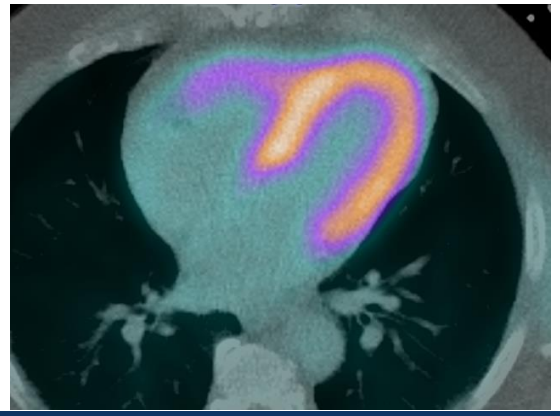

PET/CT Techniques and Protocols: What Should I Incorporate in My Lab?

Mouaz H. Al-Mallah, MD MSc

President, American Society of Nuclear Cardiology
Beverly B. and Daniel C. Arnold Distinguished Chair,
Professor of Cardiology, Houston Methodist Academic Institute
Professor of Medicine, Weill Cornell Medicine
Director, Cardiovascular PET
Houston Methodist DeBakey Heart and Vascular Center

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Disclosures

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- Research Support: Siemens
- Consultant: Pfizer, Philips, Jubilant

Why Cardiac PET?

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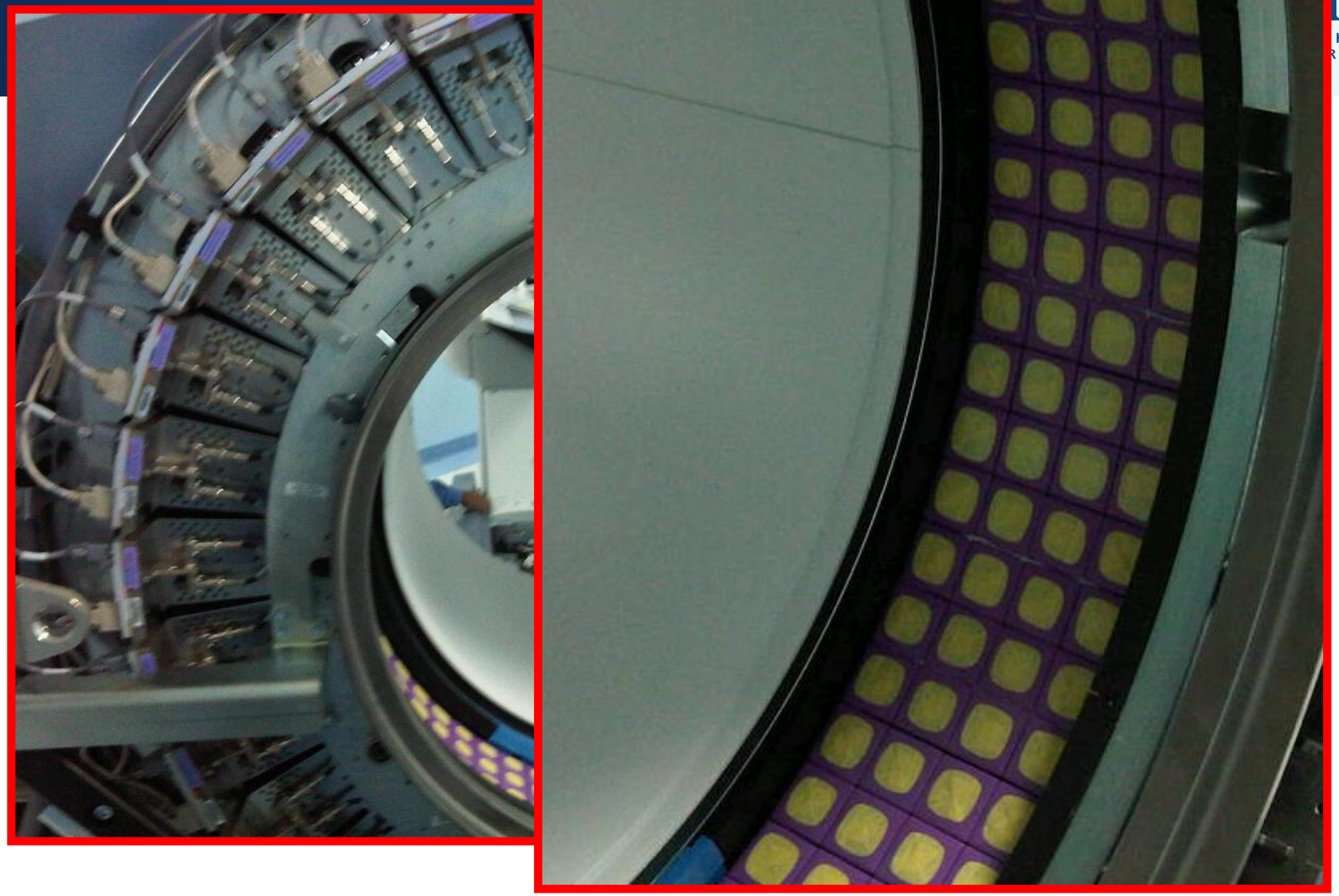

Cardiac PET technology: PMT

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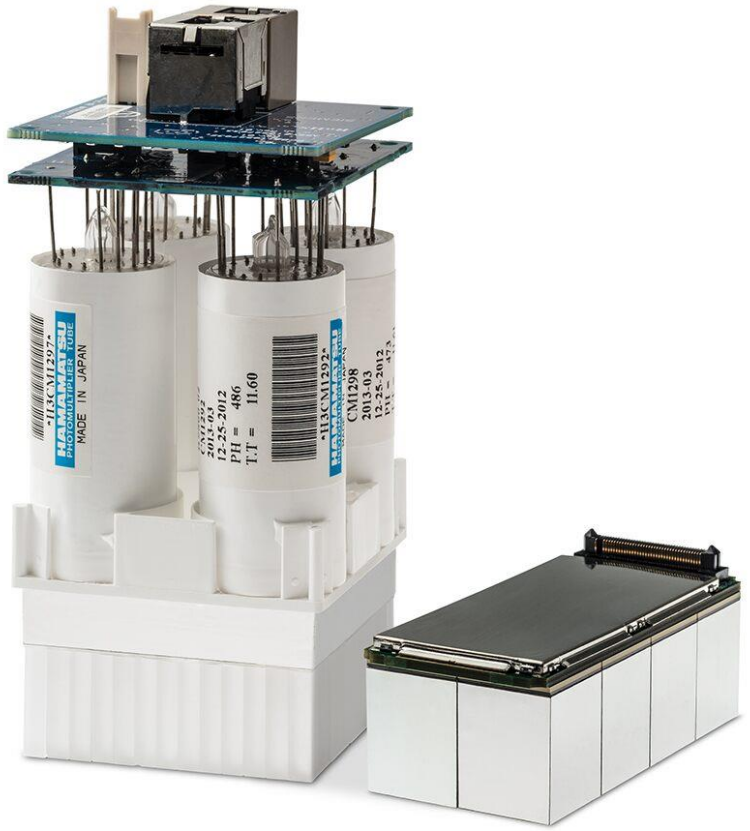

Innovations in Nuclear Cardiology

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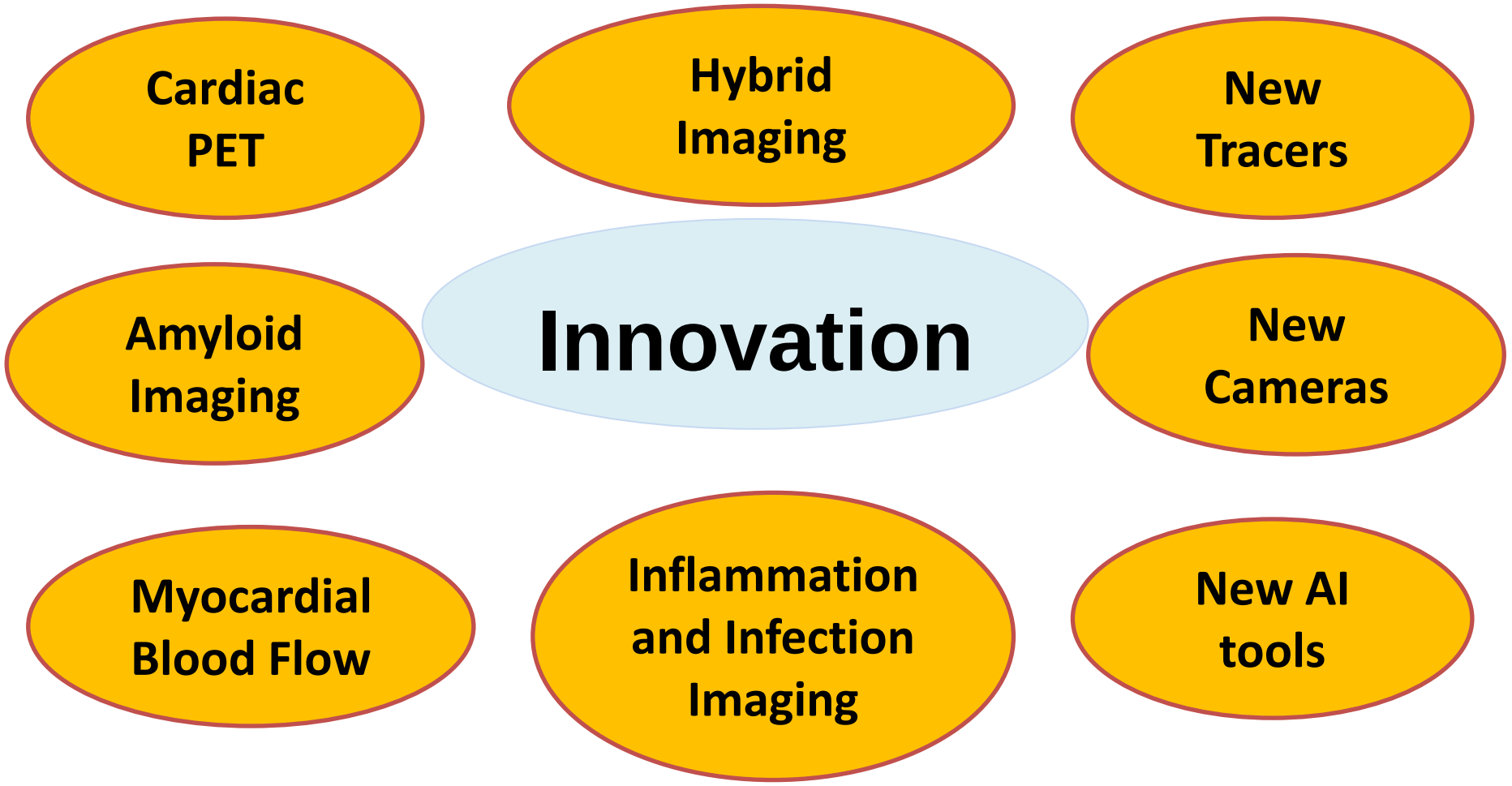


