

# THE ROLE OF CT IN CARDIAC DIAGNOSTICS

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Dave Burke – Cardiology

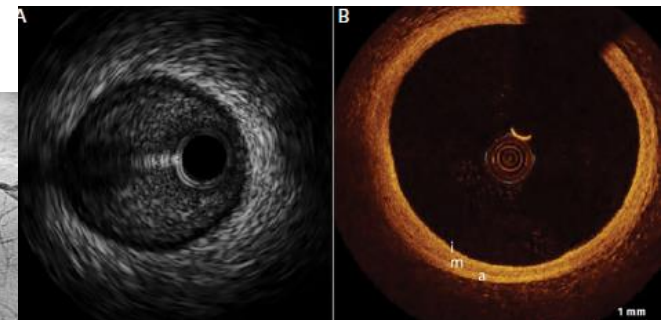
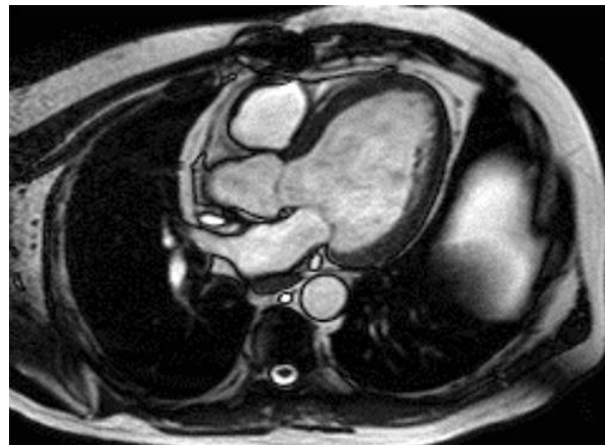
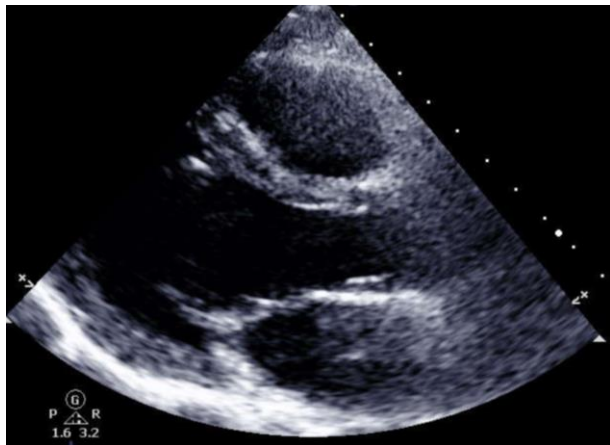
John Kavanagh - Radiology

# Advances in Cardiac Imaging

Advanced imaging, functional assessment, improved percutaneous techniques and cutting-edge equipment allow us to deliver improved patient outcomes and quality of life.

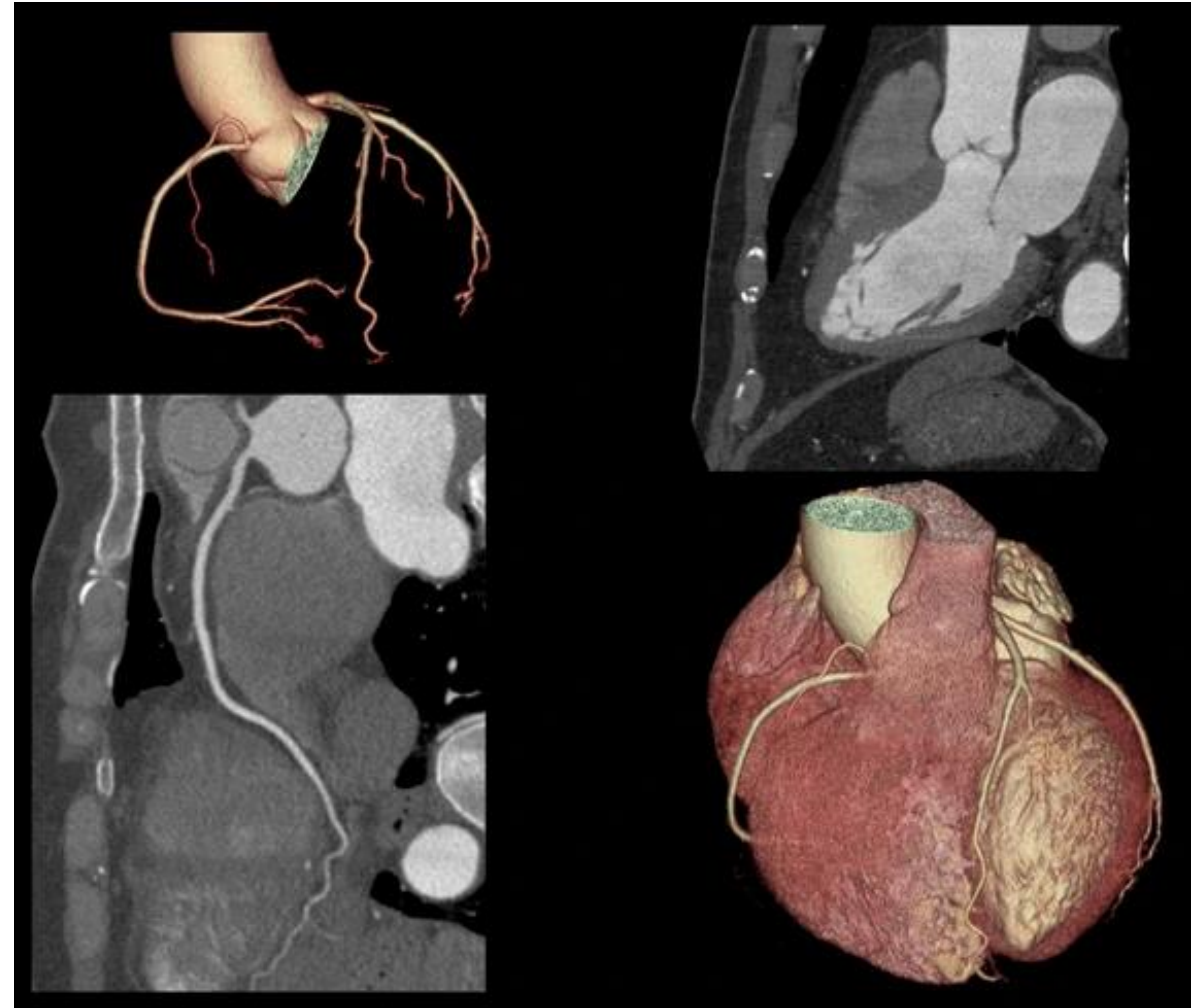
Enhanced diagnostics have helped make assessment safer, more straightforward, and more reliable.

