2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease: Executive Summary


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Full-text guideline available at: http://circ.ahajournals.org/content/126/25/e354.

The writing committee gratefully acknowledges the memory of James T. Dove, MD, who died during the development of this document but contributed immensely to our understanding of stable ischemic heart disease.

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This document was approved by the American College of Cardiology Foundation Board of Trustees, American Heart Association Science Advisory and Coordinating Committee, American College of Physicians, American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons in July 2012.


This article is copublished in the
Journal of the American College of Cardiology
and the
Annals of Internal Medicine.

Copies: This document is available on the World Wide Web sites of the American College of Cardiology (www.cardiosource.org) and the American Heart Association (my.americanheart.org). A copy of the document is available at http://my.americanheart.org/statements by selecting either the “By Topic” link or the “By Publication Date” link. To purchase additional reprints, call 843-216-2533 or e-mail kelle.ramsay@wolterskluwer.com. 

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(Circulation. 2012;126:3097-3137.)

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Circulation is available at http://circ.ahajournals.org

DOI: 10.1161/CIR.0b013e3182776f83
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Preamble

The medical profession should play a central role in evaluating the evidence related to drugs, devices, and procedures for the detection, management, and prevention of disease. When properly applied, expert analysis of available data on the benefits and risks of these therapies and procedures can improve the quality of care, optimize patient outcomes, and favorably affect costs by focusing resources on the most effective strategies. An organized and directed approach to a thorough review of evidence has resulted in the production of clinical practice guidelines that assist physicians in selecting the best management strategy for an individual patient. Moreover, clinical practice guidelines can provide a foundation for other applications, such as performance measures, appropriate use criteria, and both quality improvement and clinical decision support tools.

The American College of Cardiology Foundation (ACCF) and the American Heart Association (AHA) have jointly produced guidelines in the area of cardiovascular disease since 1980. The ACCF/AHA Task Force on Practice Guidelines (Task Force), charged with developing, updating, and revising practice guidelines for cardiovascular diseases and procedures, directs and oversees this effort. Writing committees are asked to perform a literature review; weigh the strength of evidence for or against particular tests, treatments, or procedures; and include estimates of expected outcomes where such data exist. Patient-specific modifiers, comorbidities, and issues of patient preference that may influence the choice of tests or therapies are considered. When available, information from studies on cost is considered, but data on efficacy and outcomes constitute the primary basis for the recommendations contained herein.

In analyzing the data and developing recommendations and supporting text, the writing committee uses evidence-based methodologies developed by the Task Force. The Class of Recommendation (COR) is an estimate of the size of the treatment effect, with consideration given to risks versus benefits in addition to evidence and/or agreement that a given treatment or procedure is or is not useful/effective or in some situations may cause harm. The Level of Evidence (LOE) is an estimate of the certainty or precision of the treatment effect. The writing committee reviews and ranks evidence supporting each recommendation, with the weight of evidence ranked as LOE A, B, or C according to specific definitions that are included in Table 1. Studies are identified as observational, retrospective, prospective, or randomized as appropriate. For certain conditions for which inadequate data are available, recommendations are based on expert consensus and clinical experience and are ranked as LOE C. When recommendations at LOE C are supported by historical clinical data, appropriate references (including clinical reviews) are cited if available. For issues for which sparse data are available, a survey of current practice among the clinicians on the writing committee is the basis for LOE C recommendations, and no references are cited. The schema for COR and LOE is summarized in Table 1, which also provides suggested phrases for writing recommendations within each COR. A new addition to this methodology is separation of the Class III recommendations to delineate whether the recommendation is determined to be of “no benefit” or is associated with “harm” to the patient. In addition, in view of the increasing number of comparative effectiveness studies, comparator verbs and suggested phrases for writing recommendations for the comparative effectiveness of one treatment or strategy versus another have been added for COR I and IIa, LOE A or B only.

In view of the advances in medical therapy across the spectrum of cardiovascular diseases, the Task Force has designated the term guideline-directed medical therapy (GDMT) to represent optimal medical therapy as defined by ACCF/AHA guideline-recommended therapies (primarily Class I). This new term, GDMT, will be used herein and throughout all future guidelines.

Because the ACCF/AHA practice guidelines address patient populations (and healthcare providers) residing in North America, drugs that are not currently available in North America are discussed in the text without a specific COR. For studies performed in large numbers of subjects outside North America, each writing committee reviews the potential influence of different practice patterns and patient populations on the treatment effect and relevance to the ACCF/AHA target population to determine whether the findings should inform a specific recommendation.

