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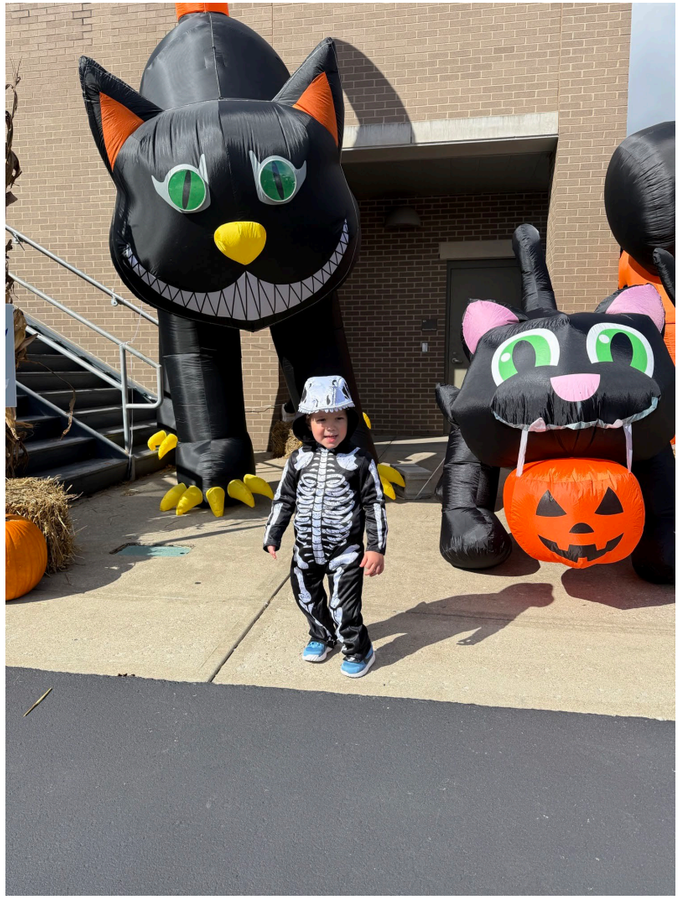
CARDIAC PET IN MODERN CARDIOVASCULAR CARE

Talal Alnabelsi, MD, FACC, FASNC
Associate Professor of Medicine
Nuclear Lab Director
Gill Heart & Vascular Institute

Connecting the Heart of Kentucky

FACULTY DISCLOSURE

- I have no relevant financial relationships with ineligible companies to disclose.





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EXPECTED OUTCOME & EDUCATIONAL NEED/ PRACTICE GAP

- **Expected outcome:** The audience will become familiar with the vast ways cardiac PET can help diagnose various cardiovascular conditions

- **Educational Need:** Lack of familiarity with this imaging tool

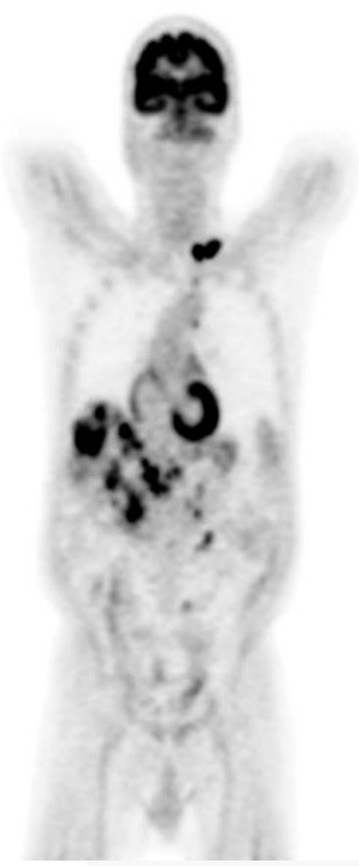
- **Practice Gap:** Current practice likely involves little to no PET imaging whereas there are many scenarios where PET is preferred

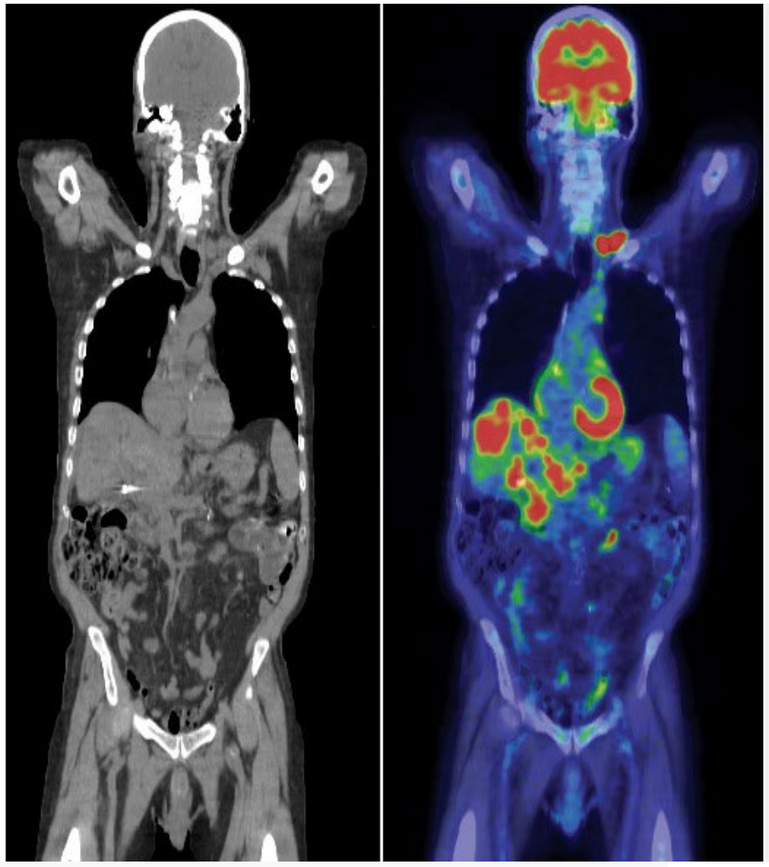
OBJECTIVES

- After completing this educational activity, participants will be able to:
  - Describe the clinical applications of cardiac PET
  - Explain the differences between cardiac PET and SPECT
  - List clinical scenarios when cardiac PET is indicated
  - Discuss operational and health system considerations for developing a cardiac PET program

WHAT IS PET?

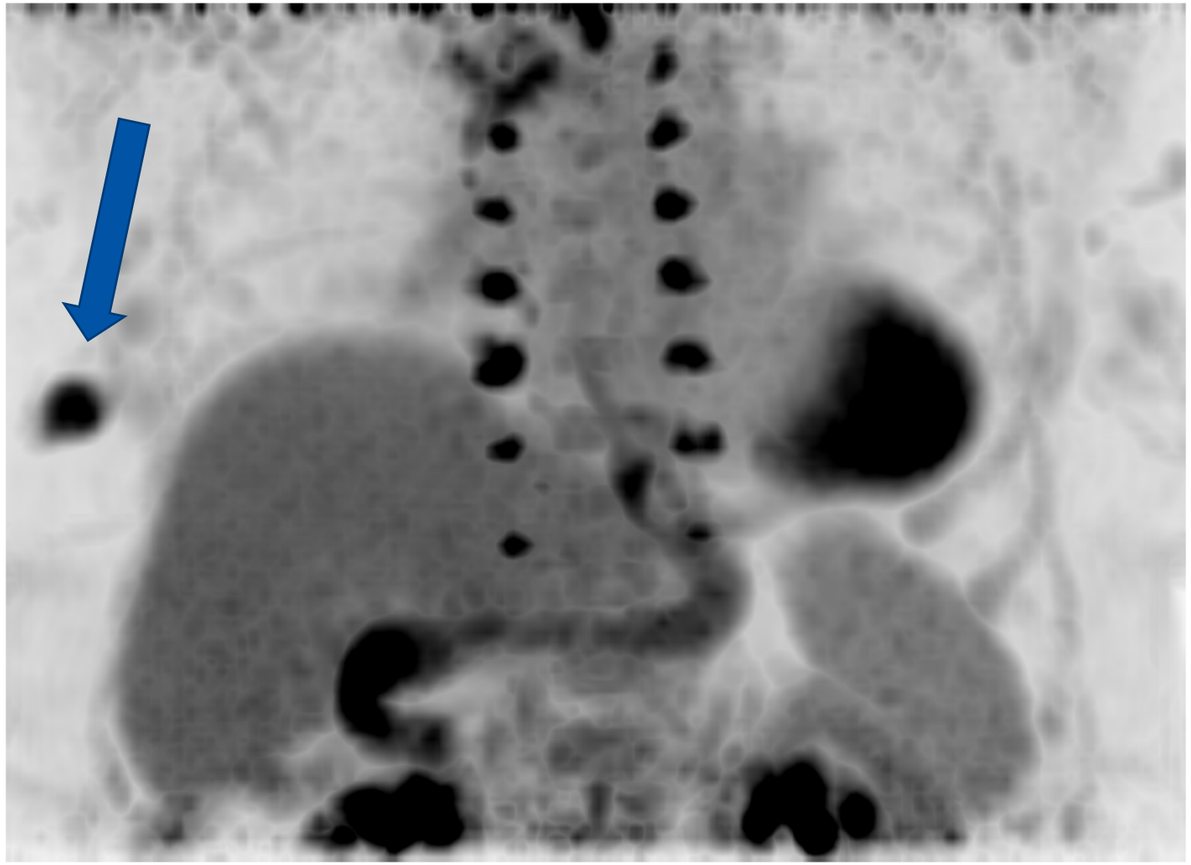
Positron Emission Tomography

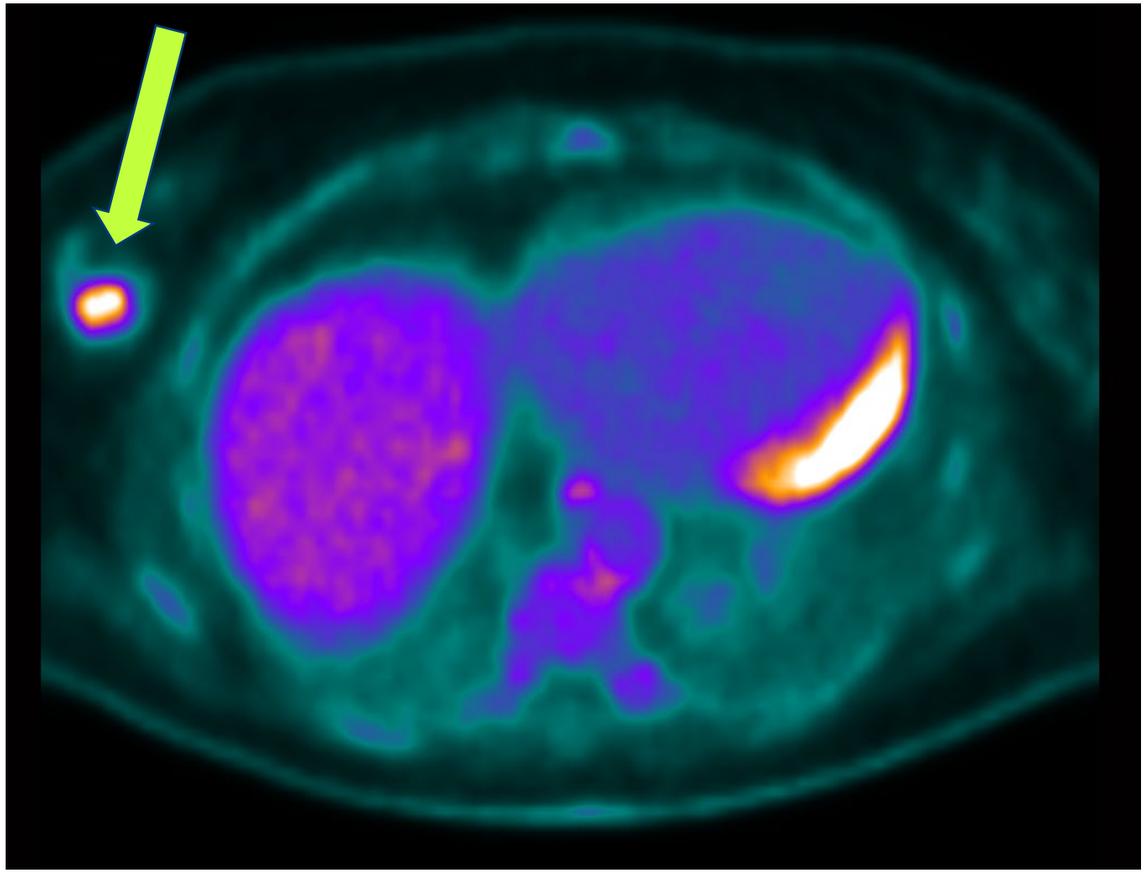






WHAT IS PET?



