
From Morphology to Function by Cardiac CT

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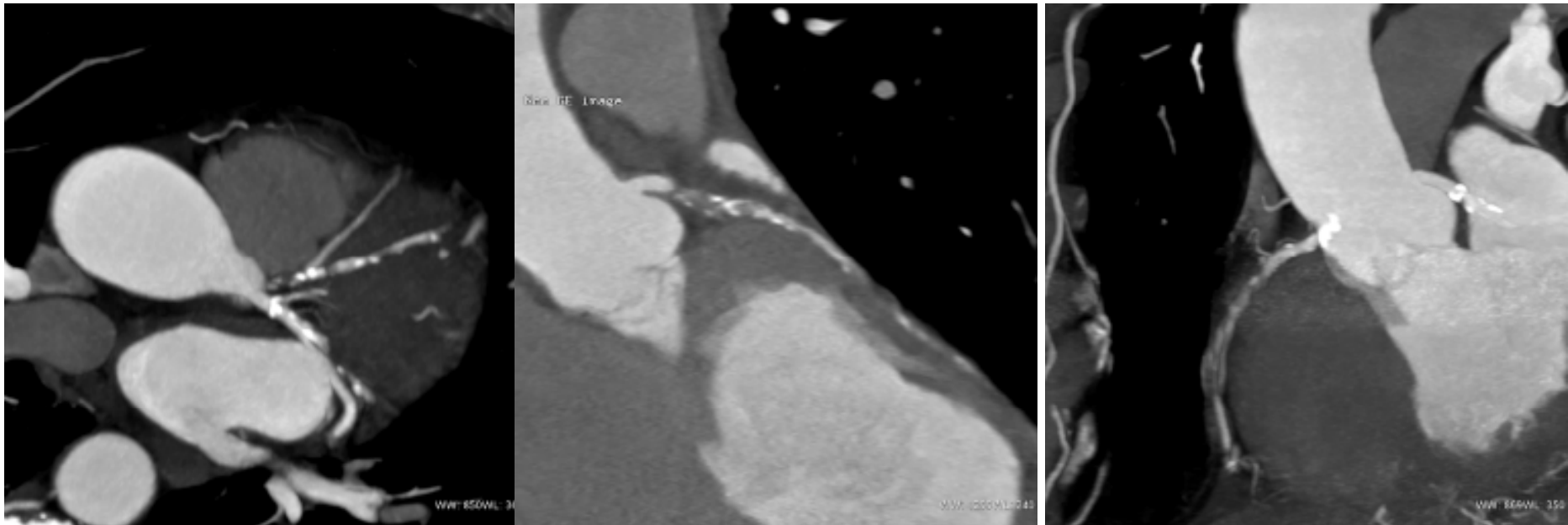
Cardiac CT for Morphology and Function

- Detection of CAD in New-Onset HF
- Evaluation of myocardial function and viability
- (Evaluation of intra- and extracardiac structures)

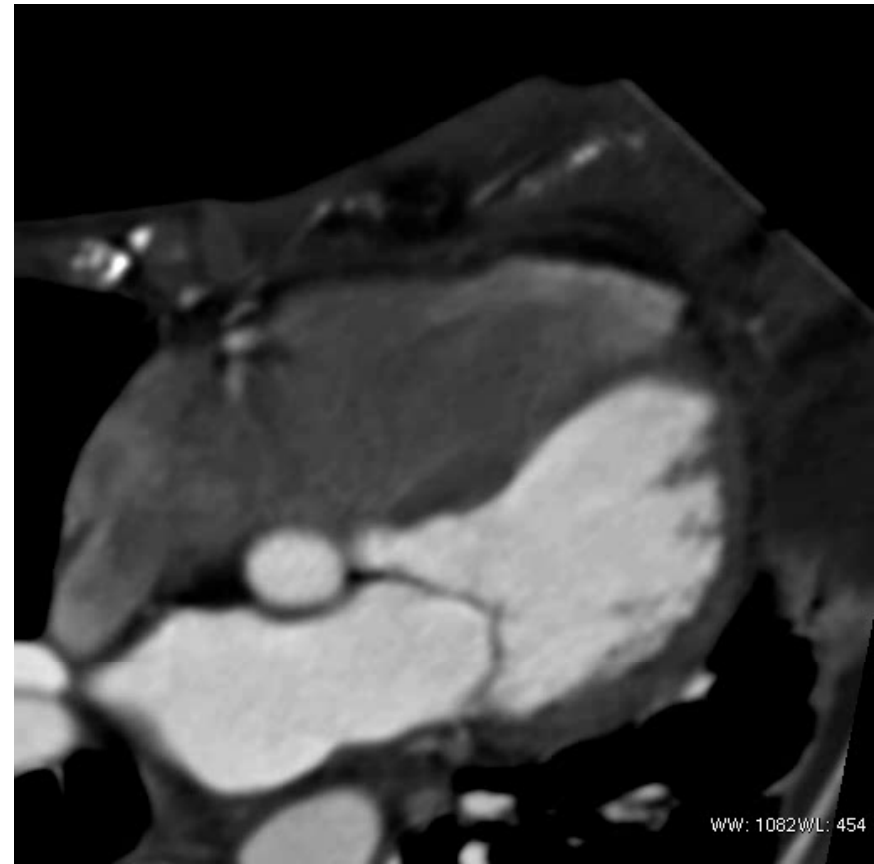
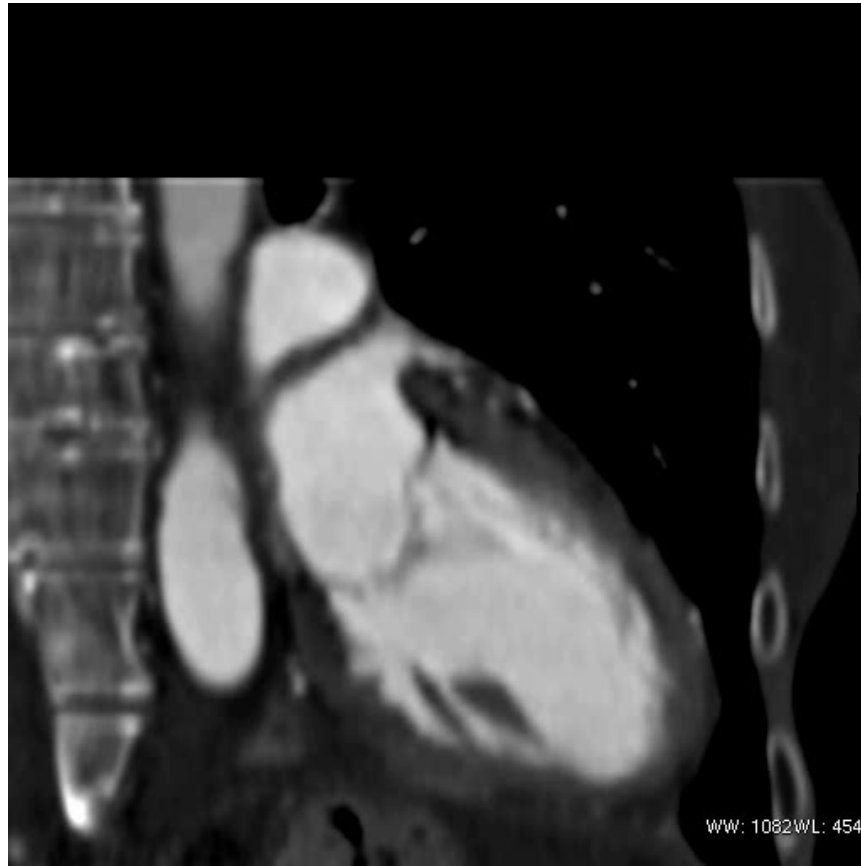
Case 1: AW 61 M with HIV and suspected AIDS CM - Present with anxiety and chest pressure: r/o IHD



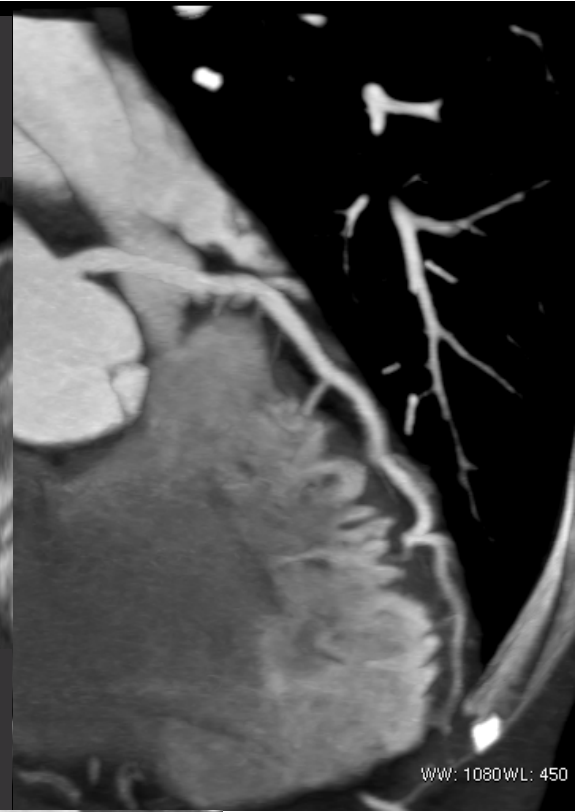
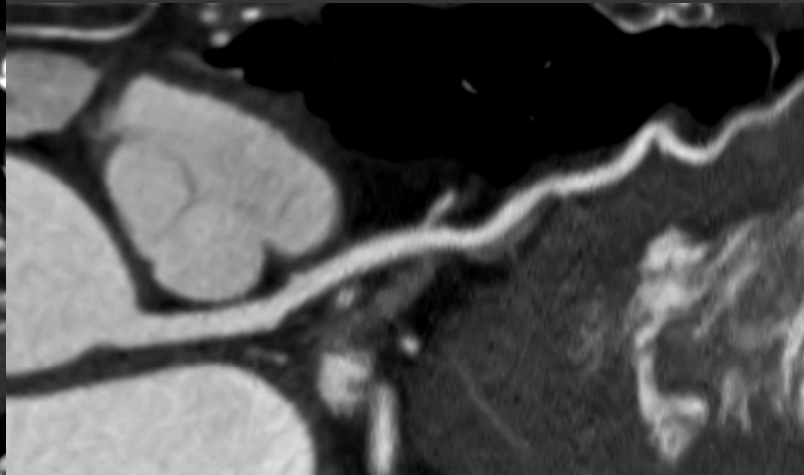
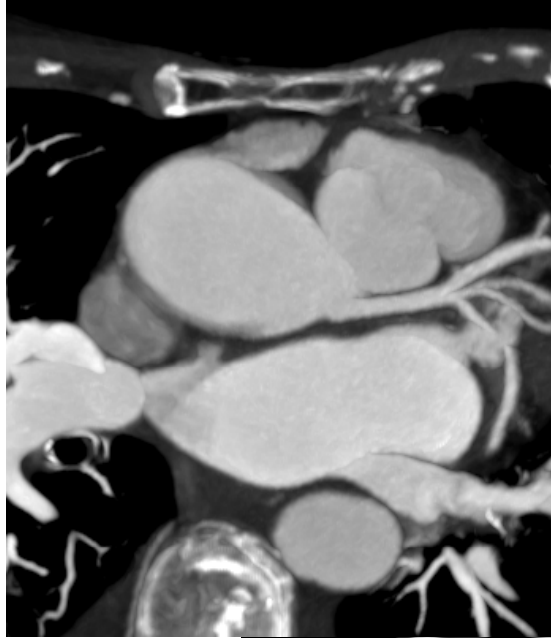
Case 1: AW 61 M with HIV and suspected AIDS CM - Present with anxiety and chest pressure: r/o IHD



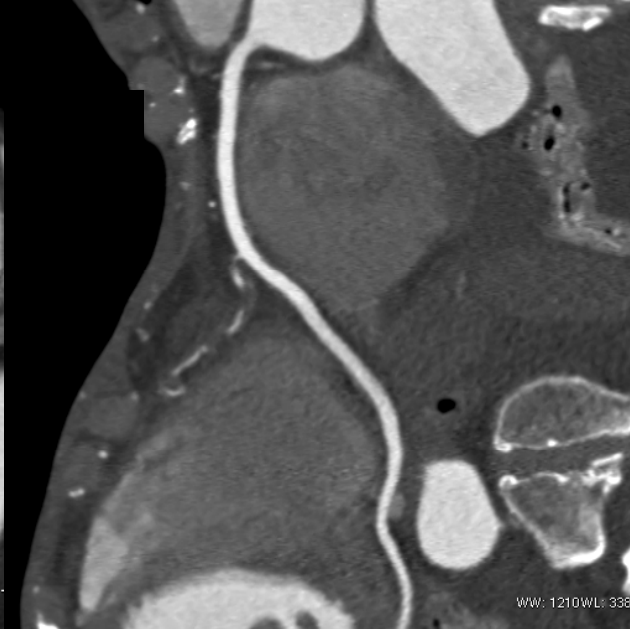
Case 2: PB 72 yo F with peripheral edema and mild troponin elevation post emergency exploratory lap; NS T wave changes; mild troponin elevation: ? ACS.



