Chest Pain Evaluation and Management

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I do not have any disclosure related to this presentations

Several Slides, tables, flow diagrams and algorithms were taken or modified from the 2021 ACC /AHA chest pain guidelines and slides sets

Learning Objectives

- Algorithm based evaluation and management of stable and acute chest pain
- Pretest probability of CAD in stable chest pain
- Risk stratification in patients with acute chest pain
- Use of high sensitivity troponin and discharge patients from the emergency department
- Discuss 2021 ACC/AHA chest pain evaluation guidelines

What is New in 2021 ACC/AHA Chest Pain Guidelines

- The terminology "Atypical chest pain" should not be used
- High-sensitivity troponins (hscTn) are preferred for establishing a biomarker diagnosis of acute MI
- Testing not needed routinely for low-risk patients.
- Clinical Decision Pathways (CDP) for chest pain should be used routinely.
- Patients presenting with chest pain, risk for CAD and adverse events should be estimated using evidence-based diagnostic protocols (structured risk assessment).

Types of Chest Pain

- Cardiac
- Possible cardiac (atypical is out)
- Non-cardiac chest pain

Acute vs Stable Chest Pain

- Acute chest pain:
  - New onset or change in frequency, intensity, or duration compared with previous episodes in a patient with recurrent symptoms.
- Stable chest pain:
  - Chronic symptoms provoked by exertion or emotional stress.

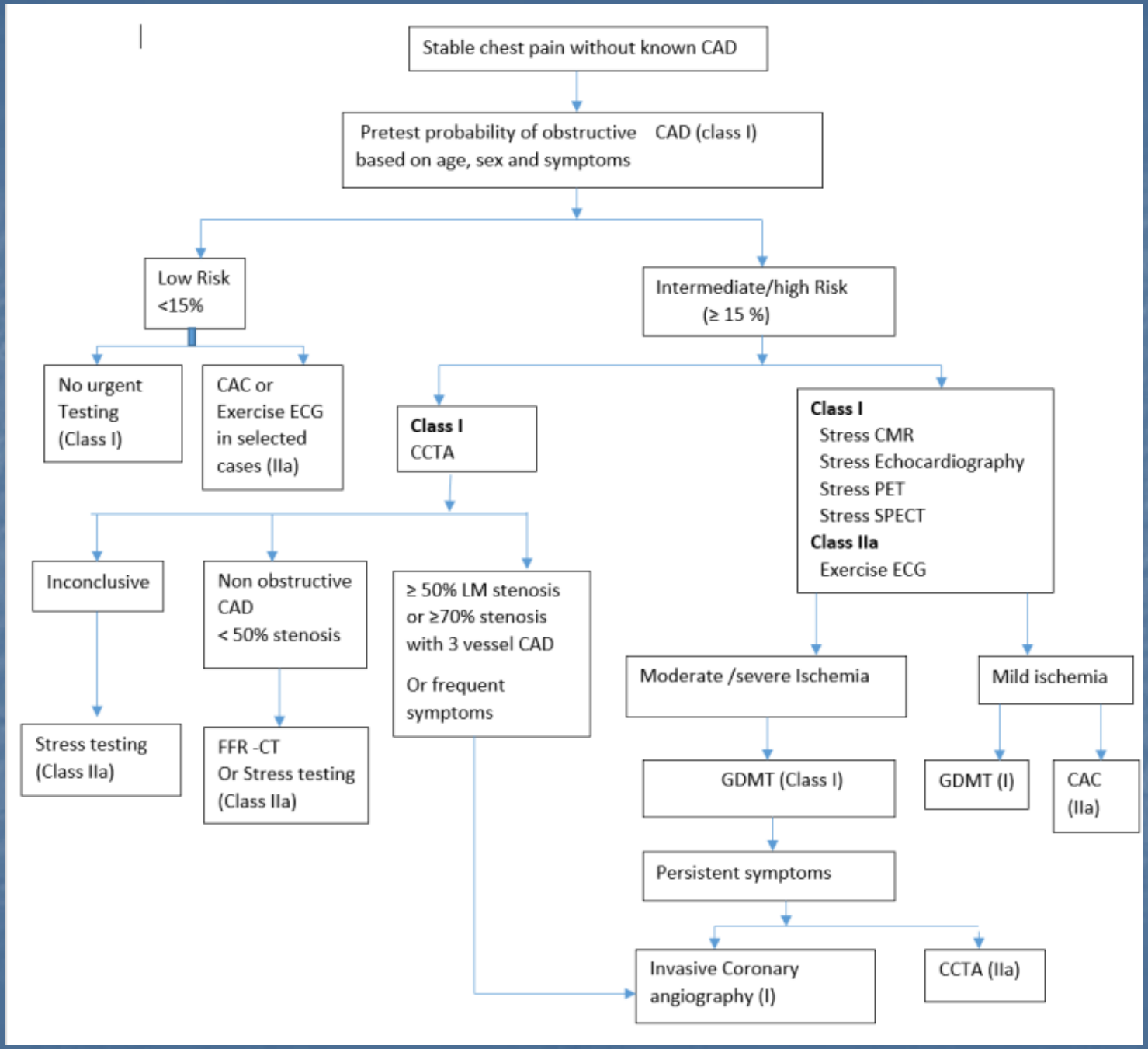
Clinical Evaluation of Stable Chest Pain

