AORTIC VALVE CASES

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DISCLOSURES

- None

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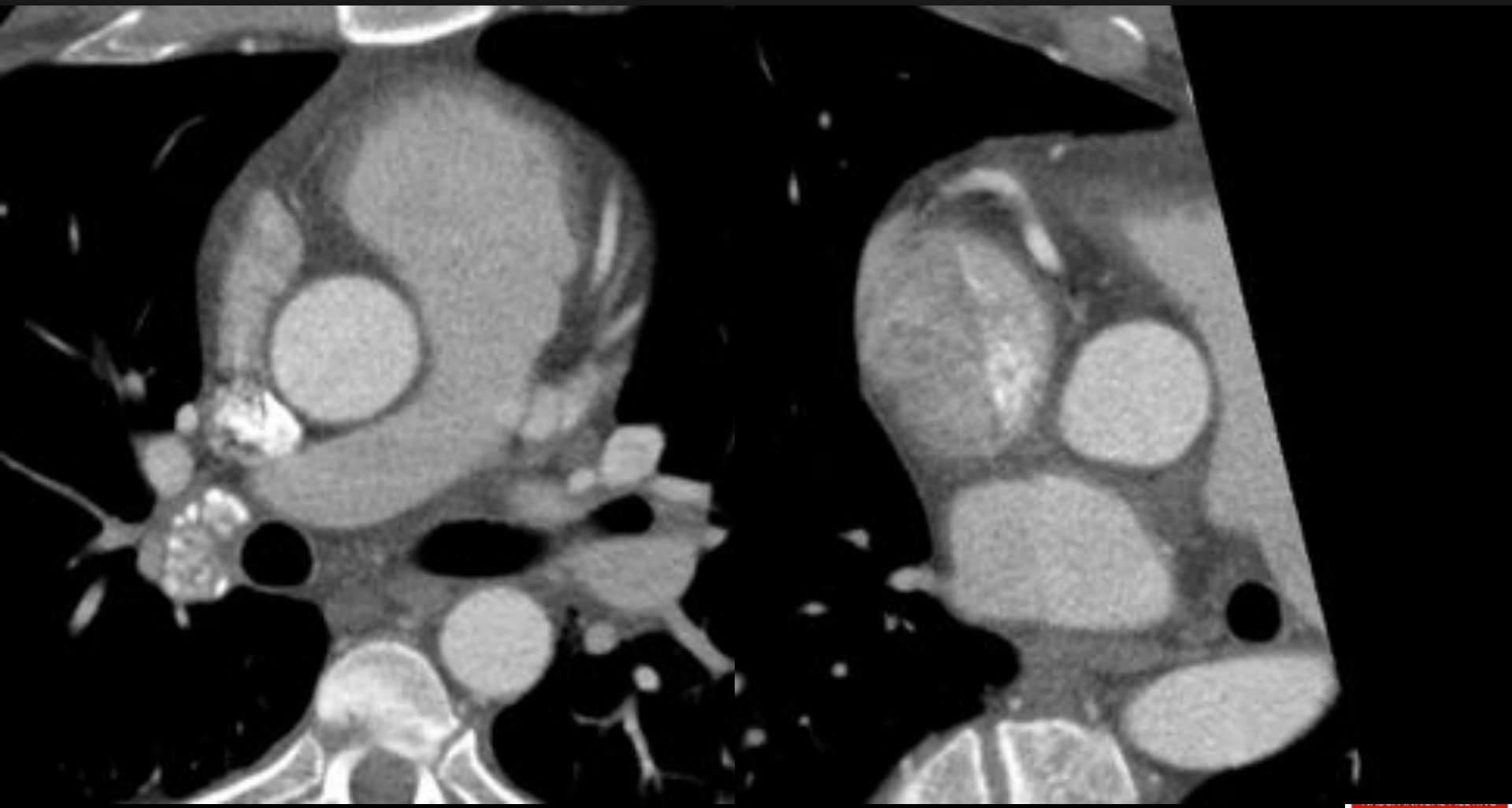
CASE ONE

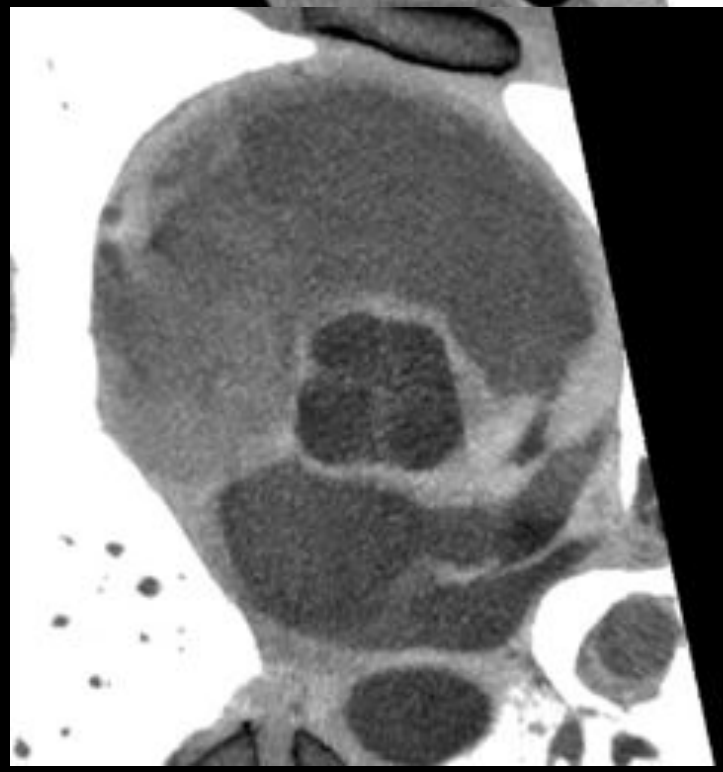
CASE ONE

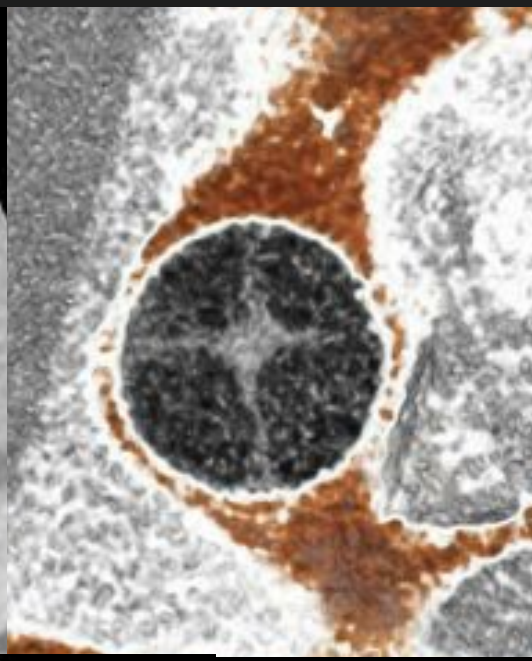
- 32 yr old male
- Atypical CP, equivocal stress echo
- Cath: “No vessel coming off R sinus”, concern for anomalous coronary artery