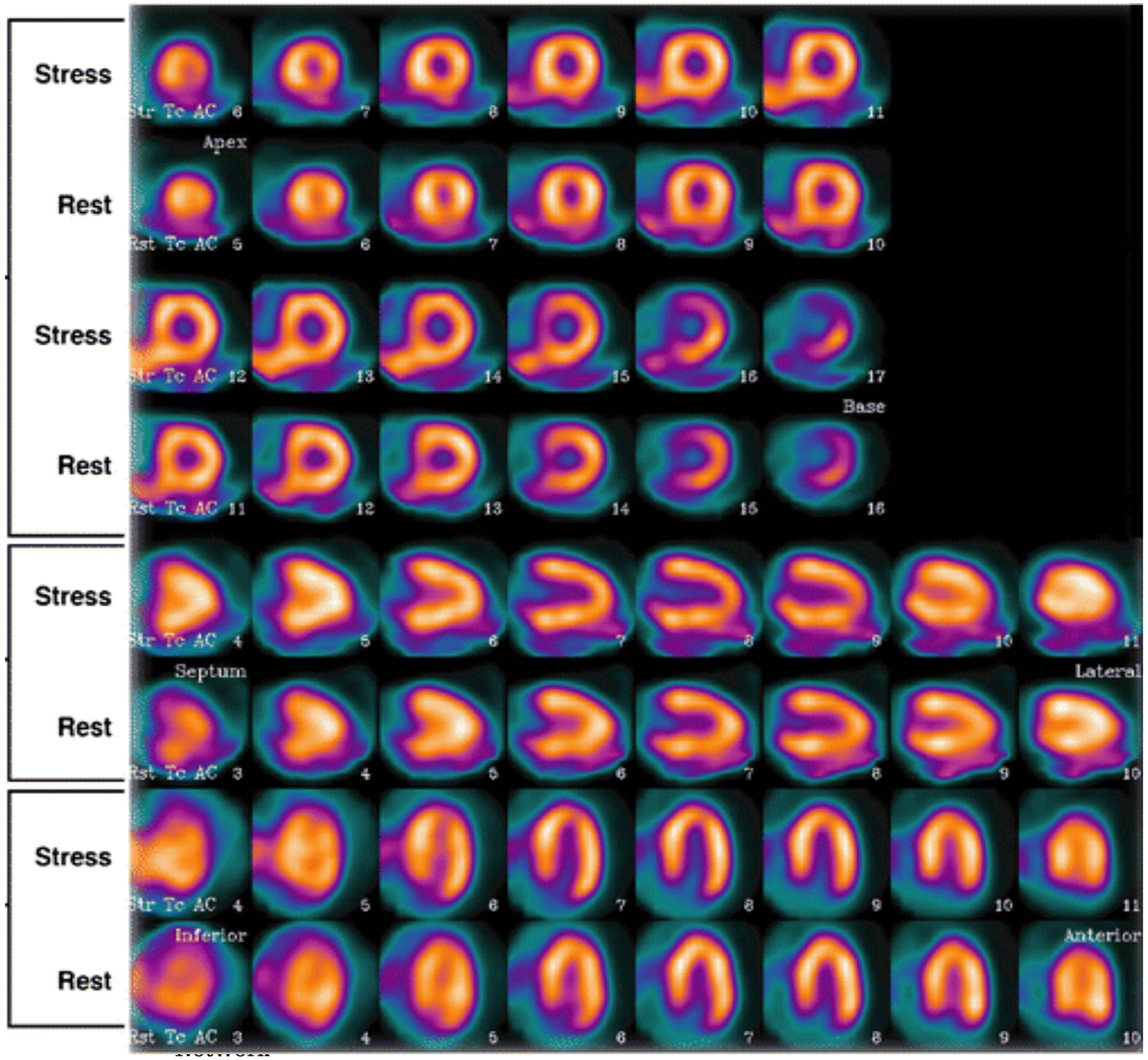


Invasive Lobular Carcinoma

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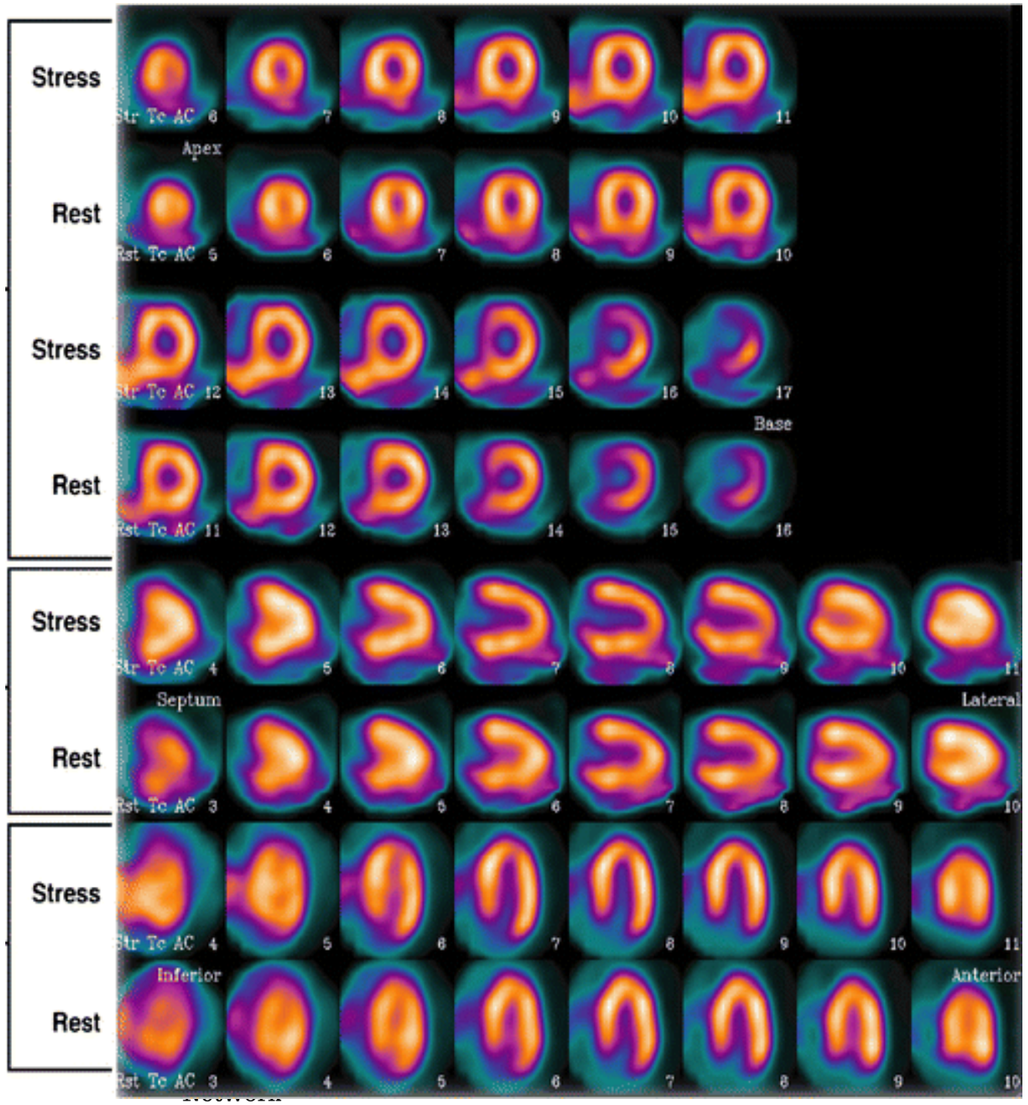
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CASE – 79 M W/ HTN, HLD & CHEST PAIN



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CASE – 79 M W/ HTN, HLD & CHEST PAIN





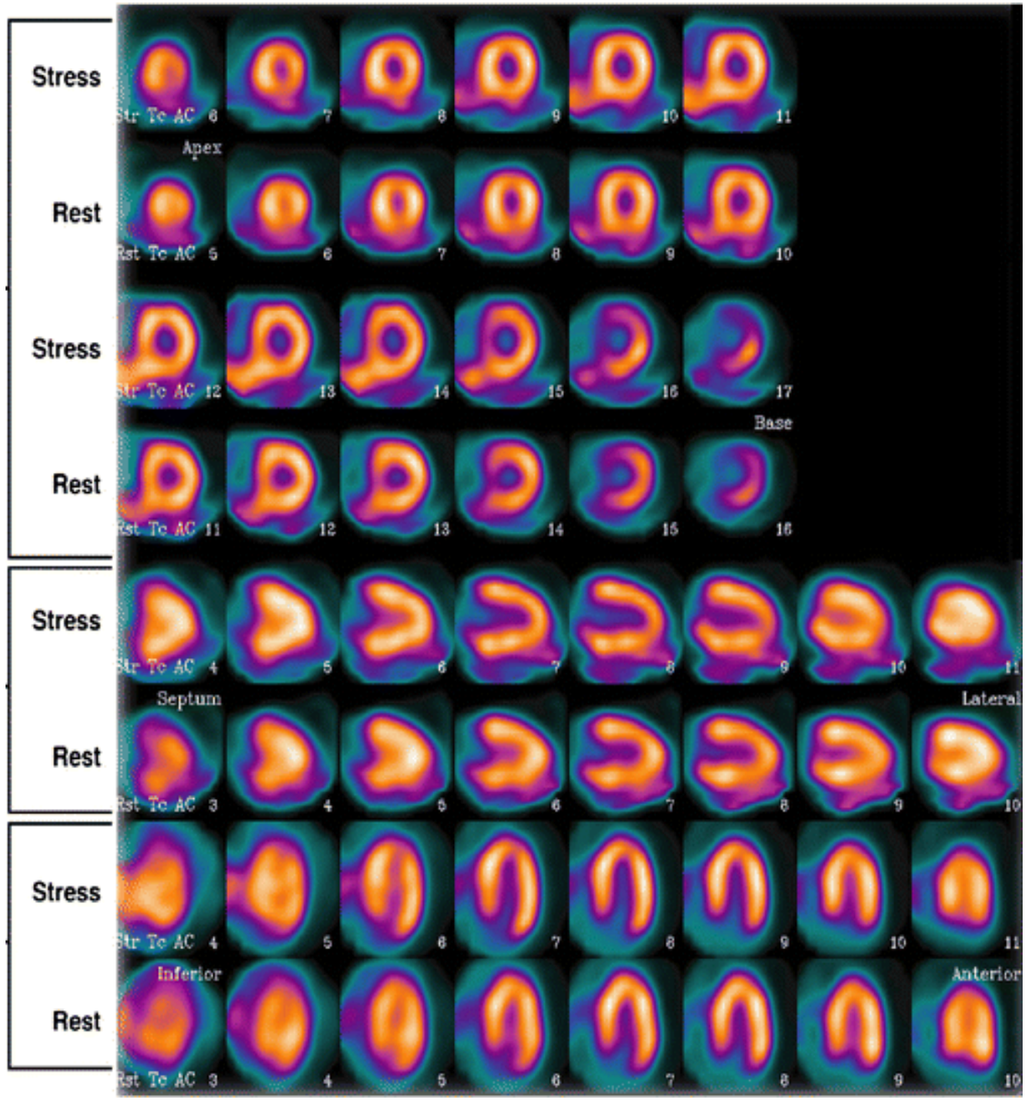


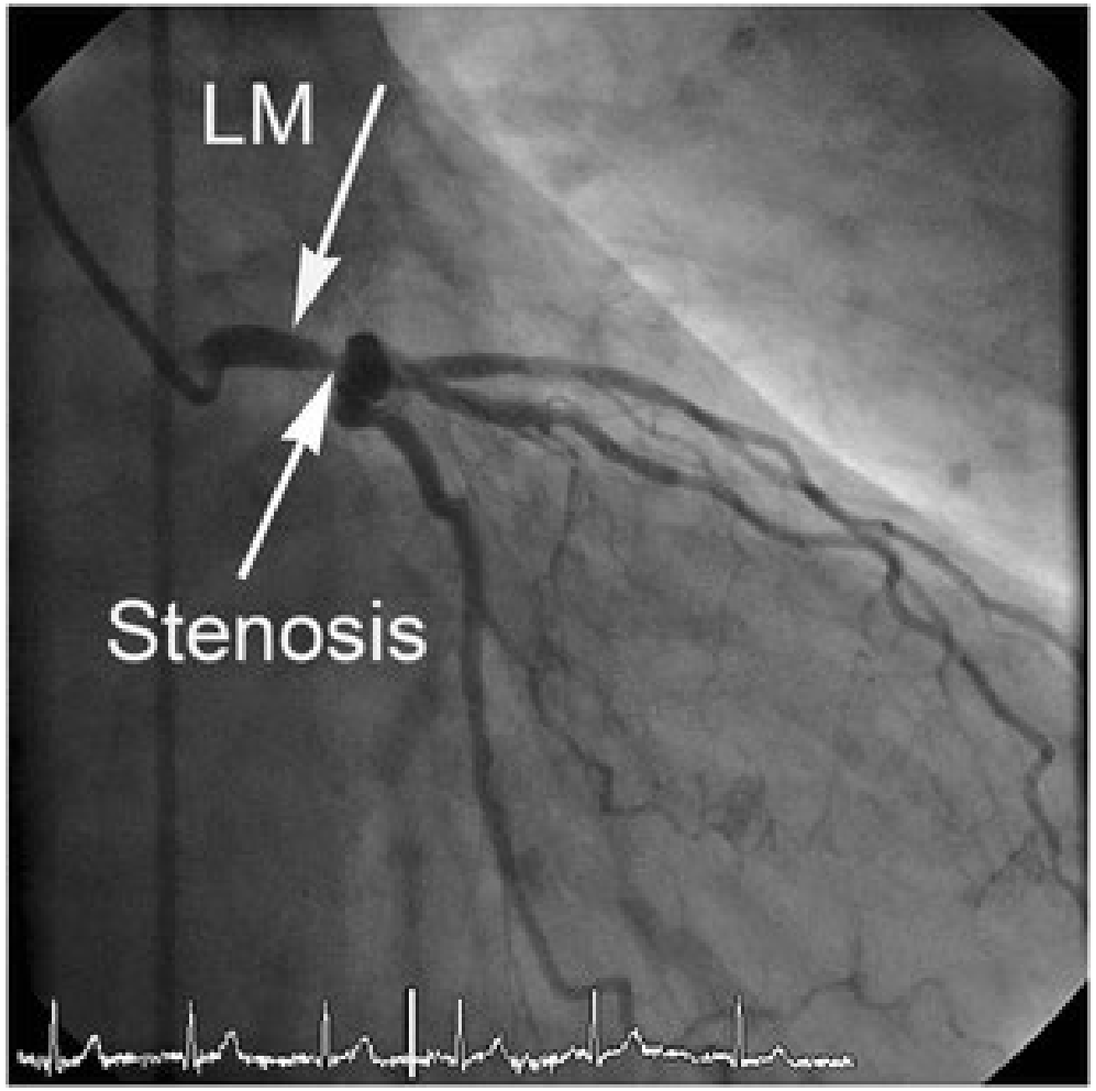
Coronary Artery Calcium score

3,204

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CASE – 79 M W/ HTN, HLD & CHEST PAIN

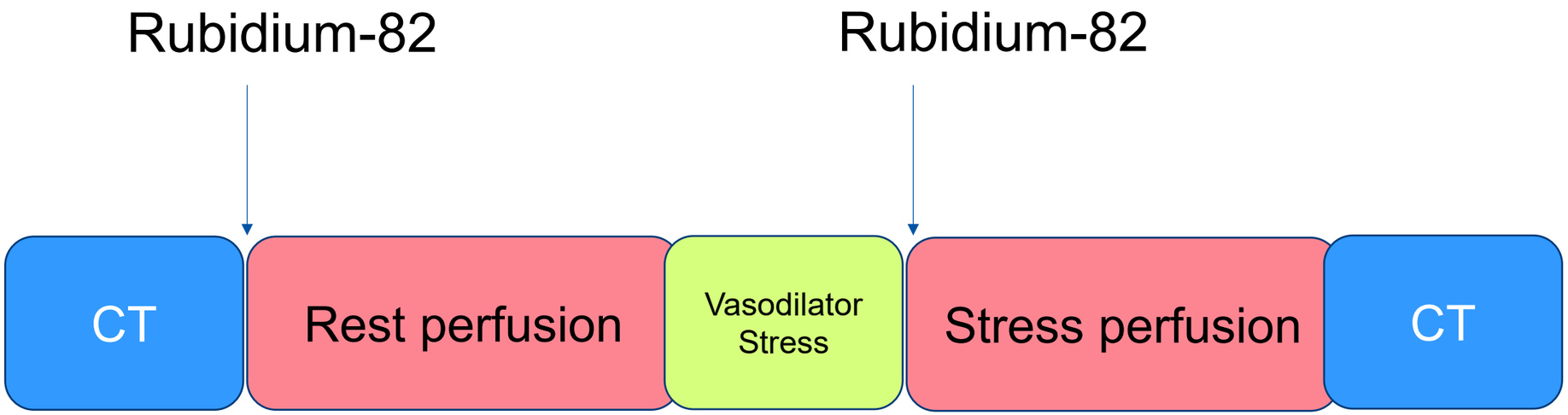




Salem Yuoness et al. Eur J Nuc Med Molec Img 2015.

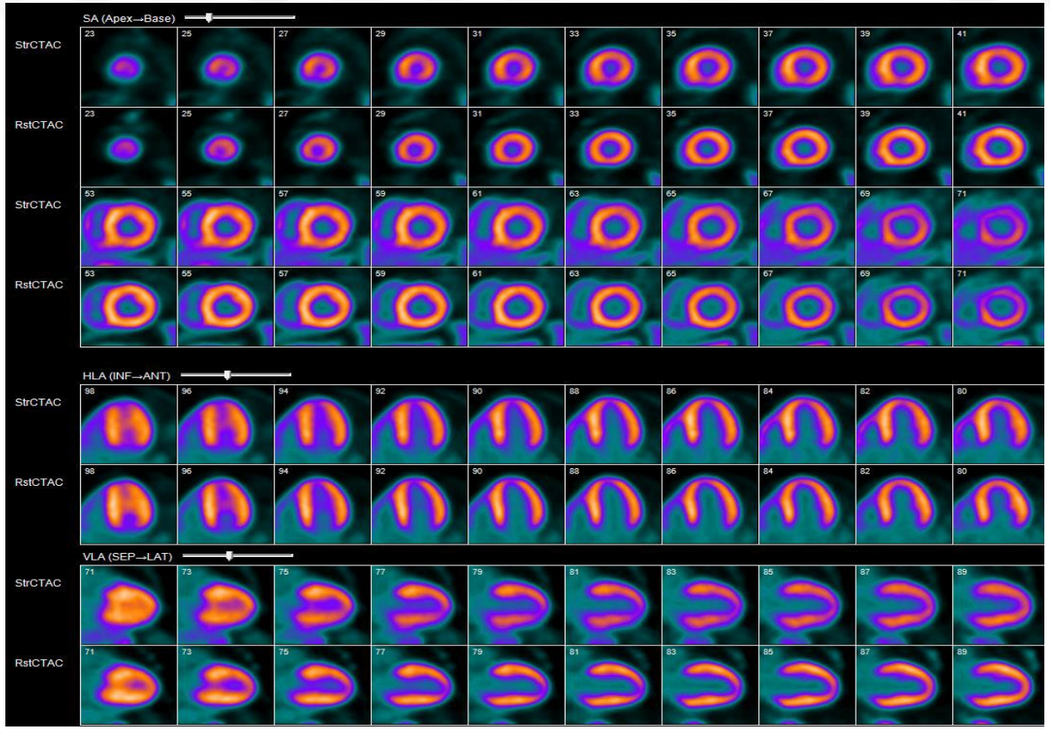

PET/CT

TYPICAL PET MPI PROTOCOL



Total time ~ 30 min

58 M W/ ESRD FOR PRE-TXP EVALUATION

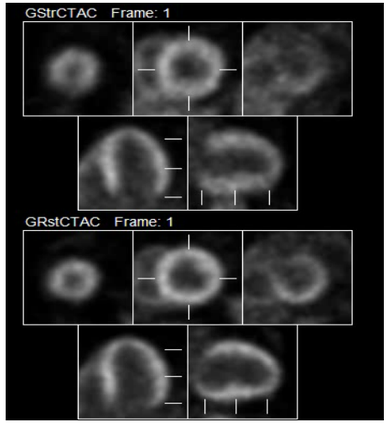


	Rest Flow (ml/min/g)	Stress Flow (ml/min/g)	Reserve
LAD	1.19	1.01	0.85
LCX	1.08	1.02	0.93
RCA	1.22	1.0	0.82
Total	1.17	1.01	0.85