- A thorough history and physical examination
- ECG
- Assess the Pre-test probability of obstructive CAD

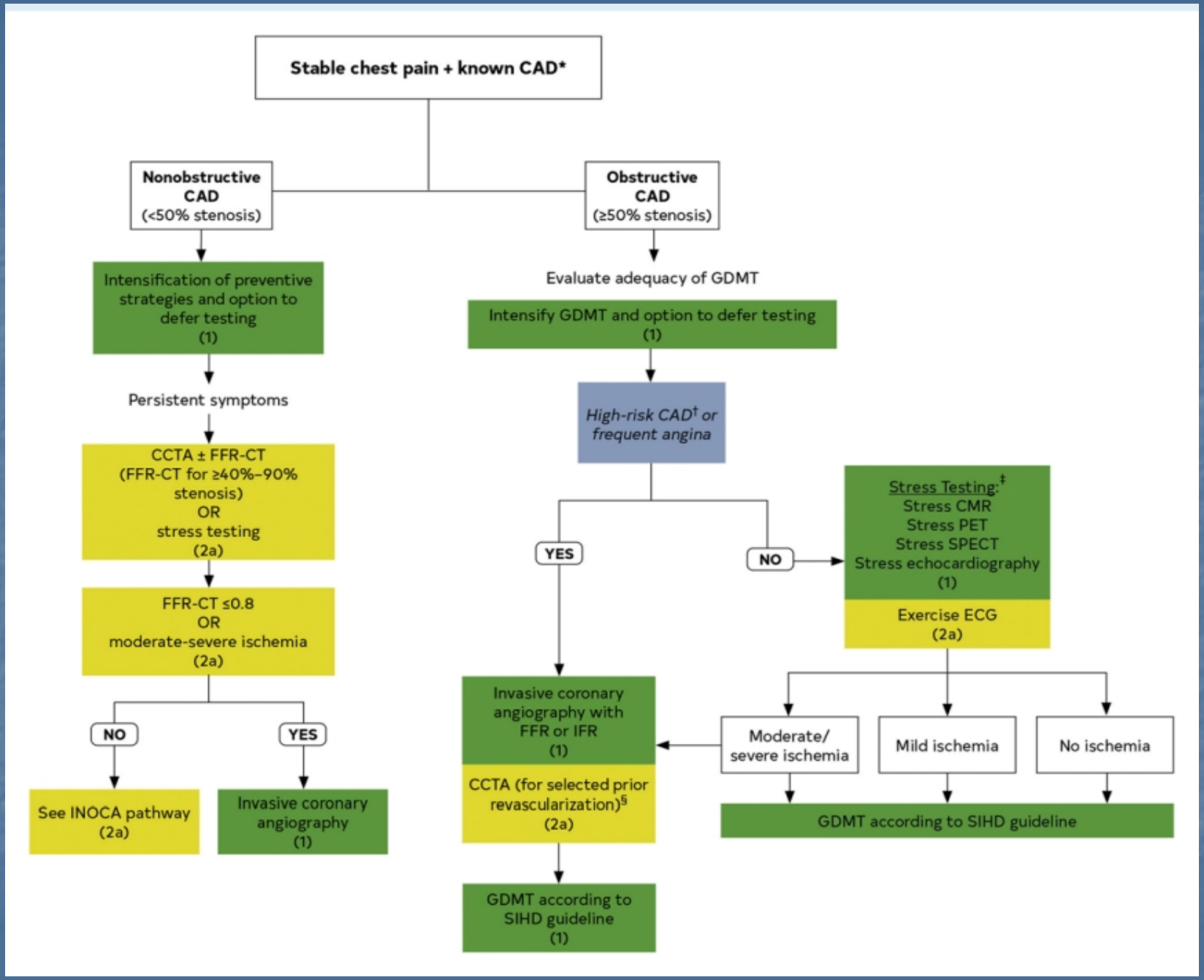
Pretest Probabilities of Obstructive CAD in Symptomatic Patients
(A) according to age, sex, and symptoms;
(B) according to age, sex, symptoms, and CAC

Age, y	Chest Pain		Dyspnea	
	Men	Women	Men	Women
30–39	≤4	≤5	0	3
40–49	≤22	≤10	12	3
50–59	≤32	≤13	20	9
60–69	≤44	≤16	27	14
70+	≤52	≤27	32	12

Gulati, M, Levy P and Mukherjee D. et al. 2021 AHA/ACC Guideline for the Evaluation and Diagnosis of Chest Pain. Circulation.