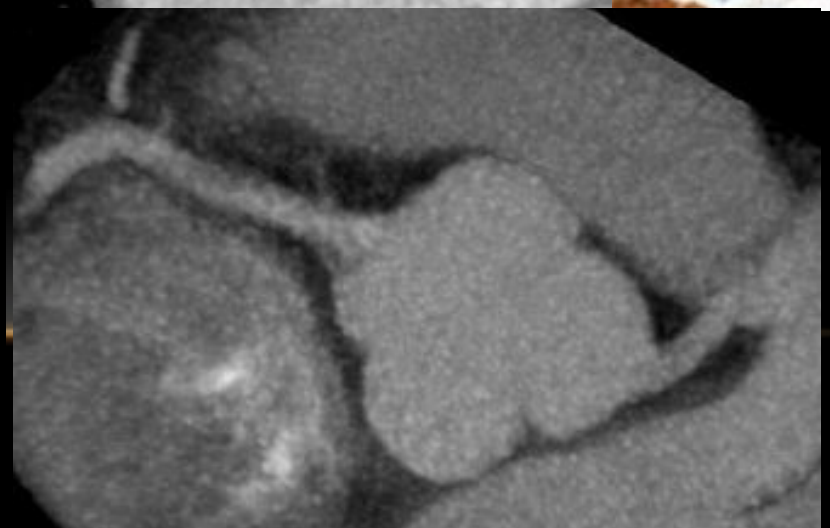
CASE ONE



QUADRACUSPID AORTIC VALVE







QUESTION

- The most common complication of Quadricuspid Aortic Valve (QAV) is:
  - A. Valvular aortic stenosis
  - B. Aortic regurgitation
  - C. Atrial fibrillation
  - D. Left ventricular hypertrophy

Douglas, H., Moore, M., & Purvis, J. (2012). Comprehensive assessment of a quadricuspid aortic valve and coronary arteries by multidetector cardiac CT. Heart, 98(24), 1838-1838.

QUESTION: ANSWER

- The most common complication of Quadricuspid Aortic Valve (QAV) is:
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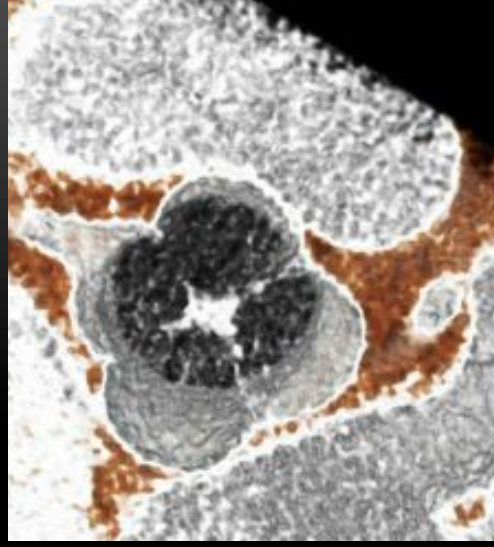
QUADRICUSPID AORTIC VALVE (QAV)

- Rare, 1/6000 aortic valve surgery patients[1]
- M = F, avg. age at Dx ~ 50
- Classification by size of cusps[2]
  - Most common: 3 same size + 1 smaller cusp (type B)
- Echo: “X”-shaped SAX view
- CT/MR: confirmatory; perform planimetry and/or flow measurement[3]

1. *Douglas, H., Moore, M., & Purvis, J. (2012) Heart 2012; 98(24), 1838-1838.*
2. *Hurwitz L, et al. Am J Cardiol 1973; 31(5) 623-626.*
3. *Khan SK, Tamin SS, Araoz PA. J Comput Assist Tomogr. 35 (5): 637-41.*

CLASSIFICATION OF QAV[1]



A	4 equal sized cusps
B	3 equal + 1 smaller (most common)
C	2 equal + 2 equal smaller
D	1 large + 2 intermediate + 1 smaller
E	3 equal + 1 larger
F	2 equal large + 2 smaller unequal sizes
G	4 unequal sized cusps

1. *Hurwitz L, et al. Am J Cardiol 1973; 31(5) 623-626.*

QUADRICUSPID AORTIC VALVE (QAV)

- Usually isolated, but can be associated with:
  - Single or Anomalous Coronary Arteries
  - Displacement of coronary ostia (from addl cusp)
  - HCM / Subaortic Stenosis
  - PDA, VSD
  - Endocarditis

1. Jagganath AD, et al. Echocardiography 2011; 28(9), 1035-1040.
2. Zhu J, et al. J Cardiothor Surg 2013; 8(1) 87.
3. Tutarel O. J. Heart Valve Dis. 2004;13 (4): 534-7.

QUADRICUSPID AORTIC VALVE (QAV)