PB 72 yo F with post-op troponin ↑



WW: 1080WL: 450



ORIGINAL ARTICLE

Diagnostic performance of computed tomography angiography for differentiating ischemic vs nonischemic cardiomyopathy

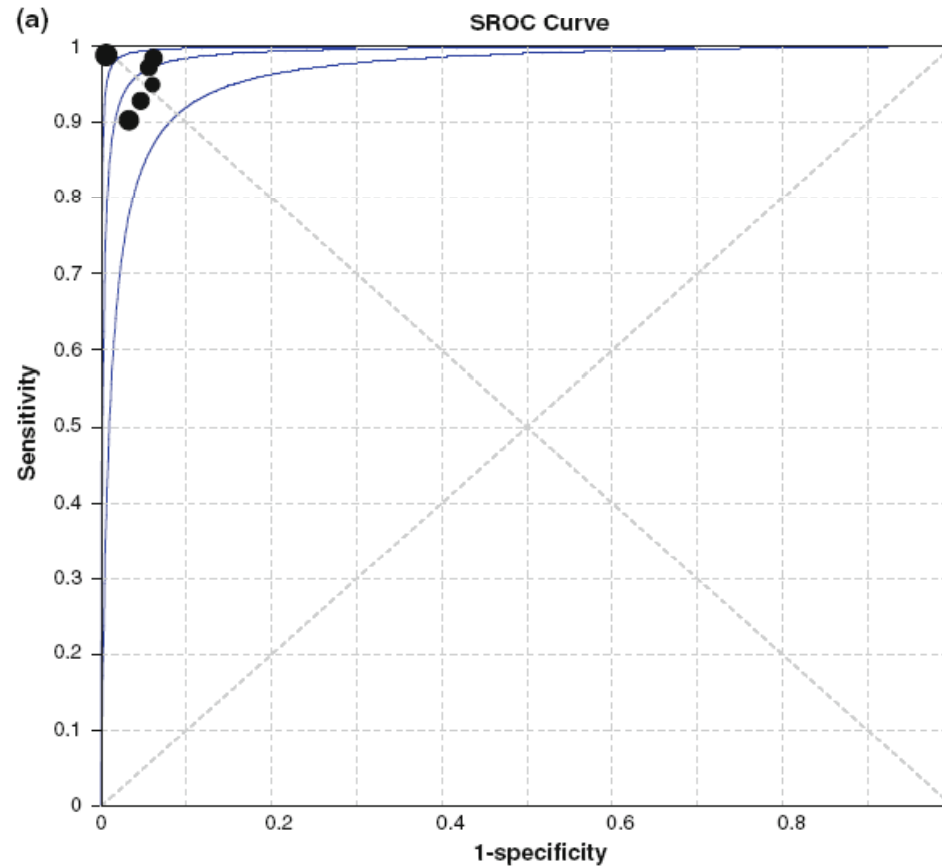
Sabha Bhatti, MD,^a Abdul Hakeem, MD,^a Mian Atif Yousuf, MD, MBA,^a Hussein R. Al-Khalidi, PhD,^b Wojciech Mazur, MD,^c and Yukitaka Shizukuda, MD, PhD^{a,d}

6 studies comparing to invasive coronary angiography

452 patients

Mean EF 32% ± 1%

Coronary CTA for Differentiating Ischemic vs Nonischemic Cardiomyopathy

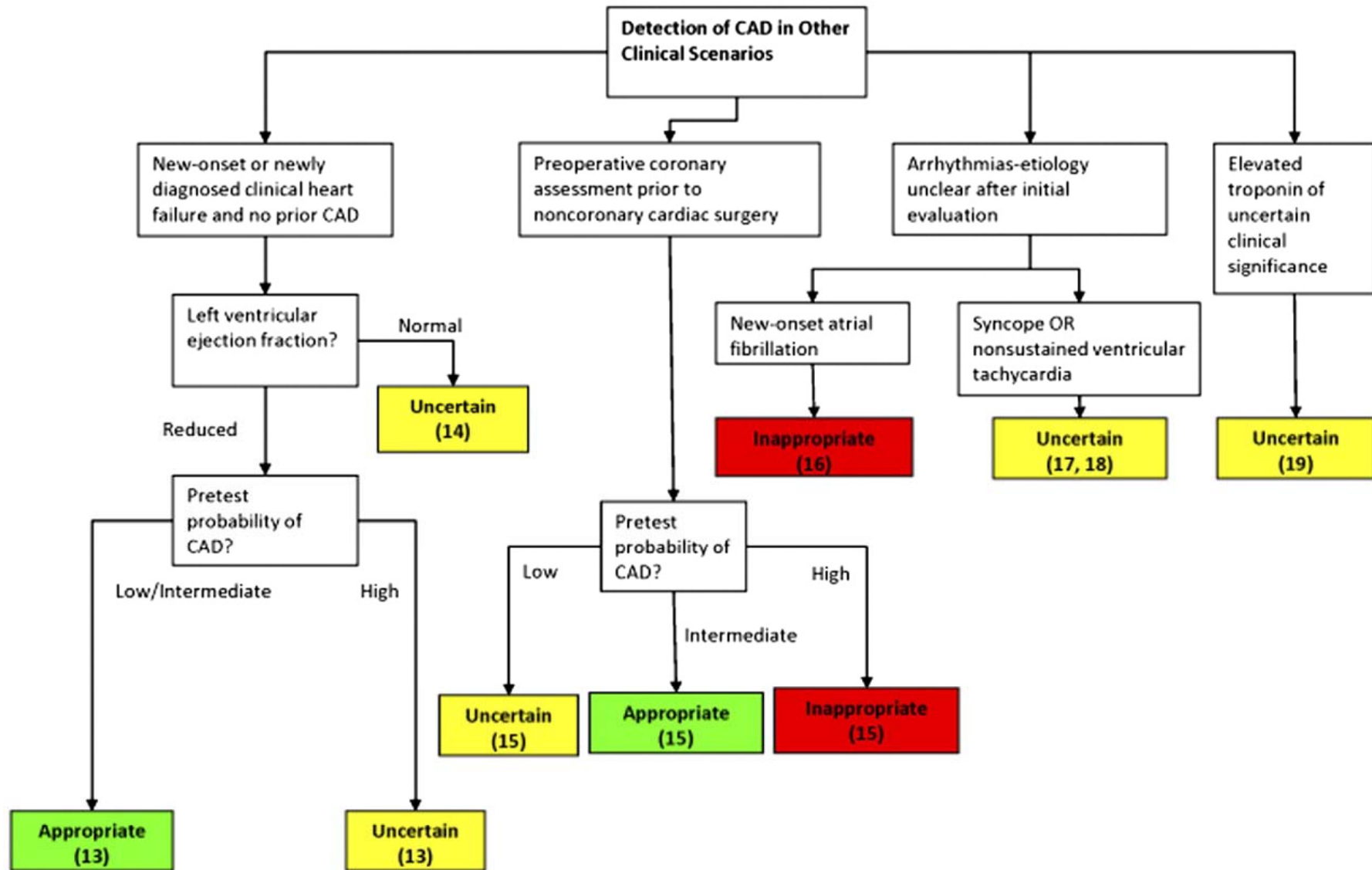


AUC = 0.99
Pooled Sn: 89%
Pooled Sp: 97%

6 studies; n=452; mean EF 32±1%

Bhatti S, et al: J Nucl Cardiol 2011;18:407-20

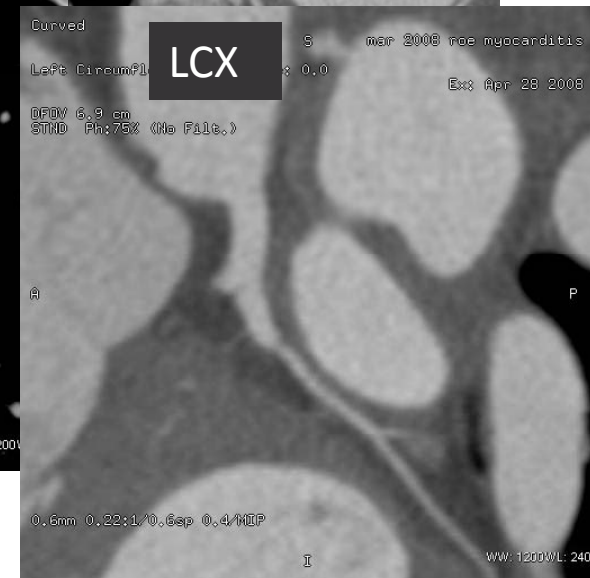
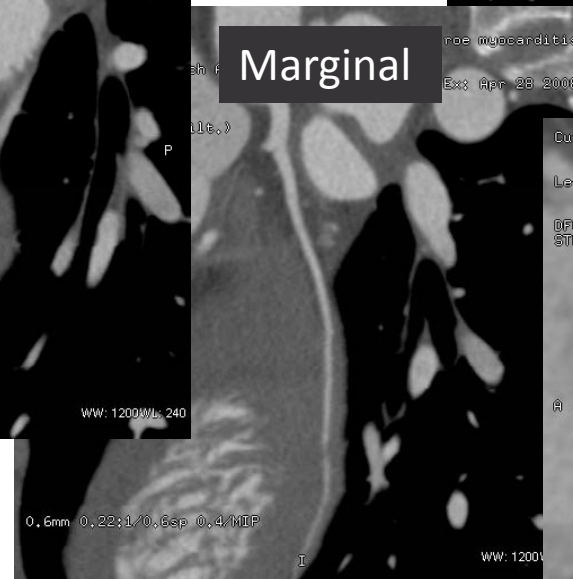
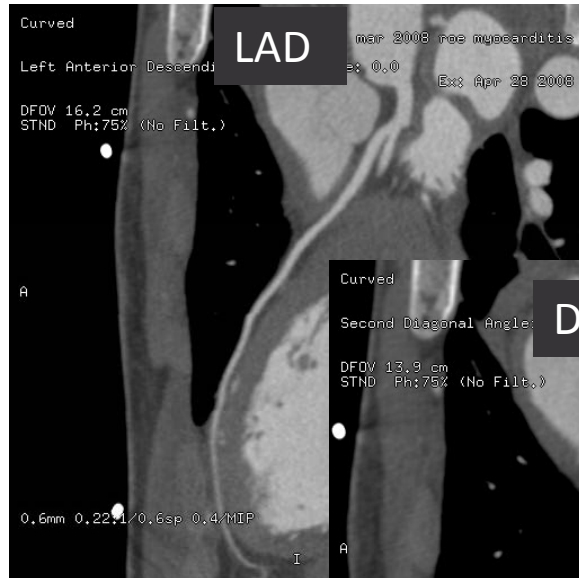
Detection of CAD in Other Clinical Scenarios



