Evaluating the Patient with Chest Pain

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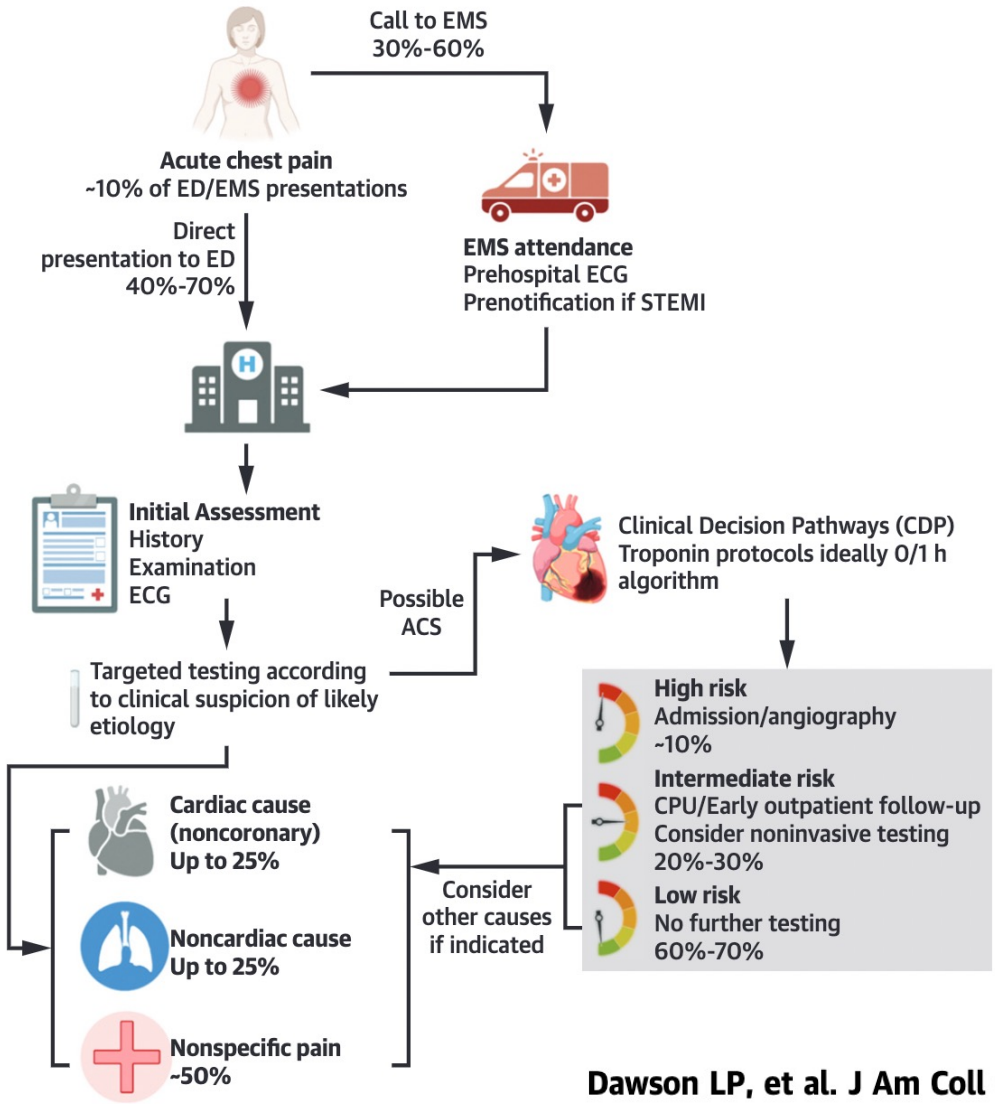
No relevant disclosures

Learning Objectives

- Review the incidence and etiologies of chest pain
- Understand the clinical decision pathways for chest pain
- Discuss the role of stress testing versus CT imaging



Dawson LP, et al. J Am Coll Cardiol. 2022;79(23):2333-2348.