‘Multimodality imaging’



# Overview of CT Cor Angio

- 'Gold standard' in non-invasive testing for coronary assessment
- Significant progression in image quality and reliability
- Reduced radiation and contrast dose
- 'Calcium Scoring' and angiographic reconstructions
- Dual reporting of scans



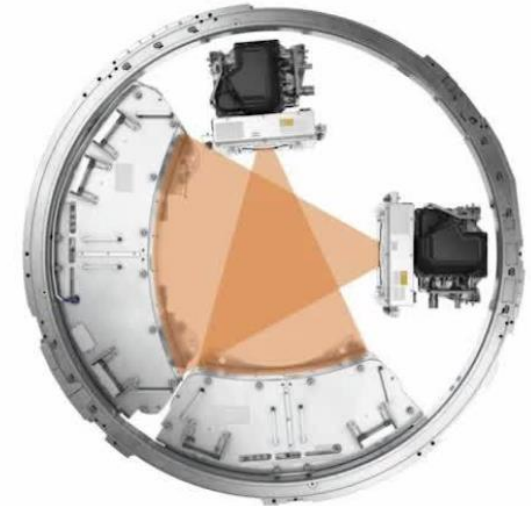
# Cardiac CT Technology – "Shutter Speed"

- High temporal Resolution
  - Cardiac Motion must be minimized
- High Spatial Resolution
  - Coronary arteries are small! (1-4mm)
- ALARA – As low as reasonably achievable

**Single Source CT**



**Dual Source CT**



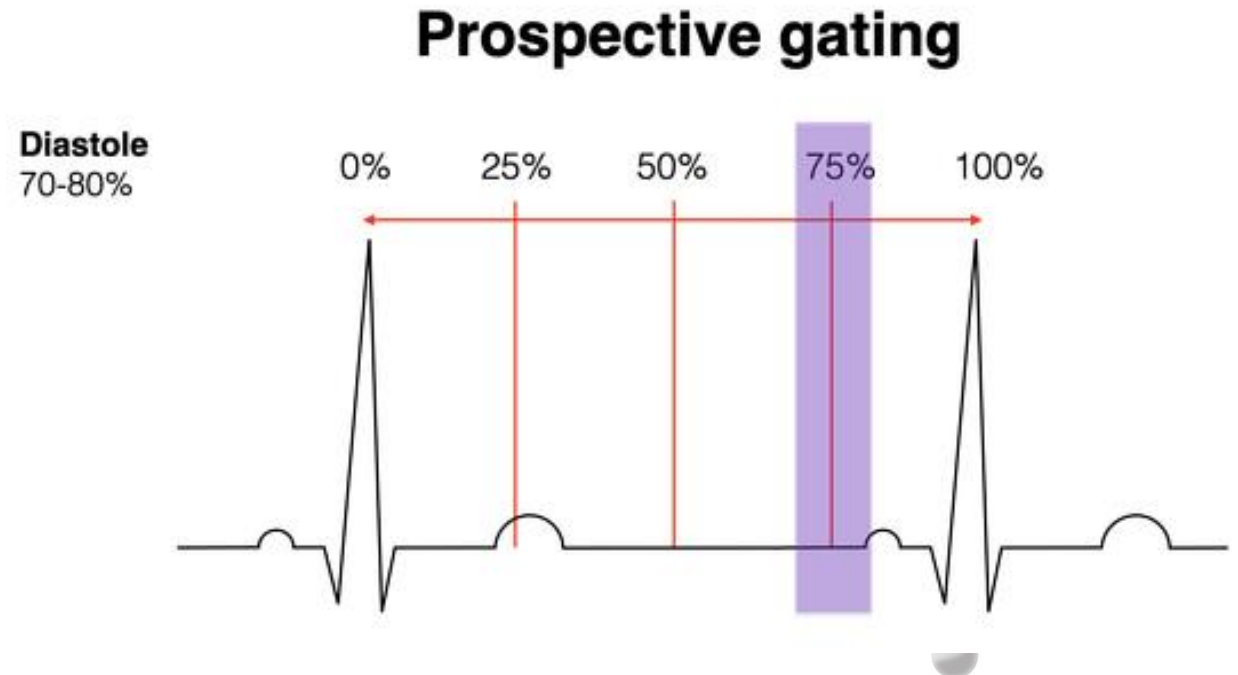
# New Beacon Hospital Cardiac CT

- Siemens Pro Pulse
- 3<sup>rd</sup> Generation Dual Source CT
- FLASH mode offers single beat scanning very low doses



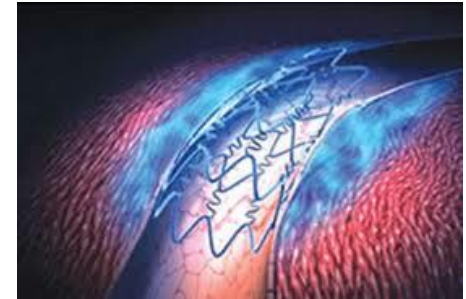
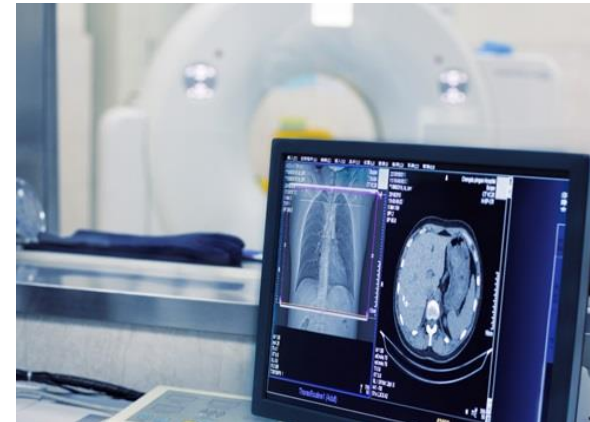
# CT Imaging Advances

- Image acquisition techniques and data processing
- Improved spatial and temporal resolution
- Artificial intelligence and machine learning in image processing
- Flow reserve measurement techniques and functional measurements
- Determination of plaque morphology – vulnerable/high risk, calcific



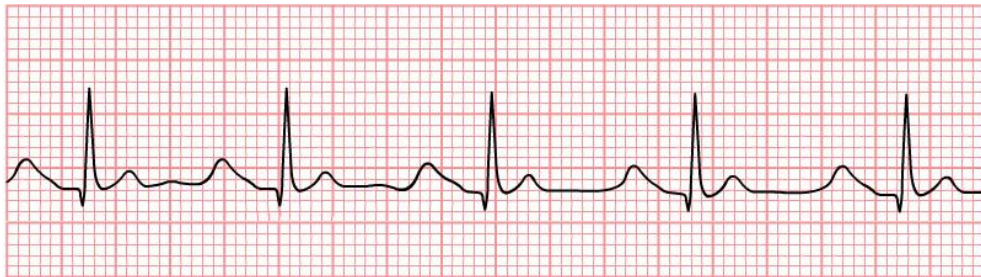
# Indications for Scanning

- Evaluation of chest pain
- Symptomatic patients with low pretest probability – the 'rule out'
- Assessment for coronary artery anomalies
- Screening for subclinical atherosclerosis
- Risk stratification and early detection / intervention
- Pre-procedural planning for PCI, structural procedures
- Previous coronary stenting or CABG



