Clinical Update

ADAPTED FROM:

2025 ACC/AHA/ACEP/NAEMSP/SCAI Guideline for the Management of Patients with Acute Coronary Syndromes.

American Heart Association.

AHA Clinical Update PPTX

Table 1. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care

CLASS (STRENGTH) OF RECOMMENDATION

CLASS 1 (STRONG) — Benefit >>> Risk

Suggested phrases for writing recommendations:
- Is recommended
- Is indicated/useful/effective/beneficial
- Should be performed/administered/other
- Comparative-Effectiveness Phrases†:
  - Treatment/strategy A is recommended/indicated in preference to treatment B
  - Treatment A should be chosen over treatment B

CLASS 2a (MODERATE) — Benefit >> Risk

Suggested phrases for writing recommendations:
- Is reasonable
- Can be useful/effective/beneficial
- Comparative-Effectiveness Phrases†:
  - Treatment/strategy A is probably recommended/indicated in preference to treatment B
  - It is reasonable to choose treatment A over treatment B

CLASS 2b (Weak) — Benefit ≥ Risk

Suggested phrases for writing recommendations:
- May/might be reasonable
- May/might be considered
- Usefulness/effectiveness is unknown/unclear/uncertain or not well-established

CLASS 3: No Benefit (MODERATE) — Benefit = Risk

Suggested phrases for writing recommendations:
- Is not recommended
- Is not indicated/useful/effective/beneficial
- Should not be performed/administered/other

CLASS 3: Harm (STRONG) — Risk > Benefit

Suggested phrases for writing recommendations:
- Potentially harmful
- Causes harm
- Associated with excess morbidity/mortality
- Should not be performed/administered/other

LEVEL (QUALITY) OF EVIDENCE‡

LEVEL A
- High-quality evidence‡ from more than 1 RCT
- Meta-analyses of high-quality RCTs
- One or more RCTs corroborated by high-quality registry studies

LEVEL B-R (Randomized)
- Moderate-quality evidence‡ from 1 or more RCTs
- Meta-analyses of moderate-quality RCTs

LEVEL B-NR (Nonrandomized)
- Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies
- Meta-analyses of such studies

LEVEL C-LD (Limited Data)
- Randomized or nonrandomized observational or registry studies with limitations of design or execution
- Meta-analyses of such studies
- Physiological or mechanistic studies in human subjects

LEVEL C-EO (Expert Opinion)
- Consensus of expert opinion based on clinical experience.

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

† For comparative-effectiveness recommendation (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely-used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

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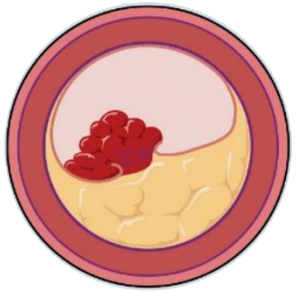
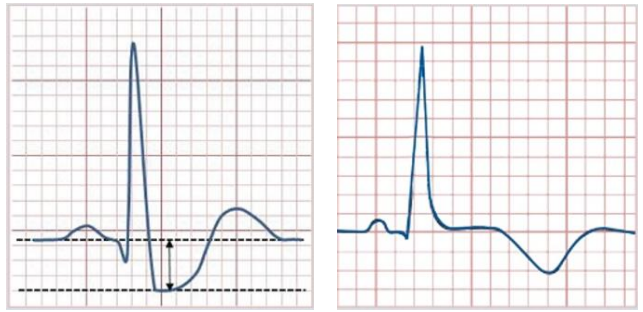
Definition and Classifications of Acute Coronary Syndromes



Non-Occlusive Thrombus

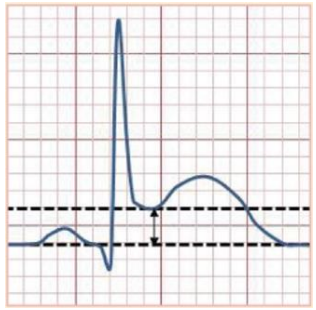


ST Depression or T Wave Inversion
(May be electrically silent)

Biomarker Negative → **Unstable Angina**

Biomarker Positive → **NSTEMI**

Occlusive Thrombus



ST Elevation

Biomarker Positive → **STEMI**

(May be negative if drawn too early from symptom onset)

Abbreviations: NSTEMI indicates non-ST-elevation myocardial infarction; and STEMI, ST-elevation myocardial infarction.

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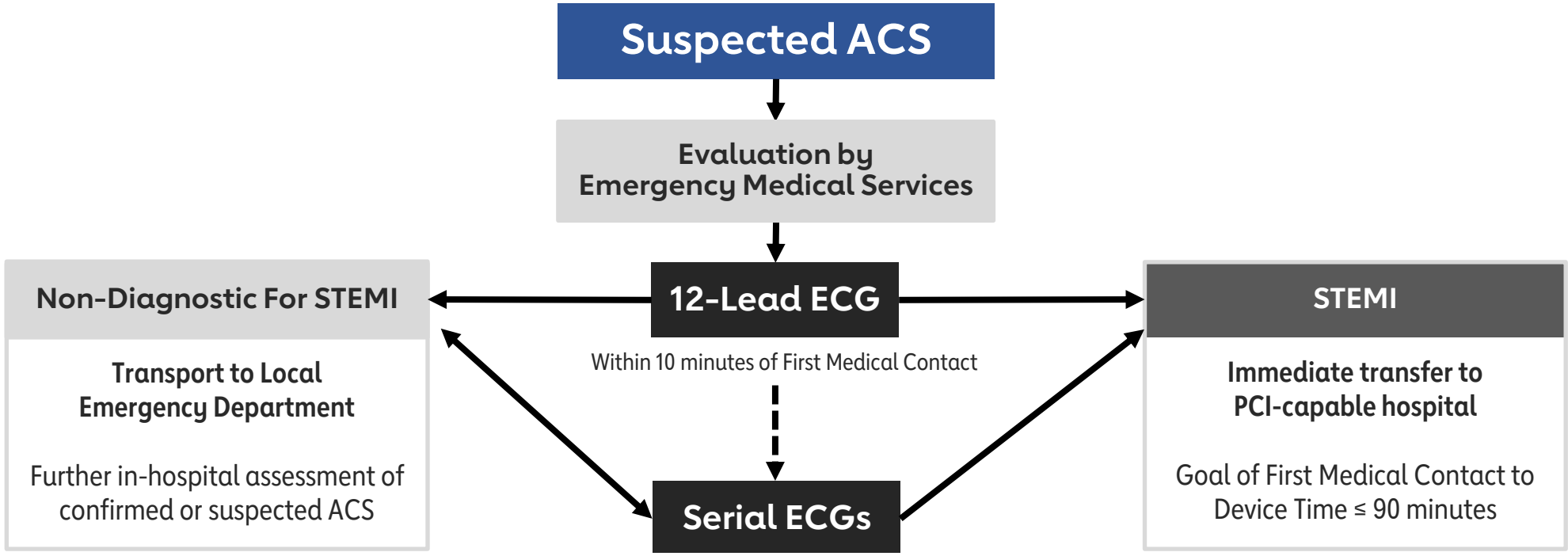
Pre-hospital Assessment and Management Considerations for Suspected ACS



In patients with STEMI managed with primary PCI

↑ each **30** minute delay is associated with ↑ **7.5%** relative risk of 1-year death

Abbreviations: ACS indicates acute coronary syndrome; ECG, electrocardiogram; STEMI, ST-elevation myocardial Infarction; and PCI, percutaneous coronary intervention.