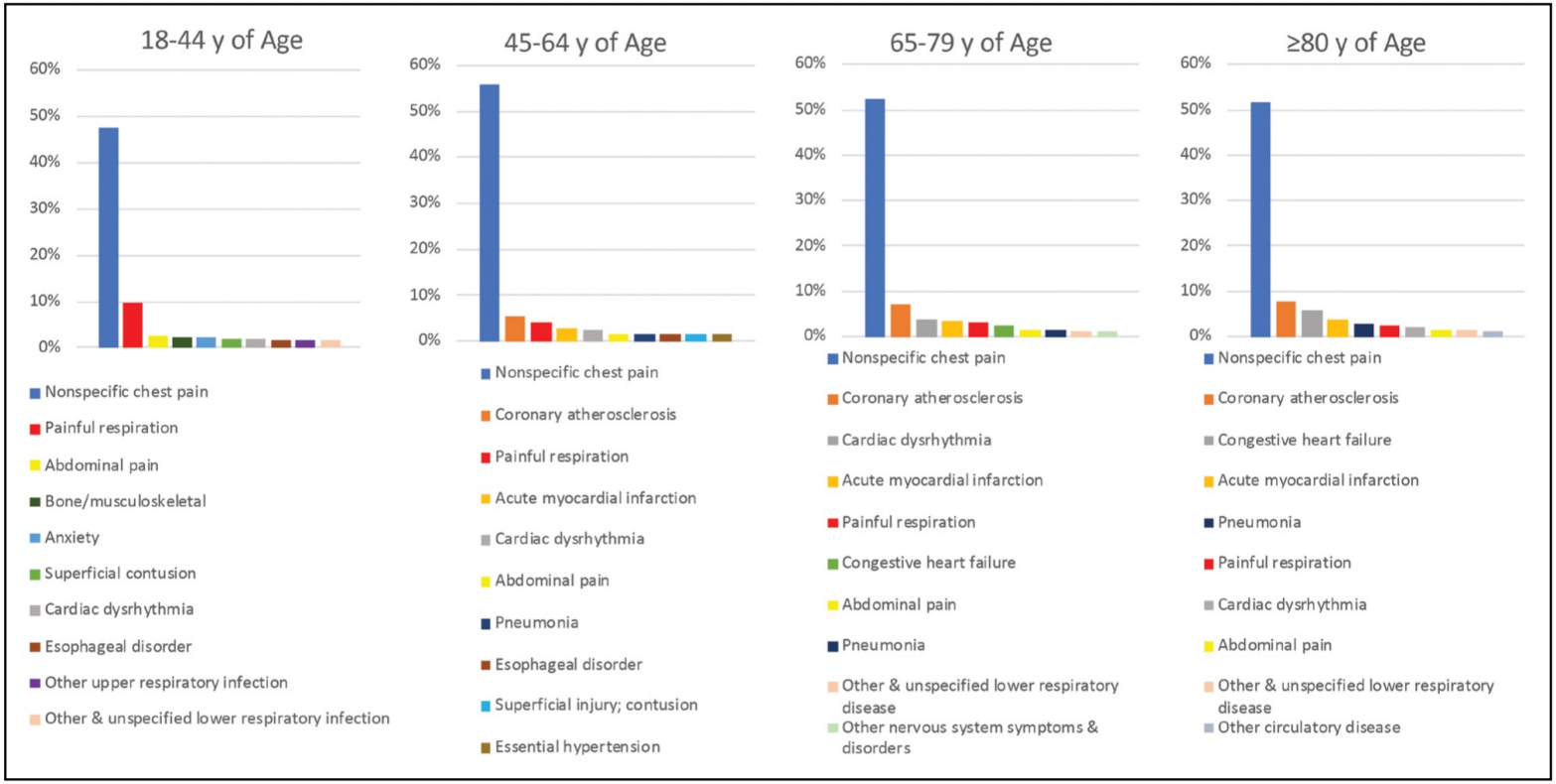


Figure 3. Top 10 Causes of Chest Pain in the ED Based on Age (Weighted Percentage)
Created using data from Hsia RY, et al.[7] ED indicates emergency department.

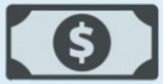
Circulation. 2021;144:e336–e367.

Problems with Existing Care Models

Prolonged Assessment Times
Commonly 4-6 hours for low-risk patients

Emergency Department Overcrowding
Associated with delays to care and poor outcomes

Ambulance Delays
Delays in ambulance attendance and off-load times secondary to ED overcrowding



High Health Care Costs
Mean costs of US $6,325 per chest pain attendance

Over-Testing and Over-Triage
Indiscriminate tests among low-risk patients associated with high costs, more downstream testing with associated risks, and no outcome benefits

Dawson LP, et al. J Am Coll Cardiol. 2022;79(23):2333-2348.

AHA/ACC CLINICAL PRACTICE GUIDELINE

2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain: Executive Summary: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

What is new:

- HEART Score
- High sensitivity troponin
- Coronary CT Angiography

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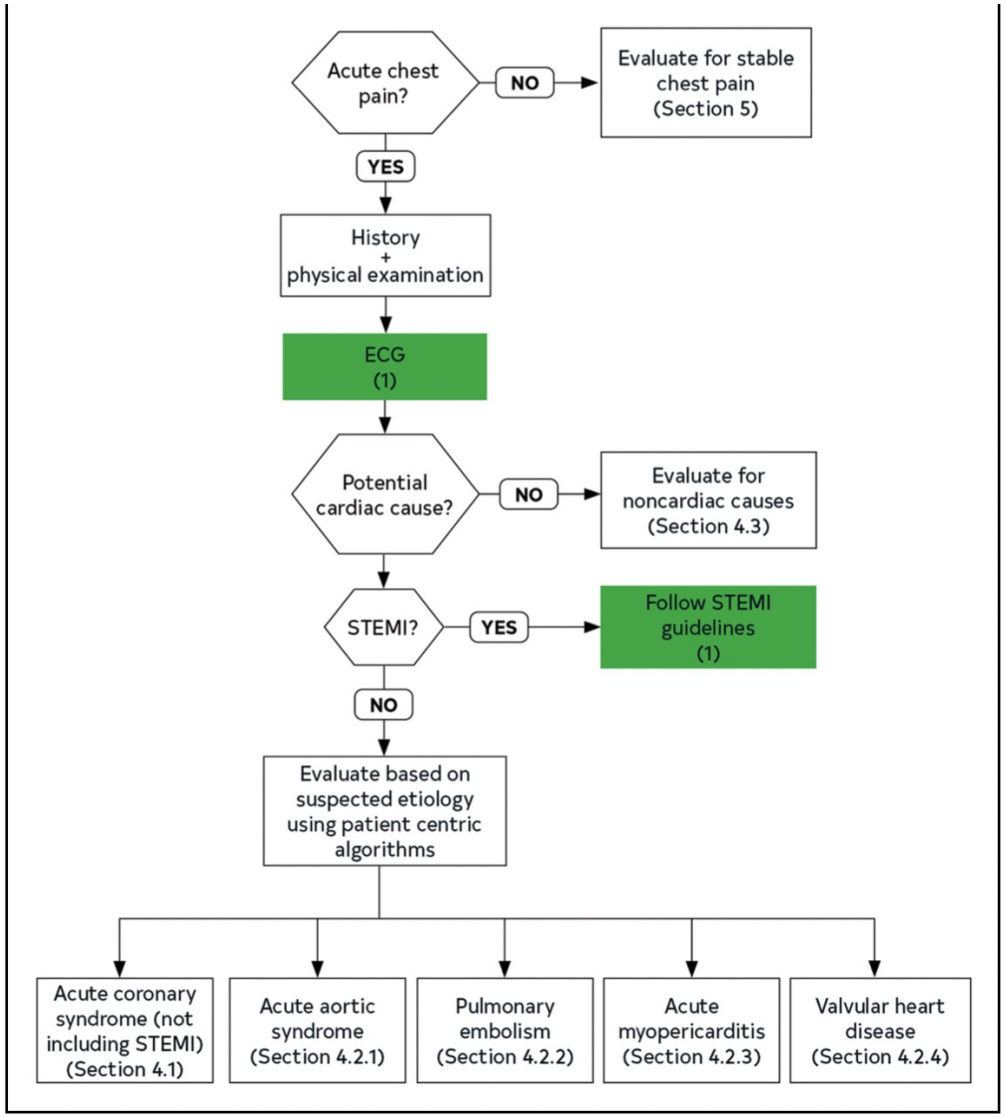

