CHEST PAIN:
EVALUATION & MANAGEMENT IN THE OFFICE

Megan Sattler, MD
Sentara Cardiology Specialists

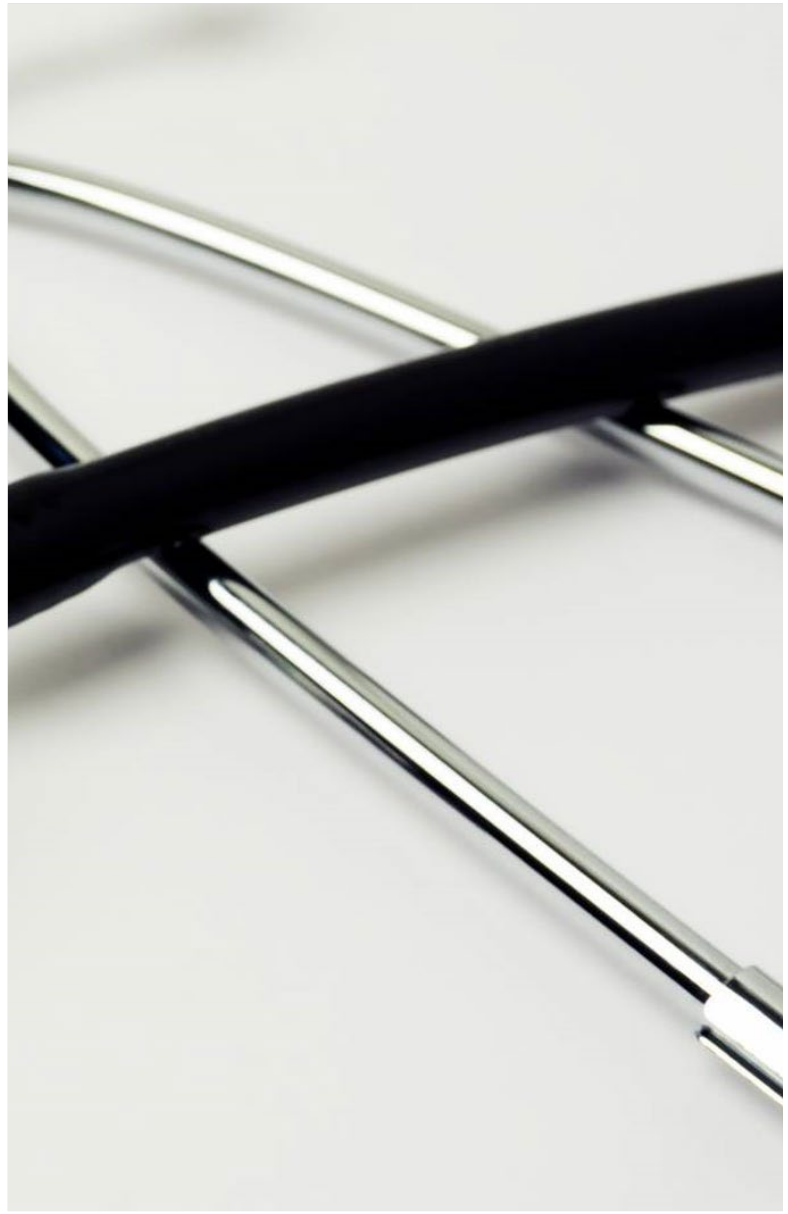
AGENDA

Epidemiology of Chest Pain

Cardiac vs Non-Cardiac Chest Pain

Diagnostic Approach to Chest Pain
How to Choose the Right Test

Early Treatment Considerations



EPIDEMIOLOGY

Chest pain (CP) accounts for 5% of all ED visits and 1-7% of outpatient visits.

Musculoskeletal CP is the most frequent cause of outpatient CP presentations (29-43% in several studies),

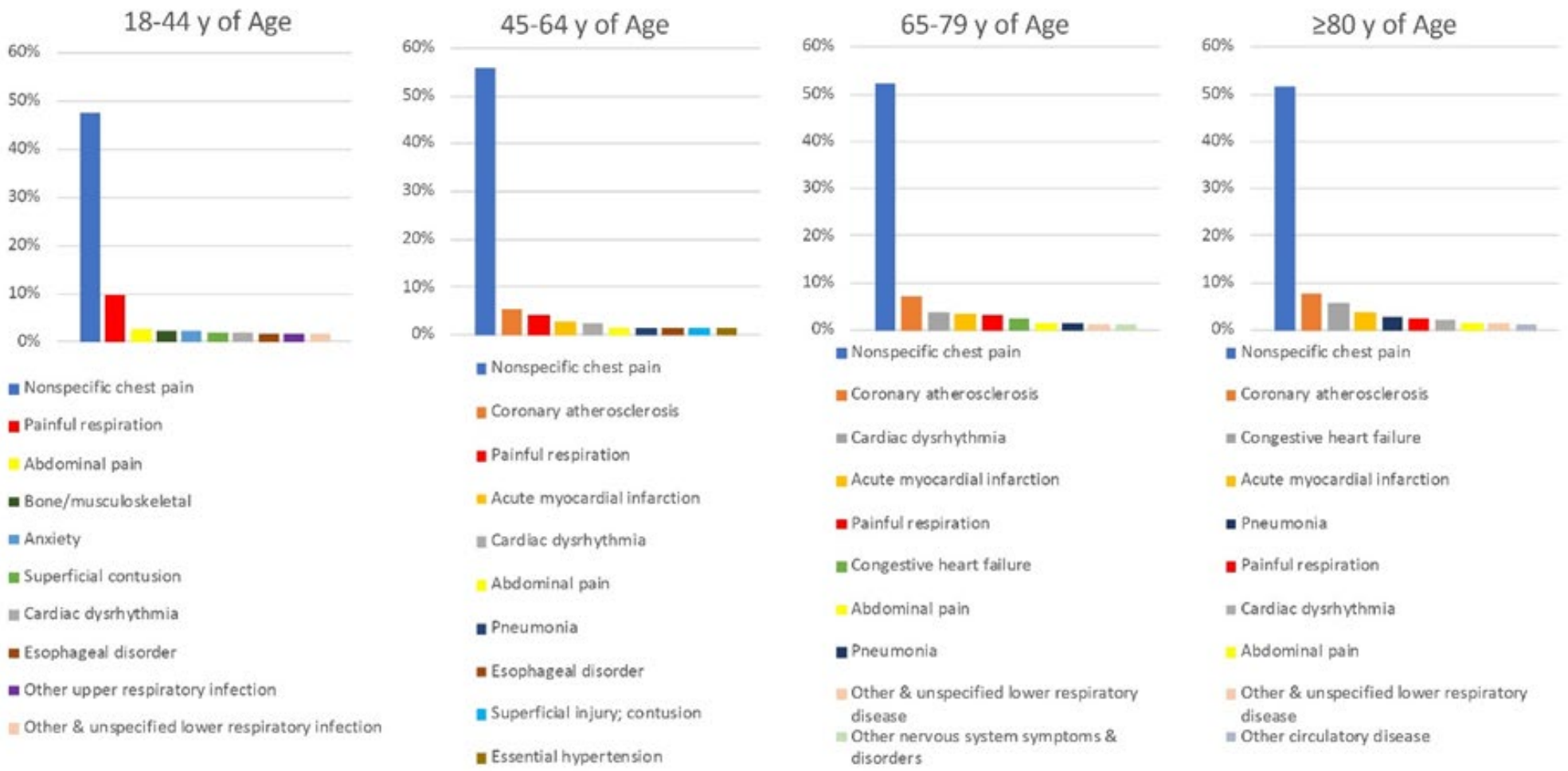
Ischemic heart disease and psychogenic disorders are the next most common causes.