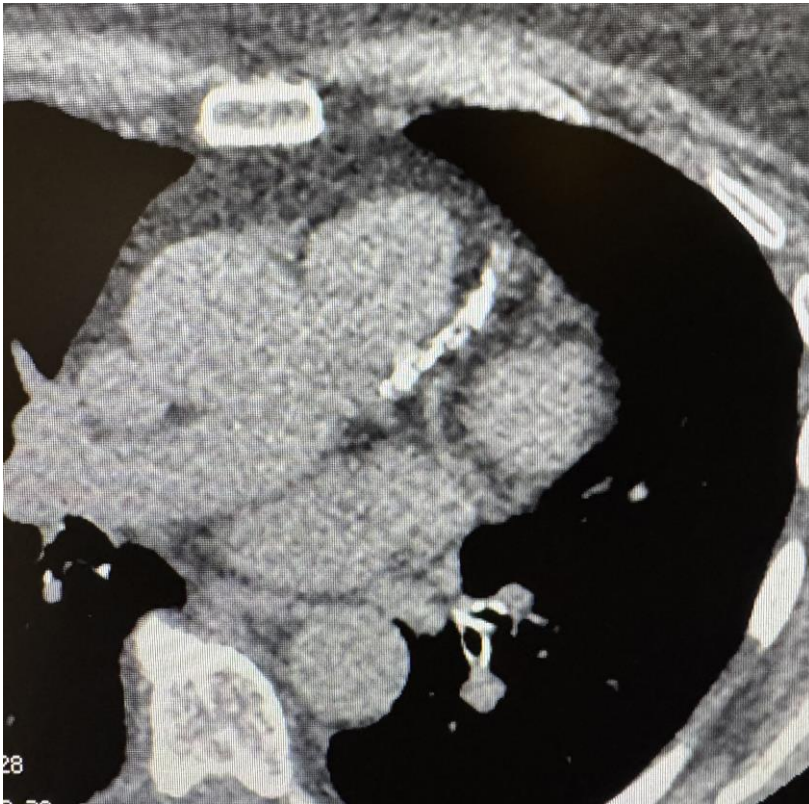
# Patient Preparation

- Patient Preparation and Safety
- Pre-scan instructions (e.g., fasting, medication adjustments)
- Managing high heart rate
- Contrast dye safety
- Radiation dose optimization



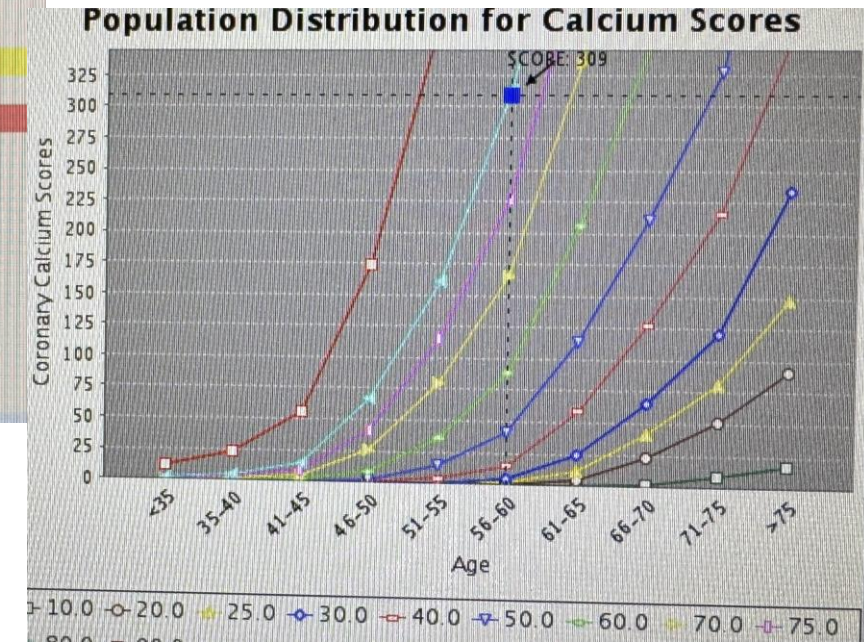
# CALCIUM SCORING:

- 2.5 mm slices. Calcium in distribution of coronary arteries.
- Score > 300 considered clinically significant.
- Caution - normal Ca score with underlying coronary disease
- Value expressed as percentile for age/sex