Radiology: Cardiothoracic Imaging

ORIGINAL RESEARCH

Cardiac Imaging Trends from 2010 to 2019 in the Medicare Population

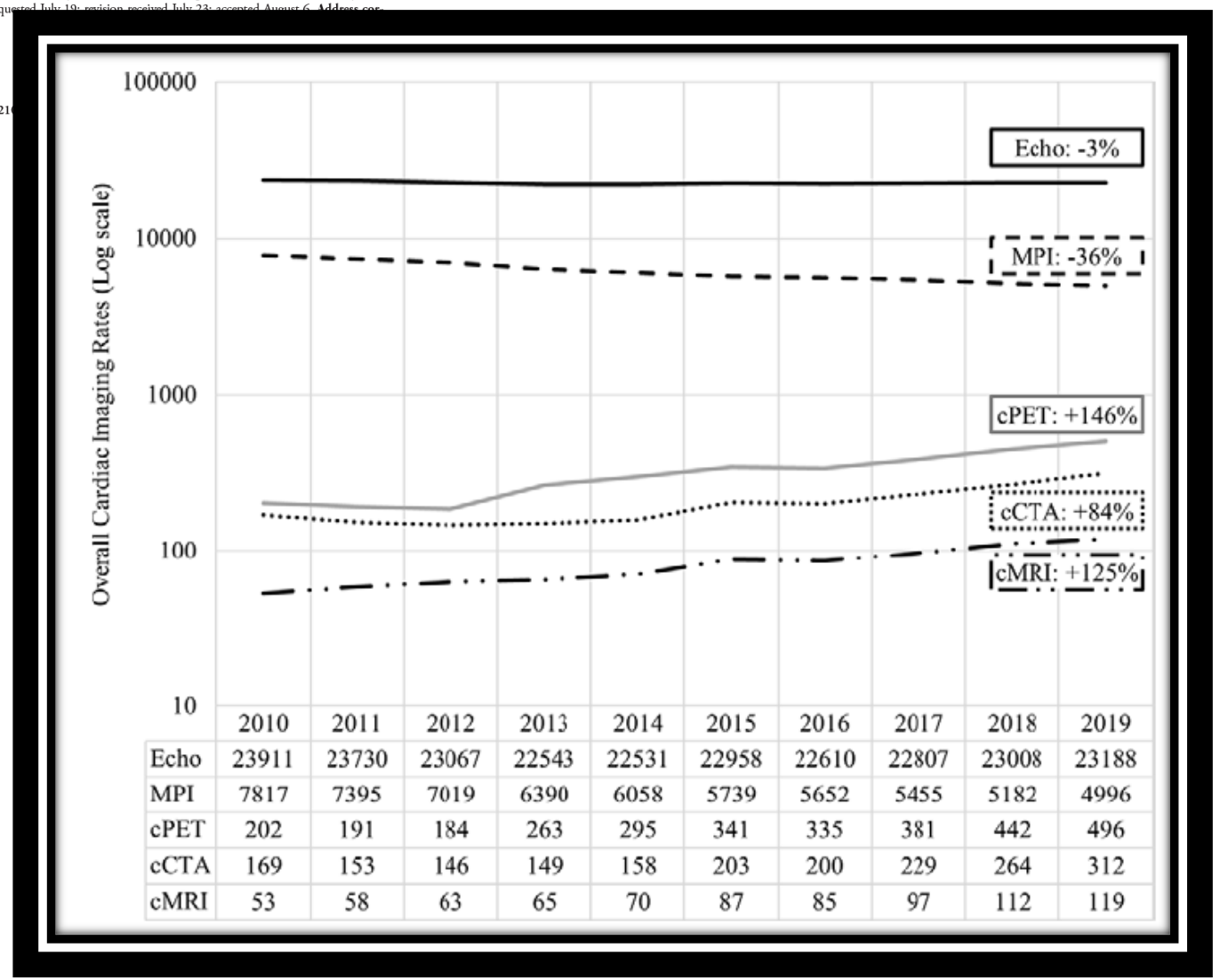
Russell A. Reeves, MD, MS • Ethan J. Halpern, MD • Vijay M. Rao, MD, FACR

From the Department of Radiology, Center for Research on Utilization of Imaging Service (CRUISE), Sidney Kimmel Medical College, Thomas Jefferson University, 132 S 10th St, Suite 1087, Main Bldg, Philadelphia, PA 19147. Received May 29, 2021; revision requested July 19; revision received July 23; accepted August 6. **Address correspondence to** R.A.R. (e-mail: *Russell.Reeves@Jefferson.edu*).

Authors declared no funding for this work.

Conflicts of interest are listed at the end of this article.

Radiology: Cardiothoracic Imaging 2021; 3(5):e210156 • https://doi.org/10.1148/ryct.202121(



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Echo	23911	23730	23067	22543	22531	22958	22610	22807	23008	23188
MPI	7817	7395	7019	6390	6058	5739	5652	5455	5182	4996
cPET	202	191	184	263	295	341	335	381	442	496
cCTA	169	153	146	149	158	203	200	229	264	312
cMRI	53	58	63	65	70	87	85	97	112	119

Why Cardiac PET MPI?

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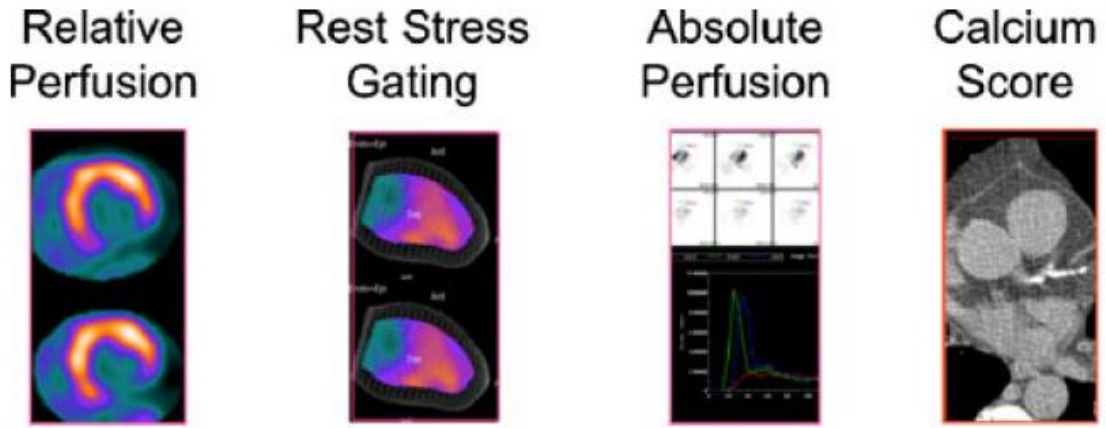
1. High diagnostic accuracy
2. Consistent high-quality images
3. Low radiation exposure
4. Short acquisition protocols
5. Quantification of myocardial blood flow
6. Strong prognostic power



Al-Mallah, M et al., J Nucl Cardiol 2010;17:498–513

Cardiac PET-CT Protocol
Rest - Stress ^{82}Rb MPI

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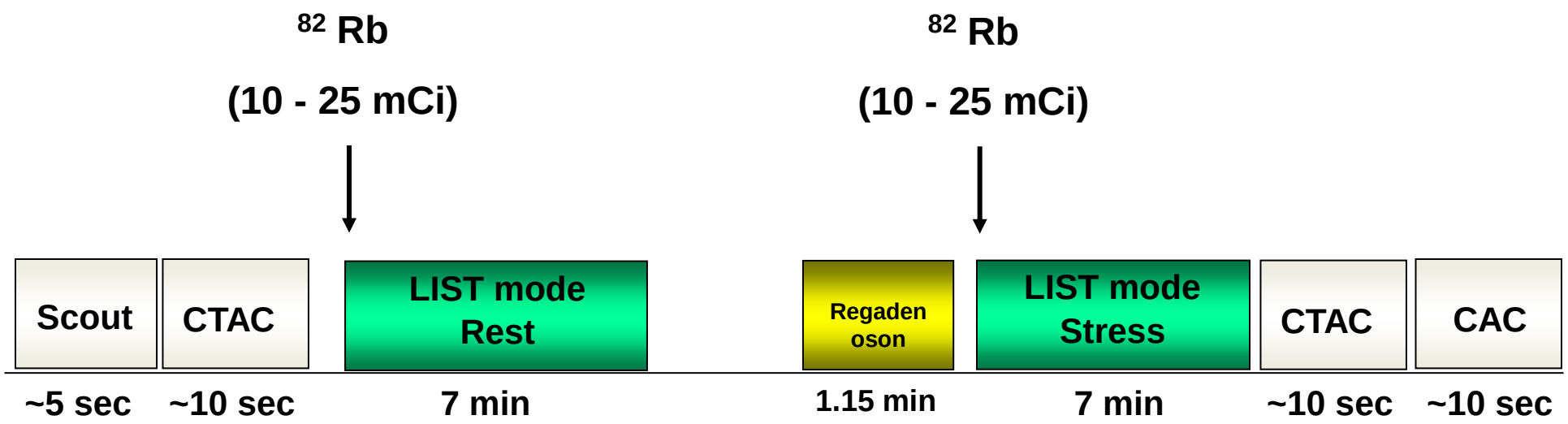
Regadenoson



~ 20 - 25 minutes

Other PET agents vs Flurpiridaz

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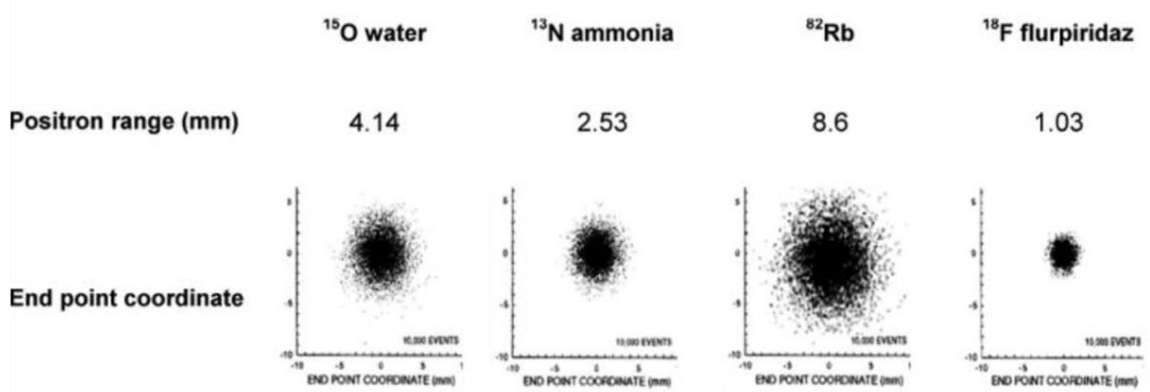
Table Characteristics of Various Cardiac PET Perfusion Tracers

	^{15}O Water	^{13}N Ammonia	^{82}Rb	Flurpiridaz F 18
Half-life (min)	2.06	9.96	1.25	109
Production	Onsite cyclotron	Onsite or nearby cyclotron	Generator	Regional cyclotron
Positron range (mm)	4.14	2.53	8.6	1.03
Image resolution	Intermediate	Intermediate-high	Lowest	Highest
Myocardial extraction fraction (%)	100	80	65	94
Perfusion defect contrast	Intermediate*	Intermediate	Lowest	Highest
Pharmacologic stress imaging protocol	Feasible	Feasible	Feasible	Feasible
Treadmill exercise imaging protocol	Not feasible	Feasible but not practical	Not feasible	Feasible

*Theoretically, 100% myocardial extraction fraction of ^{15}O water should result in the highest perfusion defect contrast. However, poor myocardial-to-background ratio reduces defect contrast.