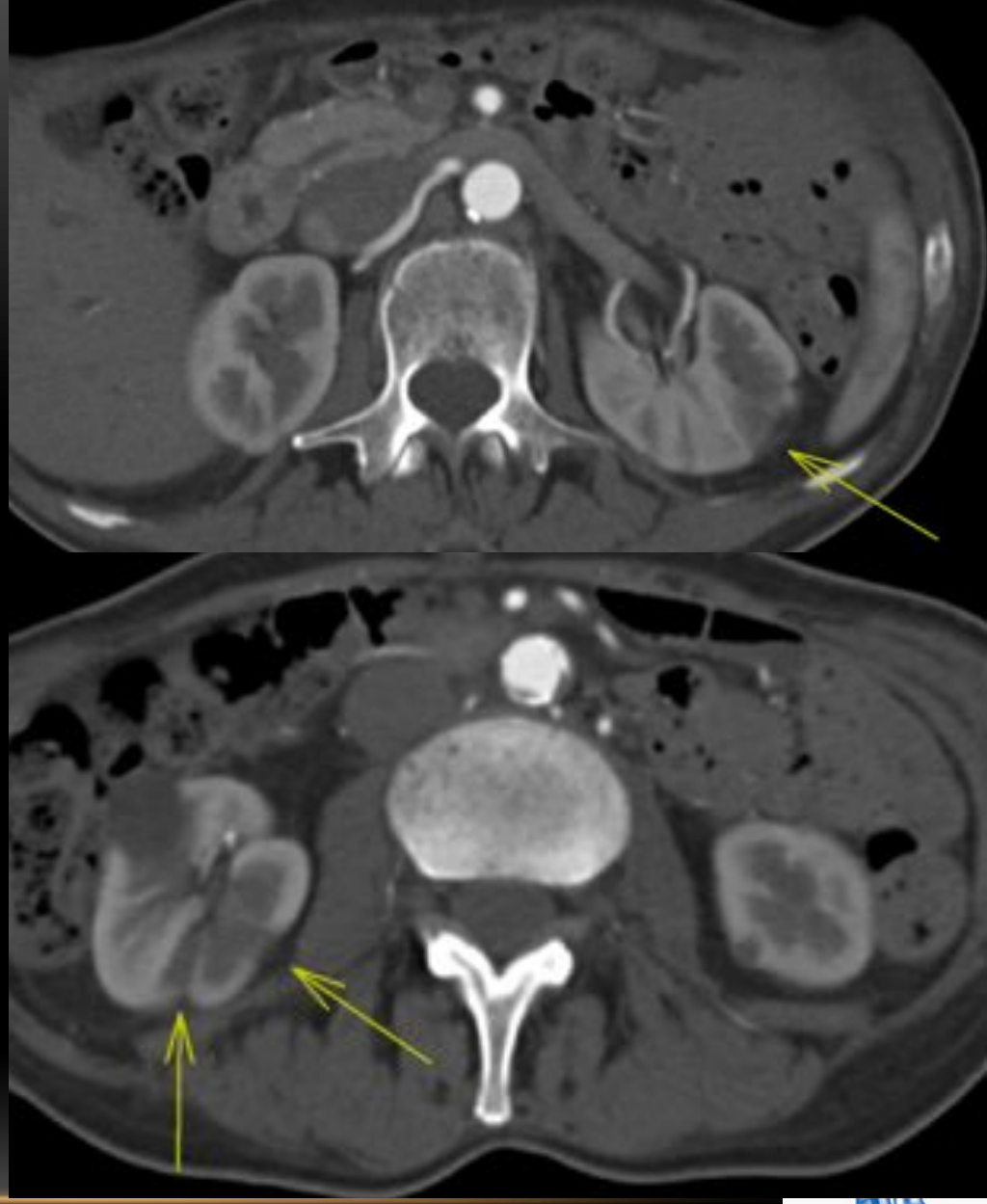
- Complications:
  - Aortic Insufficiency (#1)
    - Up to 75% at time of Dx
  - LVH
  - Conduction problems (BBB)
- TX: Reconstruction and/or Surgical valve replacement

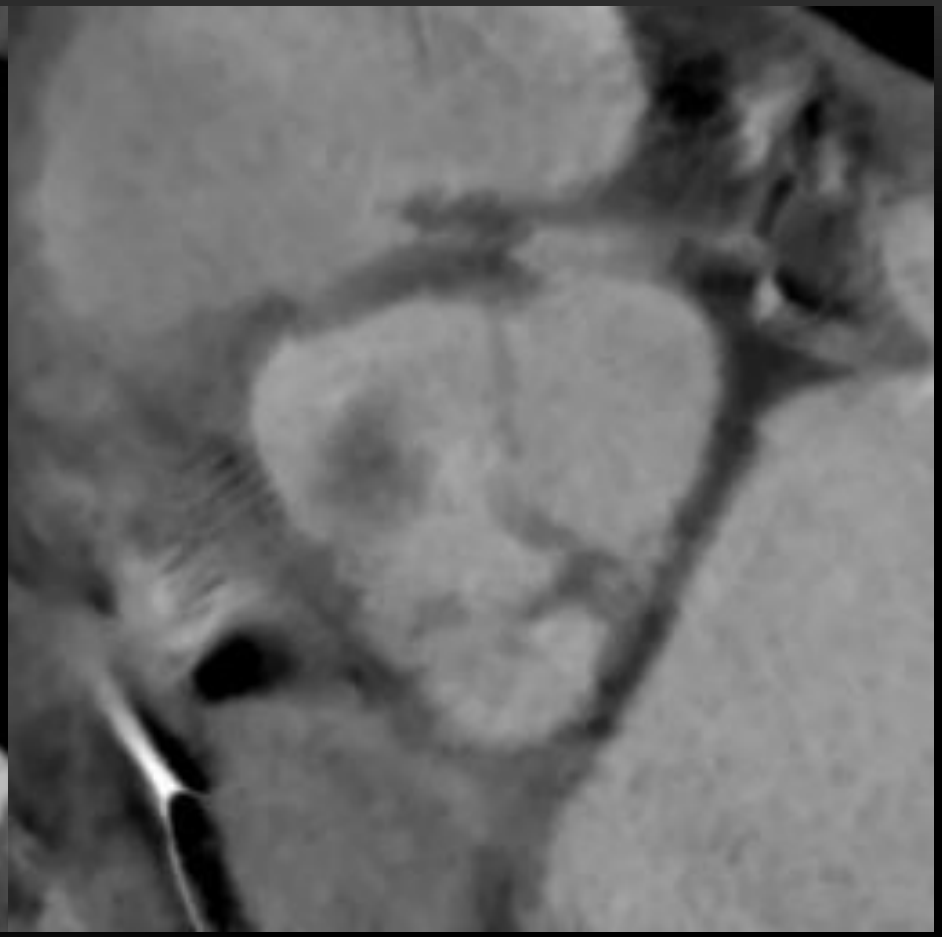
1. Jagganath AD, et al. Echocardiography 2011; 28(9), 1035-1040.
2. Zhu J, et al. J Cardiothor Surg 2013; 8(1) 87.
3. Tutarel O. J. Heart Valve Dis. 2004;13 (4): 534-7.