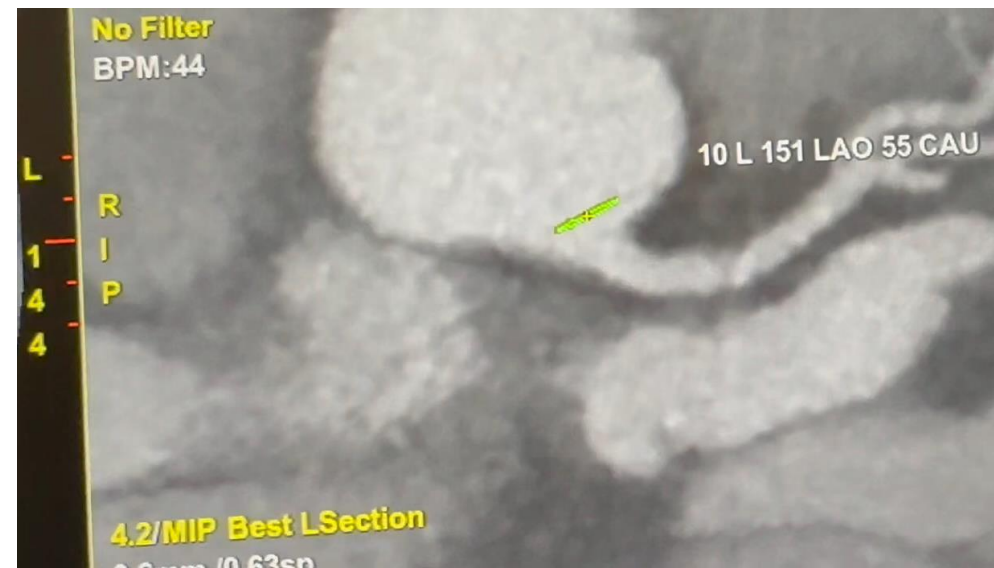
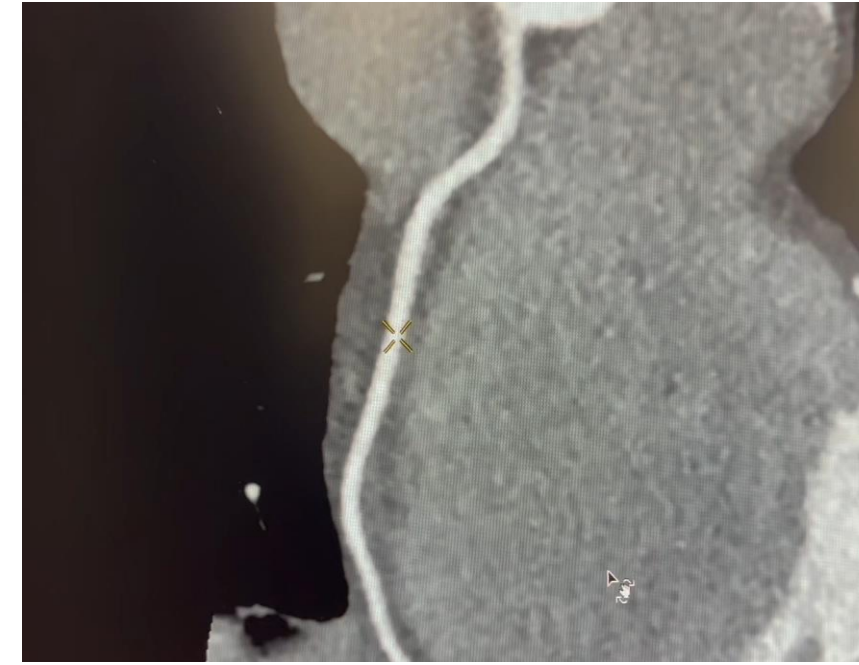
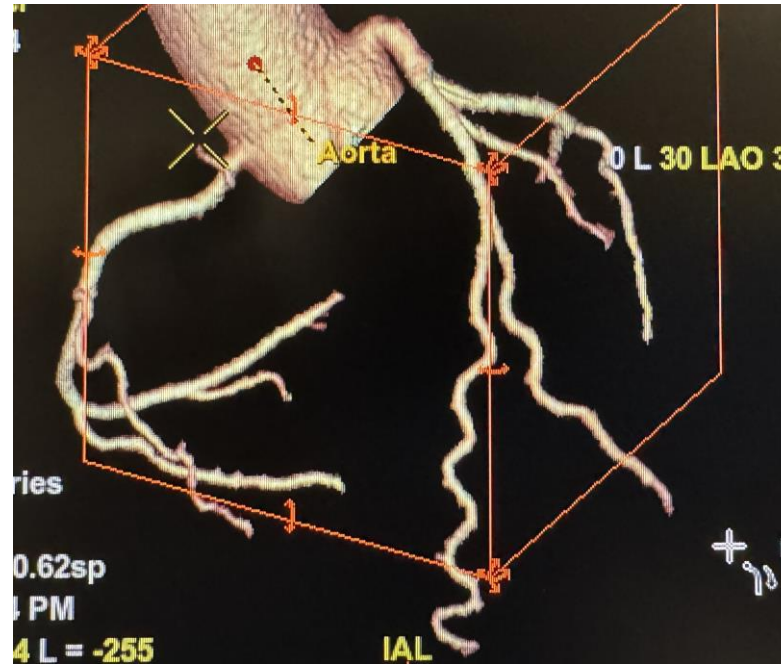
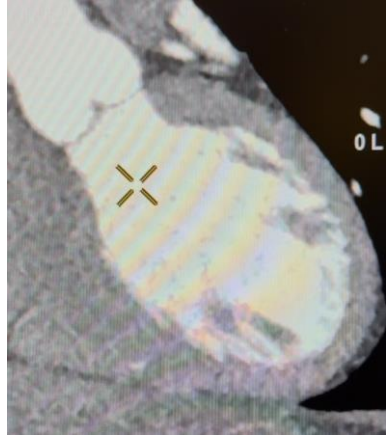


| CORONARY                    | Level       | AJ-130 |
|-----------------------------|-------------|--------|
| Total Score                 | Total Score | 309    |
| (LAD) Left Anterior Desc... | Coronary    | 142    |
| + Lesion1                   | Lesion      | 47     |
| + Lesion2                   | Lesion      | 85     |
| + Lesion3                   | Lesion      | 2      |
| + Lesion4                   | Lesion      | 8      |
| (LCX) Left Circumflex       | Coronary    | 7      |
| + Lesion15                  | Lesion      | 7      |
| (RCA) Right Coronary Art... | Coronary    | 160    |
| + Lesion5                   | Lesion      | 1      |
| + Lesion6                   | Lesion      | 5      |
| + Lesion7                   | Lesion      | 22     |
| + Lesion8                   | Lesion      | 0      |
| + Lesion9                   | Lesion      | 4      |
| + Lesion10                  | Lesion      | 84     |
| + Lesion11                  | Lesion      | 14     |
| + Lesion12                  | Lesion      | 11     |
| + Lesion13                  | Lesion      | 18     |
| + Lesion14                  | Lesion      | 1      |