[^{18}F] Flurpiridaz

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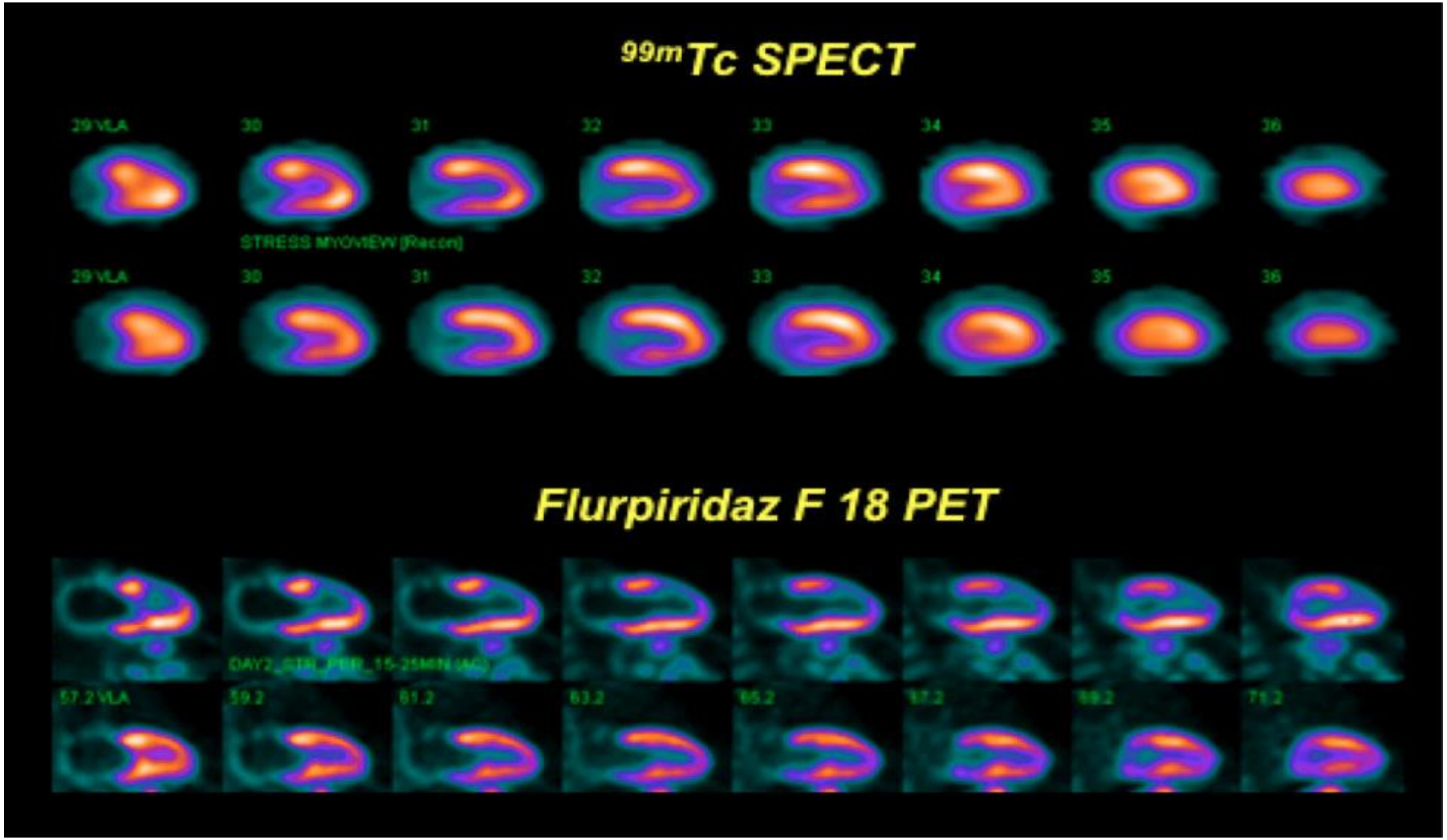

J Nucl Cardiol 2012;19:S30–7.

Not All Chest Pain is Obstructive Epicardial CAD

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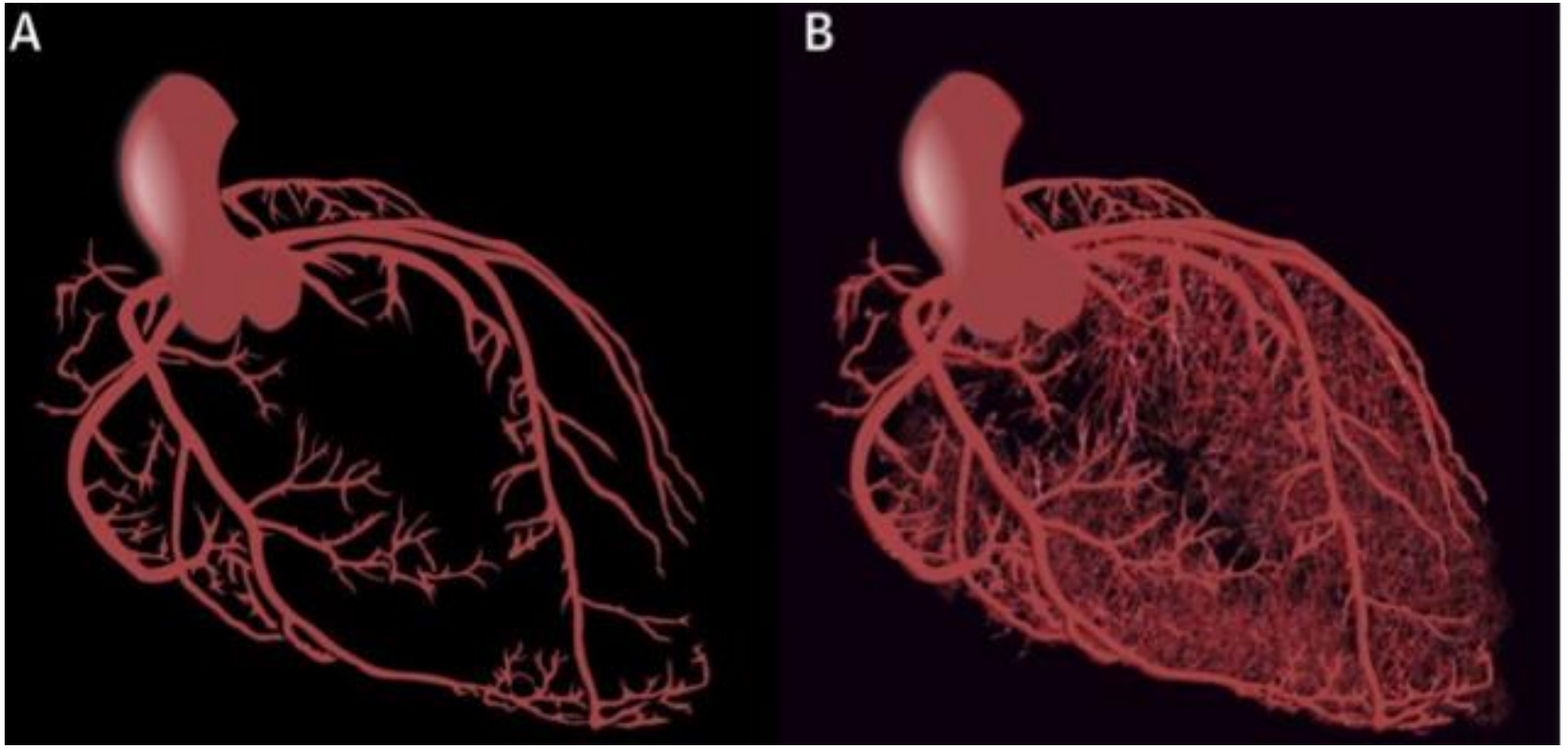
Coronary Circulation