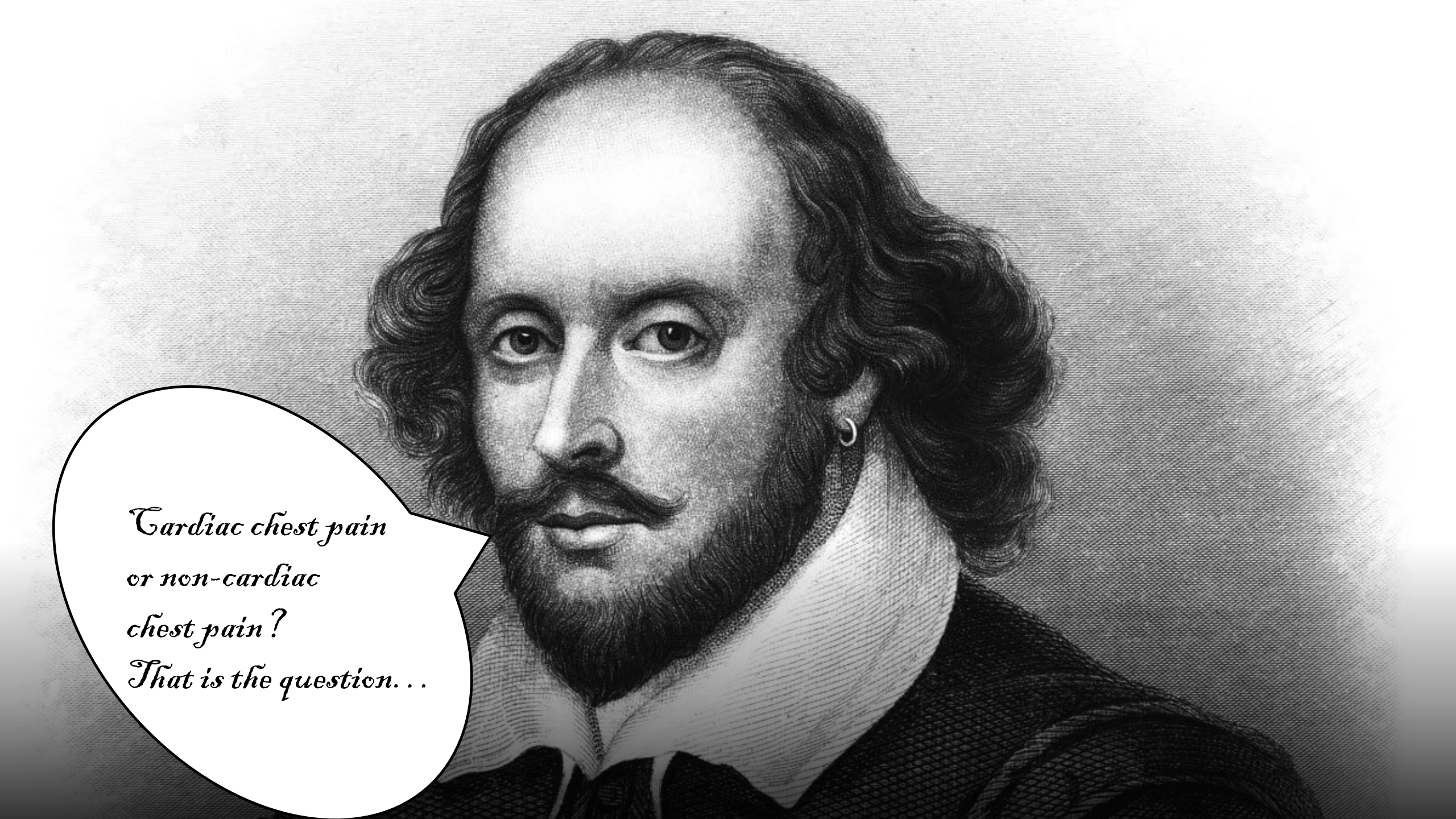
Chronic stable angina is the most prevalent type of ischemic heart disease seen in the office.

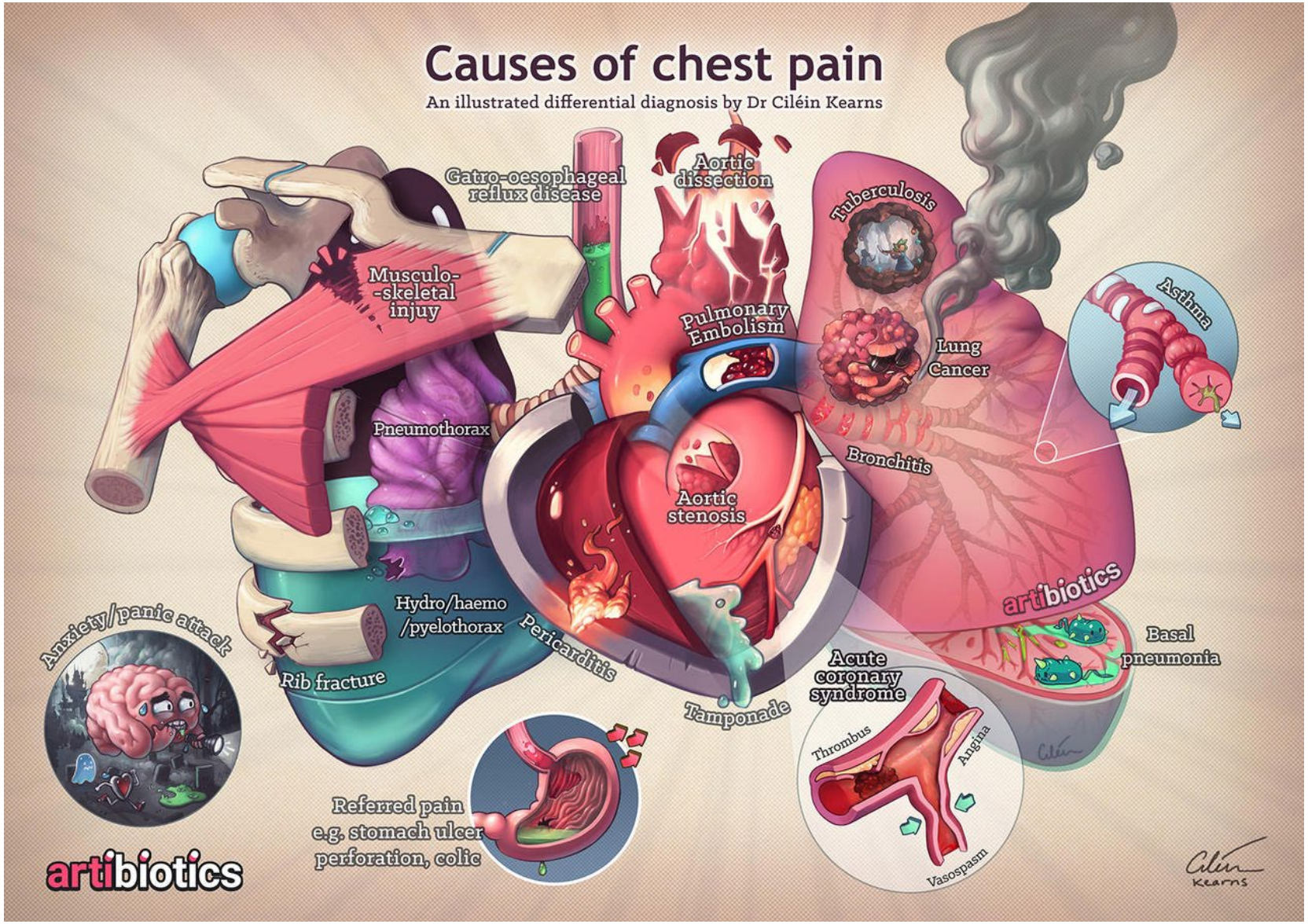
Annual Total Cost of CP Evaluations in the US? ~ $10 Billion

Only 10% are ultimately diagnosed with ACS or other acute diagnoses requiring urgent treatment.

TOP 10 CAUSES OF CHEST PAIN IN THE ED BY AGE




Cardiac chest pain
or non-cardiac
chest pain?
That is the question...


