not appropriate

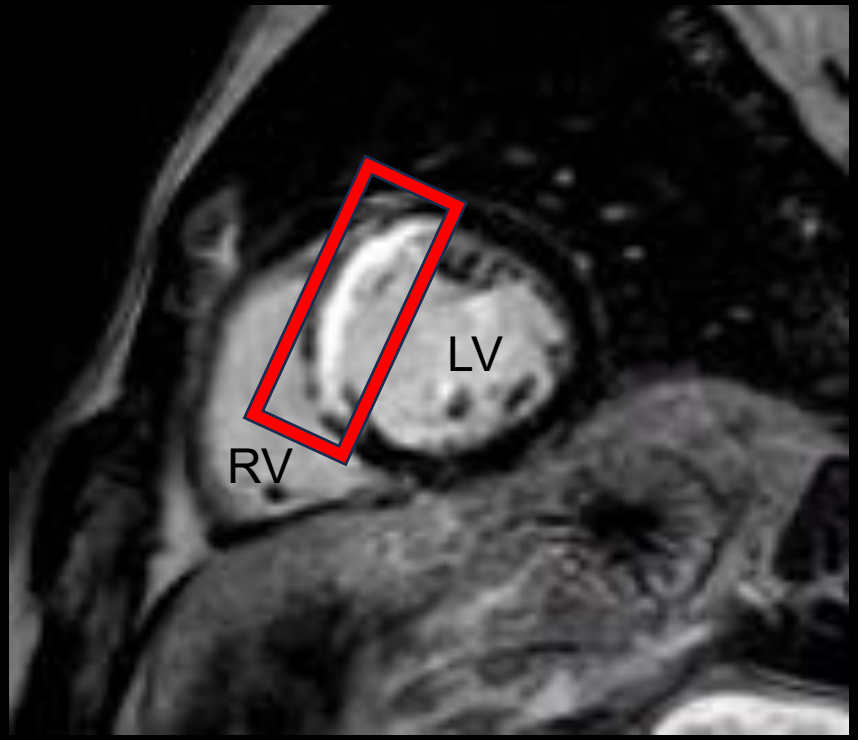
This imaging modality was ordered by the Cardiologist

AMSER

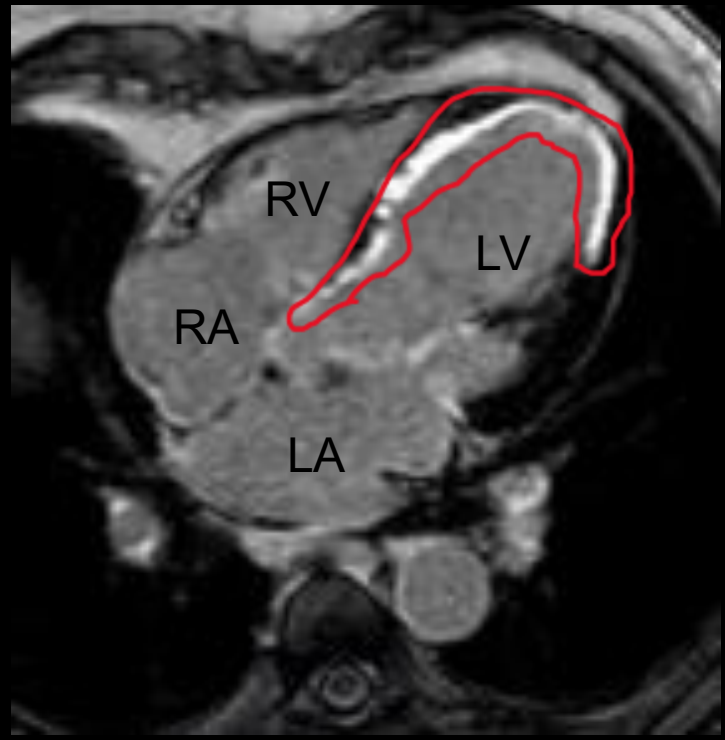
Findings: (unlabeled)



Findings: (labeled)



Delayed enhancement of the anterior septum of the left ventricle (red box) extended to the anterior wall on short axis images.



Delayed enhancement can be seen to involve the apex to base (inside red drawing) on the 4 chamber view.

RV= Right ventricle, LV= Left ventricle, RA= right atrium, LA= left atrium

AMSER

Final Dx:

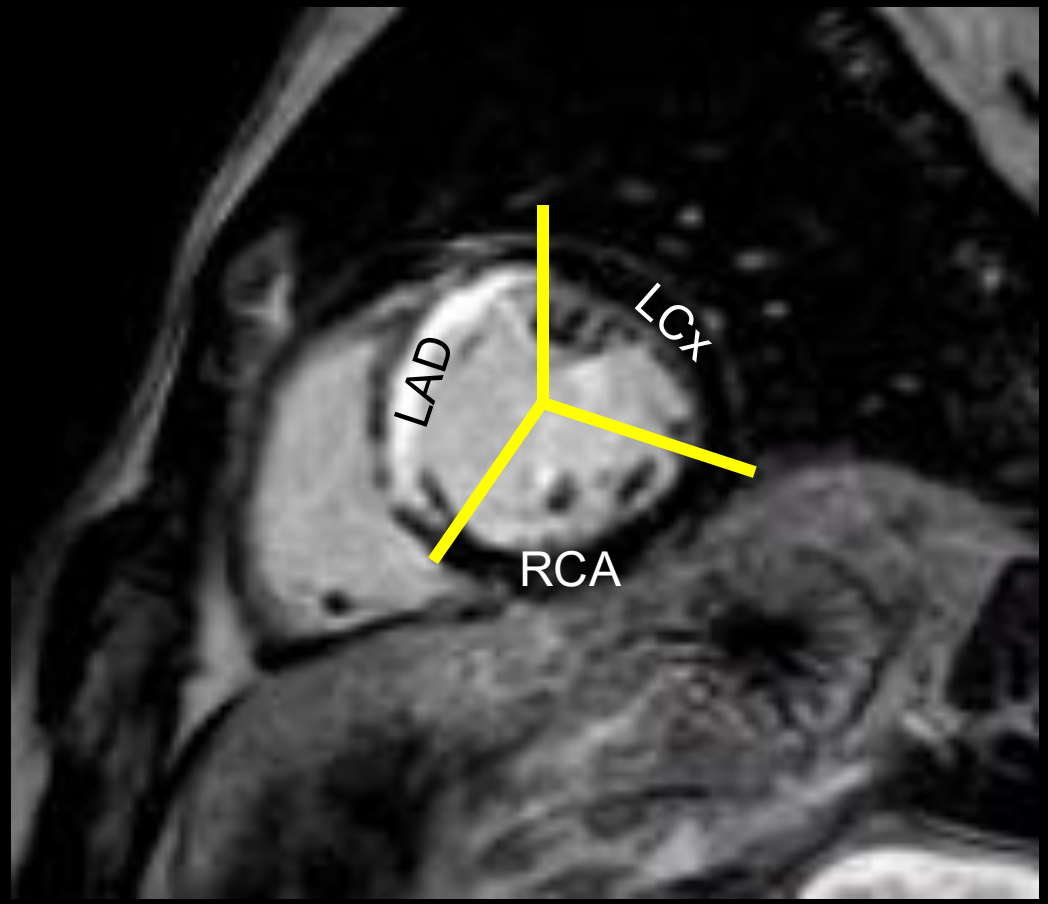
Ischemic cardiomyopathy (left ventricular ejection fraction= 42%) with transmural infarct of the LAD

Case Discussion: Late Gadolinium Enhancement

- Late gadolinium enhancement (LGE)/delayed enhancement is a MR imaging technique where gadolinium contrast is injected and images are obtained around 10 min after contrast administration.[1]
- How does this work?
  - Gadolinium is an extracellular contrast. In a normal heart, myocytes have limited extracellular space and gadolinium exits relatively quickly due to efficient venous and lymphatic drainage.
  - However, in myocardial infarcts, such as this case, the gadolinium cannot washout due to fibrosis and this leads to enhancement on delayed imaging.
  - Gadolinium retention can also occur in a diseased heart by other conditions which alter the extracellular matrix such as with edema (i.e. myocarditis) or in infiltrative conditions (i.e. cardiac amyloid).

Case Discussion: Late Gadolinium Enhancement

- Ischemic versus non-ischemic cardiomyopathies can be differentiated on MR by the following:
  1. Enhancement from ischemia can range from mild, involving only the subendocardial layer, to severe, which involves all layers of the myocardium (i.e., transmural).
  2. Enhancement from ischemia follows the coronary artery vascular territories.[2]



Coronary Artery Territories

RCA= Right coronary artery

LCx= Circumflex

LAD = Left anterior descending

Case Discussion: Patient Follow-Up

- MR imaging identified the distribution of injury and allowed for determination of current systolic function (not shown), data which can better guide the cardiologist to what goal directed therapies are indicated.
- Multiple studies have shown transthoracic echocardiography (TTE) is less reproducible compared to MR for quantification of cardiac function which could have implications for patient management[3-4]
  - TTE remains a more commonly used examination for assessment of cardiac function given its increased accessibility compared to MR at this time
  - MR has the potential in cases where there is clinical uncertainty, such as this case, to provide additional data to improve patient care and risk stratification

References:

1. Aquaro G, De Gori C, Faggioni L, Parisella ML, Cioni D, Lencioni R, & Neri E. Diagnostic and prognostic role of late gadolinium enhancement in cardiomyopathies. Eur Heart J. 2023;25C130-C136. doi: 10.1093/eurheartjsupp/suad015.
2. Jackson E, Bellenger N, Seddon M, Harden S, & Peebles C. Ischaemic and non-ischaemic cardiomyopathies - cardiac MRI appearances with delayed enhancement. Clinical Radiology 2007; 62:395-403. doi: 10.1016/j.crad.2006.11.013
3. Dhall E, Mahmood A, Aung N, & Khanji M. Cardiovascular magnetic resonance versus echocardiography derived left ventricular ejection fraction for decision-making. Future Cardiology. 2024; 20:811–814. doi: 10.1080/14796678.2024.2426875.
4. Alexis J, Costello B, Iles L, Ellims A, Hare J, & Taylor A. Assessment of the accuracy of common clinical thresholds for cardiac morphology and function by transthoracic echocardiography. J Echocardiogr. 2017; 15:27-36. doi: 10.1007/s12574-016-0322-4.

AMSER