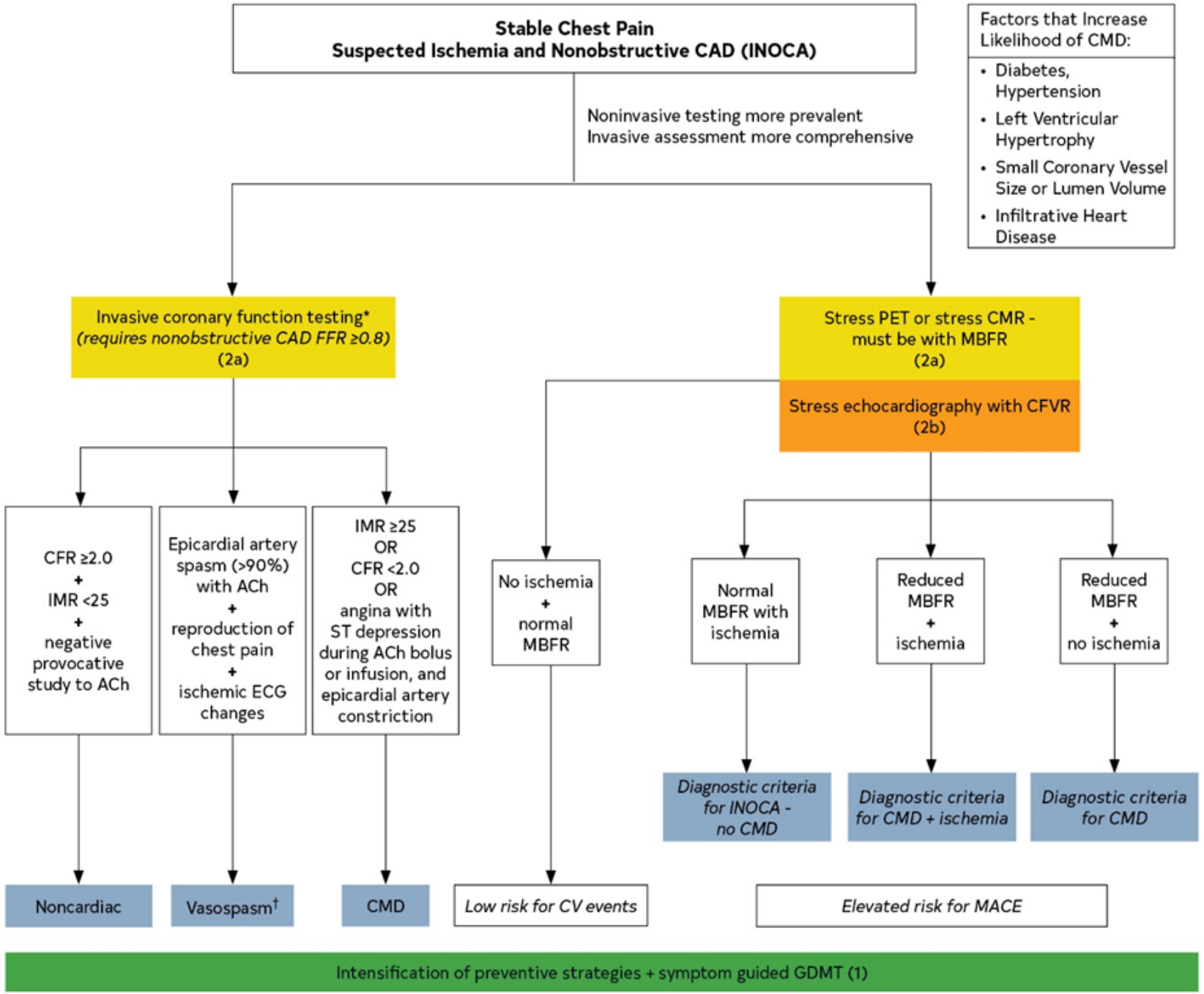


Macrocirculation

Macrocirculation & Microcirculation

Taqueti and Di Carli. J Am Coll Cardiol 2018;72:2625-41.

Clinical Decision Pathway for INOCA



Non-Coronary Applications

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Viability Imaging

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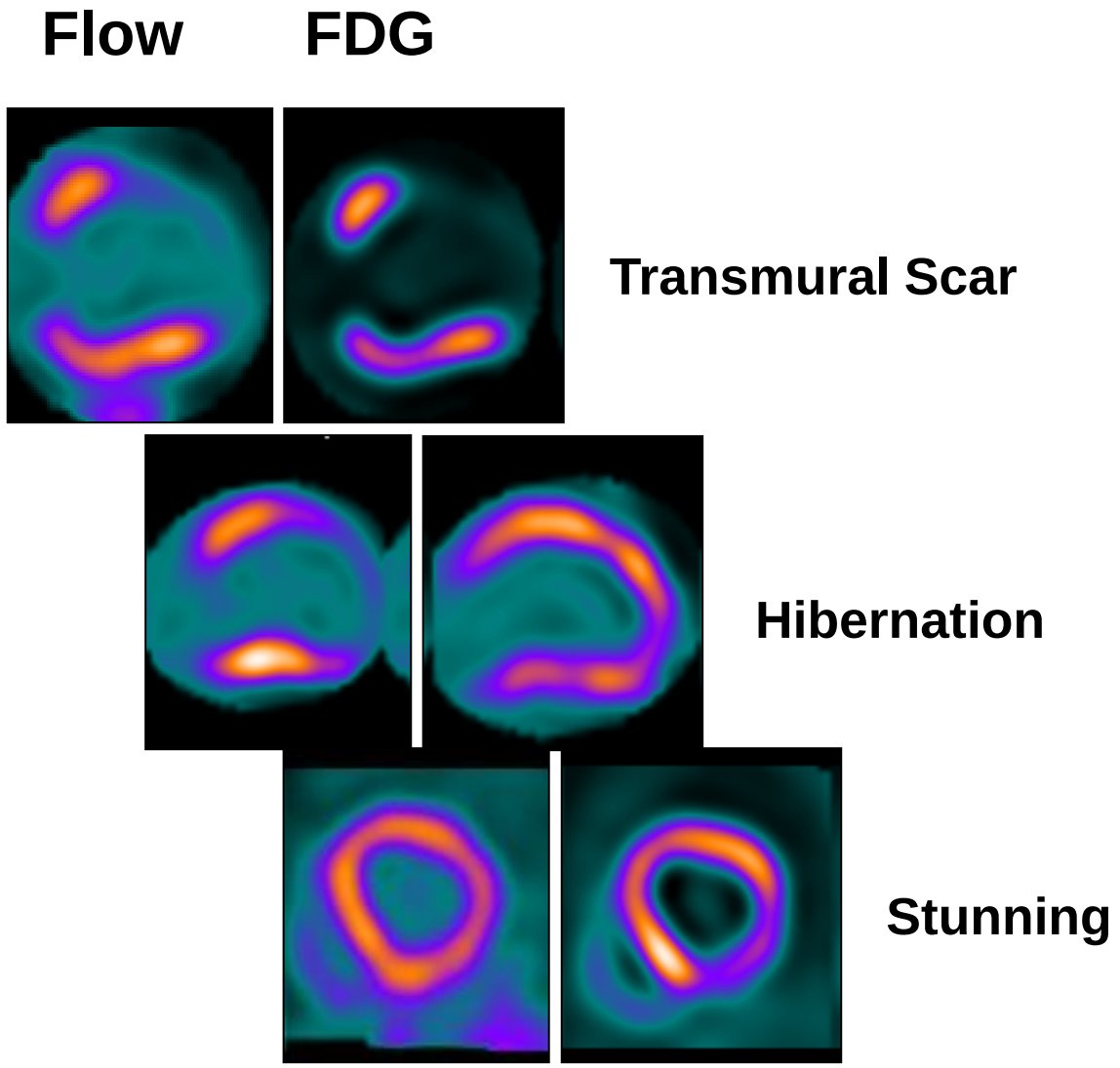

Cardiac Inflammation ^{18}F-FDG PET

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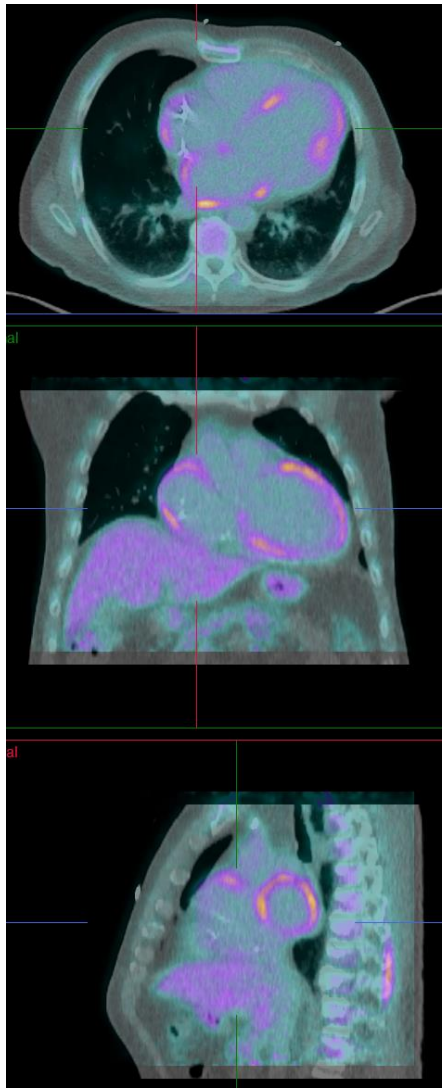

