



Cardiac MR Imaging: from Physics to Protocols Case Examples

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Disclosures

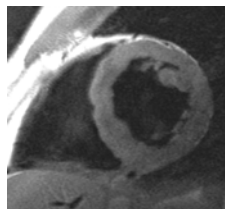
Consultant: Berlex, GE-Healthcare

Research support: Epix Medical

Off-label use: gadolinium enhanced
MRI of the heart

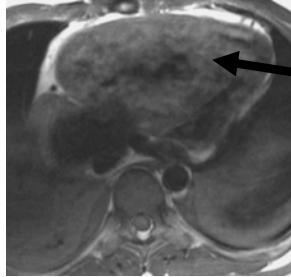
Which is the current best method for obtaining T1 or T2 weighted images of the heart?

1. Spin echo
2. Double inversion
recovery fast / turbo spin
echo
3. Diffusion MRI
4. SSFP cine (eg, TruFISP)



You are evaluating a suspected RV cardiac mass and protocol a long axis double IR black blood image – but the blood is not black: why?

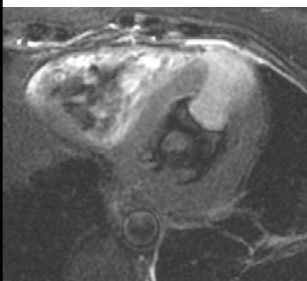
1. Usually this is due to poor technologist scanning.
2. The tech gave gadolinium; it's impossible to get black blood after gad.
3. Blood flow must be perpendicular for this sequence to work.



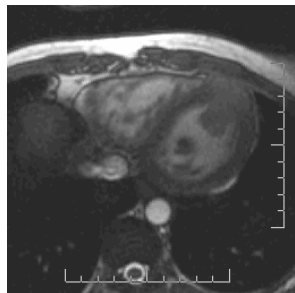
Review of Cardiac MRI

- MR cardiac pulse sequences
- Evaluation of myocardial mass
- Evaluation of coronary heart disease
- Evaluation of the right ventricle

67 yr old female with LV cardiac mass: which is most likely?



T2



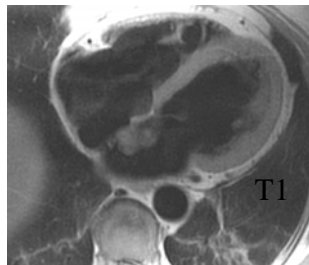
cine

Primary malignant tumors:

- 1. Angiosarcoma 31%
- 2. Rhabdomyosarcoma 20%
- 3. Other sarcoma 16%
- 4. Mesothelioma 15%
- 5. Primary Lymphoma 6%

43 yo woman with TIA's, mass discovered on echocardiography. Most likely diagnosis?

- 1. Myxoma
- 2. Blood clot
- 3. Rhabdomyosarcoma
- 4. Metastasis

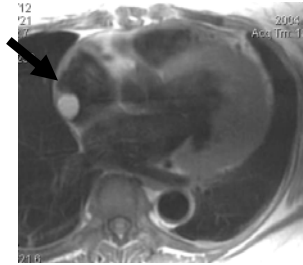


Primary benign tumors:

- 1. Myxoma 41%
- 2. Lipoma 14%
- 3. Papillary fibroelastoma 13%
- 4. Rhabdomyoma 11%

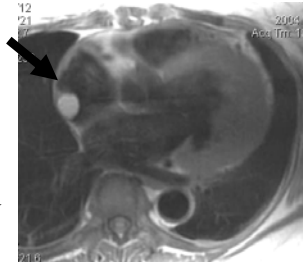
23 yo female, ambulance transfer from community hospital for RA mass on echocardiography. Which is not bright on T1?

1. Blood clot
2. Myxoma
3. Melanoma met
4. Lipoma
5. Proteinaceous cyst



5 high signal masses on T1:

1. Blood clot
2. Melanoma met
3. Lipoma
4. Proteinaceous cyst
5. Gadolinium enhanced mass



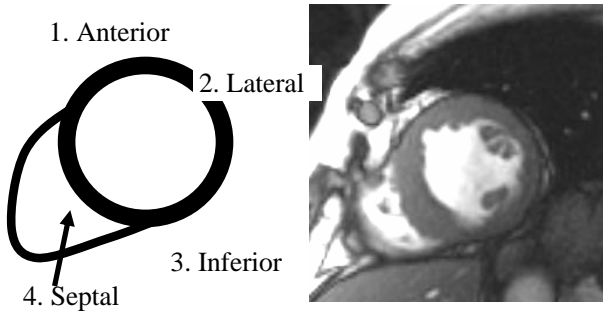
not myxoma – remember the last case?