Causes of chest pain
An illustrated differential diagnosis by Dr Ciléin Kearns
Gastro-oesophageal reflux disease
Aortic dissection
Tuberculosis
Musculo-skeletal injuy
Pulmonary Embolism
Lung Cancer
Asthma
Pneumothorax
Bronchitis
Aortic stenosis
artibiotics
Hydro/haemo /pyelothorax
Pericarditis
Basal pneumonia
Anxiety/panic attack
Rib fracture
Acute coronary syndrome
Tamponade
Thrombus
Angina
Referred pain e.g. stomach ulcer perforation, colic
Vasospasm
artibiotics
Kearns

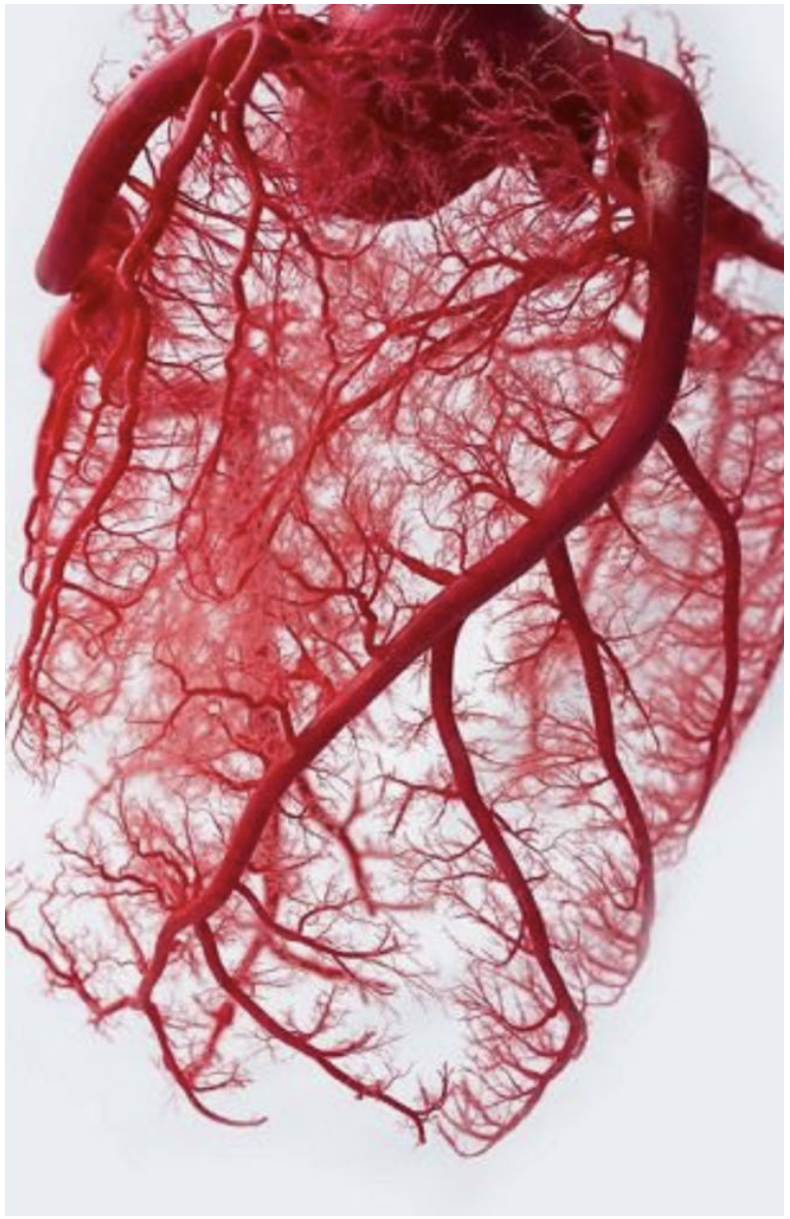
Differential Diagnosis of Chest Pain

Diagnosis	Characteristics
Ischemic heart disease	Typical or atypical angina
Nonischemic heart disease	
Arrhythmias	Palpitations or typical angina
Valvular heart disease	Typical angina, often exertional
Aortic dissection	"Tearing" pain, often abrupt onset
Pericarditis	Pleuritic pain, relieved by sitting up and leaning forward
Pulmonary disease	
Pulmonary embolus	Pleuritic pain, associated dyspnea
Pneumothorax	Acute onset, pleuritic pain, associated dyspnea
Pneumonia	Pleuritic pain
Pulmonary parenchymal disease	Dyspnea, cough
Pulmonary hypertension	Exertional pain
Gastrointestinal disease	
Esophageal disease	May be indistinguishable from angina
Biliary disease	May be indistinguishable from angina; right upper quadrant pain that radiates to the back or scapula
Pancreatitis	"Boring" epigastric pain, may radiate to the back
Chest wall or dermatologic pain	
Costochondritis	Localized reproduction of pain with palpation or movement
Rib fracture	
Sternoclavicular arthritis	
Herpes zoster	Pain may precede rash
	Characteristic point tenderness
Anxiety disorders	Often associated with palpitations, dyspnea, sweating, and anxiety

CARDIAC VS NON-CARDIAC CP

- *TYPICAL/CLASSIC CARDIAC CP HAS ALL 3 OF THE FOLLOWING CRITERIA:*
  - SUBSTERNAL PRESSURE OR HEAVINESS
  - WORSE WITH EXERTION +/- EMOTIONAL STRESS
  - LASTS FOR AT LEAST 2 MIN AND THEN RESOLVES WITH REST OR NITROGLYCERIN

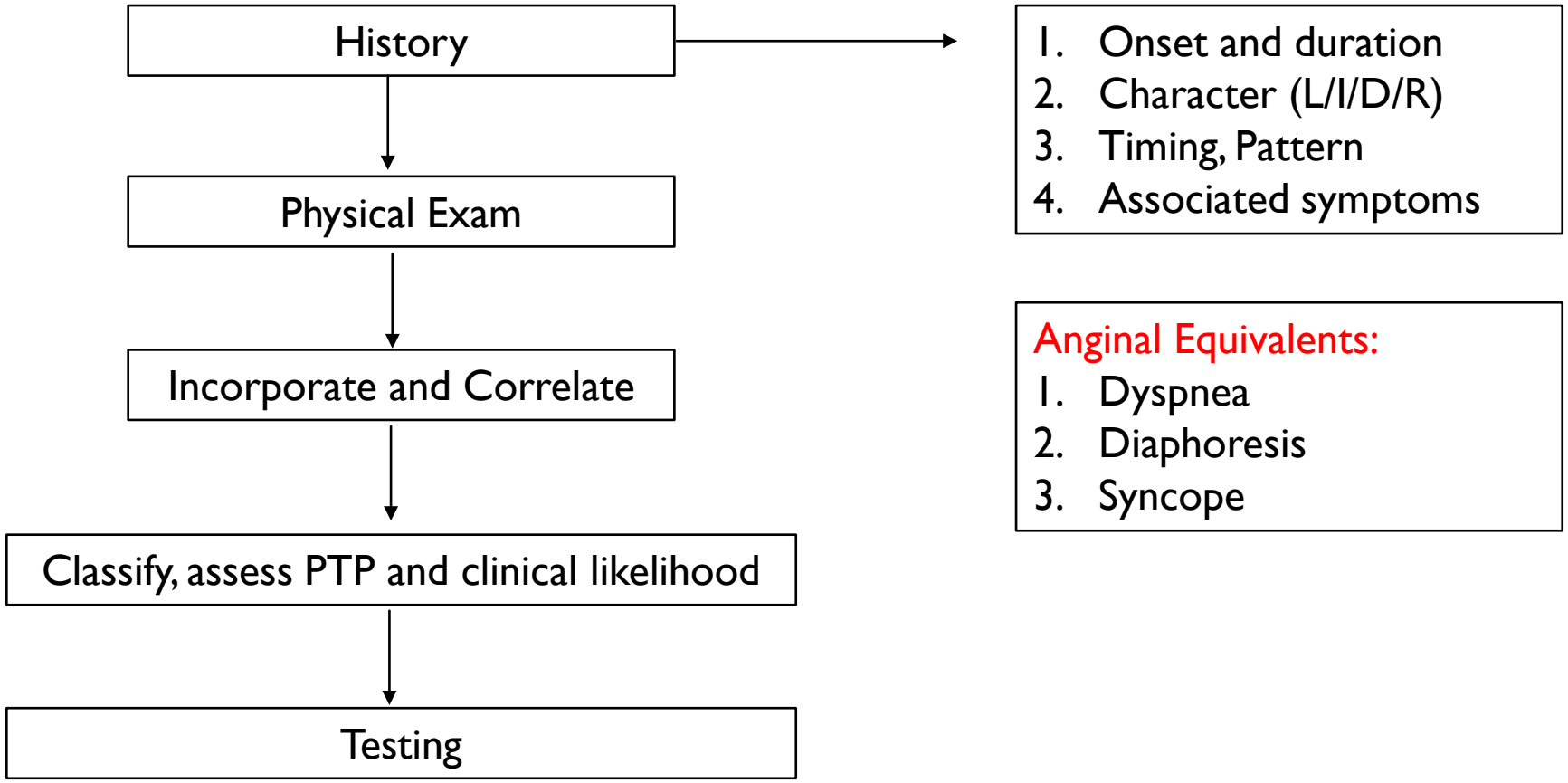
- *2/3?* → ATYPICAL CP
- *1/3 or 0/3?* → NON-CARDIAC CP