Calcium Score 308  
80<sup>th</sup> Percentile



# Coronary Imaging



# Coronary Imaging

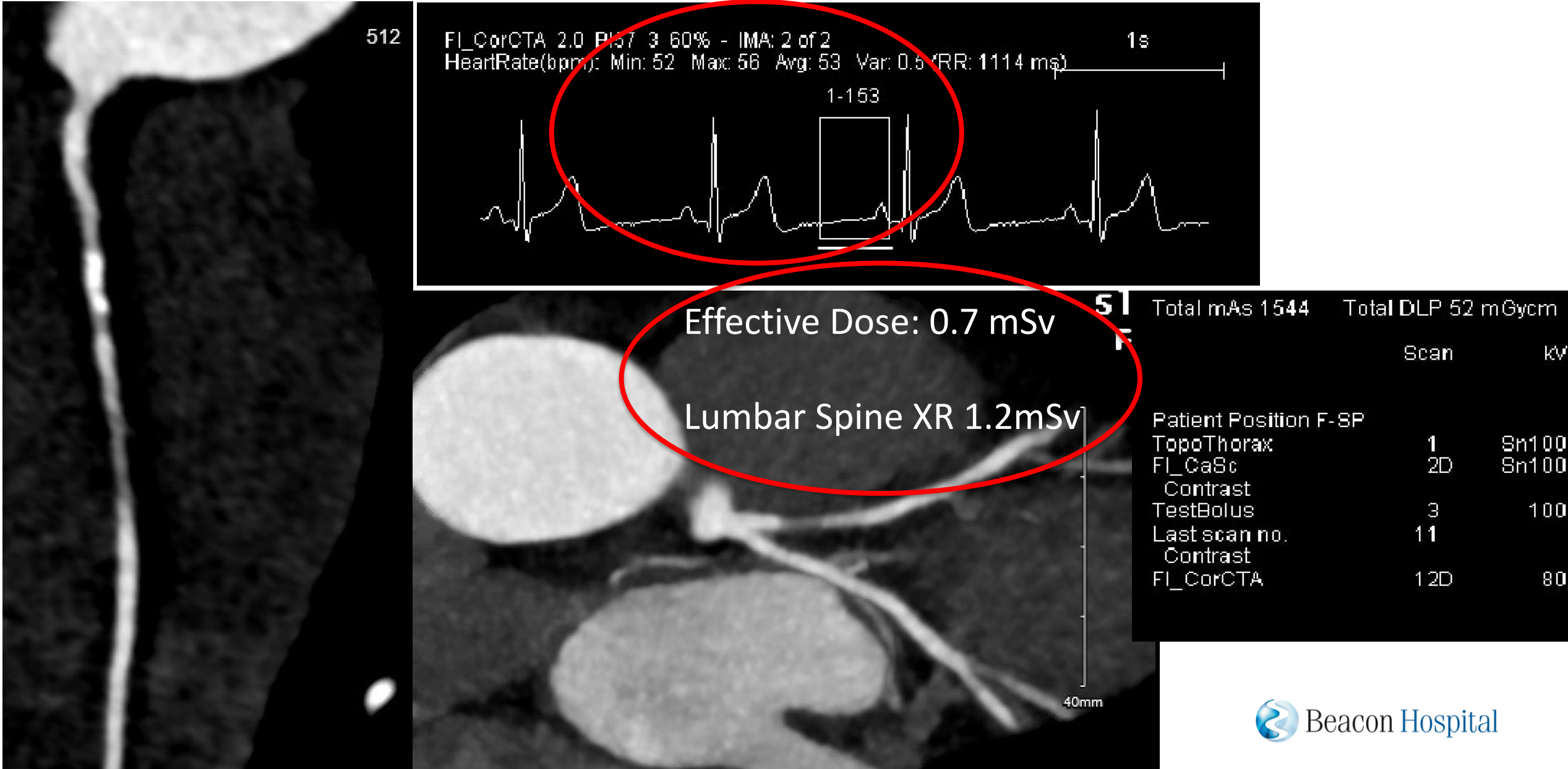


# LIMITATIONS:

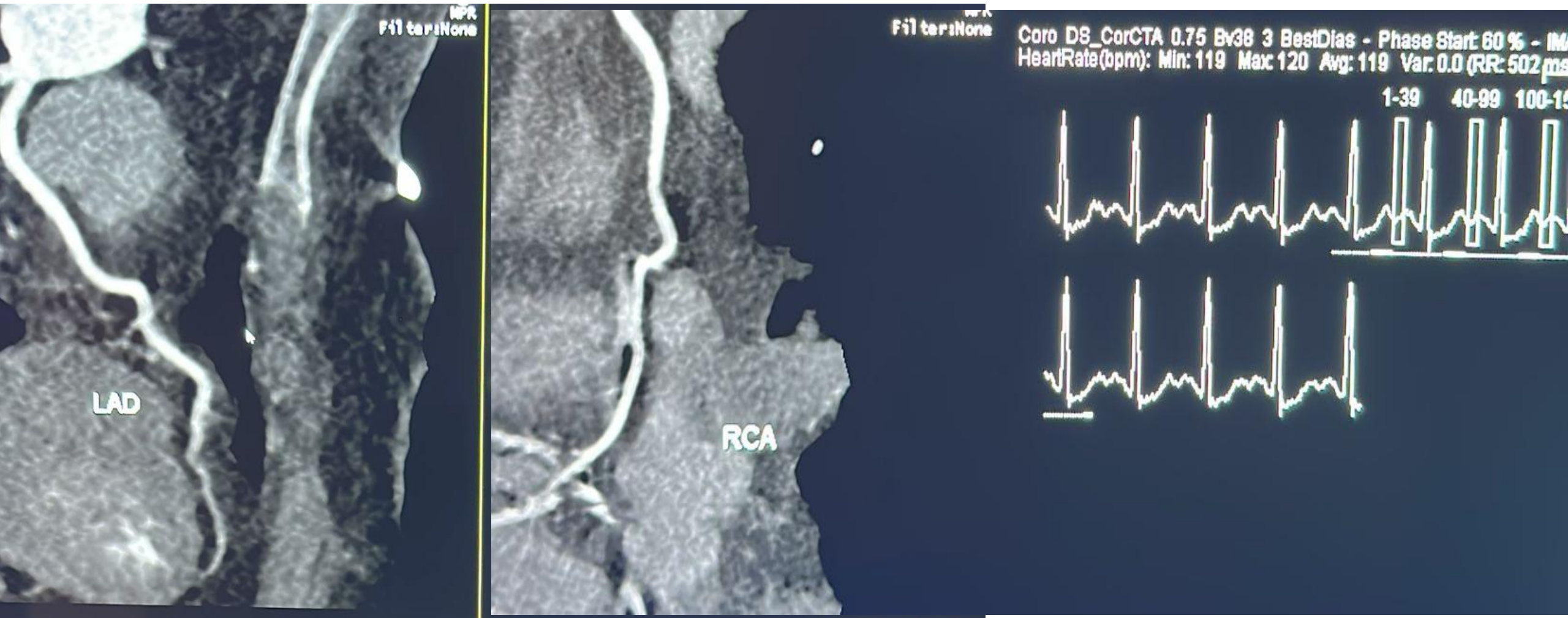
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- Radiation exposure
- Contrast-induced nephropathy
- Limited temporal resolution in patients with high heart rates
- Overestimation of stenosis severity
- Artifacts and Image Quality Issues
- Incidental Findings

39 yo Male; Mediastinal lymphoma with RTx; No cardiac RFs; Chest Pain in ED



# How fast can you go?



119 bpm. DLP 91 – 41 yo man with Aortic Valve endocarditis

# Ultra low dose Chest CT

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- Challenging in larger patients
- Younger Patients
- Anxiety regarding Radiation.
- Can significantly cut doses even compared to “standard” low dose Chest CT

