Circulation

ACC/AHA CLINICAL PRACTICE GUIDELINE

2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization: Executive Summary: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

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AIM: The executive summary of the American College of Cardiology/American Heart Association/Society for Cardiovascular Angiography and Interventions coronary artery revascularization guideline provides the top 10 items readers should know about the guideline. In the full guideline, the recommendations replace the 2011 coronary artery bypass graft surgery guideline and the 2011 and 2015 percutaneous coronary intervention guidelines. This summary offers a patient-centric approach to guide clinicians in the treatment of patients with significant coronary artery disease undergoing coronary revascularization, as well as the supporting documentation to encourage their use.

METHODS: A comprehensive literature search was conducted from May 2019 to September 2019, encompassing studies, reviews, and other evidence conducted on human subjects that were published in English from PubMed, EMBASE, the Cochrane Collaboration, CINHL Complete, and other relevant databases. Additional relevant studies, published through May 2021, were also considered.

STRUCTURE: Recommendations from the earlier percutaneous coronary intervention and coronary artery bypass graft surgery guidelines have been updated with new evidence to guide clinicians in caring for patients undergoing coronary revascularization. This summary includes recommendations, tables, and figures from the full guideline that relate to the top 10 take-home messages. The reader is referred to the full guideline for graphical flow charts, supportive text, and tables with additional details about the rationale for and implementation of each recommendation, and the evidence tables detailing the data considered in the development of this guideline.

Key Words: AHA Scientific Statements ■ angioplasty ■ angiogram ■ angiography ■ arterial graft ■ cardiac surgery, stent(s) ■ coronary artery bypass graft surgery ■ coronary atherosclerosis ■ internal mammary artery graft ■ internal thoracic artery graft ■ left ventricular dysfunction ■ multivessel PCI ■ myocardial infarction ■ myocardial revascularization ■ non–ST-segment–elevated myocardial infarction ■ percutaneous coronary intervention ■ percutaneous transluminal coronary angioplasty ■ post-bypass ■ saphenous vein graft ■ vein graft lesions

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TOP 10 TAKE-HOME MESSAGES

1. Treatment decisions regarding coronary revascularization in patients with coronary artery disease (CAD) should be based on clinical indications, regardless of sex, race, or ethnicity, because there is no evidence that some patients benefit less than others, and efforts to reduce disparities of care are warranted.
2. In patients being considered for coronary revascularization for whom the optimal treatment strategy is unclear, a multidisciplinary Heart Team approach is recommended. Treatment decisions should be patient-centered, incorporate patient preferences and goals, and include shared decision-making.
3. For patients with significant left main disease, surgical revascularization is indicated to improve survival relative to that likely to be achieved with medical therapy. Percutaneous revascularization is a reasonable option to improve survival, compared with medical therapy, in selected patients with low-to-medium anatomic complexity of CAD and left main disease that is equally suitable for surgical or percutaneous revascularization.
4. Updated evidence from contemporary trials supplement older evidence with regard to mortality benefit of revascularization in patients with stable ischemic heart disease, normal left ventricular ejection fraction, and triple-vessel CAD. Surgical revascularization may be reasonable to improve survival. A survival benefit with percutaneous revascularization is uncertain. Revascularization decisions are based on consideration of disease complexity, technical feasibility of treatment, and a Heart Team discussion.
5. The use of a radial artery as a surgical revascularization conduit is preferred versus the use of a saphenous vein conduit to bypass the second most important target vessel with significant stenosis after the left anterior descending coronary artery. Benefits include superior patency, reduced adverse cardiac events, and improved survival.
6. Radial artery access is recommended in patients undergoing percutaneous intervention who have acute coronary syndromes or stable ischemic heart disease, to reduce bleeding and vascular complications compared with a femoral approach. Patients with acute coronary syndromes also benefit from a reduction in mortality rate with this approach.
7. A short duration of dual antiplatelet therapy after percutaneous revascularization in patients with stable ischemic heart disease is reasonable to reduce the risk of bleeding events. After consideration of recurrent ischemia and bleeding risks, select patients may safely transition to P2Y12 inhibitor monotherapy and stop aspirin after 1 to 3 months of dual antiplatelet therapy.
8. Staged percutaneous intervention (while in hospital or after discharge) of a significantly stenosed nonculprit artery in patients presenting with an ST-segment–elevation myocardial infarction is recommended in select patients to improve outcomes. Percutaneous intervention of the nonculprit artery at the time of primary percutaneous coronary intervention is less clear and may be considered in stable patients with uncomplicated revascularization of the culprit artery, low-complexity nonculprit artery disease, and normal renal function. In contrast, percutaneous intervention of the nonculprit artery can be harmful in patients in cardiogenic shock.
9. Revascularization decisions in patients with diabetes and multivessel CAD are optimized by the use of a Heart Team approach. Patients with diabetes who have triple-vessel disease should undergo surgical revascularization; percutaneous coronary intervention may be considered if they are poor candidates for surgery.
10. Treatment decisions for patients undergoing surgical revascularization of CAD should include the calculation of a patient's surgical risk with the Society of Thoracic Surgeons score. The usefulness of the SYNTAX (Synergy Between PCI With TAXUS and Cardiac Surgery) score calculation in treatment decisions is less clear because of the interobserver variability in its calculation and its absence of clinical variables.