Coronary Artery Calcium Score

745



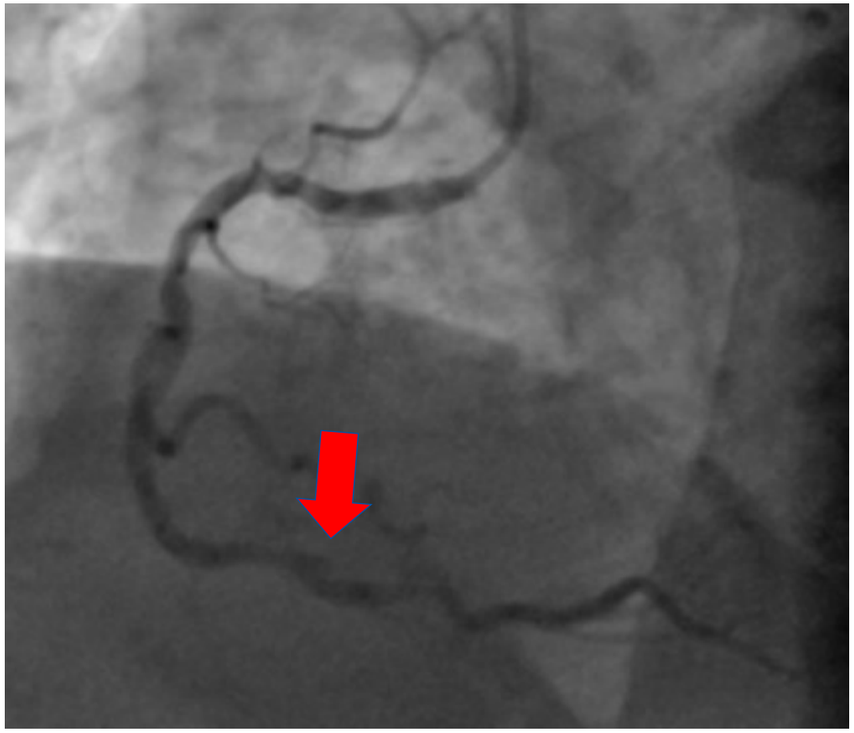
Stress LVEF 58%

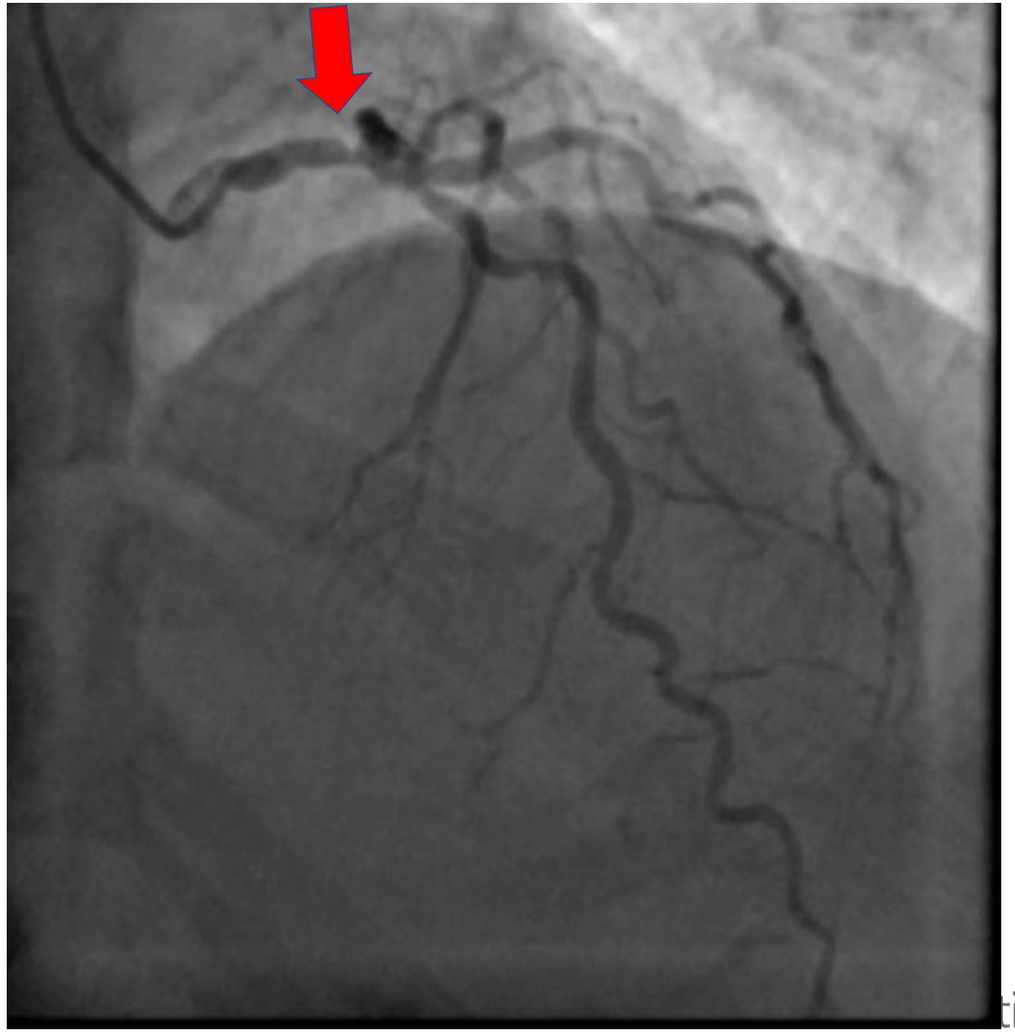
Rest LVEF 57%

58 M W/ ESRD FOR PRE-TXP EVALUATION

- Normal myocardial perfusion
- Severely reduced MFR in the setting of high CAC
- High risk scan; multi-vessel disease needs to be excluded

58 M W/ ESRD FOR PRE-TXP EVALUATION





MULTI-PARAMETRIC PET MPI

Clinical History

- Symptoms and symptom characterization
- Pretest probability / risk factors
- Prior CAD / revascularization
- Comorbidities (e.g., diabetes, CKD)

Myocardial Blood Flow Quantification

Absolute MBF (mL/min/g) and myocardial flow reserve (MFR)

Region	Stress MBF	Rest MBF	MFR
LAD	2.1	0.8	2.6
LCx	1.8	0.7	2.4
RCA	2.0	0.8	2.5
Global	2.0	0.8	2.5

Cardiac PET MPI



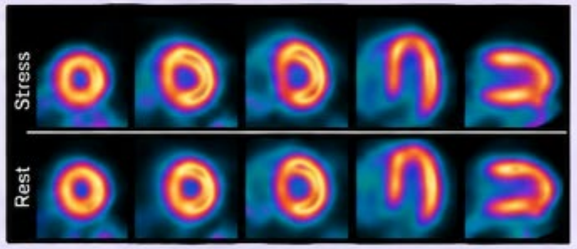
Electrocardiogram (ECG)

Assessment for ischemia, arrhythmias, and hemodynamic response during stress



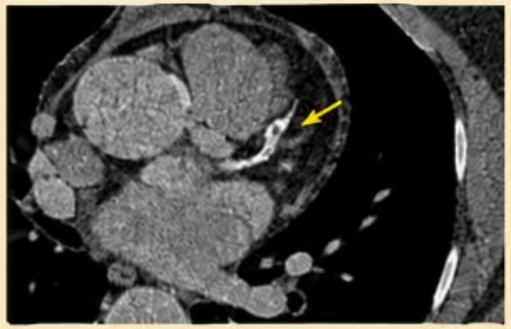
Myocardial Perfusion

Relative perfusion imaging to identify and localize ischemia and infarction



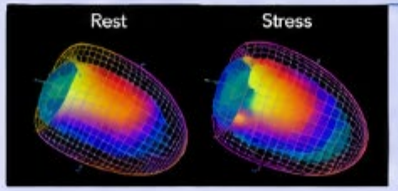
Calcium Score (CT)

Assessment of coronary artery calcium and atherosclerotic burden



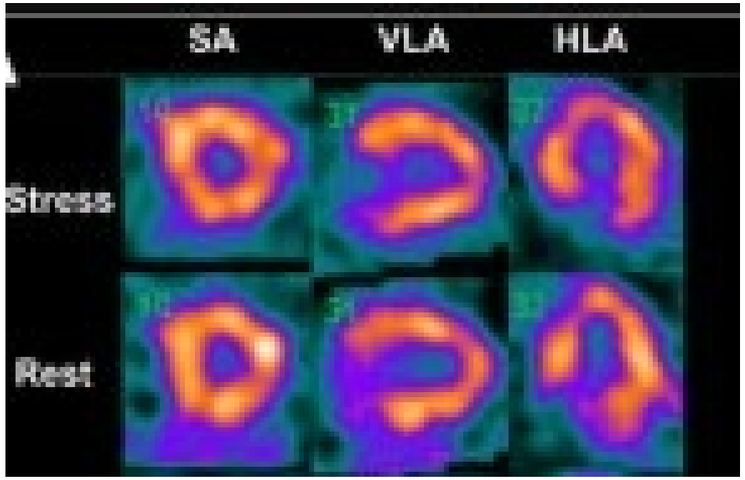
Ventricular Function (Gated PET)

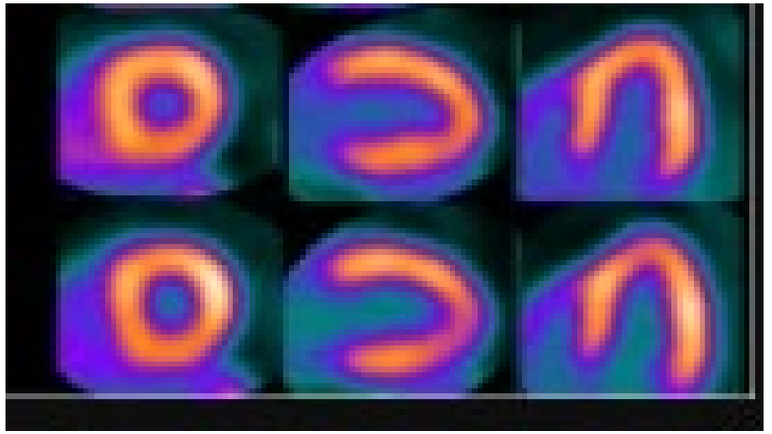
Assessment of left ventricular function, volumes, and wall motion



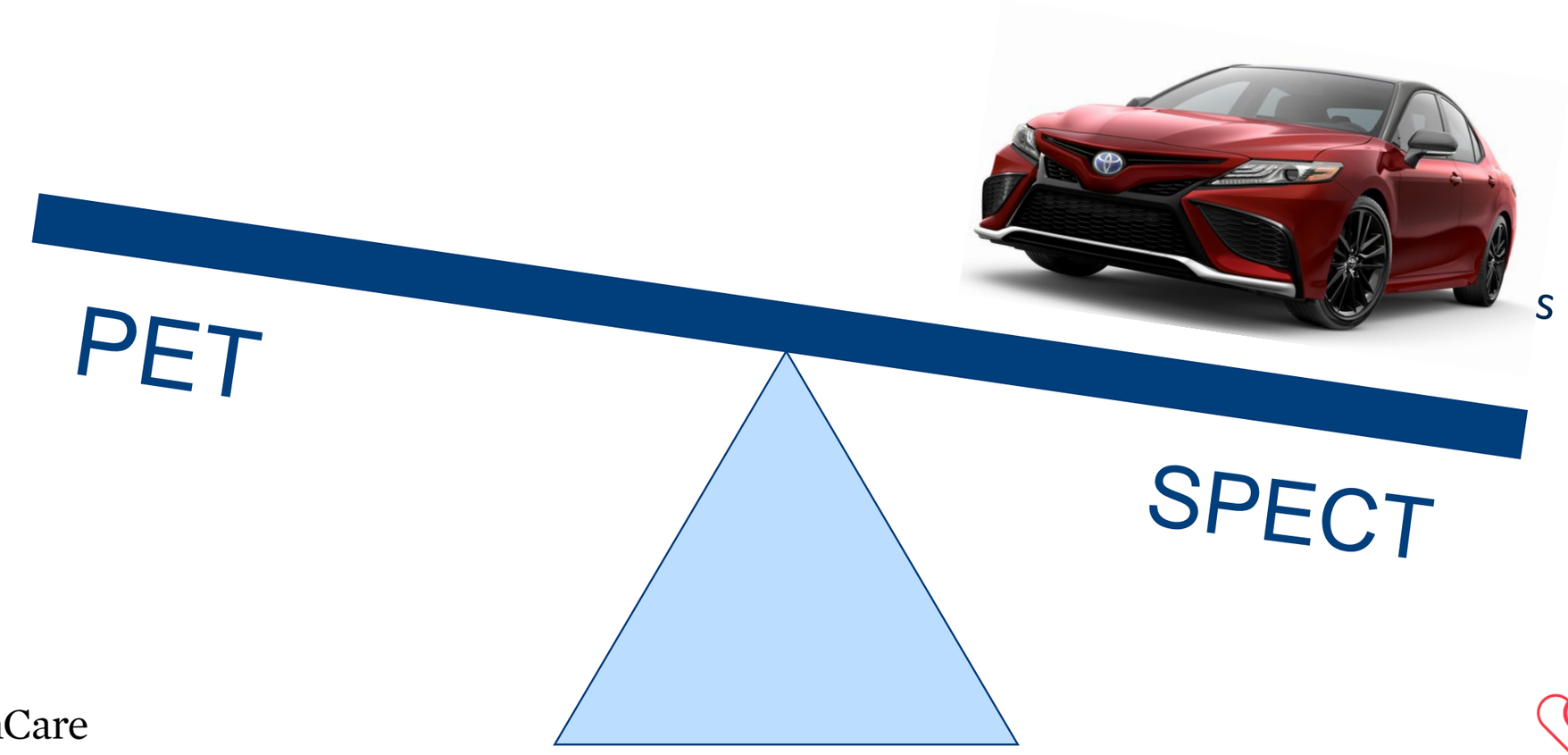
LVEF (rest)	56%
LVEF (stress)	62%
EDV	98 mL
ESV	43 mL
Transient ischemic dilation	0.92

SPECT VS PET

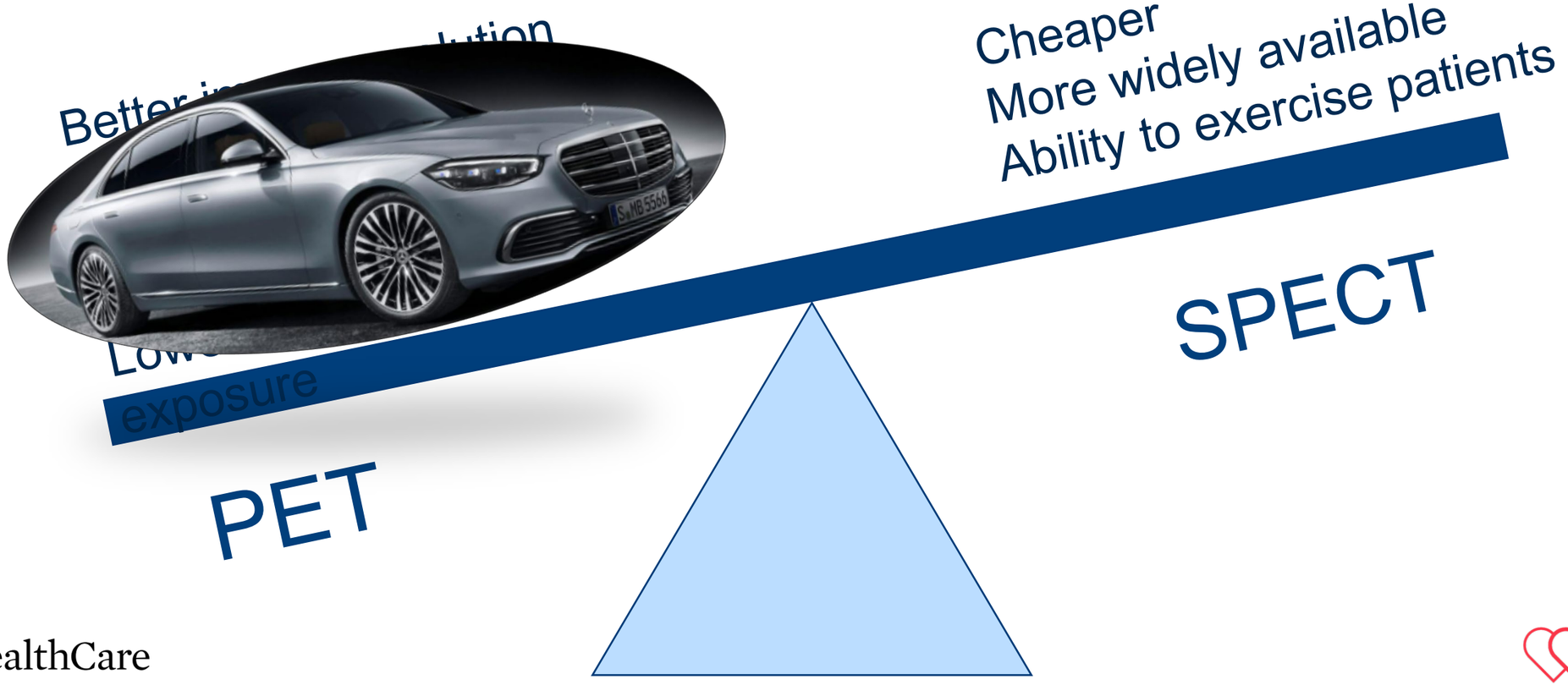




SPECT VS PET



SPECT VS PET


Better
lution
Low
exposure
PET
Cheaper
More widely available
Ability to exercise patients
SPECT

