

# **MRI Work-up Of Cardiac Masses**

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NO DISCLOSURE

## OBJECTIVES:

How MRI excels in mass characterization.

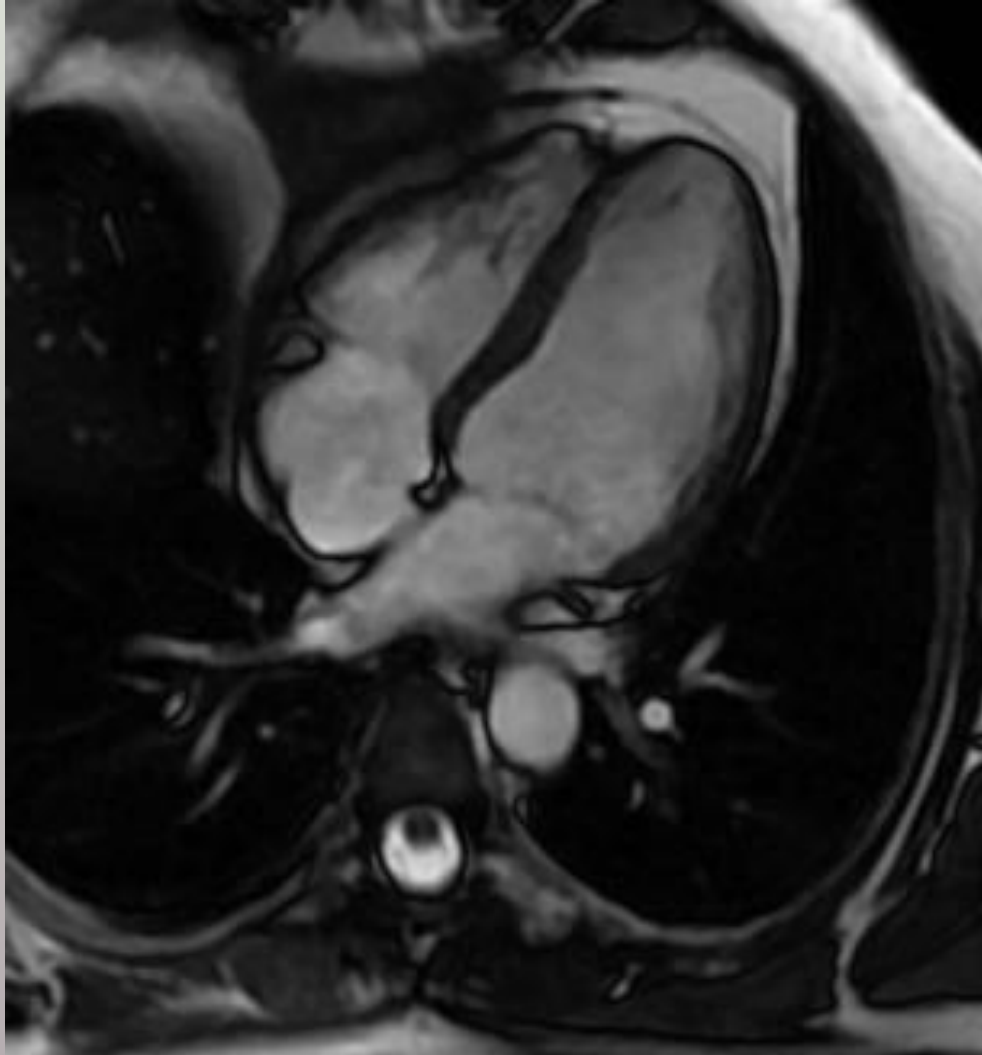
MRI of cardiac thrombus.

MRI and CT sequences for mass work up.