THE BROADENING SPECTRUM OF ISCHEMIC HEART DISEASE

- Acute Coronary Syndrome: Due to acute plaque rupture.
  - STEMI
  - NSTEMI
  - Unstable Angina
- CAD with Stable Angina
- INOCA: Ischemia with Non-Obstructed Coronary Arteries.
  - Coronary Vasospasm
  - Coronary Microvascular Dysfunction
  - Stress Cardiomyopathy

DIAGNOSTIC APPROACH

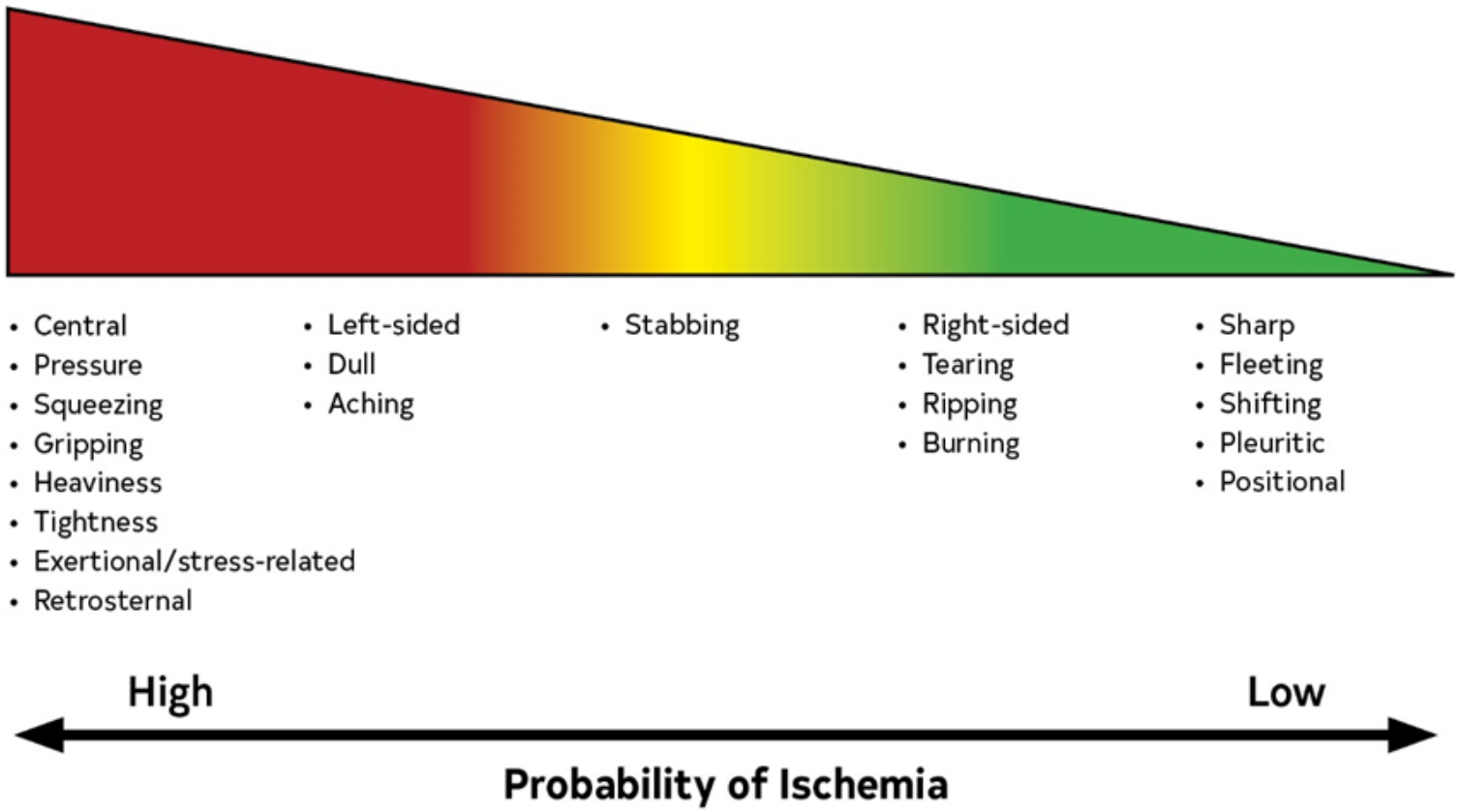


HISTORY: ONSET & DURATION

- Onset: New vs Chronic vs Recurrent
- Sudden versus gradual onset
- Relationship to recent illnesses, injuries or events
- Comparison with previous angina or equivalents (if known) and other chest pain
- New angina is not necessarily unstable
- Chronic stable angina: stable symptom frequency ≥2 months that are predictable, repetitive, inducible

HISTORY: CHARACTER

- Location; Radiation
- Intensity of discomfort
- Descriptive quality
- Aggravating & alleviating factors



Don't forget: women, the elderly, and diabetics often have atypical symptoms!

	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.**

	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	**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.**

HISTORY: CHARACTER

Triggers are often the most telling:

- Angina: Exertional symptoms relieved by rest.
- GERD: 1-2 hr after meal, especially when lying down.
- Pleural: worse with inspiration/cough, with cough and SOB being the more major symptom.
- Costochondritis: can be similar to pleural, but also positional and provoked by palpation.

Meanwhile, relief with nitroglycerin is NOT diagnostic.

HISTORY: TIMING & PATTERN

Coronary Spasm: circadian pattern, often in the early morning at rest

Fleeting chest pain lasting few seconds is unlikely to be related to ischemic heart disease

Anginal symptoms gradually build in intensity over a few minutes.

HISTORY: ASSOCIATED SYMPTOMS

Typical: SOB, palpitations, diaphoresis, lightheadedness.

Less typical: presyncope/syncope, upper abdominal pain or heartburn unrelated to meals or N/V.

Ask other discriminating questions:

- Dyspnea: ask about wheezing, ongoing triggers in setting of known pulmonary disease
- Does this feel like your prior anxiety / panic attacks?