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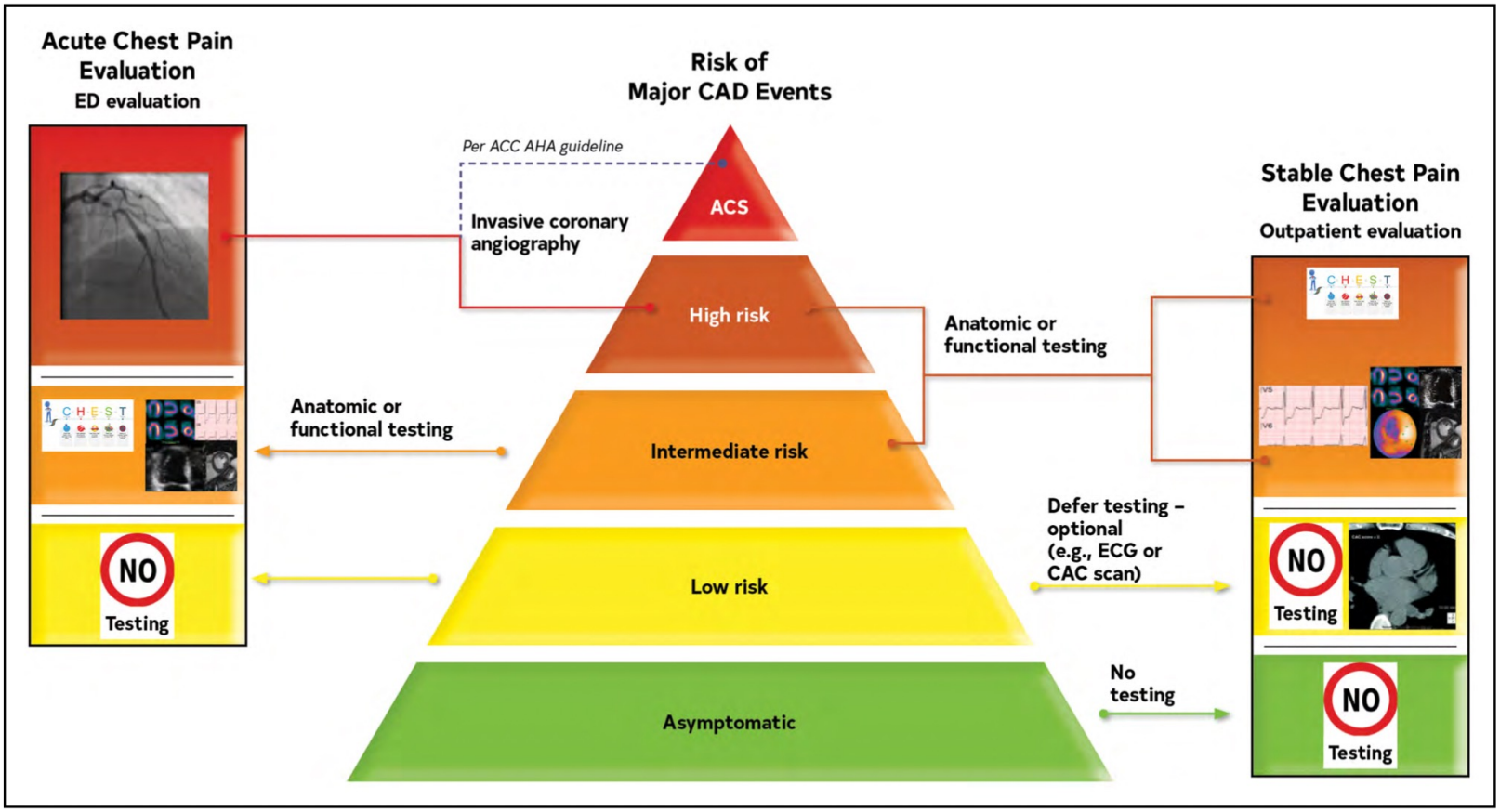

Figure 5. Chest Pain and Cardiac Testing Considerations

The choice of imaging depends on the clinical question of importance, to either a) ascertain the diagnosis of CAD and define coronary anatomy or b) assess ischemia severity among patients with an expected higher likelihood of ischemia with an abnormal resting ECG or those incapable of performing maximal exercise.

ACS indicates acute coronary syndrome; CAC, coronary artery calcium; CAD, coronary artery disease; and ECG, electrocardiogram.

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'Angina' is another expression in the class of an 'interpreted symptom' – like 'claudication'. It is often caused by coronary atherosclerosis, but it isn't the same thing. All it means is that 'I have listened to you describe your chest discomfort and I think its cause is cardiac'.