Adapted and modified from ACC/AHA 2021 chest pain guidelines



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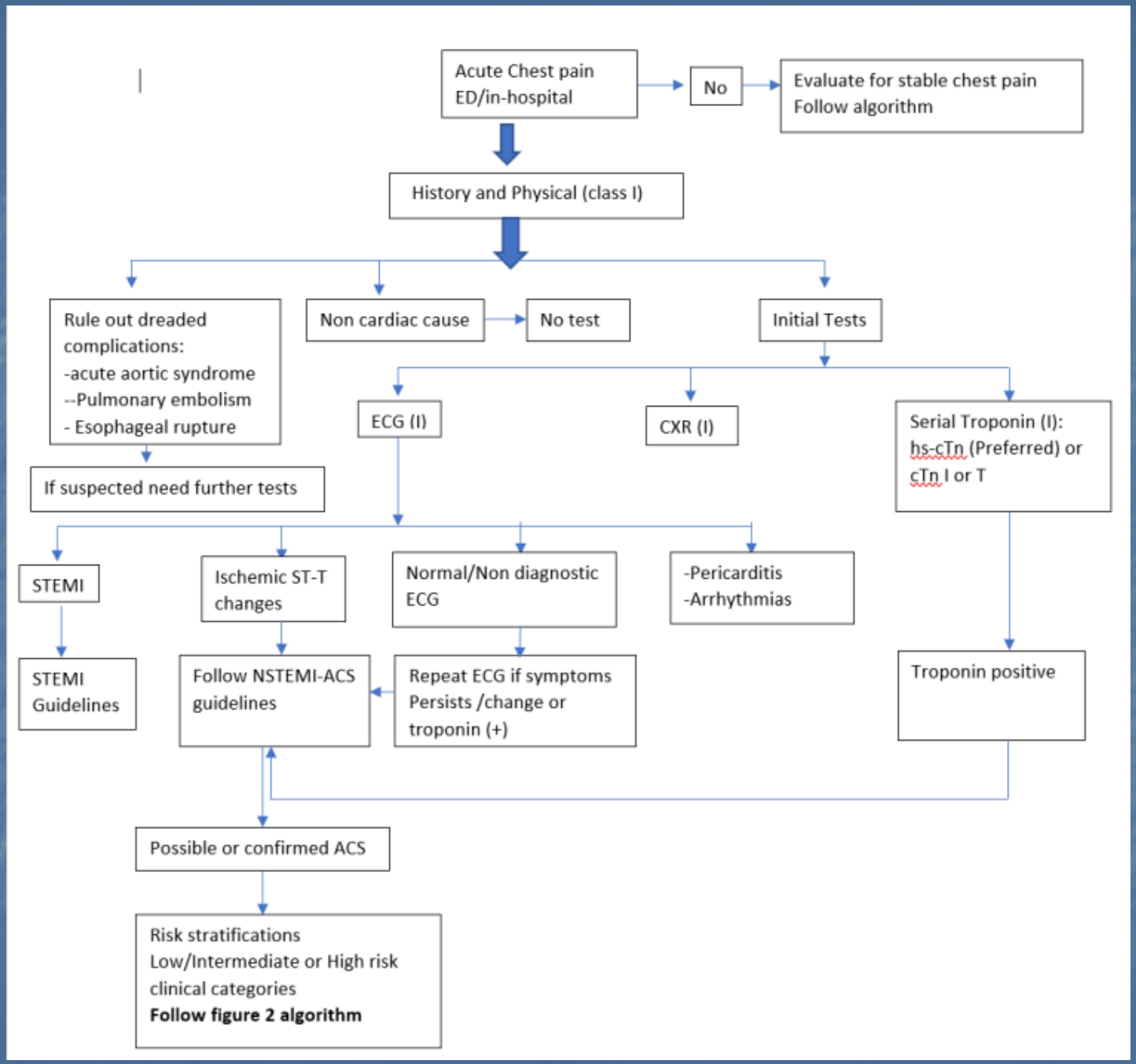
Acute Chest Pain

