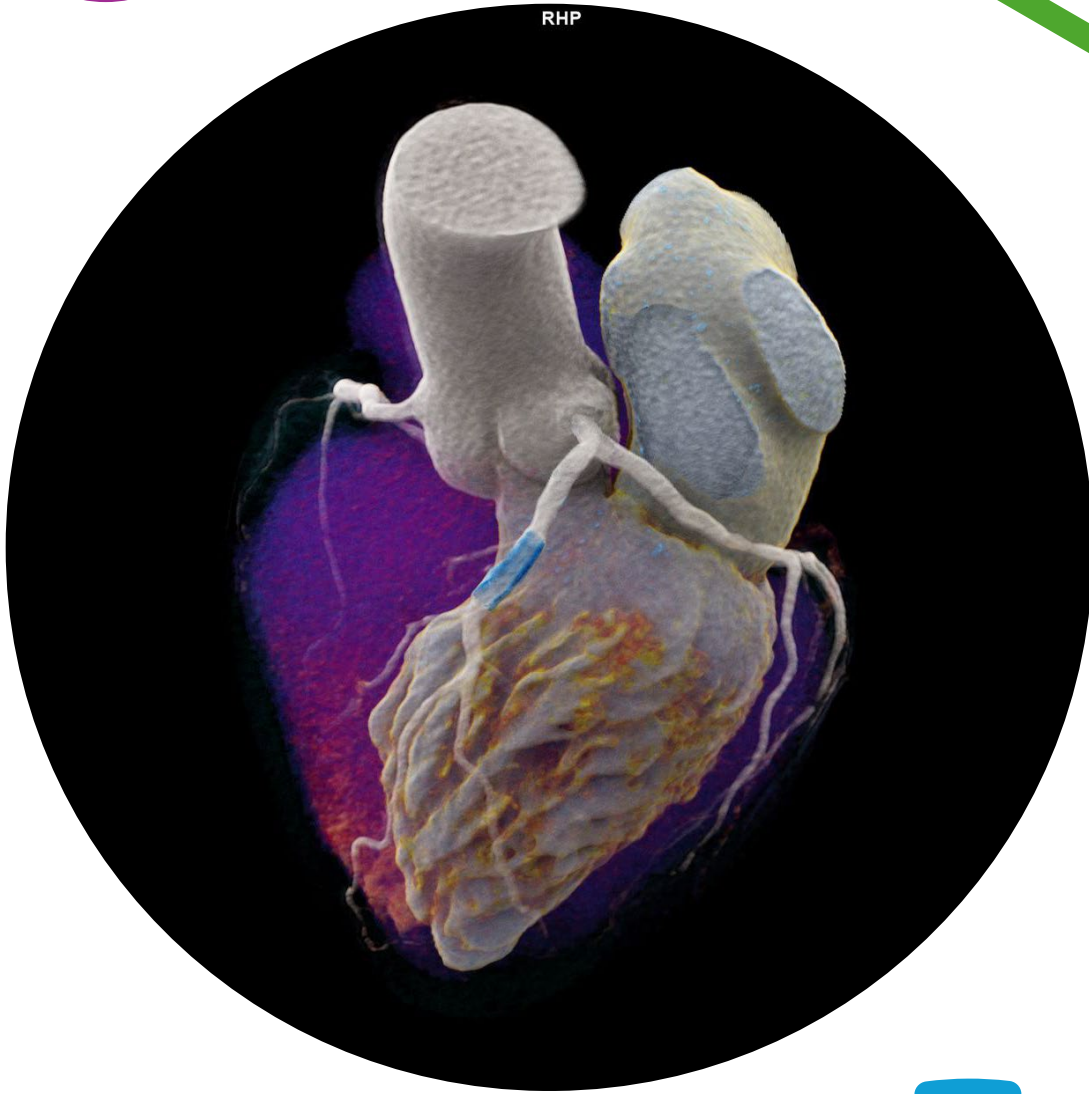# Coronary CT anatomy and plaque morphology: a full evaluation of coronary disease
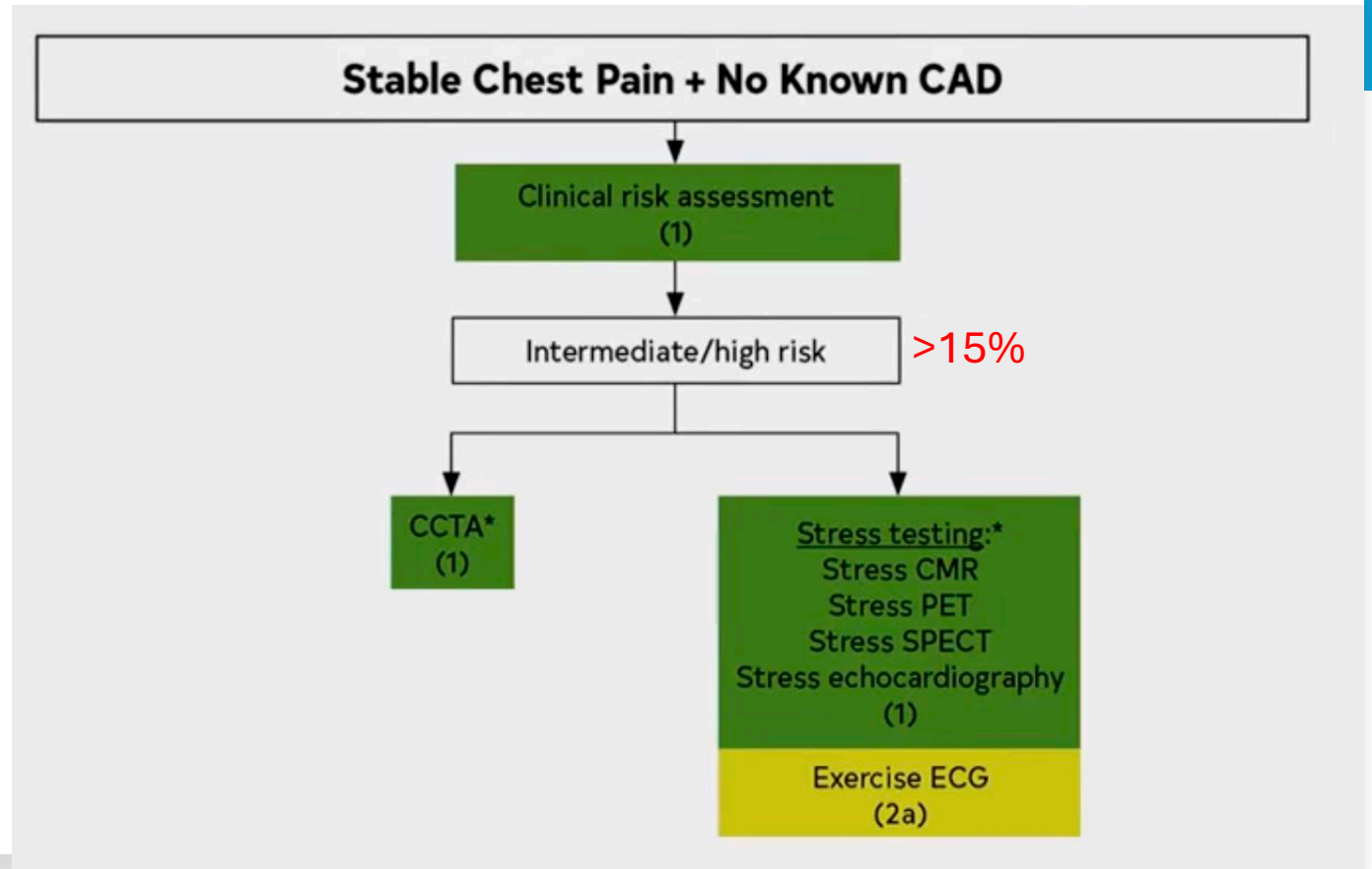
Angelina Zhyvotovska, MD

65 year old patient with PMHx of HTN and HLD presents with complains of chest pressure

- The chest pressure is worsened with exertion, sometimes when he is doing yard work. It has been present for a year now.