The ACCF/AHA practice guidelines are intended to assist healthcare providers in clinical decision making by describ-
ing a range of generally acceptable approaches to the diagnosis, management, and prevention of specific diseases or conditions. The guidelines attempt to define practices that meet the needs of most patients in most circumstances. The ultimate judgment about care of a particular patient must be made by the healthcare provider and patient in light of all the circumstances presented by that patient. As a result, situations may arise in which deviations from these guidelines might be appropriate. Clinical decision making should involve consideration of the quality and availability of expertise in the area where care is provided. When these guidelines are used as the basis for regulatory or payer decisions, the goal should be improvement in quality of care. The Task Force recognizes that situations arise in which additional data are needed to inform patient care more effectively; these areas will be identified within each respective guideline when appropriate.

Prescribed courses of treatment in accordance with these recommendations are effective only if followed. Because lack of patient understanding and adherence may adversely affect outcomes, physicians and other healthcare providers should make every effort to engage the patient’s active participation in prescribed medical regimens and lifestyles. In addition, patients should be informed of the risks, benefits, and alternatives to a particular treatment and should be involved in shared decision making whenever feasible, particularly for COR IIa and IIb, for which the benefit-to-risk ratio may be lower.

The Task Force makes every effort to avoid actual, potential, or perceived conflicts of interest that may arise as a

Table 1. Applying Classification of Recommendations and Level of Evidence

<table>
<thead>
<tr>
<th>SIZE OF TREATMENT EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASS I</td>
</tr>
<tr>
<td>Procedure/Treatment</td>
</tr>
<tr>
<td>CLASS IIa</td>
</tr>
<tr>
<td>Additional studies with focused objectives needed</td>
</tr>
<tr>
<td>CLASS IIb</td>
</tr>
<tr>
<td>Additional studies with broad objectives needed; additional registry data would be helpful</td>
</tr>
<tr>
<td>CLASS III</td>
</tr>
<tr>
<td>Procedure/Test</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESTIMATE OF CERTAINTY (PRECISION OF TREATMENT EFFECT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVEL A</td>
</tr>
<tr>
<td>Data derived from multiple randomized clinical trials or meta-analyses</td>
</tr>
<tr>
<td>- Recommendation that procedure or treatment is useful/effective</td>
</tr>
<tr>
<td>- Sufficient evidence from multiple randomized trials or meta-analyses</td>
</tr>
<tr>
<td>LEVEL B</td>
</tr>
<tr>
<td>Data derived from a single randomized trial or nonrandomized studies</td>
</tr>
<tr>
<td>- Recommendation that procedure or treatment is useful/effective</td>
</tr>
<tr>
<td>- Evidence from single randomized trial or nonrandomized studies</td>
</tr>
<tr>
<td>LEVEL C</td>
</tr>
<tr>
<td>Only consensus opinion of experts, case studies, or standard of care</td>
</tr>
<tr>
<td>- Recommendation that procedure or treatment is useful/effective</td>
</tr>
<tr>
<td>- Only expert opinion, case studies, or standard of care</td>
</tr>
</tbody>
</table>

Suggested phrases for writing recommendations

- should be
- is indicated
- is useful/effective/beneficial

Comparative effectiveness phrases

- treatment A is probably recommended/indicated in preference to treatment B
- it is reasonable to choose treatment A over treatment B

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

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as sex, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use. †For comparative effectiveness recommendations (Class I and IIa; Level of Evidence A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.
result of industry relationships or personal interests among the members of the writing committee. All writing committee members and peer reviewers of this guideline were required to disclose all such current healthcare-related relationships, as well as those existing 24 months (from 2005) before initiation of the writing effort. The writing committee chair may not have any relevant relationships with industry or other entities (RWI); however, RWI are permitted for the vice chair position. In December 2009, the ACCF and AHA implemented a new policy that requires a minimum of 50% of the writing committee have no relevant RWI; in addition, the disclosure term was changed to 12 months before writing committee initiation. The present guideline was developed during the transition in RWI policy and occurred over an extended period of time. In the interest of transparency, we provide full information on RWI existing over the entire period of guideline development, including delineation of relationships that expired more than 24 months before the guideline was finalized. This information is included in Appendix 1. These statements are reviewed by the Task Force and all members during each conference call and meeting of the writing committee and are updated as changes occur. All guideline recommendations require a confidential vote by the writing committee and must be approved by a consensus of the voting members. Members who recused themselves from voting are indicated in the list of writing committee members, and section recusals are noted in Appendix 1. Authors' and peer reviewers' RWI pertinent to this guideline are disclosed in Appendixes 1 and 2, respectively. Comprehensive disclosure information for the Task Force is also available online at http://www.cardiosource.org/ACC/About-ACC/Who-We-Are/Leadership/Guidelines-and-Documents-Task-Forces.aspx. The work of the writing committee is supported exclusively by the ACCF, AHA, American College of Physicians (ACP), American Association for Thoracic Surgery (AATS), Preventive Cardiovascular Nurses Association (PCNA), Society for Cardiovascular Angiography and Interventions (SCAI), and Society of Thoracic Surgeons (STS), without commercial support. Writing committee members volunteered their time for this activity.