PURPOSE OF THE EXECUTIVE SUMMARY

This executive summary provides the reader with the Top 10 items they should know about the American College of Cardiology (ACC)/American Heart Association (AHA)/Society for Cardiovascular Angiography and Interventions 2021 coronary artery revascularization guideline[1] and includes the justification of those updates, as well as the consolidation of the 2011 coronary artery bypass graft (CABG) and the 2011 and 2015 percutaneous coronary intervention (PCI) guidelines, with the added consideration of using a patient-centric disease approach.[1] The full guideline[1] provides the most up-to-date evidence to direct the clinician in patient decision-making. The intended primary target audience consists of cardiovascular clinicians who are involved in the care of patients for whom revascularization is considered or indicated. CAD is to be approached with the most current treatment options and treated as a "condition."

The scope of the full text "2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization"[1] updates and consolidates 3 previously published

guidelines[2-4] and replaces applicable sections on revascularization in 3 other guidelines,[5-7] with the added consideration of using a patient-centric disease approach. The 2021 guideline replaces these documents/sections:

1. Replace/retire the 2011 PCI guideline.[2]
2. Replace/retire the 2011 CABG guideline.[3]
3. Replace/retire the 2015 update in PCI in ST-segment–elevation myocardial infarction (STEMI) guideline.[4]
4. Replace/retire 2013 STEMI guideline, Sections 4.1, 4.2, 4.3, 4.4, 5.3 (deals with transfer after lytic with intent to do PCI) 6.2, 6.4, 7.1, and 7.2.[6]
5. Replace/retire 2014 non–ST-segment–elevation acute coronary syndrome guideline, Sections 4.4.4, 5.1.1, 5.1.2.1, 5.1.2.2, 5.1.2.3, and 5.2.[7]
6. Replace/retire 2012 stable ischemic heart disease (SIHD) guideline, Section 5.[5]

DOCUMENT REVIEW AND APPROVAL

The full guideline was reviewed by 2 official reviewers each nominated by the ACC and AHA; 1 reviewer each from the ACC, AHA, Society of Thoracic Surgeons, American Association for Thoracic Surgery, and the Society for Cardiovascular Angiography and Interventions; and 31 individual content reviewers. Authors' relationships with industry and other entities information is published in Appendix 1 of the full guideline.[1] Reviewers' relationships with industry and other entities information is published in Appendix 2 of the full guideline.[1]

Table 1. Applying American College of Cardiology/American Heart Association Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care (Updated May 2019)*

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) **(Generally, LOE A or B use only)**	**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 recommendations (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.

CLASS OF RECOMMENDATION AND LEVEL OF EVIDENCE

The Class of Recommendation (COR) indicates the strength of recommendation, encompassing the estimated magnitude and certainty of benefit in proportion to risk. The Level of Evidence (LOE) rates the quality of scientific evidence supporting the intervention on the basis of the type, quantity, and consistency of data from clinical trials and other sources (Table 1).[8]

TAKE-HOME MESSAGE NO. 1

Treatment decisions regarding coronary revascularization in patients with CAD should be based on clinical indications regardless of sex, race, or ethnicity, because there is no evidence that some patients benefit less than others, and efforts to reduce disparities of care are warranted.

Recommendation to Improve Equity of Care in Revascularization
Referenced studies that support the recommendation are summarized in Online Data Supplement 1.

COR	LOE	Recommendation
1	B-NR	1. In patients who require coronary revascularization, treatment decisions should be based on clinical indication, regardless of sex,[9-15] or race or ethnicity,[16-18] and efforts to reduce disparities of care are warranted.[19,20]

TAKE-HOME MESSAGE NO. 2

In patients being considered for coronary revascularization for whom the optimal treatment strategy is unclear, a multidisciplinary Heart Team approach is recommended. Treatment decisions should be patient-centered, incorporate patient preferences and goals, and include shared decision-making.

Recommendation for the Heart Team
Referenced studies that support the recommendation are summarized in Online Data Supplement 2.

COR	LOE	Recommendation
1	B-NR	1. In patients where the optimal treatment strategy is unclear, a Heart Team approach that includes representatives from interventional cardiology, cardiac surgery, and clinical cardiology is recommended to improve patient outcomes.[21-26]

Recommendations for Shared Decision-Making and Informed Consent
Referenced studies that support the recommendation are summarized in Online Data Supplement 2.

COR	LOE	Recommendation
1	C-LD	1. In patients undergoing revascularization, decisions should be patient-centered—that is, considerate of the patient's preferences and goals, cultural beliefs, health literacy, and social determinants of health—and made in collaboration with the patient's support system.[27,28]
1	C-LD	2. In patients undergoing coronary angiography or revascularization, adequate information about benefits, risks, therapeutic consequences, and potential alternatives in the performance of percutaneous and surgical myocardial revascularization should be given, when feasible, with sufficient time for informed decision-making to improve clinical outcomes.[29-31]

Ideal situations for Heart Team consideration include patients with complex coronary disease, comorbid conditions that could impact the success of the revascularization strategy, and other clinical or social situations that may impact outcomes (Figure 1 and Table 2). Shared decision-making (Figure 2) is a collaborative approach that provides patients with unbiased, evidence-based information on treatment choices and encourages a dialogue with patients and providers to make decisions that use scientific evidence and align with the patient's values and preferences.[29,30,32] Procedure-related and long-term risks