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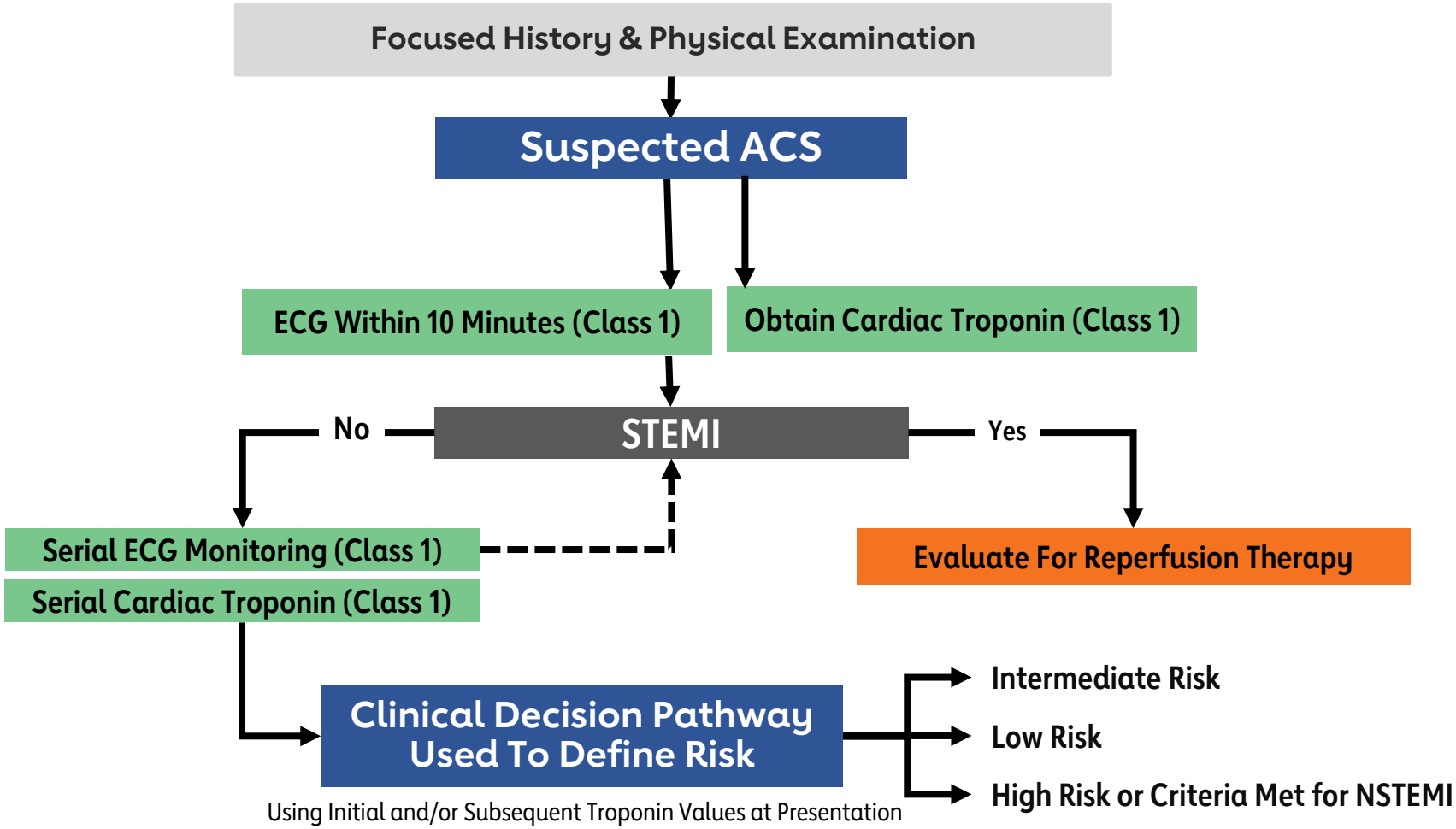
Initial In-Hospital Assessment of Patients with Confirmed or Suspected ACS

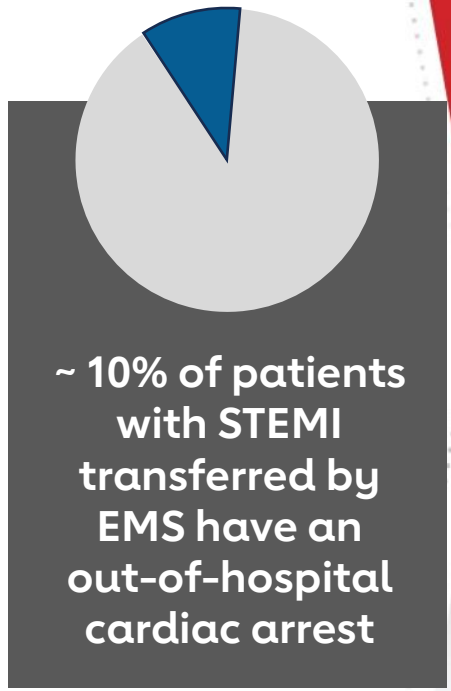


Abbreviations: ACS indicates acute coronary syndrome; ECG, electrocardiogram; and STEMI, ST-elevation myocardial infarction.

Management of Patients Presenting with Cardiac Arrest

Following achievement of return of spontaneous circulation (ROSC)

Mental Status	Awake	Comatose	Comatose	Comatose
Presence of STEMI	Yes	Yes	Yes	No
Prognostic Features	--	Favorable	Unfavorable	--
Guideline Recommendation	**PPCI** (Class 1)	**PPCI** (Class 1)	**PPCI Reasonable After Individualized Assessment** (Class 2b)	**Immediate Coronary Angiography Not Recommended** (Class 3: No Benefit)



Abbreviations: EMS indicates emergency medical services; PPCI, primary percutaneous coronary intervention; and STEMI, ST- elevation myocardial infarction.

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Standard Medical Therapy for Acute Coronary Syndromes

Analgesic Treatment Options

Medication	Route	Considerations
Nitroglycerin (SL)	• 0.4 mcg sublingual every 5 minutes for up to 3 doses	• Avoid use in suspected RV infarction or SBP < 90 mm Hg
Nitroglycerin (IV)	• Start at 10 mcg/min and titrate to pain relief and hemodynamic tolerability	• Consider for persistent anginal pain after oral nitrate therapy • Use if ACS is complicated by hypertension or flash pulmonary edema • Avoid use in suspected RV infarction or SBP < 90 mm Hg
Morphine (IV)	• 2-4 mg; may repeat if needed every 5-15 minutes up to 10 mg total dose	• Use for pain that is resistant to maximal anti-ischemic medications • May delay the effects of oral P2Y12 therapy
Fentanyl (IV)	• 25-50 mcg; may repeat if needed up to 100 mcg total dose	• Use for pain that is resistant to maximally tolerated anti-ischemic medications • May delay the effects of oral P2Y12 therapy

Analgesic therapies provide symptomatic relief but have not been shown to improve clinical outcomes in ACS.
If ischemic symptoms persist despite efforts at pain control, consider urgent coronary angiography.

Abbreviations: ACS indicates acute coronary syndromes; IV, intravenous; RV, right ventricle; SBP, systolic blood pressure; and SL, sublingual.

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Antiplatelet Therapy: Aspirin During Hospitalization

Aspirin	
COR	**RECOMMENDATIONS**
1	In patients with **ACS**, an initial **oral loading dose of aspirin**, followed by daily low-dose aspirin is recommended to reduce death and MACE

Abbreviations: ACS indicates acute coronary syndrome; and MACE, major adverse cardiovascular event.

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Antiplatelet Therapy: Oral P2Y12 Inhibitors During Hospitalization

P2Y12 Inhibitors

COR	RECOMMENDATIONS
1	In patients with ACS, an **oral P2Y12 inhibitor** should be administered in addition to aspirin to reduce MACE
3: HARM	In patients with a history of stroke or TIA, prasugrel should **NOT** be administered because of worse net clinical outcomes

Abbreviations: ACS indicates acute coronary syndrome; MACE, major adverse cardiovascular event; and TIA, transient ischemic attack.

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Oral P2Y12 Inhibitors: In-Hospital Management of Patients with NSTE-ACS

In patients with NSTE-ACS undergoing PCI, prasugrel or ticagrelor is recommended to reduce MACE and stent thrombosis. (Class 1)

In patients with NSTE-ACS who are managed without planned invasive evaluation, ticagrelor is recommended to reduce MACE. (Class 1)

In patients with NSTE-ACS, clopidogrel is recommended to reduce MACE when prasugrel or ticagrelor are not available, cannot be tolerated, or are contraindicated. (Class 1)

In patients with NSTE-ACS planned for an invasive strategy with timing of angiography anticipated to be >24h, upstream treatment with clopidogrel or ticagrelor may be considered to reduce MACE. (Class 2b)

Abbreviations: ACS, acute coronary syndrome; MACE, major adverse cardiovascular event; NSTE, non-ST elevation; STEMI, ST-elevation myocardial infarction.

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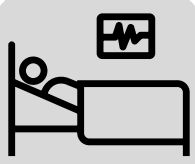
Oral P2Y12 Inhibitors: In-Hospital Management of Patients with STEMI

In patients with STEMI managed with PPCI, prasugrel or ticagrelor should be administered to reduce MACE and stent thrombosis.
(Class 1)



In patients with STEMI managed with PPCI, clopidogrel is recommended to reduce MACE and stent thrombosis when prasugrel or ticagrelor are not available, cannot be tolerated, or are contraindicated.
(Class 1)

In patients with STEMI managed with fibrinolytic therapy, clopidogrel should be administered concurrently to reduce death and MACE.
(Class 1)

Abbreviations: ACS, acute coronary syndrome; MACE, major adverse cardiovascular event; NSTE, non-ST elevation; STEMI, ST-elevation myocardial infarction.

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Antiplatelet Therapy: Intravenous P2Y12

Intravenous P2Y12 Inhibitors	
COR	**RECOMMENDATIONS**
2b	Among patients with ACS undergoing PCI who have not received a P2Y12 inhibitor, **intravenous cangrelor** may be reasonable to reduce periprocedural ischemic events

Intravenous Cangrelor: Rapid and potent platelet inhibitory effects with restoration of platelet function occurring within one hour of drug discontinuation

Consider in clinical scenarios where:

- Absorption of orally administered P2Y12 inhibitors is impaired or not possible
- Patients requiring CABG or other surgery early after PCI when prolonged discontinuation of a P2Y12 inhibitor is not thought to be safe

The transition from intravenous to oral P2Y12 inhibition is an important consideration to ensure adequate platelet inhibition upon completion of cangrelor infusion

Abbreviations: ACS, acute coronary syndrome; and PCI, percutaneous coronary intervention.