Review of Cardiac MRI

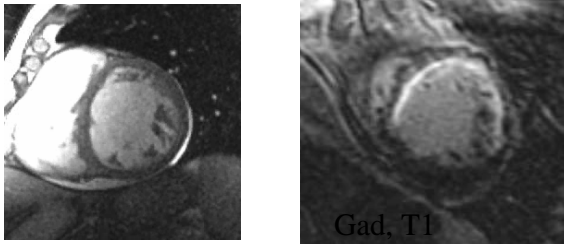
- MR cardiac pulse sequences
- Evaluation of myocardial mass
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62yo with prior non-Q wave myocardial infarction. Where is the abnormality?



80 yo, CHF, best diagnosis



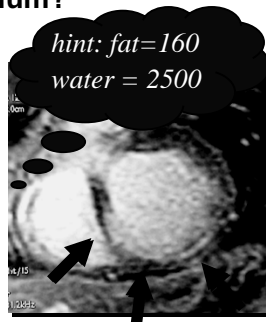
1. Myocarditis
2. Left main/ LAD infarction
3. RCA infarction
4. Sarcoidosis

What are the inversion times at 1.5 T for fat (STIR) and CSF (FLAIR sequences)

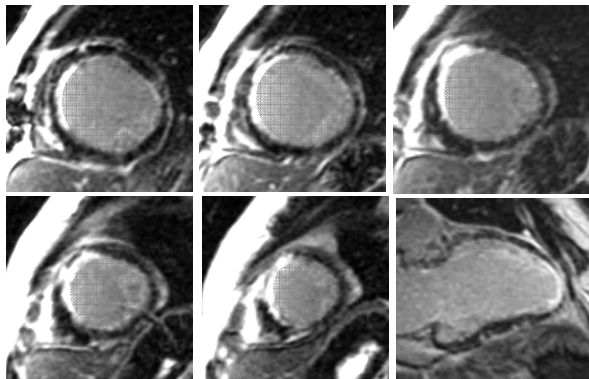
1. 160 msec (fat), 2500 msec (CSF)
2. 160 msec for both fat and CSF
3. 2500 msec for both fat and CSF

If there is more gadolinium level in the heart/ blood pool (eg, renal failure), what value of TI is needed to suppress the myocardium?

1. a smaller (shorter) TI
2. a larger (longer) TI
3. makes no difference



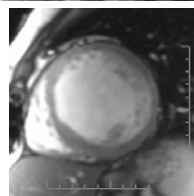
72yo male with heart failure: delayed gadolinium images

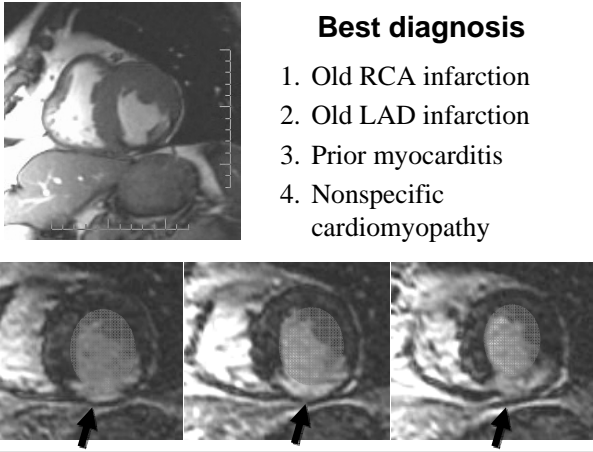


72yo male with heart failure

Diagnosis:

1. Prior RCA infarction
2. Prior LAD infarction
3. Prior myocarditis
4. Nonspecific cardiomyopathy

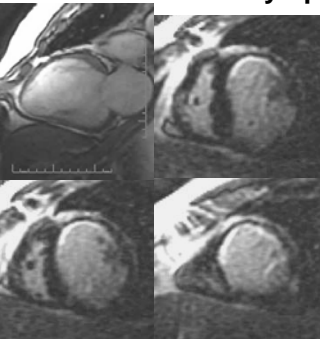




Best diagnosis

1. Old RCA infarction
2. Old LAD infarction
3. Prior myocarditis
4. Nonspecific cardiomyopathy

78 yo male, known CAD, increasing CHF symptoms

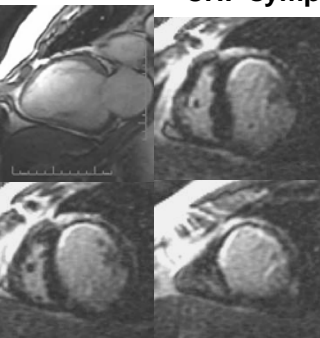


delayed gadolinium images

Management options

1. Bypass (LAD)
2. Stent (LAD)
3. Surgical ventricular restoration

78 yo male, known CAD, increasing CHF symptoms



delayed gadolinium images

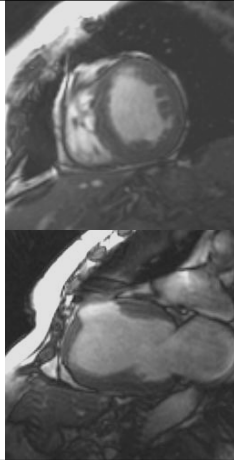
All of these!

1. Bypass (LAD)
2. Stent (LAD)
3. Surgical ventricular restoration

65 yo female

Best diagnosis

1. Pseudoaneurysm of the left ventricle (rupture)
2. True LV aneurysm
3. Mycotic aneurysm



Which is typical of true aneurysm:

1. “wide” neck with diameter comparable to the aneurysm diameter
2. Typically RCA distribution
3. Late rupture is common

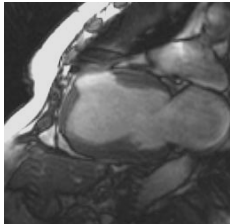
Which is typical of pseudo aneurysm:

1. Disruption of the pericardium
2. Wide necked appearance
3. 45% incidence of rupture

65 yo female, new onset CHF

Most appropriate next step:

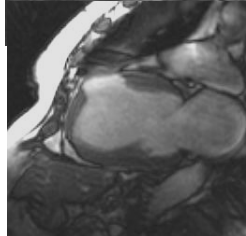
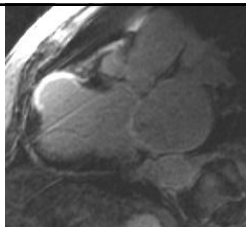
1. Immediate surgery
2. Repeat cardiac cath for stenting
3. MRI with contrast (delay)
4. MRI with hemosiderin sensitive sequences



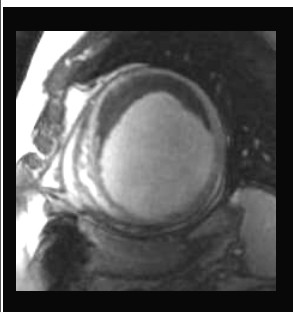
65 yo female, CHF

Best diagnosis

1. Pseudoaneurysm of the left ventricle (rupture)
2. True LV aneurysm
3. Mycotic aneurysm

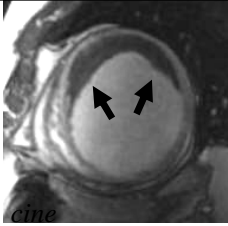


Elderly male, CHF, 9% EF, 820 ml EDV



short axis cine

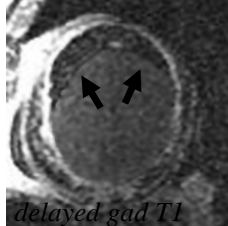





cine

What is the dark area in the aneurysm?

1. Thickened infarct
2. Blood clot
3. High concentration of Gad

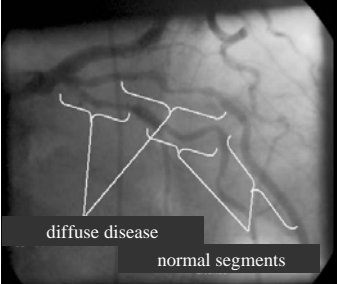


delayed gad T1



63 yo female, CHF

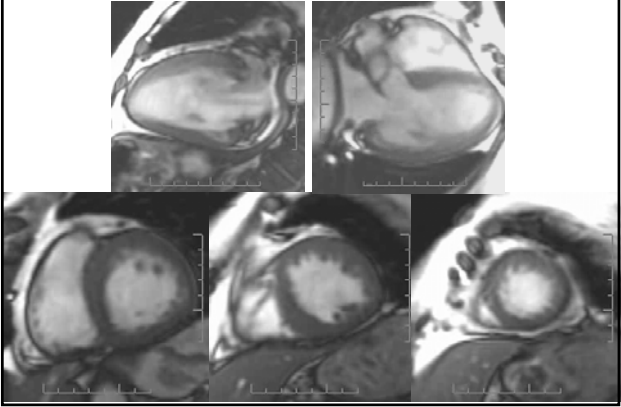
- Known diffuse coronary artery disease
- ECG: nonspecific T wave changes
- MRI ordered for treatment planning