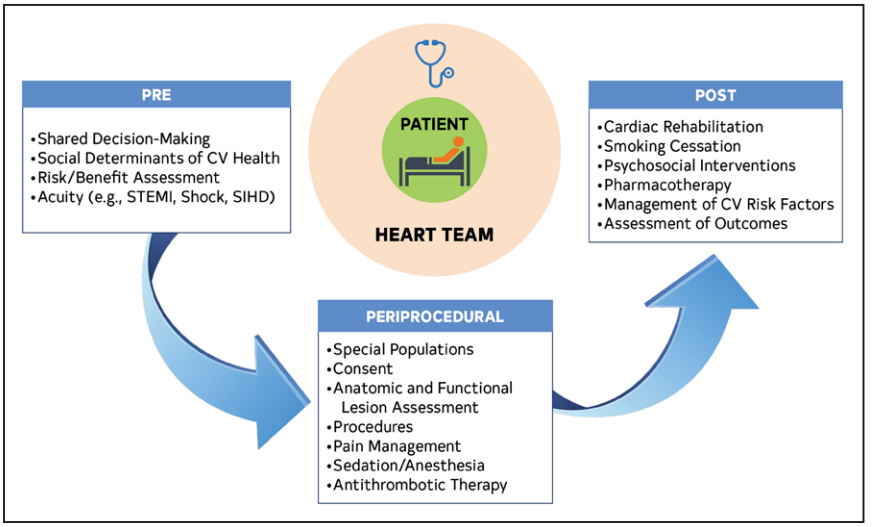

Figure 1. Phases of Patient-Centric Care in the Treatment of Coronary Artery Disease.
CV indicates cardiovascular; SIHD, stable ischemic heart disease; and STEMI, ST-segment elevation myocardial infarction.

Table 2. Factors for Consideration by the Heart Team

Coronary Anatomy
Left main disease
Multivessel disease
High anatomic complexity (ie, bifurcation disease, high SYNTAX score)
Comorbidities
Diabetes
Systolic dysfunction
Coagulopathy
Valvular heart disease
Frailty
Malignant neoplasm
End-stage renal disease
Chronic obstructive pulmonary disease
Immunosuppression
Debilitating neurological disorders
Liver disease/cirrhosis
Prior CVA
Calcified/porcelain aorta
Aortic aneurysm
Procedural Factors
Local and regional outcomes
Access site for PCI
Surgical risk
PCI risk
Patient Factors
Unstable presentation or shock
Patient preferences
Inability or unwillingness to adhere to DAPT
Patient social support
Religious beliefs
Patient education, knowledge, and understanding

CVA indicates cerebrovascular accident; DAPT, dual antiplatelet therapy; PCI, percutaneous coronary intervention; and SYNTAX, Synergy Between PCI With TAXUS and Cardiac Surgery.

and benefits such as survival, quality of life, and the need for late reintervention should be included in such discussions (Table 3).[33]

TAKE-HOME MESSAGE NO. 3

For patients with significant left main disease, surgical revascularization is indicated to improve survival relative to that likely to be achieved with medical therapy. Percutaneous revascularization is a reasonable option to improve survival, compared with medical therapy, in selected patients with low to medium anatomic complexity of CAD and left main disease that is equally suitable for surgical or percutaneous revascularization.

Recommendations for Revascularization to Improve Survival in SIHD Compared With Medical Therapy
Referenced studies that support the recommendations are summarized in Online Data Supplement 10.

COR	LOE	Recommendations
1	B-R	1. In patients with SIHD and significant left main stenosis, CABG is recommended to improve survival.[36-39]
2a	B-NR	2. In selected patients with SIHD and significant left main stenosis for whom PCI can provide equivalent revascularization to that possible with CABG, PCI is reasonable to improve survival.[36]

Studies have shown that CABG confers a survival benefit over medical therapy in multiple subsets of patients, including left main CAD (Figure 3),[36-39] triple vessel CAD,[40] and ischemic cardiomyopathy.[41-49]

TAKE-HOME MESSAGE NO. 4

Updated evidence from contemporary trials supplement older evidence with regard to mortality benefit of revascularization in patients with SIHD, normal left ventricular ejection fraction, and triple-vessel CAD. Surgical revascularization may be reasonable to improve survival. A survival benefit with percutaneous revascularization is uncertain. Revascularization decisions are based on consideration of disease complexity, technical feasibility of treatment, and a Heart Team discussion.

Recommendations for Revascularization to Improve Survival in SIHD Compared With Medical Therapy
Referenced studies that support the recommendations are summarized in Online Data Supplement 10.

COR	LOE	Recommendations
2b	B-R	1. In patients with SIHD, normal ejection fraction, significant stenosis in 3 major coronary arteries (with or without proximal LAD), and anatomy suitable for CABG, CABG may be reasonable to improve survival.[37,40,50,51]
2b	B-R	2. In patients with SIHD, normal ejection fraction, significant stenosis in 3 major coronary arteries (with or without proximal LAD), and anatomy suitable for PCI, the usefulness of PCI to improve survival is uncertain.[50-60]

TAKE-HOME MESSAGE NO. 5

The use of a radial artery as a surgical revascularization conduit is preferred to the use of a saphenous vein conduit to bypass the second most important target vessel with significant stenosis after the left anterior descending coronary artery. Benefits include superior patency, reduced adverse cardiac events, and improved survival.