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Antiplatelet Therapy: Intravenous Glycoprotein IIb/IIa Inhibitors

Intravenous Glycoprotein IIb/IIIa Inhibitors

COR	RECOMMENDATIONS
2a	 In patients with ACS undergoing PCI with large thrombus burden, no-reflow, or slow flow, adjunctive use of an **intravenous or intracoronary glycoprotein IIb/IIIa inhibitor** is reasonable to improve procedural success and reduce infarct size
3: HARM	 In patients with ACS, glycoprotein IIb/IIIa inhibitors should **not be administered** routinely due to lack of ischemic benefit and increased risk of bleeding

Abbreviations: ACS indicates acute coronary syndrome; and PCI, percutaneous coronary intervention.

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Parenteral Anticoagulation

PCI Not Planned

COR	RECOMMENDATIONS
1	In patients with NSTE-ACS, **intravenous unfractionated heparin (UFH)** is useful to reduce ischemic events.
1	In patients with NSTE-ACS in whom an early invasive approach is not anticipated, either **enoxaparin** or **fondaparinux** are recommended alternatives to UFH.

Coronary Revascularization

COR	RECOMMENDATIONS
1	In patients with ACS undergoing coronary revascularization (CABG or PCI) in the same admission, parenteral anticoagulation should be continued until revascularization to reduce ischemic events.

PCI Planned

COR	RECOMMENDATIONS
1	In patients with ACS undergoing PCI, **intravenous UFH** is useful to reduce ischemic events.
1	In patients with STEMI undergoing PCI, **bivalirudin** is useful as an alternative to UFH to reduce mortality and bleeding
2b	In patients with NSTE-ACS undergoing PCI, **bivalirudin** may be reasonable as an alternative to UFH to reduce bleeding
2b	In patients with ACS, **intravenous enoxaparin** may be considered as an alternative to UFH at the time of PCI to reduce ischemic events
3: HARM	In patients with ACS, fondaparinux should NOT be used to support PCI because of the risk of catheter thrombosis

Abbreviations: ACS indicates acute coronary syndrome; NSTE, non-ST elevation; PCI, percutaneous coronary intervention; STEMI, ST elevation myocardial infarction; and UFH, unfractionated heparin.

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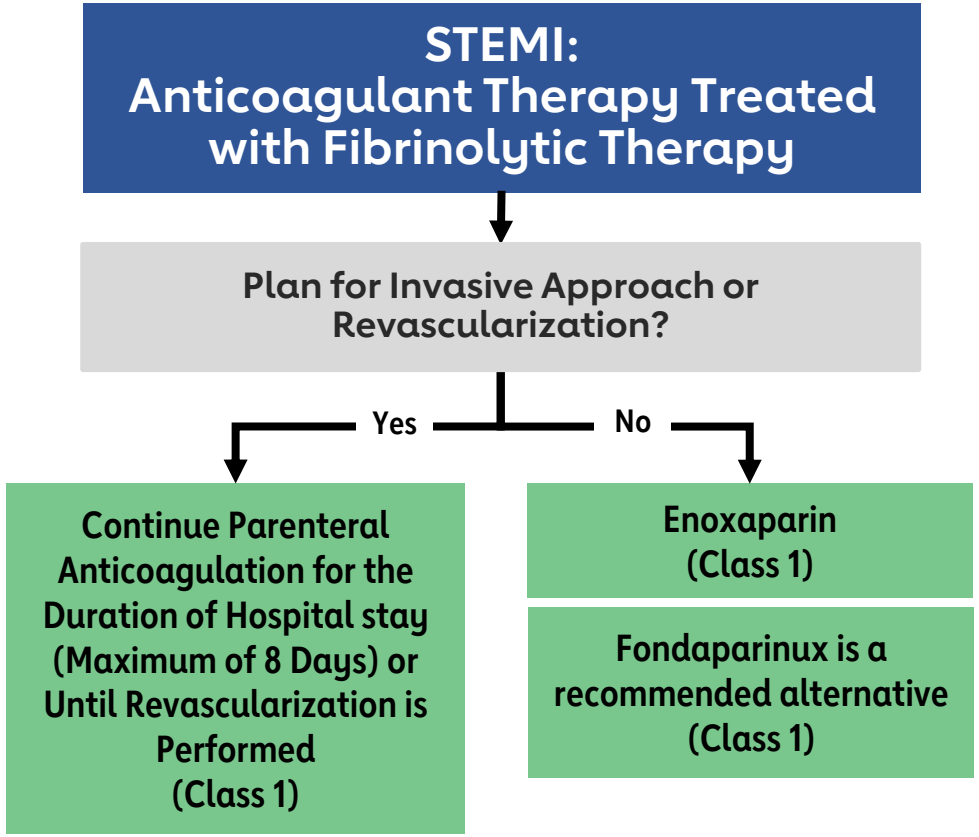
Parenteral Anticoagulation



Abbreviations: STEMI indicates ST elevation myocardial infarction.

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Lipid Management

Statin Therapy

COR	RECOMMENDATIONS
1	In patients with ACS, **high-intensity statin** therapy is recommended to reduce the risk of MACE
1	In patients with ACS who are already on maximally tolerated statin therapy with **LDL ≥70 mg/dL (≥1.8 mmol/l)**, adding a non-statin lipid lowering agent is recommended to further reduce the risk of MACE
2a	In patients with ACS who are already on maximally tolerated statin therapy with **LDL 55-69 mg/dL (≥1.4- <1.8 mmol/l)**, adding a non-statin lipid lowering agent is reasonable to reduce the risk of MACE
2b	In patients with ACS, the concurrent initiation of **ezetimibe** in combination with maximally tolerated statin may be considered to reduce the risk of MACE

Statin Intolerance

COR	RECOMMENDATIONS
1	In patients with ACS who are statin intolerant, **non-statin lipid lowering therapy** is recommended to lower LDL and reduce the risk of MACE

Non-Statin Lipid Lowering Therapies:

- Ezetimibe
- PCSK9 Inhibitors (monoclonal antibodies or inclisiran)
- Bempedoic Acid

Abbreviations: ACS indicates acute coronary syndrome; LDL, low-density lipoprotein, and MACE, major adverse cardiovascular event.

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Beta Blocker Therapy and Renin-Angiotensin System Inhibitors

All patients without contraindication**

↓

Early (<24 h) initiation of oral beta blocker therapy to reduce risk of reinfarction and ventricular arrhythmias (Class 1)

****Contraindications to Beta Blocker Therapy**

- Acute HF
- Low output state or risk for CS
- PR > 0.24 ms
- 2nd or 3rd degree AVB without a pacemaker
- Severe bradycardia
- Active bronchospasm

COR	RECOMMENDATIONS
1	In high-risk patients with ACS (LVEF ≤40%, HTN, diabetes mellitus or STEMI with anterior location), an oral ACEi or an ARB is indicated to reduce all-cause mortality and MACE.
1	In patients with ACS and LVEF ≤ 40%, and with HF symptoms and/or diabetes mellitus, a MRA is indicated to reduce all-cause mortality and MACE.
2a	In ACS patients who are not considered high risk, an oral ACEi or an ARB is reasonable to reduce MACE.

Abbreviations: ACEi indicates angiotensin-converting enzyme inhibitor; ACS, acute coronary syndrome; ARB, angiotensin receptor blocker; CS, cardiogenic shock; HF, heart failure; HTN, hypertension; LVEF, left ventricular ejection fraction; MACE, major adverse cardiovascular event; MRA, mineralocorticoid receptor antagonist; and STEMI, ST-elevation myocardial infarction.