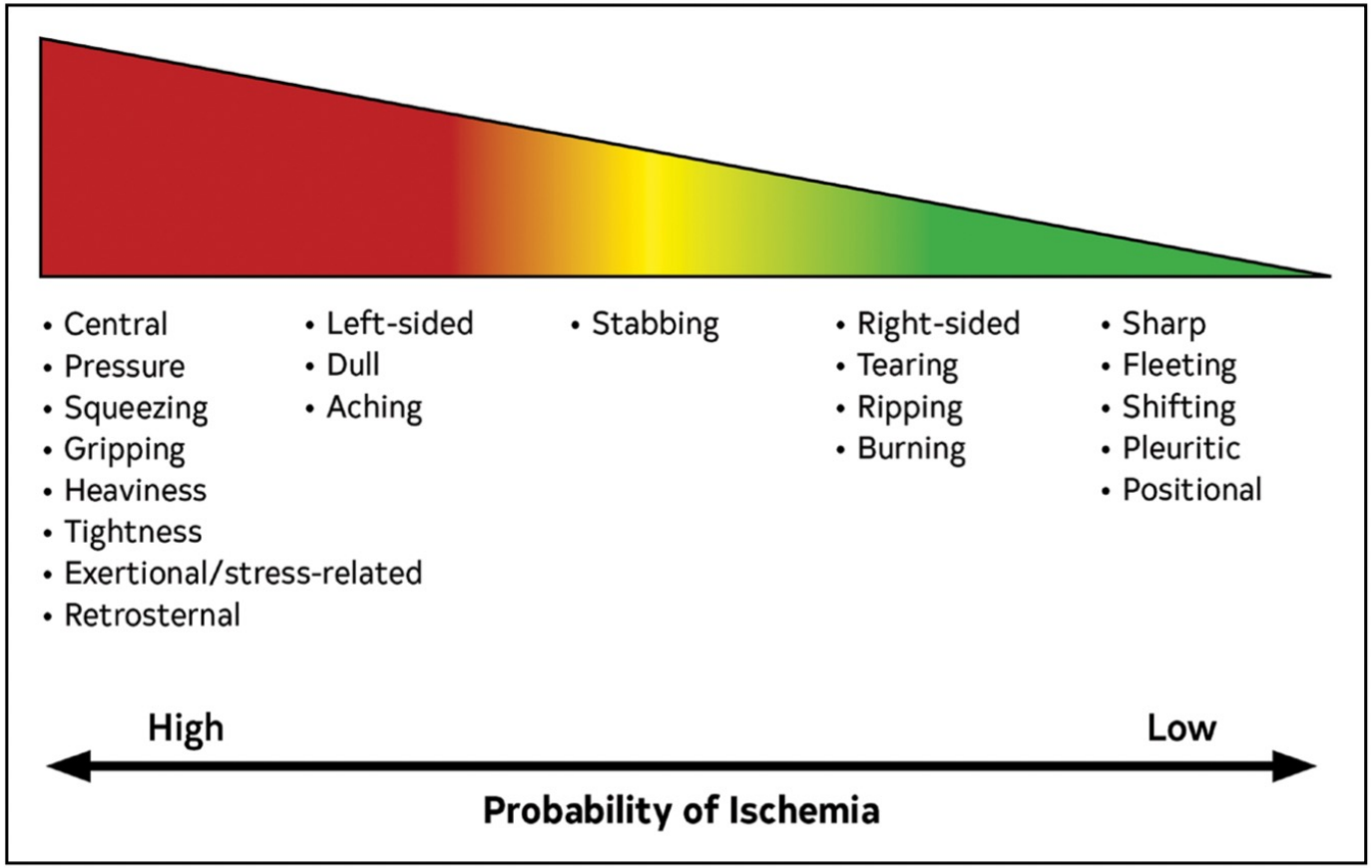

Figure 2. Index of Suspicion That Chest "Pain" Is Ischemic in Origin on the Basis of Commonly Used Descriptors