The recommendations in this guideline are considered current until they are superseded by a focused update or the full-text guideline is revised. The reader is encouraged to consult the full-text guideline for additional guidance and details about stable ischemic heart disease since the Executive Summary contains only the recommendations. Guidelines are official policy of both the ACCF and AHA.

Jeffrey L. Anderson, MD, FACC, FAHA
Chair, ACCF/AHA Task Force on Practice Guidelines

1. Introduction

1.1. Methodology and Evidence Overview

The recommendations listed in this document are, whenever possible, evidence based. An extensive evidence review was conducted as the document was compiled through December 2008. Repeated literature searches were performed by the guideline development staff and writing committee members as new issues were considered. When available, current and credible meta-analyses were used instead of conducting a systematic review of all primary literature. New clinical trials published in peer-reviewed journals and articles through December 2011 were also reviewed and incorporated when relevant. Furthermore, because of the extended development time period for this guideline, peer review comments indicated that the sections focused on imaging technologies required additional updating, which occurred during 2011. Therefore, the evidence review for the imaging sections includes published literature through December 2011.

Searches were limited to studies, reviews, and other evidence in human subjects and published in English. Key search words included, but were not limited to: accuracy, angina, asymptomatic patients, cardiac magnetic resonance (CMR), cardiac rehabilitation, chest pain, chronic angina, chronic coronary occlusions, chronic ischemic heart disease (IHD), chronic total occlusion, connective tissue disease, coronary artery bypass graft (CABG) versus medical therapy, coronary artery disease (CAD) and exercise, coronary calcium scanning, cardiac/coronary computed tomography angiography (CCTA), CMR angiography, CMR imaging, coronary stenosis, death, depression, detection of CAD in symptomatic patients, diabetes, diagnosis, dobutamine stress echocardiography, echocardiography, elderly, electrocardiogram (ECG) and chronic stable angina, emergency department, ethnic, exercise, exercise stress testing, follow-up testing, gender, glycemic control, hypertension, intravascular ultrasound, fractional flow reserve, invasive coronary angiography, kidney disease, low-density lipoprotein lowering, magnetic resonance imaging (MRI), medication adherence, minority groups, mortality, myocardial infarction (MI), noninvasive testing and mortality, nuclear myocardial perfusion, nutrition, obesity, outcomes, patient follow-up, patient education, prognosis, proximal left anterior descending (LAD) disease, physical activity, reoperation, risk stratification, smoking, stable ischemic heart disease (SIHD), stable angina and reoperation, stable angina and revascularization, stress echocardiography, radionuclide stress testing, stenting versus CABG, unprotected left main, weight reduction, and women.

1.2. Organization of the Writing Committee

The writing committee was composed of physicians, cardiovascular interventionalists, surgeons, general internists, imagers, nurses, and pharmacists. The writing committee included representatives from the ACP, AATS, PCNA, SCAI, and STS.

1.3. Document Review and Approval

This document was reviewed by 2 external reviewers nominated by both the ACCF and the AHA; 2 reviewers nominated by the ACP, AATS, PCNA, SCAI, and STS; and 19 content reviewers, including representatives from the ACCF Imaging Council, ACCF Interventional Scientific Council, and the AHA Council on Clinical Cardiology. All reviewer RWI information was collected and distributed to the writing committee and is published in this document (Appendix 2). Because extensive peer review comments resulted in substantial revision, the guideline was subjected to a second peer review by all official and organizational reviewers. Lastly,
the imaging sections were also peer reviewed separately, after an update to that evidence base.

This document was approved for publication by the governing bodies of the ACCF, AHA, ACP, AATS, PCNA, SCAI, and STS.

1.4. Scope of the Guideline

These guidelines are intended to apply to adult patients with stable known or suspected IHD, including new-onset chest pain (ie, low-risk unstable angina [UA]), or to adult patients with stable pain syndromes (Figure 1). Patients who have “ischemic equivalents,” such as dyspnea or arm pain with exertion, are included in the latter group. Many patients with IHD can become asymptomatic with appropriate therapy. Accordingly, the follow-up sections of this guideline pertain to patients who were previously symptomatic, including those who have undergone percutaneous coronary intervention (PCI) or CABG.