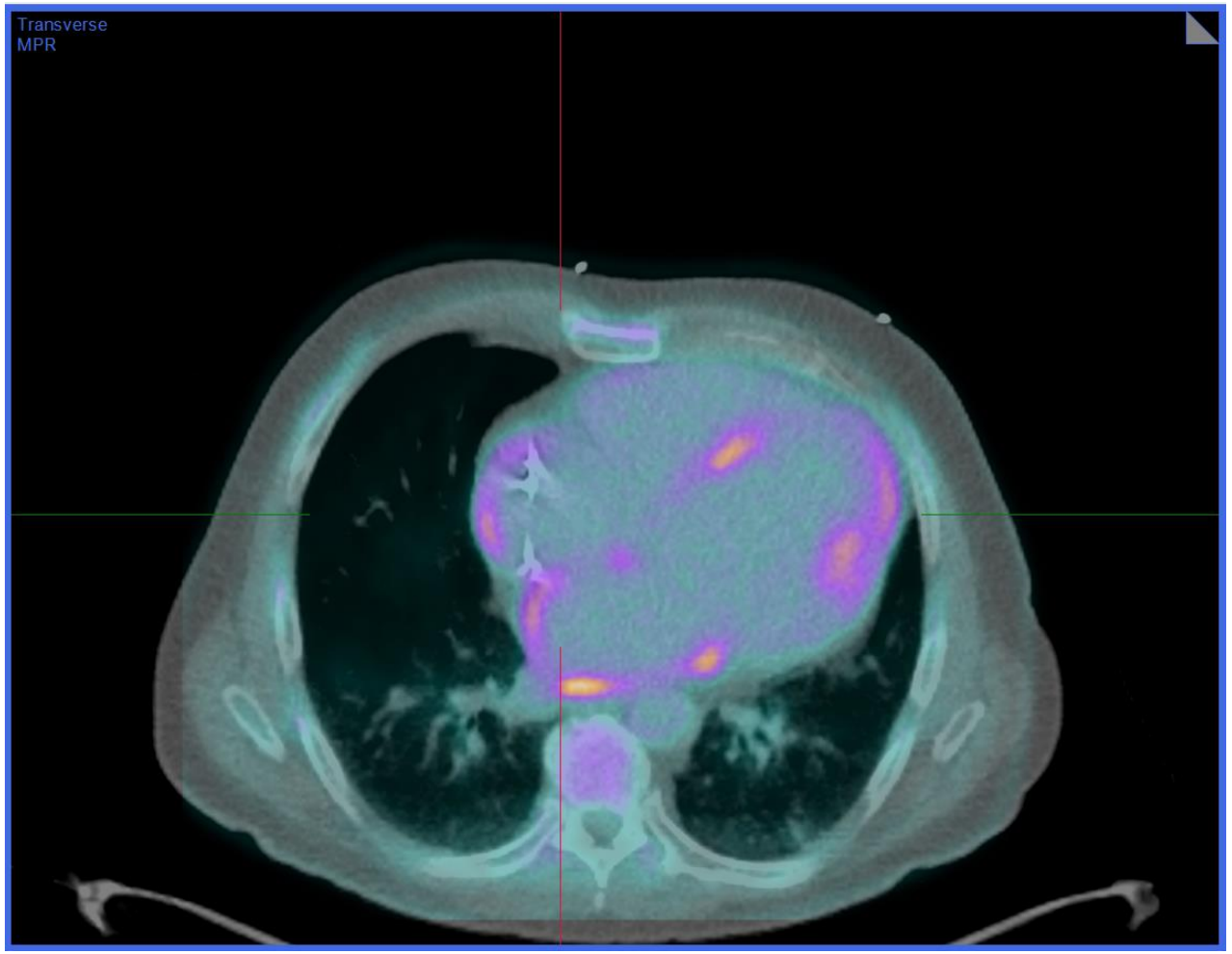

Extracardiac Sarcoidosis

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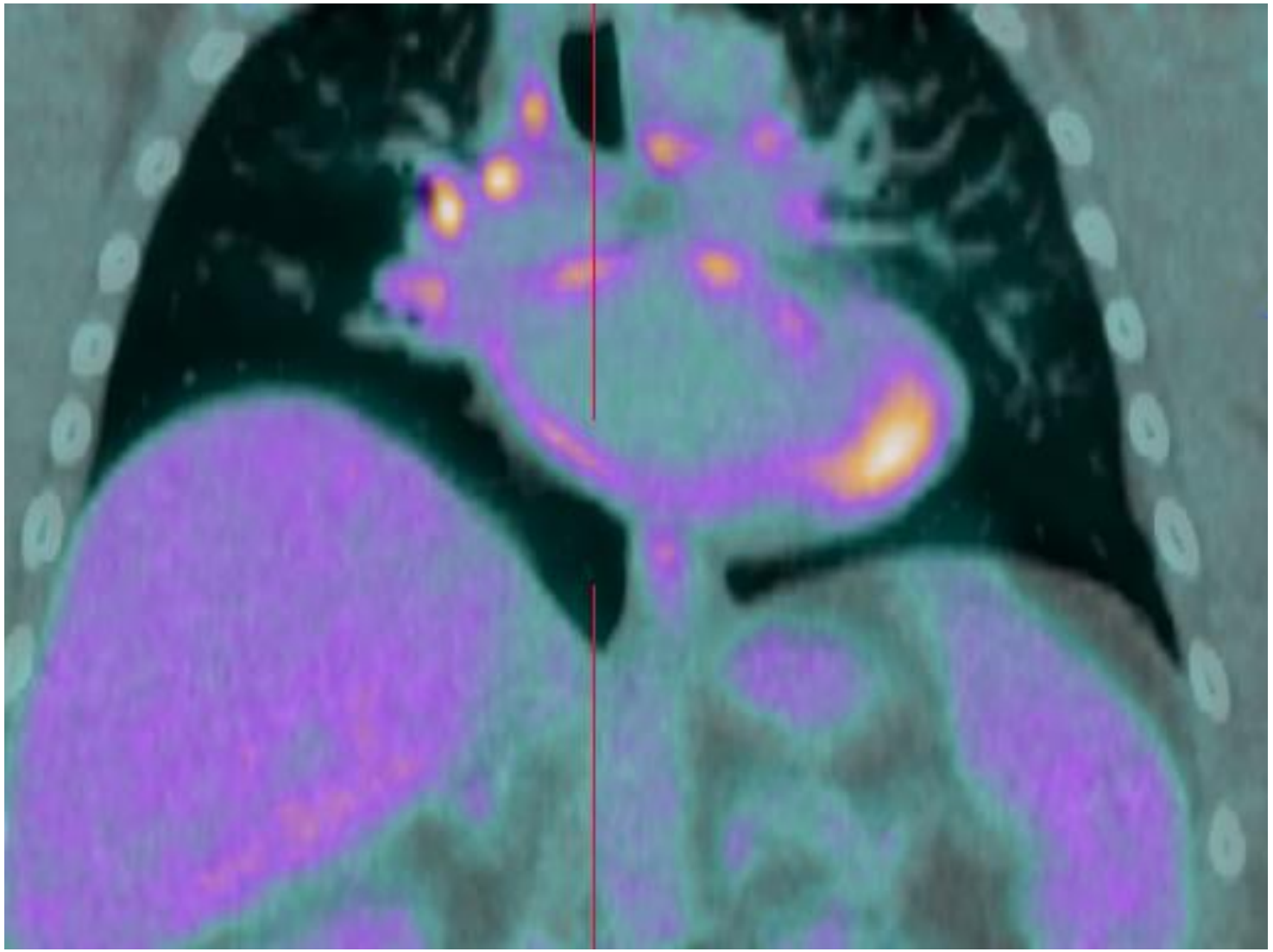

Cardiac Inflammation PET/MRI

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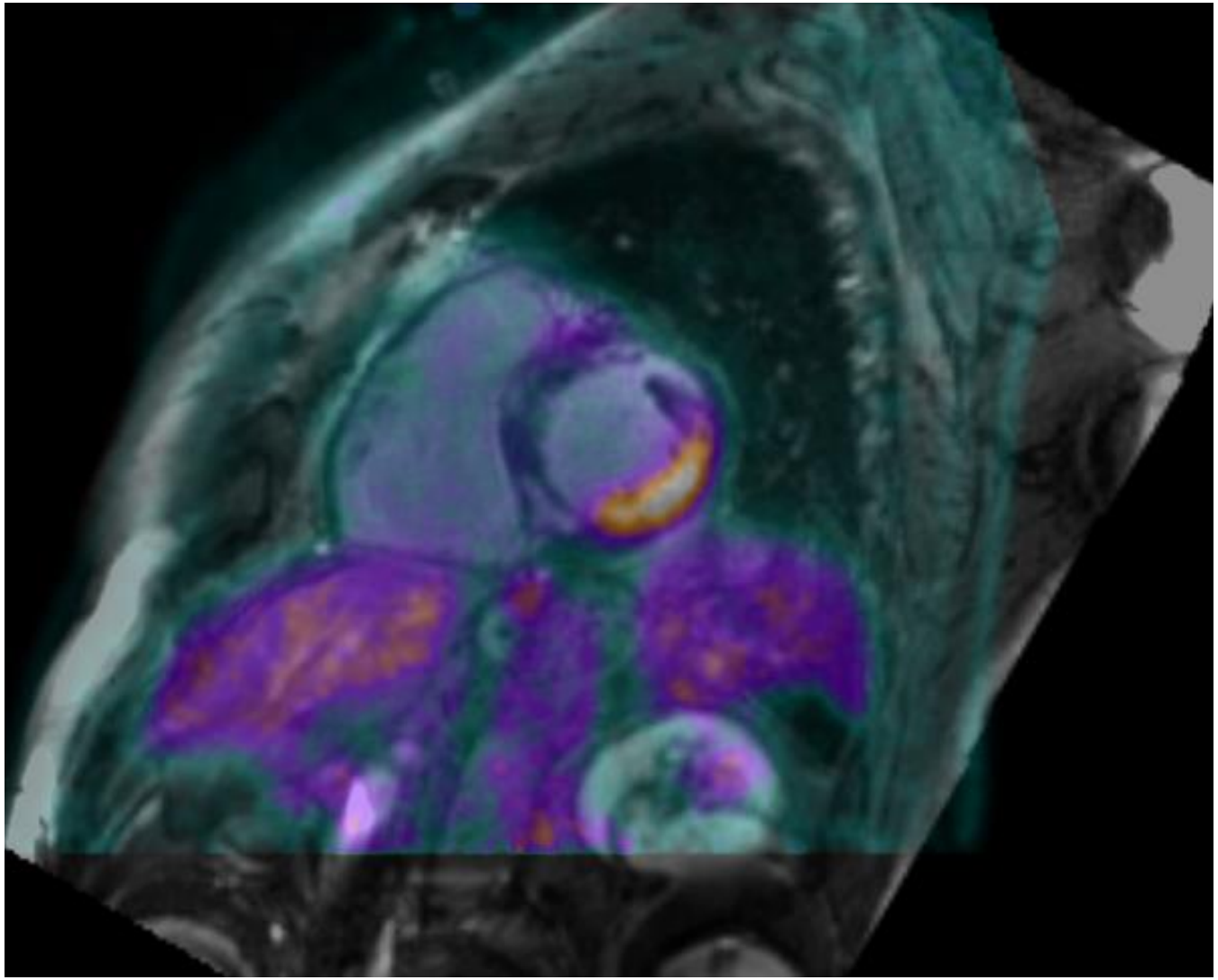