- No prior CAD

- Medications: Atorvastatin 10 mg PO daily, Lisinopril 5 mg PO daily.

- EKG: Normal
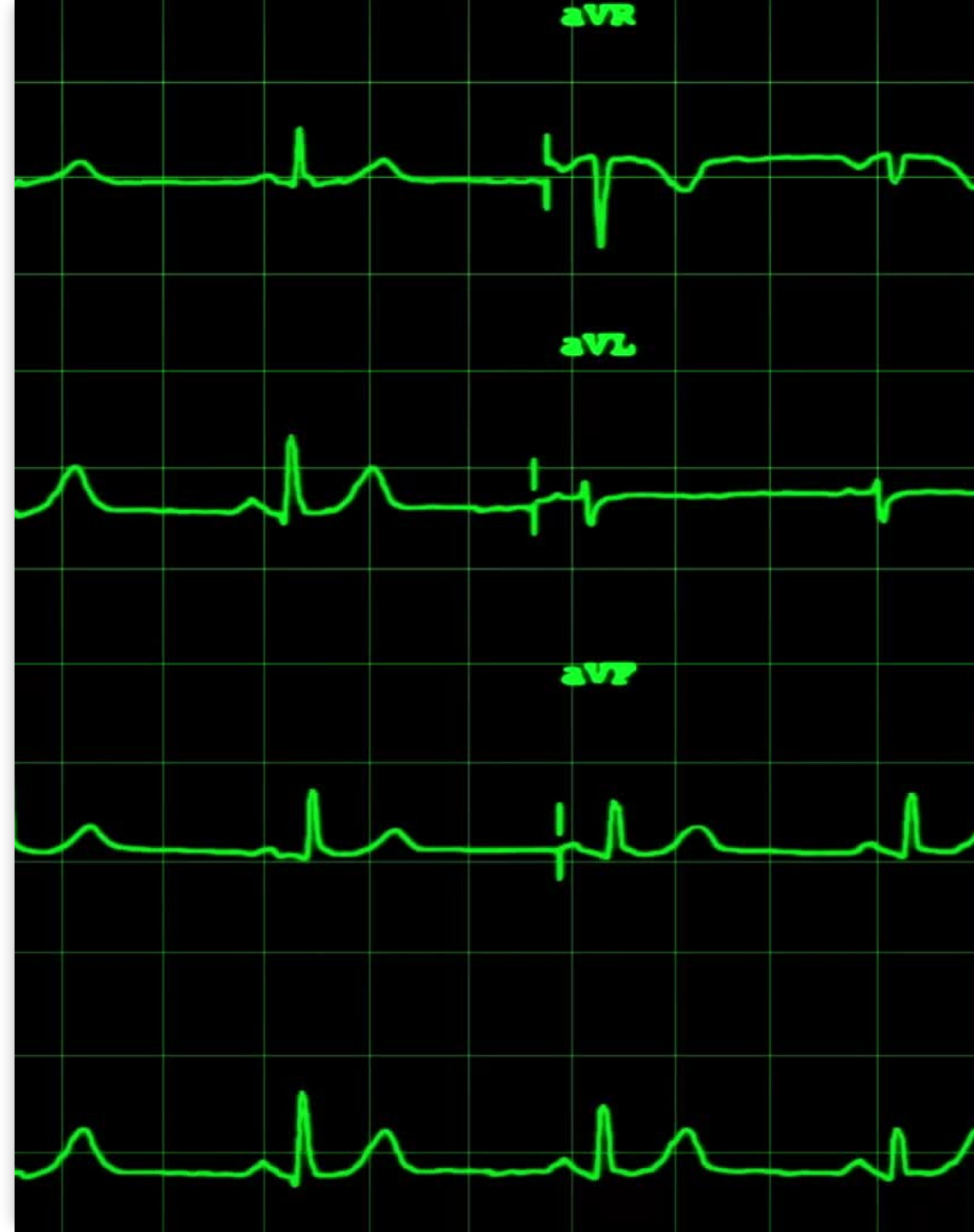
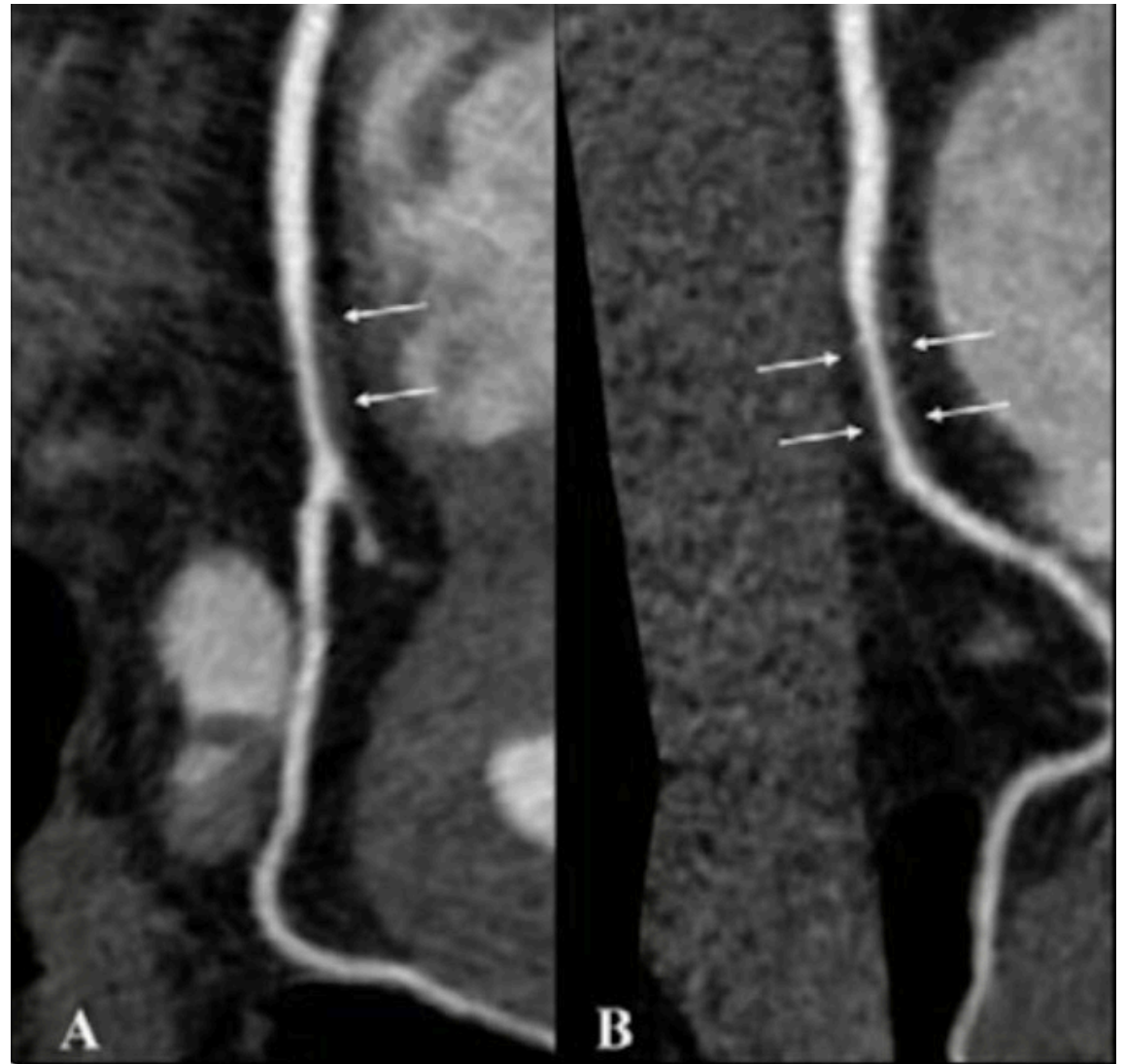# 2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR chest pain guidelines