This guideline also addresses the initial diagnostic approach to patients who present with symptoms that suggest IHD, such as anginal-type chest pain, but who are not known to have IHD. In this circumstance, it is essential that the practitioner ascertain whether such symptoms represent the initial clinical recognition of chronic stable angina, reflecting gradual progression of obstructive CAD or an increase in supply/demand mismatch precipitated by a change in activity or concurrent illness (such as anemia or infection), or whether they represent an acute coronary syndrome (ACS), most likely due to an unstable plaque causing acute thrombosis. For patients with newly diagnosed stable angina, this guideline should be used. For patients with acute MI, the reader is referred to the ACCF/AHA guidelines for the management of patients with ST-elevation MI.3,4 and for patients with UA, the reader is referred to the “ACCF/AHA Guidelines for the Management of Patients With Unstable Angina/Non-ST-Elevation Myocardial Infarction.”5,5a There are, however, patients with UA who can be categorized as low risk and are addressed in this guideline (Table 2).

A key premise of this guideline is that once a diagnosis of IHD is established, it is necessary in most patients to assess their risk of subsequent complications, such as acute myocardial infarction or death. Because the approach to diagnosis of suspected IHD and the assessment of risk in a patient with known IHD are conceptually different and are based on different literature, these issues are addressed separately. A clinician might, however, select a procedure for a patient with a moderate to high pretest likelihood of IHD to provide information for both diagnosis and risk assessment, whereas in a patient with a low likelihood of IHD, it could be sensible to select a test simply for diagnostic purposes without regard to risk assessment. The purpose of this dichotomy is to promote the sensible application of appropriate testing rather than routine use of the most expensive or complex tests whether warranted or not.

Additionally, this guideline addresses the approach to asymptomatic patients with SIHD that has been diagnosed solely on the basis of an abnormal screening study, rather than on the basis of clinical symptoms or events such as anginal symptoms or ACS. Multiple ACCF/AHA guidelines and scientific statements have discouraged the use of ambulatory monitoring, treadmill testing, stress echocardiography, stress myocardial perfusion imaging (MPI), and computed tomography scoring of coronary calcium or coronary angiography as routine screening tests in asymptomatic individuals.

When patients with documented IHD develop recurrent chest pain, the symptoms still could be attributable to another condition. Such patients are included in this guideline if there

Figure 1. Spectrum of IHD. Guidelines relevant to the spectrum of IHD are in parentheses. CABG indicates coronary artery bypass graft; CV, cardiovascular; ECG, electrocardiogram; IHD, ischemic heart disease; PCI, percutaneous coronary intervention; SCD, sudden cardiac death; SIHD, stable ischemic heart disease; STEMI, ST-elevation myocardial infarction; UA, unstable angina; UA/NSTEMI, unstable angina/non-ST-elevation myocardial infarction; and VA, ventricular arrhythmia.
Table 2. Short-Term Risk of Death or Nonfatal MI in Patients With UA/NSTEMI

<table>
<thead>
<tr>
<th>Feature</th>
<th>High Risk</th>
<th>Intermediate Risk</th>
<th>Low Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At least 1 of the following features must be present:</td>
<td>No high-risk features are present, but patient must have 1 of the following:</td>
<td>No high- or intermediate-risk features are present, but patient may have any of the following:</td>
</tr>
<tr>
<td><strong>History</strong></td>
<td>Accelerating tempo of ischemic symptoms in preceding 48 h</td>
<td>Prior MI, peripheral or cerebrovascular disease, or CABG</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Characteristics of pain</strong></td>
<td>Prolonged ongoing (&gt;20 min) rest pain</td>
<td>Prolonged (&gt;20 min) rest angina, now resolved, with moderate or high likelihood of CAD</td>
<td>Increased angina frequency, severity, or duration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rest angina (&gt;20 min) or relieved with rest or sublingual NTG</td>
<td>Angina provoked at a lower threshold</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nocturnal angina</td>
<td>New-onset angina with onset 2 wk to 2 mo before presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New-onset or progressive CCS Class III or IV angina in previous 2 wk without prolonged (&gt;20 min) rest pain but with intermediate or high likelihood of CAD</td>
<td></td>
</tr>
<tr>
<td><strong>Clinical findings</strong></td>
<td>Pulmonary edema, most likely due to ischemia</td>
<td>S_{2} or new/worsening rales</td>
<td>Age &gt;70 y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypotension, bradycardia, or tachycardia</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age &gt;75 y</td>
<td></td>
</tr>
<tr>
<td><strong>ECG</strong></td>
<td>Angina at rest with transient ST-segment changes &gt;0.5 mm</td>
<td>T-wave changes</td>
<td>Normal or unchanged ECG</td>
</tr>
<tr>
<td></td>
<td>Bundle-branch block, new or presumed new</td>
<td>Pathological Q waves or resting ST-depression &lt;1 mm in multiple lead groups (anterior, inferior, lateral)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sus tained ventricular tachycardia</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cardiac markers</strong></td>
<td>Elevated cardiac TnT, TnI, or CK-MB (ie, TnT or TnI &gt;0.1 ng/mL)</td>
<td>Slightly elevated cardiac TnT, TnI, or CK-MB (ie, TnT &gt;0.01 but &lt;0.1 ng/mL)</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Estimation of the short-term risks of death and nonfatal cardiac ischemic events in UA or NSTEMI is a complex multivariable problem that cannot be fully specified in a table such as this. Therefore, the table is meant to offer general guidance and illustration rather than rigid algorithms.