## CLINICAL APPLICATIONS:

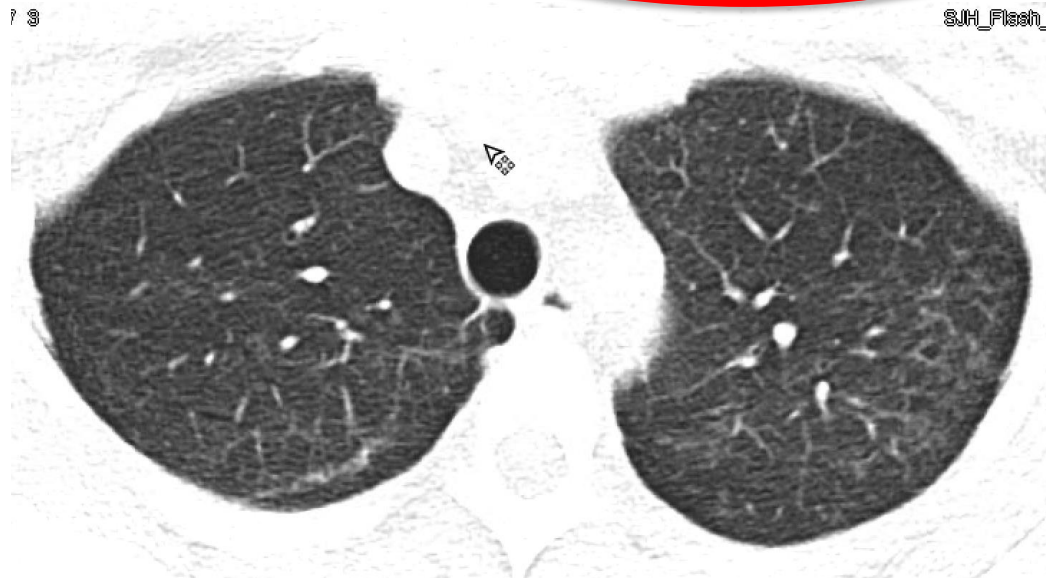
- Lung cancer screening
- Cancer screening in Genetic Cancer syndromes (Li Fraumeni Syndrome)
- Younger patient Cohorts (Sickle cell anaemia/Leukemia)

# CASE: 39 yo Female; Stage 3 Sarcoid; Worsening symptoms; Annual CT F/U

|                       |      |                    |            |                 |              |         |           |  |
|-----------------------|------|--------------------|------------|-----------------|--------------|---------|-----------|--|
| Total mAs 372         |      | Total DLP 26 mGycm |            |                 |              |         |           |  |
|                       | Scan | kV                 | mAs / ref. | CTDIvol*<br>mGy | DLP<br>mGycm | TI<br>s | cSL<br>mm |  |
| Patient Position F-SP |      |                    |            |                 |              |         |           |  |
| TopoThorax            | 1    | Sn100              | 48 mA      | 0.01 L          | 0.5          | 2.5     | 0.6       |  |
| FI_LungLowDose        | 2D   | Sn140              | 24 / 24    | 0.71 L          | 25.2         | 0.28    | 0.6       |  |