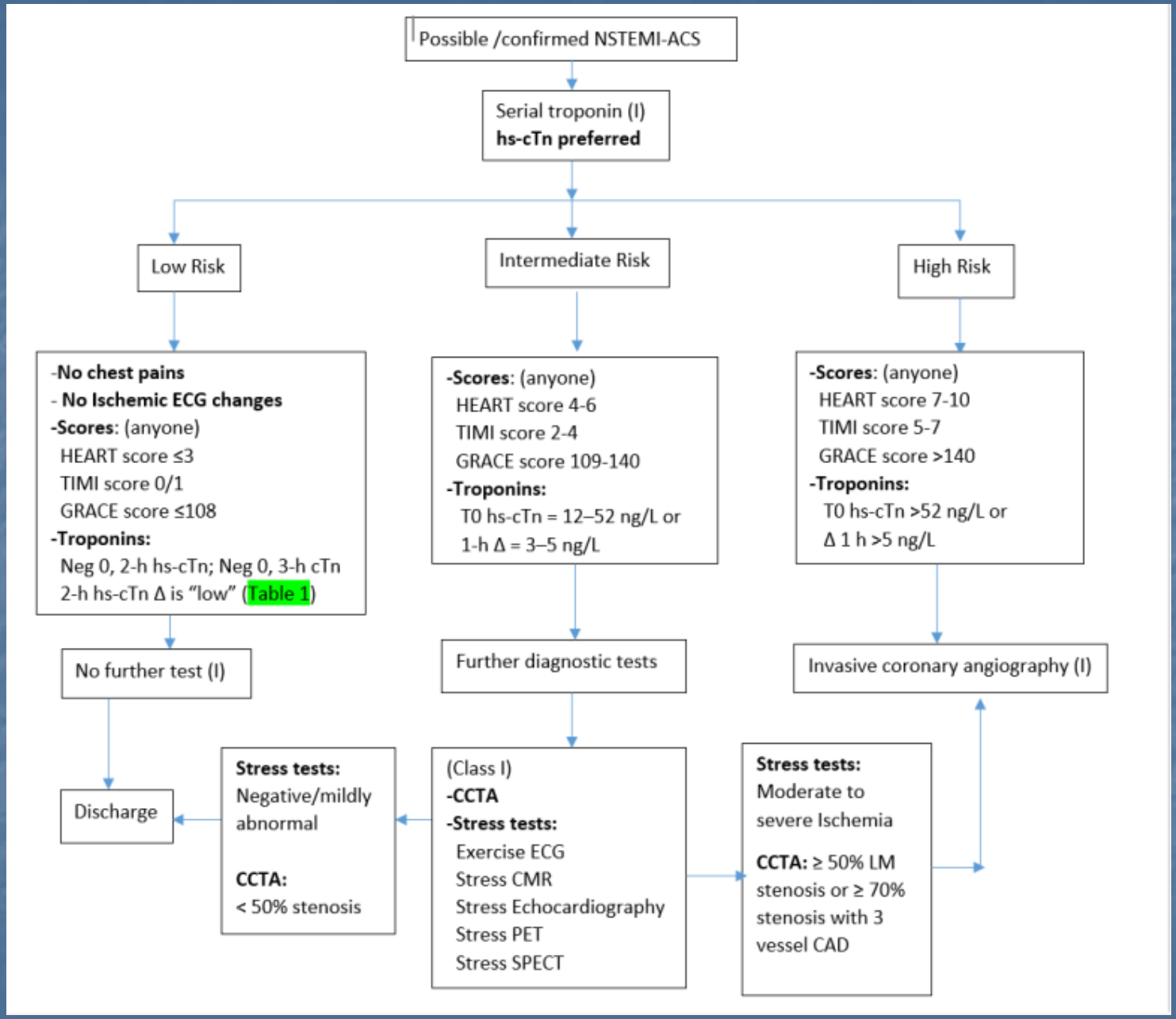
- A thorough history and physical examination
- Immediate EKG should be performed (within 10 min)
- Chest Xray
- Serial troponin (high sensitivity troponin is preferred) as soon as possible
- Risk Stratification: Clinical Decision Pathways
  - Low, intermediate or high-risk clinical categories



Adapted and modified from ACC/AHA 2021 chest pain guidelines

Clinical Decision Pathways (CDPs) and Troponin

- Patients with acute chest pain and suspected ACS
  - CDPs should categorize patients into low-, intermediate-, and high-risk strata to facilitate disposition and subsequent diagnostic evaluation.
  - Institutions should implement a CDP that includes a protocol for troponin sampling based on their particular assay.



Adapted and modified from ACC/AHA 2021 chest pain guidelines: Circulation

High Sensitivity Troponin Assays

- Clinicians should be familiar with the analytical performance and the 99th percentile upper reference limit that defines myocardial injury for the hscTn assay at their institution.