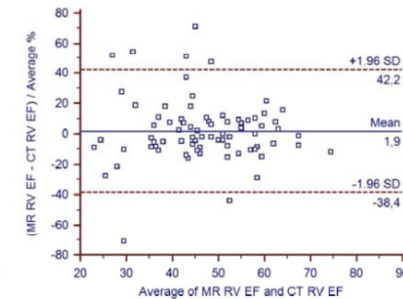
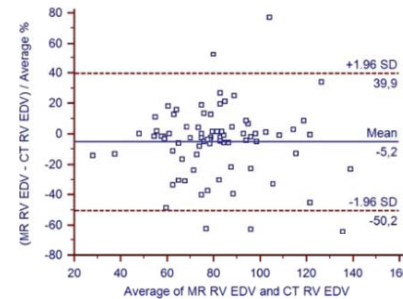
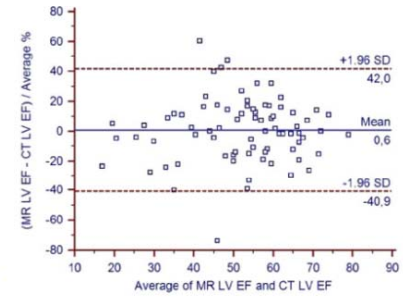
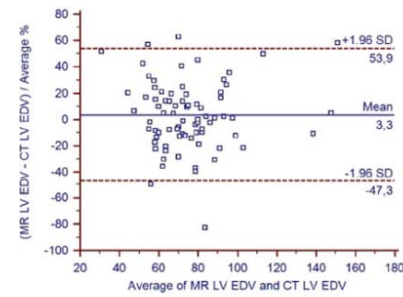
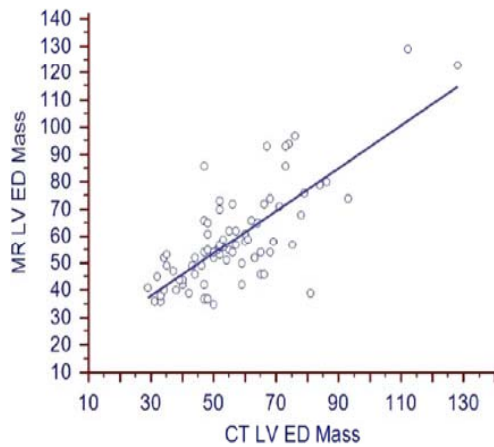
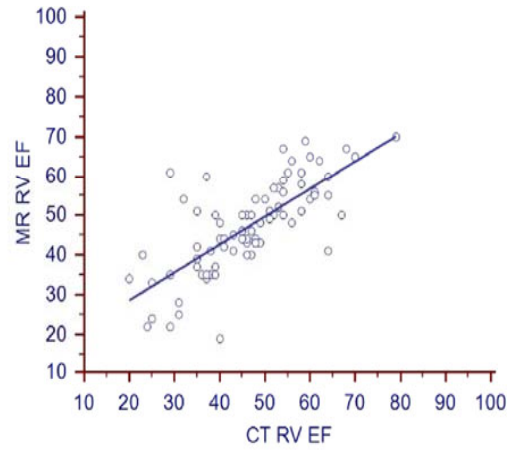
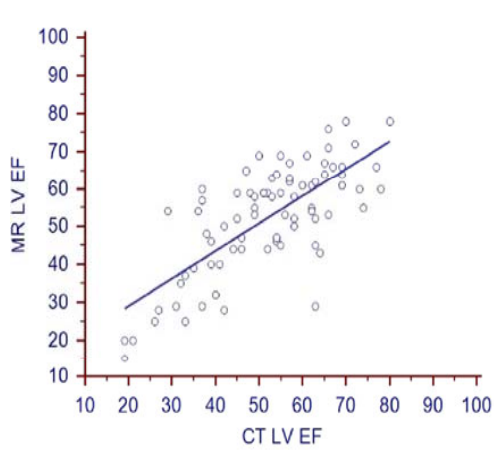
Cardiac CT for Morphology and Function

- Detection of CAD
- **Evaluation of myocardial function and viability**
- Evaluation of intra- and extracardiac structures

Case 3: 18 y/o man with chest pain, (+) Troponin 3 mg/dl, (-) ECG; LVEF 45%



Left and right ventricular assessment with Cardiac CT: Validation vs. Cardiac MR: Systematic Review



12 studies

No significant difference in EF
Bias of 0,0 (-3.7, 3.7, 95% CI)

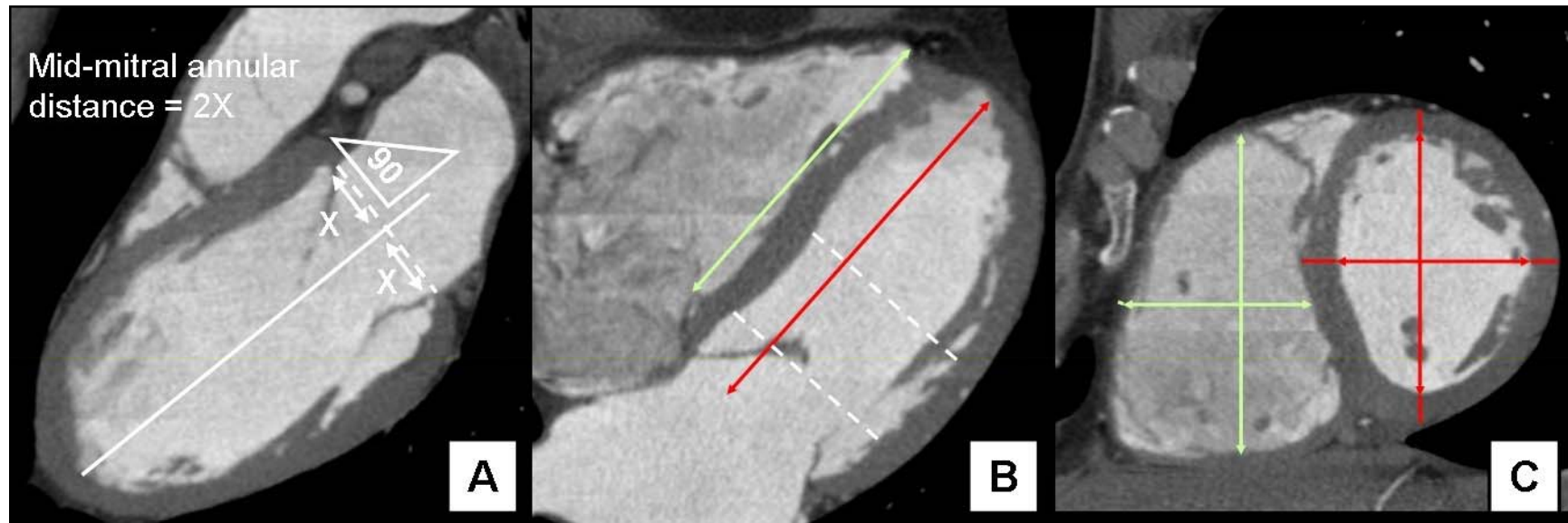
Maffei, et al Eur Radiol 2012 (n=79)