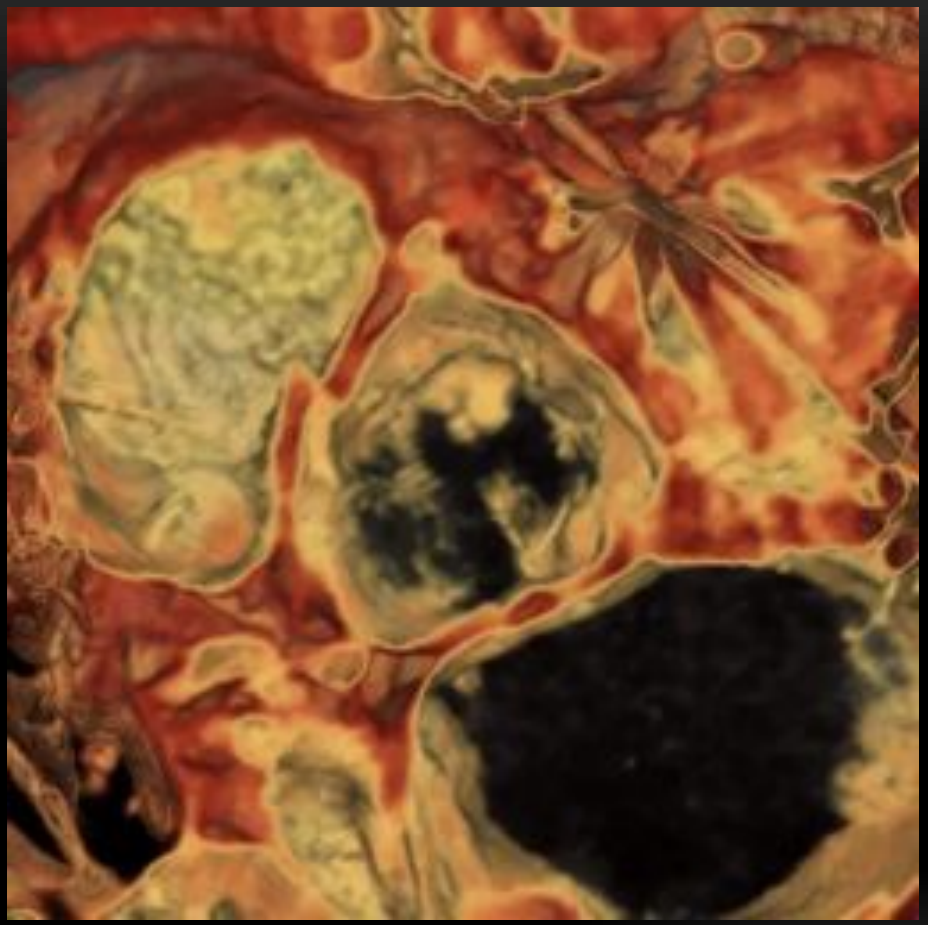
CASE TWO

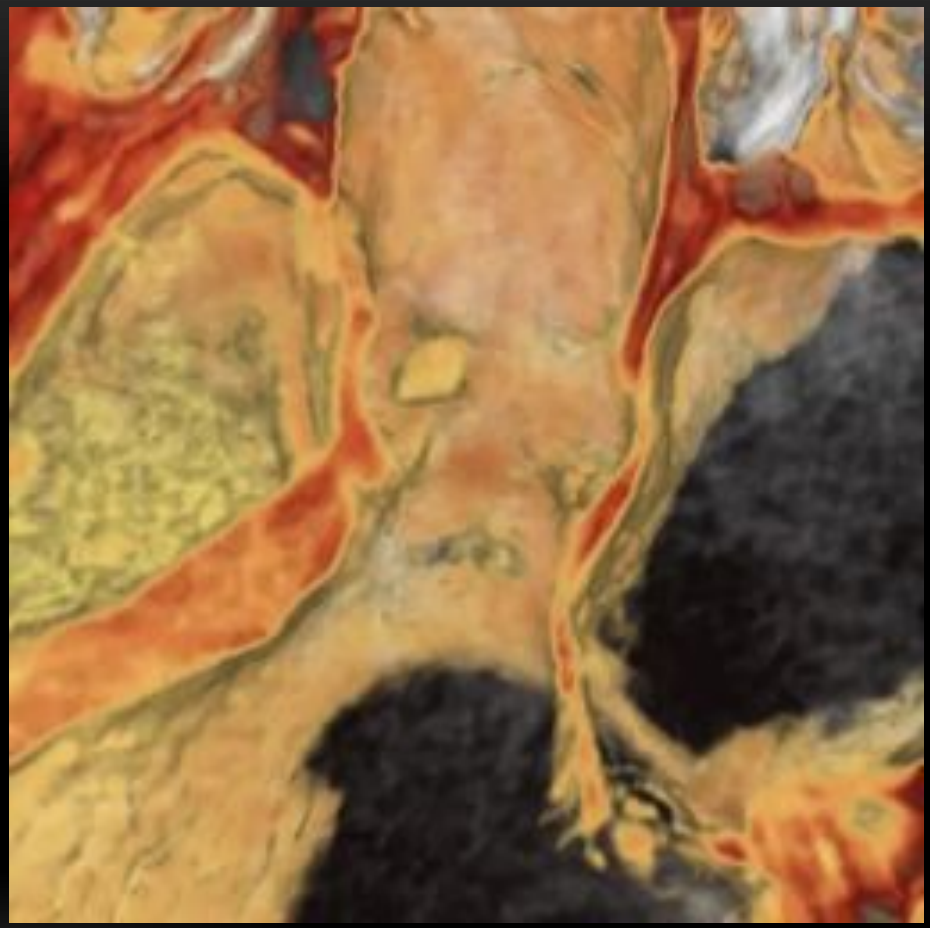
CASE TWO

- 68 yo Male, embolic lesions in kidneys on CT
- Technically difficult echo exam, ? AoV lesion









CASE TWO: DDX

- Vegetation
- Thrombus
- Tumor
- Degenerated valve tissue

CASE TWO: PAPILLARY FIBROELASTOMA

QUESTION:

- Papillary Fibroelastoma is:
  - A. the most common cardiac tumor
  - B. potentially malignant
  - C. more common in females
  - D. responsible for 75% of valvular tumors

QUESTION: ANSWER

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Grebenc ML, Rosado de Christenson ML, Burke AP, Green CE, Galvin JR. Radiographics. 2000;20(4):1073–103.

PAPILLARY FIBROELASTOMA

- Avg age 60
- M=F
- #1 neoplasm of cardiac valves
  - (prevalence only ~ 0.02%)
- #2 or 3 cardiac neoplasm overall (myxoma, lipoma)
- Often Asx but can present w/ embolic disease (tumor or bland), TIA/stroke, dyspnea, sudden cardiac death
- Imaging Diagnosis!

Grebenc ML, Rosado de Christenson MI et al. Radiographics. 2000;20(4):1073–103.
Kumbala, D, Sharp, T, Kamalesh M. *Angiology*, 2008; *59*(5), 625–628.