High Sensitivity Troponin Assays

Assay	Low	99th percentile			1h Δ	2h Δ
		Overall	Male	Female		
hs-cTn T (Elecsys; Roche)	<5	19	22	14	≥5	≥10
hs-cTn I (Architect; Abbott)	<4	26	34	16	≥6	≥15
hs-cTn I (Centaur; Siemens)	<3	47	62	39	≥12	≥20
hs-cTn I (Access; Beckman Coulter)	<4	18	20	12	≥15	≥20
hs-cTn I (Clarity; Singulex)	<1	6.74	9.24	3.35	≥6	NA
hs-cTn I (Vitros; Clinical Diagnostics)	<1	11	12	9	≥4	NA
hs-cTn I (Pathfast; LSI Medience)	<3	25	27	21	≥20	NA
hs-cTn I (TriageTrue; Quidel)	<4	20.5	25.7	14.4	≥8	NA

Adapted and modified from 2020 ESC NSTEMI Guidelines

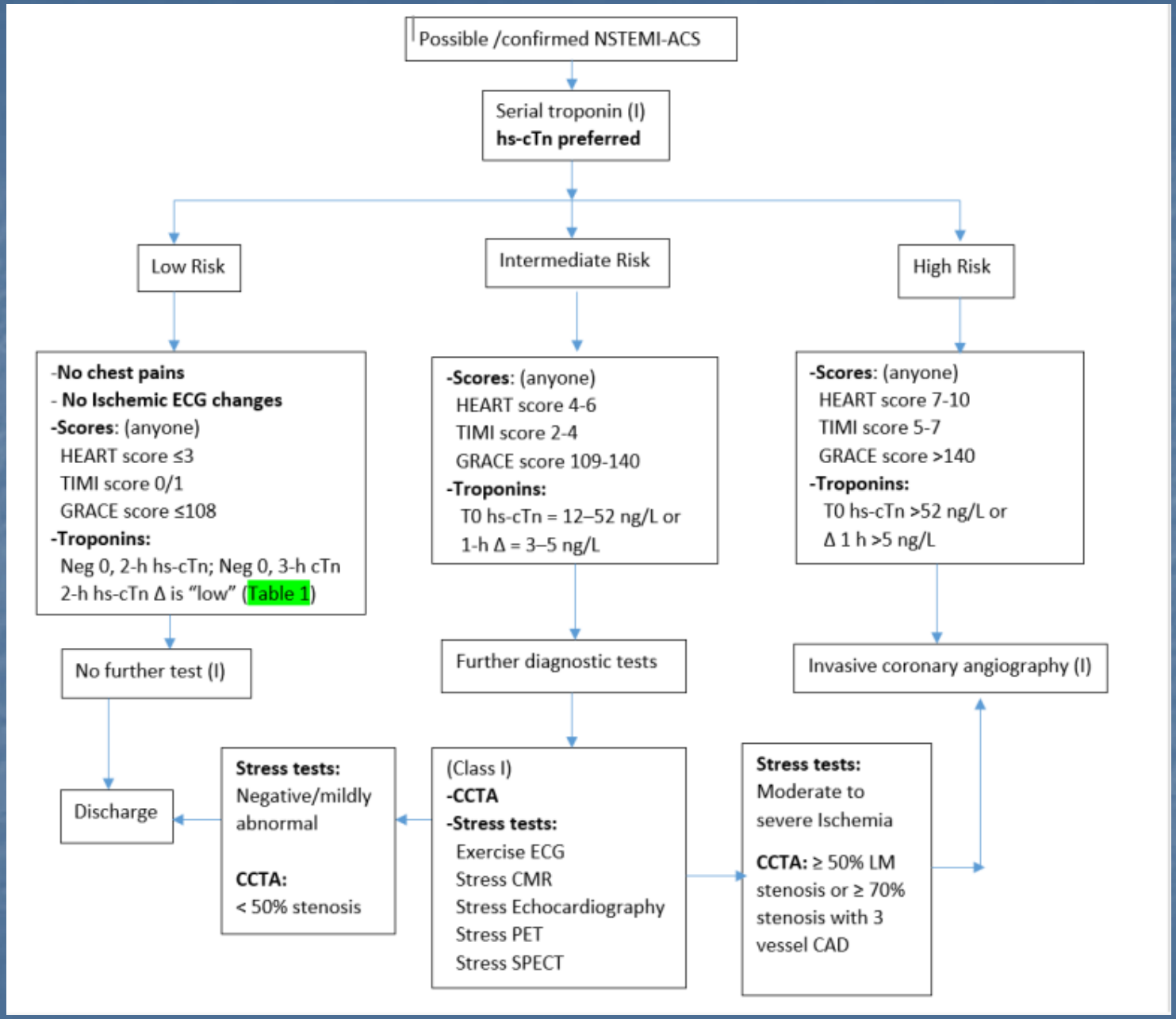
Recommended Time Interval for Troponin

- After the initial troponin sample collection (time zero), repeat measurements timing:
  - 1 to 3 hours for high-sensitivity troponin
  - 3 to 6 hours for conventional troponin

High Risk Patients
Acute Chest Pain and Suspected ACS

- New ischemic changes on ECG
- Troponin-confirmed acute myocardial injury
- New-onset LV systolic dysfunction (EF<40%)
- Newly diagnosed moderate-severe ischemia on stress testing
- High-Risk findings on CCTA or Stress Testing
- Hemodynamic instability

  and/ or
- High clinical decision pathway (CDP) risk score



Adapted and modified from ACC/AHA 2021 chest pain guidelines: Circulation

Intermediate Risk Patient with Acute Chest Pain

- TTE is recommended as a rapid, bedside test to establish baseline ventricular and valvular function, evaluate for wall motion abnormalities, and to assess for pericardial effusion.