PHYSICAL EXAM

Clinical Syndrome	Findings
ACS	Diaphoresis, tachypnea, tachycardia, hypotension, crackles, S3, MR murmur
Noncoronary cardiac: AS, AR, HCM	AS: Characteristic systolic murmur, tardus or parvus carotid pulse AR: Diastolic murmur at right of sternum, rapid carotid upstroke HCM: Increased or displaced LV impulse, prominent *a* wave in JVP, systolic murmur
Pericarditis	Fever, pleuritic chest pain, increased in supine position, friction rub
Myocarditis	Fever, chest pain, heart failure, S3
Esophagitis, PUD, GB disease	Epigastric tenderness; Right upper quadrant tenderness, Murphy sign
Pneumonia	Fever, localized CP, may be pleuritic, friction rub, dullness to percussion, egophony
Pneumothorax	Dyspnea and pain on inspiration, unilateral absence of breath sounds
Costochondritis, Tietze syndrome	Tenderness of costochondral joints
Herpes zoster	Dermatomal distribution, triggered by touch; characteristic rash

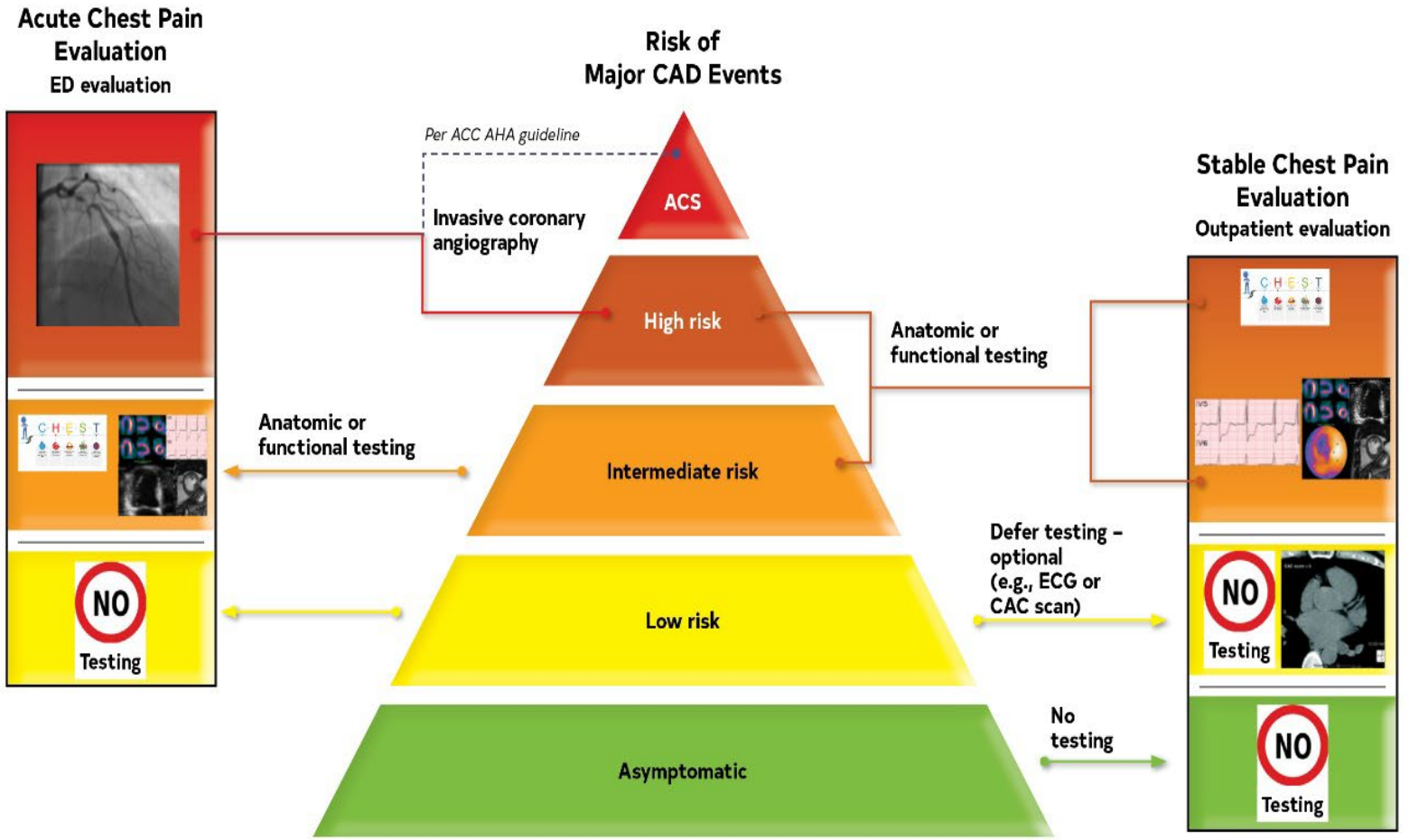
TESTING: QUICK UPDATES TO THE GUIDELINES

- Chest Pain Means More Than Pain in the Chest → Anginal equivalents
- Patient-centered approach to diagnostic testing that is determined by patient's unique CV risk
- Shared Decision-Making
- Use Clinical Decision Pathways
- Assess Accompanying Symptoms
- Use a Structured Risk Assessment

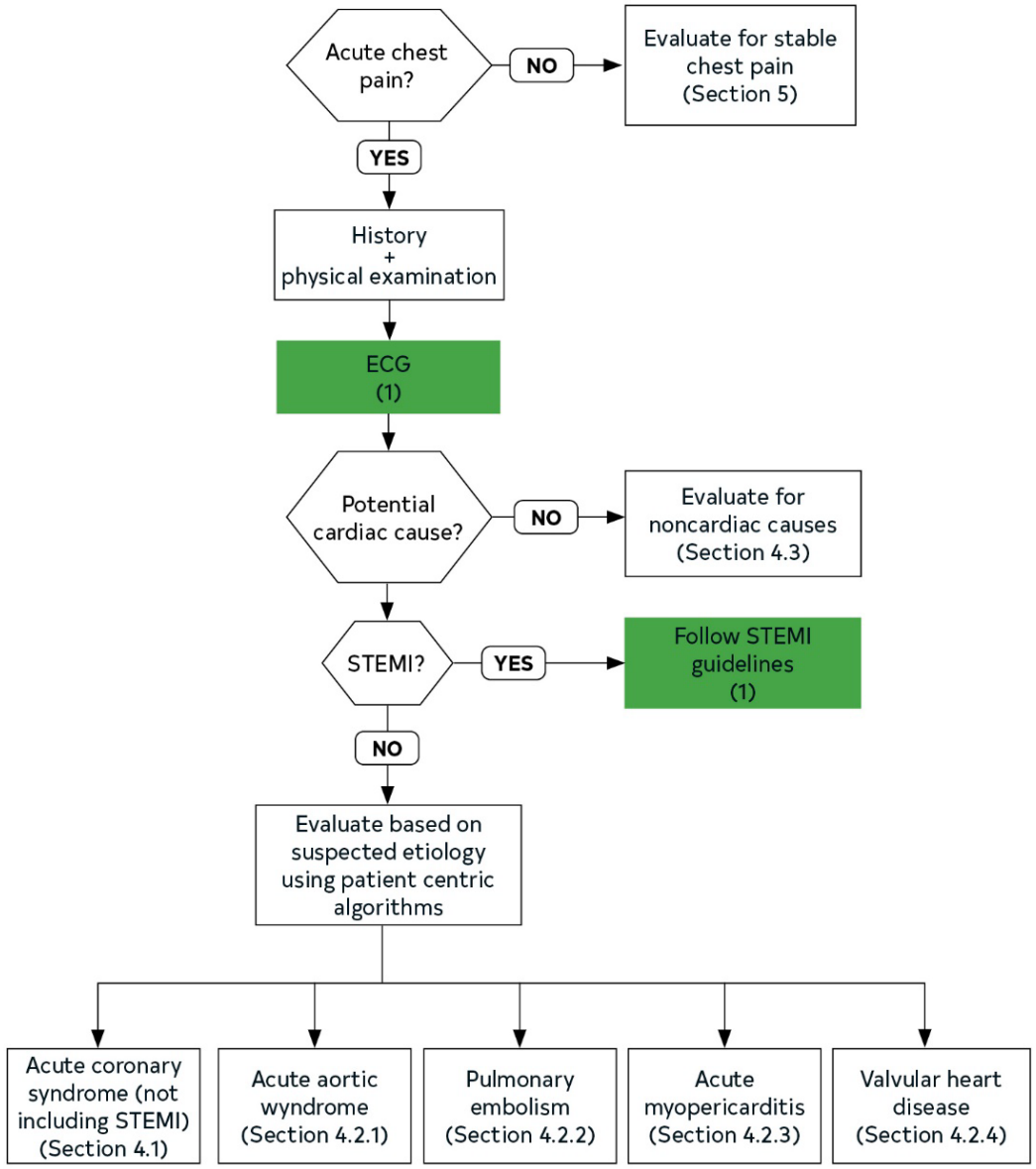
TESTING: QUICK UPDATES TO THE GUIDELINES