More

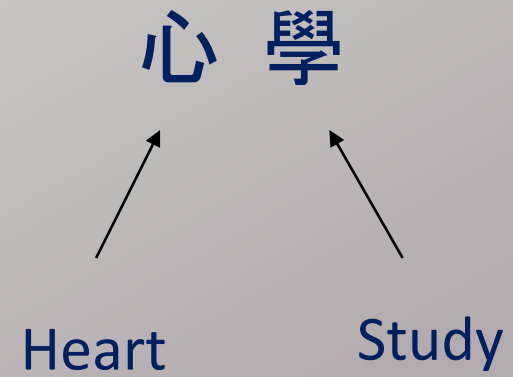
Radiology

Income



# Wang Shouren

1472-1529 AD



*Cicero: Natural law is above all governmental laws.*

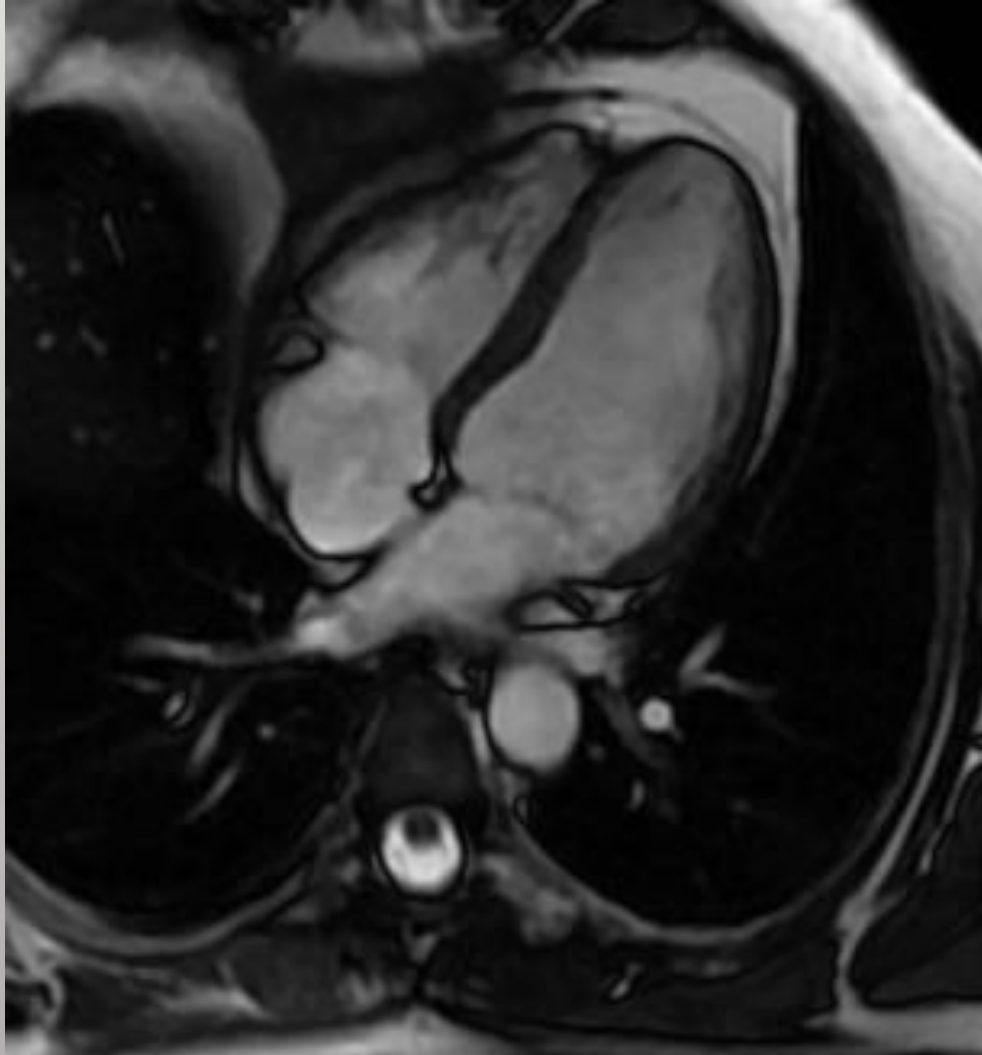
*We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights...*

*St Paul: I know what is good, I keep doing evil.*

*John Locke: God's laws are imprinted on the human understanding, but not understood.*

*Wang: Study the heart. Knowing and doing are ONE.*

*Humanity is God's law.*



Mass detected on echo



Cardiac CT

MRI

3 phases:

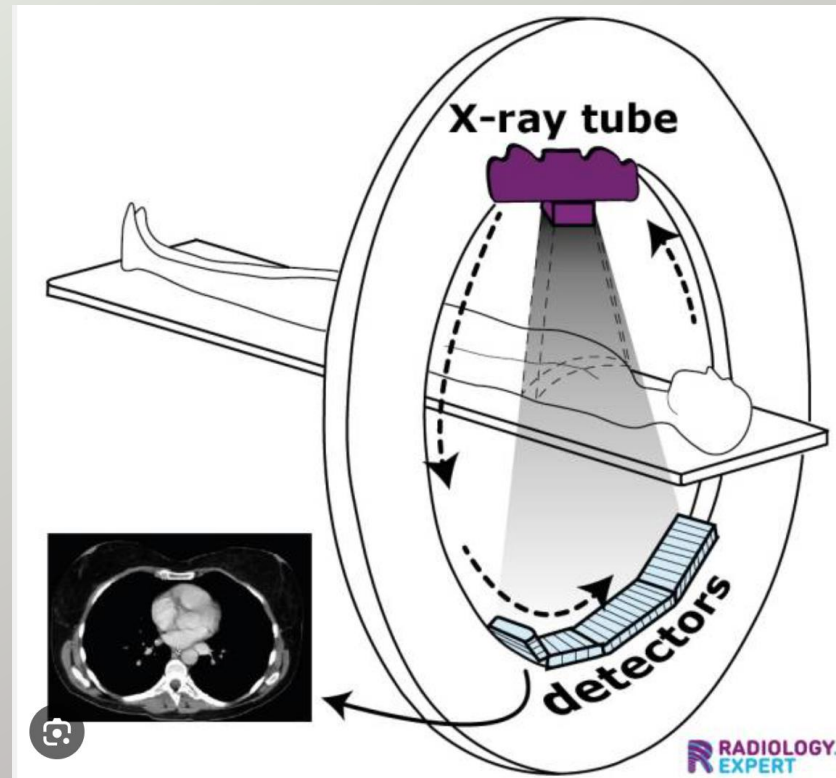
No contrast

Arterial phase

Venous phase

- Bright blood cine
- T1 and T2 weighted images
- Post contrast images (arterial phase, venous phase and delayed phase)