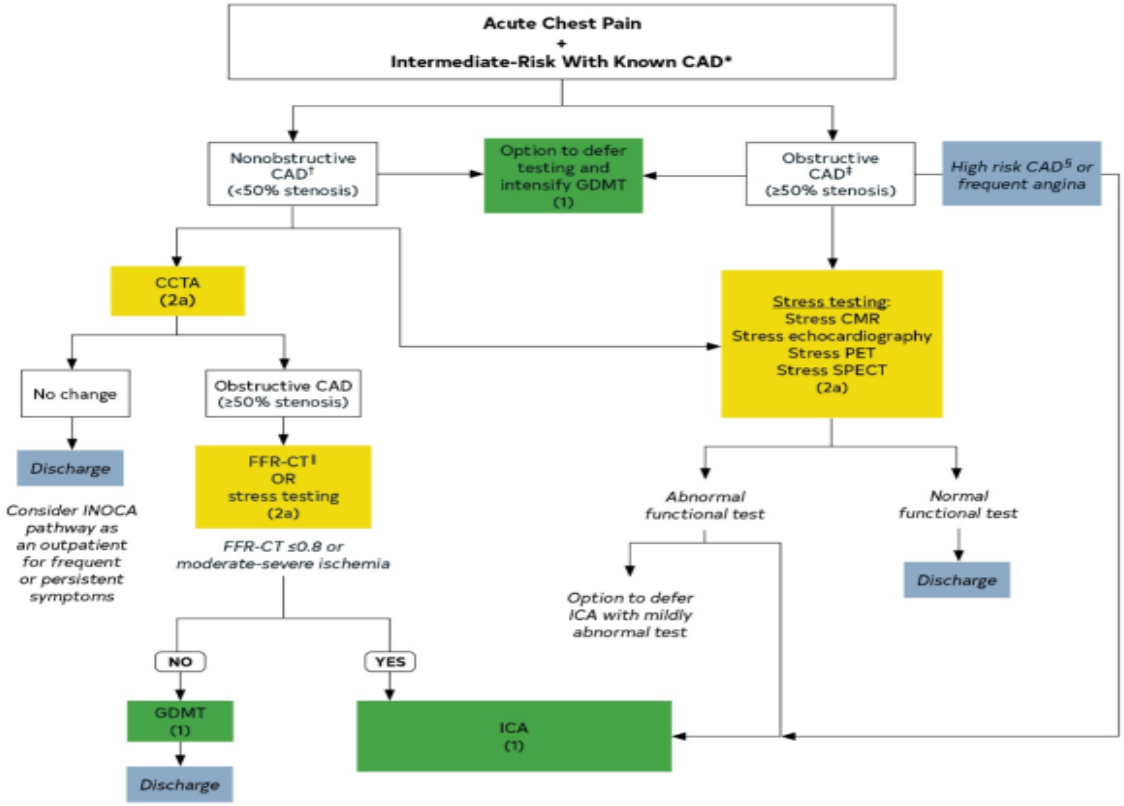
- Management in an observation unit is reasonable to shorten length of stay and lower cost relative to an inpatient admission.

Intermediate-risk Patients with Acute Chest Pain and no Known CAD

- Moderate-severe ischemia on current or prior (≤1 year) stress testing, and no known CAD established by prior anatomic testing, ICA is recommended (class I).
- Previous mildly abnormal stress test results (≤1 year), CCTA is reasonable for diagnosing obstructive CAD (IIa).
- Inconclusive prior stress test, CCTA is reasonable.
- Inconclusive prior CCTA, stress imaging is reasonable.
- Stenosis 40% to 90% in a proximal or middle coronary artery on CCTA, FFR-CT can be useful.
- If extensive plaque is present a high-quality CCTA is unlikely to be achieved, and stress testing is preferred

Algorithm for Patients With Suspected ACS at Intermediate Risk With Known CAD

Colors correspond to the Class of Recommendation in Table 1.