When choosing conduits for CABG, both clinical and technical factors (eg, life expectancy, presence of dia-

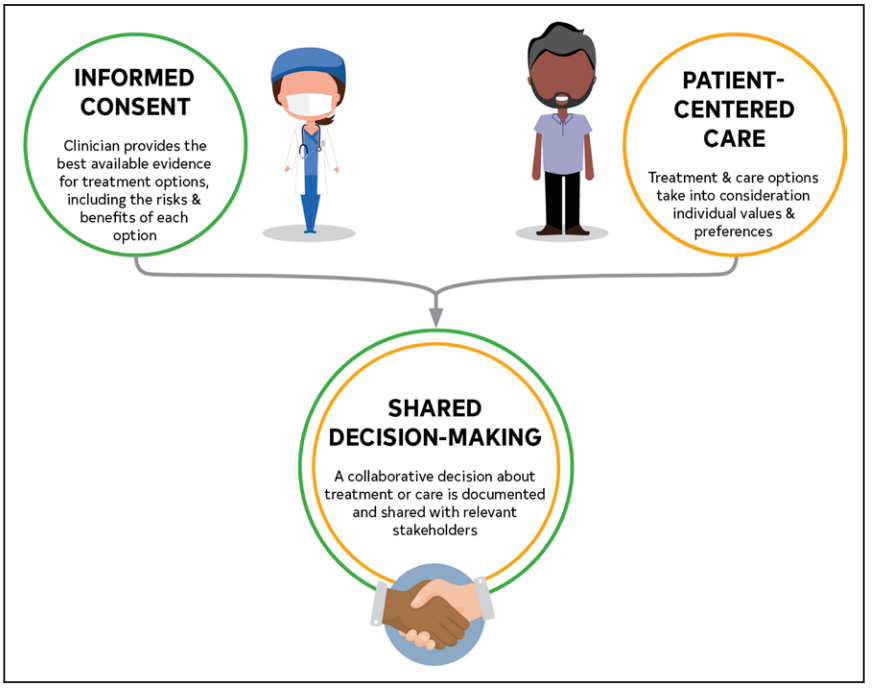

Figure 2. Shared Decision-Making Algorithm.

betes, presence of CKD, degree of target stenosis) are considered (Table 4).

Recommendation for Bypass Conduits in Patients Undergoing CABG Referenced studies that support the recommendation are summarized in Online Data Supplement 37.		
COR	**LOE**	**Recommendation**
1	**B-R**	1. In patients undergoing isolated CABG, the use of a radial artery is recommended in preference to a saphenous vein conduit to graft the second most important, significantly stenosed, non–LAD vessel to improve long-term cardiac outcomes.[61-63]

TAKE-HOME MESSAGE NO. 6

Radial artery access is recommended in patients undergoing percutaneous intervention who have acute coronary syndromes or SIHD, to reduce bleeding and vascular complications compared to a femoral approach. Patients with acute coronary syndromes also benefit from a reduction in mortality rate with this approach.

Recommendations for Radial and Femoral Approaches for PCI Referenced studies that support the recommendations are summarized in Online Data Supplement 23.		
COR	**LOE**	**Recommendations**
1	**A**	1. In patients with ACS undergoing PCI, a radial approach is indicated in preference to a femoral approach to reduce the risk of death, vascular complications, or bleeding.[64-67]
1	**A**	2. In patients with SIHD undergoing PCI, the radial approach is recommended to reduce access site bleeding and vascular complications.[67-70]

TAKE-HOME MESSAGE NO. 7

A short duration of dual antiplatelet therapy following percutaneous revascularization in patients with SIHD is reasonable to reduce the risk of bleeding events. After consideration of recurrent ischemia and bleeding risks, select patients may safely transition to P2Y12 inhibitor monotherapy and stop aspirin after 1-3 months of dual antiplatelet therapy.

Pooled data have demonstrated less bleeding with shorter DAPT (3-6 months) and fewer ischemic events (including stent thrombosis) with longer DAPT (>12 months)[75] (Figure 4).

Recommendation for Dual Antiplatelet Therapy in Patients After PCI Referenced studies that support the recommendation are summarized in Online Data Supplement 44.		
COR	**LOE**	**Recommendation**
2a	**A**	1. In selected patients undergoing PCI, shorter-duration DAPT (1 to 3 months) is reasonable with subsequent transition to P2Y12 inhibitor monotherapy to reduce the risk of bleeding events.[71-74]

TAKE-HOME MESSAGE NO. 8

Staged percutaneous intervention (while in hospital or after discharge) of a significantly stenosed nonculprit artery in patients presenting with STEMI is recommended in selected patients to improve outcomes. Percutaneous intervention of the nonculprit artery at the time of primary PCI is less clear and may be considered in stable patients with uncomplicated revascularization of the culprit artery, low-complexity nonculprit artery disease, and

Table 3. Ideal Components of the Shared Decision-Making and Informed Consent Process