Standardized approach to cardiac chamber measures

Sagittal

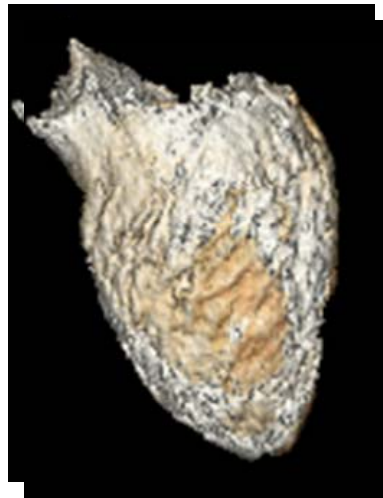
Long-Axis

Double-oblique SAX

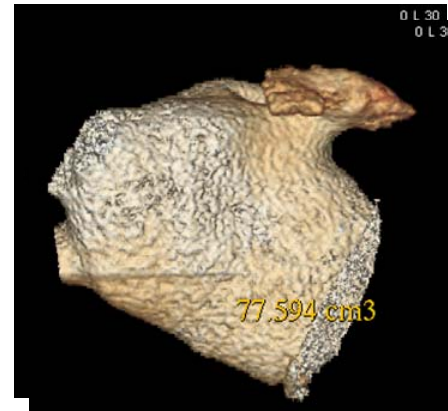


Beyond EF: Volumetric quantification

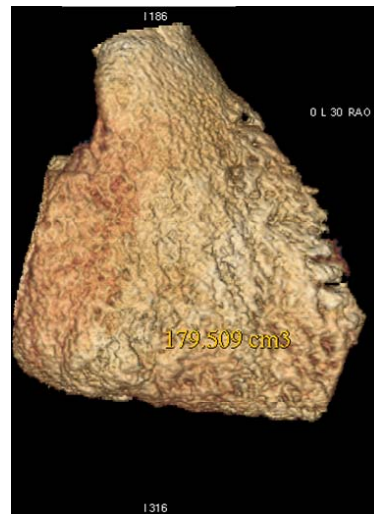
Left Ventricle



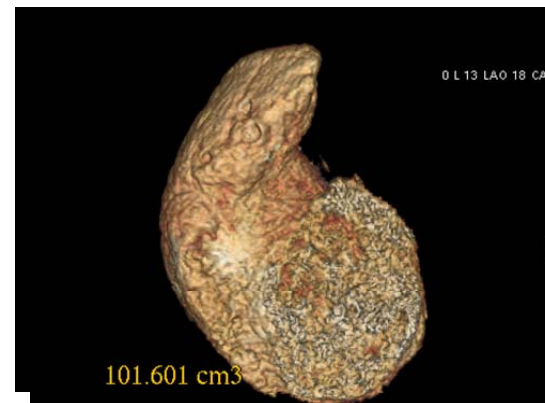
Left atrium



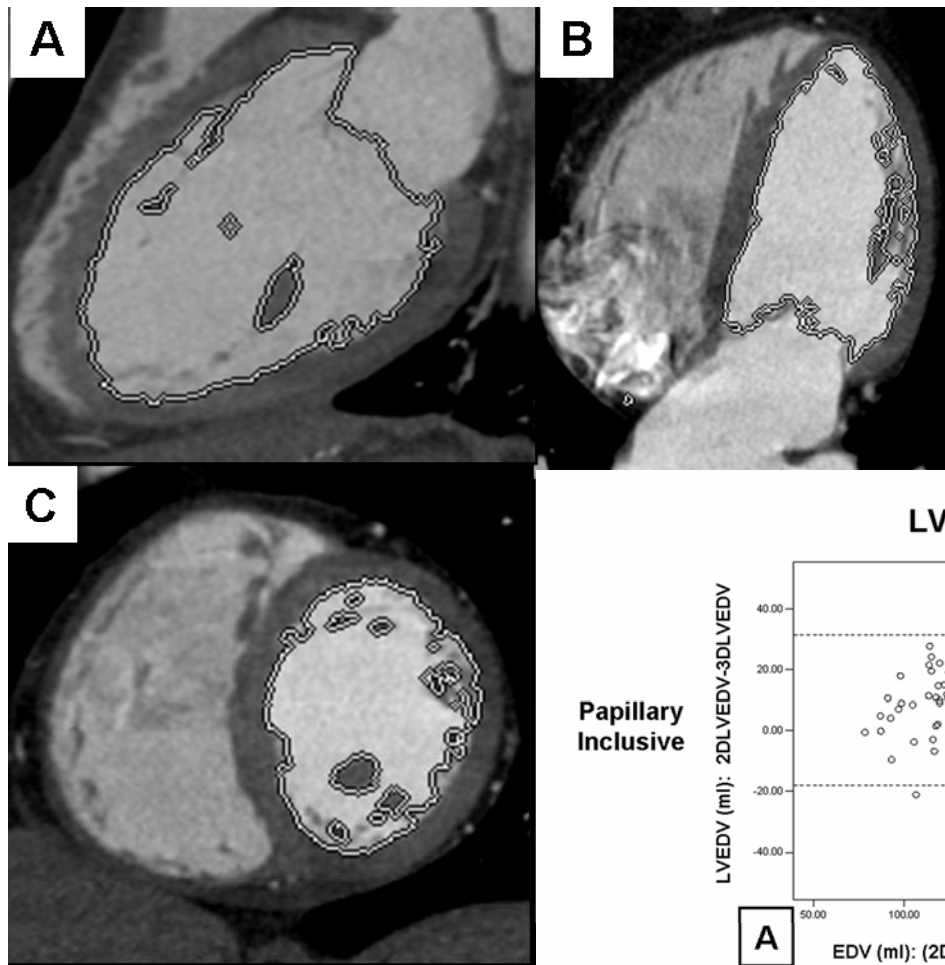
Right Ventricle



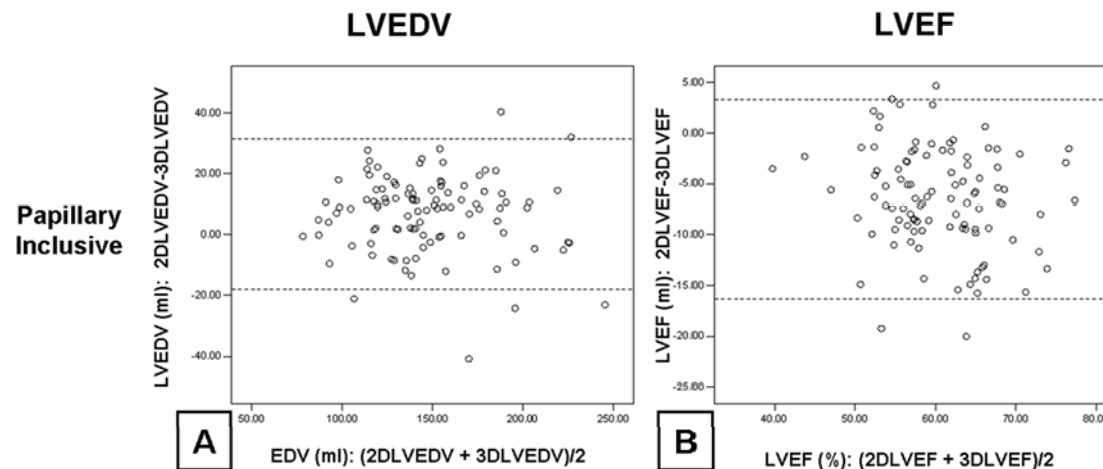
Right atrium



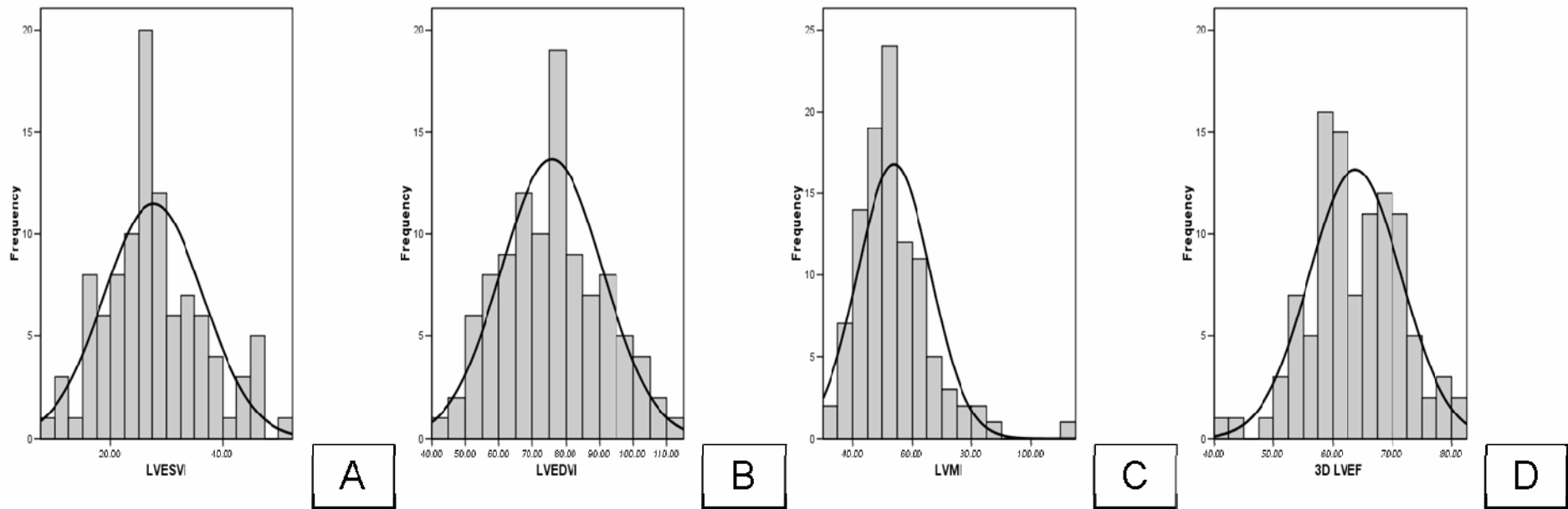
More muscle than echo -



- Papillary-exclusive volumes should be standard for **volumes**
- Papillary-inclusive measures should be standard for **LV mass**

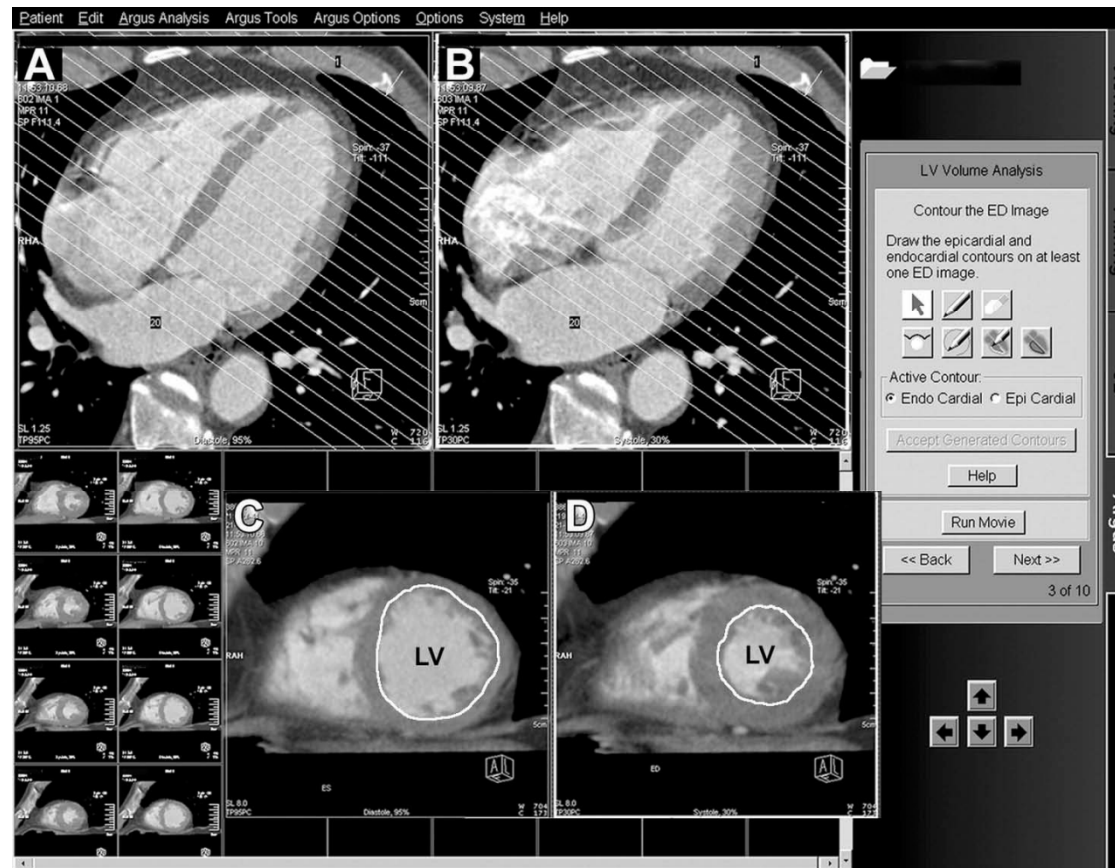


Age- and gender reference values



- Age- and gender reference values for healthy individuals free of obesity, hypertension and CV disease
- Significant differences exist between 1-D, 2-D, and 3-D values
- Beta blockade, relative volume depletion, Valsalva maneuver and scanner resolution (temporal, spatial, contrast) will affect cardiac chamber measures

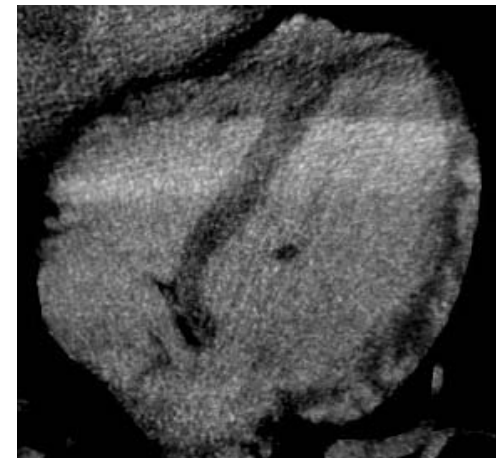
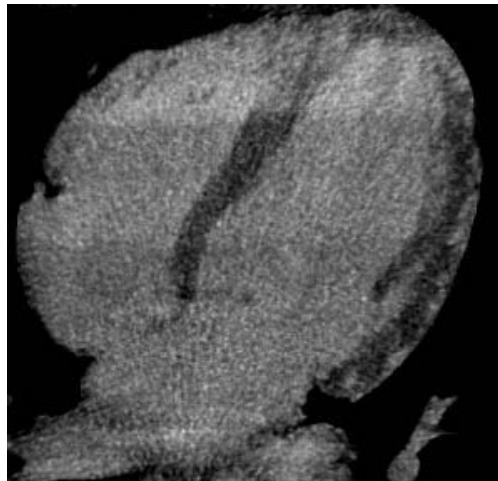
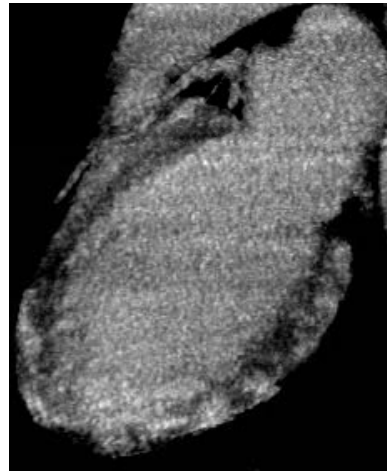
Automated Quantitative Assessment of LV Volumes and EF