Choosing the Right Diagnostic Tests

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

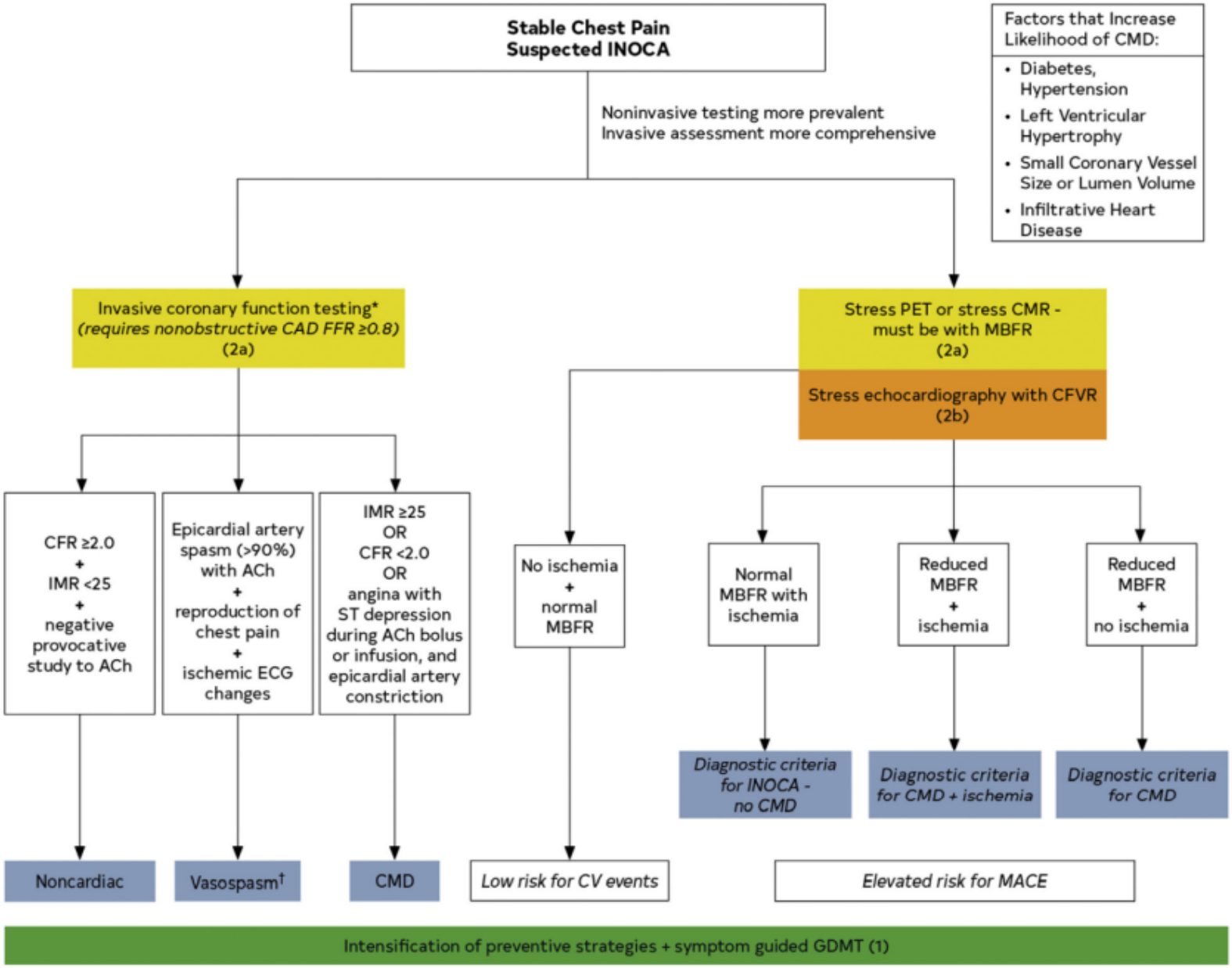
	Favors use of CCTA	Favors use of stress imaging
Goal	• Rule out obstructive CAD • Detect Nonobstructive CAD	• Ischemia guided management
Availability and expertise	• High quality imaging and exert interpretation routinely available	• High quality imaging and expert interpretation routinely available
Likelihood of obstructive CAD	• Age <65	• Age ≥65
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)

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		✓	✓	✓	✓

Chest Pain Without Significant Coronary Stenosis

- Microvascular disease
- Coronary spasm (Printzmetal angina)
- Spontaneous coronary dissection (pregnancy)
- Myocardial bridging
- Coronary artery ectasia/aneurysms
- Proximal subclavian stenosis in LIMA to LAD CABG
- MINOCA
- **INOCA**
- Other common causes of cardiac chest pain with normal coronaries:
  - Diastolic dysfunction
  - Pulmonary hypertension with right ventricular ischemia
  - HOCM
  - Aortic stenosis, Aortic regurgitation

FIGURE 14 Clinical Decision Pathway for INOCA



Acute Chest Pain With Suspected Myopericarditis (Class I)

- In patients with acute chest pain and myocardial injury who have nonobstructive CAD on anatomic testing, CMR with gadolinium contrast is effective to distinguish myopericarditis from other causes, including myocardial infarction and nonobstructive coronary arteries (MINOCA).
- CMR is useful if there is diagnostic uncertainty, or to determine the presence and extent of myocardial and pericardial inflammation and fibrosis.
- TTE is effective to determine the presence of ventricular wall motion abnormalities, pericardial effusion, valvular abnormalities, or restrictive physiology.