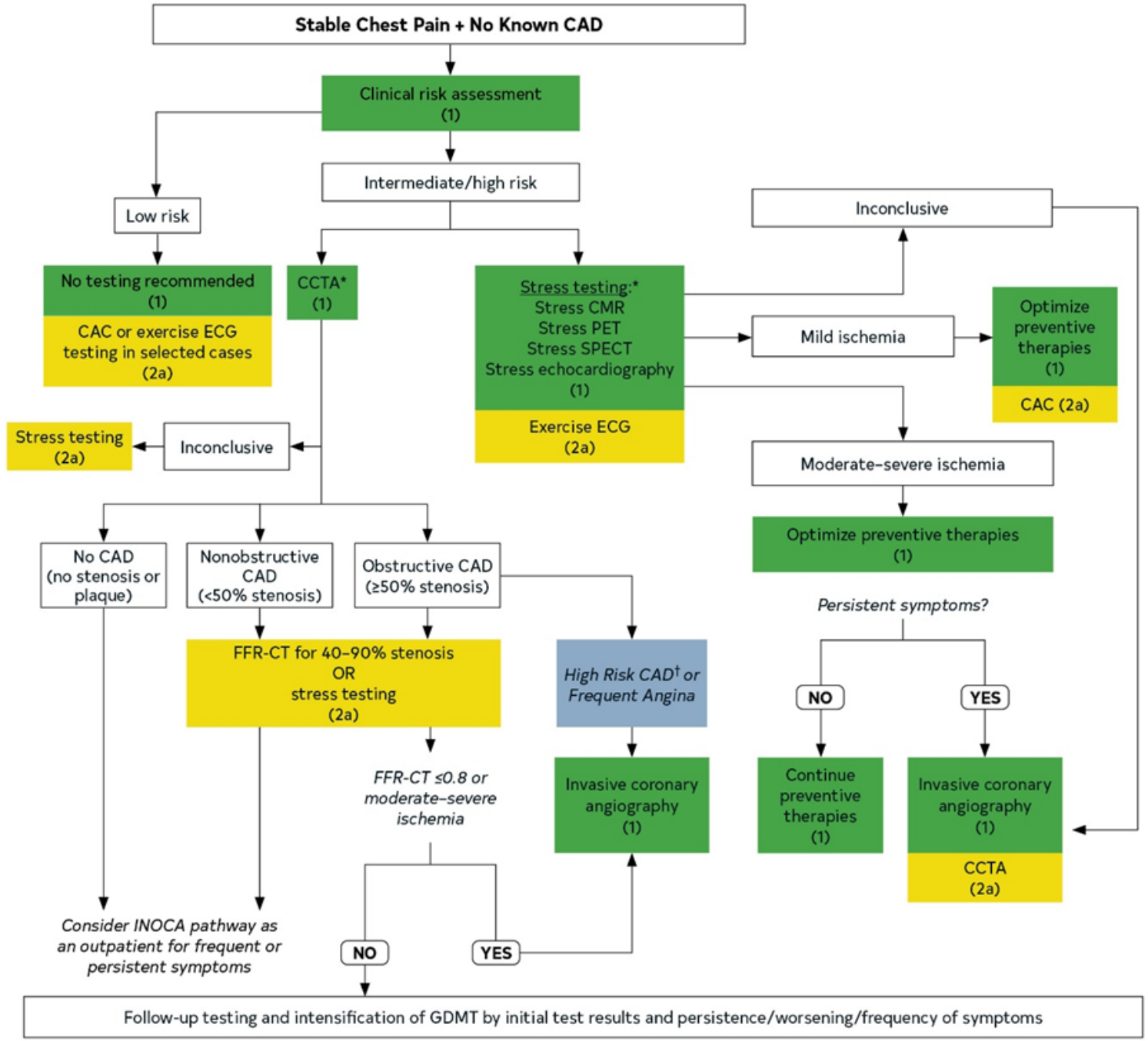
- CCTA favored due to its high NPV in those younger, less likely obstructive CAD or prior inconclusive functional study.
- Stress imaging favored in those older, more likely to have obstructive CAD, or with prior inconclusive CCTA
- More focus on assessing entire coronary perfusion system - microcirculation and not just epicardial disease
- Recommendation of PET MPI over SPECT MPI if available for CP patients referred for pharmacologic stress MPI
- Incorporation of FFR-CT into diagnostic testing
- Epicardial microcirculation in addition to microcirculation, especially relevant in women
- Flow reserve and ability to assess CMD