PERFORMANCE OF NON-INVASIVE TESTS

Non-invasive modality	Sensitivity	Specificity
Exercise treadmill	61%	71%
Stress echo	75%	87%
SPECT	85%	76%
PET	93%	85%
CMR	90%	81%
CCTA	95%	70% (80% w/ FFR)

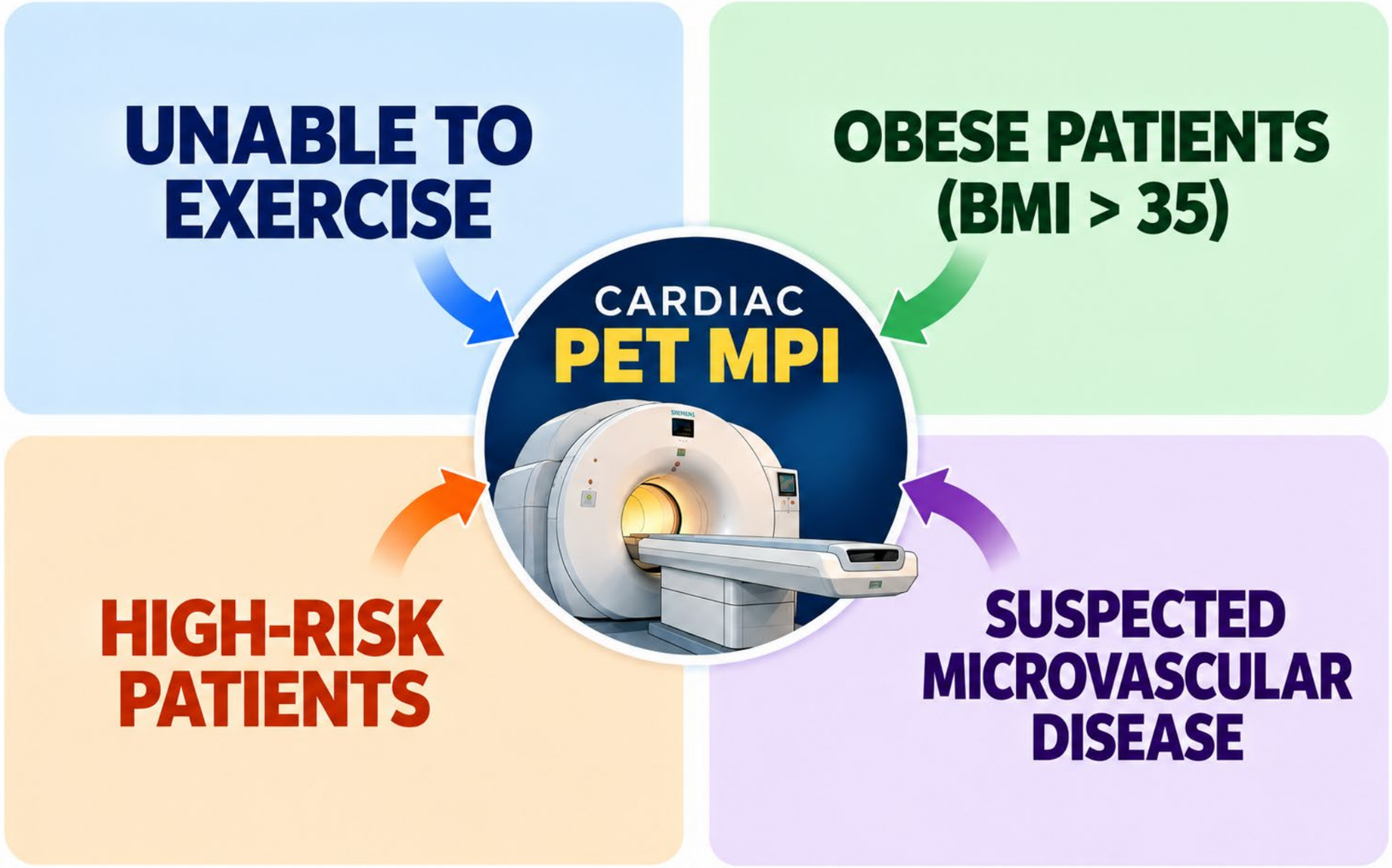
DISADVANTAGES OF PET

- COST $$$$
- Training and expertise
- Availability
- Short half-life of radiotracers**



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WHEN SHOULD WE CONSIDER PET MPI?



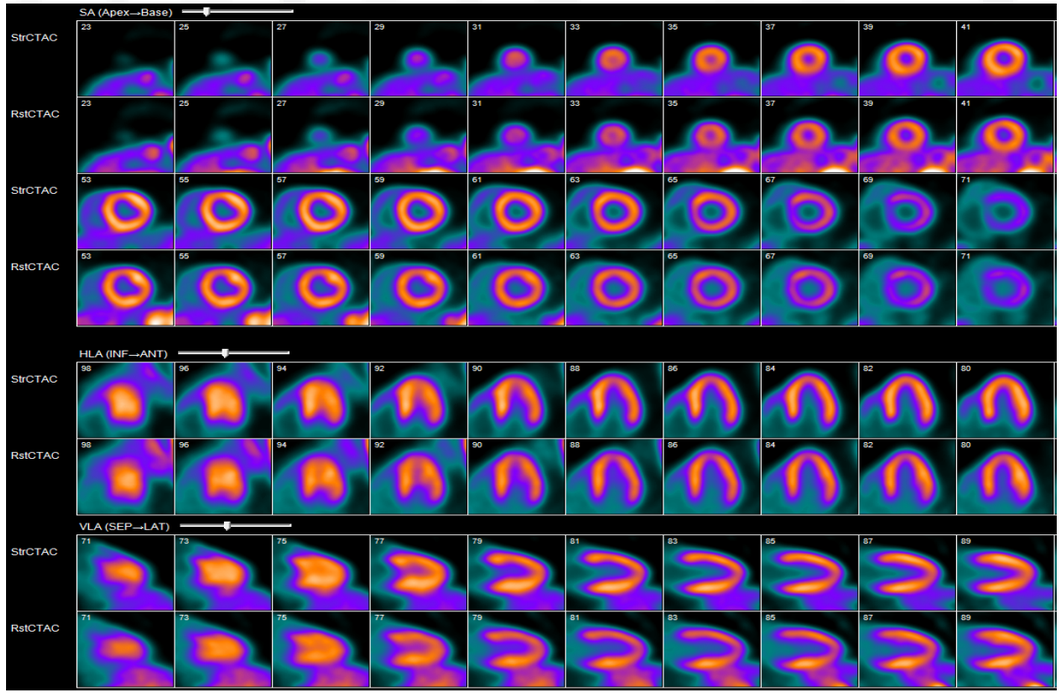
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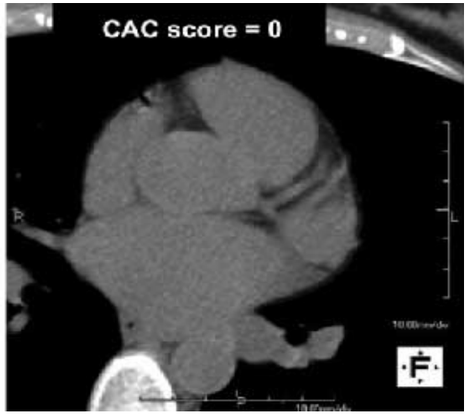
CASE

- 42-year-old F
- History of non obstructive CAD based on coronary angiogram
- Presents for evaluation of persistent chest pain

42 F W/ NON-OBSTRUCTIVE DISEASE AND PERSISTENT CHEST PAIN

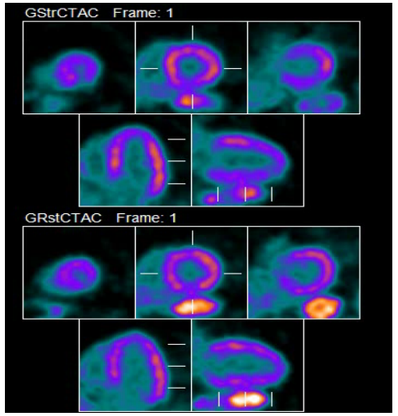


	Rest Flow (ml/min/g)	Stress Flow (ml/min/g)	Reserve
LAD	0.77	1.38	1.79
LCX	0.85	1.45	1.70
RCA	0.82	1.54	1.88
Total	0.81	1.44	1.79



Coronary Artery Calcium Score

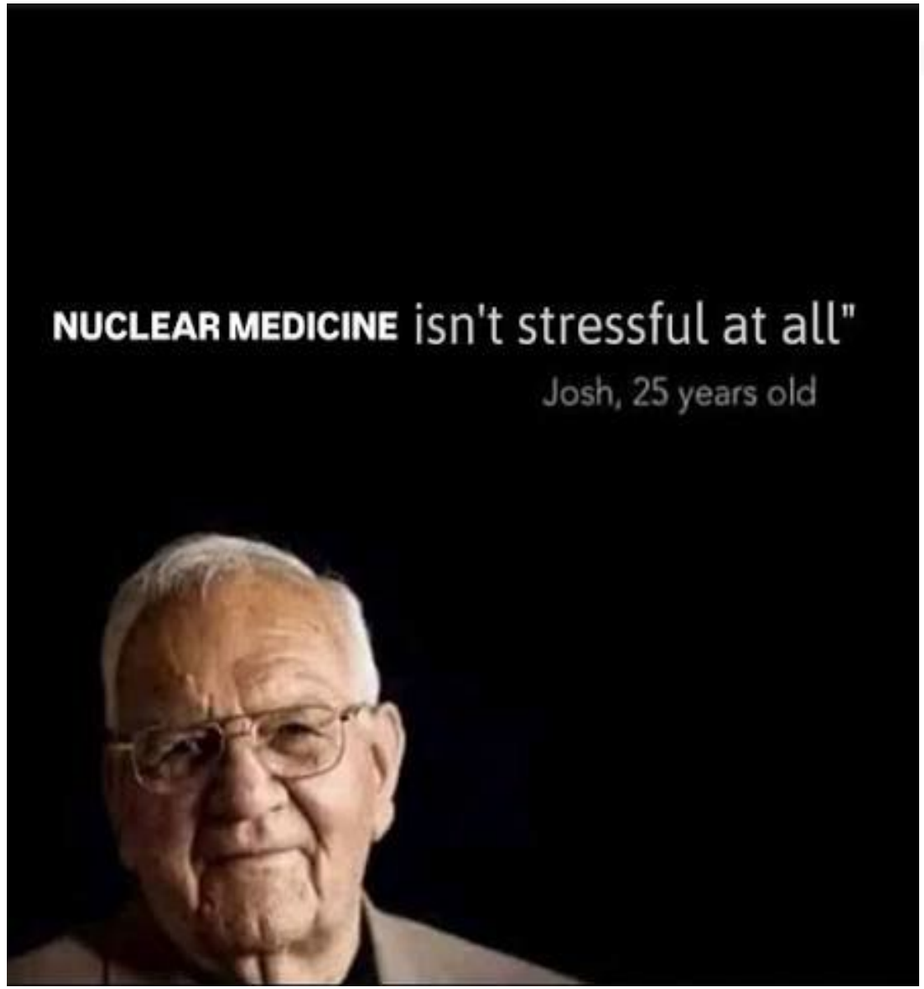
Zero



Stress LVEF 61%

Rest LVEF 57%

OTHER CLINICAL SCENARIOS TO CONSIDER CARDIAC PET



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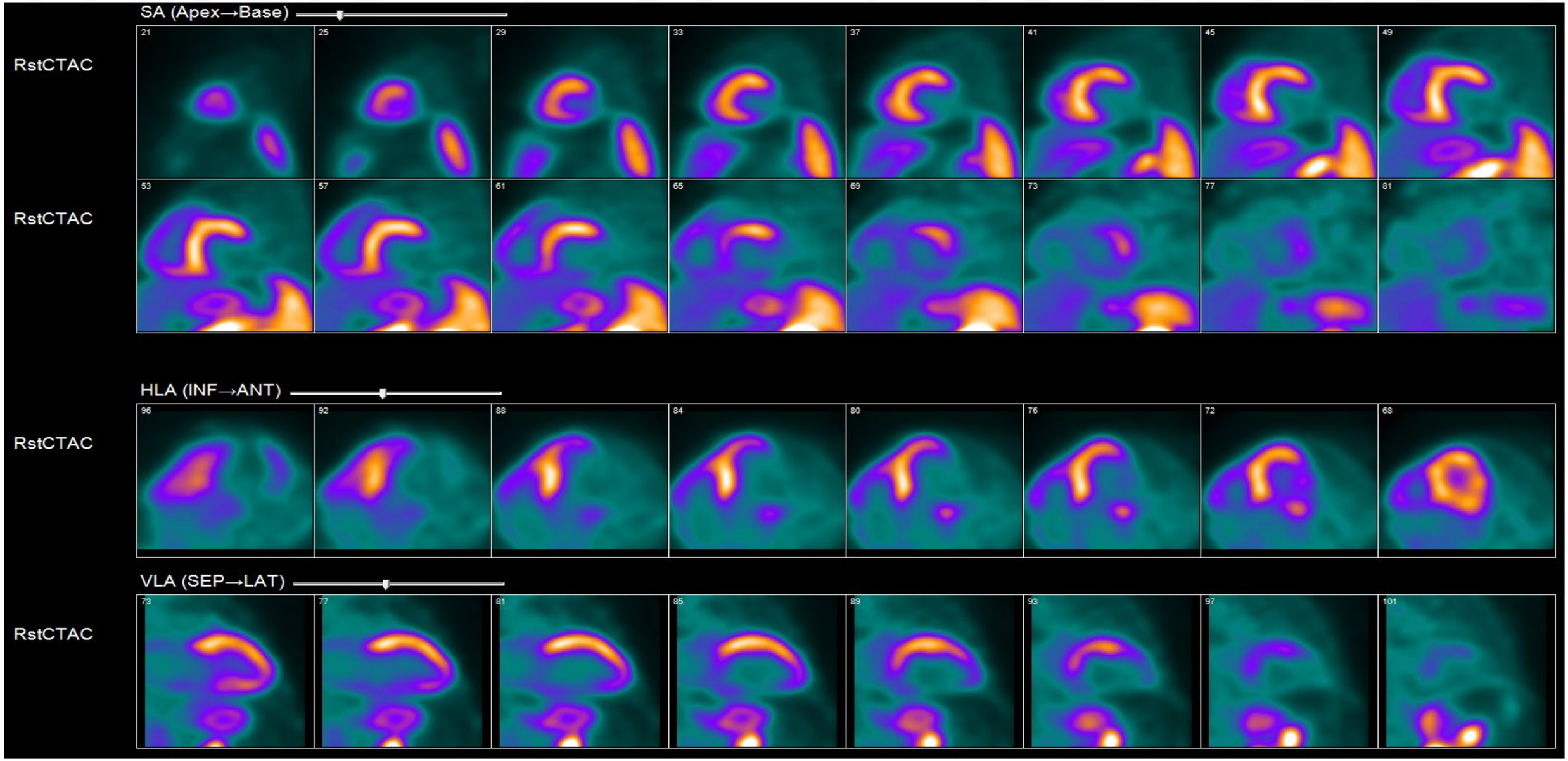
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VIABILITY