CABG indicates coronary artery bypass graft; CAD, coronary artery disease; CCS, Canadian Cardiovascular Society; CK-MB, creatine kinase-MB fraction; ECG, electrocardiogram; MI, myocardial infarction; NTG, nitroglycerin; N/A, not available; TnI, troponin I; TnT, troponin T; and UA/NSTEMI, unstable angina/non–ST-elevation myocardial infarction.

Modified from Braunwald et al.7

is sufficient suspicion that their heart disease is a likely source of symptoms to warrant cardiac evaluation. Just as in the case of patients with new-onset chest pain, if the pain seems to be cardiac in origin, the clinician must determine whether such recurrent or worsening pain is consistent with ACS or simply represents symptoms more consistent with chronic stable angina that do not require emergent attention.

The approach to screening and management of asymptomatic patients who are at risk for IHD but who are not known to have IHD is beyond the scope of this guideline, but it is addressed in the “ACCF/AHA Guideline for Assessment of Cardiovascular Risk in Asymptomatic Adults.”6 Similarly, the present guideline does not apply to patients with chest pain symptoms early after revascularization, that is, within 6 months of revascularization.

1.5. General Approach and Overlap With Other Guidelines or Statements
This guideline overlaps with numerous clinical practice guidelines published by the ACCF/AHA Task Force on Practice Guidelines; the National Heart, Lung, and Blood Institute; and the ACP (Table 3). To maintain consistency, the writing committee worked with members of other committees to harmonize recommendations and eliminate discrepancies.

This document recommends a combination of lifestyle modifications and medications that constitute GDMT. Recommendations for risk reduction are consistent with the “AHA/ACC Secondary Prevention and Risk Reduction Therapy for Patients With Coronary and Other Vascular Disease: 2011 Update.”8 Recommendations related to revascularization are the result of collaboration discussions among several writing committees, including those addressing SIHD, PCI, CABG, and unstable angina/non–ST-elevation MI. To the fullest extent possible, these guidelines are consistent with the appropriate use criteria documents for imaging testing, diagnostic catheterization, and coronary revascularization that are also sponsored by the ACCF.9–14

1.6. Magnitude of the Problem
It is estimated that 1 in 3 adults in the United States (about 71 million) has some form of cardiovascular disease, including >13 million with CAD and nearly 9 million with angina pectoris.26,27 Among persons 60 to 79 years of age, approximately 23% of men and 15% of women have prevalent IHD,
and these figures rise to 33% and 22% among men and women ≥80 years of age, respectively.27

Although the survival rate of patients with IHD has been steadily improving,28 it was still responsible for nearly 380,000 deaths in the United States in 2010, with an age-adjusted mortality rate of 113 per 100,000 population.29 Although IHD is widely known to be the number 1 cause of death in men, this is also the case for women, among whom this condition accounts for 27% of deaths (compared with 22% due to cancer).30 IHD also accounts for the vast majority of the mortality and morbidity of cardiac disease. Each year, 1.5 million patients have an MI. Many more are hospitalized for UA and evaluation and treatment of stable chest pain syndromes. Patients who have had ACS, such as acute MI, remain at risk for recurrent events even if they have no, or limited, symptoms, and they should be considered to have SIHD.

In approximately 50% of patients, angina pectoris is the initial manifestation of IHD.27 The incidence of angina rises continuously with age in women, whereas the incidence of angina in men peaks between 55 and 65 years of age before declining.27 It has been estimated that there are 30 patients with stable angina for every patient hospitalized with infarction, and symptoms in many of these patients are poorly controlled.31–33 The direct and indirect costs of caring for patients with IHD are estimated to exceed $150 billion in the United States.