- CT is preferable in patients <65 years of age and not on optimal preventative therapy.

- Prior inconclusive stress testing

- To rule out obstructive CAD

Stable Chest Pain + No Known CAD

Clinical risk assessment (1)

Intermediate/high risk — >15%

CCTA* (1)

Stress testing:*
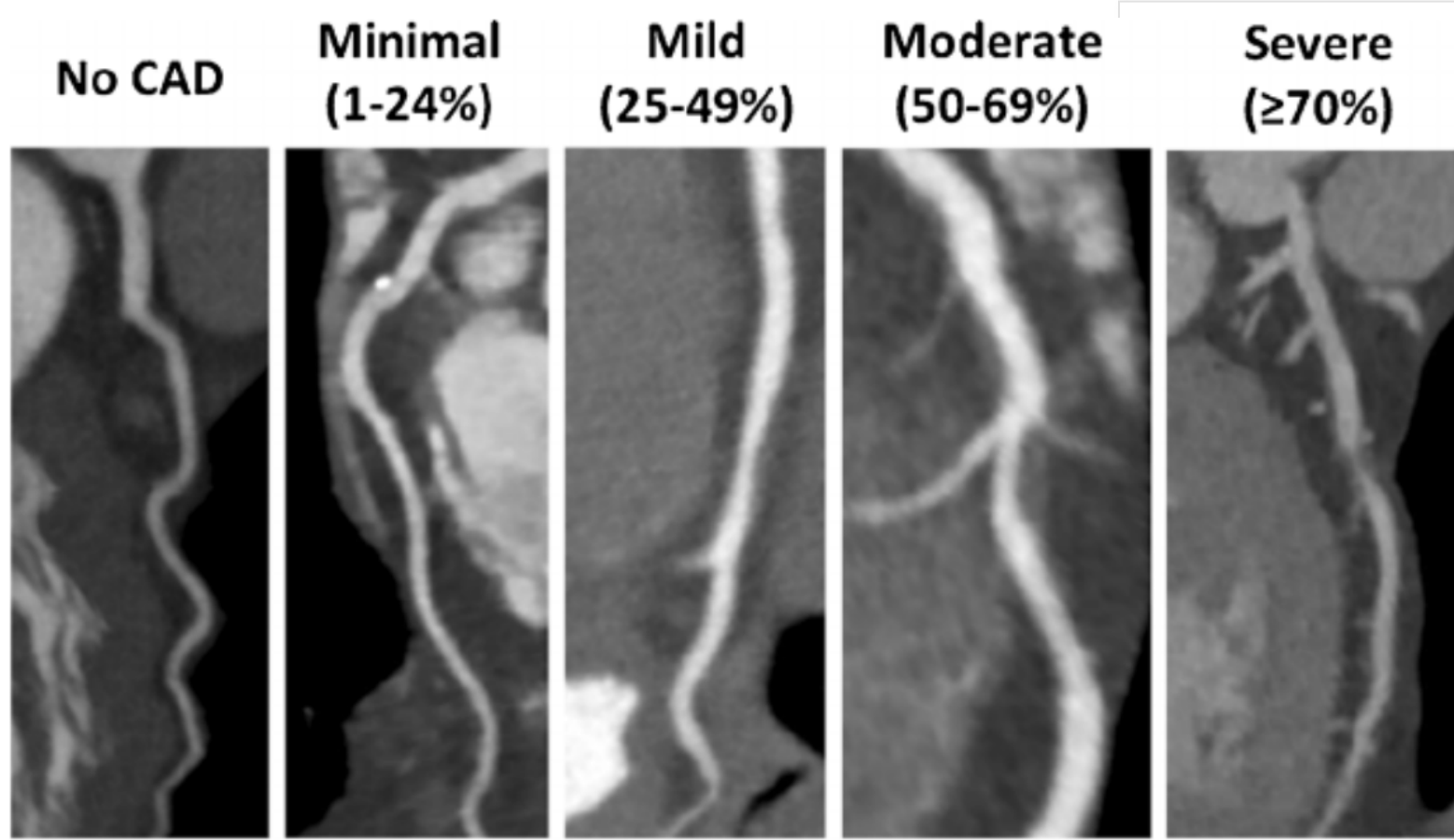Stress CMR
Stress PET
Stress SPECT
Stress echocardiography (1)

Exercise ECG (2a)

Our patient

- Has this smooth, moderate non calcific stenosis (50-69%) in mid RCA

Coronary CTA: stenosis degree

Class I, LOA A indication for coronary CT in guidelines in stable and acute chest pain in intermediate to high-risk patients.

Stable chest pain

1	A	1. For intermediate-high risk patients with stable chest pain and no known CAD, CCTA is effective for diagnosis of CAD, for risk stratification, and for guiding treatment decisions (1-12).

Acute chest pain

1	A	1. For intermediate-risk patients with acute chest pain and no known CAD eligible for diagnostic testing after a negative or inconclusive evaluation for ACS, CCTA is useful for exclusion of atherosclerotic plaque and obstructive CAD (1-11).