PAPILLARY FIBROELASTOMA

- Path: gelatinous, avascular papilloma covered by single layer epithelium
- “sea anemone” surface: but can be obscured by surface thrombus
- Mobile, pedunculated lesions w/ connection to endothelium by stalk

Grebenc ML, Rosado de Christenson MI et al. Radiographics. 2000;20(4):1073–103.
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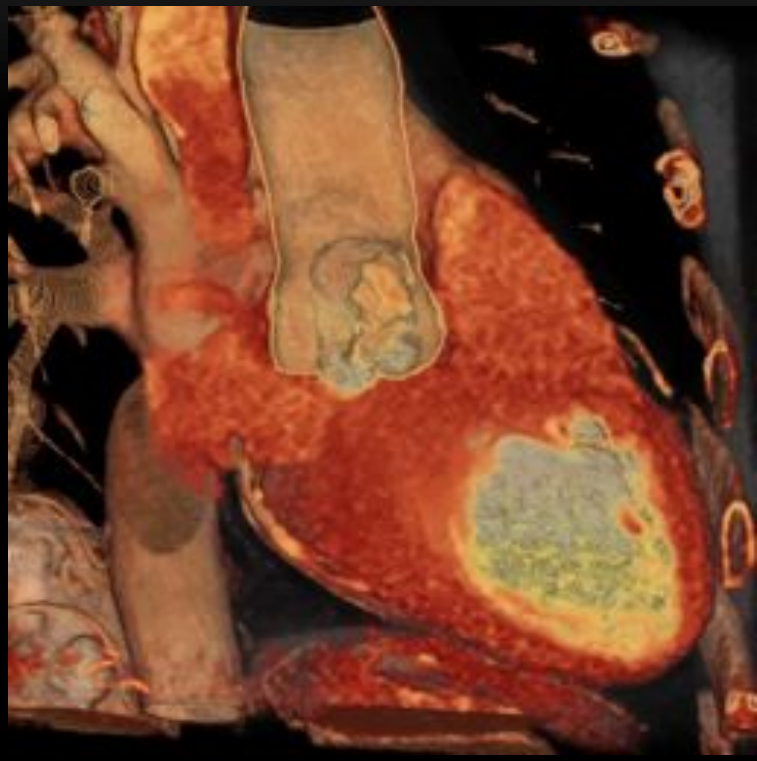
PAPILLARY FIBROELASTOMA

- Aortic >> mitral > tricuspid > pulmonic
- Can also occur on endocardial surfaces of atria / ventricles
- Mobility is independent predictor of non-fatal and fatal events (surgical treatment)



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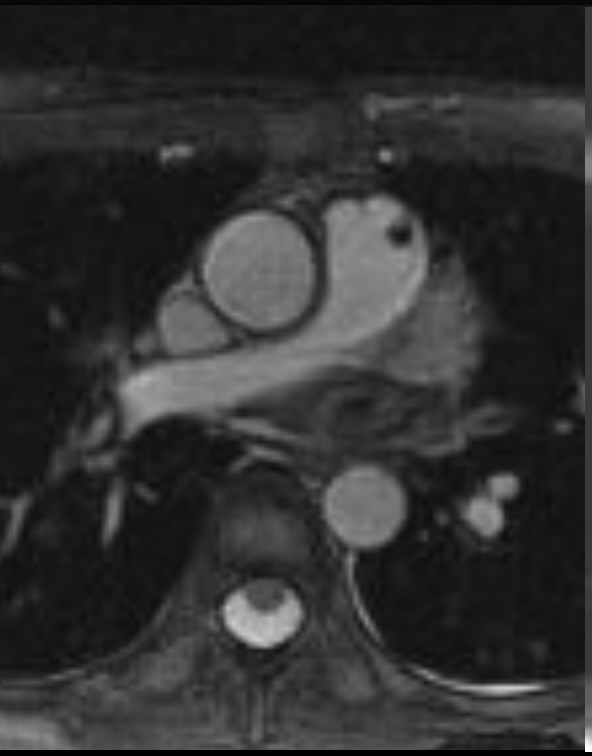
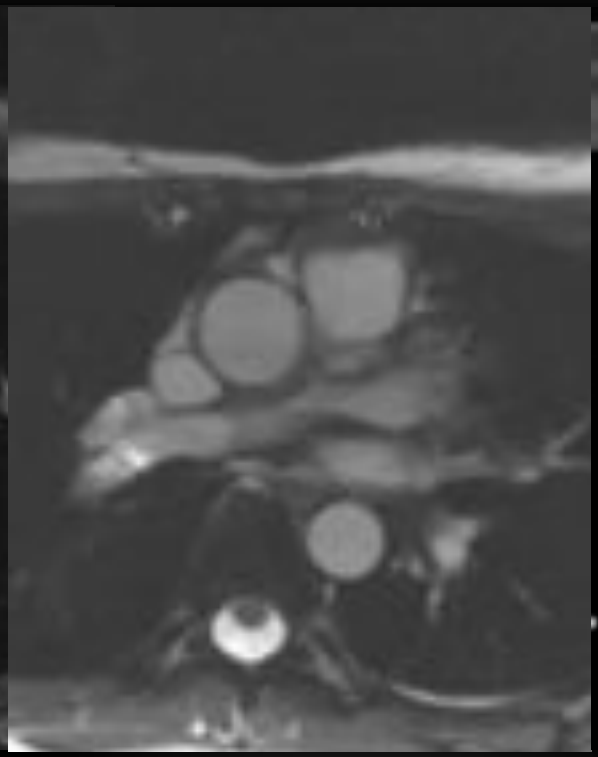
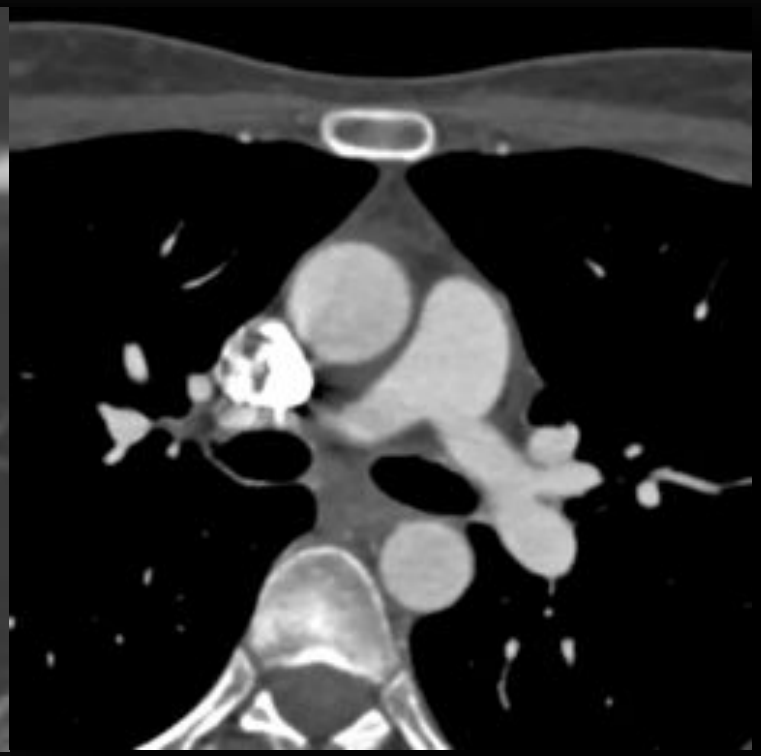
Kumbala, D, Sharp, T, Kamalesh M. *Angiology*, 2008; *59*(5), 625–628.