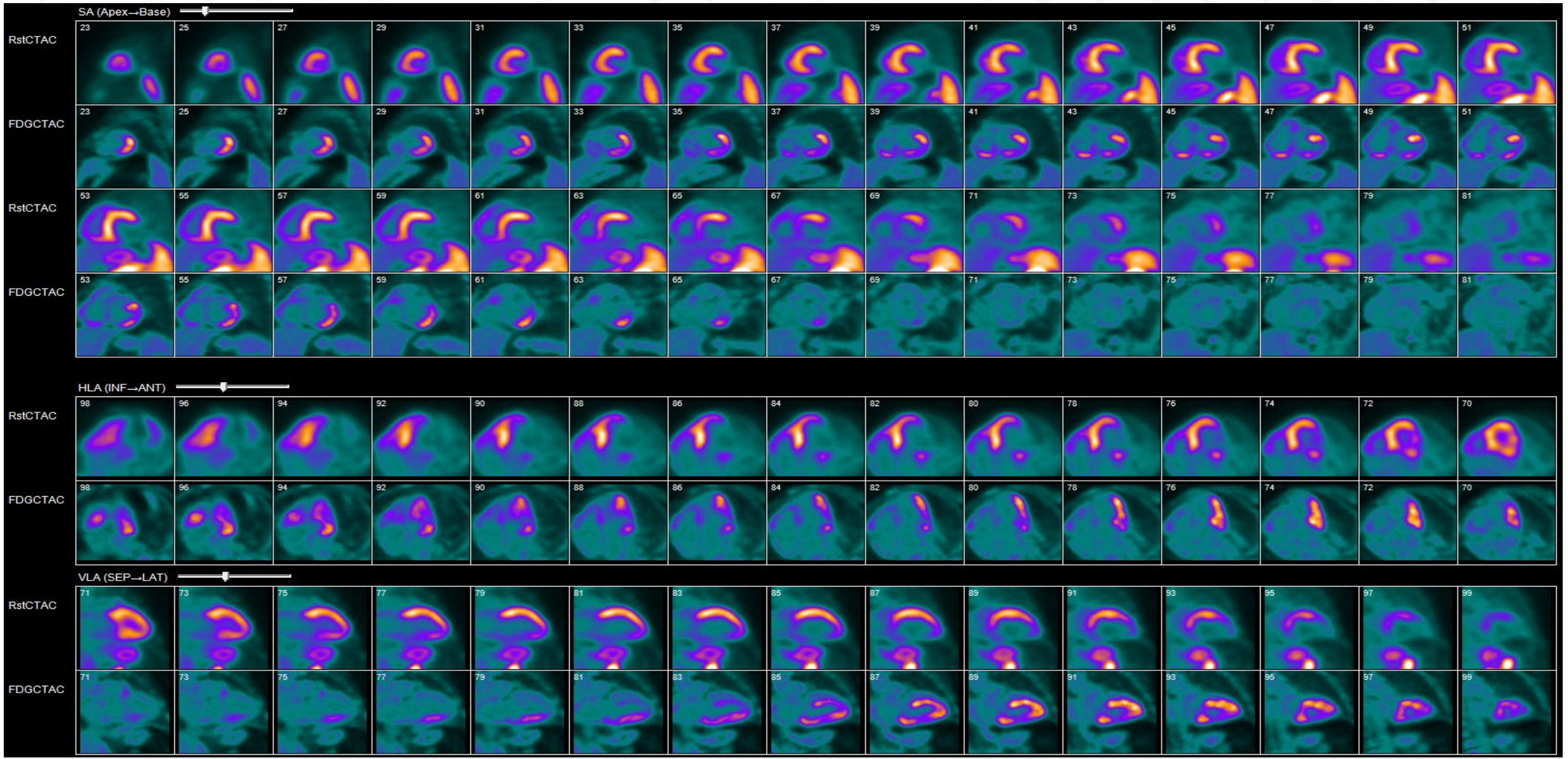
CASE

- 50-year-old female
- History of CAD s/p CABG
- Patent LIMA to LAD, occluded SVG to OM, SVG to RCA
- Referred for viability assessment

50 F W/ ICM FOR VIABILITY TESTING



50 F W/ ICM FOR VIABILITY TESTING



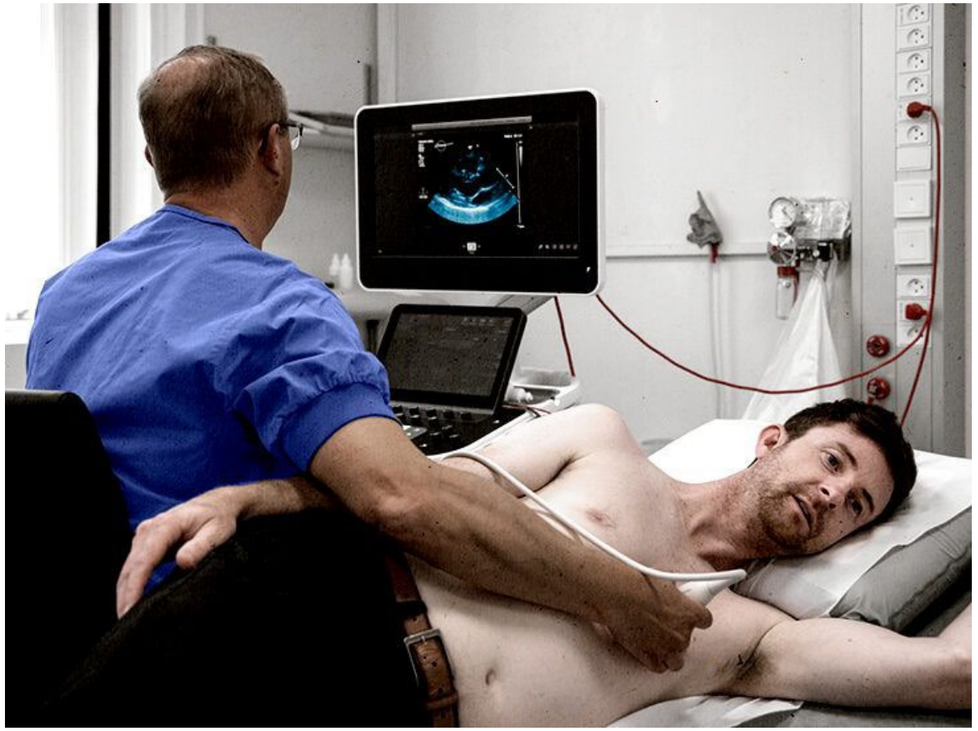
INFILTRATIVE CARDIOMYOPATHIES

CASE

- 37 M land surveyor
- Presented to the ED with dizziness
- Found to be bradycardic with 2:1 AV block