1.7. Organization of the Guideline

The overarching framework adopted in this guideline reflects the complementary goals of treating patients with known SIHD, alleviating or improving symptoms, and prolonging life. This guideline is divided into 4 basic sections summarizing the approaches to diagnosis, risk assessment, treatment, and follow-up summarized in 5 algorithms: diagnosis (Figure 2), risk assessment (Figure 3), GDMT (Figure 4), and revascularization (Figures 5 and 6). In clinical practice, steps delineated in the algorithms often overlap. An essential principle that transcends all recommendations in this guideline is that of informing and involving patients in all decisions that affect them, directly or indirectly, as summarized in the following recommendation:

### 1.8. Vital Importance of Involvement by an Informed Patient: Recommendation

**Class I**

1. Choices about diagnostic and therapeutic options should be made through a process of shared decision making involving the patient and provider, with the provider explaining information about risks, benefits, and costs to the patient. (*Level of Evidence: C*)

2. Diagnosis of SIHD: Recommendations

2.1. Clinical Evaluation of Patients With Chest Pain

2.1.1. Clinical Evaluation in the Initial Diagnosis of SIHD in Patients With Chest Pain

**Class I**

1. Patients with chest pain should receive a thorough history and physical examination to assess the probability of IHD before additional testing.34 (*Level of Evidence: C*)

2. Patients who present with acute angina should be categorized as stable or unstable; patients with UA should be further categorized as being at high, moderate, or low risk.5,5a (*Level of Evidence: C*)
Figure 2. Diagnosis of patients with suspected IHD. *"Colors correspond to the class of recommendations in the ACCF/AHA Table 1. The algorithms do not represent a comprehensive list of recommendations (see full guideline text for all recommendations). †See Table 2 for short-term risk of death or nonfatal MI in patients with UA/NSTEMI. ‡CCTA is reasonable only for patients with intermediate probability of IHD. CCTA indicates computed coronary tomography angiography; CMR, cardiac magnetic resonance; ECG, electrocardiogram; Echo, echocardiography; IHD, ischemic heart disease; MI, myocardial infarction; MPI, myocardial perfusion imaging; Pharm, pharmacological; UA, unstable angina; and UA/NSTEMI, unstable angina/non–ST-elevation myocardial infarction.
2.1.2. Electrocardiography

2.1.2.1. Resting Electrocardiography to Assess Risk

Class I

1. A resting ECG is recommended in patients without an obvious, noncardiac cause of chest pain.36–38 (Level of Evidence: B)

2.1.3. Stress Testing and Advanced Imaging for Initial Diagnosis in Patients With Suspected SIHD Who Require Noninvasive Testing

See Table 4 for a summary of recommendations from this section.

2.1.3.1. Able to Exercise

Class I

1. Standard exercise ECG testing is recommended for patients with an intermediate pretest probability of IHD who have an interpretable ECG and at least moderate physical functioning or no disabling comorbidity.39–42 (Level of Evidence: A)

2. Exercise stress with nuclear MPI or echocardiography is recommended for patients with an intermediate to high pretest probability of IHD who have an uninterpretable ECG and at least moderate physical functioning or no disabling comorbidity.43–53 (Level of Evidence: B)

Class IIa

1. For patients with a low pretest probability of obstructive IHD who do require testing, standard exercise ECG testing can be useful, provided the patient has an interpretable ECG and at least moderate physical functioning or no disabling comorbidity. (Level of Evidence: C)

2. Exercise stress with nuclear MPI or echocardiography is reasonable for patients with an intermediate to high pretest probability of obstructive IHD who have an interpretable ECG and at least moderate physical functioning or no disabling comorbidity.43–53 (Level of Evidence: B)

3. Pharmacological stress with CMR can be useful for patients with an intermediate to high pretest probability of obstructive IHD who have an uninterpretable ECG and at least moderate physical functioning or no disabling comorbidity.43–53 (Level of Evidence: B)
table ECG and at least moderate physical functioning or no disabling comorbidity.50,54,55 (Level of Evidence: B)

Class IIIb

1. CCTA might be reasonable for patients with an intermediate pretest probability of IHD who have at least moderate physical functioning or no disabling comorbidity.55–63 (Level of Evidence: B)

2. For patients with a low pretest probability of obstructive IHD who do require testing, standard exercise stress echocardiography might be reasonable, provided the patient has an interpretable ECG and at least moderate physical functioning or no disabling comorbidity. (Level of Evidence: C)