Patient-Centered Care
Assess a patient's ability to understand complex health information
Seek support of family/others
Elicit and respect cultural, racial, ethnic, or religious preferences and values
Evaluate social determinants of health (education, income, access to health care)
Improve telephone/telemedicine access
Discuss treatment alternatives and how each affects the patient's quality of life
Shared Decision-Making
Encourage questions and explain the patient's role in the decision-making partnership
Clearly and accurately communicate the potential risks and benefits of a particular procedure and alternative treatments
Ensure that patients have a key role in deciding what revascularization approach is appropriate
Use shared decision aids: Alphabetical List of Decision Aids by Health Topic, Ottawa Hospital Research Institute (https://decisionaid.ohri.ca/implement.html)[34] SHARE Approach Curriculum Tools, Agency for Healthcare Research and Quality (https://www.ahrq.gov/health-literacy/curriculum-tools/shared-decisionmaking/tools/tool-1/index.html)[35]
Spend sufficient time to engage in shared decision-making; allow for a second opinion
Work with a chaplain, social worker, or other team members to facilitate shared decision-making
Encourage patients to share their fears, stress, or other emotions, and address appropriately
Negotiate decision in partnership with the patient and family members
Respect patient's autonomy to decline recommended treatment
Consent Procedures
Use plain language, avoiding jargon, and adopt the patient's words; integrate pictures to teach
Document teach-back of patient's knowledge and understanding
Conduct conversations with a trained interpreter, as needed
Provide patient-specific short- and long-term risks, benefits, and alternative treatments
Provide unbiased, evidence-based, reliable, accessible, and relevant information to patient
Discuss specific risks and benefits with regard to survival, relief of angina, quality of life, and potential additional intervention, as well as uncertainties associated with different treatment strategies
Provide patient time to reflect on the trade-offs imposed by the outcome estimates
Provide information on the level of operator expertise, volume of the facility, and local results in the performance of coronary revascularization options
Clearly inform of the need for continued medical therapy and lifestyle modifications

normal renal function. In contrast, percutaneous intervention of the nonculprit artery can be harmful in patients in cardiogenic shock.

Recommendations for Revascularization of the Noninfarct Artery in Patients With STEMI
Referenced studies that support the recommendations are summarized in Online Data Supplement 8.

COR	LOE	Recommendations
1	A	1. In selected hemodynamically stable patients with STEMI and multivessel disease, after successful primary PCI, staged PCI of a significant noninfarct artery stenosis is recommended to reduce the risk of death or MI.[77-80]
2a	C-EO	2. In selected patients with STEMI with complex multivessel noninfarct artery disease, after successful primary PCI, elective CABG is reasonable to reduce the risk of cardiac events.
2b	B-R	3. In selected hemodynamically stable patients with STEMI and low-complexity multivessel disease, PCI of a noninfarct artery stenosis may be considered at the time of primary PCI to reduce cardiac event rates.[77,78,81-83]
3: Harm	B-R	4. In patients with STEMI complicated by cardiogenic shock, routine PCI of a noninfarct artery at the time of primary PCI should not be performed because of the higher risk of death or renal failure.[84-86]

Revascularization strategies (Figure 5) for patients with STEMI and multivessel disease include multivessel PCI at the time of primary PCI, PCI of the infarct artery only followed by staged PCI of a noninfarct artery, PCI of the infarct artery only with an ischemia-guided approach to treatment of a noninfarct artery, or PCI of the infarct artery only with elective CABG.

TAKE-HOME MESSAGE NO. 9

Revascularization decisions in patients with diabetes and multivessel CAD are optimized by the use of a Heart Team approach. Patients with diabetes who have triple-vessel disease should undergo surgical revascularization; PCI may be considered if they are poor candidates for surgery.

Recommendations for Patients With Diabetes
Referenced studies that support the recommendations are summarized in Online Data Supplement 14.

COR	LOE	Recommendations
1	A	1. In patients with diabetes and multivessel CAD with involvement of the LAD, who are appropriate candidates for CABG, CABG (with a LIMA to the LAD) is recommended in preference to PCI to reduce mortality and repeat revascularizations.[87-94]
2a	B-NR	2. In patients with diabetes, who have multivessel CAD amenable to PCI and an indication for revascularization and are poor candidates for surgery, PCI can be useful to reduce long-term ischemic outcomes.[95,96]
2b	B-R	3. In patients with diabetes, who have left main stenosis and low- or intermediate-complexity CAD in the rest of the coronary anatomy, PCI may be considered an alternative to CABG to reduce major adverse cardiovascular outcomes.[91,97]