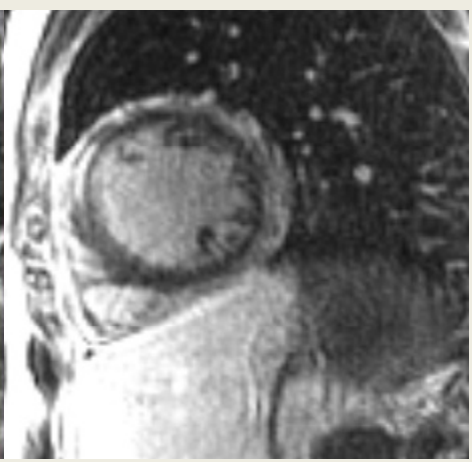
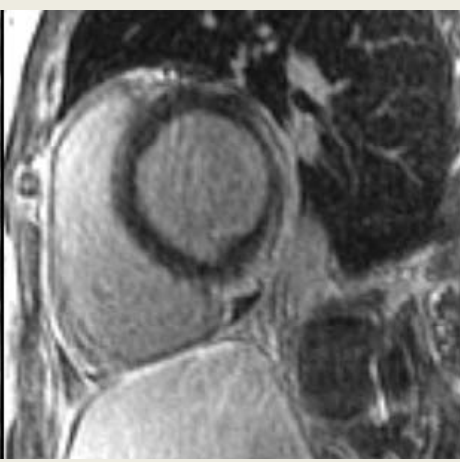
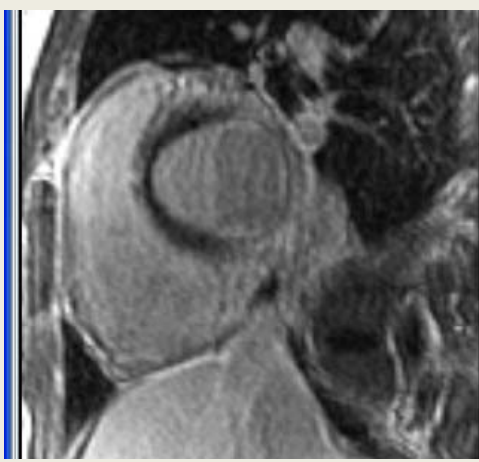
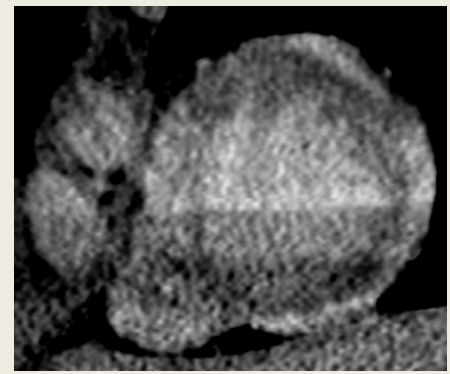
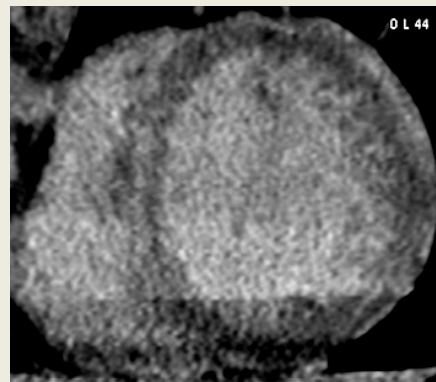
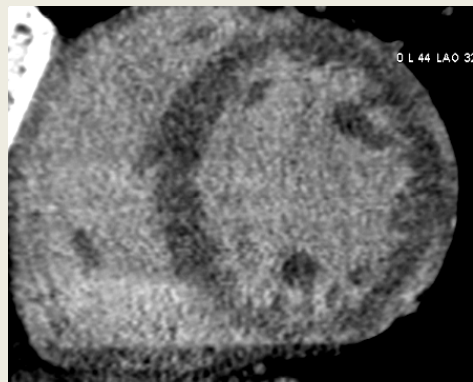
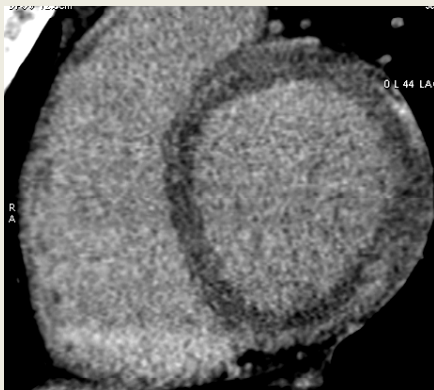
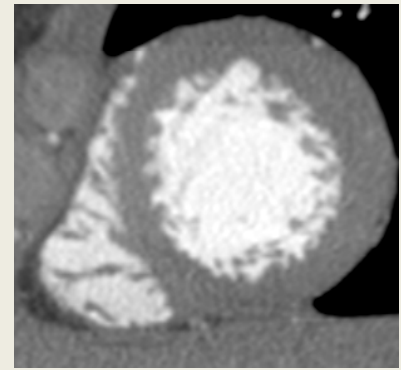
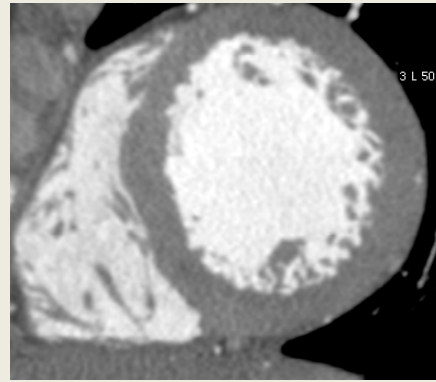
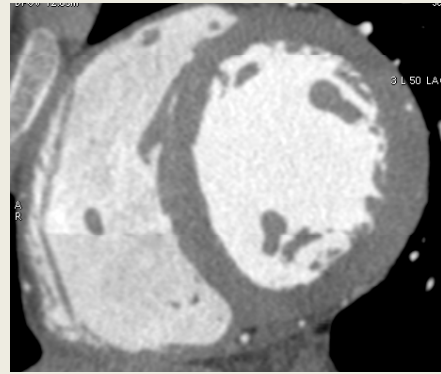
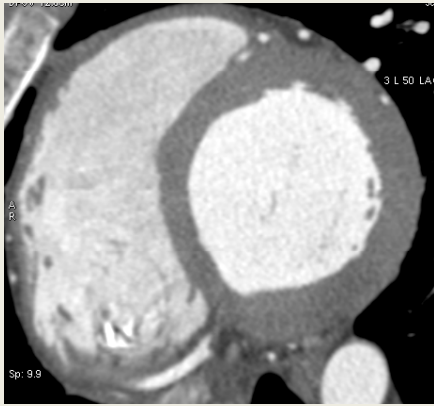


Ghormallah Alzahrani

Delayed Enhancement CCTA

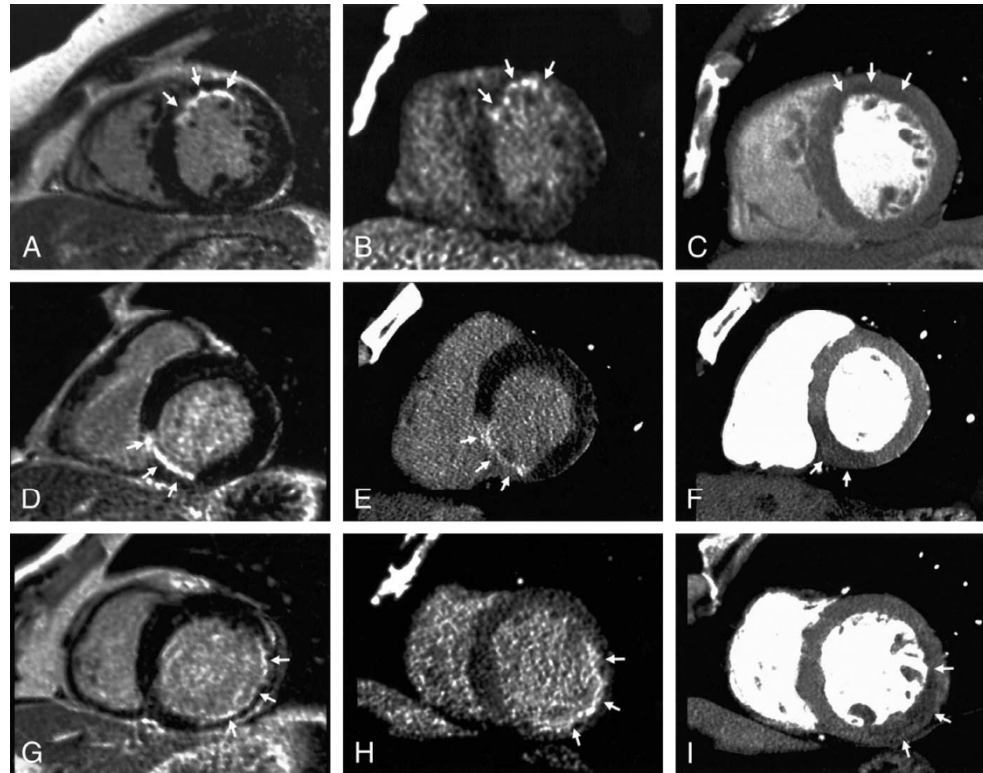
100 cc contrast re-injected
5 minutes delay post-CCTA acquisition
700 mA, 100 kV, single-segment acquisition, 0.625mm





Myocardial Viability Assessment by MDCT

28 consecutive patients (23 men; 55.9 ± 11.4 years) with reperfused MI 16-slice MDCT. Images were acquired “first pass” and “late phase” (15 min). Within 5 days, patients underwent MRI.



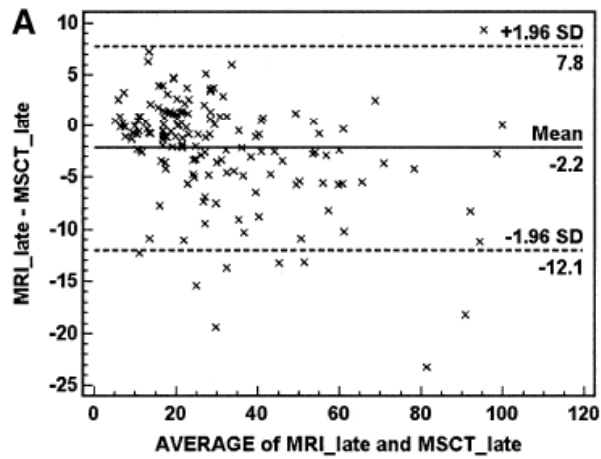
Mean infarct size:

MRI ($31.2 \pm 22.5\%$ per slice)

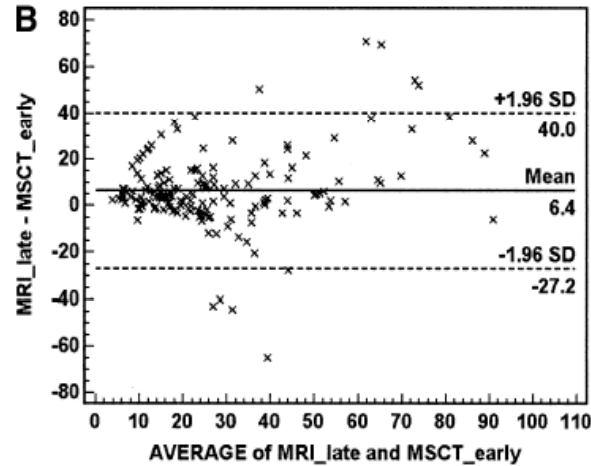
MDCT LE ($33.3 \pm 23.8\%$ per slice)

First Pass MDCT ($24.5 \pm 18.3\%$ per slice)

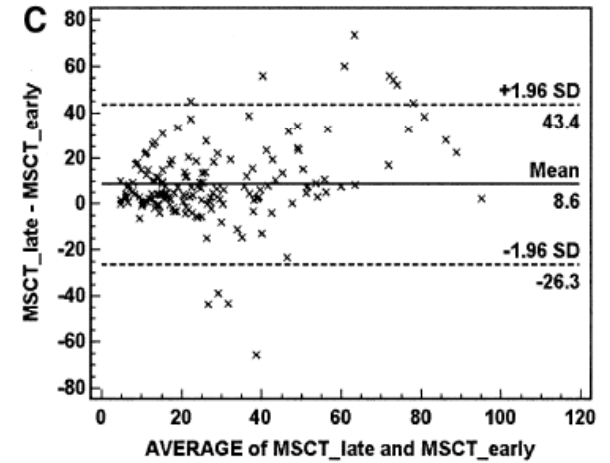
Comparison of MRI/CT and CT/CT



MRI LE vs. MDCT LE,
-2.2% (-12.1%, +7.8%)



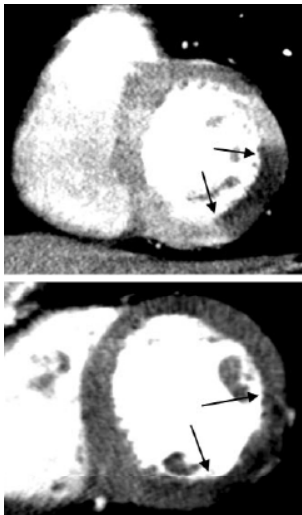
MRI LE vs. MDCT ED,
6.4% (27.2%, 40.0%)



MDCT LE vs. MDCT ED,
8.6% (26.3%, 43.4%)

Late enhancement predicts lack of myocardial function recovery

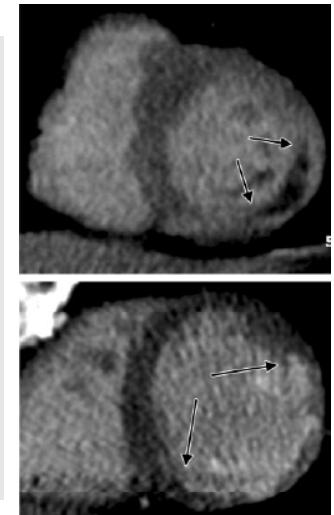
26 patients underwent MDCT and echo within 1 week of AMI f/u echo 3 months. ED, LE, and late hypoattenuation were compared with regional left ventricular function and MFR.