37 M W/ 2:1 AV BLOCK



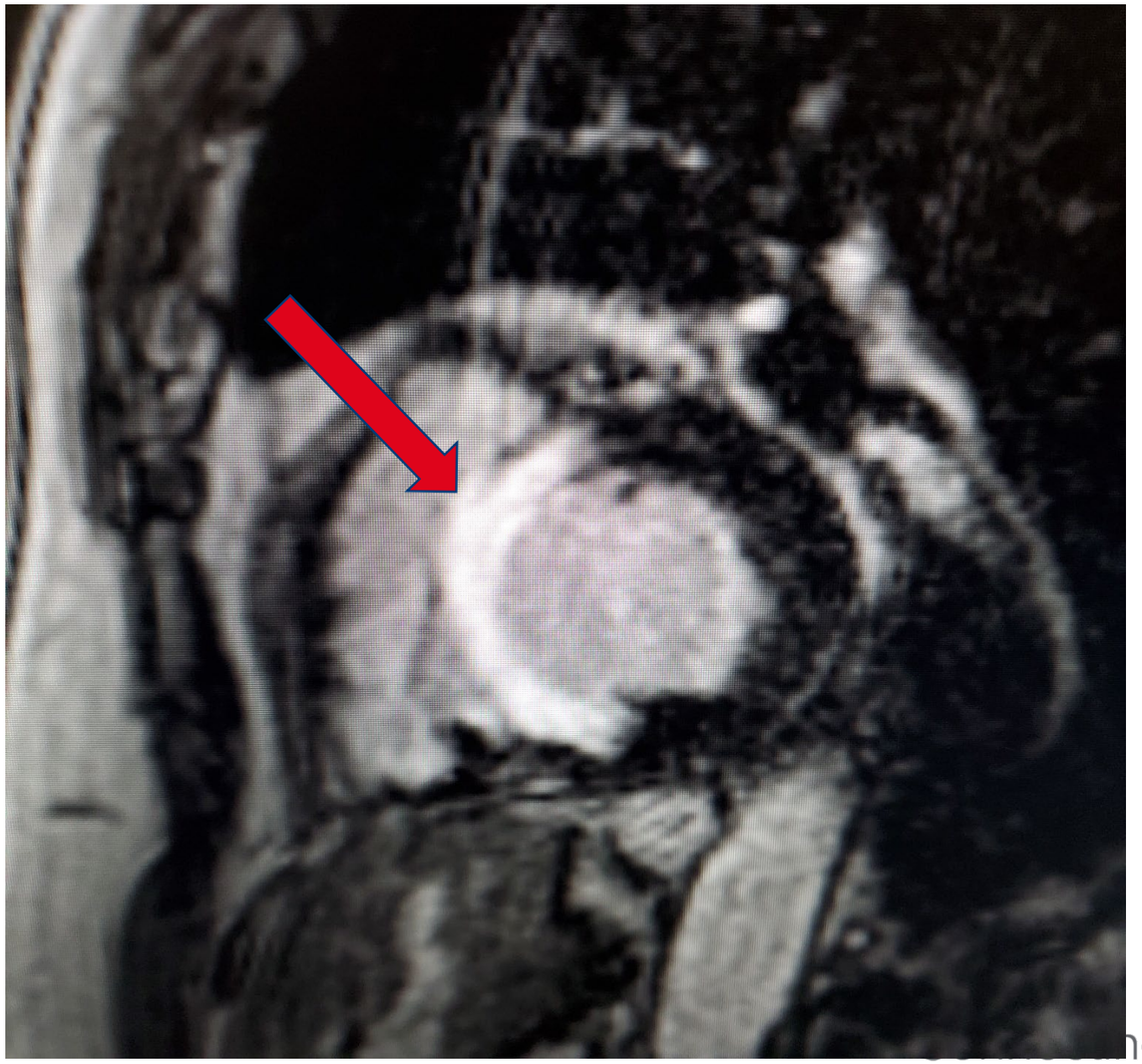
Normal LV size and function



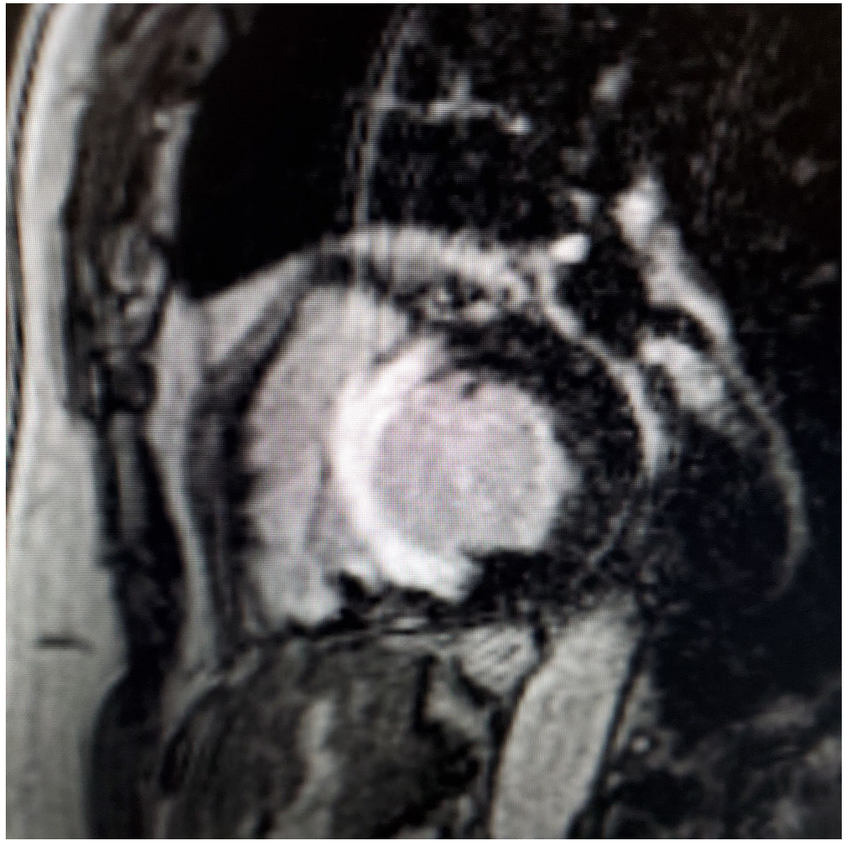
Negative Lyme serology

37 M W/ 2:1 AV BLOCK

- CMR:
- Extensive LGE in the septum



37 M W/ 2:1 AV BLOCK

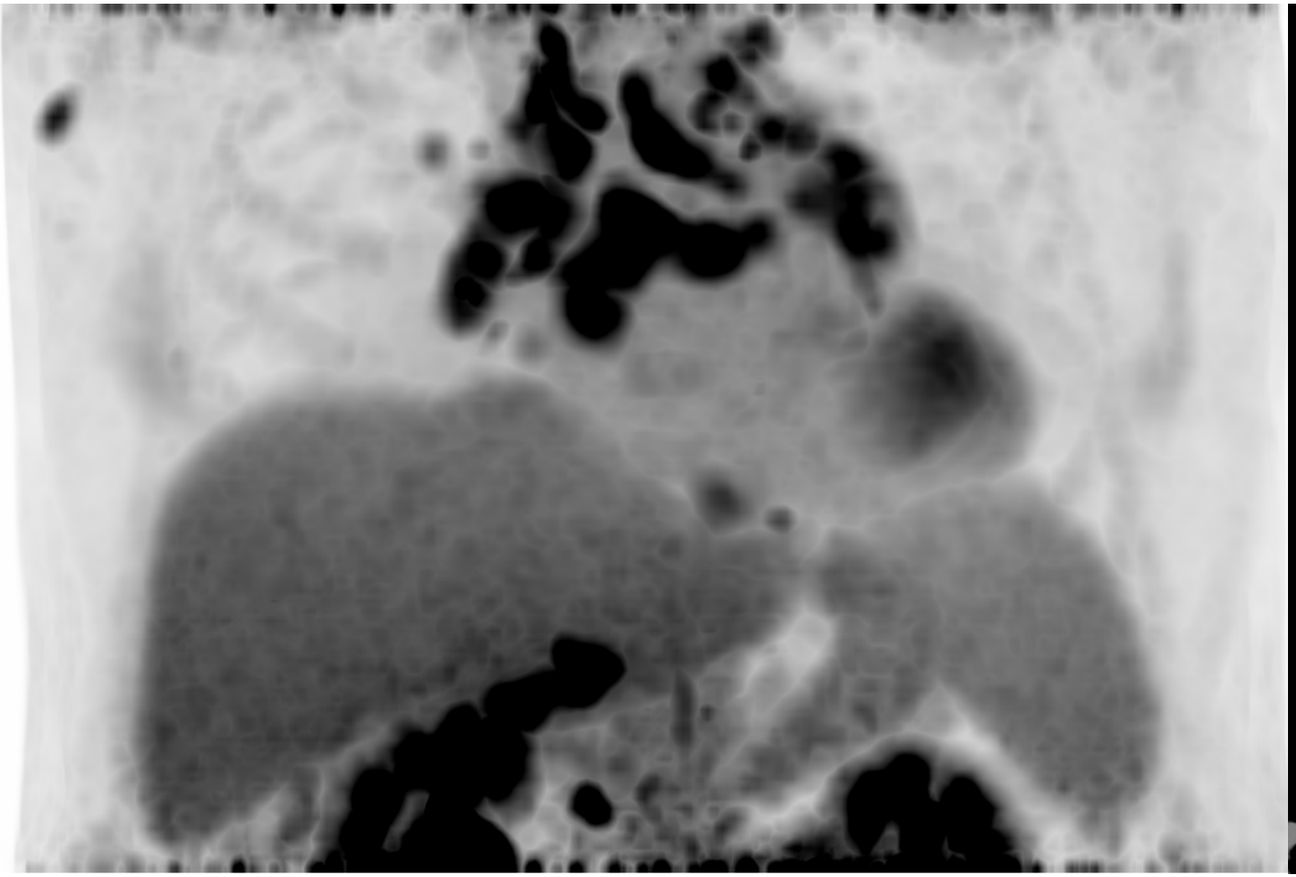


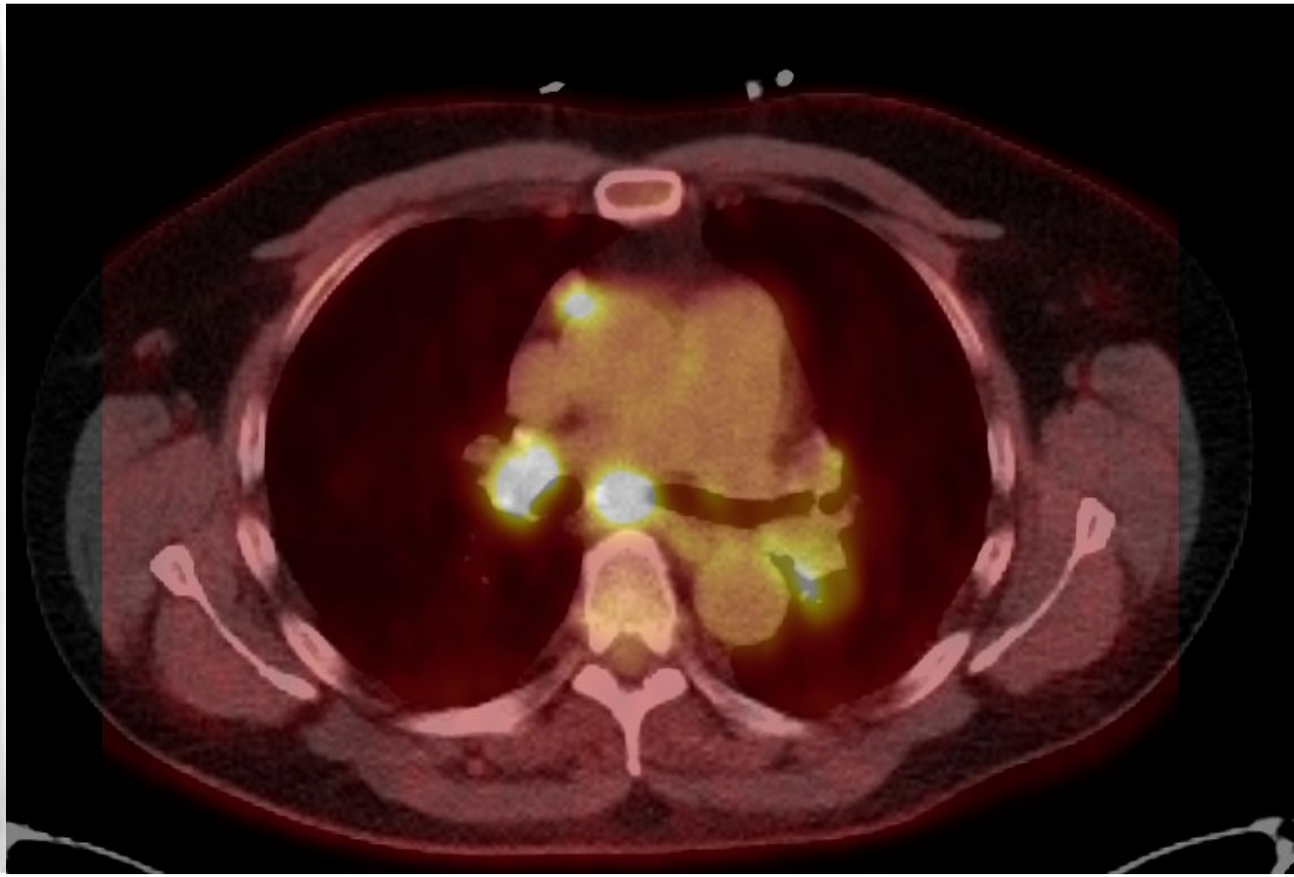


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37 M W/ 2:1 AV BLOCK

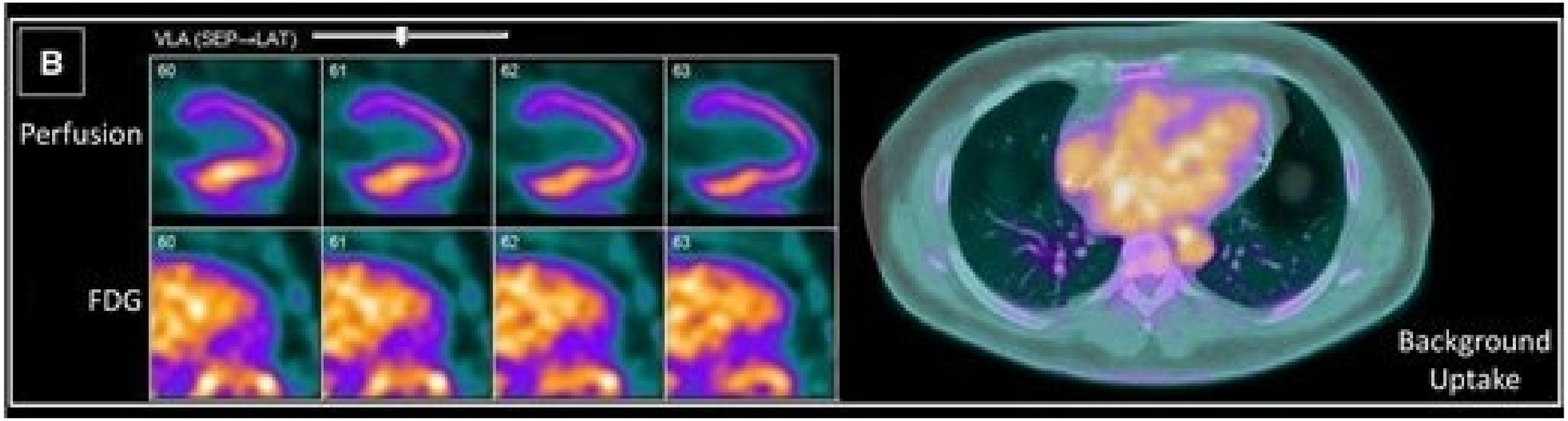




37 M W/ SUSPECTED CARDIAC SARCOID

- Started on prednisone w/ long taper
- Underwent EBUS w/ biopsy → no granulomas
- Discharged with event monitor → resolution of 2:1 AV block

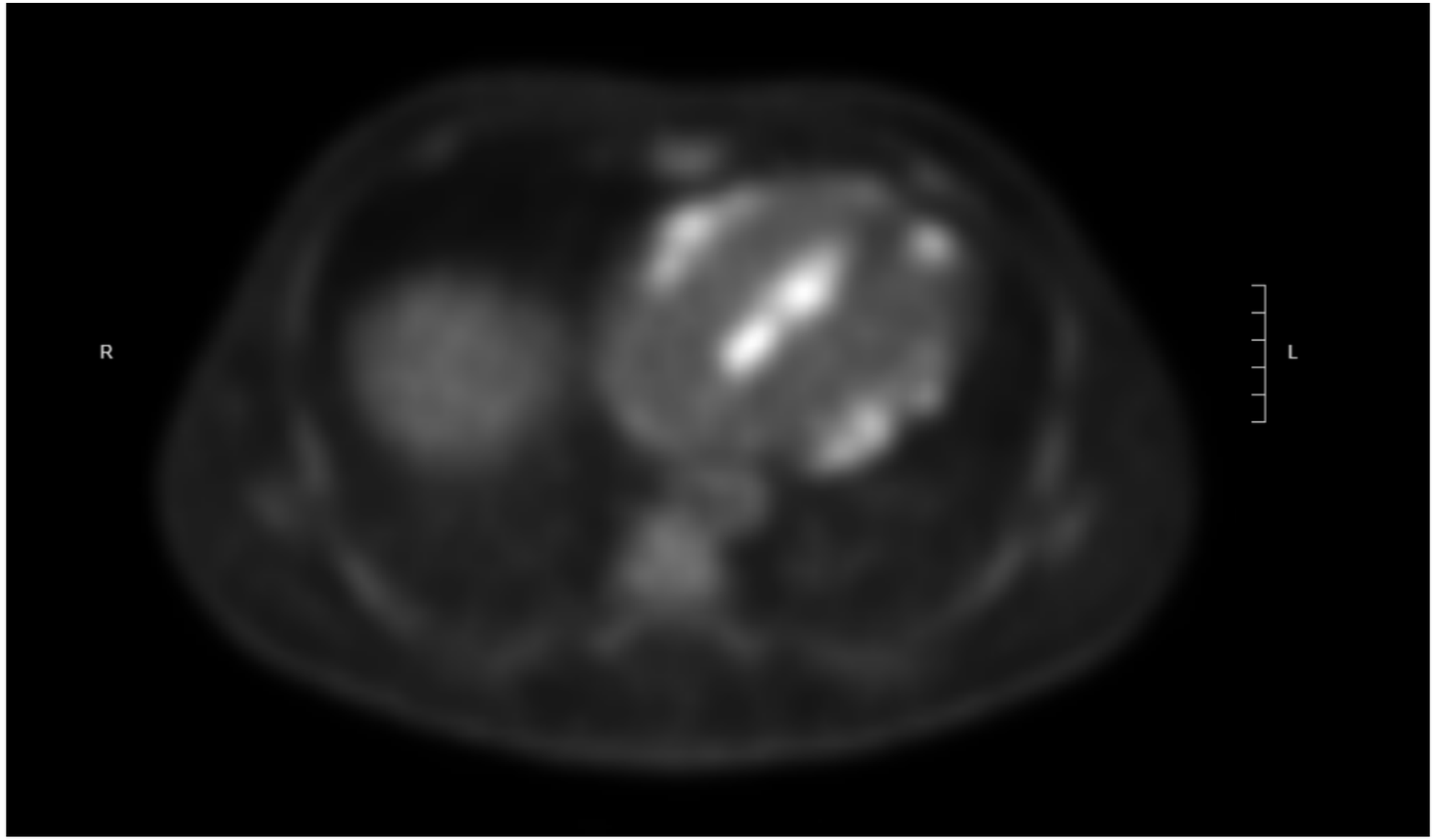
37 M W/ PRESUMED CARDIAC SARCOID



- Prolonged steroid taper +/- steroid sparing agent
- Patient decided to discontinue meds due to side effects

37 M W/ SUSPECTED CARDIAC SARCOID

- 1 year later gets admitted with symptomatic bradycardia



CASE

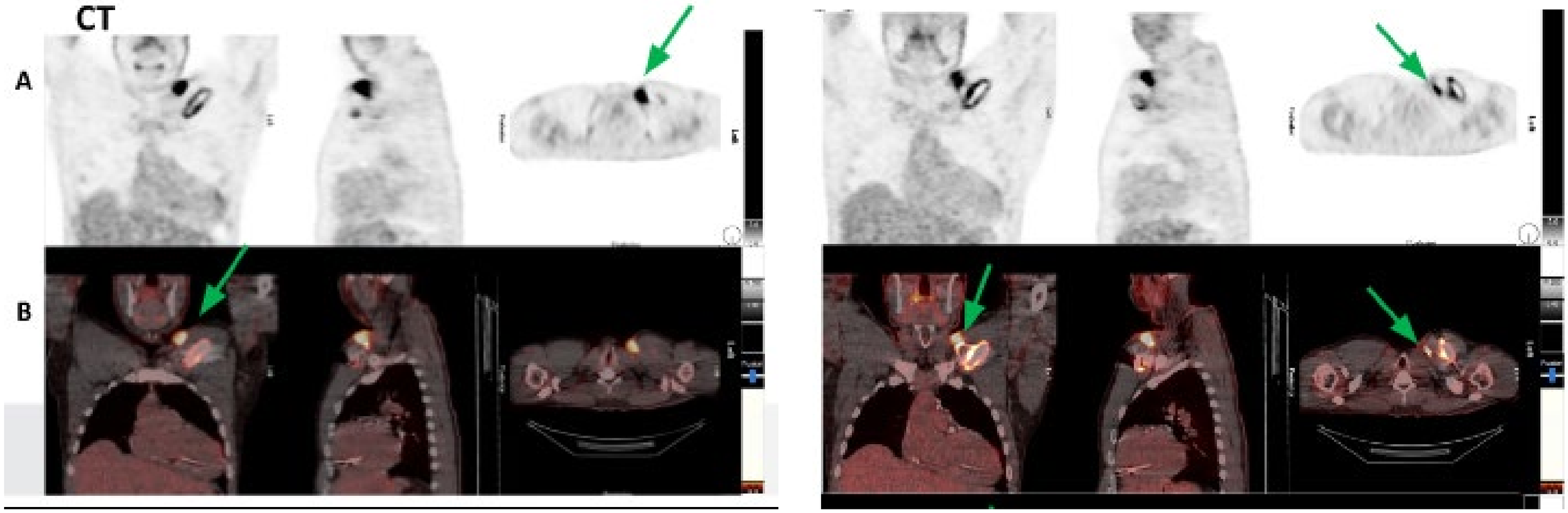
- 51 year old Male
- History of HCM s/p primary prevention ICD
- Presents with redness at ICD site (implanted 2018)
- No fevers, no bacteremia, normal WBC, no vegetations on echo.

ENDOCARDITIS

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51 M W/ SWELLING AROUND ICD SITE



ESC European Society of Cardiology
European Heart Journal (2023) **00**, 1–95
https://doi.org/10.1093/eurheartj/ehad193

2023 ESC Guidelines for the management of endocarditis

Developed by the task force on the management of endocarditis of the European Society of Cardiology (ESC)

(ii) Imaging positive for IE:

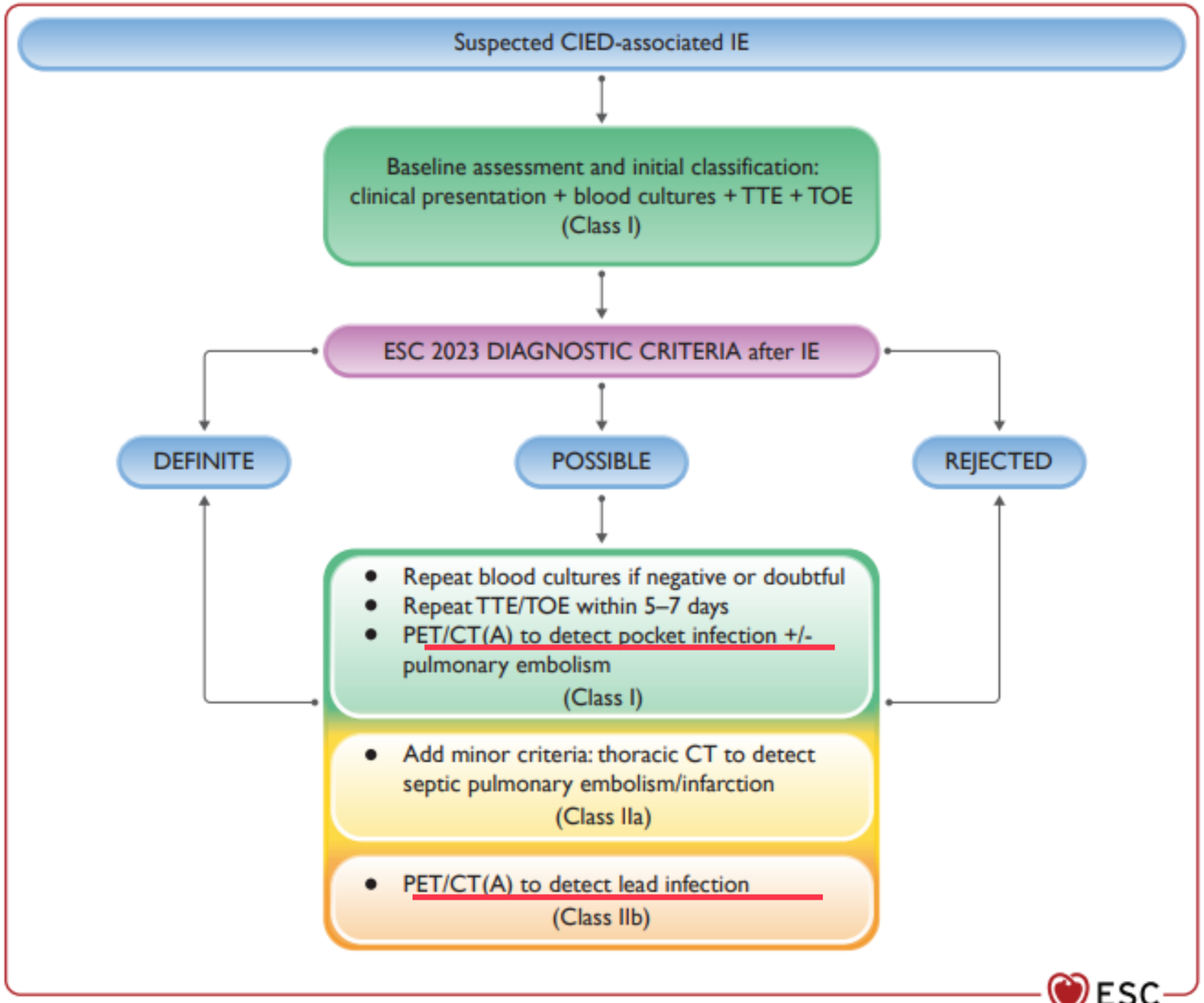
Valvular, perivalvular/periprosthetic and foreign material anatomic and metabolic lesions characteristic of IE detected by any of the following imaging techniques:

- Echocardiography (TTE and TOE).
- Cardiac CT.
- [18F]-FDG-PET/CT(A).
- WBC SPECT/CT.