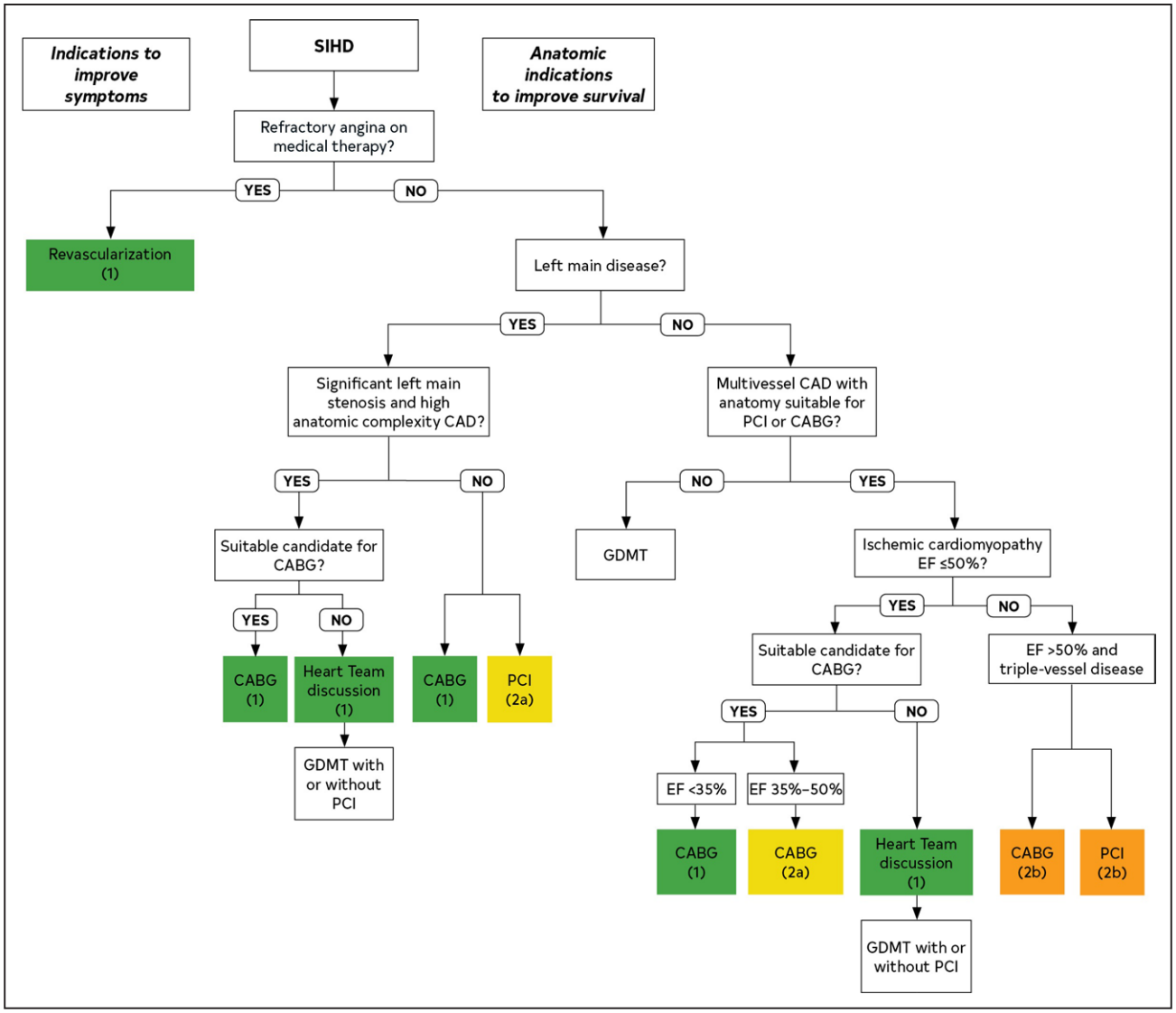

Figure 3. Revascularization in Patients With Stable Ischemic Heart Disease.
Colors correspond to Table 1. CABG indicates coronary artery bypass graft; CAD, coronary artery disease; EF, ejection fraction; GDMT, guideline-directed medical therapy; PCI, percutaneous coronary intervention; and SIHD, stable ischemic heart disease. This algorithm summarizes the recommendations in this guideline for the care of patients with stable CAD. It is not meant to encompass every patient scenario or situation, and clinicians are encouraged to use a Heart Team approach when care decisions are unclear and to see the accompanying supportive text for each recommendation. Additionally, in situations that lack sufficient data to make formal recommendations for care, please see Section 17, "Unanswered Questions and Future Directions," in the full guideline.[1]

Table 4. Best Practices for the Use of Bypass Conduits in CABG

Objectively assess palmar arch completeness and ulnar compensation before harvesting the radial artery. Use the arm with the best ulnar compensation for radial artery harvesting.
Use radial artery grafts to target vessels with subocclusive stenoses.
Avoid the use of the radial artery after transradial catheterization.
Avoid the use of the radial artery in patients with chronic kidney disease and a high likelihood of rapid progression to hemodialysis.
Use oral calcium channel blockers for the first postoperative year following radial artery grafting.
Avoid bilateral percutaneous or surgical radial artery procedures in patients with CAD to preserve the artery for future use.

Table 4. (Continued)

Harvest the internal mammary artery using the skeletonization technique to reduce the risk of sternal wound complications.
Use an endoscopic saphenous vein harvest technique in patients at risk of wound complications.
Use a no-touch saphenous vein harvest technique in patients at low risk of wound complications.
Use the skeletonized right gastroepiploic artery to graft right coronary artery target vessels with subocclusive stenosis if the operator is experienced with the use of the artery.

CABG indicates coronary artery bypass graft; and CAD, coronary artery disease.