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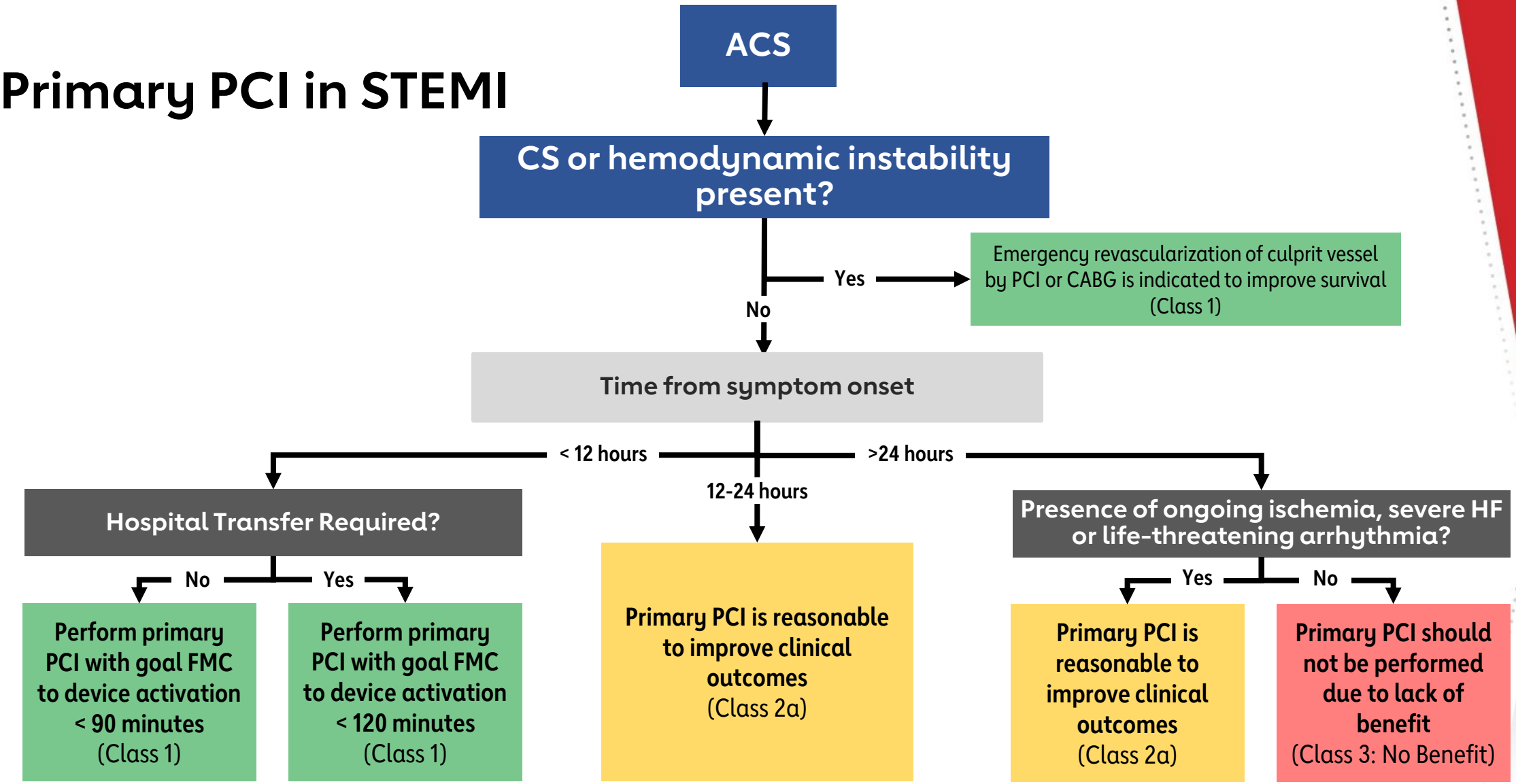
Primary PCI in STEMI



Abbreviations: ACS indicates acute coronary syndrome; CS, cardiogenic shock; CABG, coronary artery bypass graft; FMC, first medical contact; HF, heart failure; STEMI, ST-elevation myocardial infarction; and PCI, percutaneous coronary intervention.

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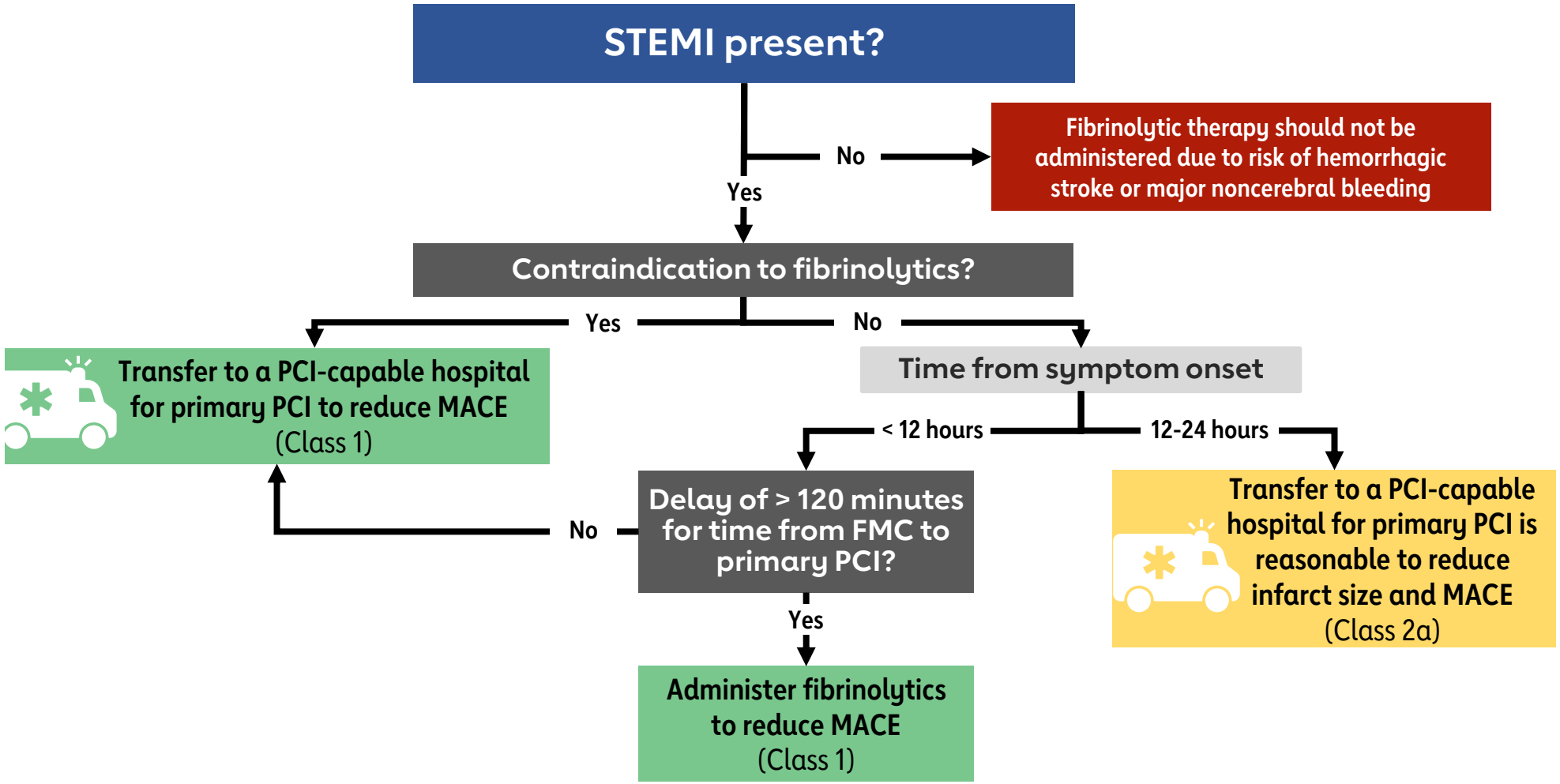
Reperfusion at Non-PCI Capable Hospitals



Abbreviations: FMC indicates first medical contact; MACE, major adverse cardiovascular event; STEMI, ST-elevation myocardial infarction; and PCI, percutaneous coronary intervention.

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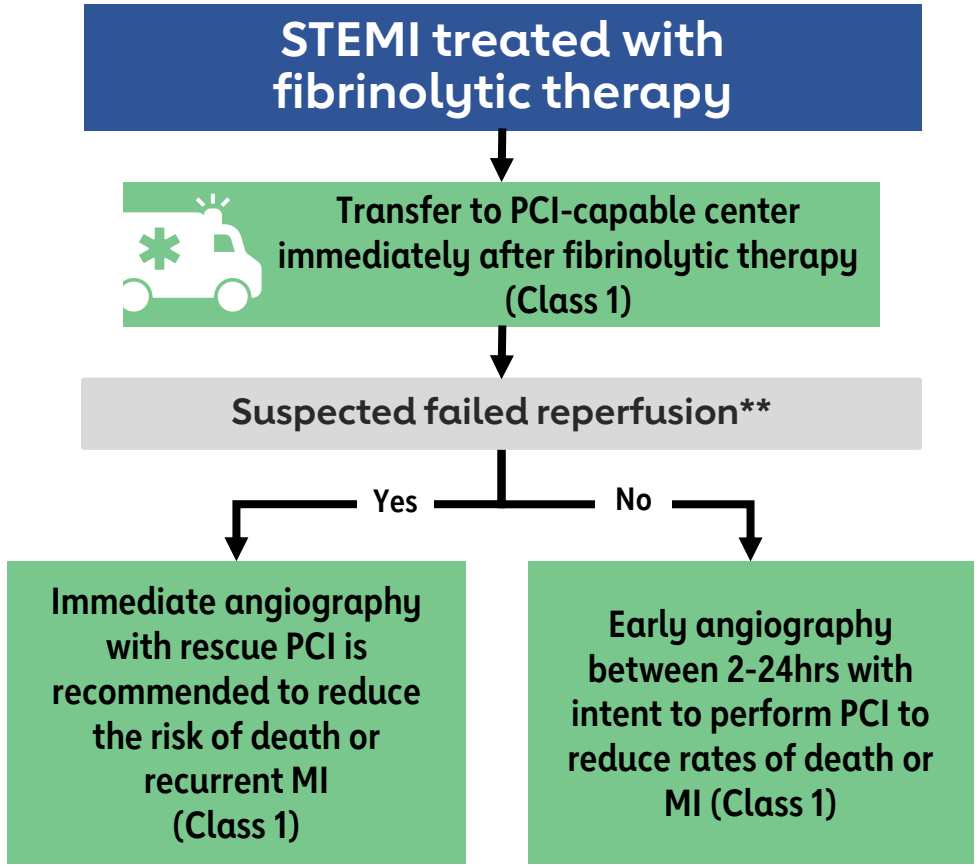
Coronary Angiography and PCI After Fibrinolytic Therapy



****Clinical Signs of Failed Reperfusion:**

- Ongoing ischemic symptoms
- Persistent ST-segment elevation (<50% resolution of ST-segment elevation in anterior leads or <70% in inferior leads
- Hemodynamic or electrical instability

Abbreviations: Mi indicates myocardial infarction; STEMI, ST-elevation myocardial infarction; and PCI, percutaneous coronary intervention.