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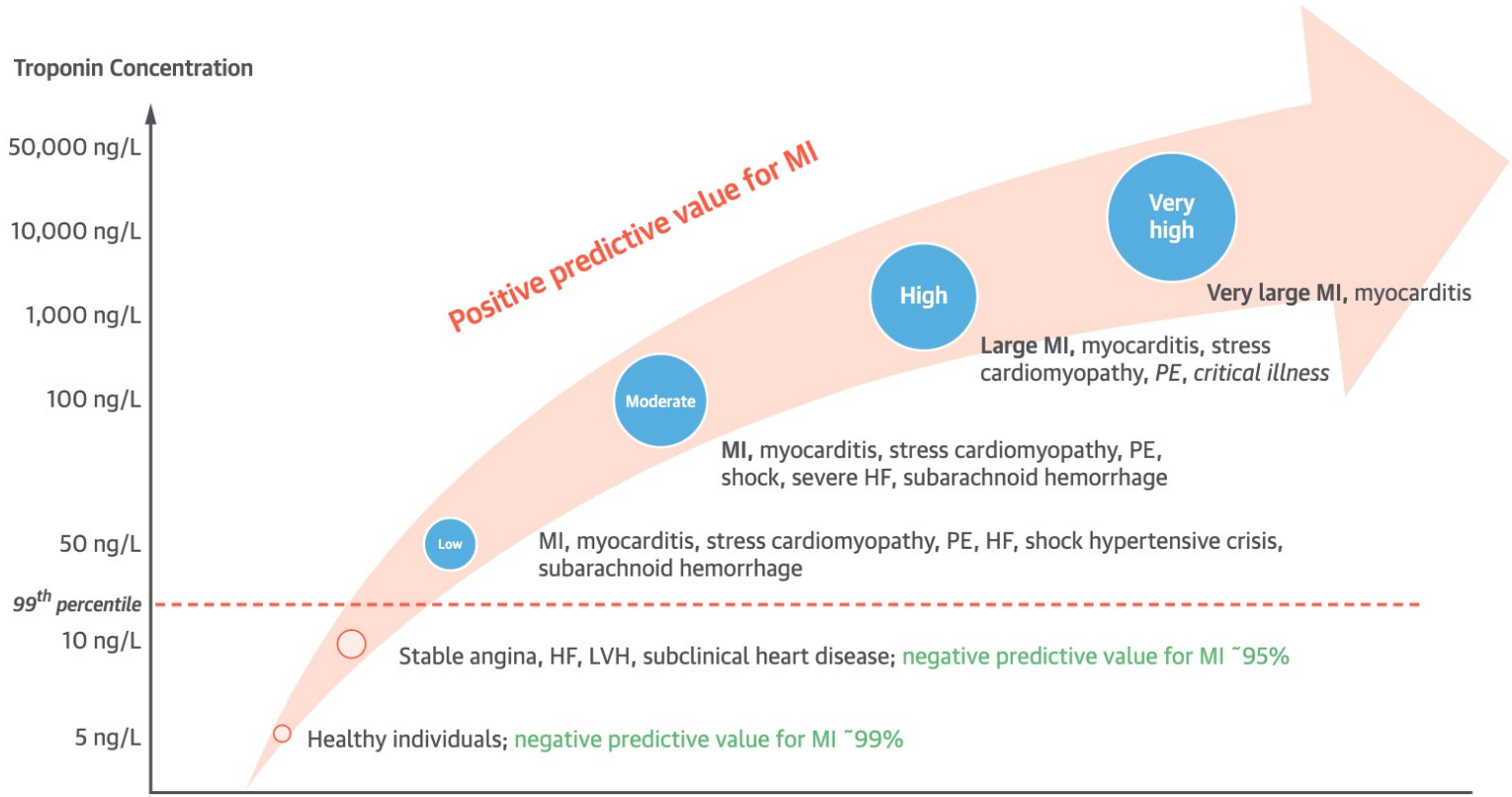
Figure 1. HEART score for patients with chest pain.

History (anamnesis)	Highly suspicious	2	
	Moderately suspicious	1	
	Slightly suspicious	0	
ECG	Significant ST-segment deviation	2	
	Nonspecific repolarization disturbance/LBBB/PM	1	
	Normal	0	
Age	≥65 y	2	
	45–65 y	1	
	≤45 y	0	
Risk factors*	≥3 risk factors or history of atherosclerotic disease	2	
	1 or 2 risk factors	1	
	No known risk factors	0	
Troponin	≥3 × normal limit	2	
	1–3 × normal limit	1	
	Normal limit or lower	0	
		Total	

ECG = electrocardiogram; HEART = History, ECG, Age, Risk factors, and initial Troponin; LBBB = left bundle branch block; PM = pacemaker.
* Hypercholesterolemia, hypertension, diabetes mellitus, cigarette smoking, family history of atherosclerotic disease, and obesity (body mass index >30 kg/m^2).

FIGURE 3 **Range of Diagnoses Across hs-cTn Concentrations**



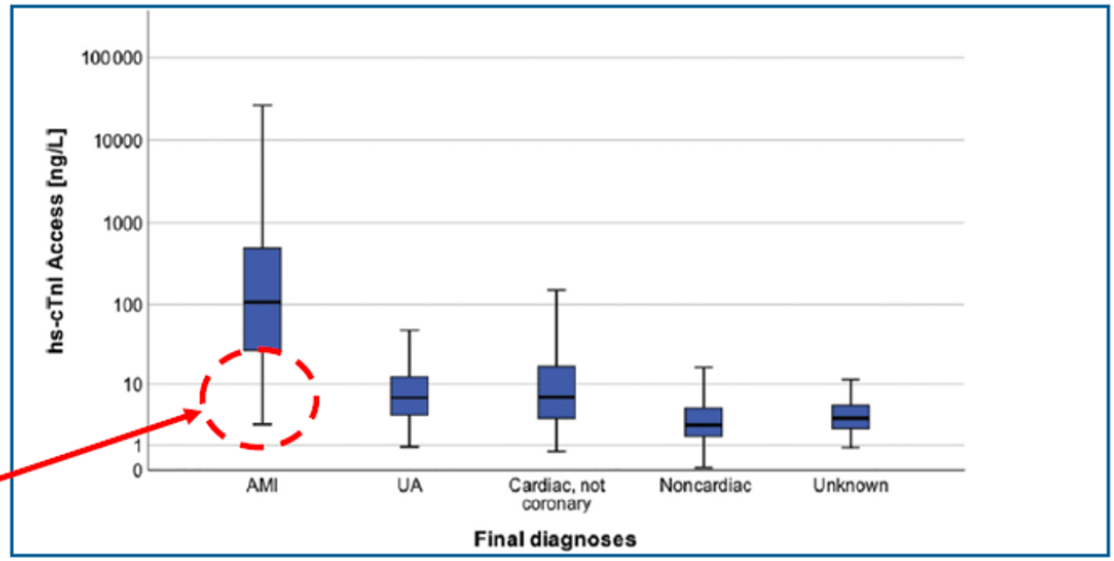
A broader differential diagnosis associated with lower-range elevations of hs-cTn begins to narrow as concentrations are higher. HF = heart failure; LVH = left ventricular hypertrophy; MI = myocardial infarction; PE = pulmonary embolism. Modified with permission from Mueller (21).