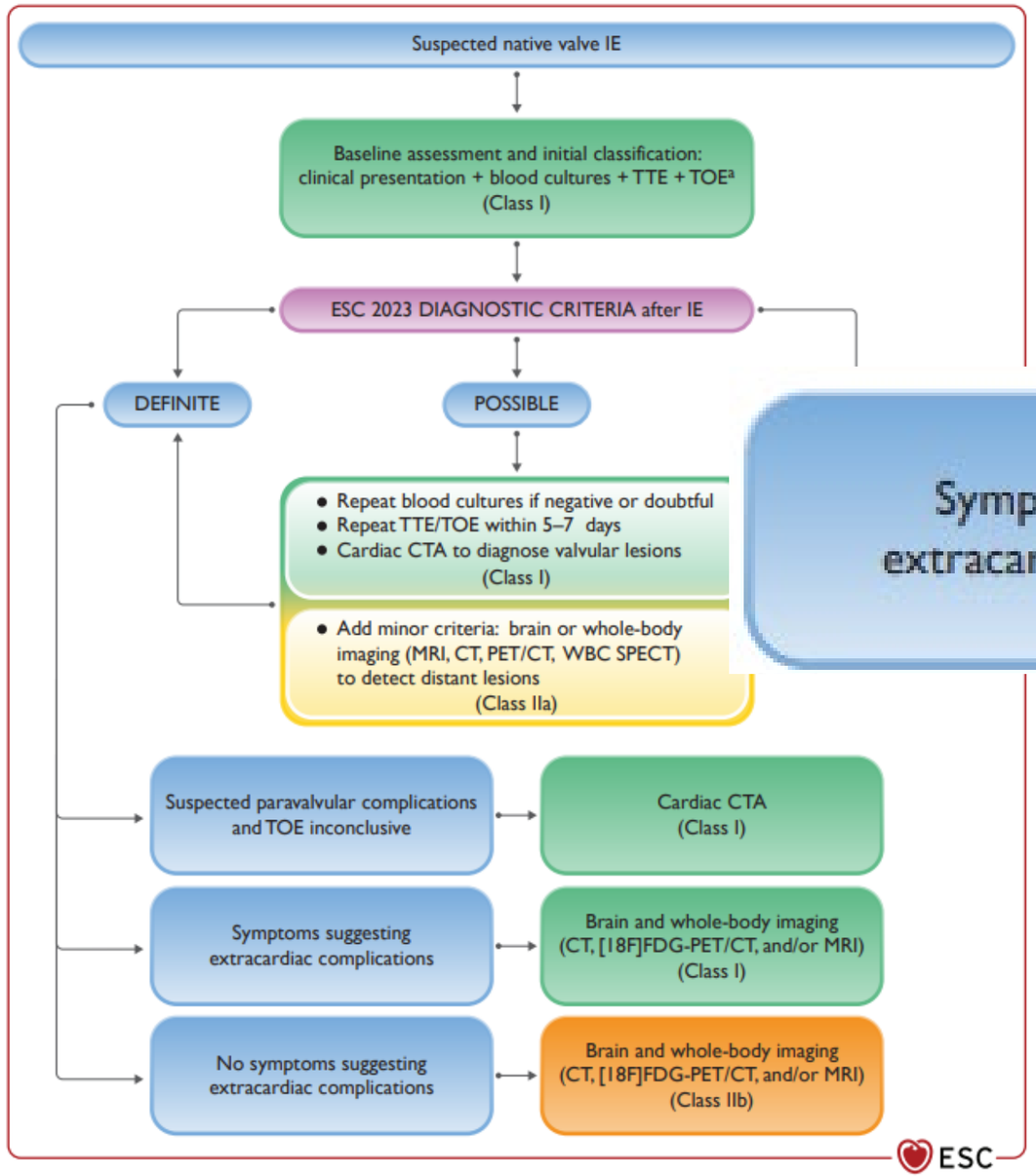
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ROLE OF PET IN SUSPECTED CIED-IE



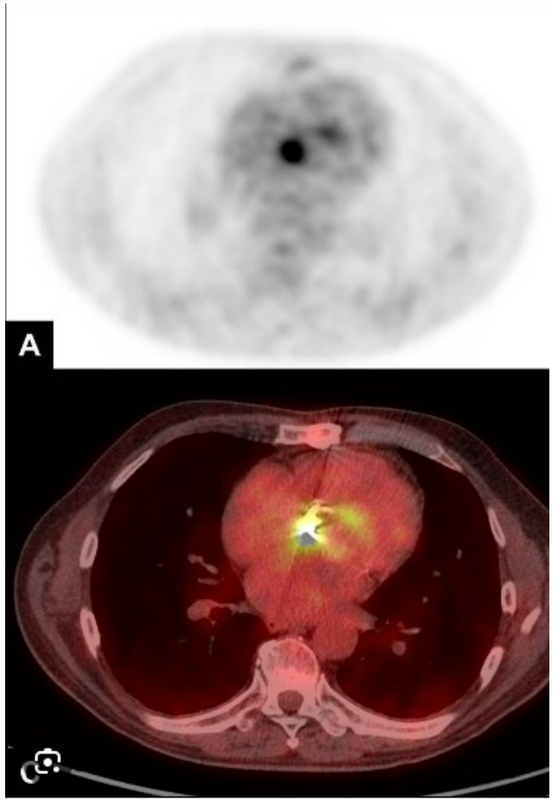
PET IN NATIVE VALVE ENDOCARDITIS

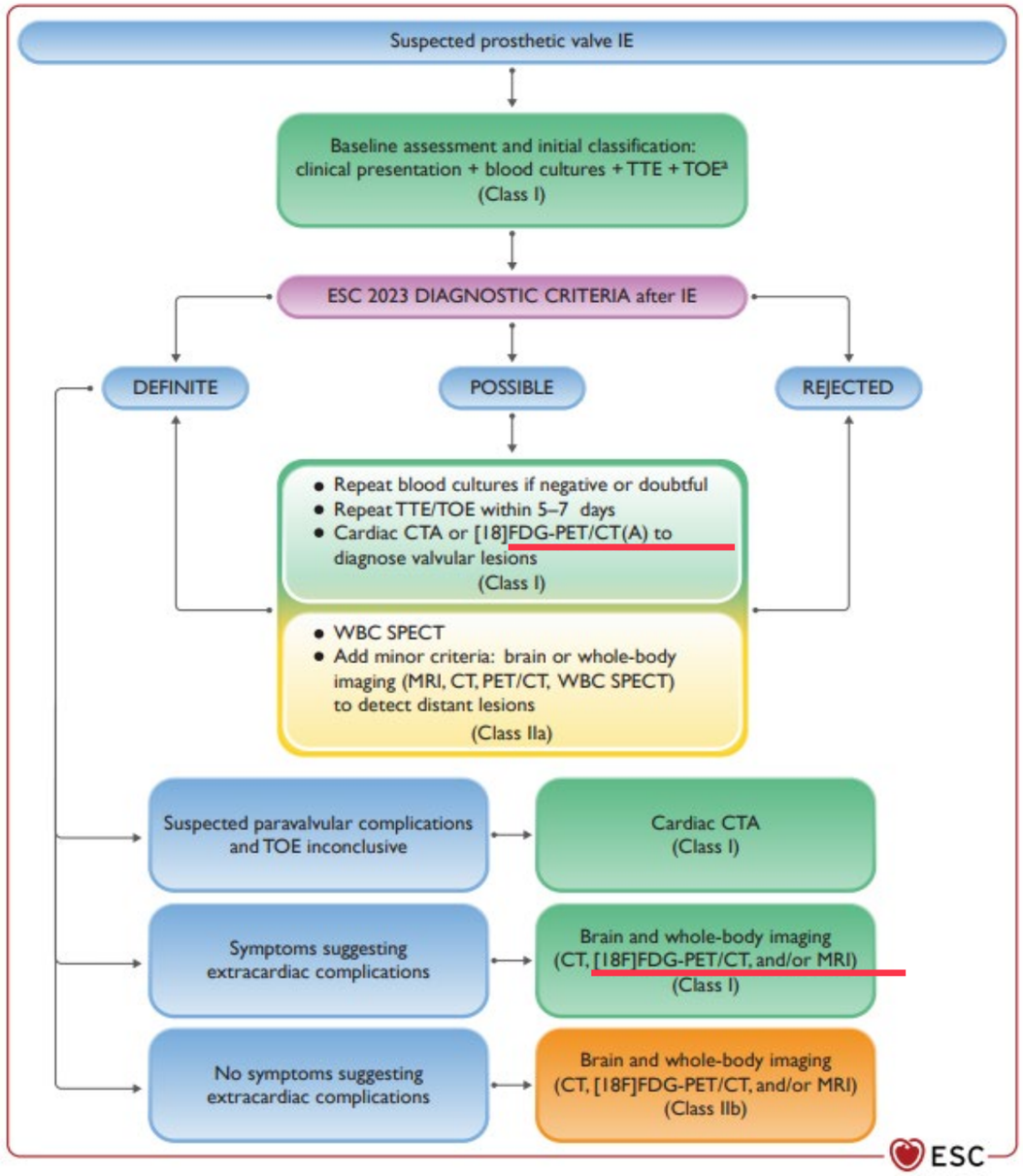


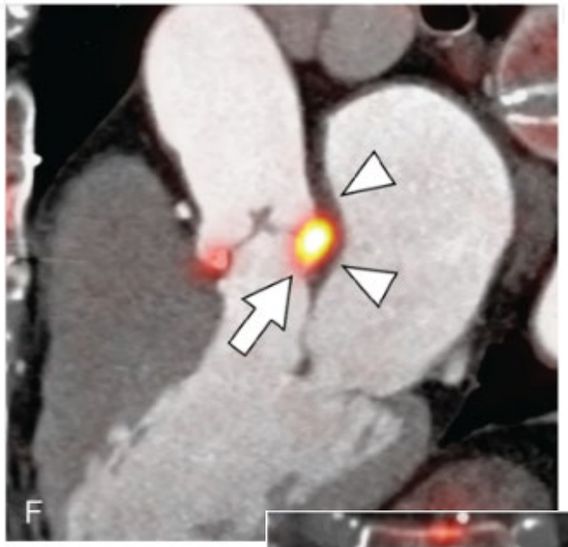
Symptoms suggesting extracardiac complications → Brain and whole-body imaging (CT, [18F]FDG-PET/CT, and/or MRI) (Class I)

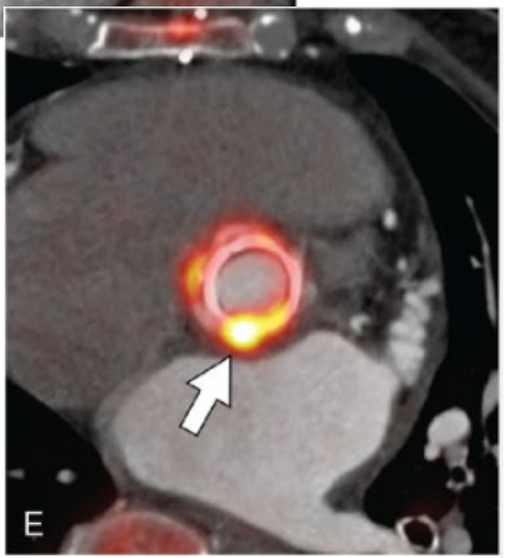
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PET IN PROSTHETIC VALVE ENDOCARDITIS







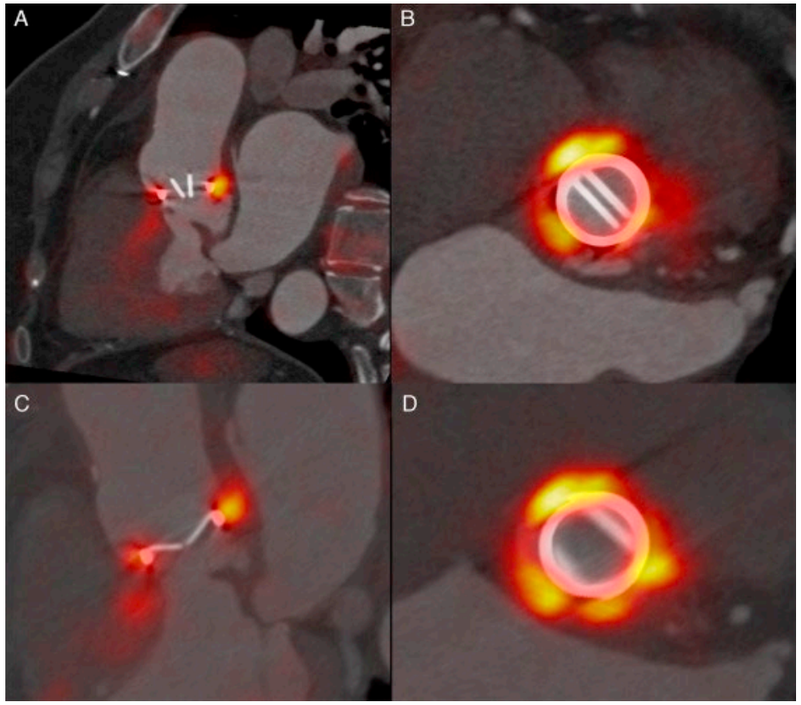


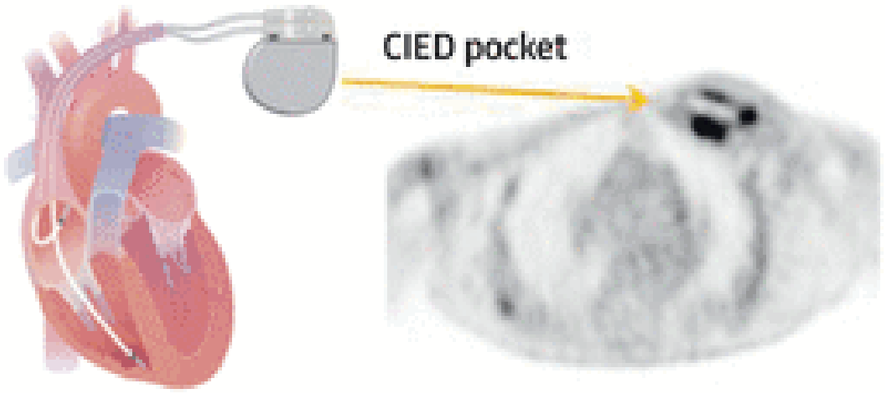
Pizzi MN, Roque A, Cuéllar-Calabria H, et al. Infective versus inflammatory patterns in 18F-FDG-PET/CTA of prosthetic cardiac valves and valve-tube grafts. *J Am Coll Cardiol Img.* 2016;9:1224-1227.

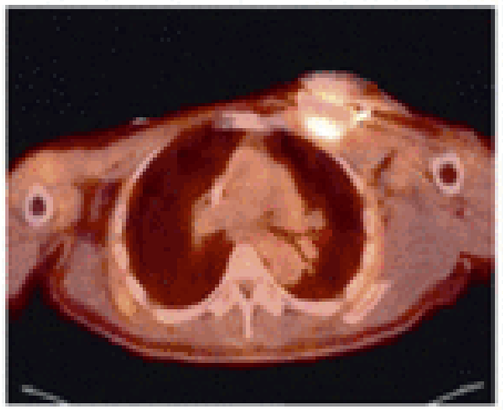
WHEN TO CONSIDER PET IN ENDOCARDITIS

- Concern for prosthetic valve endocarditis

- Concern for CIED infection







PET IN SUSPECTED VASCULAR GRAFT INFECTIONS

› Ann Vasc Surg. 2022 Nov;87:422-429. doi: 10.1016/j.avsg.2022.05.029. Epub 2022 Jun 25.

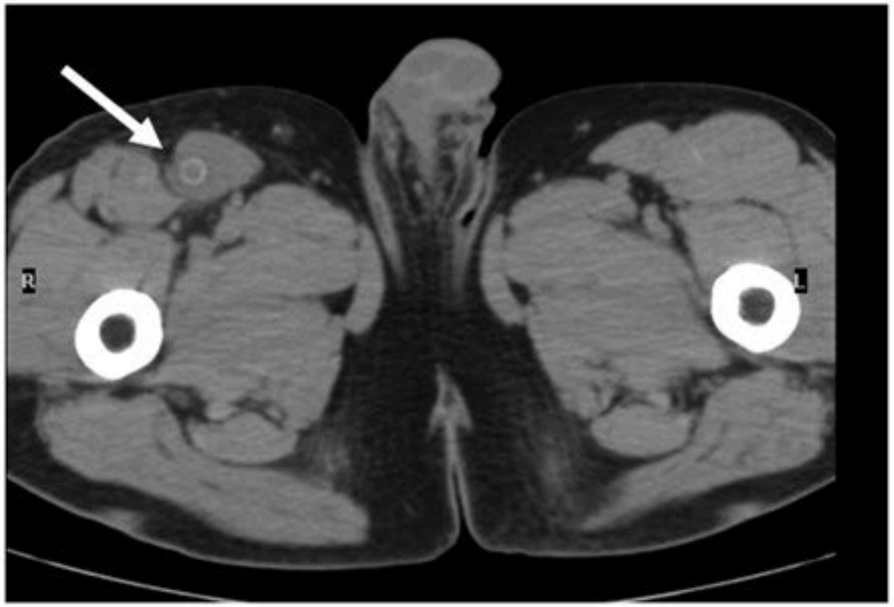
Diagnostic Accuracy of FDG PET for the Identification of Vascular Graft Infection