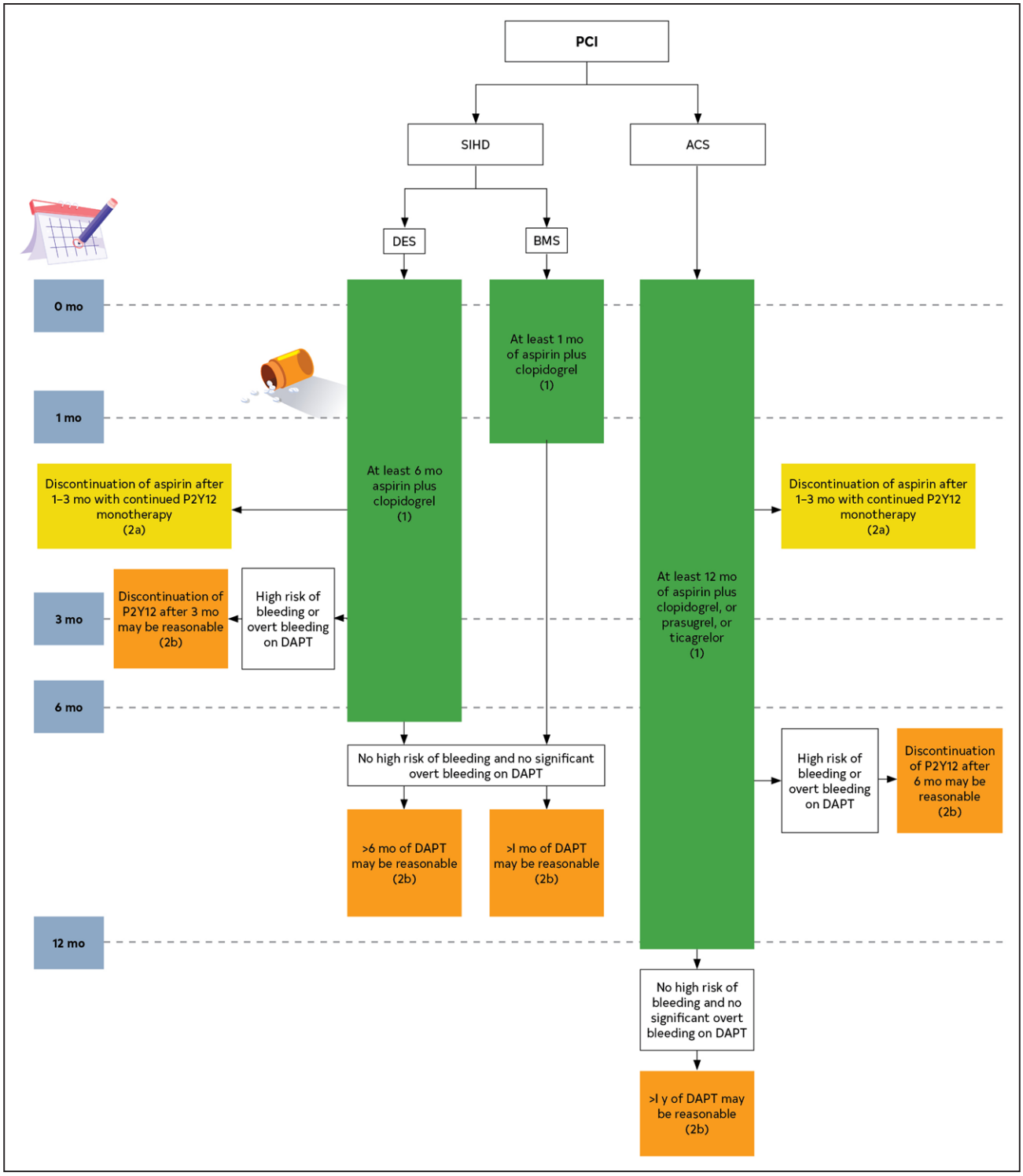

Figure 4. Use of Dual Antiplatelet Therapy for Patients After PCI.
Colors correspond to Table 1. ACS indicates acute coronary syndrome; BMS, bare metal stent; DAPT, dual antiplatelet therapy; DES, drug-eluting stent; P2Y12, platelet adenosine diphosphate P2Y12 receptor; PCI, percutaneous coronary intervention; and SIHD, stable ischemic heart disease. This algorithm is adapted from the 2016 DAPT guideline[76] and includes new recommendations from this guideline for the care of patients with CAD. It is not meant to encompass every patient scenario or situation, and clinicians are encouraged to use a Heart Team approach when care decisions are unclear and to see the accompanying supportive text for each recommendation. Additionally, in situations that lack sufficient data to make formal recommendations for care, please see Section 17, "Unanswered Questions and Future Directions," in the full guideline.[1]