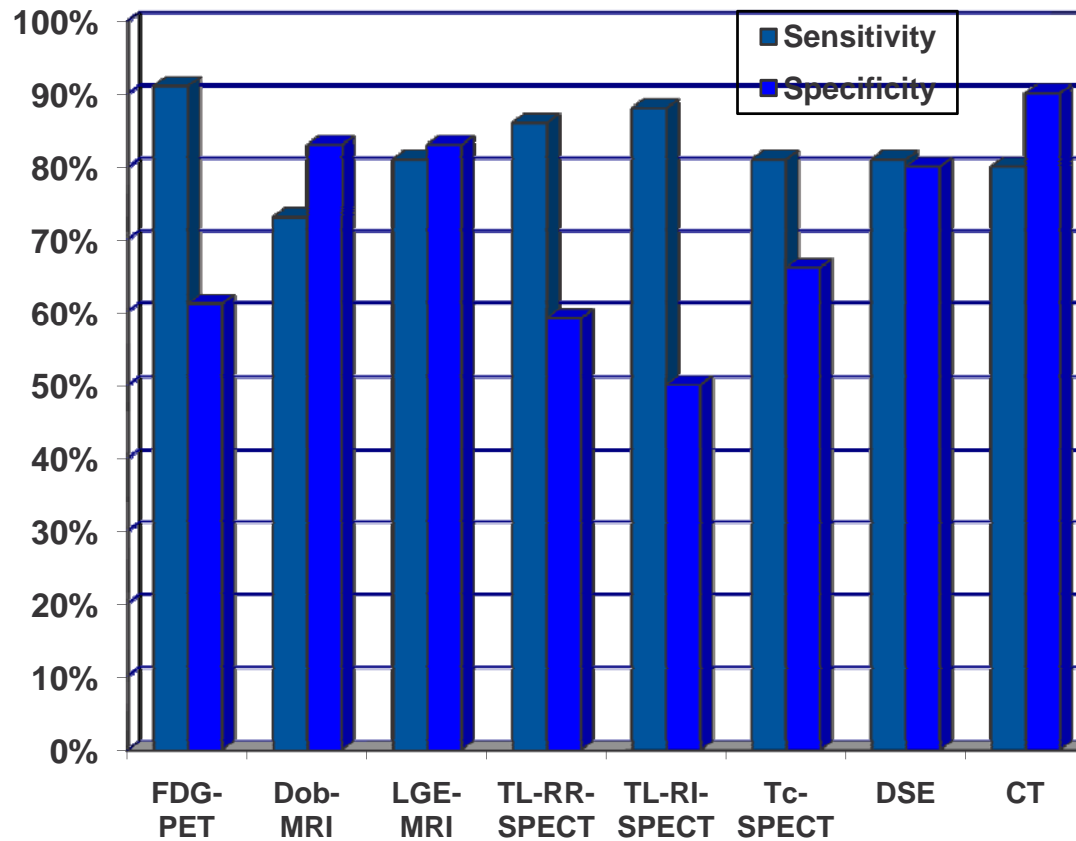
Logistic Regression Model for Prediction of Absence of Segment MFR and Follow-up Segment Dysfunction

Variable	Absence of MFR (Abnormal Baseline Function)		Follow-up Segment Dysfunction (All Segments)	
	Odds Ratio	95% Confidence Interval	Odds Ratio	95% Confidence Interval
No percutaneous coronary intervention	2.73	0.82, 9.06	1.48	0.77, 2.87
LE area	1.85*	1.18, 2.88	2.31	1.74, 3.06
ED area	1.95*	0.92, 4.14	3.07	1.86, 5.07

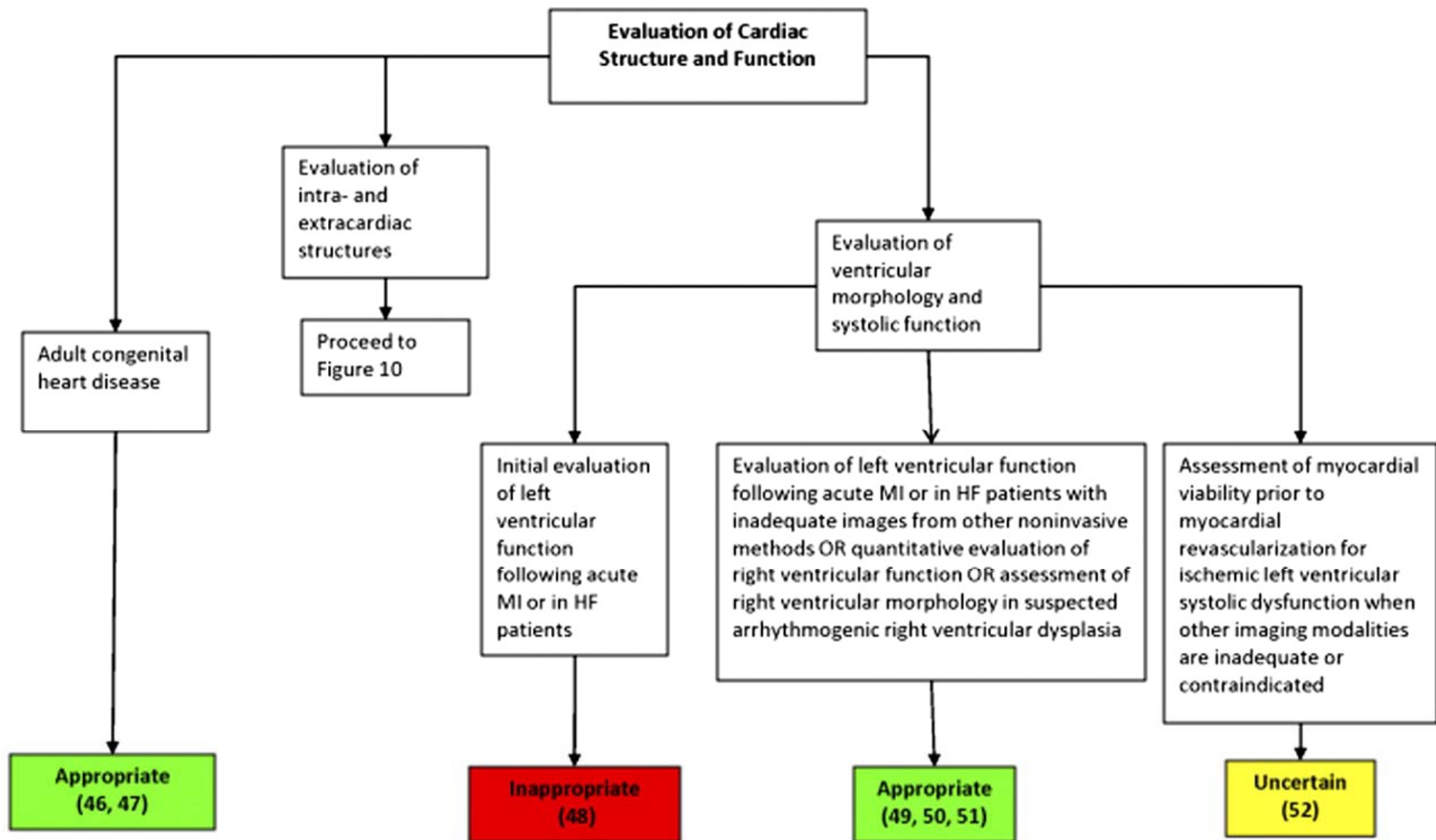
* Area per square centimeter of myocardium taken up by ED or LE.



Comparing CT to Other Modalities



Evaluation of Cardiac Structure and Function



Thank you.

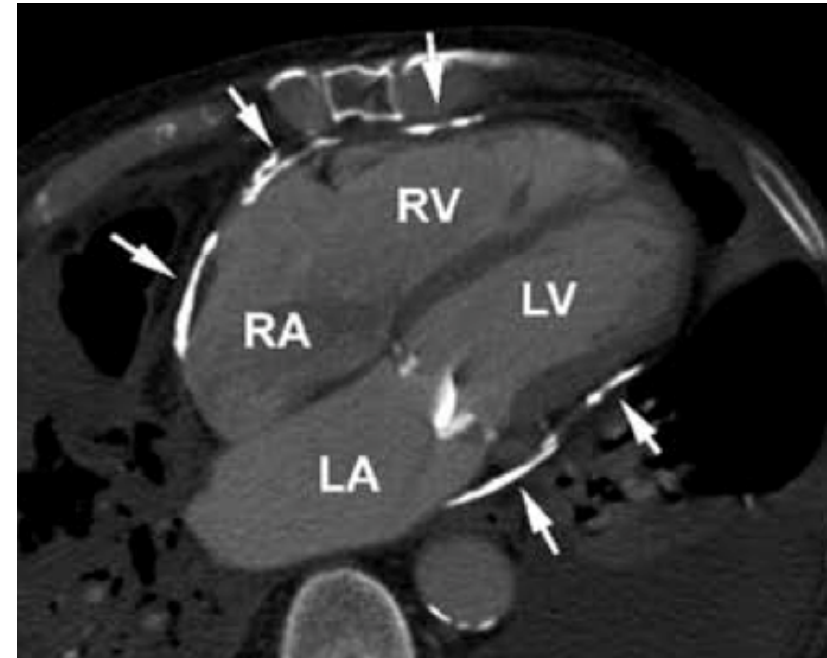
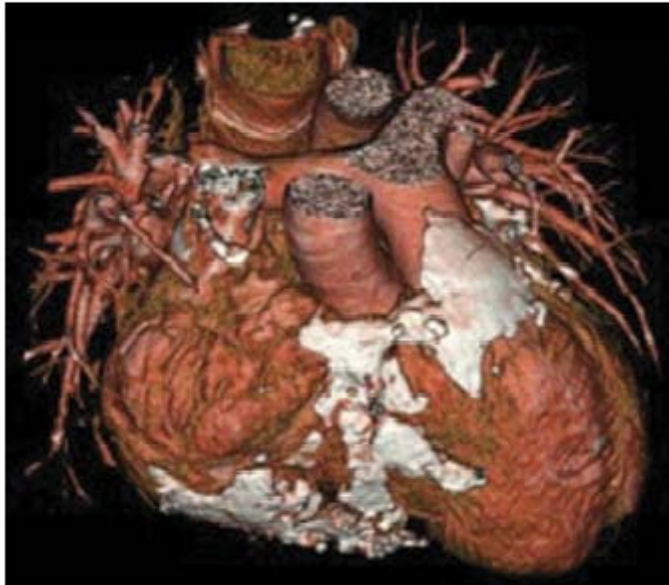
Cardiac CT in Advanced Heart Failure