TESTING IS STRATIFIED BY RISK CLASSIFICATION

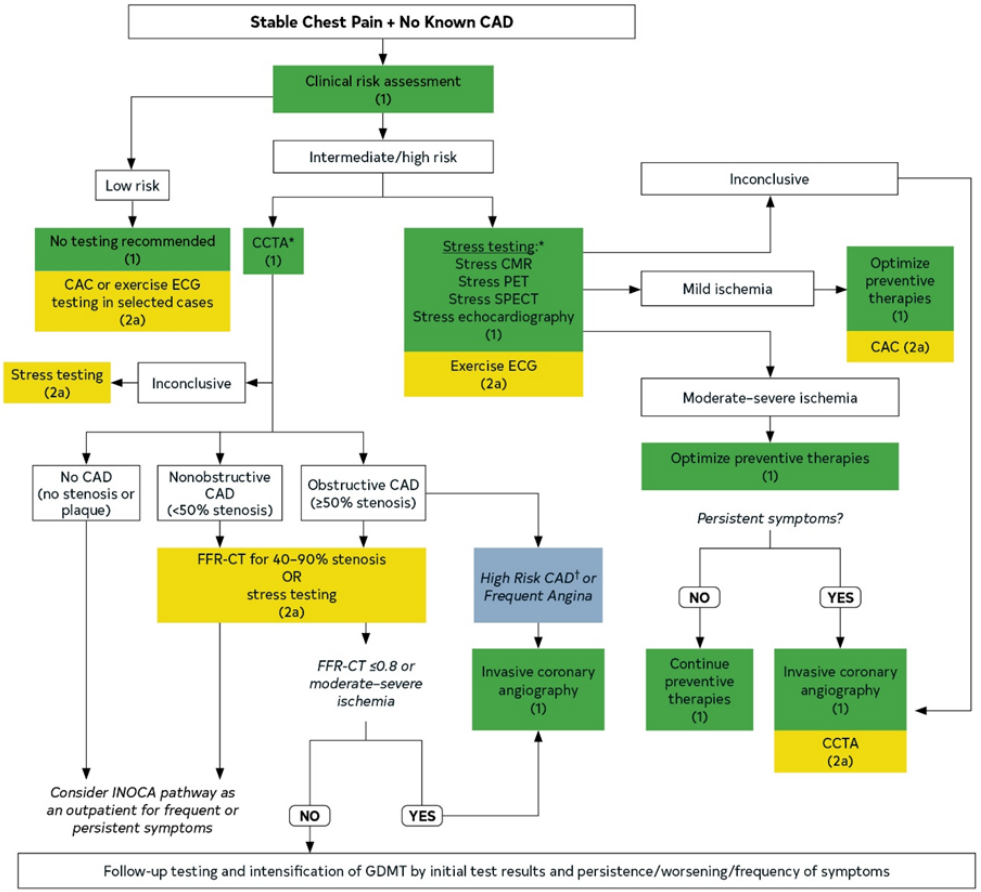


TESTING FOR ACUTE CHEST PAIN




Stable Chest Pain + No Known CAD
Clinical risk assessment (1)
Low risk
Intermediate/high risk
No testing recommended (1)
CAC or exercise ECG testing in selected cases (2a)
CCTA* (1)
Stress testing:* Stress CMR Stress PET Stress SPECT Stress echocardiography (1)
Exercise ECG (2a)
Inconclusive
Stress testing (2a)
Inconclusive
Mild ischemia
Optimize preventive therapies (1)
CAC (2a)
Moderate–severe ischemia
Optimize preventive therapies (1)
No CAD (no stenosis or plaque)
Nonobstructive CAD (<50% stenosis)
Obstructive CAD (≥50% stenosis)
FFR-CT for 40–90% stenosis OR stress testing (2a)
High Risk CAD† or Frequent Angina
Invasive coronary angiography (1)
FFR-CT ≤0.8 or moderate–severe ischemia
NO
YES
Consider INOCA pathway as an outpatient for frequent or persistent symptoms
Persistent symptoms?
NO
YES
Continue preventive therapies (1)
Invasive coronary angiography (1)
CCTA (2a)
Follow-up testing and intensification of GDMT by initial test results and persistence/worsening/frequency of symptoms

2a	B-R	For patients with stable chest pain and no known CAD categorized as low risk, CAC testing is reasonable as a first-line test for excluding calcified plaque and identifying patients with a low likelihood of obstructive CAD.
2a	B-NR	For patients with stable chest pain and no known CAD categorized as low risk, exercise testing without imaging is reasonable as a first-line test for excluding myocardial ischemia and determining functional capacity in patients with an interpretable ECG.



Anatomic Testing		
		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.

Stress Testing		
1	B-R	2. For intermediate-high risk patients with stable chest pain and no known CAD, stress imaging (stress echocardiography, PET/SPECT MPI or CMR) is effective for diagnosis of myocardial ischemia and for estimating risk of MACE.
2a	B-R	3. For intermediate-high risk patients with stable chest pain and no known CAD for whom rest/stress nuclear MPI is selected, PET is reasonable in preference to SPECT, if available to improve diagnostic accuracy and decrease the rate of non-diagnostic test results.

2a	B-R	4. For intermediate-high risk patients with stable chest pain and no known CAD with an interpretable ECG and ability to achieve maximal levels of exercise (≥5 METs), exercise electrocardiography is reasonable.
2b	B-NR	5. In intermediate-high risk patients with stable chest pain selected for stress MPI using SPECT, the use of attenuation correction or prone imaging may be reasonable to decrease the rate of false-positive findings.

What about a TTE? When is it useful?

Assessment of Left Ventricular Function		
1	B-NR	6. In intermediate-high risk patients with stable chest pain who have pathological Q waves, symptoms or signs suggestive of heart failure, complex ventricular arrhythmias, or a heart murmur with unclear diagnosis, use of TTE is effective for diagnosis of resting left ventricular systolic and diastolic ventricular function and detection of myocardial, valvular, and pericardial abnormalities.

WHICH STRESS TEST SHOULD I CHOOSE?

Remember to consider:

- Pretest probability of CAD
- Patient preference
- Patient characteristics / comorbidities
- Equipment and expertise availability
- Exercise is always preferred if possible
- ECG and Echo and MRI avoid radiation
- MRI detects myocardial edema and microvascular obstruction
- PET > SPECT

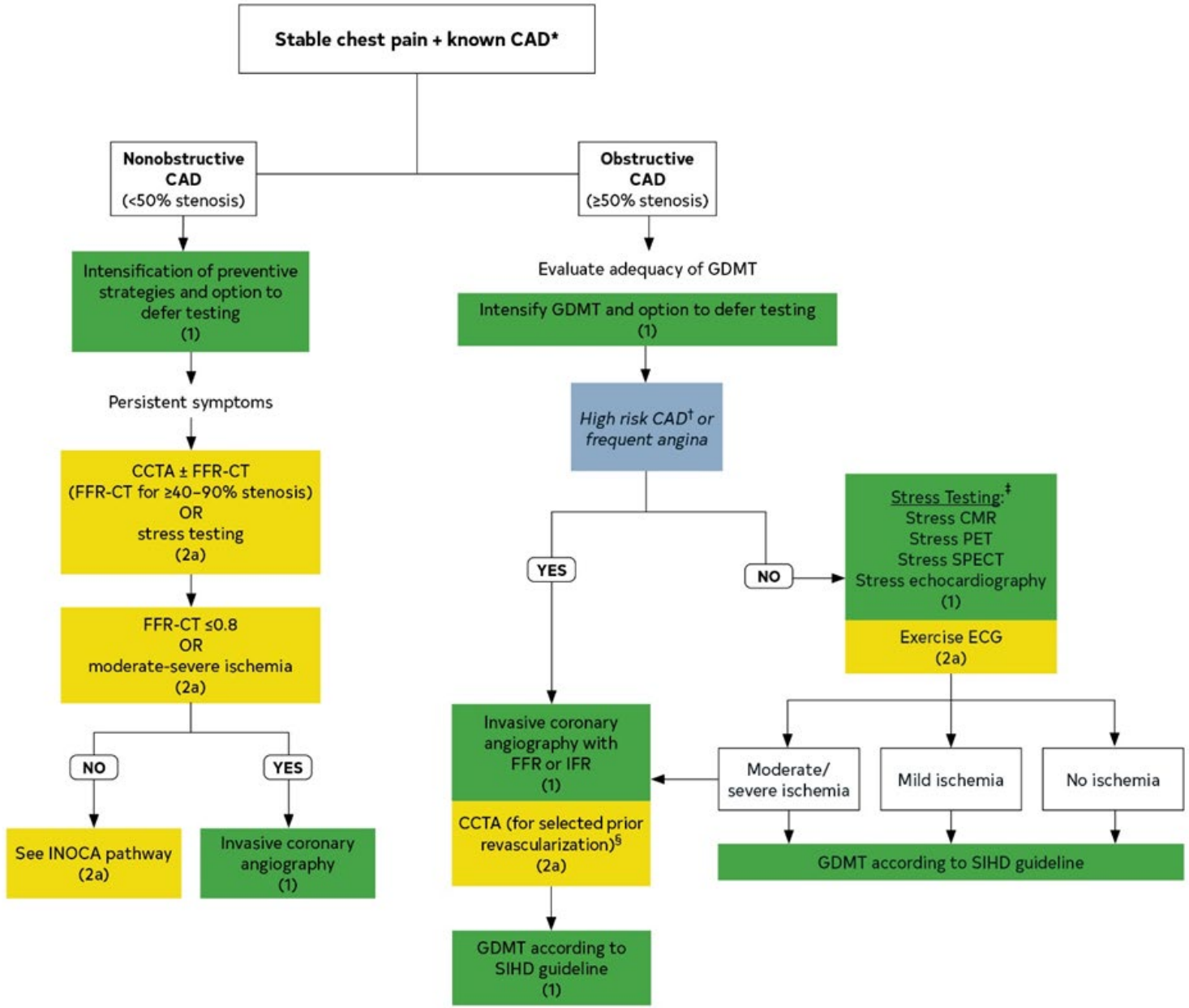
Stress testing information					
	ETT	Stress echocardiography	SPECT MPI	PET MPI	Stress CMR MPI
Patient capable of exercise	√	√	√		
Pharmacologic stress indicated		√	√	√	√
Quantitative flow				√ √	√
LV dysfunction/scar		√	√	√	√

	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)

Warranty Period ~ 2 year ~ 1 year

Secondary Diagnostic Testing: What to Do If Index Test Results Are Positive or Inconclusive		
Sequential or Add-on Testing		
2a	B-NR	7. For intermediate-high risk patients with stable chest pain and known coronary s… f 40% to 90% in a proximal or … oronary segment on CCTA, FFR- … l for diagnosis of … emia and to guide decision- … se o… n.
2a	B-NR	8. Fo… hest pain after an inconclusive or abnorma… g study, CCTA is reasonable.
2a	B-NR	9. For inte… table chest pain and no known CAD … sting can be useful.
2a	B-NR	1… gh risk pat… pain after inconclusive CCTA, … g is reasonable.
2b	C-EO	11. Fo… ntermediate-high risk patients with stabl… chest pain after a negative stress test but with high clinical suspicion of CAD, CCTA or ICA may be reasonable.