Coronary CT is NOT appropriate for all patients

- Morbid obesity >50 kg/m2
- Small stents
- Severe coronary calcifications
- Bypass grafts in relation to their insertion points
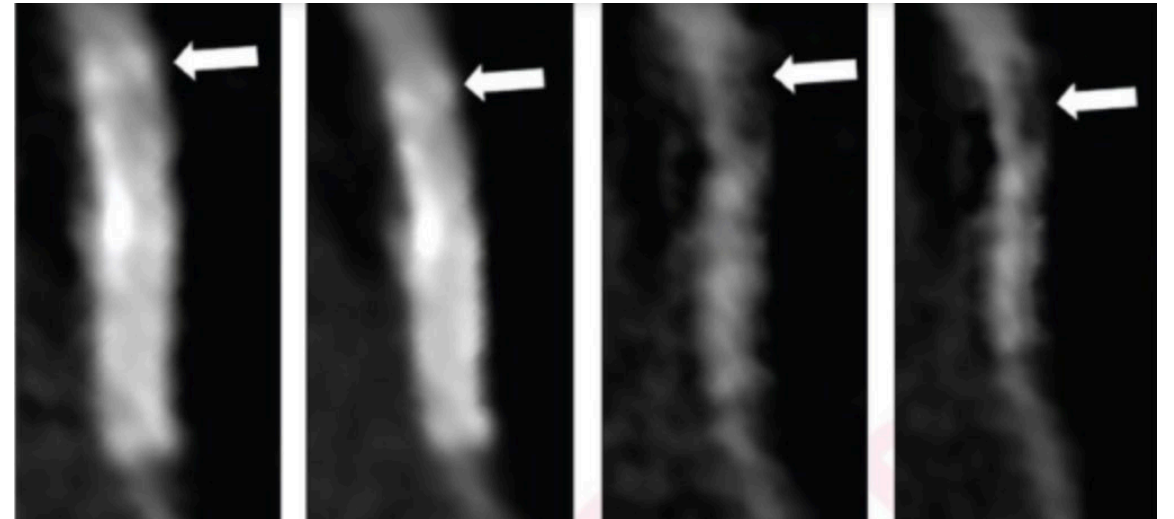
Advantages of coronary CT

- High negative predictive value

- Detects non-obstructive plaque

- It is a safe and rapid test

CAD-RADS 2 plaque reporting

Table 1: Grading scale for stenosis severity, plaque burden and ischemia.*

Degree of luminal diameter stenosis	Terminology
0%	No visible stenosis
1–24%	Minimal stenosis
25–49%	Mild stenosis
50–69%	Moderate stenosis
70–99%	Severe stenosis
100%	Occluded

Grading Scale for plaque burden:

Terminology	Overall plaque burden
P1	Mild amount of plaque
P2	Moderate amount of plaque
P3	Severe amount of plaque
P4	Extensive amount of plaque

Table 2: Different methods to categorize the overall amount of coronary plaque.

|	Overall amount of coronary plaque	CAC	SIS*	Visual*
P1	Mild	1–100	≤2	1-2 vessels with mild amount of plaque
P2	Moderate	101–300	3–4	1 -2 vessels with moderate amount; 3 vessels with mild amount of plaque
P3	Severe	301–999	5–7	3 vessels with moderate amount; 1 vessel with severe amount of plaque
P4	Extensive	>1000	≥8	2-3 vessels with severe amount of plaque

Patients with severe coronary plaque burden

Antiplatelet therapy
- All ASCVD: aspirin 81 mg/day indefinitely
- After ACS or PCI: DAPT for 12 months duration may be adjusted based on bleeding or thrombosis risk factors

Cholesterol
- High dose or maximally tolerated statin for LDL reduction of ≥50%
- Goal LDL <1.81 mmol/l per AHA/ACC guidelines (or <1.42 mmol/l per ESC guidelines) for high-risk patients
- Add-on therapy of ezetimibe (and PCSK9 inhibitor as needed) to achieve goal

Diet
- Mediterranean, DASH or healthy vegetarian diets

Diabetes management
- Goal HbA$_{1c}$ of <7% if it can be achieved without hypoglycaemia
- Consider SGLT2 inhibitor and GLP1-RA for CVD prevention

Exercise
- 150 min/week of moderate-intensity exercise (or 75 min/week of vigorous-intensity exercise)

Cardiac rehabilitation
- After MI, revascularisation, angina or HF

Smoking cessation
- Counselling, Five As and pharmacotherapy

Hypertension control
- Goal BP <130/80 mmHg
- Lifestyle + pharmacotherapy

ACS = acute coronary syndrome; ASCVD = atherosclerotic cardiovascular disease; BP = blood pressure; CVD = cardiovascular disease; DAPT = dual antiplatelet therapy; DASH = Dietary Approaches to Stop Hypertension; GLP1-RA = glucagon-like peptide-1 receptor agonists; HF = heart failure; PCI = percutaneous coronary intervention; PCSK9 = proprotein convertase subtilisin/kexin type 9; SGLT2 = sodium–glucose cotransporter 2. Figure created using BioRender.
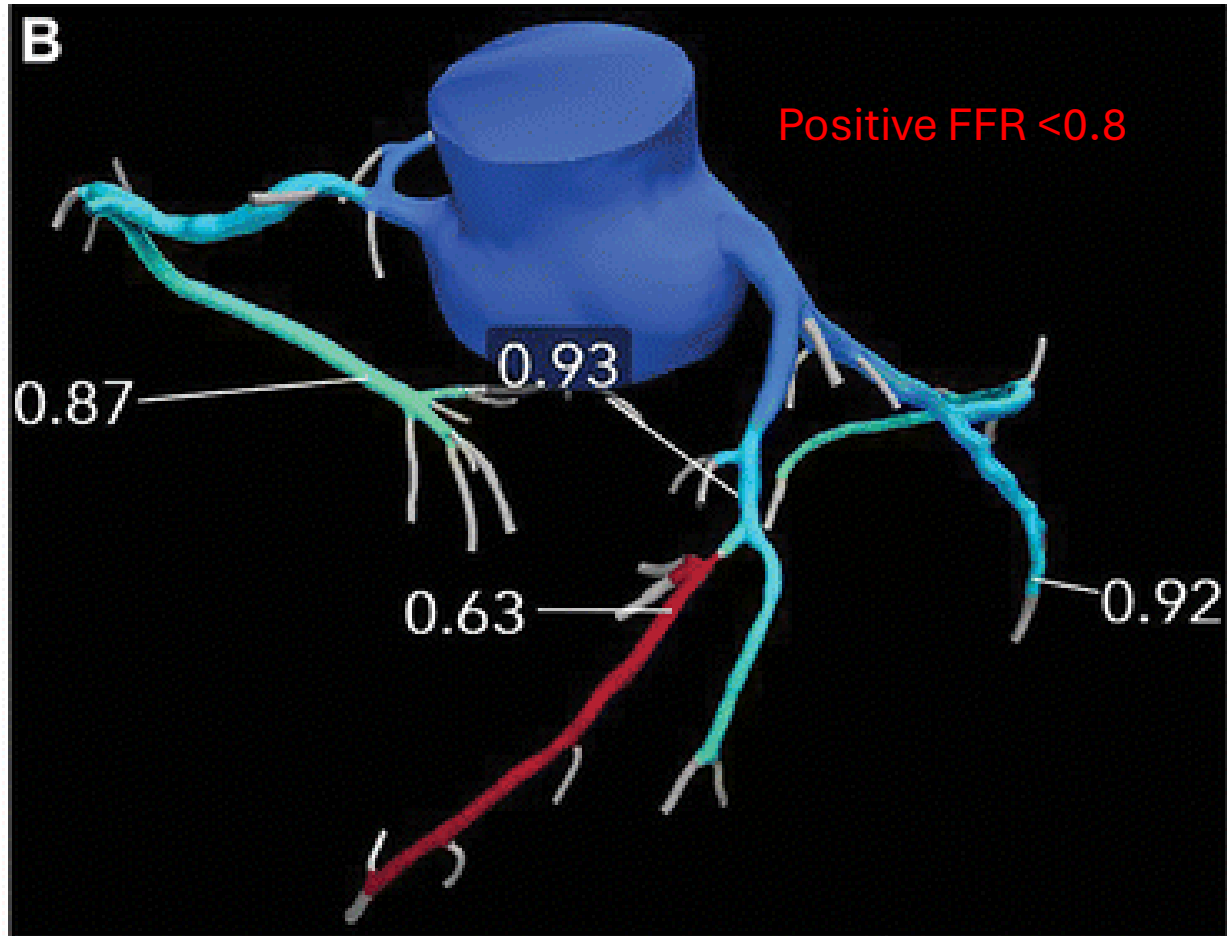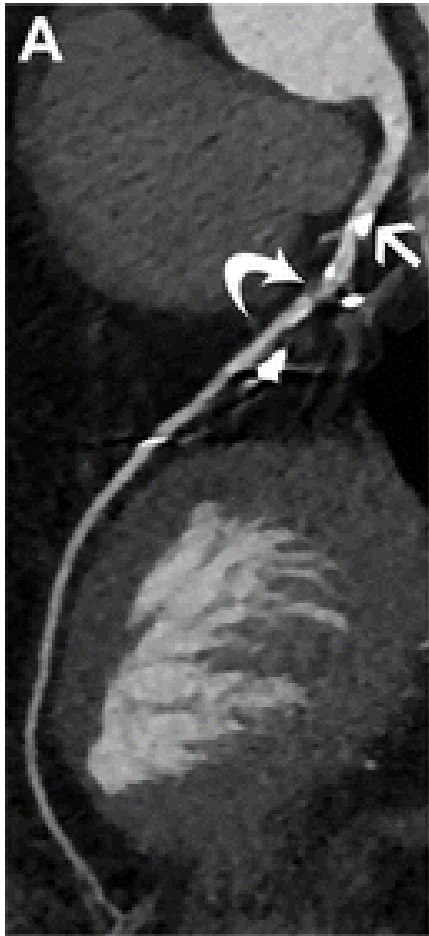
Back to our patient