Impact of Therapy

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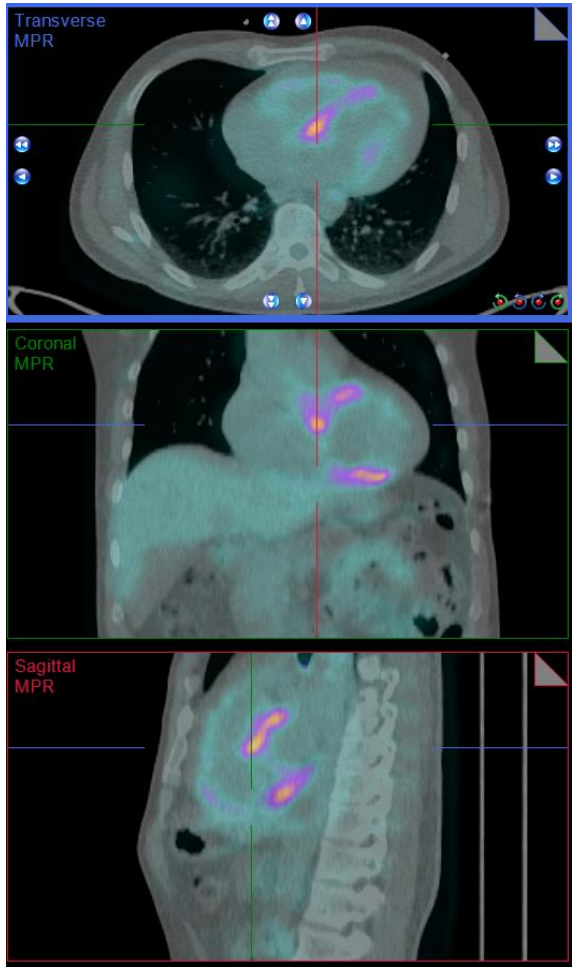
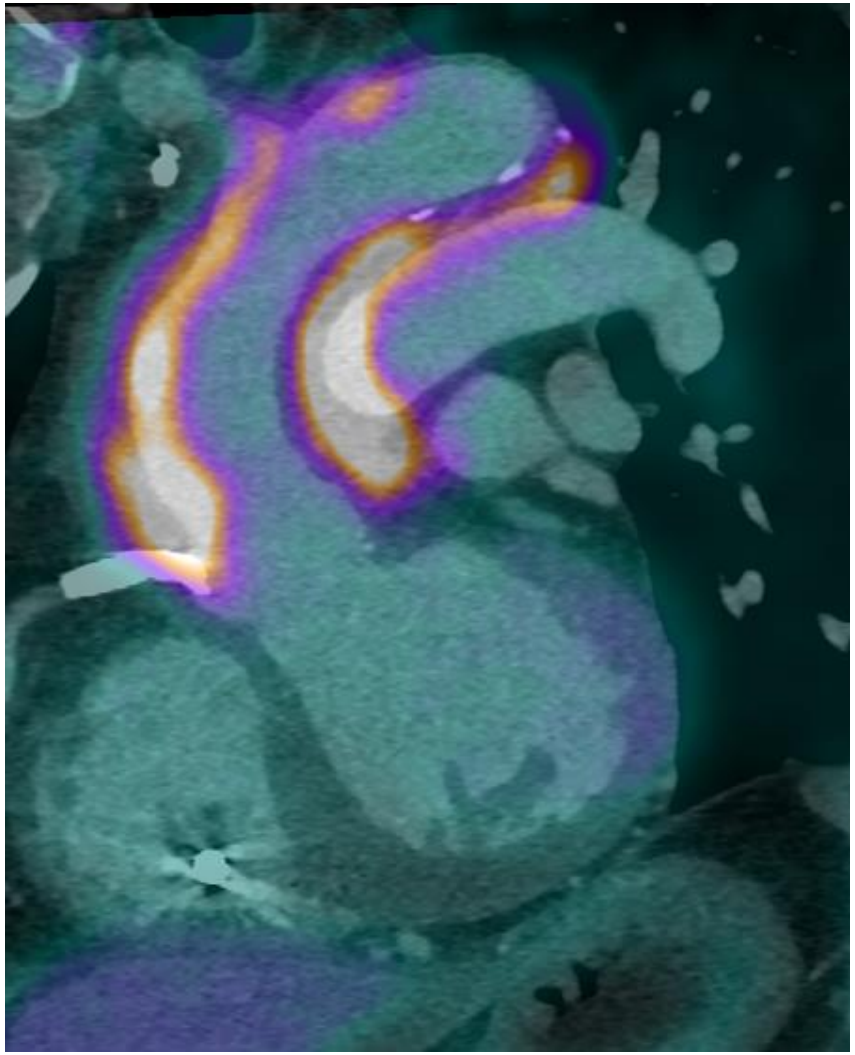


Pre therapy

Post therapy

Aortitis



PET/ CT in Endocarditis

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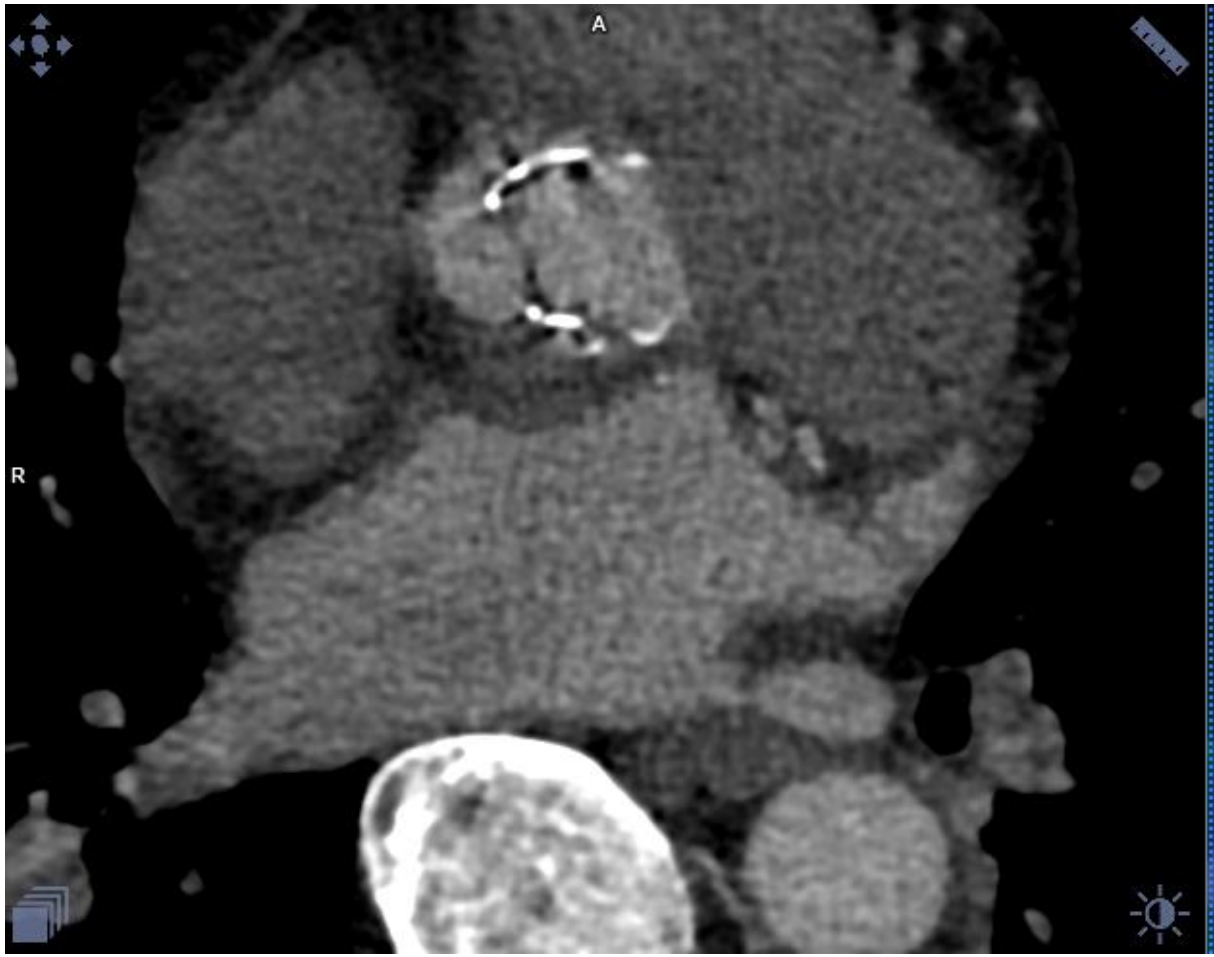