PULMONIC VALVE FIBROELASTOMA



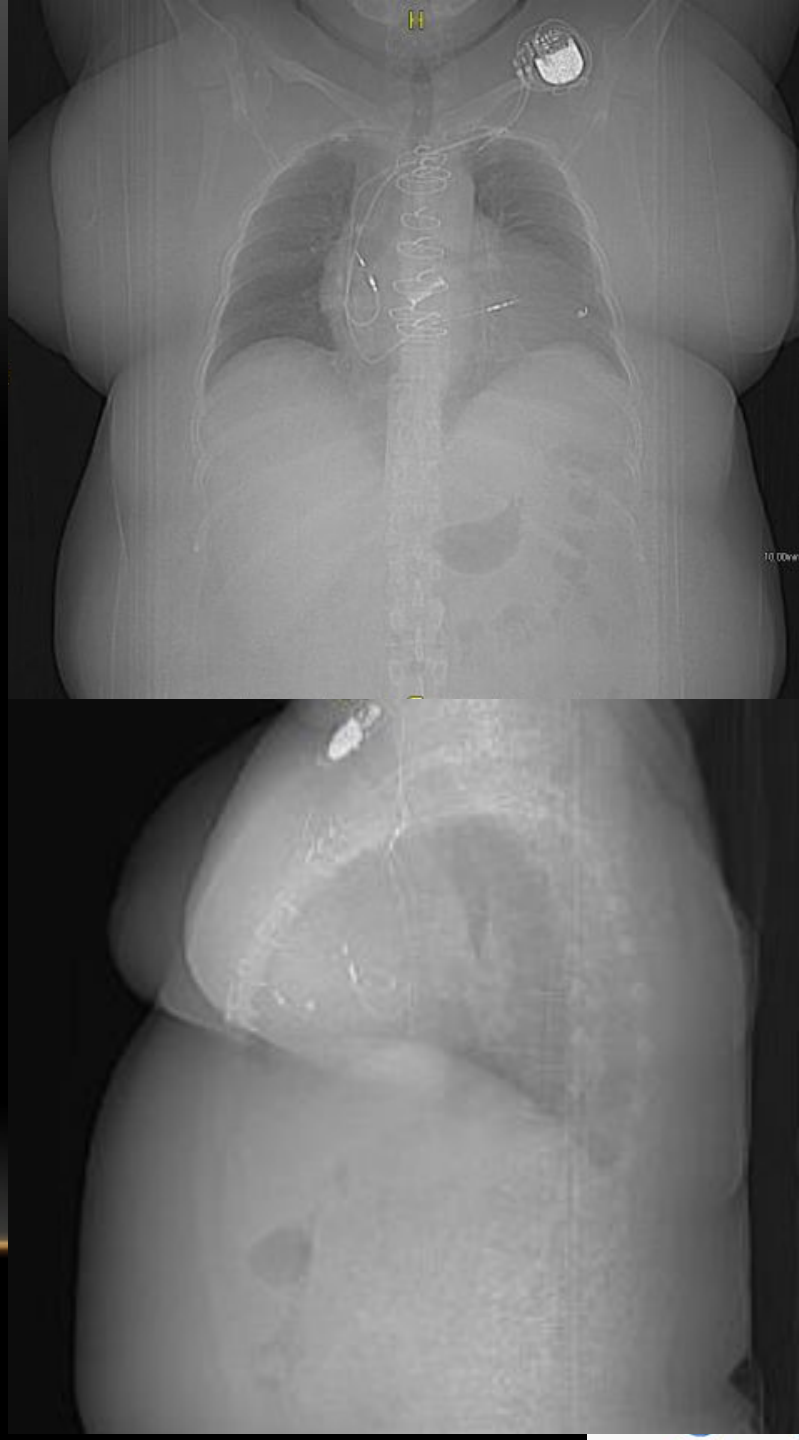




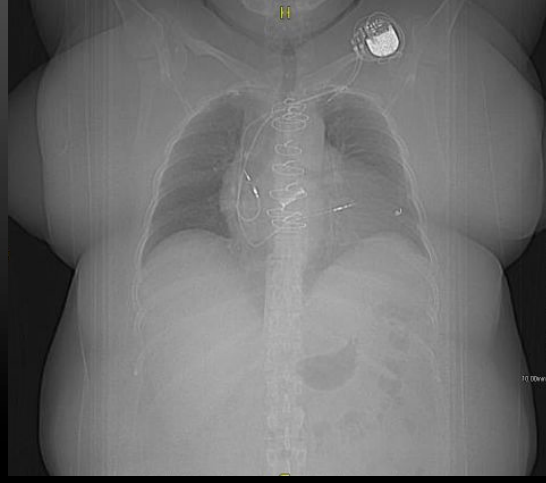
CASE THREE

CASE THREE

- 45 yr old female
- 330 lb, 5’2”
- Previous pacer (vent rate 75)
- Previous aortic valve replacement