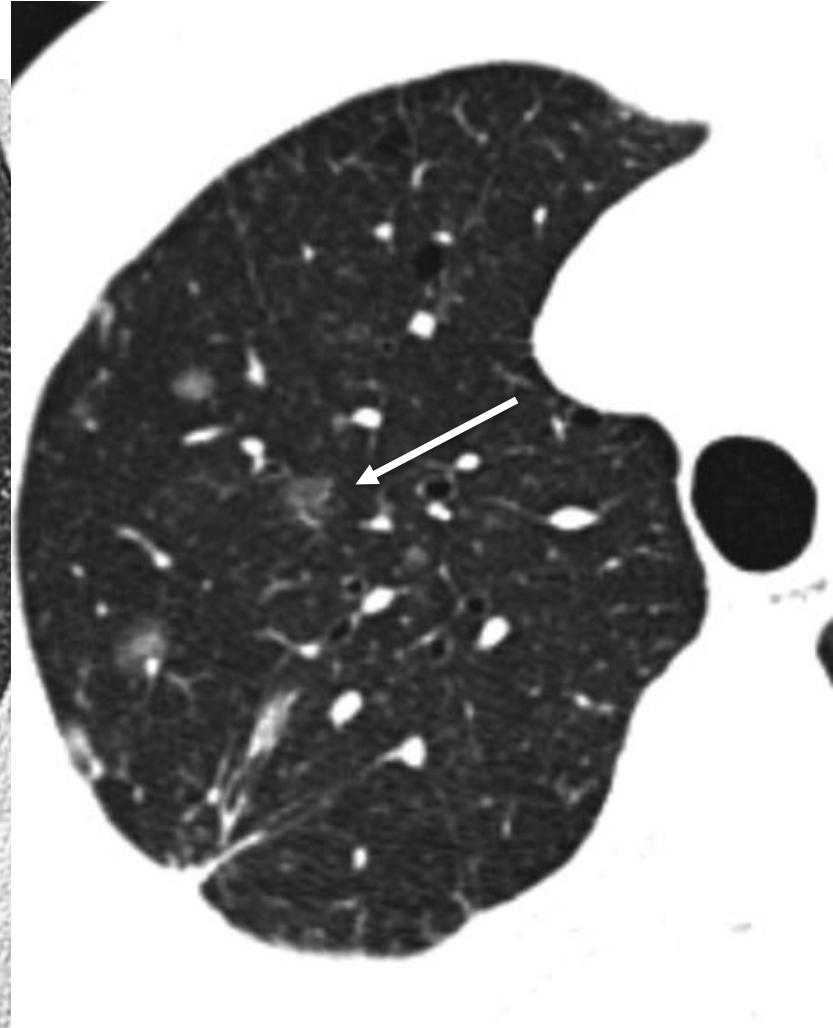
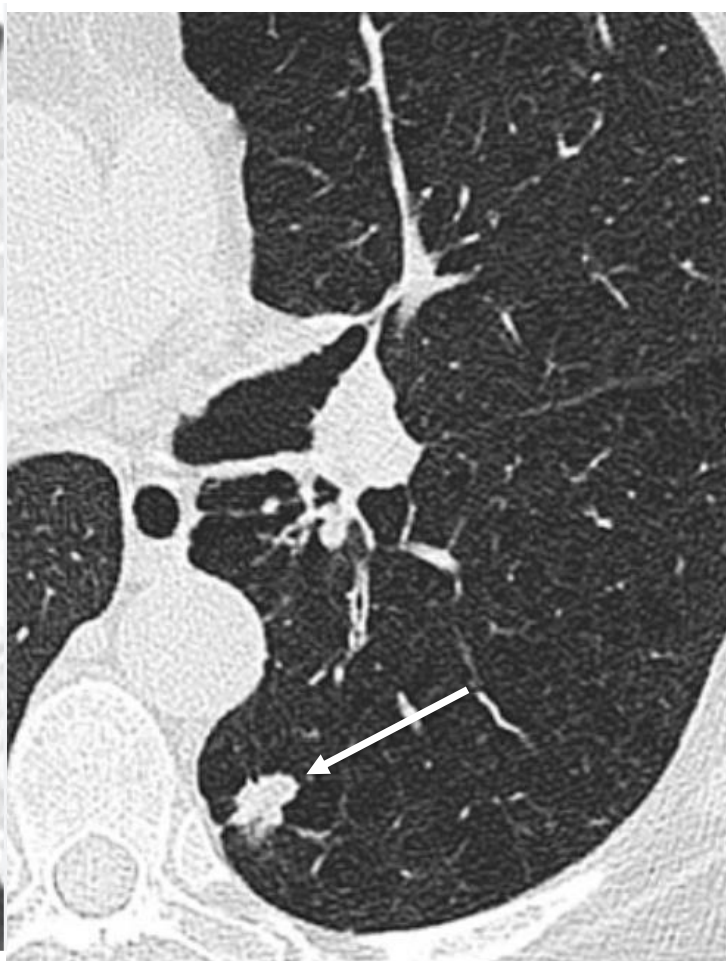
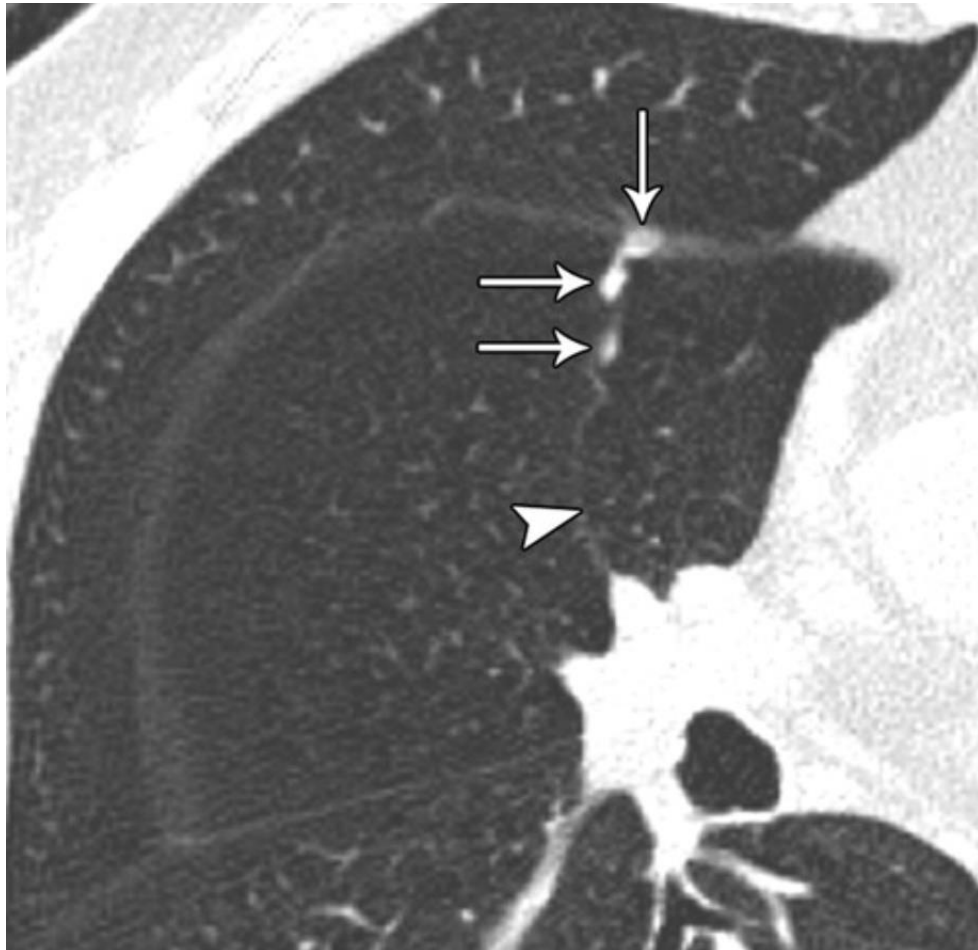
|                      |      |                |               |             |                 |              |             |
|----------------------|------|----------------|---------------|-------------|-----------------|--------------|-------------|
| Total mAs: 695       |      | Total DLP: 161 |               |             |                 |              |             |
|                      | Scan | kV             | Q.ref.<br>mAs | eff.<br>mAs | CTDIvol*<br>mGy | DLP<br>mGycm | T rot.<br>s |
| Patient Position HFS |      |                |               |             |                 |              |             |
| Topogram             | 100  | 110            |               | 15 mA       | 0.03 L          | 1.12         |             |
| Thorax               | 200  | 130            | 54            | 41          | 4.35 L          | 159          | 0.80        |