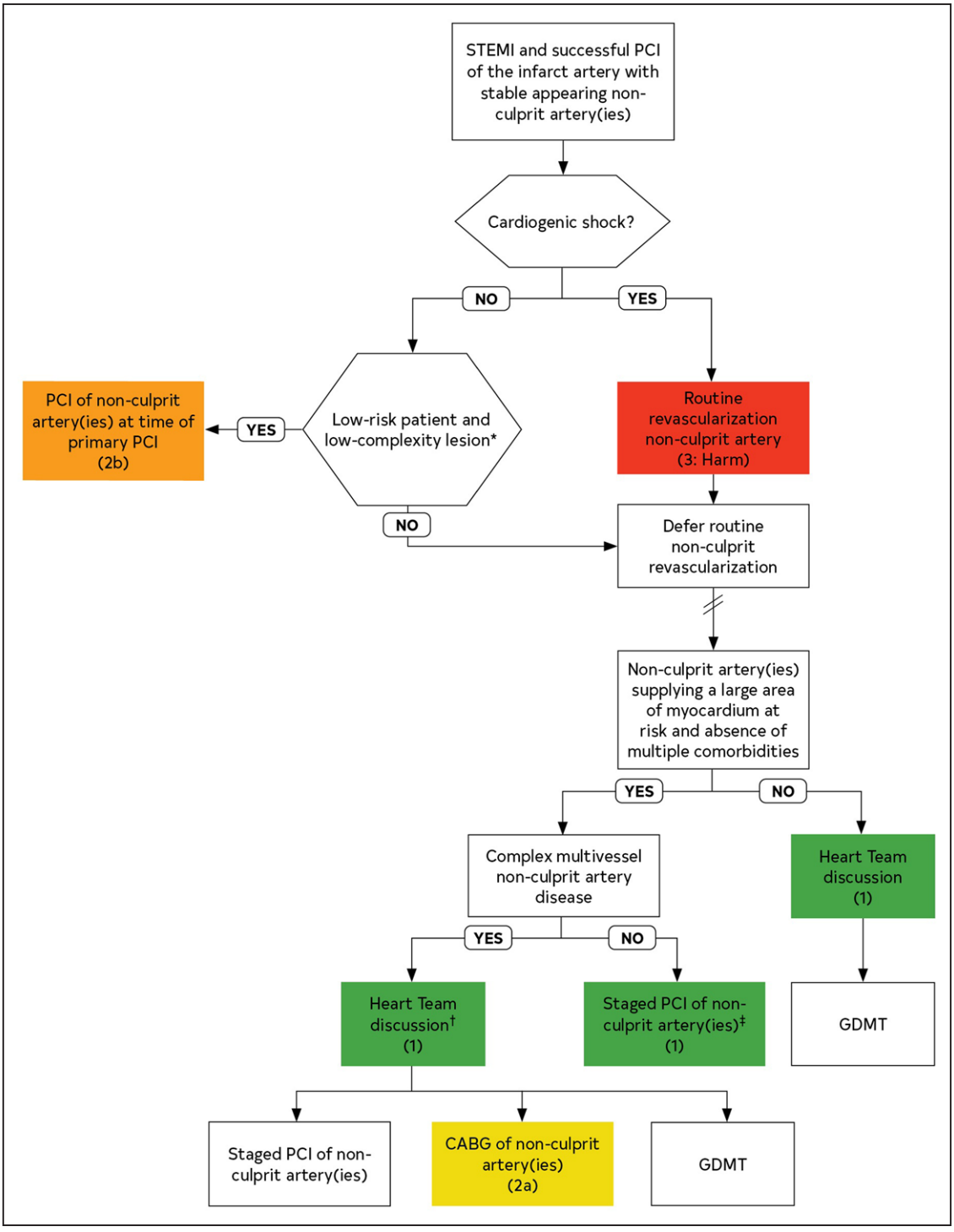

Figure 5. Revascularization of Noninfarct-Related Coronary Artery Lesions in Patients With STEMI.
Colors correspond to Table 1. CABG indicates coronary artery bypass graft; GDMT, guideline-directed medical therapy; PCI, percutaneous coronary intervention; and STEMI, ST-segment–elevation myocardial infarction. *Normal blood pressure and heart rate, left ventricular end-diastolic pressure <20 mm Hg, no chronic renal insufficiency or acute kidney injury, and expected total contrast volume <3× glomerular filtration rate, simple lesion anatomy. †In making the decision about the need for and mode of revascularization the Heart Team should consider the suitability of the non-culprit artery for PCI, the coronary complexity and the risk of revascularization, the extent of myocardium at risk, and patient comorbidities, including life expectancy or other significant patient comorbidities, such as chronic renal insufficiency or acute kidney injury. ‡Staged PCI can be performed in hospital or after discharge, up to 45 days post MI. ⫽ Symbol denotes time elapsed before proceeding to the next procedure. This algorithm summarizes the recommendations in this guideline for the care of patients with STEMI and noninfarct artery disease. It is not meant to encompass every patient scenario or situation, and clinicians are encouraged to use a Heart Team approach when care decisions are unclear and to see the accompanying supportive text for each recommendation. Additionally, in situations that lack sufficient data to make formal recommendations for care, please see Section 17, "Unanswered Questions and Future Directions," in the full guideline.[1]

Table 5. Assessment of Risk Factors Not Quantified in the STS Score

Risk Factor	Assessment Tool
Cirrhosis	Model for End-Stage Liver Disease (MELD) score[98-100,112-114]
Frailty	Gait speed[102,104-108,110]
Malnutrition	Malnutrition Universal Screening Tool (MUST)[101,103,109,110]

STS indicates Society of Thoracic Surgeons.

TAKE-HOME MESSAGE NO. 10

Treatment decisions for patients undergoing surgical revascularization of CAD should include the calculation of a patient's surgical risk with the Society of Thoracic Surgeons score. The usefulness of the SYNTAX score calculation in treatment decisions is less clear because of the interobserver variability in its calculation and its absence of clinical variables.

Recommendation for Predicting Patient Risk of Death With CABG
Referenced studies that support the recommendation are summarized in Online Data Supplements 3.

COR	LOE	Recommendation
1	B-NR	1. In patients who are being considered for CABG, calculation of the Society of Thoracic Surgeons risk score is recommended to help stratify patient risk.[98,99]

Patients with liver cirrhosis, frailty, and malnutrition have increased perioperative morbidity and mortality after cardiac surgery[100-111] and may be assessed by other tools (Table 5).

Recommendation for Defining Coronary Artery Lesion Complexity: Calculation of the SYNTAX Score
Referenced studies that support the recommendation are summarized in Online Data Supplement 4.

COR	LOE	Recommendation
2b	B-NR	1. In patients with multivessel CAD, an assessment of CAD complexity such as the SYNTAX score may be useful to guide revascularization[115-118]

Many factors contribute to the estimation of complexity of CAD (Table 6).

Table 6. Angiographic Features Contributing to Increasing Complexity of CAD

Multivessel disease
Left main or proximal LAD artery lesion
Chronic total occlusion
Trifurcation lesion
Complex bifurcation lesion
Heavy calcification
Severe tortuosity
Aorto-ostial stenosis
Diffusely diseased and narrowed segments distal to the lesion
Thrombotic lesion
Lesion length >20 mm

CAD indicates coronary artery disease; and LAD, left anterior descending.

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ARTICLE INFORMATION

This document was approved by the American College of Cardiology Clinical Policy Approval Committee, the American Heart Association Science Advisory and Coordinating Committee, the American College of Cardiology Science and Quality Committee, the American Heart Association Executive Committee, and the Society for Cardiovascular Angiography and Interventions Executive Committee in August 2021.

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*Former Joint Committee member; current member during the writing effort.

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