Detection of CAD

Evaluation of myocardial function and viability

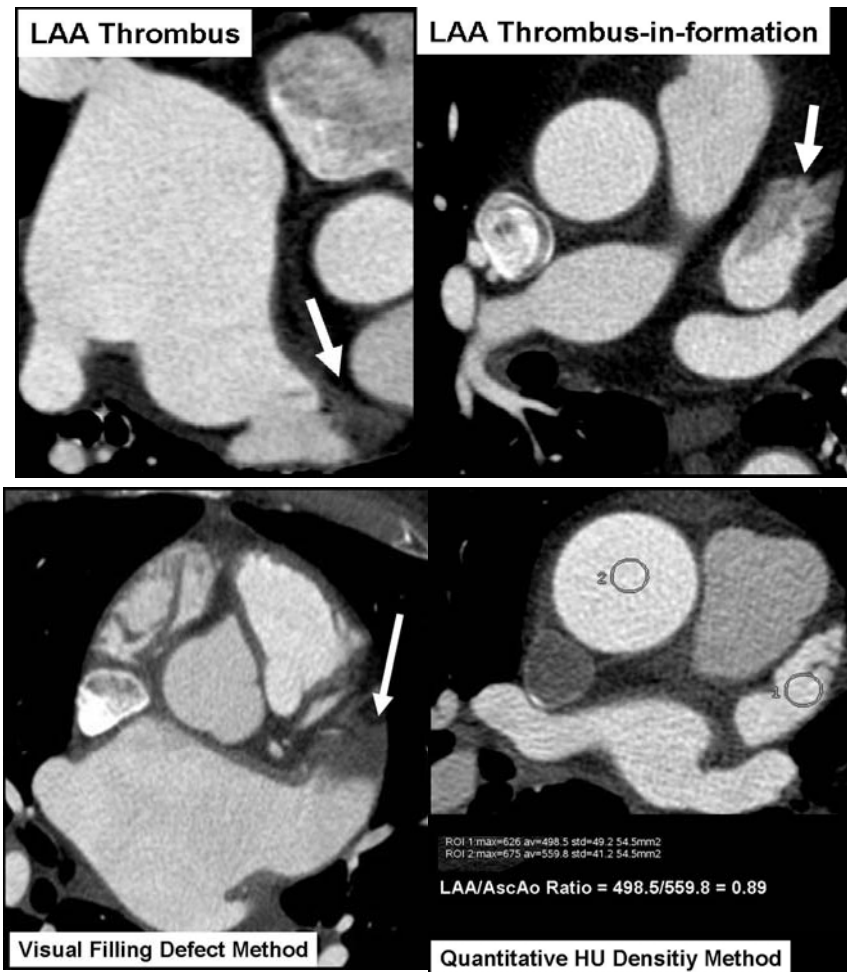
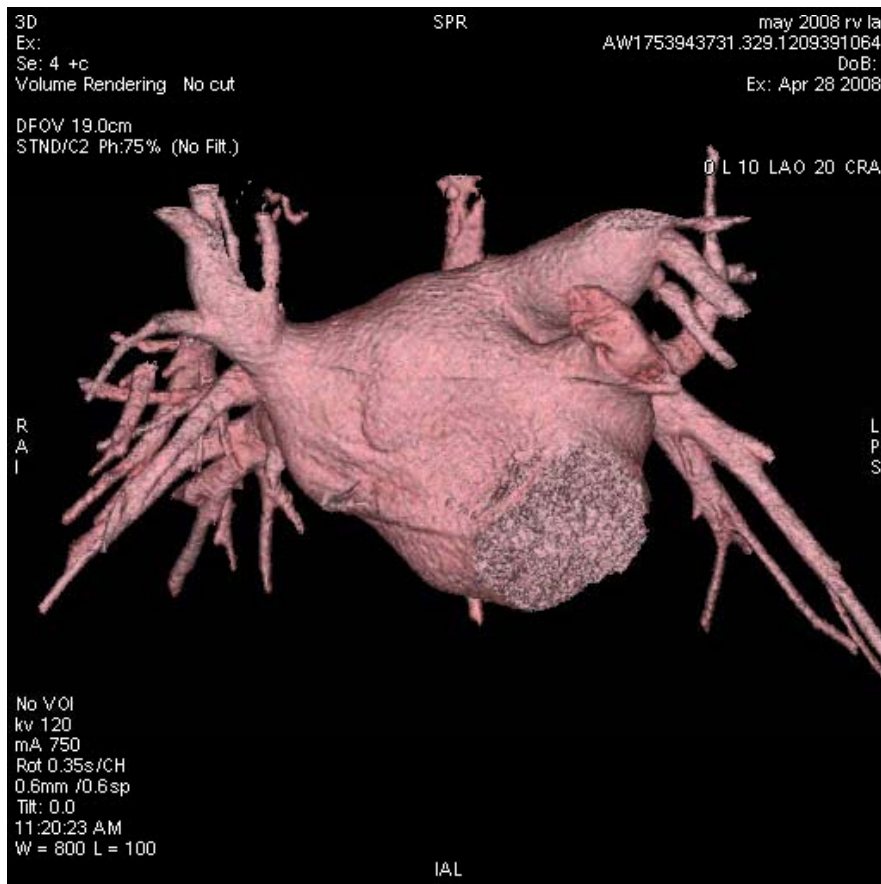
Evaluation of intra- and extracardiac structures

Calcification versus Constrictive Pericarditis

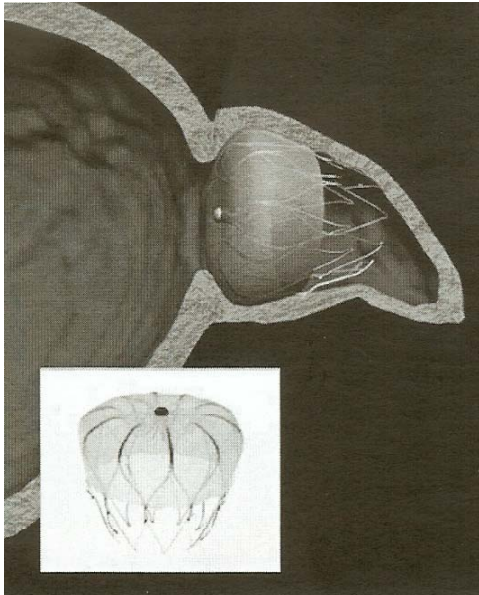


- Clinical diagnosis
- Typical Findings
 - Pericardial calcification
 - Pericardial thickening $>4\text{mm}$
 - Septal flattening, RV narrow
- Thickness $\leq 2\text{ mm}$ in 18% of patients

Pulmonary Vein Anatomy and LA Appendage

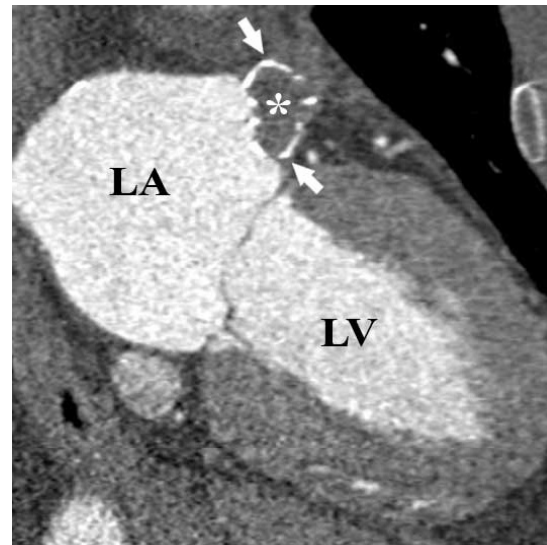
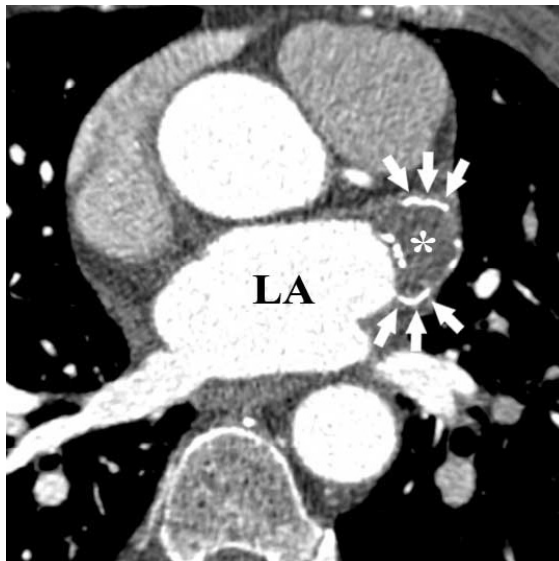


LA Appendage WATCHMAN Device

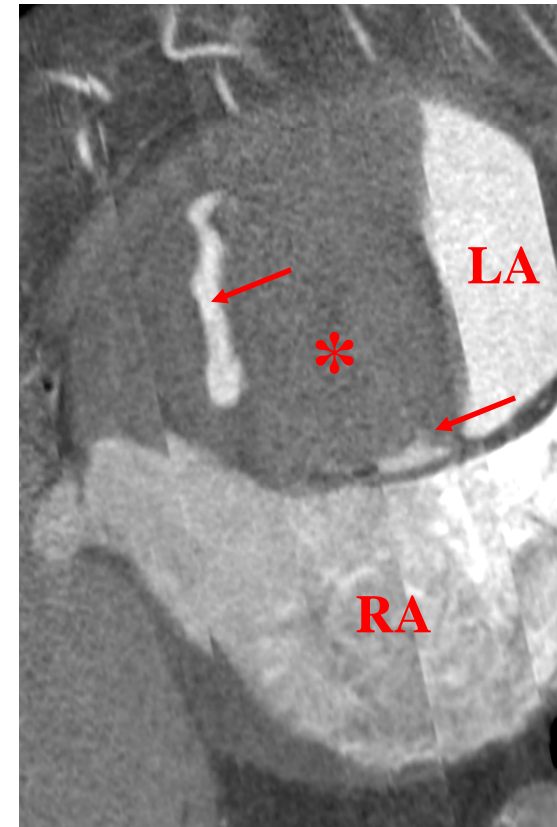
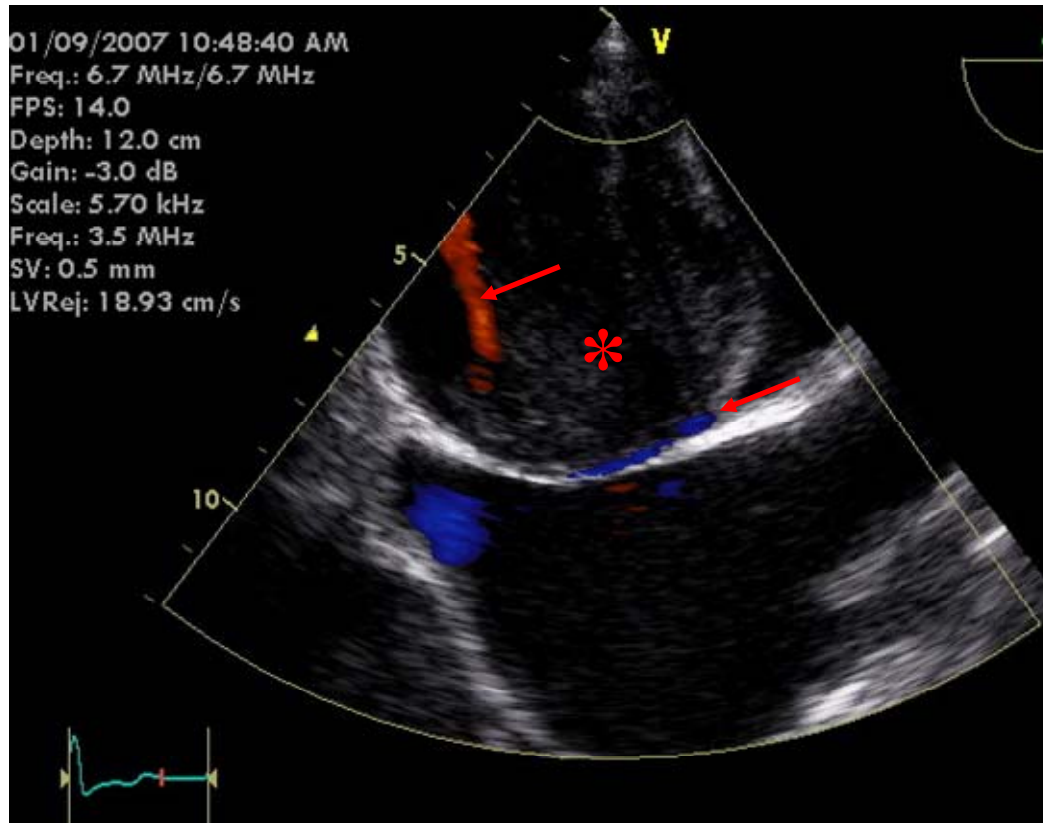