Effective Dose – 0.36mSv  
PA/Lat CXR – up to 0.22mSv



# Incidentals – Lung Nodules, Lymph Nodes and “Liquid”

# Incidental Pulmonary Nodules



# Follow up – Lung Nodules

## Solid

<6mm – No follow up\*

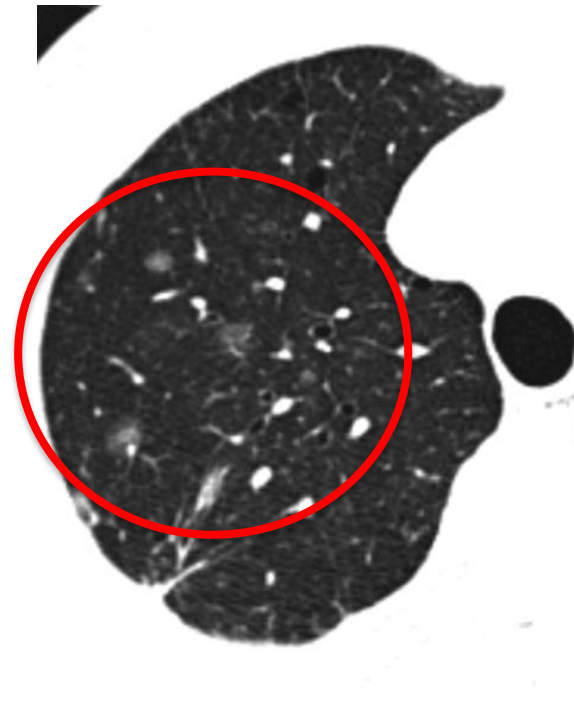
6-8mm - 6-12 then 18-24 months

>8mm – Refer

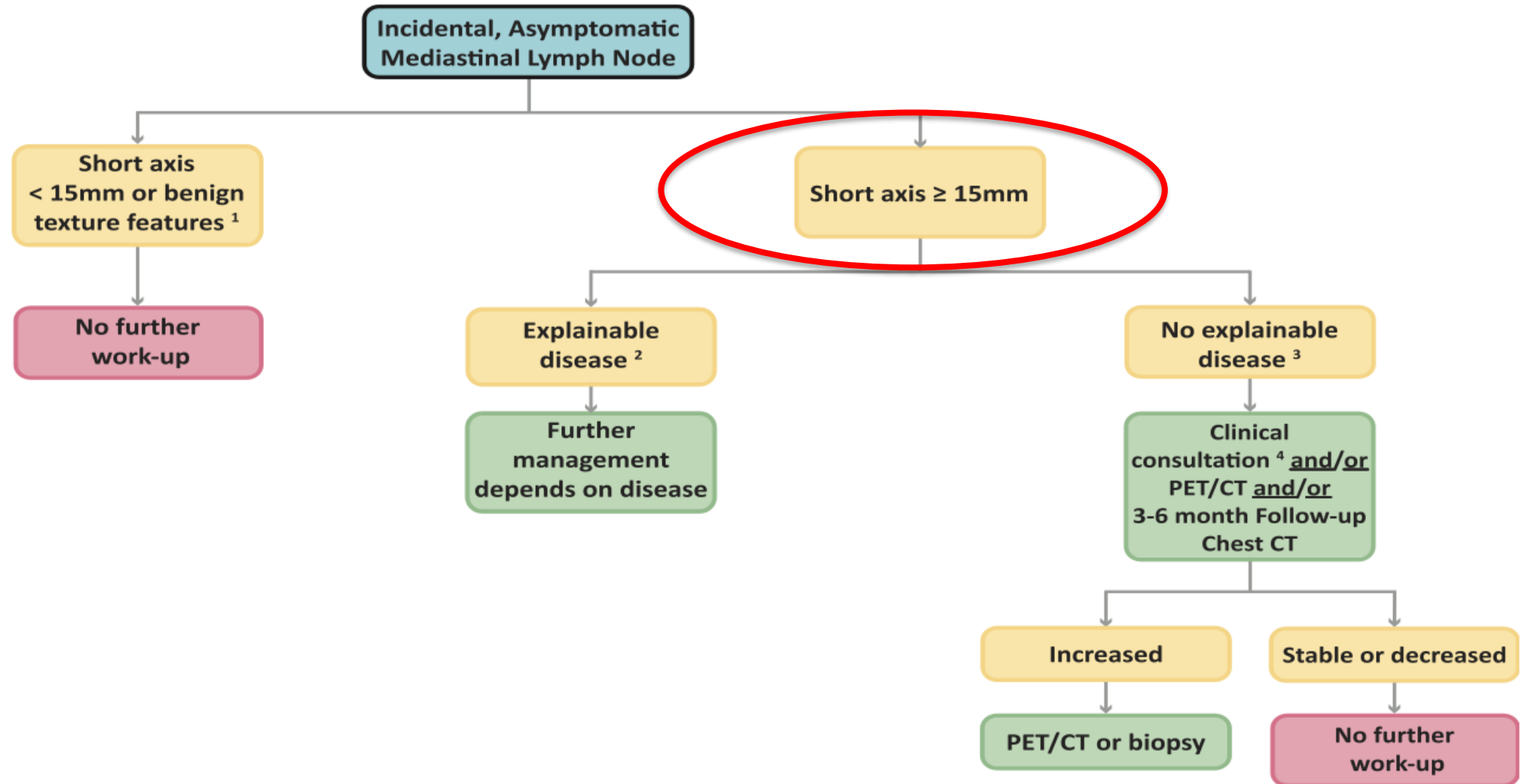
## Groundglass (Probably need referral)

<6mm – No follow up

>6mm – Follow up to 5 years



# Follow up – Mediastinal Lymph Nodes

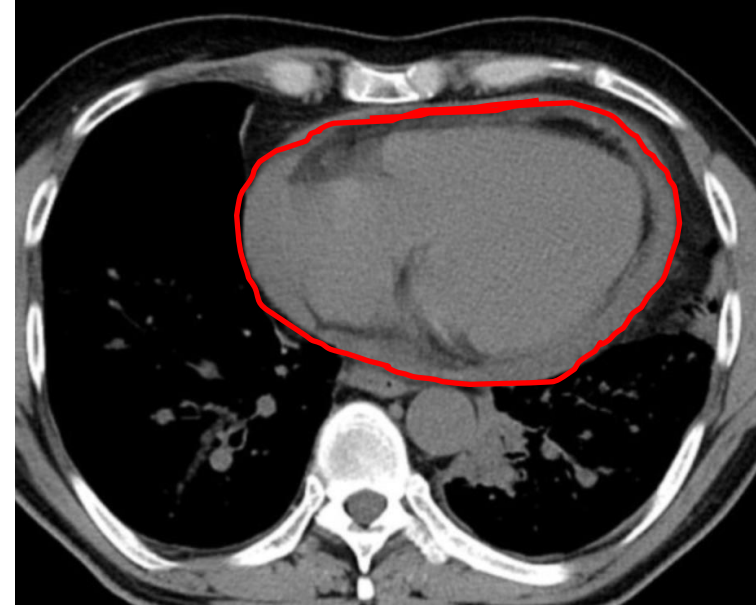


# Follow up – Pleural and Pericardial Effusions

## Pericardial fluid/Thickening/Cyst

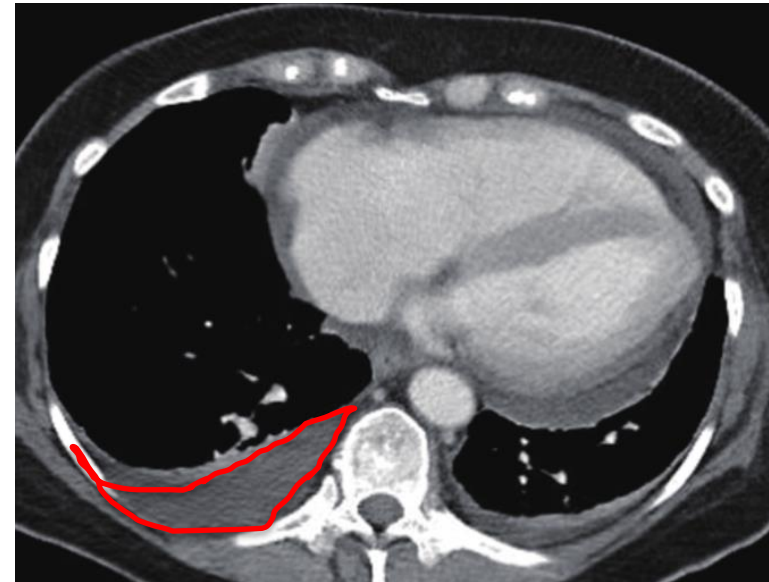
Pericardial cyst are benign/No follow up

Cardiac Failure, Malignancy,  
Connective Tissue Disease



## Pleural Effusions

If not explainable due to recent  
pneumonia or cardiac failure needs  
further investigation.



# CONCLUSION

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- CT is/will become the 'go to' non-invasive cardiac test
- Fits within the 'multimodality' approach in cardiology
- Greater level of reassurance
- New scanner arriving
- Availability Monday to Sunday
- Dual reported scans