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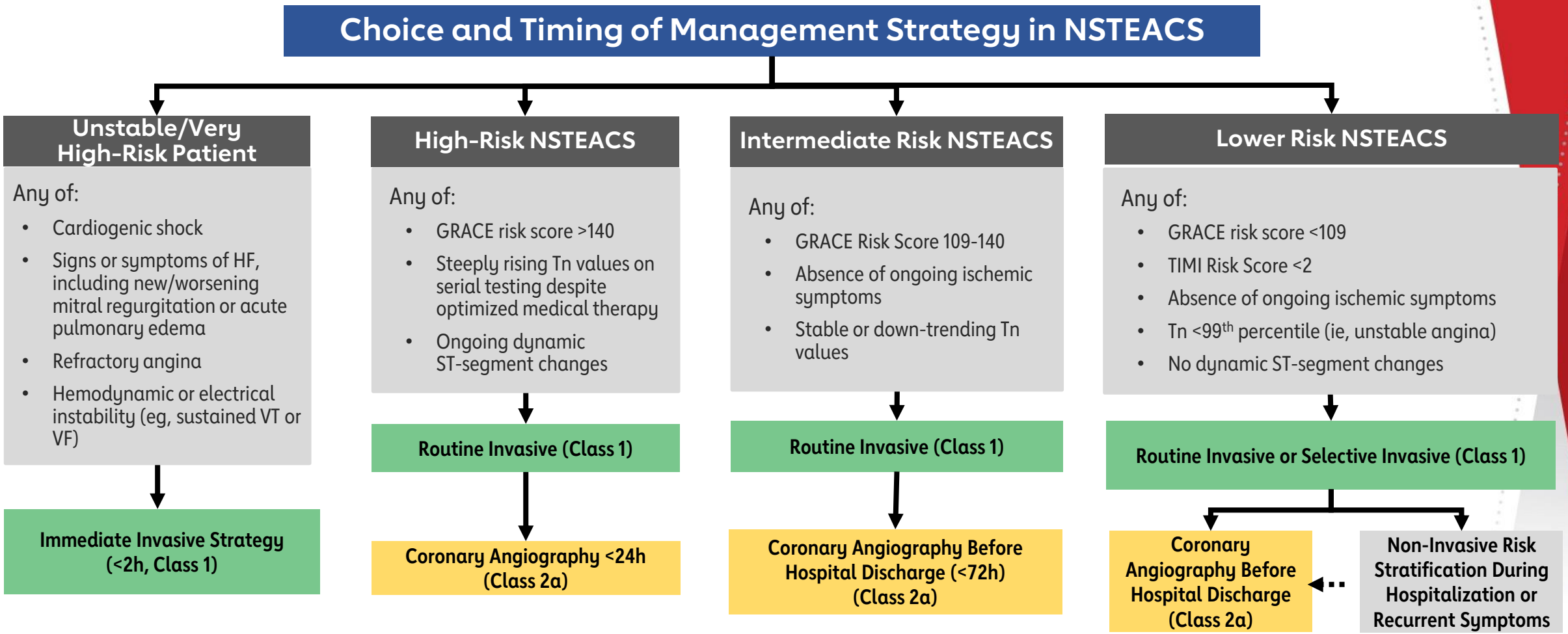
Rationale and Timing for a Routine Invasive or Selective Invasive Approach



Abbreviations: GRACE indicates Global Registry of Acute Coronary Events; HF, heart failure; NSTEACS, non-ST-segment elevation acute coronary syndrome; Tn, troponin; TIMI, Thrombolysis in Myocardial Infarction; VF, ventricular fibrillation; and VT, ventricular tachycardia.

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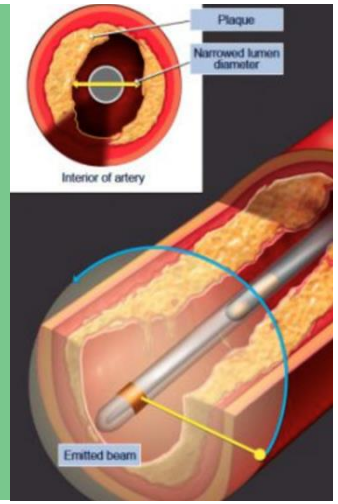
Catheterization Lab Considerations in ACS

Radial approach is preferred to a femoral approach to reduce bleeding, vascular complications and mortality (1)

For coronary stent implantation in left main artery or in complex lesions, intracoronary imaging (ICI) with intravascular imaging ultrasound (IVUS) or optical coherence tomography (OCT) is recommended for procedural guidance to reduce ischemic events (1)



Among patients with STEMI undergoing PPCI, manual aspiration thrombectomy should not be performed routinely (3: No benefit)

Source: *Arneja Heart Institute*

Abbreviations: ACS indicates acute coronary syndrome; STEMI, ST-elevation myocardial infarction; and PPCI, primary percutaneous coronary intervention.

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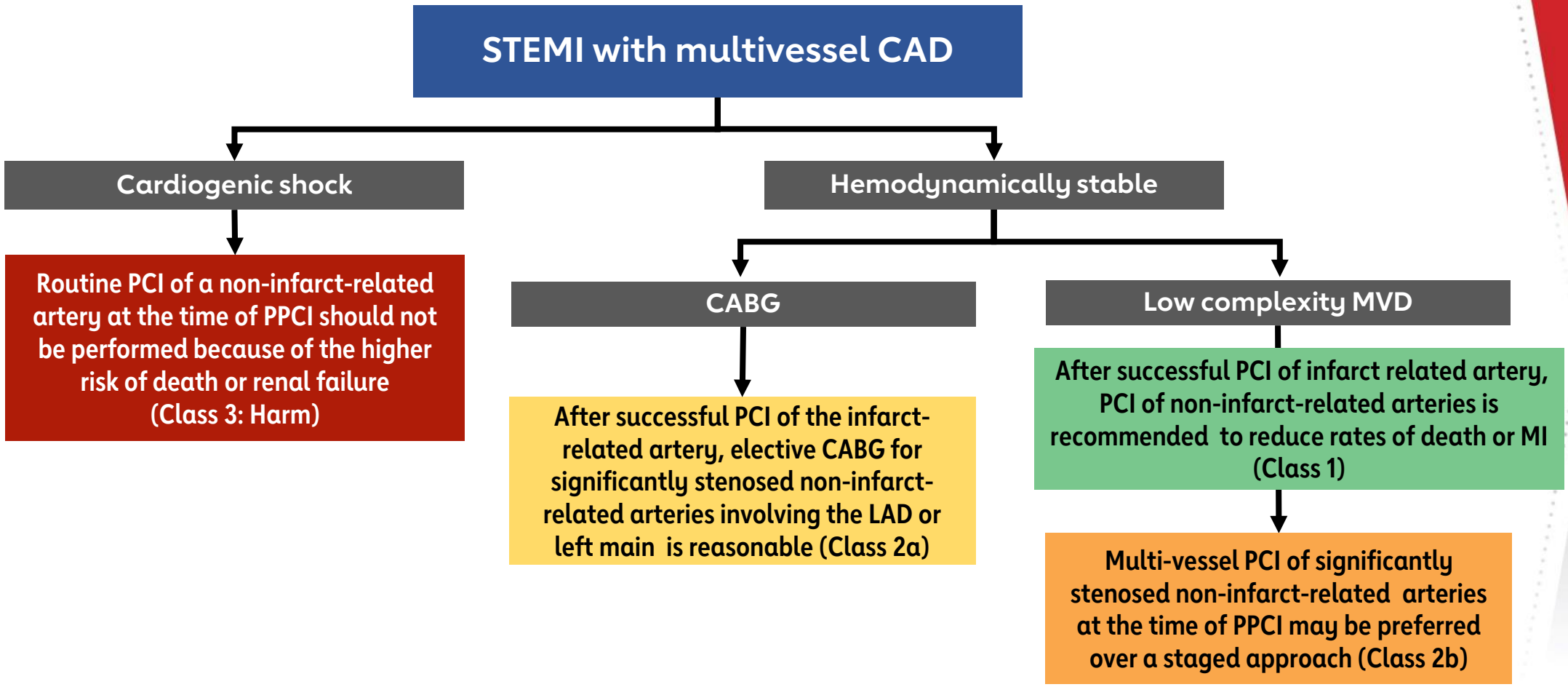
Management of the Non-Infarct-Related Artery in STEMI



Abbreviations: CAD indicates coronary artery disease; CABG, coronary artery bypass graft; STEMI, ST-elevation myocardial infarction; PCI, percutaneous coronary intervention; and PPCI, primary percutaneous coronary intervention.