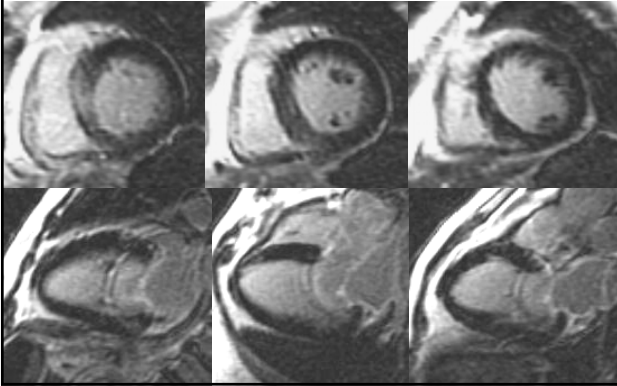
diffuse disease

normal segments

63 yo female, CHF, diffuse CAD



Delayed Gadolinium Images



63 yo female, CHF, known CAD, low ejection fraction, no delayed enhancement that would otherwise be seen in infarction

Best diagnosis:

1. Prior myocarditis or other nonischemic cardiomyopathy
2. Small infarcts too small to be seen on MRI
3. Hibernating myocardium

64 yo male, 24 hrs after acute MI: delayed stent/ reperfusion

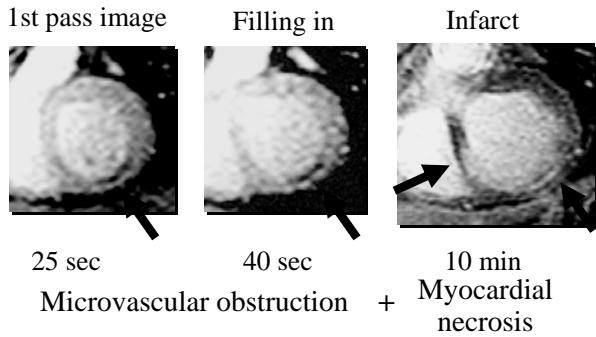


1st pass perfusion

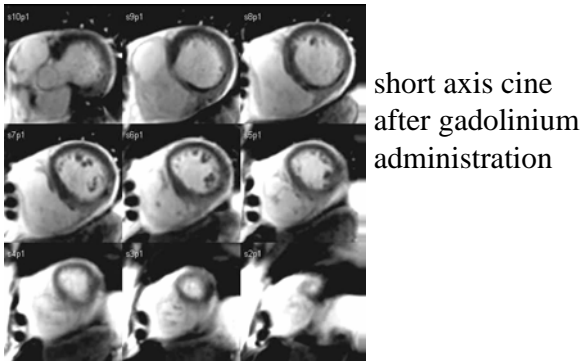
Rest perfusion abnormality indicates:

1. coronary artery narrowing
2. myocardial infarction
3. microvascular obstruction (“no-reflow”)

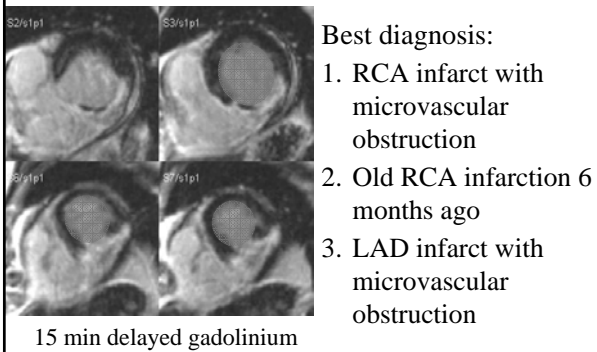
Acute infarct with microvascular obstruction (at the infarct core)



52 yo male, acute chest pain, emergent cath/ stent. MRI for extent of disease.



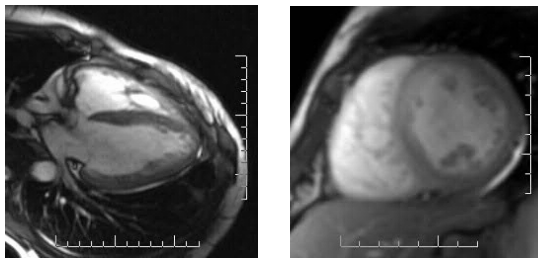
52 yo male, acute chest pain, emergent cath/ stent. MRI for extent of disease.