- We now know that he has a moderate stenosis in mRCA.

- How do we know if this is flow limiting and is the reason for his CP?
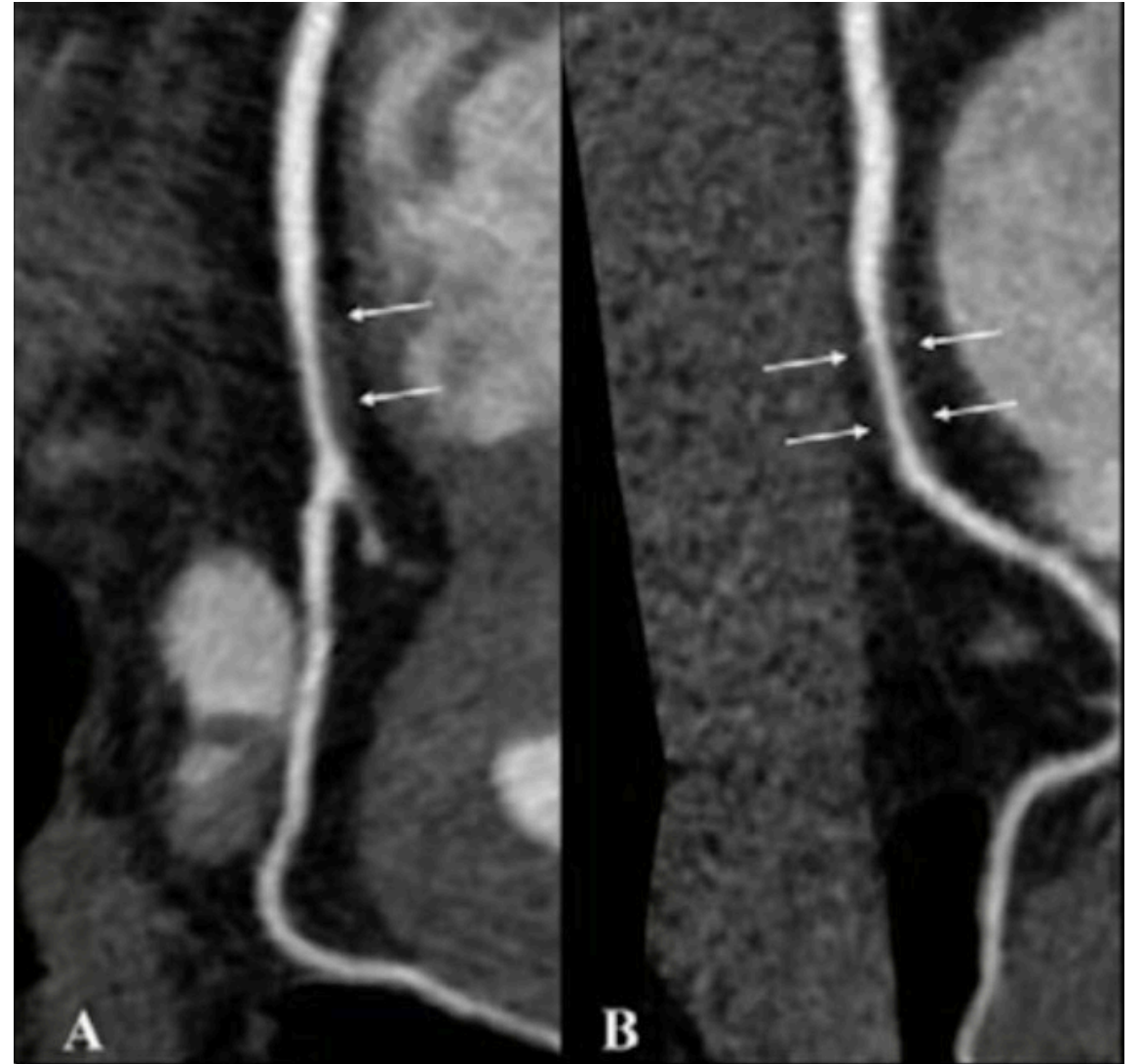