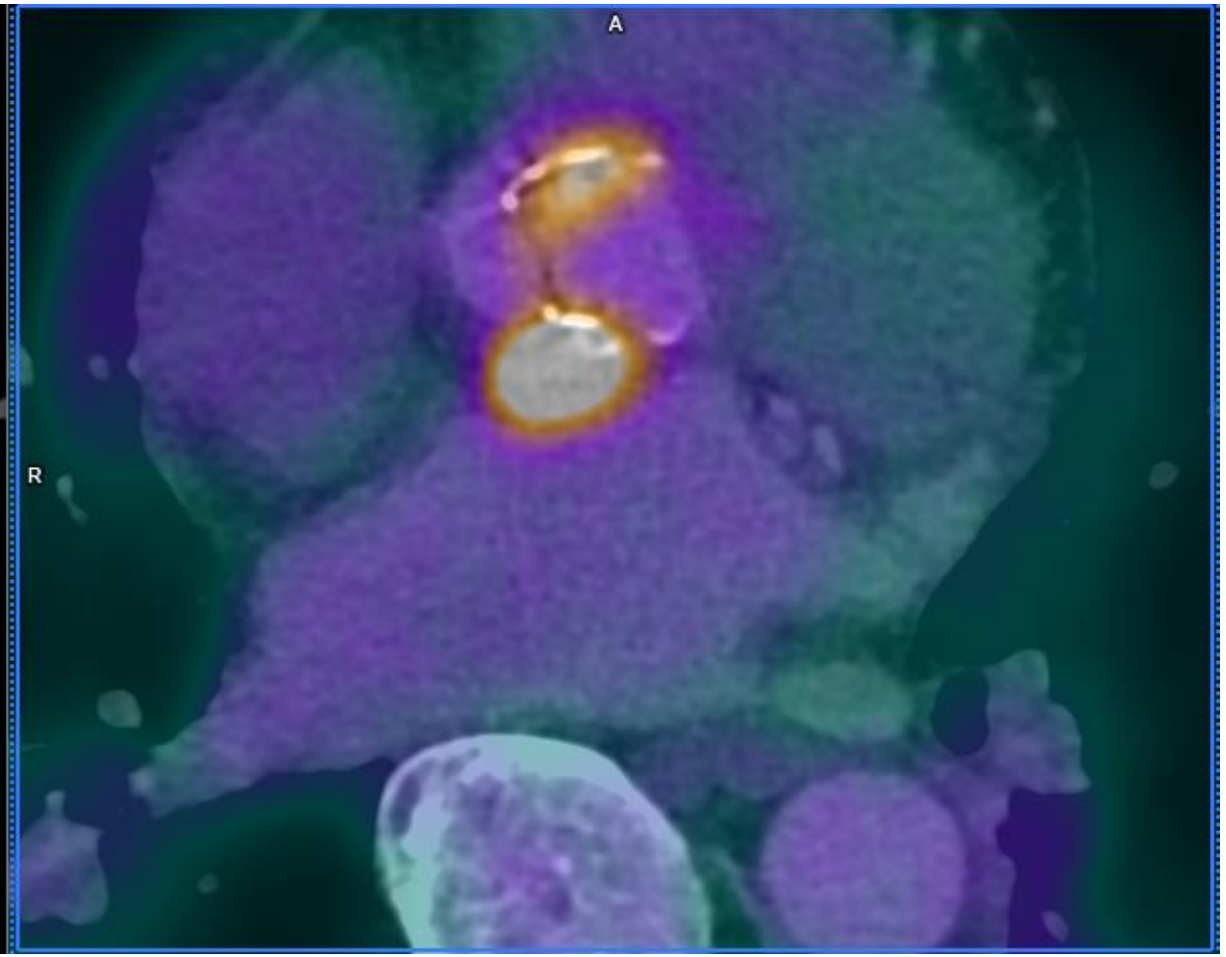

Pacemaker Infection

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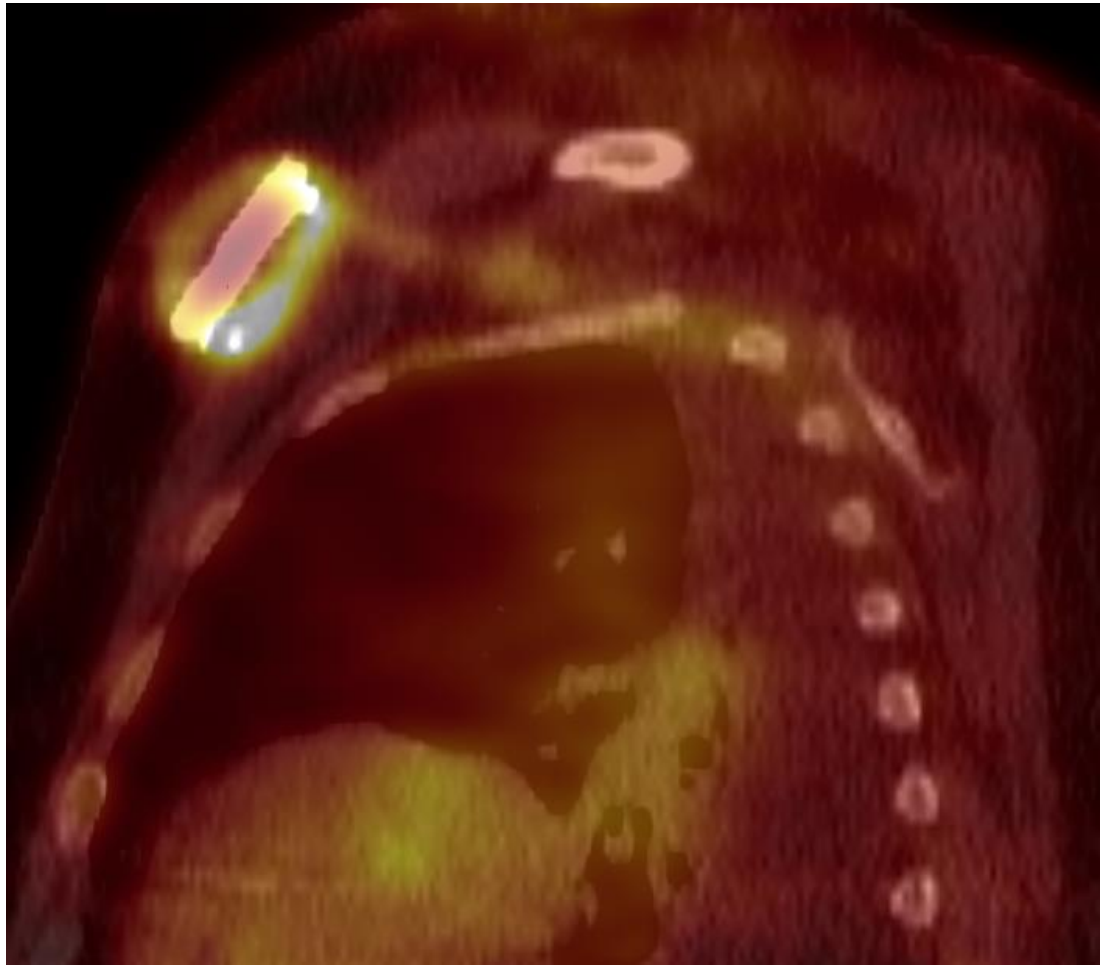

FDG PET/CT- Outflow Cannula

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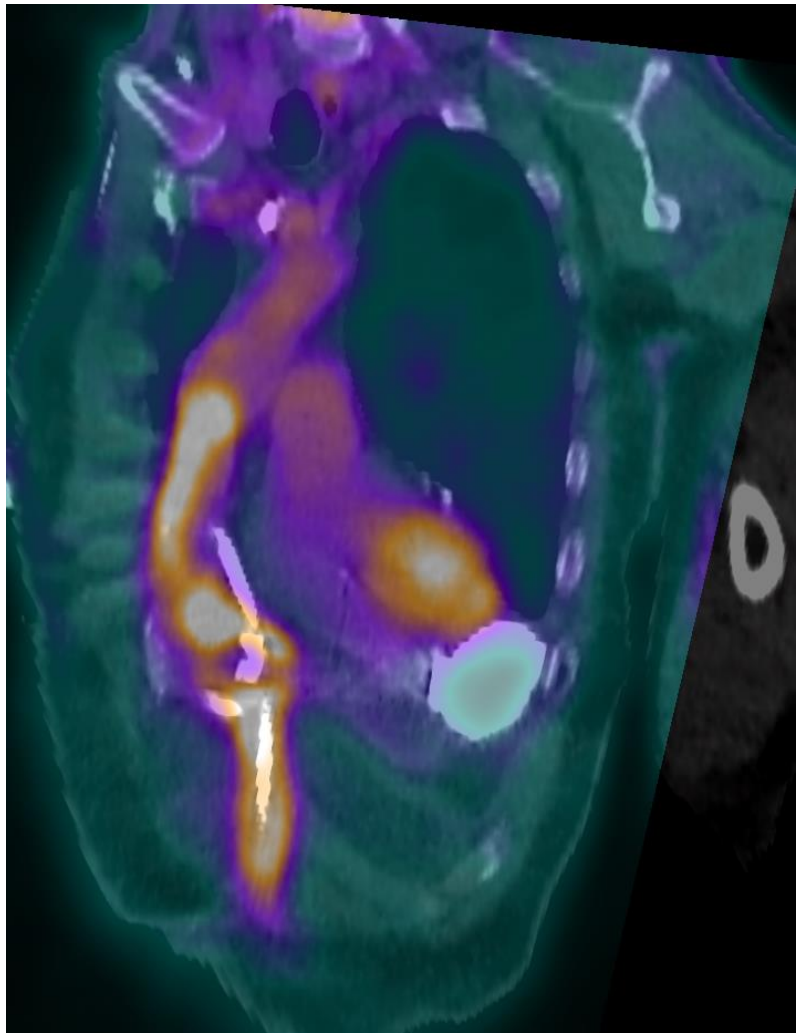

#CVNuc

FDG PET/CT - Driveline

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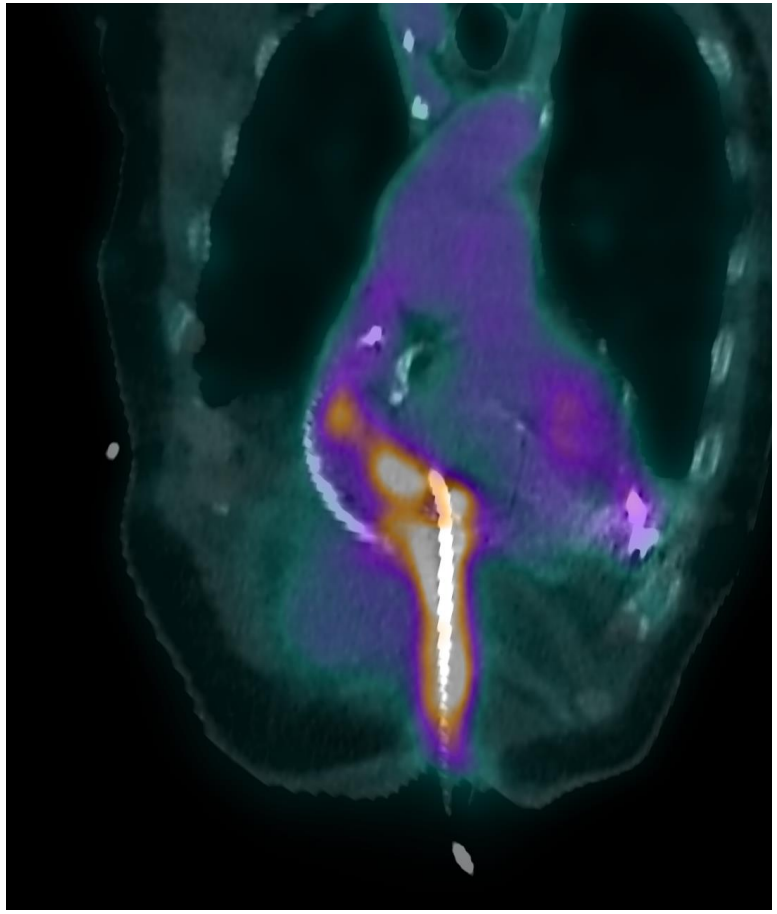

Future Applications

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Amyloid PET Tracers
F-18 Florbetapir

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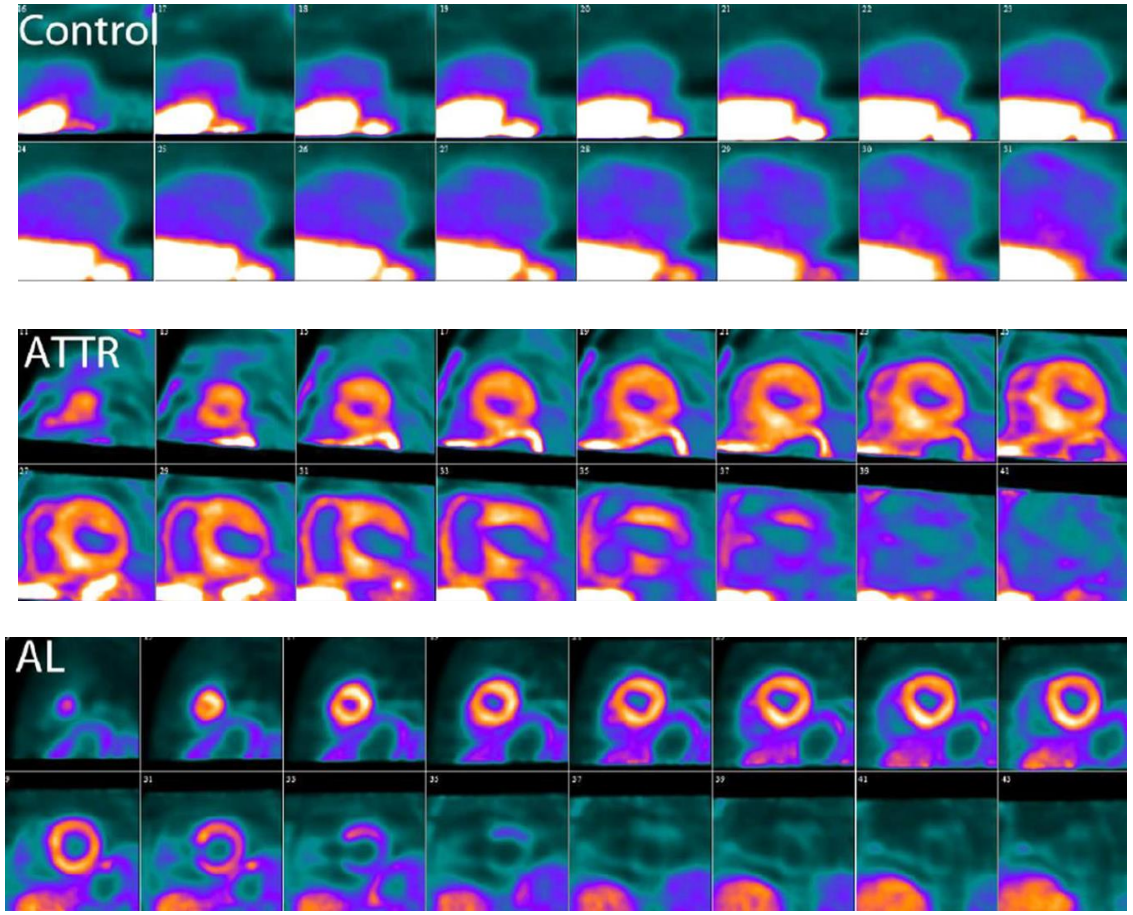