Class III: No Benefit

1. Pharmacological stress with nuclear MPI, echocardiography, or CMR is not recommended for patients who have an interpretable ECG and at least moderate physical functioning or no disabling comorbidity.52,64,65 (Level of Evidence: C)

2. Exercise stress with nuclear MPI is not recommended as an initial test in low-risk patients who have an interpretable ECG and at least moderate physical functioning or no disabling comorbidity. (Level of Evidence: C)

2.1.3.2. Unable to Exercise

Class I

1. Pharmacological stress with nuclear MPI or echocardiography is recommended for patients with an intermediate to high pretest probability of IHD who are incapable of at least moderate physical functioning or have disabling comorbidity.43,46,47,49–53 (Level of Evidence: B)

Class IIa

1. Pharmacological stress echocardiography is reasonable for patients with a low pretest probability of IHD who require testing and are incapable of at least moderate physical functioning or have disabling comorbidity. (Level of Evidence: C)

2. CCTA is reasonable for patients with a low to intermediate pretest probability of IHD who are incapable of at least moderate physical functioning or have disabling comorbidity.55–63 (Level of Evidence: B)

3. Pharmacological stress CMR is reasonable for patients with an intermediate to high pretest probability of IHD who are incapable of at least moderate physical functioning or have disabling comorbidity.50,54,55,66–69 (Level of Evidence: B)
Class III: No Benefit

1. Standard exercise ECG testing is not recommended for patients who have an uninterpretable ECG or are incapable of at least moderate physical functioning or have disabling comorbidity.43-53,58 (Level of Evidence: C)

2.1.3. Other

Class IIa

1. CCTA is reasonable for patients with an intermediate pretest probability of IHD who a) have continued symptoms with prior normal test findings, or b) have inconclusive results from prior exercise or pharmacological stress testing, or c) are unable to undergo stress with nuclear MPI or echocardiography.70 (Level of Evidence: C)

Class IIb

1. For patients with a low to intermediate pretest probability of obstructive IHD, noncontrast cardiac computed tomography to determine the coronary artery calcium score may be considered.71 (Level of Evidence: C)

Figure 5. Algorithm for revascularization to improve survival of patients with SIHD.* Colors correspond to the class of recommendations in the ACCF/AHA Table 1. The algorithms do not represent a comprehensive list of recommendations (see full guideline text for all recommendations).

3. Risk Assessment: Recommendations

3.1. Advanced Testing: Resting and Stress Noninvasive Testing

3.1.1. Resting Imaging to Assess Cardiac Structure and Function

Class I

1. Assessment of resting left ventricular (LV) systolic and diastolic ventricular function and evaluation for abnormalities of myocardium, heart valves, or pericardium are recommended with the use of Doppler echocardiography in patients with known or suspected IHD and a prior MI, pathological Q waves, symptoms or signs suggestive of heart failure, complex ventricular arrhythmias, or an undiagnosed heart murmur.17,36,37,72,73 (Level of Evidence: B)

Class IIb

1. Assessment of cardiac structure and function with resting echocardiography may be considered in patients with hypertension or diabetes mellitus and an abnormal ECG. (Level of Evidence: C)
2. Measurement of LV function with radionuclide imaging may be considered in patients with a prior MI or pathological Q waves, provided there is no need to evaluate symptoms or signs suggestive of heart failure, complex ventricular arrhythmias, or an undiagnosed heart murmur. *(Level of Evidence: C)*

Class III: No Benefit

1. Echocardiography, radionuclide imaging, CMR, and cardiac computed tomography are not recommended for routine assessment of LV function in patients with a normal ECG, no history of MI, no symptoms or signs suggestive of heart failure, and no complex ventricular arrhythmias. *(Level of Evidence: C)*

2. Routine reassessment (<1 year) of LV function with technologies such as echocardiography radionuclide imaging, CMR, or cardiac computed tomography is not recommended in patients with no change in clinical status and for whom no change in therapy is contemplated. *(Level of Evidence: C)*

3.1.2. Stress Testing and Advanced Imaging in Patients With Known SIHD Who Require Noninvasive Testing for Risk Assessment

See Table 5 for a summary of recommendations from this section.

