



How to incorporate imaging into chest pain assessment?

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66 year old male with intermittent exertional chest pain x 5 days



Target outcome

1 ED discharge without 1 ED disc

increasing missed 30-d or 1-y MACE increa

30-d

for Death or MACE

tion of AMI; Early detection of AM

66 year old male with intermittent exertional chest pain x 5 days



HEART Score

History	Slightly suspicious	0
	Moderately suspicious	1
	Highly suspicious	2
FKG	Normal	\bigcirc
LNU	Non-specific repolarization disturbance	1
	Significant ST deviation	2
Ano	< 45	0
nge	45-64	1
	≥ 65	2
Risk Factors	No known risk factors	0
	1-2 risk factors	$\left(\right)$
	\geq 3 risk factors OR atherosclerotic disease	2
Initial troponin	Less than upper limit of normal	\bigcirc
	1 to 3x normal limit	1
	> 3x normal limit	2
	TOTAL:	5

HEART SCORE: 5 (intermediate) \rightarrow Risk of MACE 12-16%

66 year old male with intermittent exertional chest pain x 5 days



Acute Chest Pain + Intermediate-Risk With No Known CAD

Anatomic Testing				
1	А	 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). 		
		Stress Testing		
1	B-NR	4. For intermediate-risk patients with acute chest pain and no known CAD who are eligible for cardiac testing, either exercise ECG, stress echocardiography, stress PET/SPECT MPI, or stress CMR is useful for the diagnosis of myocardial ischemia (1.4.10.14-36).		



Advantages of Coronary CTA for Acute Chest Pain

- ✓ Rapid and safe exam
- Accurate for detecting stenosis
- ✓ Can detect nonobstructive plaque....

No Coronary Plaque or Stenosis





Identification of plaque \rightarrow Intensify prevention



Cardoso, Blankstein Chapter on Use of Cardiac CT in Prevention Artwork courtesy of Ana Vitoria Rocha Federal University of Goias, Brazil

Advantages of Coronary CTA for Acute Chest Pain

✓ May identify alternative explanation for symptoms



Selecting Useful Patients for Coronary CTA

Useful when...

- No known CAD
- Good image quality possible

Not useful for...

Known CAD



Morbid Obesity

(BMI 54 kg/m2)



Massive CAC



Small stents

What about patients with elevated hsTn?

ESC Guidelines: Coronary CTA for evaluation of acute chest

ESC European Society of Cardiology doi:10.10/03/wurkeurg/etka5/75

ESC GUIDELINES

2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation

Class 1A Indications for lowintermediate risk NSTE-ACS

(United States of America), Paul Dendale (Belgium), Maria Dorobantu (Romania), Thor Edvardsen (Norway), Thierry Folliguet (France), Chris P. Gale (United Kingdom), Martine Gilard (France), Alexander Jobs (Germany), Peter Jüni (Canada), Ekaterini Lambrinou (Cyprus), Basil S. Lewis (Israel), Julinda Mehilli (Germany), Emanuele Meliga (Italy), Béla Merkely (Hungary), Christian Mueller (Switzerland), Marco Roffi (Switzerland), Frans H. Rutten (Netherlands), Dirk Sibbing (Germany), George C.M. Siontis (Switzerland)

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Working Groups: Certinization Plantacotherapy, Cardinascolar Kergery, Caronary Pathaphysiology and Microtinutation, Teravisois

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pain CCTA is recommended as an alternative to invasive angiography to exclude ACS when there is a low-tointermediate likelihood of CAD and when cardiac troponin and/or ECG are normal or inconclusive (Class 1, Level A)

38 yo male with CP; negative ECG; hsTn 117ng/L



32 year old COVID(+) admitted with CP & elevated Tn



No Coronary Plaque or Stenosis











CCTA Less Useful in Risk Patients with ACS

DISHCARGE Trial (BMJ 2021)

Early CCTA (~4.2 hrs) vs. Standard Care



Source: Linde JACC 2020;75:453-463., Gray BMJ 2021;374:n2106

Limitation of CCTA: 10-15% of Lesions May Have Uncertain Hemodynamic Significance



Limitation of CCTA: 10-15% of Lesions May Have Uncertain Hemodynamic Significance

CT FFR



CT FFR: Non-invasive estimation of FFR Uses computational fluid dynamics applied to rest CCT

(Normal CT-FFR >0.8)

Other options



Nuclear Stress Test / Stress Echo



ECG Exercise Treadmill Test

Advantage of myocardial perfusion imaging Identify presence and amount of ischemia \rightarrow role of revascularization



SPECT Nuclear Stress Testing: Exercise Preferred Over Vasodilator Testing

If patient can <u>exercise</u>, can obtain useful information on:

- Exercise induced symptoms
- ✓ changes in BP / HR
- ✓ Ischemic ECG changes
- Less likely to "miss" high risk anatomy





If use <u>vasodilators</u> (e.g. adenosine):

- ✓ Safe, even when elevated Tn/ low-risk ACS
- ✓ Better tolerated than dobutamine
- Lower likelihood of nondiagnostic test (when compared to limited exercise)

Unique advantage of PET: Quantifying Myocardial Blood Flow











Coronary Flow Reserve = Stress MBF / Rest MBF



Quantifying Myocardial Blood Flow: Unique advantage of PET

Evaluate for microvascular disease

Improved risk assessment



Less Likely to "miss" 3 vessel disease with PET

68-yr old male with HTN and diabetes presenting with atypical angina







Quantitative myocardial blood flow and CFR

	Rest	Stress	CFR
LAD	1.21	1.19	0.99
LCX	1.16	0.82	0.71
RCA	1.30	1.73	1.33
Global LV	1.22	1.22	1.00

Case #3: Exercise Treadmill in the ED

- 55 y.o. male with diabetes, hypertension presents with exertional chest pain
- ETT: exercised for 12:00 minutes on Bruce protocol → no ischemic ECG changes
- In recovery → dizziness associated with hypotension









What can cardiac MRI offer ?



CMR in Acute Chest Pain

Suspected MINOCA

When need to distinguish <u>myopericarditis from other</u> <u>causes</u>, including myocardial infarction and nonobstructive coronary arteries (MINOCA)



When <u>pericarditis is suspected (but</u> <u>uncertain</u>) CMR can determine the presence and extent of myocardial and pericardial inflammation and fibrosis





48-year-old with chest pain

Past History:

- 3 days of sore throat and muscle aches
- Elevated troponin=3 and CK-MB=90
- EKG:



48-year-old with chest pain



72-year-old female, CP, elevated enzymes ; cath with no obstructive CAD



Take Home Points

- Not all patients with acute chest pain need imaging tests! (Avoid in low risk patients)
- Test selection depends on availability & expertise
- CCTA: accurate / also detect plaques / 10-15% of time may have lesions of uncertain hemodynamic significance → may require more testing
- If SPECT or stress echo, exercise preferred
- MRI: suspected MINOCA or pericarditis
- No one imaging test is perfect ; use clinal judgement

THANK YOU

Anatomy vs. Ischemia

Coronary CTA

- ✓ High NPV for "ruling out" disease
- ✓ Can detect subclinical plaque
- Limited evaluation if extensive coronary calcifications
- Requires iv contrast;

Functional Imaging

- Determine hemodynamic significance of lesions
- Amount of ischemia may guide need for coronary revascularization
 (when significant lege)
- symptoms)



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