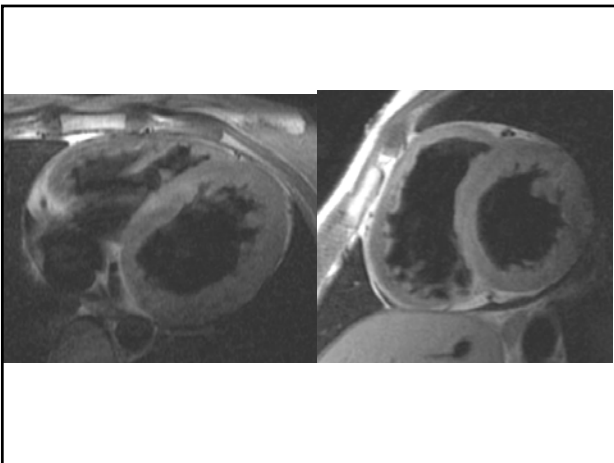


33 yo Asian female, transferred for suspected right heart failure and arrhythmia

- Palpitations, syncope, ER with VT
- Cath: normal coronaries
- Echo: normal LV, poor RV function
- LVgram: hypokinetic LV, 30% EF
- RVgram: global dysfunction

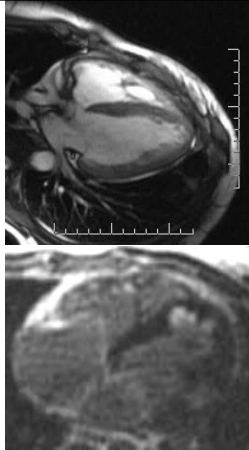
LV EF: 48%, RV EF: 25%





Best Diagnosis

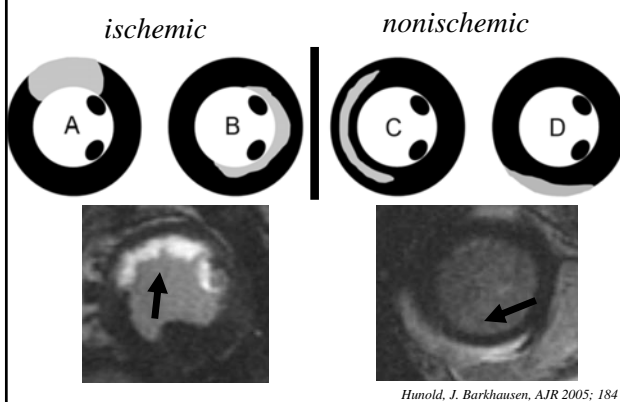
1. ARVD
2. Sarcoidosis
3. Chagas
4. Other myocarditis



Delayed Gadolinium enhancement of the heart is not specific for infarction:

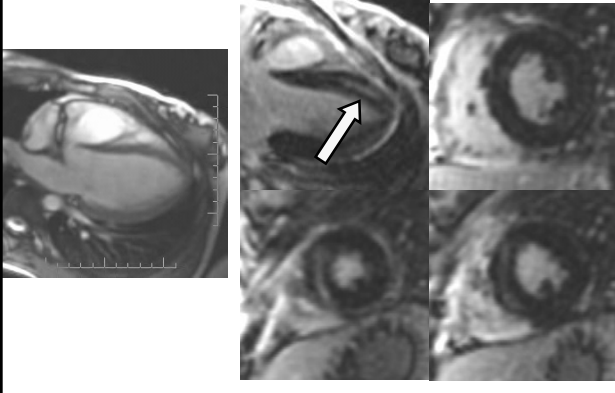
- Fibrosis (old MI)
- Myocardial necrosis (acute MI)
- Tumor
- Inflammation – myocarditis
- Amyloid
- Sarcoid
- Chagas disease (fibrosis)

Gadolinium is a nonspecific contrast agent

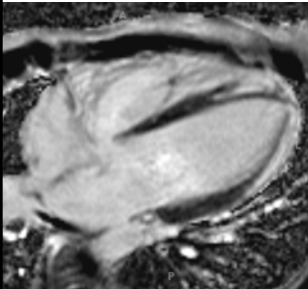


Hunold, J. Barkhausen, AJR 2005; 184

25 yo, acute chest pain 2 mos previously



25 yo, 1 yr f/u. Persistent elevated ESR.



Best diagnosis:

1. Circumflex infarction
2. ARVD
3. Myocarditis
4. Congestive heart failure

phase sensitive IR

Acute fever, malaise, arrhythmia



Best diagnosis:

1. Sarcoid
2. Myocarditis
3. Chagas
4. Amyloid

(courtesy, J. Freeby, MD)