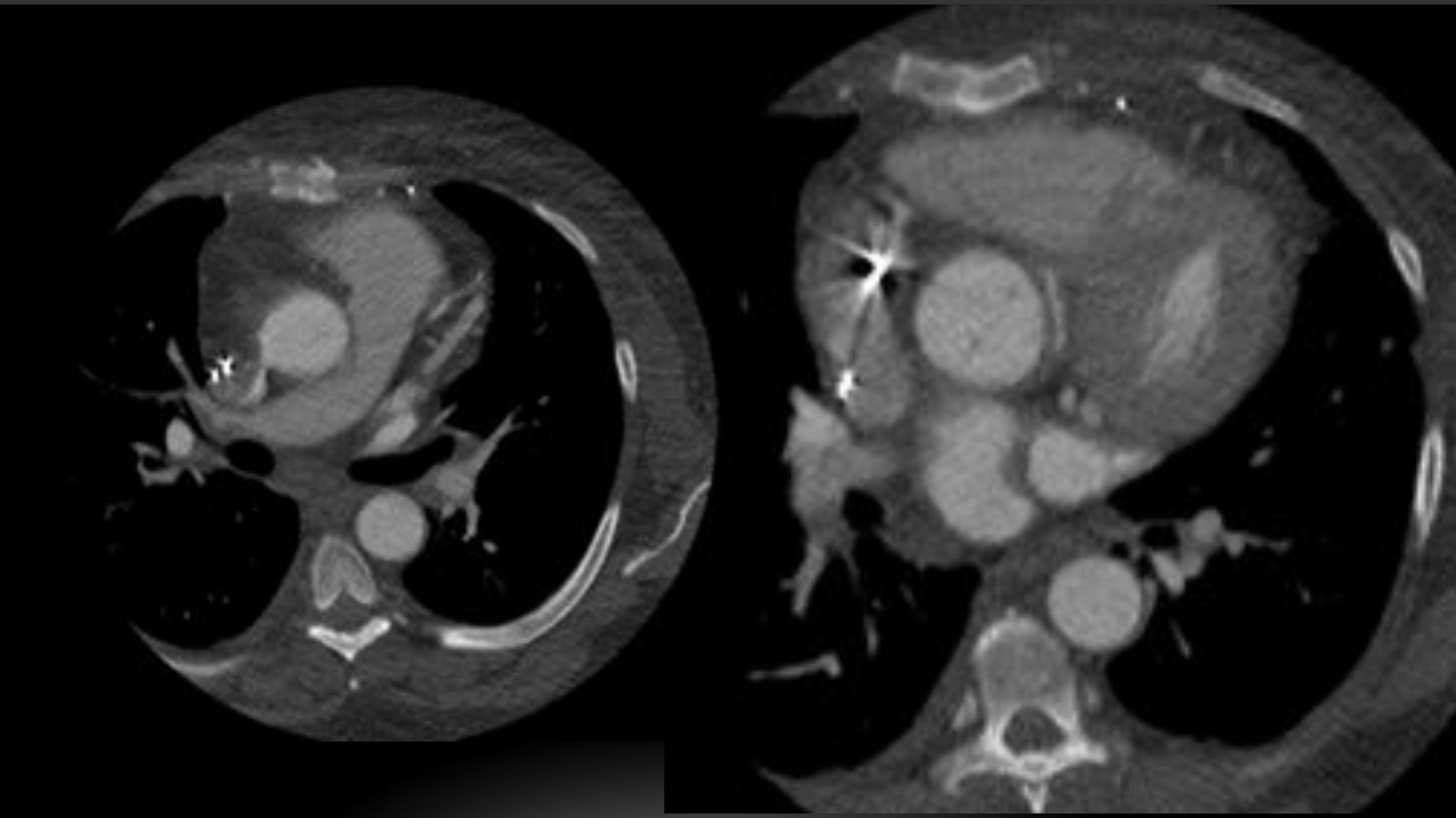
CASE THREE



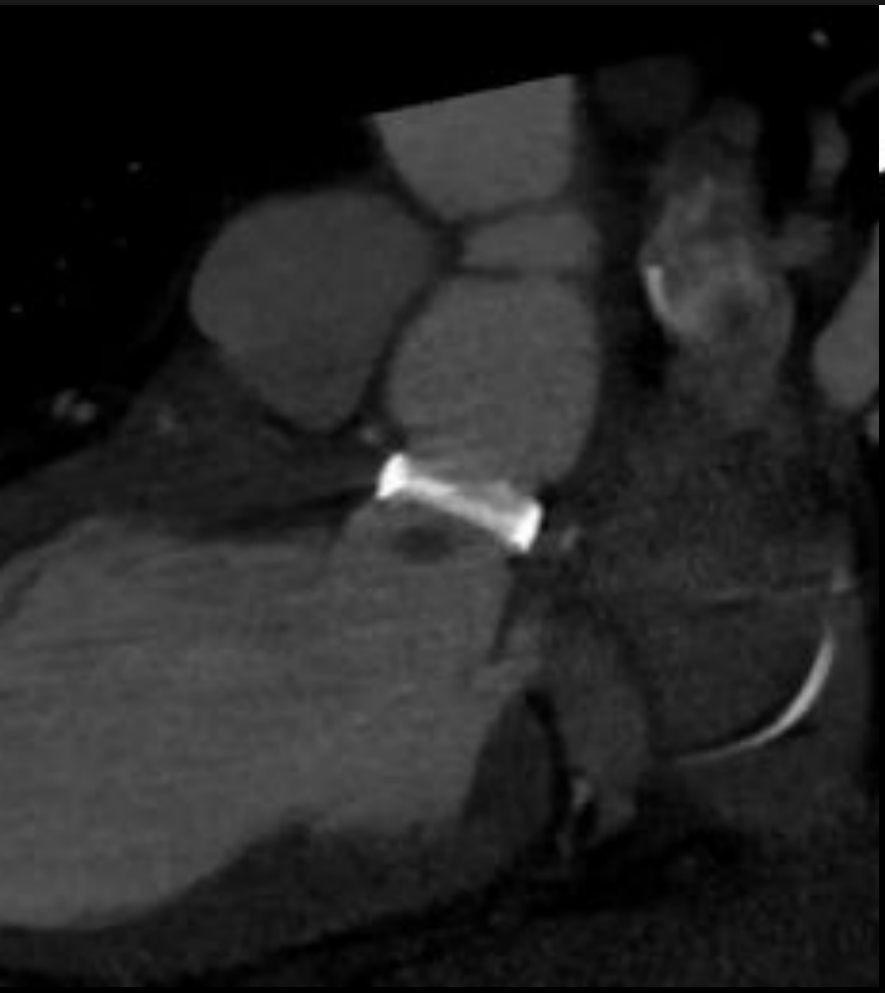
- New onset CHF
- Abnormal echo – possible lesion on prosthetic aortic valve
- CTA requested to assess valve….
- And ….CCTA requested for pre-op coronary clearance