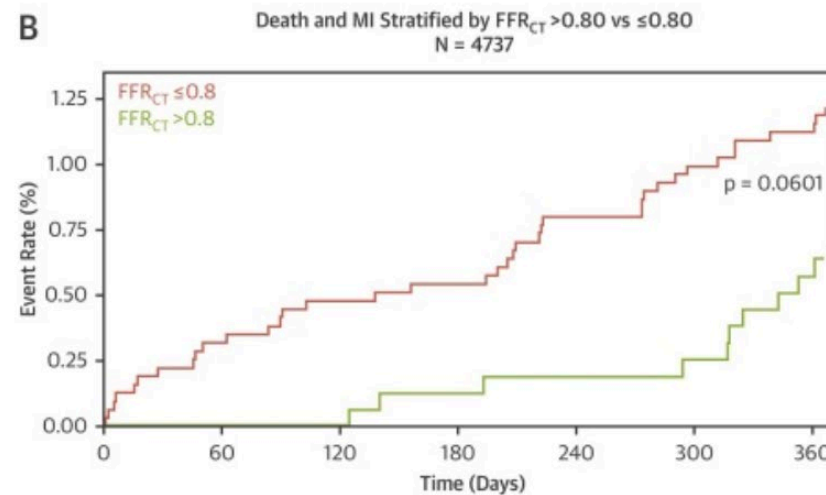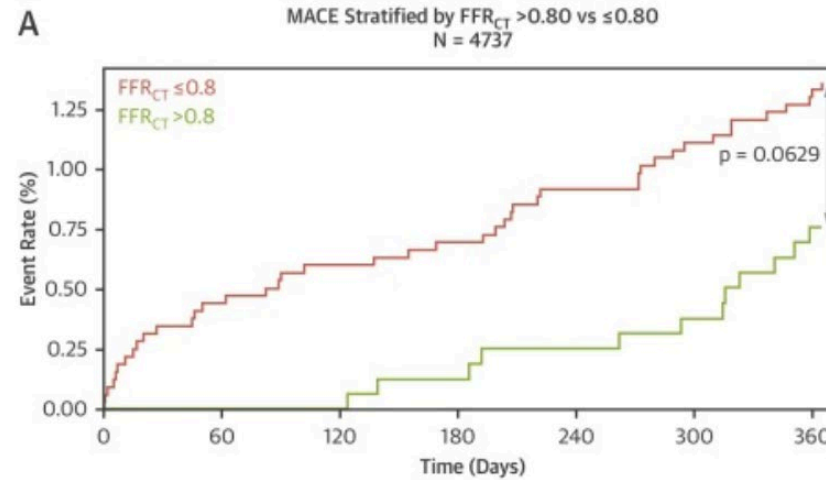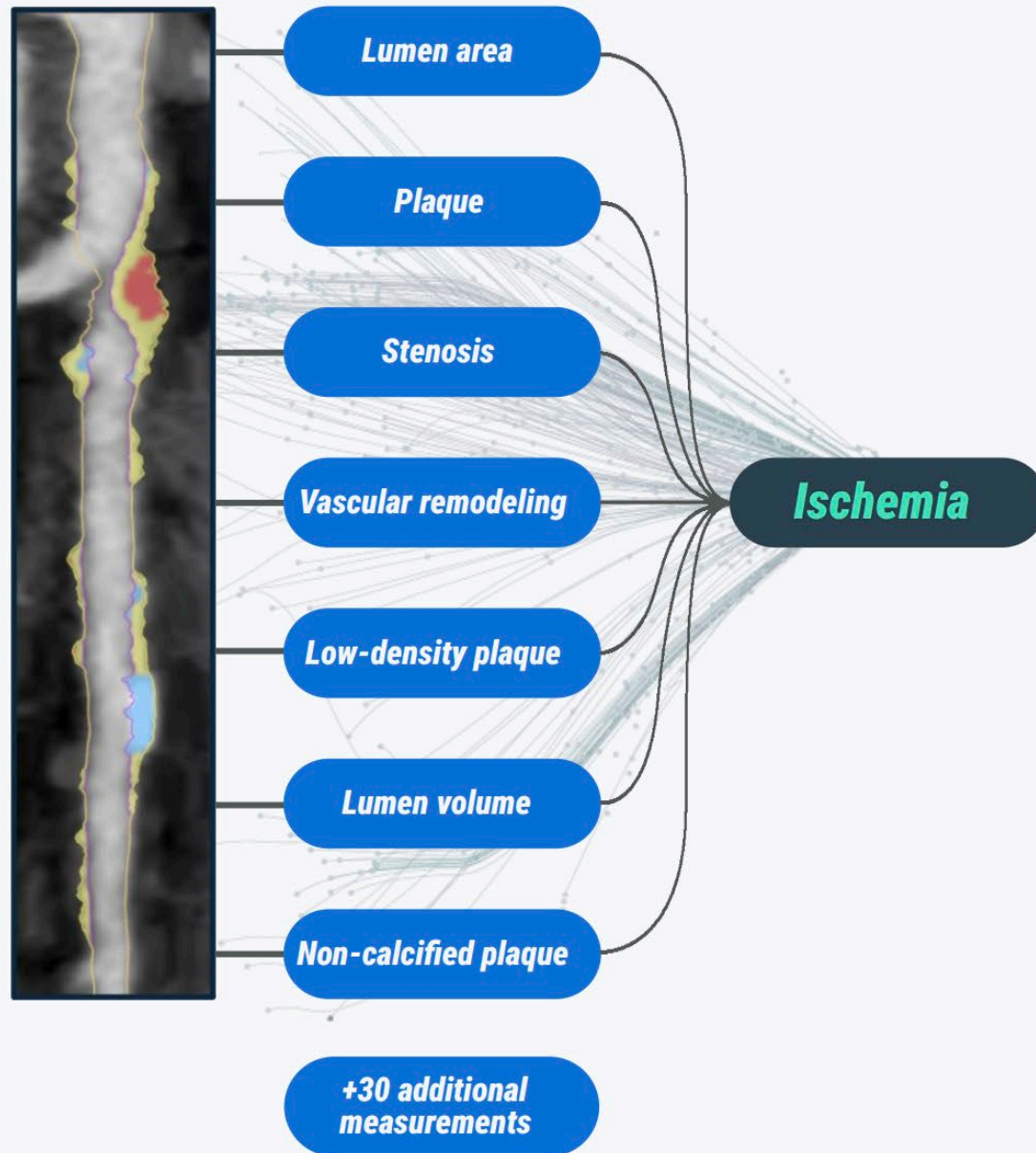
Further testing?
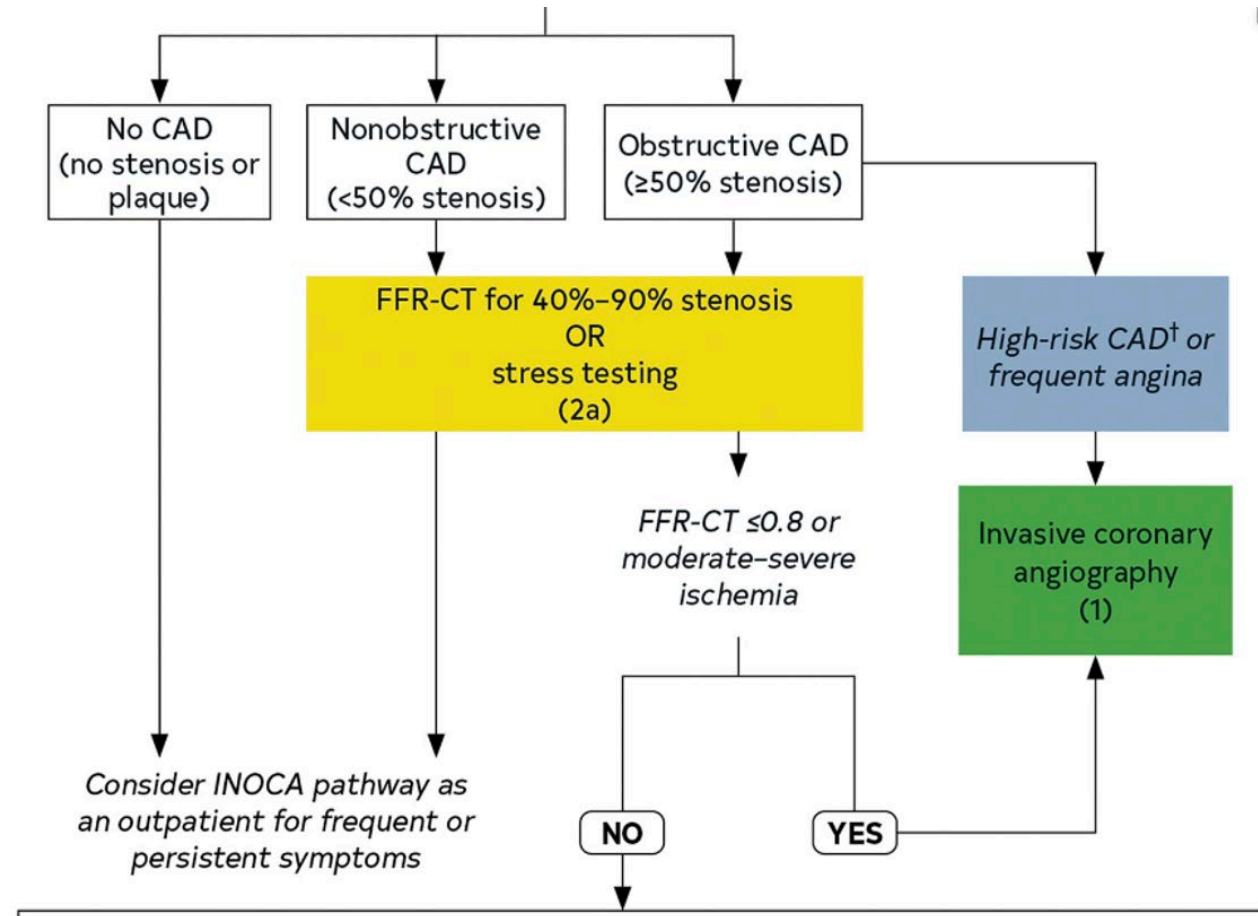
CT-FFR