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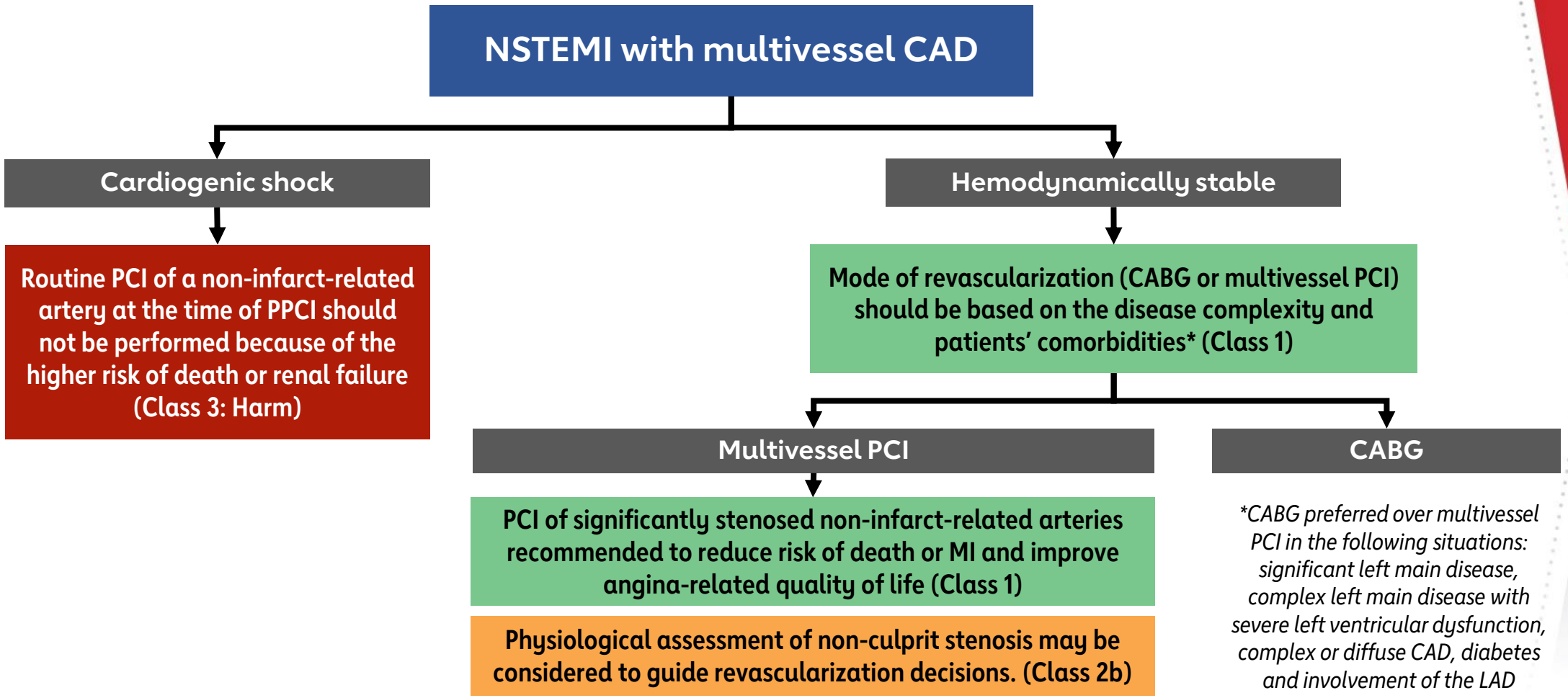
Management of the Non-Culprit Lesions in NSTE-ACS



Abbreviations: CAD indicates coronary artery disease; CABG, coronary artery bypass graft; NSTE-ACS, non-ST-elevation acute coronary syndrome; PCI, percutaneous coronary intervention; and PPCI, primary percutaneous coronary intervention.

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Revascularization in ACS with Cardiogenic Shock

COR	RECOMMENDATIONS
1	 In patients with ACS and CS or hemodynamic instability, emergency revascularization of the culprit vessel by PCI or with CABG is indicated to improve survival, irrespective of time from symptom onset.
3: HARM	 In patients with ACS complicated by CS, routine PCI of a non-infarct artery at the time of PPCI should not be performed because of the higher risk of death or renal failure.

Abbreviations: ACS indicates acute coronary syndrome; CABG, coronary artery bypass graft; STEMI, CS, cardiogenic shock; PCI, percutaneous coronary intervention; and PPCI, primary percutaneous coronary intervention.

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Electrical Complications and Prevention of Sudden Cardiac Death After ACS

Ventricular Arrhythmias	Ventricular Arrhythmias	Ventricular Arrhythmias	Bradyarrhythmias
In patients post MI, implantable cardioverter-defibrillator implantation is recommended in selected patients with an LVEF ≤40% at least 40 days post MI and at least 90 days post revascularization to reduce death.* (Class 1)	In patients post ACS, ICD implantation is reasonable in patients with clinically relevant ventricular arrhythmias more than 48 hours and within 40 days post MI to improve survival.* (Class 2a)	In patients early after MI, usefulness of a temporary wearable cardioverter-defibrillator is uncertain in patients with an LVEF ≤35% to improve survival. (Class 2b)	In patients presenting with an acute MI with sustained evidence of second-degree Mobitz type II atrioventricular block, high-grade atrioventricular block, alternating bundle-branch block, or third-degree atrioventricular block (persistent or infranodal), permanent pacing is indicated.† (Class 1)

**Adapted from 2017 AHA/ACC/HRS Guideline for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death*

†*Adapted from 2018 ACC/AHA/HRS Guideline on the Evaluation and Management of Patients With Bradycardia and Cardiac Conduction Delay*

Abbreviations: ACS indicates acute coronary syndrome; ICD, implantable cardioverter defibrillator; LVEF, left ventricular ejection fraction; and MI, myocardial infarction.

In-Hospital Issues in the Management of ACS

Cardiac Intensive Care Unit

ACS and any of the following:

- Ongoing angina
- Hemodynamic instability
- Uncontrolled arrhythmias
- Suboptimal reperfusion
- Cardiogenic shock

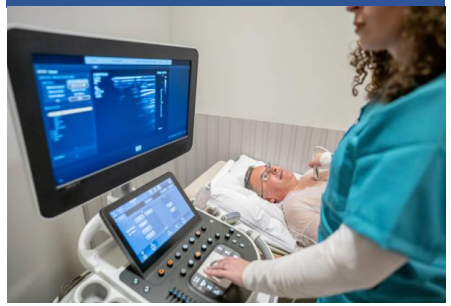
Admit to CICU
(Class 1)

Telemetry Monitoring

In ACS patients, telemetry monitoring is recommended to reduce cardiovascular events with duration determined by cardiac risk.

(Class 1)

Echocardiogram



In patients with ACS, an assessment of LVEF is recommended prior to hospital discharge to guide therapy and for risk stratification.

(Class 1)

Blood Transfusions

In patients with ACS and acute or chronic anemia, blood transfusion to achieve a hemoglobin level ≥10 g/dL may be reasonable to reduce cardiovascular events.

(Class 2b)

Abbreviations: ACS indicates acute coronary syndrome; CICU, cardiac intensive care unit; and LVEF, left ventricular ejection fraction.

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Patient Education, Lifestyle Modifications, Medication, and Follow-up Care

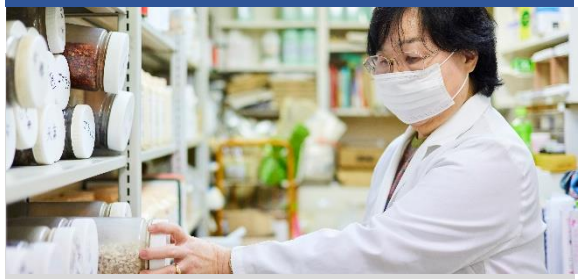
Hospital admission

- Education about CAD, diagnostic tests, procedural results
- Return to physical and sexual activity, work and travel

Lifestyle modifications

- Smoking cessation
- Healthy diet
- Regular exercise

Medications



- Antithrombotic therapy
  Lipid-lowering therapy
  Other therapies as appropriate
- Annual influenza vaccination

Follow-up care

- Follow-up appointments
- Cardiology
- Cardiac rehabilitation
- Additional testing

Symptom management and psychosocial support

Abbreviations: CAD indicates coronary artery disease.