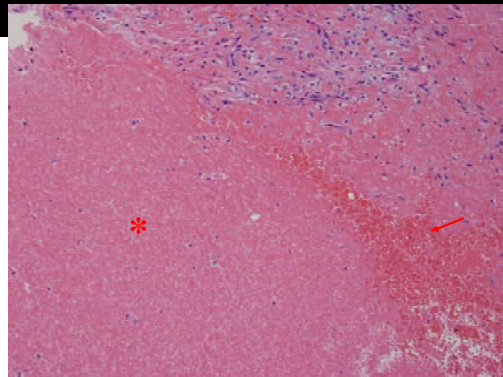
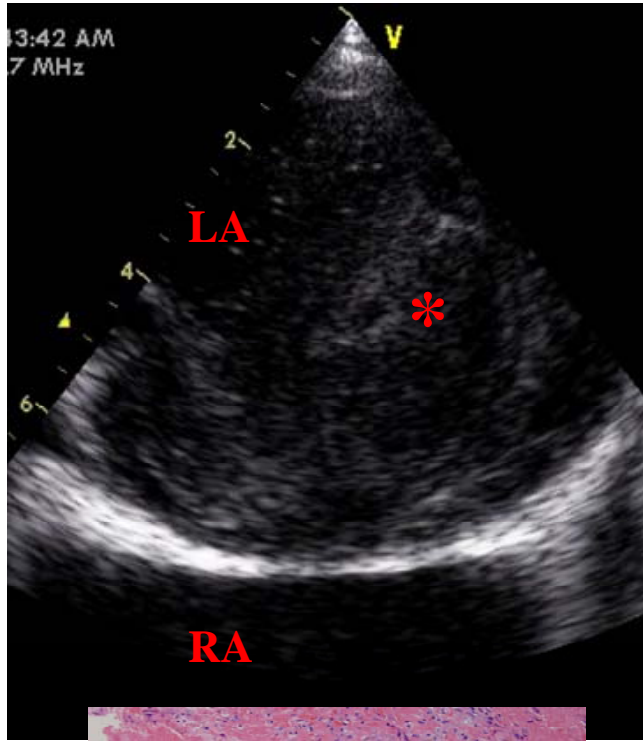
Contrast enhanced cardiac CTA is an excellent modality to:

- Evaluate proper device placement
- Assess device integrity
- Exclude residual communication between LA and LAA

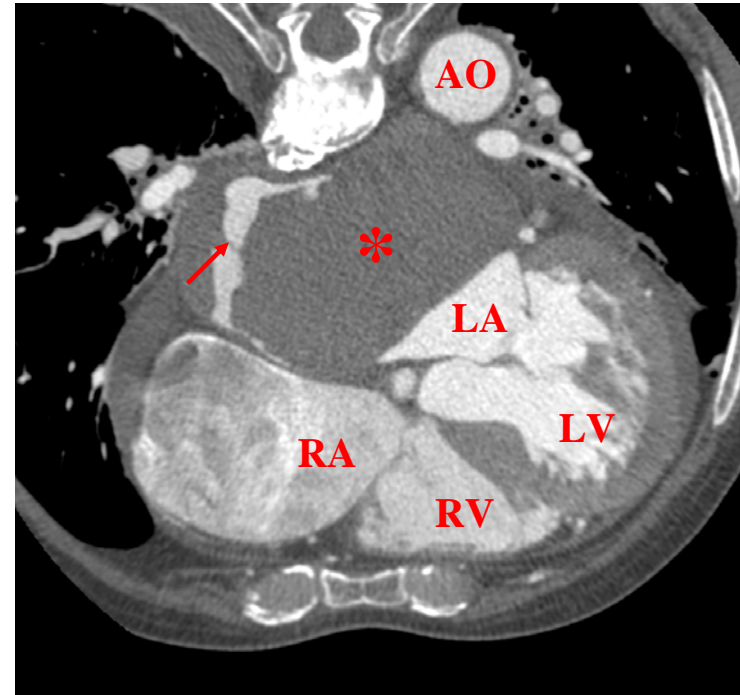


77 y/o man with progressive exertional dyspnea and left atrial mass



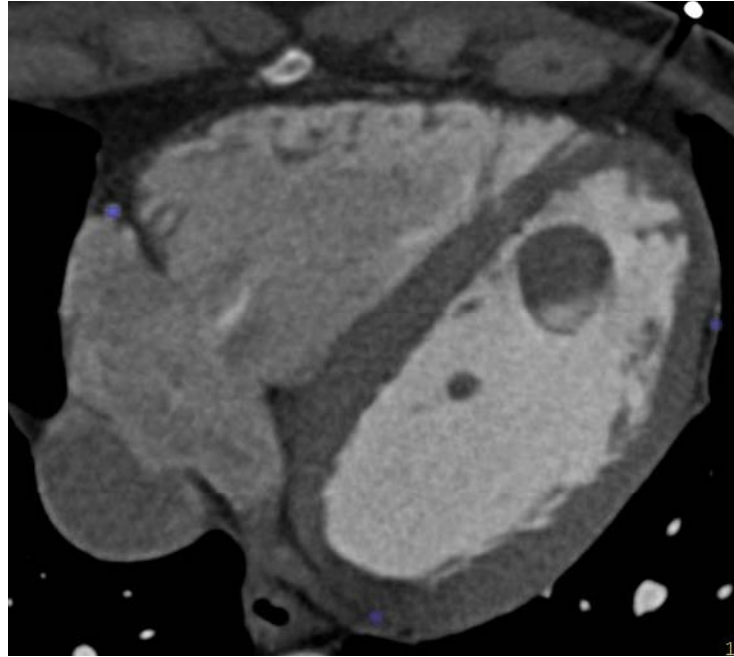


Delayed enhancement CT can provide incremental information

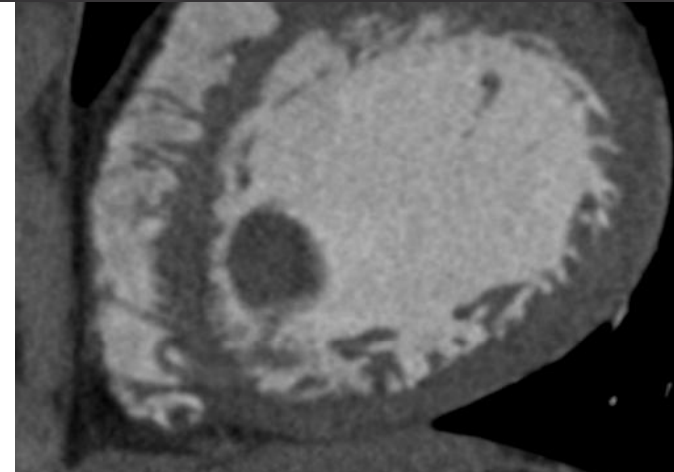
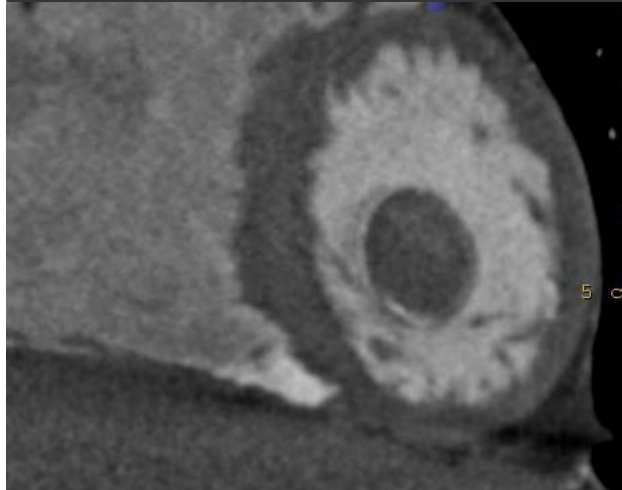


Chordal angiosarcoma:

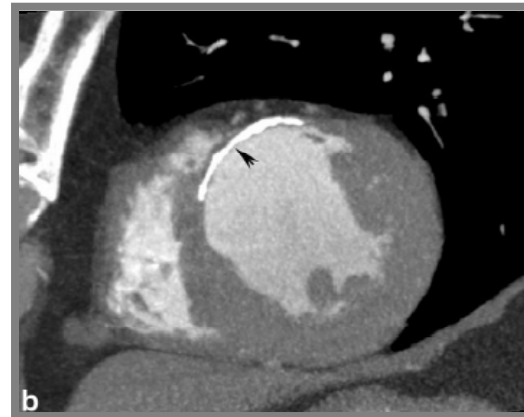
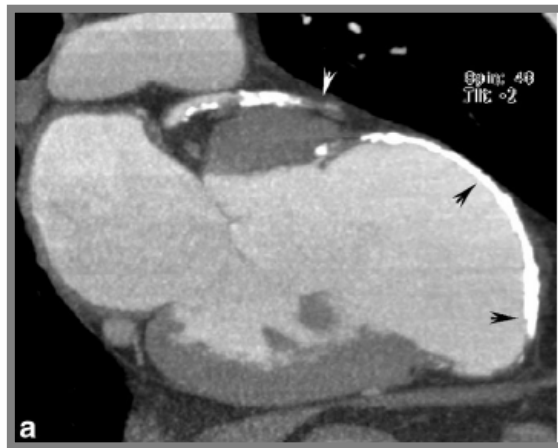
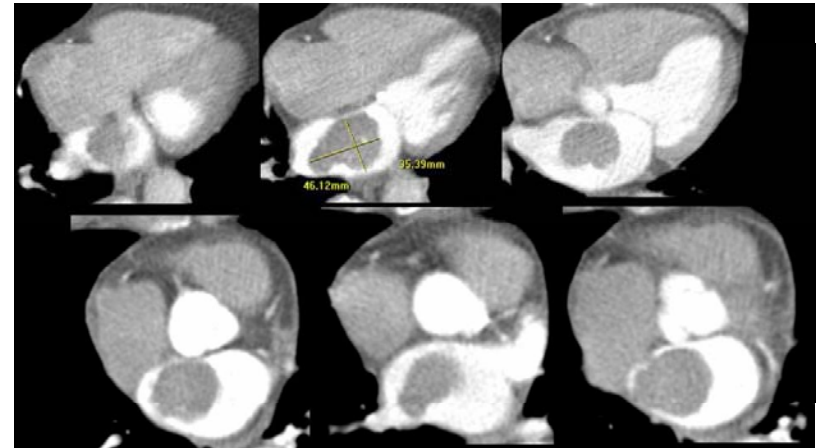
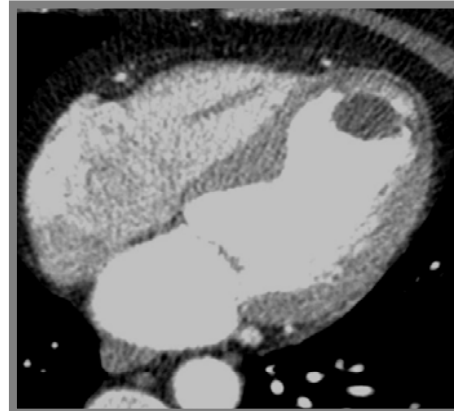
- First-Pass Perfusion
- Pedunculated location



Metastatic Disease: 10-20x more common than primary tumors



Other masses have not been studied to date



Evaluation of Cardiac Structure and Function: Intra- and Extracardiac Structures