At this point, consult with your local cardiologist for additional steps!


Stable chest pain + known CAD*
Nonobstructive CAD (<50% stenosis)
Obstructive CAD (≥50% stenosis)
Intensification of preventive strategies and option to defer testing (1)
Persistent symptoms
CCTA ± FFR-CT (FFR-CT for ≥40–90% stenosis) OR stress testing (2a)
FFR-CT ≤0.8 OR moderate-severe ischemia (2a)
NO
YES
See INOCA pathway (2a)
Invasive coronary angiography (1)
Evaluate adequacy of GDMT
Intensify GDMT and option to defer testing (1)
High risk CAD† or frequent angina
YES
NO
Stress Testing:‡ Stress CMR Stress PET Stress SPECT Stress echocardiography (1)
Exercise ECG (2a)
Invasive coronary angiography with FFR or IFR (1)
CCTA (for selected prior revascularization)§ (2a)
GDMT according to SIHD guideline (1)
Moderate/ severe ischemia
Mild ischemia
No ischemia
GDMT according to SIHD guideline

WHAT ABOUT CARDIAC CATH VS CORONARY CTA?

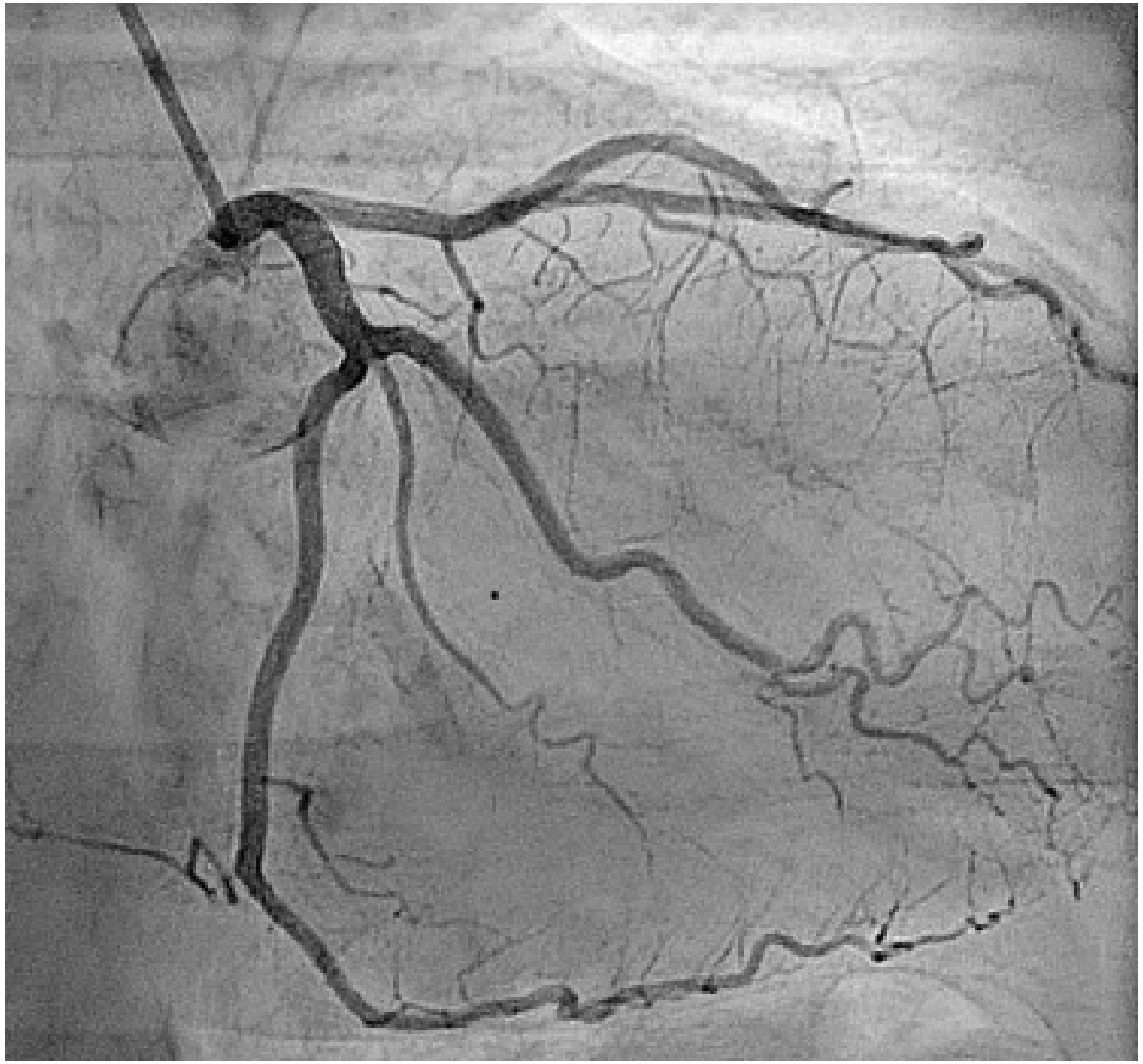
2a C-LD	3. For intermediate-risk patients with acute chest pain with evidence of previous mildly abnormal stress test results (≤1 year), CCTA is reasonable for diagnosing obstructive CAD (12,13).
1 A	1. For intermediate-high risk patients with stable chest pain and no known CAD, CCTA is effective for diagnosis of CAD, for risk stratification, and for guiding treatment decisions (1-12).
	Stress Testing
1 B-R	2. For intermediate-high risk patients with stable chest pain and no known CAD, stress imaging (stress echocardiography, PET/SPECT MPI or CMR) is effective for diagnosis of myocardial ischemia and for estimating risk of MACE (8,13-35).
1 B-R	2. In patients with CCD and a change in symptoms or functional capacity that persists despite GDMT, invasive coronary angiography (ICA) is recommended for guiding therapeutic decision-making with the goal of improving anginal symptoms.*[24-28]

DON'T FORGET ABOUT MEDICAL MANAGEMENT!

- Aspirin 81mg daily
- Statin therapy to target LDL ideally <55, at least <70
  - Alternatives to statins: Zetia, Repatha, Praluent, bempedoic acid or a combination of these
- Anti-anginals: PRN nitroglycerin, beta-blockers, long-acting nitrates, calcium channel blockers if BP and HR can tolerate these.

FINAL TIPS AND TAKEAWAYS

- Chest pain covers a broad spectrum of diseases, both cardiac and non-cardiac in etiology.
- Chest pain evaluations can pose a large burden on the health care system and patient well-being.
- History and physical are still a major part of the chest pain evaluation.
- Testing for ischemic heart disease should be patient focused and shared decision making pursued.
- Coronary CTA is emerging as a preferred testing modality.
- Medical management goes a long way in treatment, both for symptoms and prognosis!
- Invasive coronary angiography should be reserved for ACS, patients with persistent symptoms despite optimal medical management, and for select high risk non-invasive test results.



THANK YOU