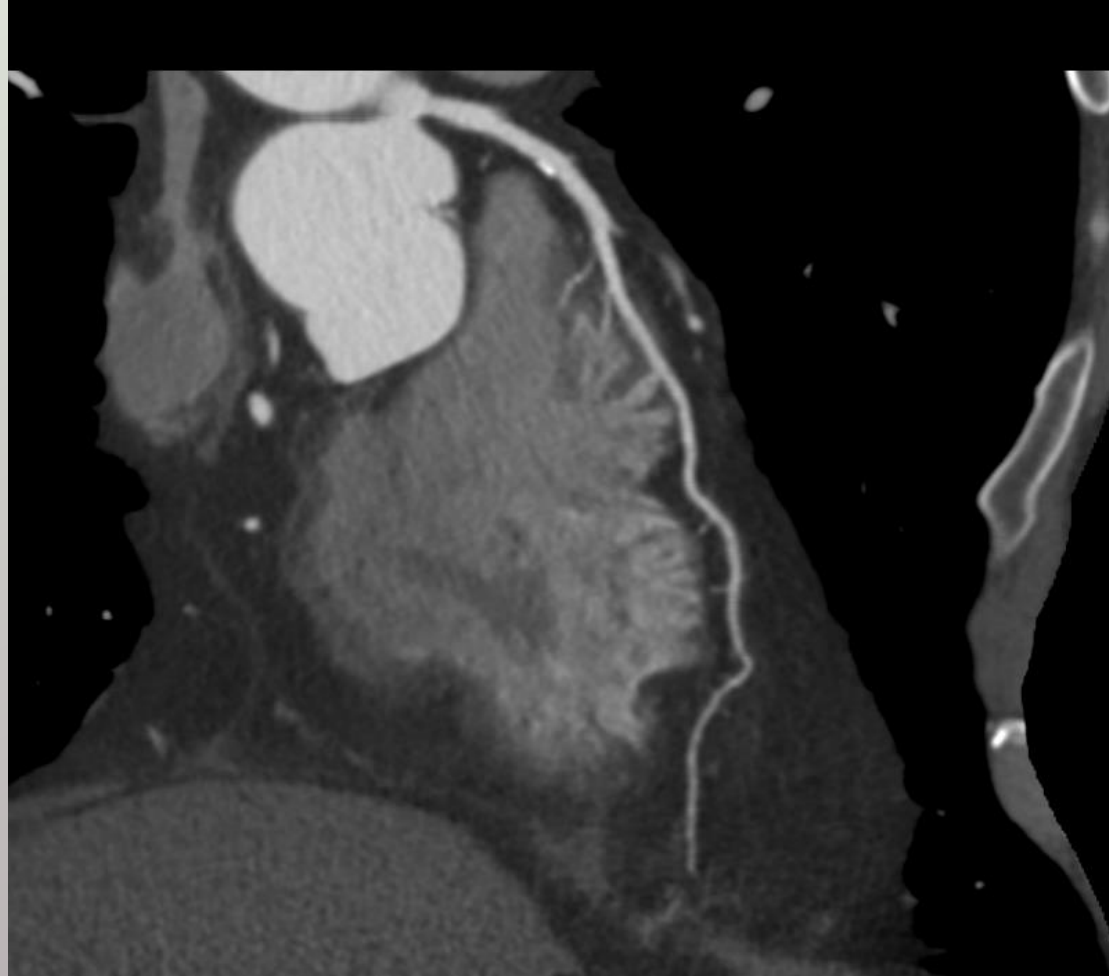
# CT



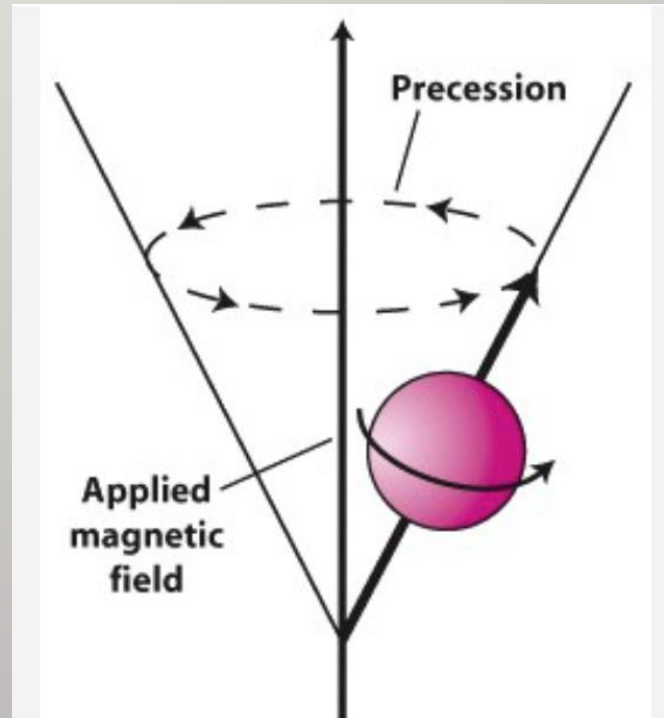
Not as cool

The CT signal is based on **how many photons are lost along the path**

attenuation  $\approx$  electron density in soft tissue  $\approx$   
physical density in soft tissue



# MRI



Smarter

T1 and T2 measure how fast the proton magnetic vector recovers or decays.  
No radiation.