J Am Coll Cardiol 2019;73:1059–77

Additional Values at Low End are Relevant

Approx 20% of AMI patients had initial Troponin BELOW 99th Percentile

Region where additional results due to hsTnI analytical sensitivity will be seen



Hs-cTnI concentration at presentation vs. final diagnoses

Table 8. Definition Used for Low-Risk Patients With Chest Pain

	Low Risk (<1% 30-d Risk for Death or MACE)
hs-cTn Based	
T-0	T-0 hs-cTn below the assay limit of detection or "very low" threshold if symptoms present for at least 3 h
T-0 and 1- or 2-h Delta	T-0 hs-cTn and 1- or 2-h delta are both below the assay "low" thresholds (>99% NPV for 30-d MACE)
Clinical Decision Pathway Based	
HEART Pathway[20]	HEART score ≤3, initial and serial cTn/hs-cTn < assay 99th percentile

Circulation. 2021;144:e336–e367.

Pretest likelihood of CAD	Low →	No testing necessary →		Option for CAC for ASCVD risk stratification		
	Intermediate-high →	Younger patient (<65 y of age)	**OR**	Less obstructive CAD suspected →	CCTA favored	
	Intermediate-high →	Older patient (≥65 y of age)	**OR**	More obstructive CAD suspected →	Stress testing favored	

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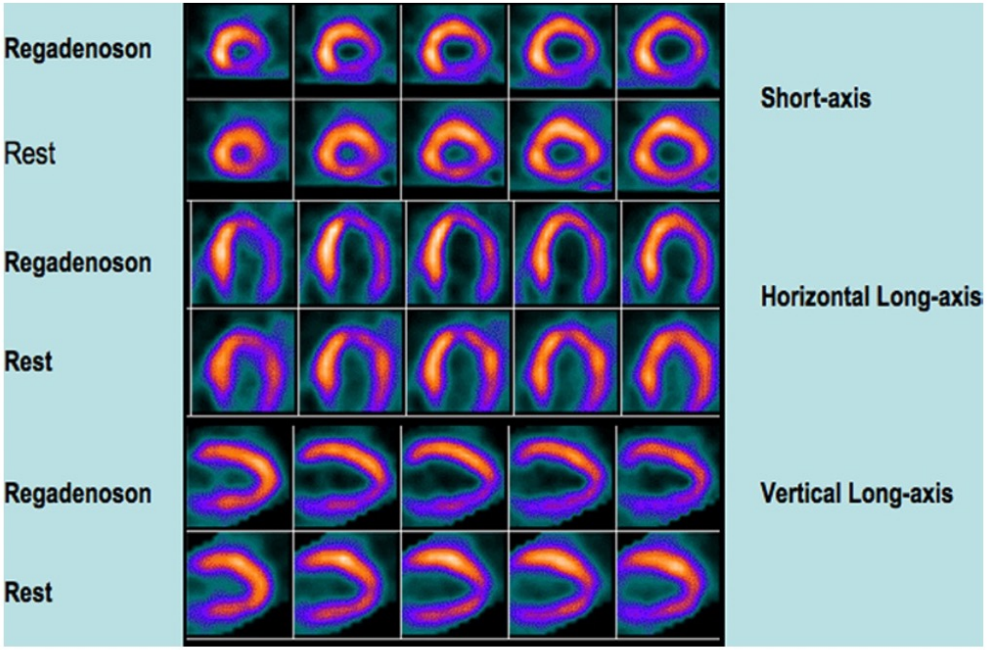
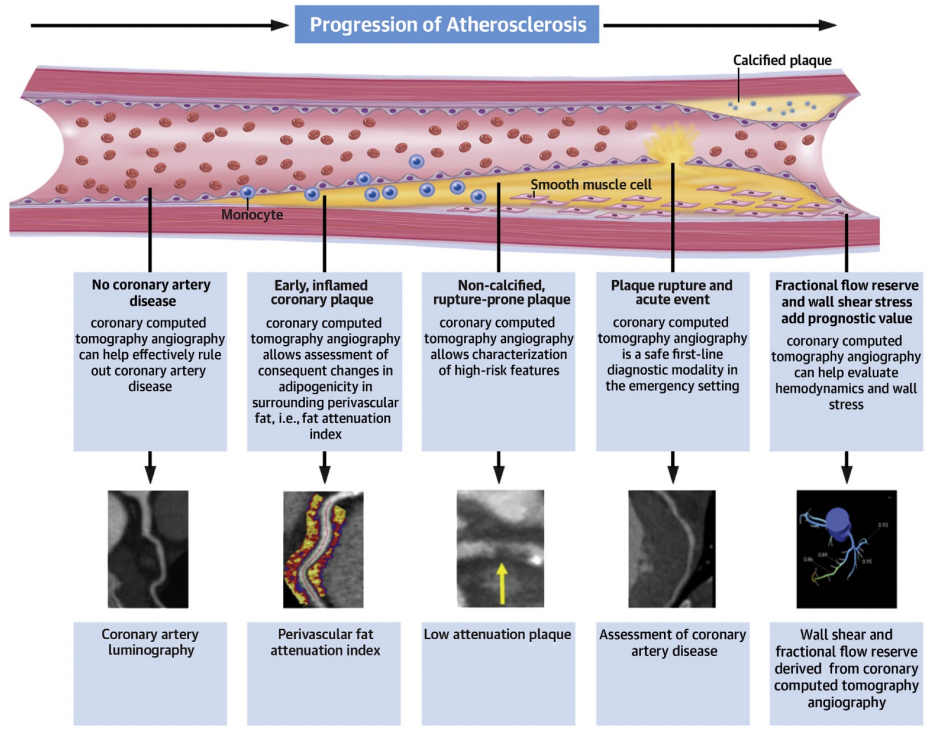


Figure 4 **Regadenoson/Rest SPECT Images Showing a Large Reversible Perfusion Abnormality in the Inferior and Lateral Segments of the LV Myocardium**

By quantitative analysis, the abnormality involved 29% of the myocardium. The patient is a 54-year-old man with chest pains. LV = left ventricular; SPECT = single-photon emission computed tomography.