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Post-discharge Follow-up and Systems of Care Coordination

Clinical Assessment

- Address comorbidities and risk factors
- Assess;
  - *Ongoing ischemic symptoms*
  - *Bleeding risk*
  - *Need for repeat echocardiogram, staged PCI*
  - *Vaccination status like influenza*
- Perform medication reconciliation

Patient/Caregiver Assessment

- Assess patient/caregiver capacity for self care
- Provide verbal and written educational information related to self care
- Use teach-back method to confirm understanding of self-care, medication regimen and adherence

Communication
Patient centered
Share decision-making

Social Determinants of Health

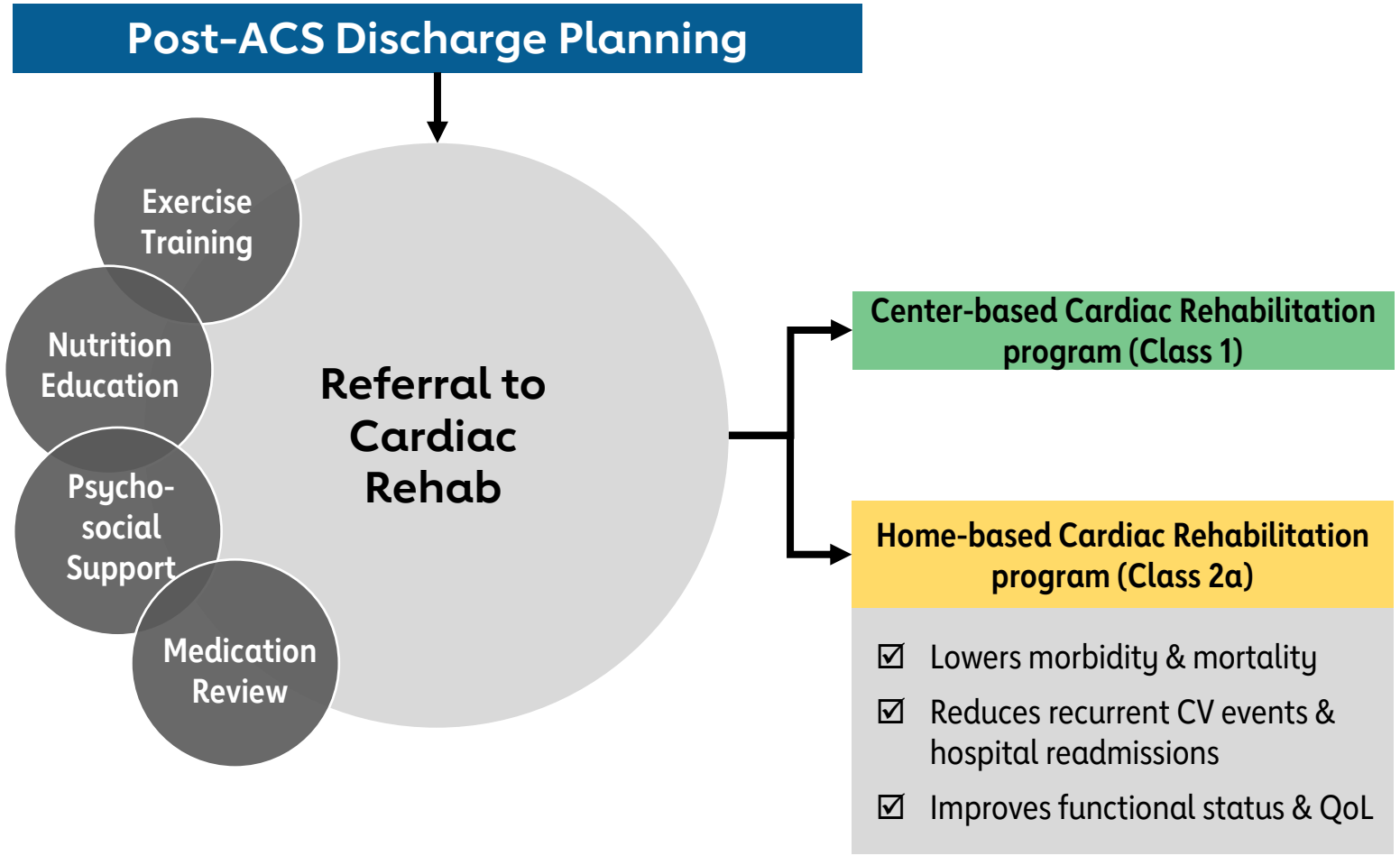
- Assess and address barriers to obtaining medications
- Refer to pharmacy assistance programs or social worker as appropriate
- Assess and address barriers to attending cardiac rehabilitation

Referrals

- Confirm referral to cardiac rehabilitation
- Provide educational materials related to cardiac rehabilitation

Abbreviations: PCI indicates percutaneous coronary intervention.

Cardiac Rehabilitation for Patients Post-ACS



Abbreviations: ACS indicates acute coronary syndrome; CV, cardiovascular; and QoL, quality of life.

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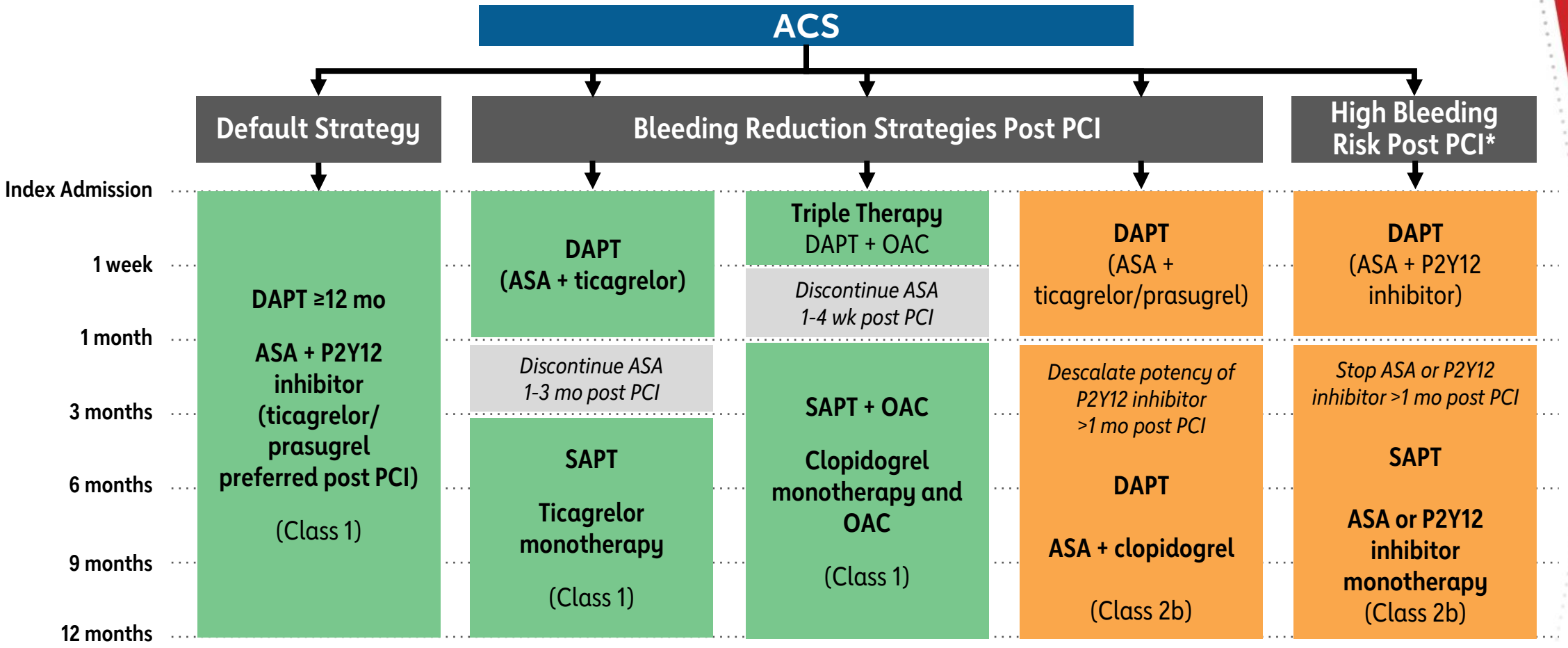
DAPT Strategies in the First 12 Months Post-Discharge



High bleeding risk discussed in supportive text 5 and outlined in Table 22.

Abbreviations: ACS indicates acute coronary syndrome; ASA, aspirin; DAPT, dual antiplatelet therapy; OAC, oral anticoagulant; PCI, percutaneous coronary intervention; SAPT, single antiplatelet therapy.