# ELECTROMAGNETIC SPECTRUM



**RADIO**



**MICROWAVE**



**INFRARED**



**VISIBLE**



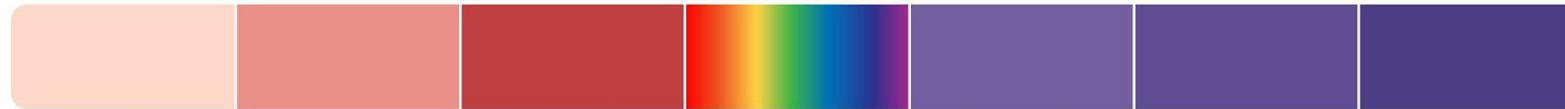
**ULTRAVIOLET**



**X-RAY**



**GAMMA RAY**



## WAVELENGTH (Approximate Size)

$10^3$  m



$10^{-2}$  m



$10^{-5}$  m



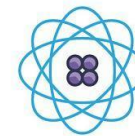
$0.5 \times 10^{-6}$  m



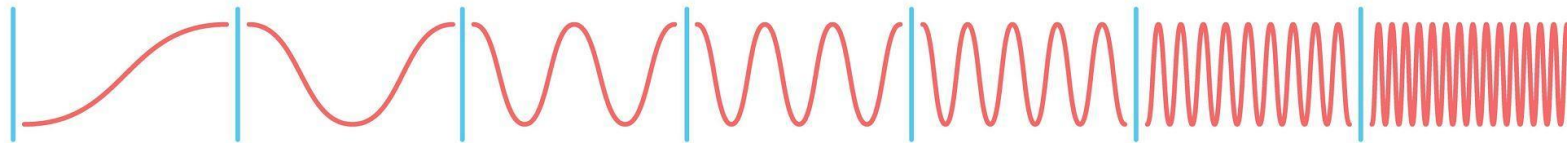
$10^{-8}$  m



$10^{-10}$  m



$10^{-12}$  m



**LONGER WAVELENGTH**

**↓ LOWER FREQUENCY**

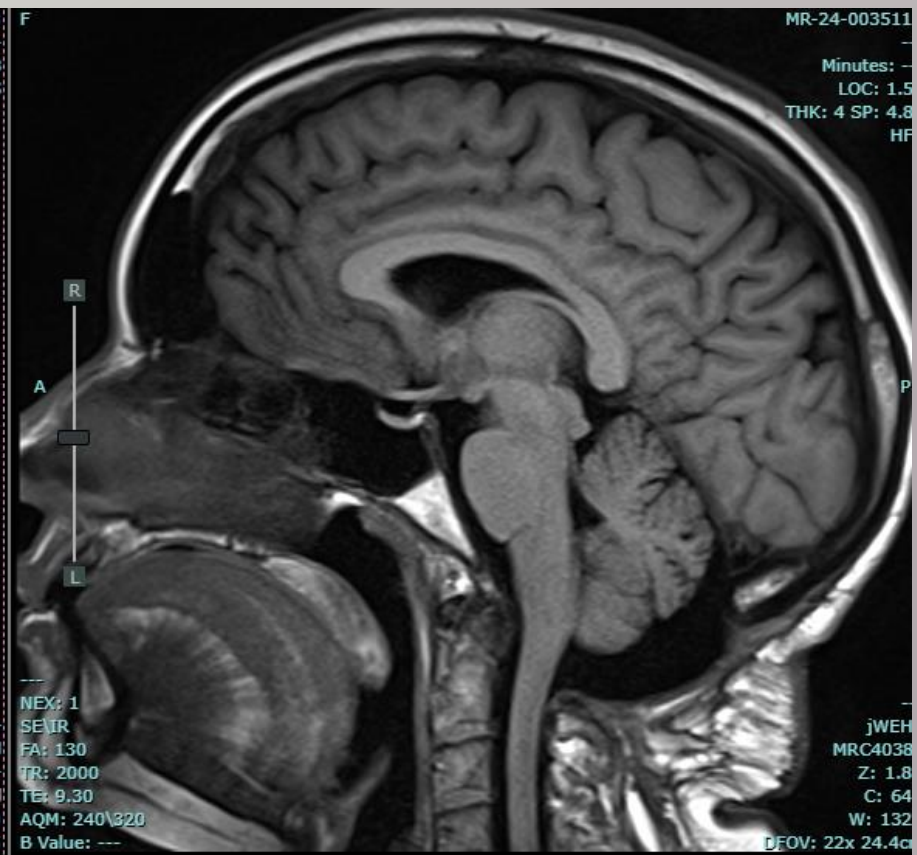
**↓ LOWER ENERGY**



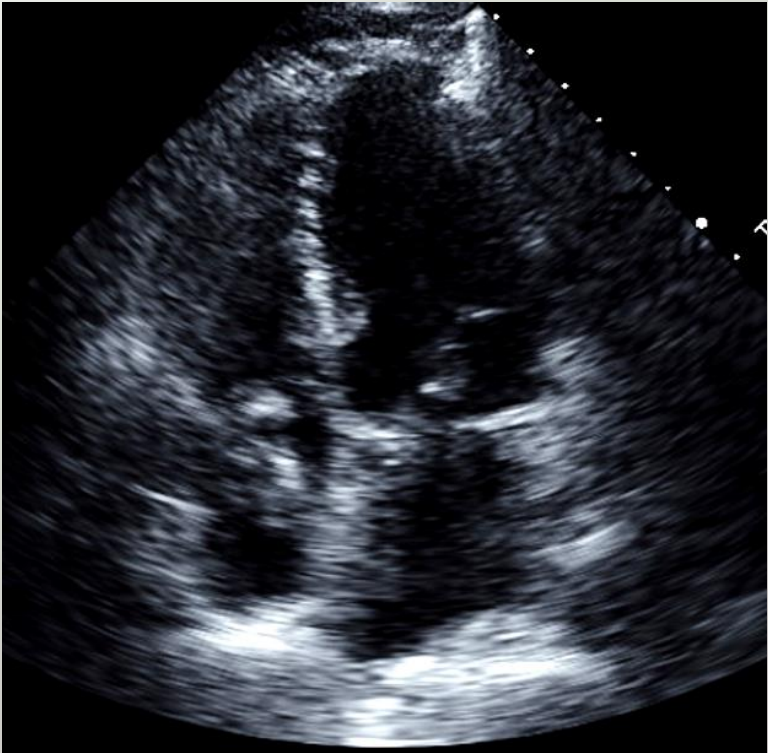