TECHNICAL ISSUES

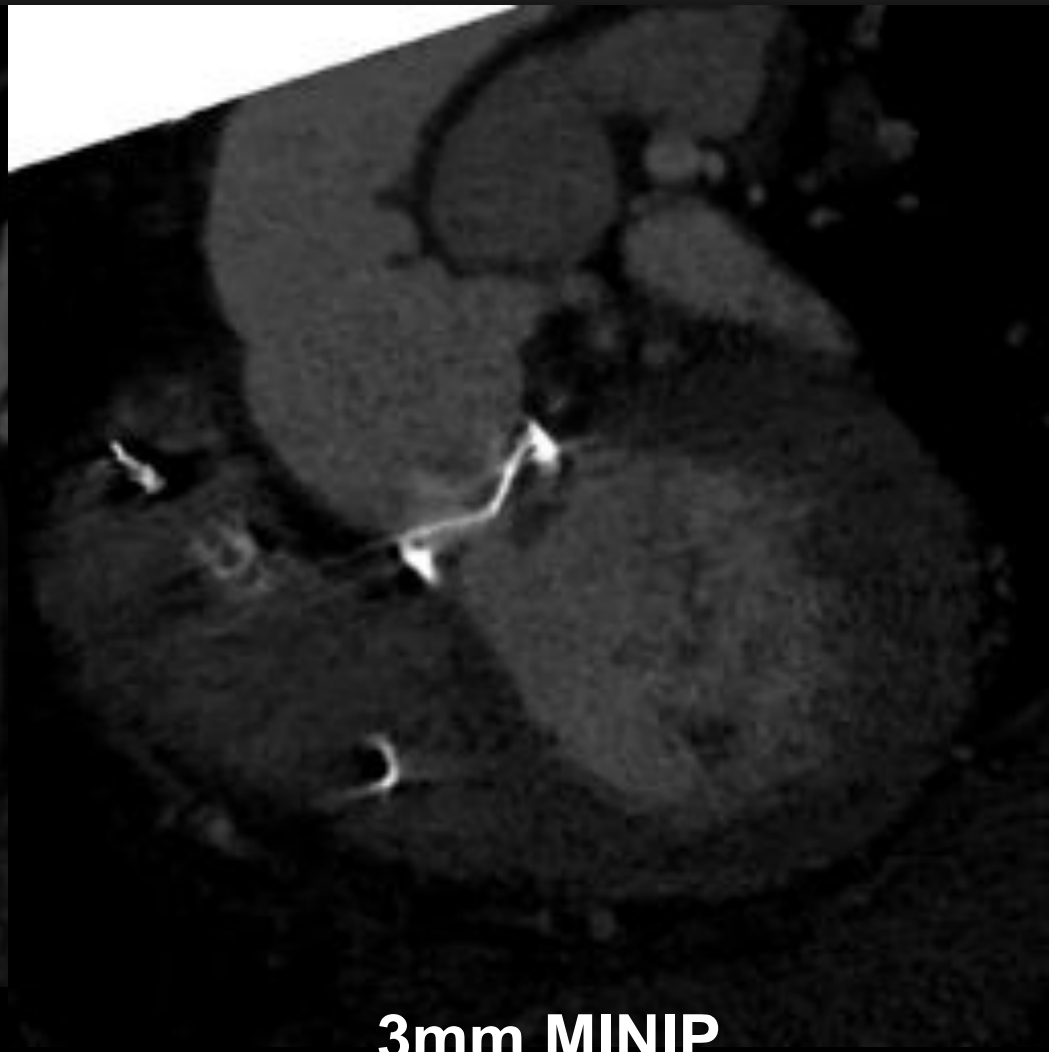
- How to scan with low enough noise to fully assess valve and coronaries
- Impact of paced HR
- Pacer wire artifacts?



VEGETATION ON ST. JUDE PROSTHETIC AORTIC VALVE (330 LB PATIENT)



5mm MPR



3mm MINIP

QUESTION

- In order to improve image quality in larger patients, one should:

  A. Use filtered back projection reconstruction

  B. Utilize ECG pulsing

  C. Utilize weight-based contrast medium dosing

  D. Scan at 100 kV to save dose

QUESTION: ANSWER

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  A. Use filtered back projection reconstruction

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  C. Utilize weight-based contrast medium dosing

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1. Fleischmann D. How to design injection protocols for multiple detector-row CT angiography (MDCTA). Eur Radiol. 2005 Dec 1;15 Suppl 5:E60–5.

PROSTHETIC VALVE DYSFUNCTION

- SX:
  - Heart Murmur
  - Heart Failure
  - Fever
  - Stroke
  - DOE
  - Angina

Habets, J., Mali, WPTM, & Budde, RPJ (2012). *Radiographics*, *32*(7): 1893–1905.

PROSTHETIC VALVE DYSFUNCTION

- Echo primary imaging tool
- Fluoroscopy can visualize stuck leaflets
- CT useful if echo limited (obese, COPD)
  - Leaflet excursion
  - Perivalvular abscess
  - Mycotic aneurysms

PROSTHETIC VALVE DYSFUNCTION: CT IMAGING

- Retrospective ECG gating useful for motion
  - No ECG pulsing
- Ni / Ti alloys : GOOD (St. Jude: Nickel alloy)
- Cobalt Chrome: BAD (Bjork – Shiley)
- Most Bioprosthetic valves are well assessed

Habets, J., Mali, WPTM, & Budde, RPJ (2012). *Radiographics*, *32*(7): 1893–1905.

TECHNICAL TIPS FOR IMAGING LARGE PATIENTS - 1

- Consider 140 kV voltage (trade-offs)
  - Less blooming artifact from metal
  - Less image noise
  - More dose
- Scan at thicker initial collimation
- Slow gantry rotation time (~ 0.5 sec)

TECHNICAL TIPS FOR IMAGING LARGE PATIENTS -2

- Use iterative reconstruction techniques
- WEIGHT-BASED Contrast medium flow-rates and volume
- Radiation dose: HIGH but re-do valve surgery for dysfunction has mortality up to 15%!!

CONCLUSIONS

- Quadricuspid aortic valve is visualized as an “X” on echo and CT/MR, and is associated with AI
- Aortic valve fibroelastoma is the most common valvular tumor
- Vegetations and lesions of prosthetic valves can be well assessed on ECG-synchronized CTA
- Adaptations / tradeoffs necessary for imaging valves in larger patients

THANKS FOR YOUR ATTENTION!

Special Thanks to:

- *Albert Hsiao, MD, PhD*
- *Dominik Fleischmann, MD*

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