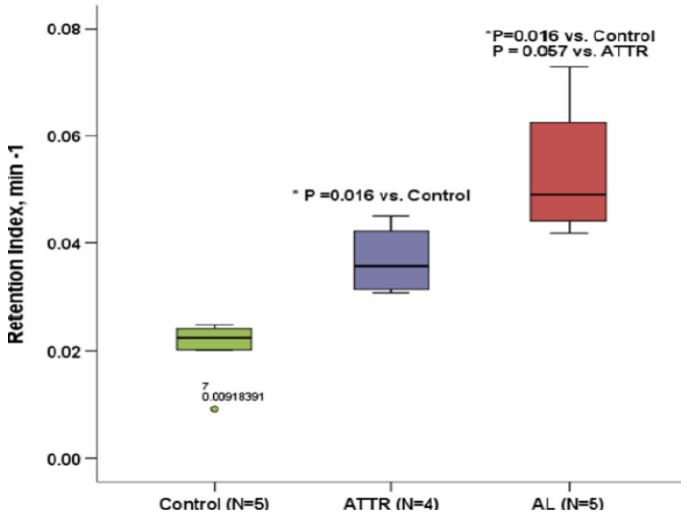

Methods measuring PET tracer uptake

- Dynamic: such as myocardial tracer retention index (RI)
- static: SUV and TBR

Dorbala et al. *CircCV imag* 2014

Fluorine-18–Sodium Fluoride Uptake in Valvular Aortic Stenosis

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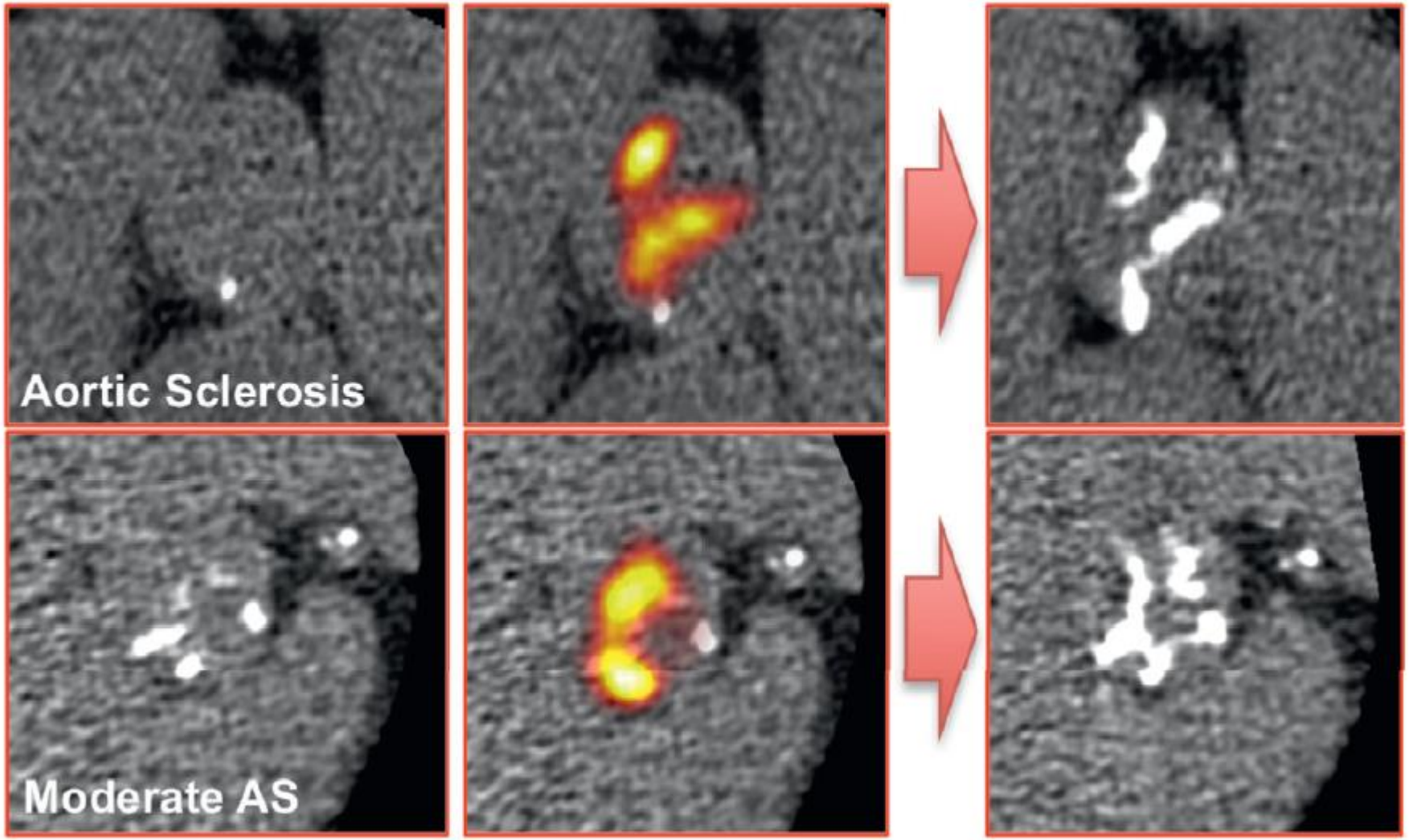

J Am Coll Cardiol. 2015; 1 1 9 8 – 2 0 5.

Cardiac PET

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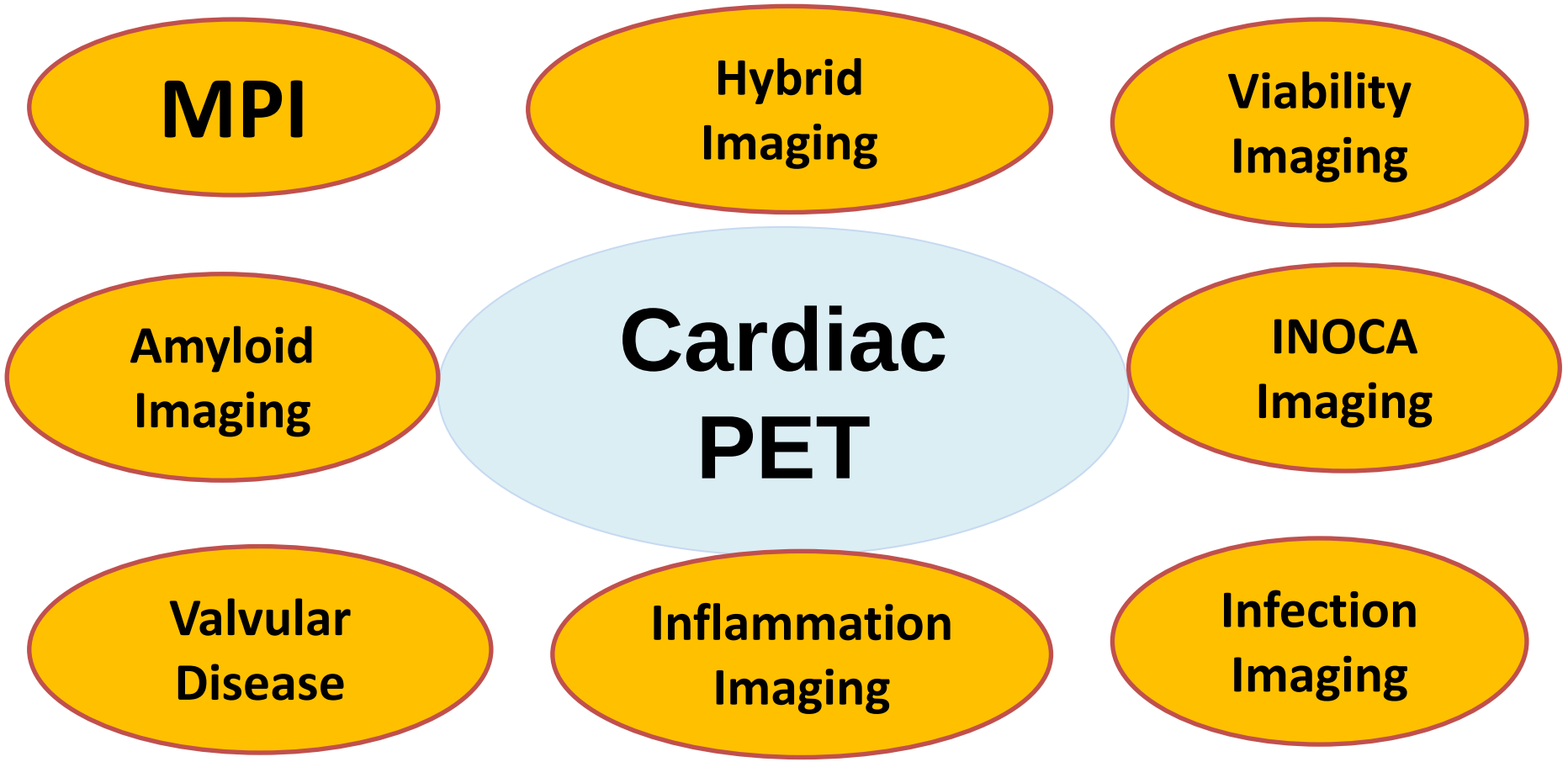

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