J Am Coll Cardiol 2009;54:1123–30

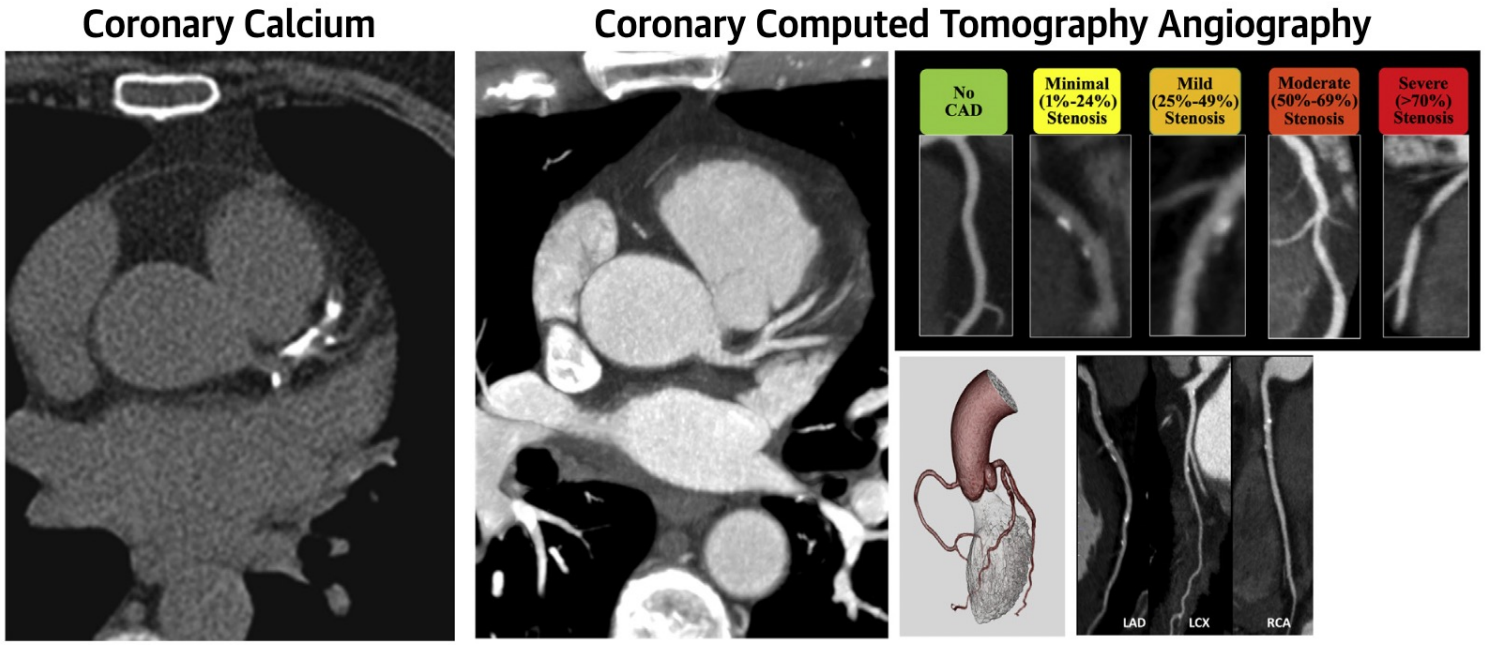
CENTRAL ILLUSTRATION **Utility of Coronary Computed Tomography Angiography in Coronary Artery Disease**



Abdelrahman, K.M. et al. J Am Coll Cardiol. 2020;76(10):1226–43.

Coronary computed tomography angiography is a powerful clinical tool that can be used to detect and characterize coronary artery disease across various stages, from early, subclinical disease to myocardial infarction.

FIGURE 2 **CACS Compared to CCTA**



CACS is quick and reproducible, does not require contrast, and provides strong prognostic data **(left)**. CCTA **(right)** provides unique practical advantages over CACS, including high resolution of plaque features such as noncalcified, rupture-prone plaque and characterization of stenosis severity. CACS = coronary artery calcium scoring; CCTA = coronary computed tomography angiography.

J Am Coll Cardiol 2020;76:1226–43

	Favors use of CCTA	Favors use of stress imaging
Goal	• Rule out obstructive CAD • Detect nonobstructive CAD	• Ischemia-guided management
Availability and expertise	• High-quality imaging and expert interpretation routinely available	• High-quality imaging and expert interpretation routinely available
Likelihood of obstructive CAD	• Age <65 y	• Age ≥65 y
Prior test results	• Prior functional study inconclusive	• Prior CCTA inconclusive
Other compelling indications	• Anomalous coronary arteries • Require evaluation of aorta or pulmonary arteries	• Suspect scar (especially if PET or stress CMR available) • Suspect coronary microvascular dysfunction (when PET or CMR available)

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Stress testing information			
	ETT	Stress echocardiography	SPECT MPI
Patient capable of exercise	✓	✓	✓
Pharmacologic stress indicated		✓	✓