**SHORTER WAVELENGTH**

**HIGHER FREQUENCY ↑**

**HIGHER ENERGY ↑**



40 F h/o  
malignancy



# Hematoma MRI Signal Evolution

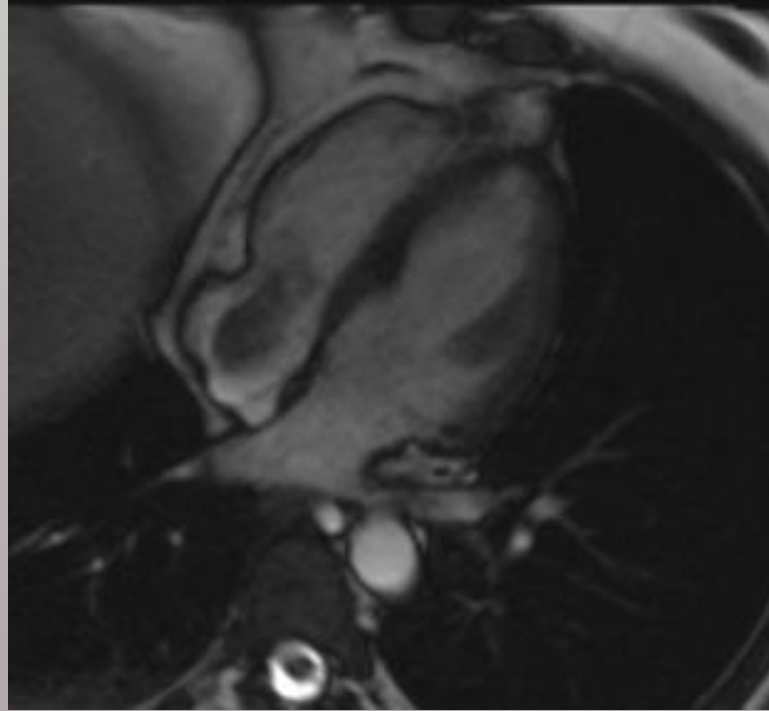
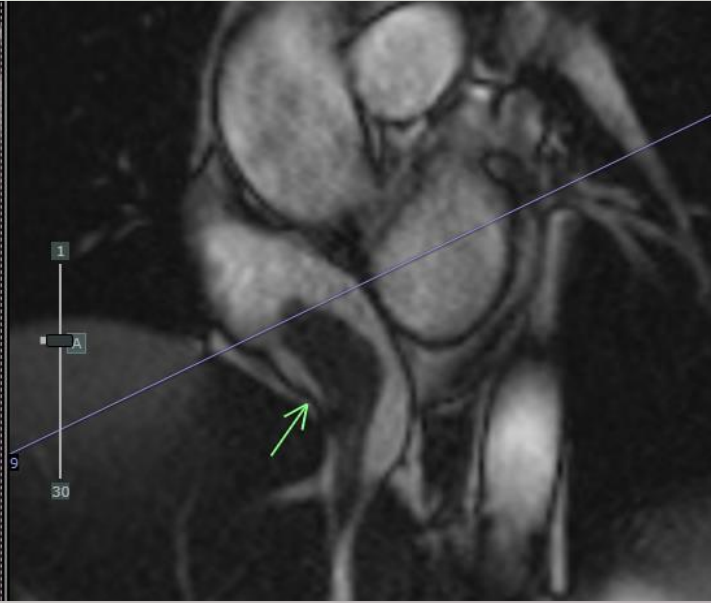
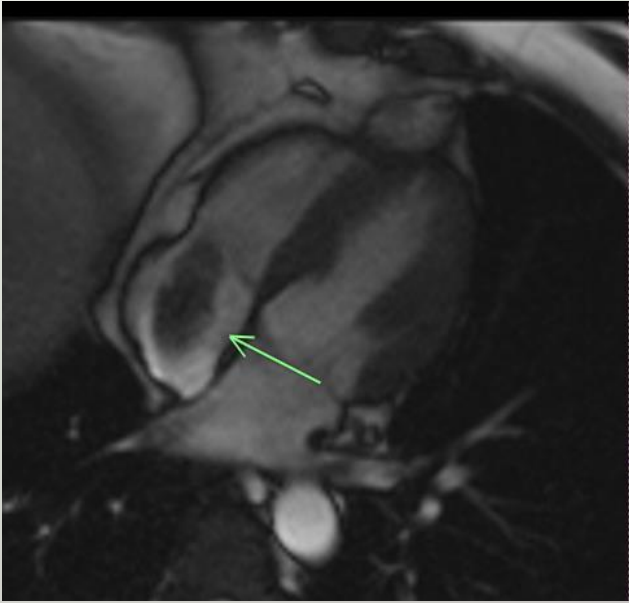
Stage	Time	Dominant form	T1	T2
Hyperacute	<24 hr	Intracellular oxyhemoglobin	Iso / mildly low	High
Acute	1–3 days	Intracellular deoxyhemoglobin	Low	Low
Early subacute	3–7 days	Intracellular methemoglobin	High	Low
Late subacute	1–4 weeks	Extracellular methemoglobin	High	High
Chronic	>2–4 weeks	Hemosiderin / ferritin	Low	Low

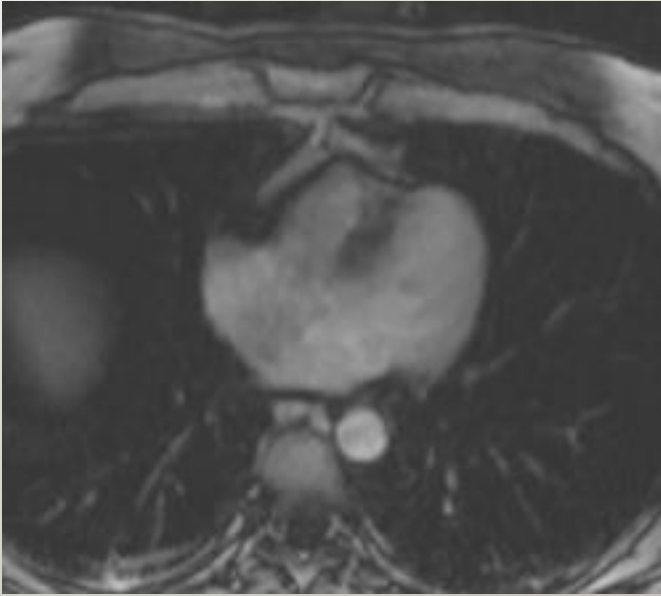
A simplified memory aid:

- **Acute blood = dark on T2**
- **Subacute blood = bright on T1**
- **Late subacute = bright on both T1 and T2**
- **Chronic blood = dark on everything**

The most important transition clinically is:

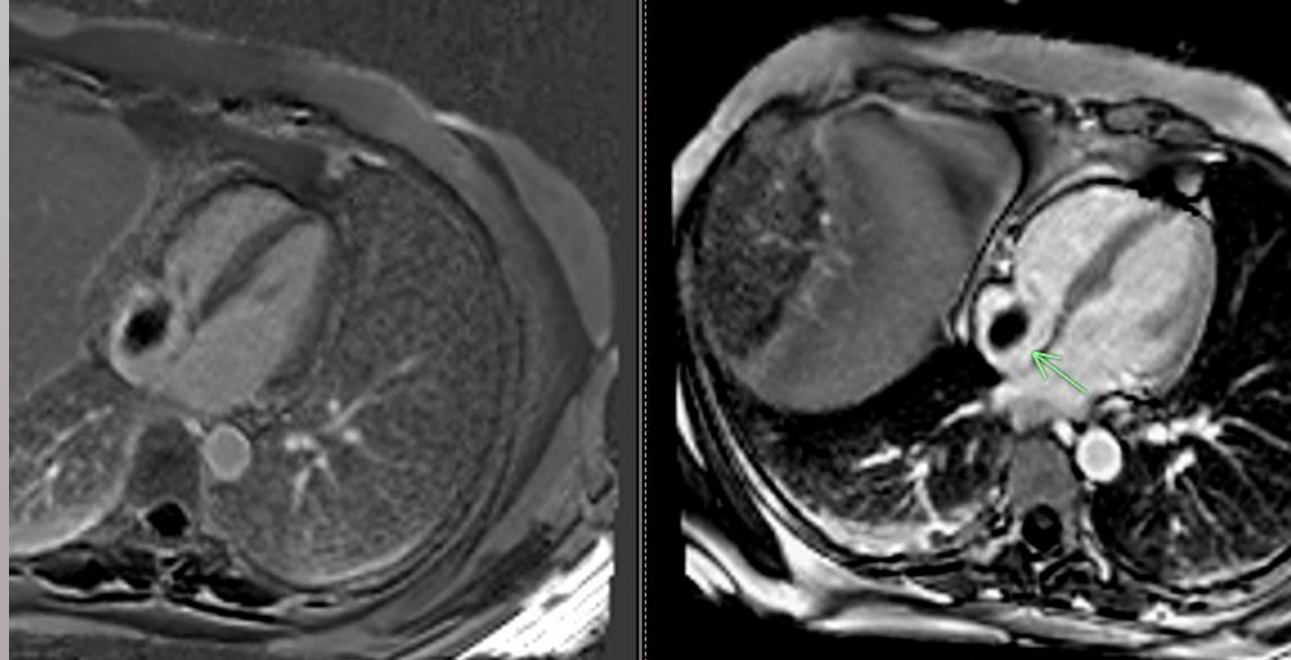
**Deoxyhemoglobin → Methemoglobin → Hemosiderin**

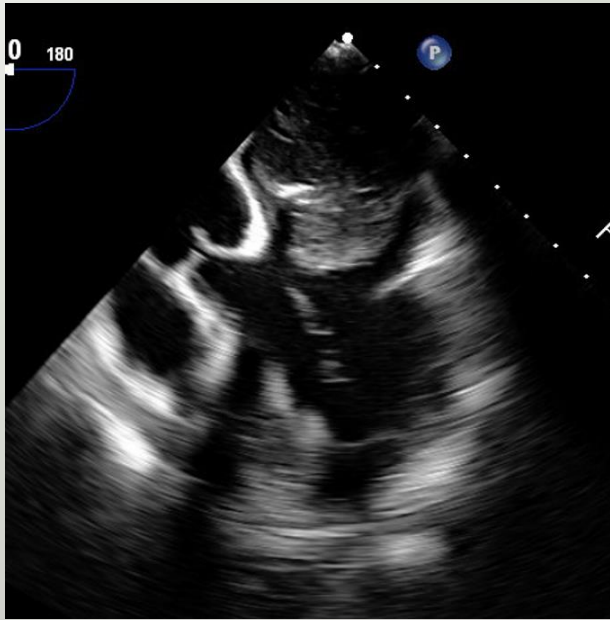




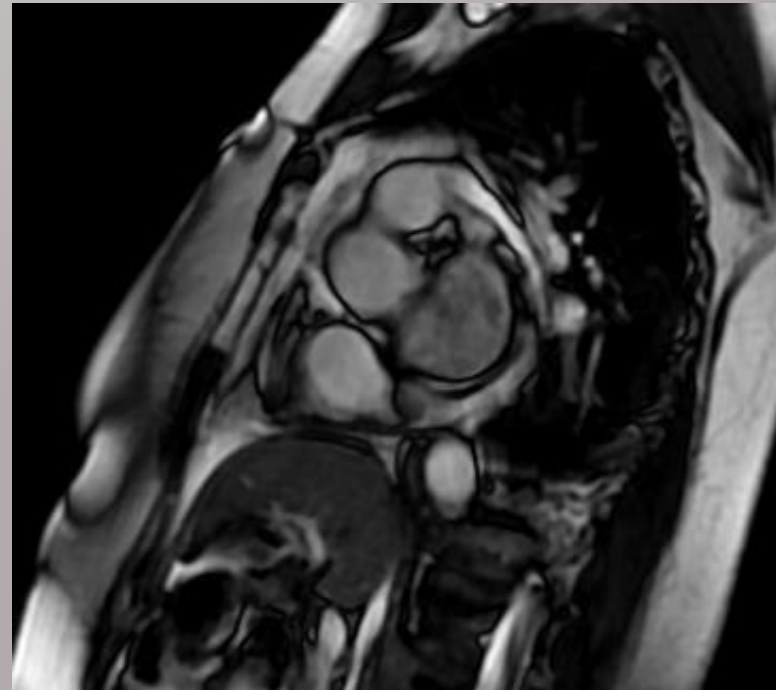
Axial T1 post contrast fat sat venous phase