Summary

- Atypical chest pain is out, possible cardiac is in
- High-sensitivity troponins (hscTn) are preferred
- CDPs for chest pain should be used routinely
- Patients presenting with chest pain, risk for CAD and adverse events should be estimated using evidence-based diagnostic protocols

Summary

- Patients presenting with chest pain should be categorized as acute vs stable.
- Determine pre-test probability of obstructive CAD for stable chest pain
  - Low pretest probability – no test
  - Intermediate or high pre-test probability – CCTA or stress imaging (class I)
  - Exercise ECG is now class IIa

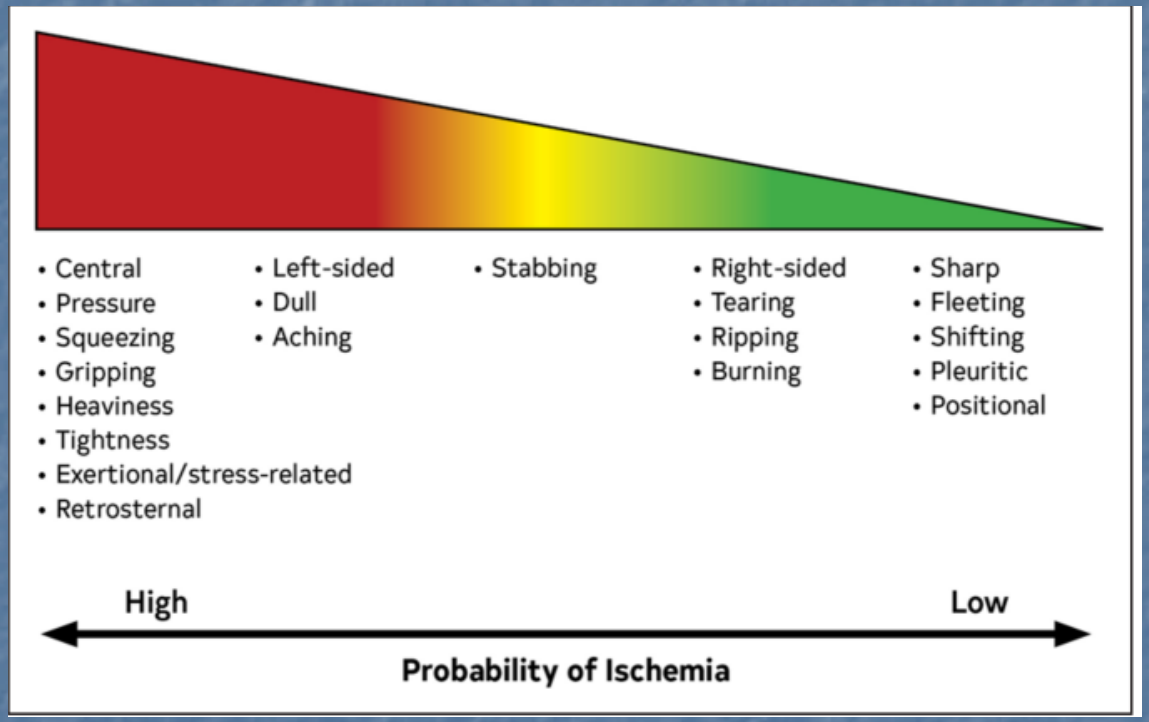
Summary

- Low risk stress imaging – GDMT
- Moderate or high-risk images
  - GDMT first and if symptoms persists
  - Coronary angiography

Summary

- Acute chest pain: Follow CDPs
  - Low risk:
    - TIMI 0/1 or GRACE score ≤108
    - hscTn- negative
    - No tests, discharge from ED
  - Intermediate risk
    - TIMI score 2-4 or GRACE score 109-140
    - Low T0 hs-cTn = 12–52 ng/L or 1-h Δ = 3–5 ng/L
    - CCTA or stress tests
  - High risk
    - TIMI score 5-7 or GRACE score >140
    - Low T0 hs-cTn > 52 ng/L or 1-h Δ >5 ng/L
    - Invasive coronary angiography

Probability of Ischemia Based on Type of Chest Pain



ACC /AHA 2021 chest pain guidelines. Circulation. 2021;144:e368–e454

Types of chest pain

- Chest pain descriptors:

  1 substernal chest discomfort

  2. provoked by exertion or emotional stress

  3. relieved by rest or nitroglycerin

  Cardiac chest pain: 3/3 criteria

  Likely cardiac pain : 2/3 criteria

  Non- cardiac pain: 1 or 0 criteria