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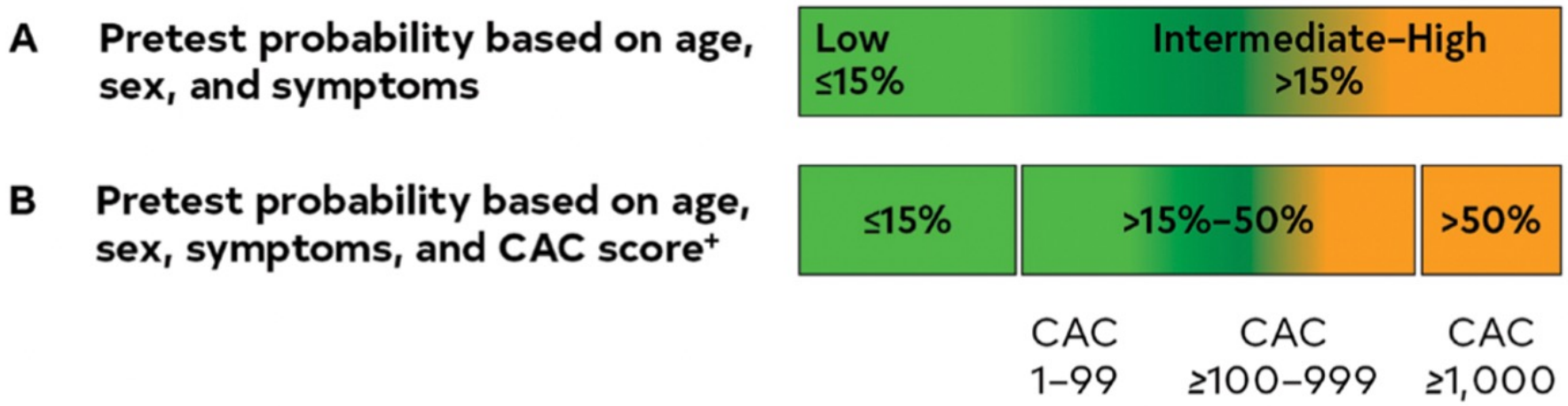

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2.1.1. A Focus on the Uniqueness of Chest Pain in Women

Recommendations for a Focus on the Uniqueness of Chest Pain in Women Referenced studies that support the recommendations are summarized in Online Data Supplements 3 and 4.		
COR	**LOE**	**Recommendations**
1	B-NR	1. Women who present with chest pain are at risk for underdiagnosis, and potential cardiac causes should always be considered.[1-7]
1	B-NR	2. In women presenting with chest pain, it is recommended to obtain a history that emphasizes accompanying symptoms that are more common in women with ACS.[1-7]

2.1.2. Considerations for Older Patients With Chest Pain

Recommendation for Considerations for Older Patients With Chest Pain		
COR	**LOE**	**Recommendation**
1	C-LD	1. In patients with chest pain who are >75 years of age, ACS should be considered when accompanying symptoms such as shortness of breath, syncope, or acute delirium are present, or when an unexplained fall has occurred.[1]

2.1.3. Considerations for Diverse Patient Populations With Chest Pain

Recommendations for Considerations for Diverse Patient Populations With Chest Pain		
COR	**LOE**	**Recommendations**
1	C-LD	1. Cultural competency training is recommended to help achieve the best outcomes in patients of diverse racial and ethnic backgrounds who present with chest pain.
1	C-LD	2. Among patients of diverse race and ethnicity presenting with chest pain in whom English may not be their primary language, addressing language barriers with the use of formal translation services is recommended.

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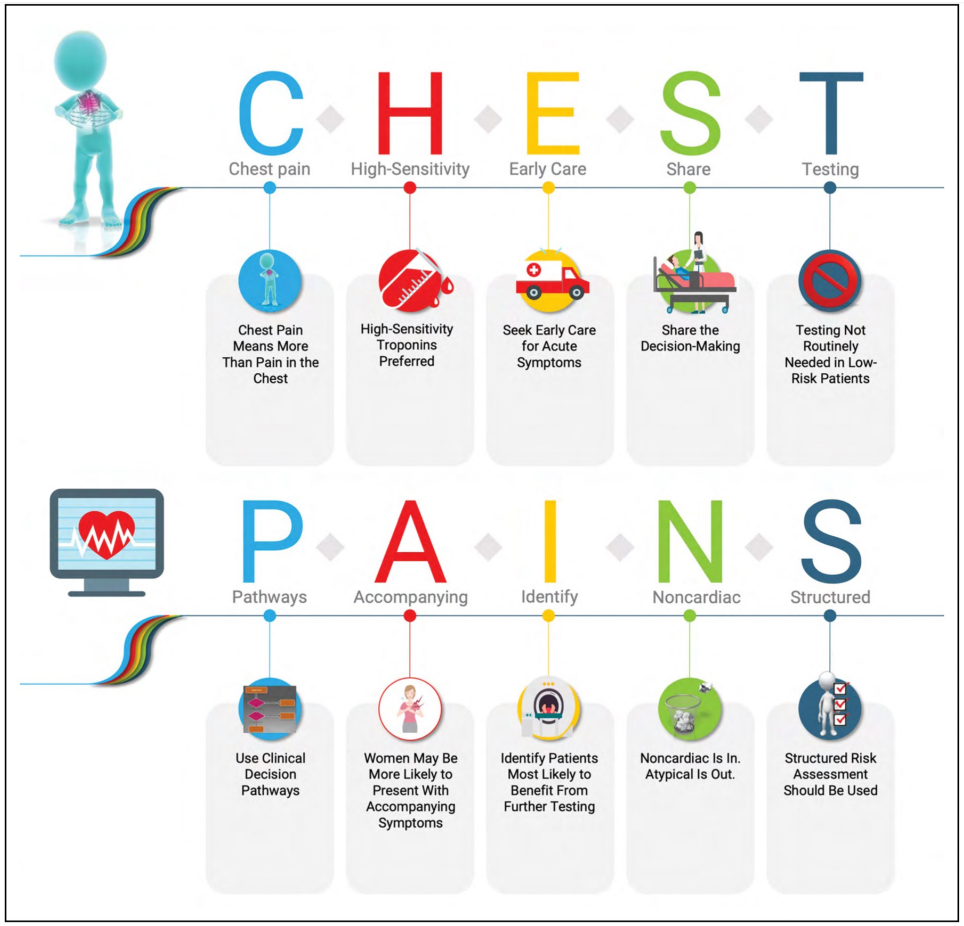

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