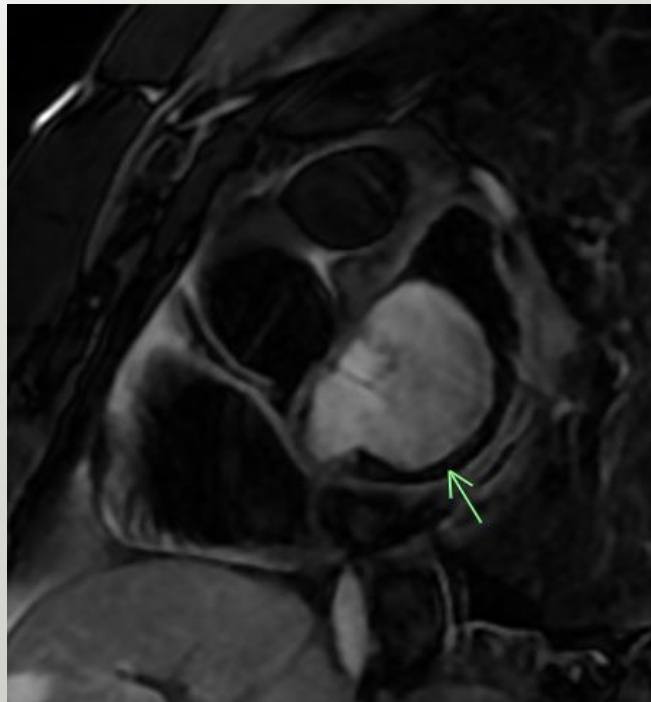
Delayed enhancement  
TI 300 ms and 700 ms



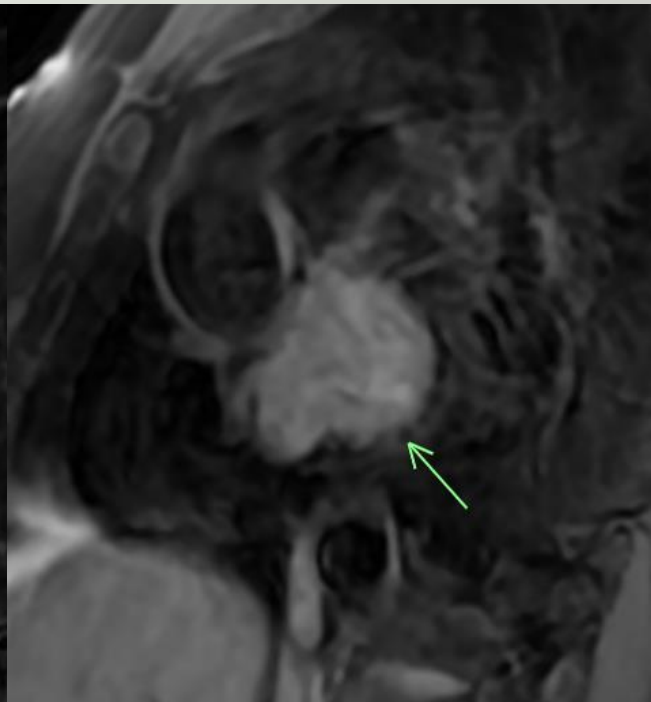


TEE: There is a pedunculated, septated mass in the left atrium with portions of central scattered calcification. It measures 5.8 cm x 4.3 cm with a stalk adherent to the LA aspect of the atrial septum.