CT FFR ADVANCE Registry

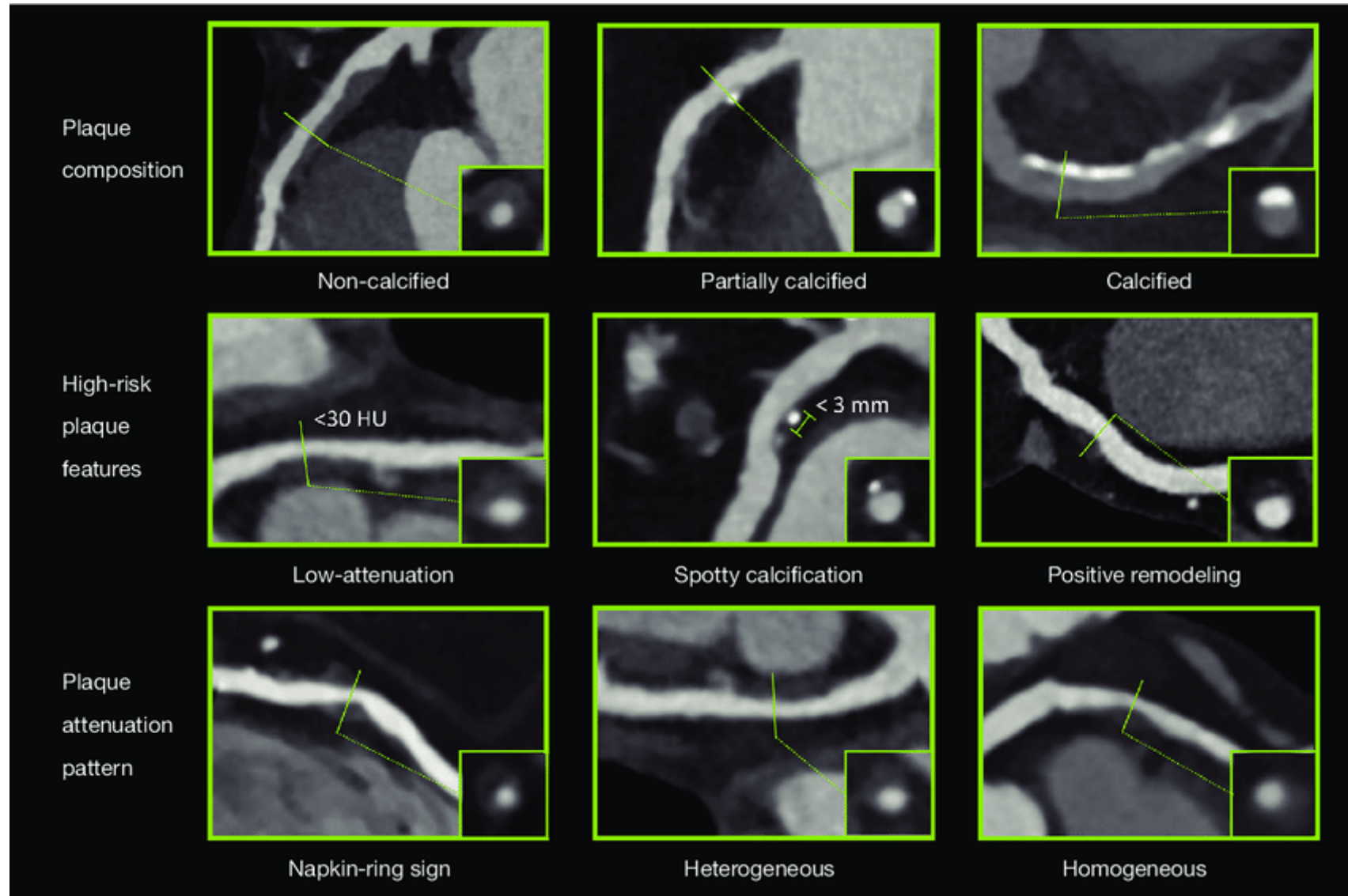**CENTRAL ILLUSTRATION: Kaplan-Meier Event Curves for MACE**

Overview of **Cleerly ISCHEMIA**

- Method of Determining Likelihood of Coronary Ischemia

- Does **not** use Computational Fluid Dynamics

- Uses 37 variables from Cleerly LABS

- Proprietary AI machine learning based algorithm to determine probability of ischemia based on a thresh[old] equivalent to an invasive FFR of >0.80 vs. <0.80 respectively