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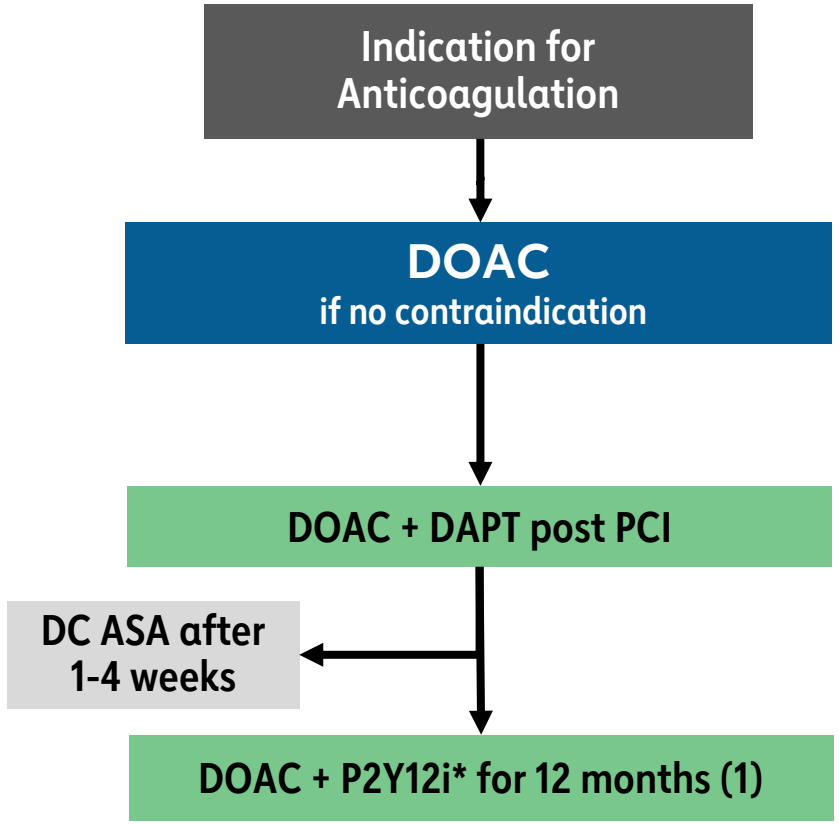
Antiplatelet Therapy in Patients on Anticoagulation Post-Discharge



*preferably clopidogrel

Abbreviations: AF indicates atrial fibrillation; ACS, acute coronary syndrome; ASA, aspirin; DAPT, dual antiplatelet therapy; DC, discontinue; DOAC, direct-acting oral anticoagulant; PCI, percutaneous coronary intervention; and VTE, venous thromboembolism.

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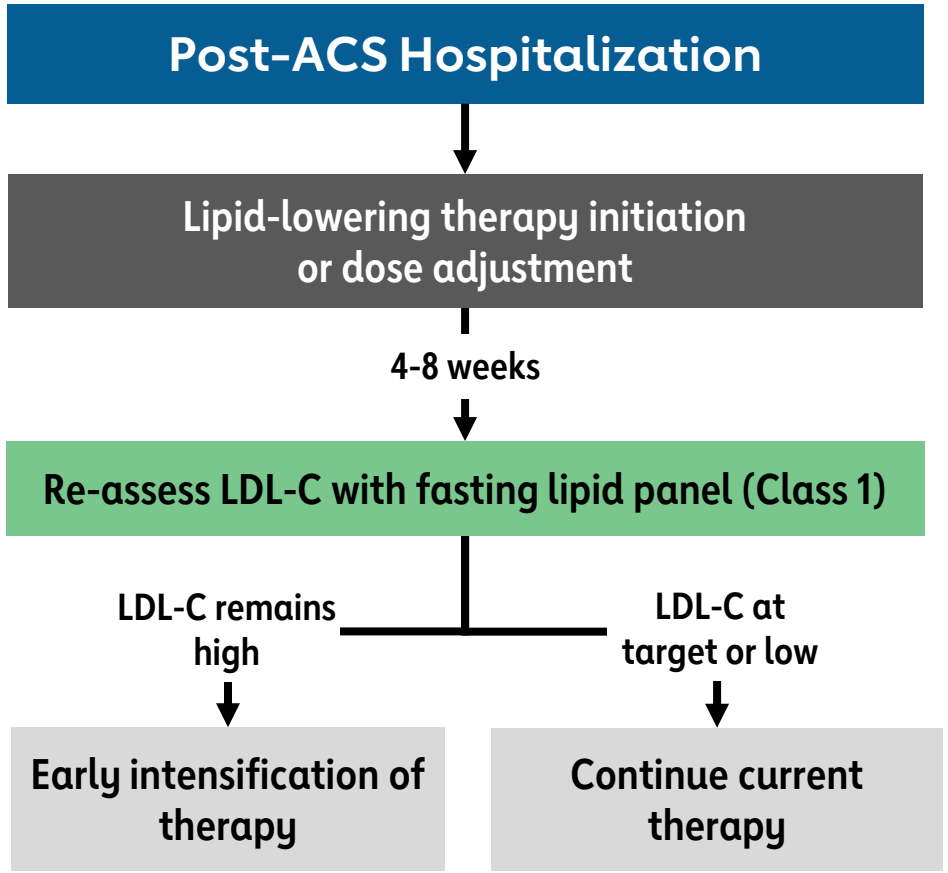
Reassessment of Lipid Levels Post-Discharge



Abbreviations: ACS indicates acute coronary syndrome; and LDL-C, low-density lipoprotein cholesterol.

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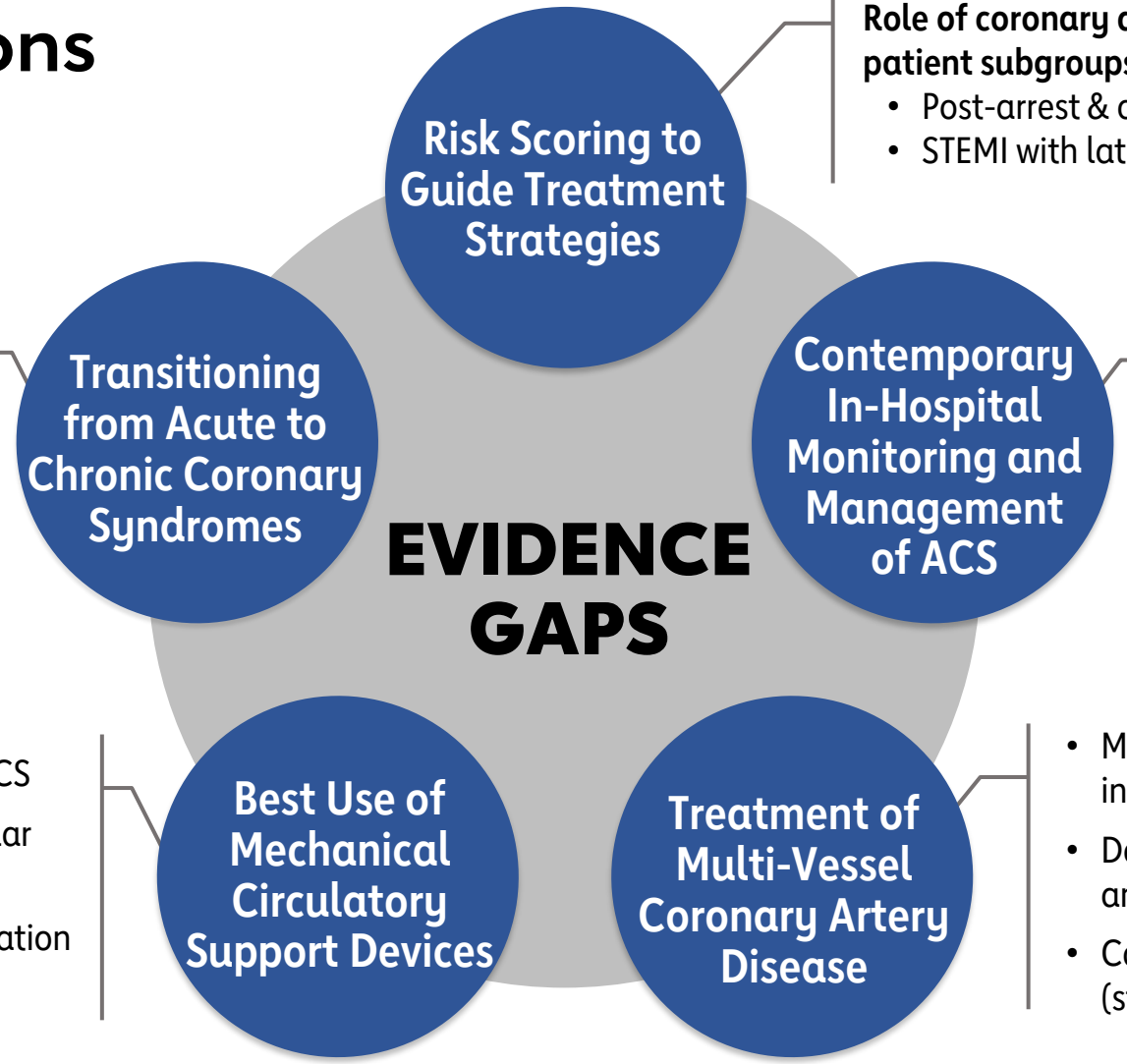
Immunization Management

COR	RECOMMENDATIONS
1	In patients with ACS without a contraindication, annual influenza vaccination is recommended to reduce the risk of death and MACE.

Abbreviations: ACS indicates acute coronary syndrome; and MACE, major adverse cardiovascular event.

Future Directions



Abbreviations: ACS indicates acute coronary syndromes; CABG, coronary artery bypass grafting MCS, mechanical circulatory support; MI, myocardial infarction; NSTEMI, non-ST-elevation myocardial infarction; STEMI, ST-elevation myocardial infarction; and PCI, percutaneous coronary intervention.

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