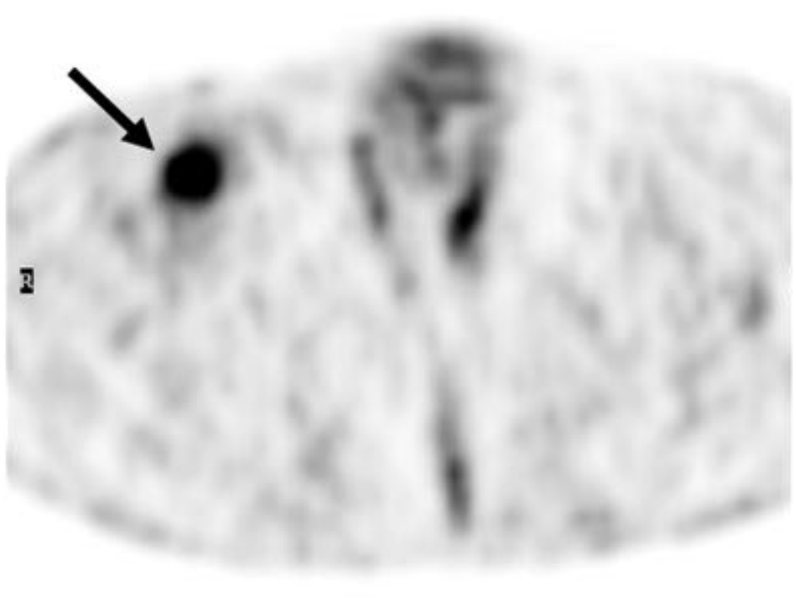
Maham Rahimi [1], Muath Adlouni [2], Ahmed Ibrahim Ahmed [1], Talal Alnabelsi [3], Ponraj Chinnadurai [4], Mouaz H Al-Mallah [5]

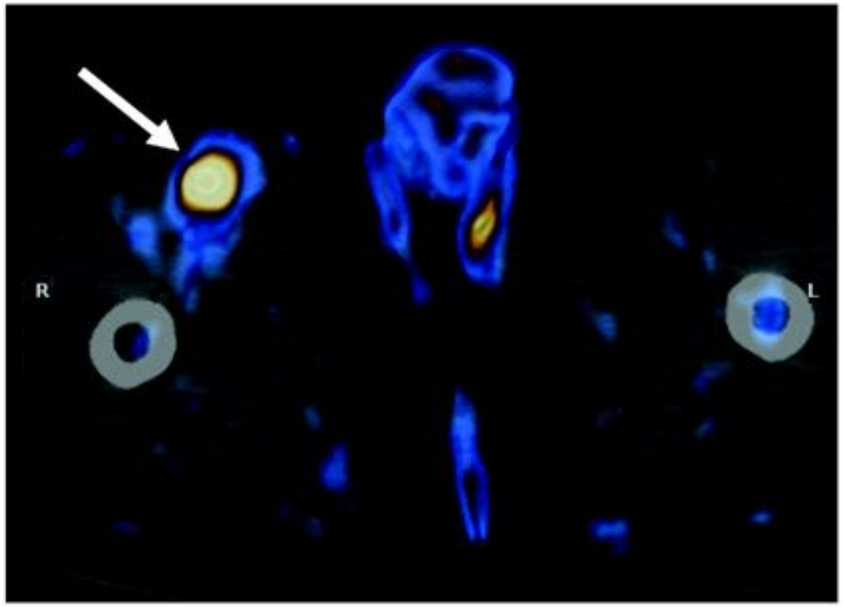
Affiliations + expand

PMID: 35760267 DOI: 10.1016/j.avsg.2022.05.029

PET IN SUSPECTED VASCULAR GRAFT INFECTIONS

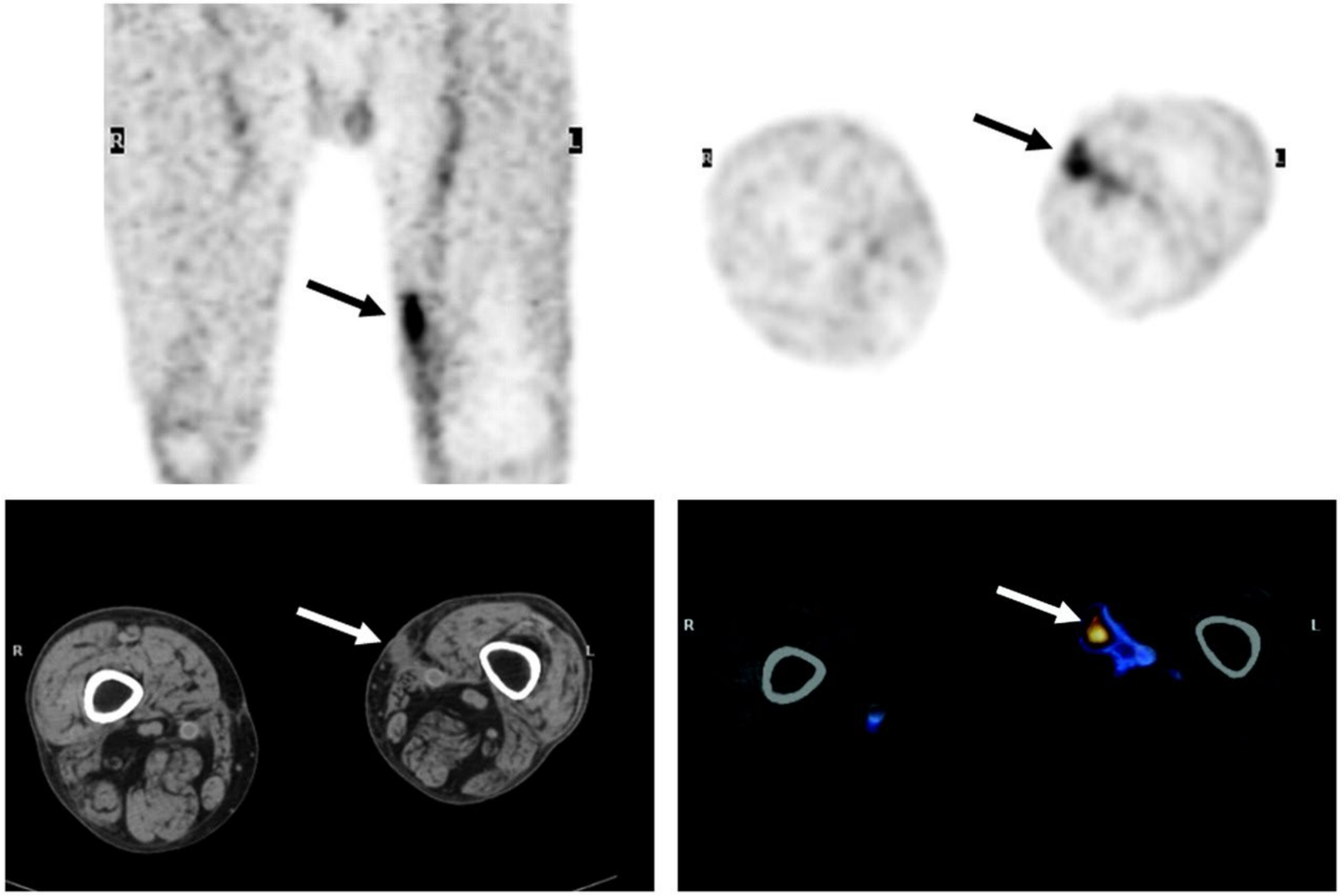






Prosthetic Vascular Graft Infection: The Role of ^{18}F-FDG PET/CT Zohar Keidar, Ahuva Engel, Aaron Hoffman, Ora Israel, Samy Nitecki. Journal of Nuclear Medicine Aug 2007, 48 (8) 1230-1236; **DOI:** 10.2967/jnumed.107.040253

PET IN SUSPECTED VASCULAR GRAFT INFECTIONS



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WHEN TO CONSIDER CARDIAC PET?

- Ischemic Evaluation
- Endocarditis/infection
- Miscellaneous

WHEN TO CONSIDER CARDIAC PET?

Ischemic Evaluation (Rubidium)	• All • Obesity • Inability to exercise
Endocarditis/infection	
Miscellaneous	

WHEN TO CONSIDER CARDIAC PET?

Ischemic Evaluation (Rubidium)	• All • Obesity • Inability to exercise
Endocarditis/infection (FDG)	• Prosthetic valves • CIED • Vascular graft infection
Miscellaneous	

WHEN TO CONSIDER CARDIAC PET?

Ischemic Evaluation (Rubidium)	• All • Obesity • Inability to exercise
Endocarditis/infection (FDG)	• Prosthetic valves • CIED • Vascular graft infection
Miscellaneous (Rubidium + FDG)	• Sarcoidosis • Viability

Operational Considerations



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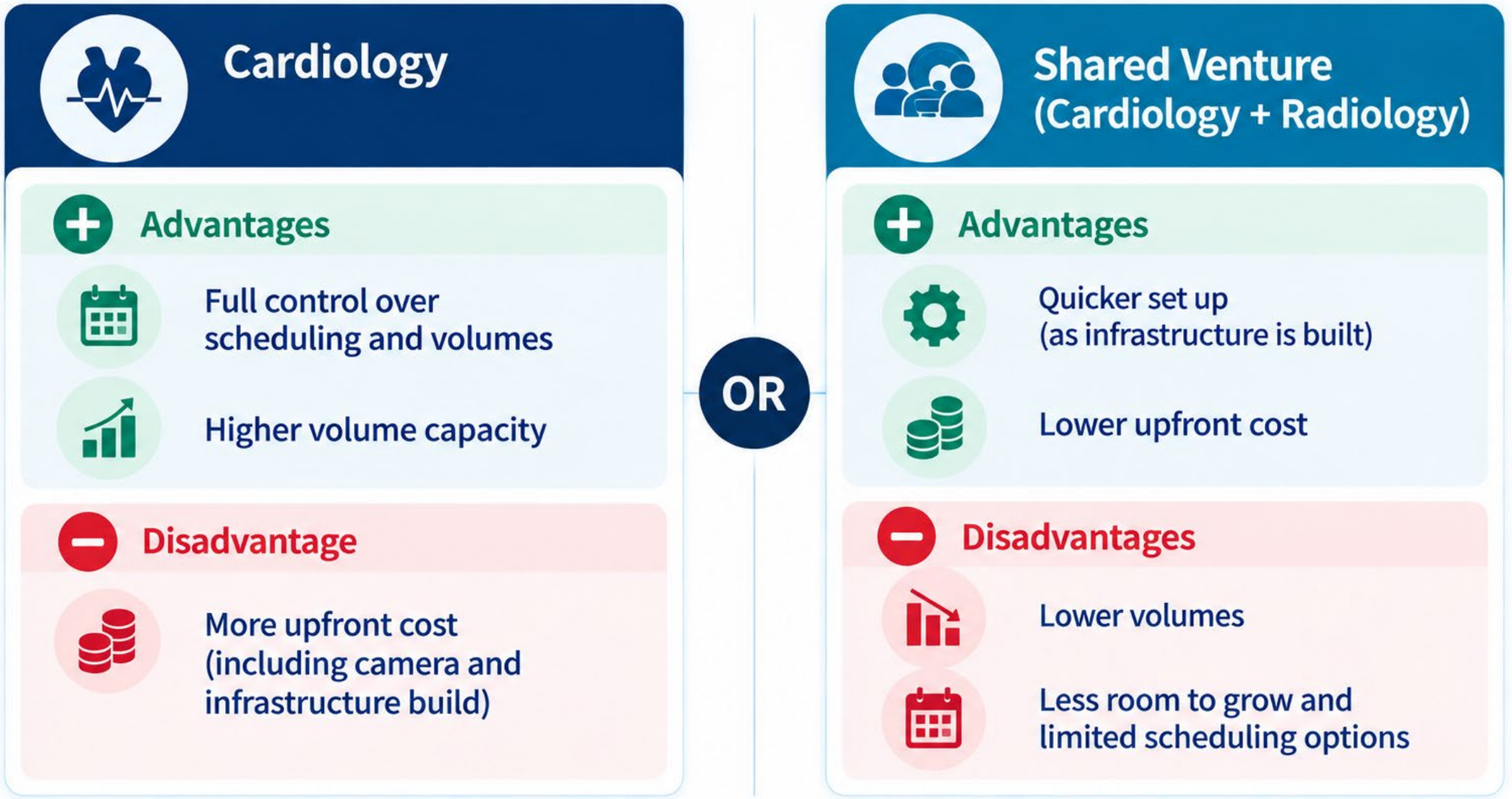
OPERATIONAL CONSIDERATIONS – WHY?

- Aged equipment
- Reduce radiation exposure
- High BMI
- Better image quality
- Higher sensitivity/specificity

OPERATIONAL CONSIDERATIONS – HOW?



OPERATIONAL CONSIDERATIONS – HOW?



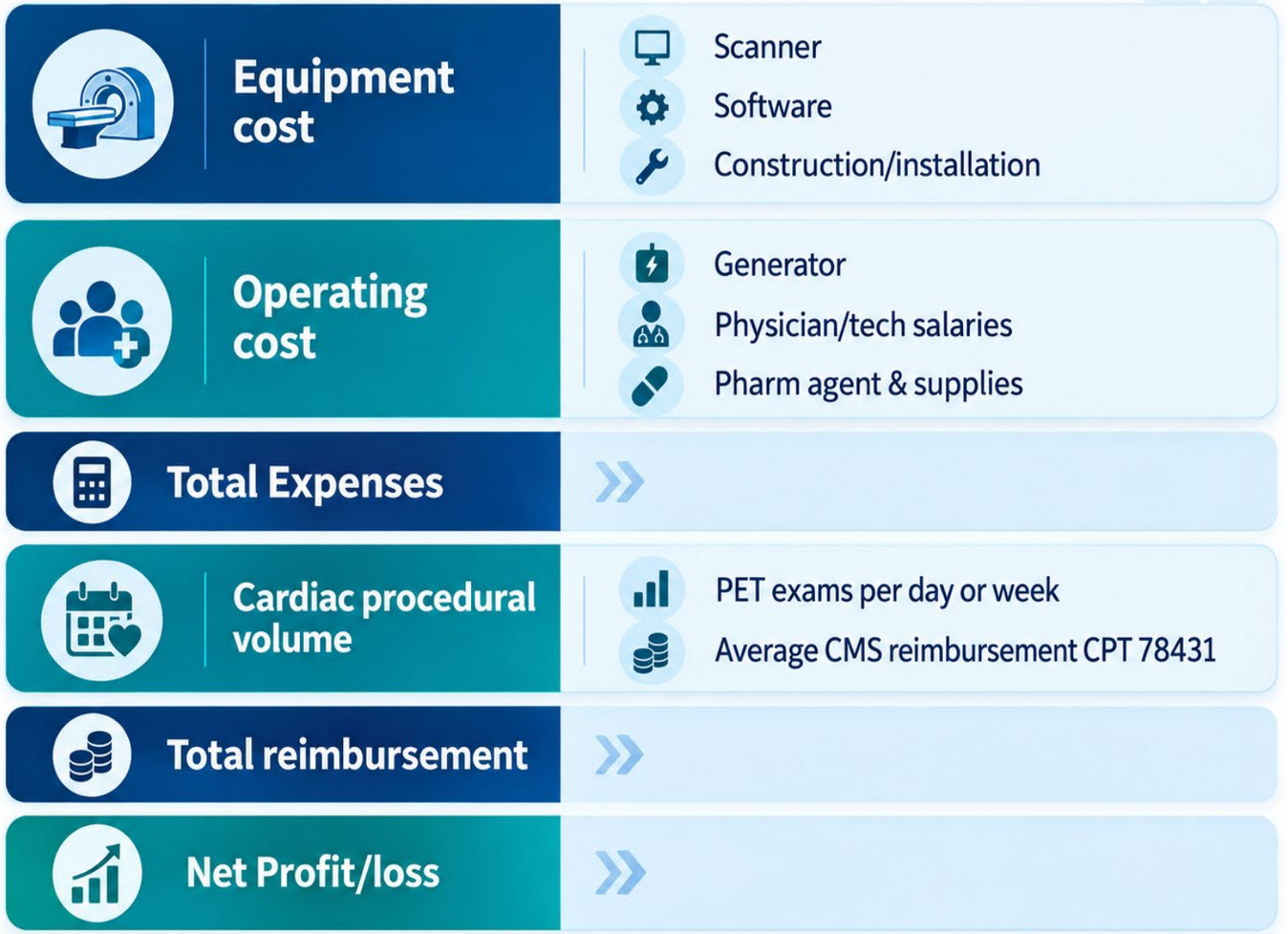
OPERATIONAL CONSIDERATIONS – HOW?

Cardiac PET Tracer Choice: Operational Executive Summary

Factor	Rb-82	N-13 Ammonia	Flyrcado / F-18 Flurpiridaz
How tracer is obtained	On-site generator	On-site/nearby cyclotron	Delivered unit doses
Up-front infrastructure	Moderate	High	Low
Setup complexity	Generator + QC workflow	Production + synthesis + QC	Similar to F-18 dose delivery
Scheduling flexibility	Best for high-volume blocks	Tied to production runs	Flexible, but delivery-dependent
Best use case	Busy dedicated PET lab	Center with existing cyclotron	New or lower-volume program
Biggest advantage	Fastest throughput	Excellent tracer + local control	Easiest program launch
Biggest disadvantage	Fixed generator cost	Major infrastructure burden	Delivery dependence

OPERATIONAL CONSIDERATIONS – HOW?

Proforma



FINAL REMARKS

- Cardiac PET can be used across a wide spectrum of cardiac conditions

- Should be an integral part of your diagnostic armamentarium

#ThinkPET

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THANK YOU FOR ATTENDING THIS SESSION!

Questions/Discussion

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