- Outputs a binary decision
  - **Ischemia likely**
  - **Ischemia not likely**

Diagram labels: Lumen area, Plaque, Stenosis, Vascular remodeling, Low-density plaque, Lumen volume, Non-calcified plaque, +30 additional measurements → Ischemia
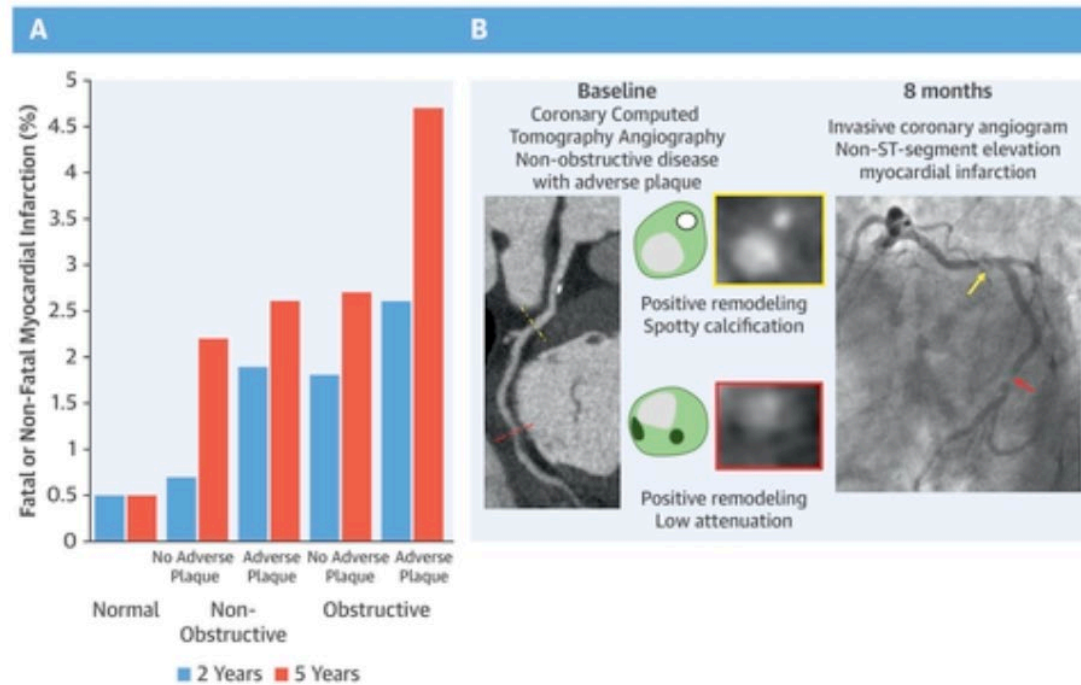
High risk plaque

SCOT-Heart study

CENTRAL ILLUSTRATION: Adverse Plaque on Computed Tomography Coronary Angiography Identifies Patients at an Increased Risk of Subsequent Events
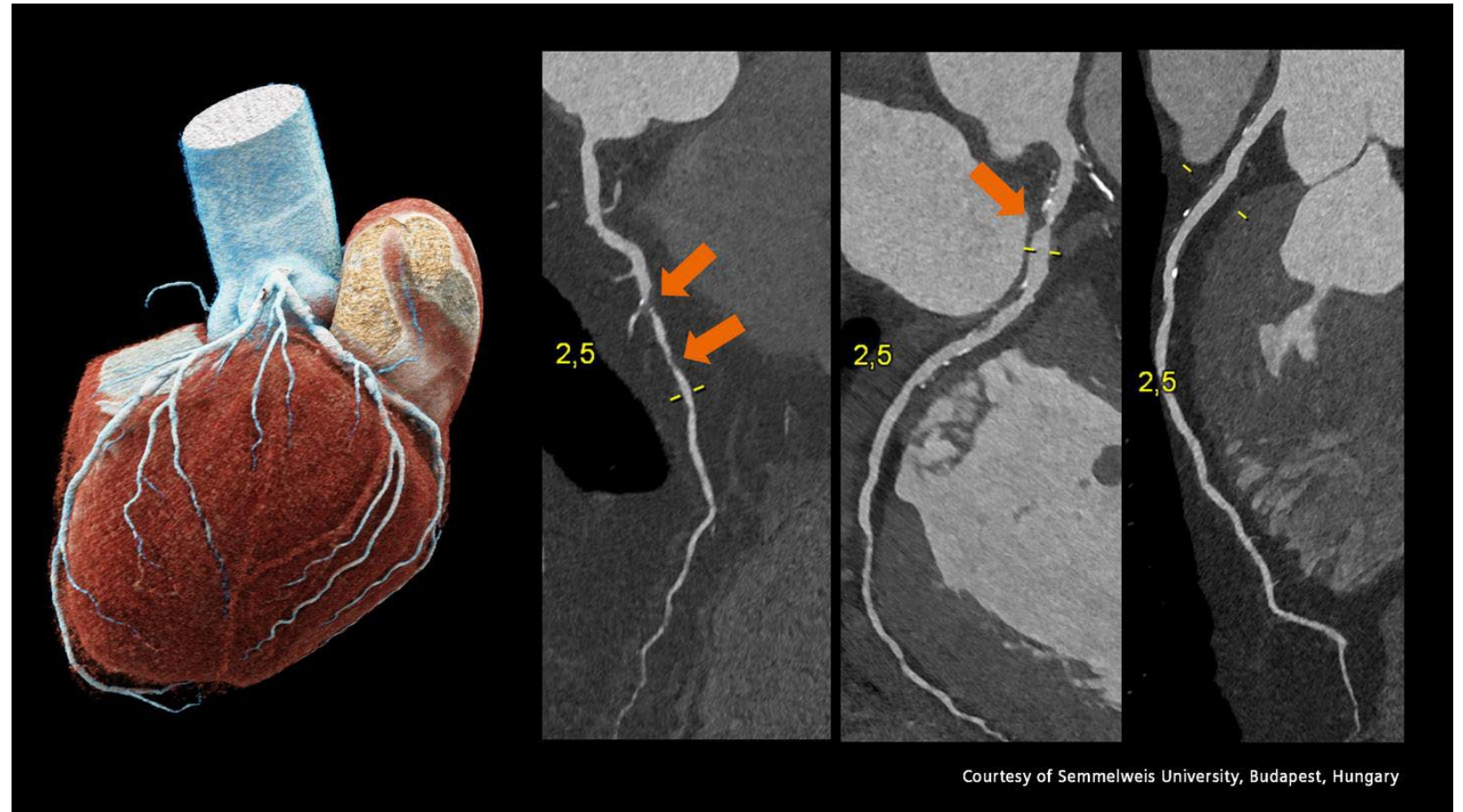
Williams, M.C. et al. J Am Coll Cardiol. 2019;73(3):291-301.

Higer risk of MI and CVD death was not significant once adjusted for plaque burden (coronary calcium score)

Future of CT

Photon-counting CT
AI in multiple aspects of CT work flow
Plaque analysis to guide management

Courtesy of Semmelweis University, Budapest, Hungary

Our patient

- Had a negative Invasive FFR, he was optimized on GDMT. His chest pain resolved on anti-anginal medications.

Conclusion

- Coronary CT/CT FFR – high negative predictive value, detects non-obstructive plaque, helps prevent unnecessary invasive angiography, helps identify the patients at higher risk for medical management optimization.

- Plague analysis – assessment of response to treatment, risk assessment

- Improved imaging protocols, technology and AI – will expand cardiac CT capabilities with coronary assessment as well as structural procedures.

Thank you!

ARH