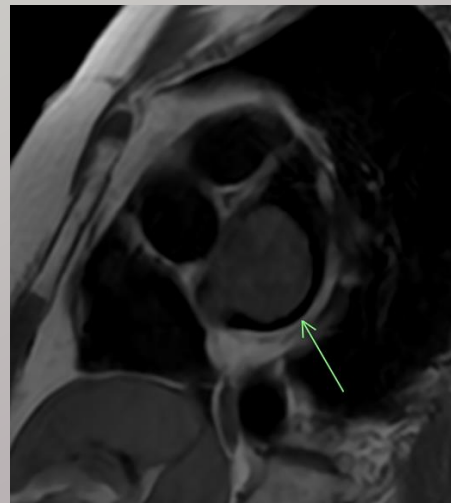
SA T2 fat sat



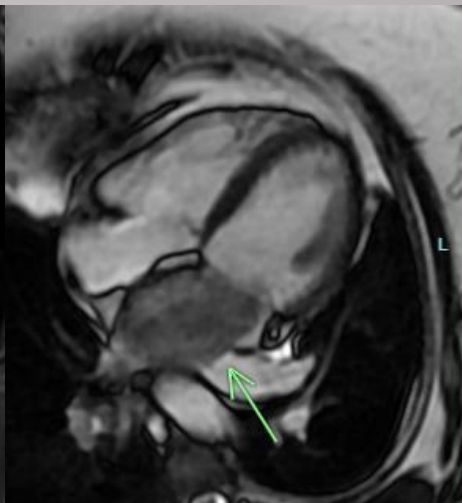
SA T1 fat sat



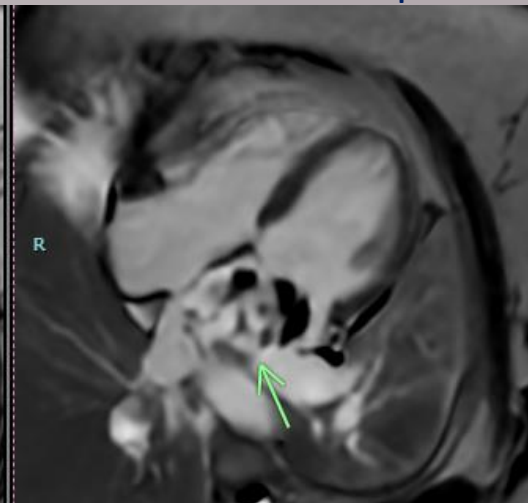
SA T1 fat sat 2 min  
post contrast



SA T1

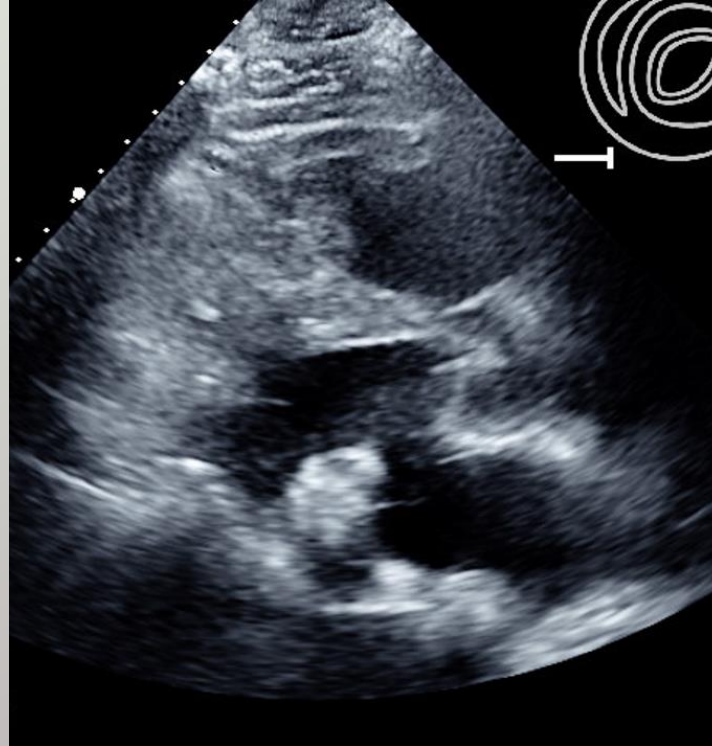


4ch Fiesta

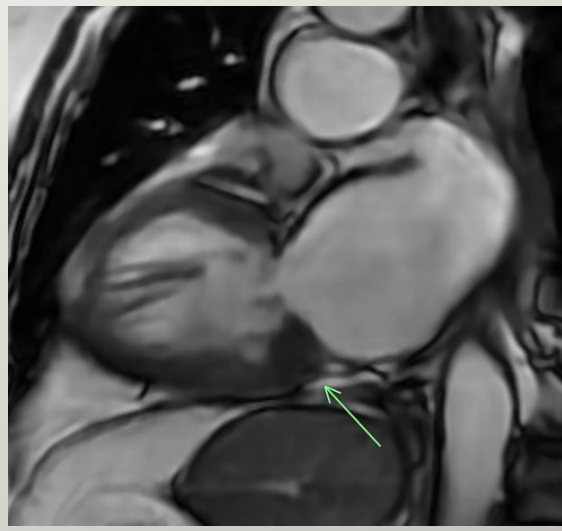


4ch 7 min post contrast

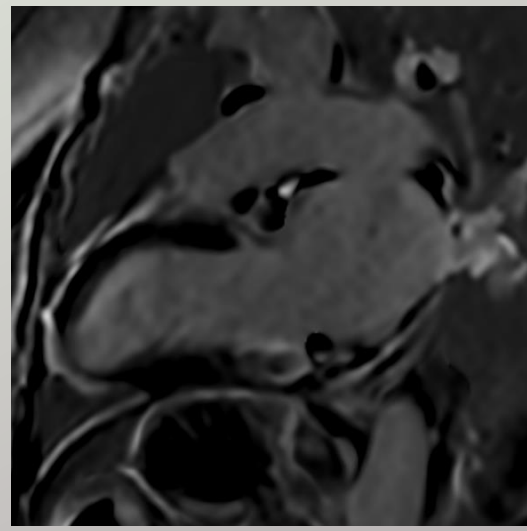
70 F with stroke



There is a large, non-mobile echodensity adjacent to the posterior aspect of the mitral annulus, likely representing caseous mitral annular calcification. Other etiologies of cardiac masses cannot be excluded.



2 ch fiesta



2 ch delayed enhance



CT with contrast



CT w/o contrast

OPERATIVE FINDINGS: Present within the left atrium and attached adjacent to the mitral annulus is a 3 cm long finger-like projection. It appears as though it could be healed fibrous tissue from maybe a healed thrombus. The mitral valve itself appeared relatively normal with the exception of the extensive mitral annular calcification.

Pathology: Nodular calcifications.

MRI is a great tool characterizing cardiac masses, but CT can be complementary and offers superior spatial resolution.

A cardiac mass MRI exam is not an easy test for the patient. Often more than 1 hr long.



It is destiny. It is the vicissitudes of fortune. You are busy after money or fame. Why not take a break, sit down, and eat?



## References:

Cardiovascular MRI: Physical Principles to Practical Protocols 1st Edition  
by Ph.D. Lee, Vivian S., M.D. (Author), Martha Helmers (Illustrator)

Cardiovascular magnetic resonance physics for clinicians  
John D Biglands, Aleksandra Radjenovic, John P Ridgway  
Journal of Cardiovascular Magnetic Resonance, Volume 14, Issue 1, 6 January 2012, 78