Class I

1. Standard exercise ECG testing is recommended for risk assessment in patients with SIHD who are able to exercise to an adequate workload and have an interpretable ECG. *(Level of Evidence: B)*

2. The addition of either nuclear MPI or echocardiography to standard exercise ECG testing is recommended for risk assessment in patients with SIHD who are able to exercise to an adequate workload but have an uninterpretable ECG not due to left bundle-branch block or ventricular pacing. *(Level of Evidence: B)*
Table 4. Stress Testing and Advanced Imaging for Initial Diagnosis in Patients With Suspected SIHD Who Require Noninvasive Testing

<table>
<thead>
<tr>
<th>Test</th>
<th>Exercise Status</th>
<th>ECG Interpretable</th>
<th>Pretest Probability of IHD</th>
<th>COR</th>
<th>LOE</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise ECG</td>
<td>X</td>
<td>X</td>
<td>I</td>
<td>A</td>
<td></td>
<td>(39–42)</td>
</tr>
<tr>
<td>Exercise with nuclear MPI or Echo</td>
<td>X</td>
<td>X</td>
<td>I</td>
<td>A</td>
<td></td>
<td>(43–53)</td>
</tr>
<tr>
<td>Exercise ECG</td>
<td>X</td>
<td>X</td>
<td>IIa</td>
<td>B</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Exercise with nuclear MPI or Echo</td>
<td>X</td>
<td>X</td>
<td>IIa</td>
<td>B</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Pharmacological stress CMR</td>
<td>X</td>
<td>X</td>
<td>IIa</td>
<td>B</td>
<td></td>
<td>(50, 54, 55)</td>
</tr>
<tr>
<td>CCTA</td>
<td>X</td>
<td>Any</td>
<td>IIb</td>
<td>B</td>
<td></td>
<td>(55–63)</td>
</tr>
<tr>
<td>Exercise Echo</td>
<td>X</td>
<td>X</td>
<td>IIb</td>
<td>C</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Pharmacological stress with nuclear MPI, Echo, or CMR</td>
<td>X</td>
<td>X</td>
<td>III: No Benefit</td>
<td>C</td>
<td></td>
<td>(52, 64, 65)</td>
</tr>
<tr>
<td>Exercise stress with nuclear MPI</td>
<td>X</td>
<td>X</td>
<td>III: No Benefit</td>
<td>C</td>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>

Patients unable to exercise

<table>
<thead>
<tr>
<th>Test</th>
<th>Exercise Status</th>
<th>ECG Interpretable</th>
<th>Pretest Probability of IHD</th>
<th>COR</th>
<th>LOE</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacological stress with nuclear MPI or Echo</td>
<td>X</td>
<td>Any</td>
<td>I</td>
<td>B</td>
<td></td>
<td>(43, 46, 47, 49–53)</td>
</tr>
<tr>
<td>Pharmacological stress Echo</td>
<td>X</td>
<td>Any</td>
<td>IIa</td>
<td>C</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>CCTA</td>
<td>X</td>
<td>Any</td>
<td>IIa</td>
<td>B</td>
<td></td>
<td>(55–63)</td>
</tr>
<tr>
<td>Pharmacological stress CMR</td>
<td>X</td>
<td>Any</td>
<td>IIa</td>
<td>B</td>
<td></td>
<td>(50, 54, 55, 66–69)</td>
</tr>
<tr>
<td>Exercise ECG</td>
<td>X</td>
<td>Any</td>
<td>III: No Benefit</td>
<td>C</td>
<td></td>
<td>(43–53, 58)</td>
</tr>
</tbody>
</table>

Other

<table>
<thead>
<tr>
<th>Test</th>
<th>Exercise Status</th>
<th>ECG Interpretable</th>
<th>Pretest Probability of IHD</th>
<th>COR</th>
<th>LOE</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTA</td>
<td>Any</td>
<td>Any</td>
<td>IIa</td>
<td>C</td>
<td></td>
<td>(70)</td>
</tr>
<tr>
<td>CAC score</td>
<td>Any</td>
<td>Any</td>
<td>IIb</td>
<td>C</td>
<td></td>
<td>(71)</td>
</tr>
</tbody>
</table>

*Patients are candidates for exercise testing if they are capable of performing at least moderate physical functioning (ie, moderate household, yard, or recreational work and most activities of daily living) and have no disabling comorbidity. Patients should be able to achieve 85% of age-predicted maximum heart rate.

CAC indicates coronary artery calcium; CCTA, cardiac computed tomography angiography; CMR, cardiac magnetic resonance imaging; COR, class of recommendation; ECG, electrocardiogram; Echo, echocardiography; IHD, ischemic heart disease; LOE, level of evidence; MPI, myocardial perfusion imaging; N/A, not available; and SIHD, stable ischemic heart disease.

Class IIa

1. The addition of either nuclear MPI or echocardiography to standard exercise ECG testing is reasonable for risk assessment in patients with SIHD who are able to exercise to an adequate workload and have an interpretable ECG.88–97 (Level of Evidence: B)

2. CMR with pharmacological stress is reasonable for risk assessment in patients with SIHD who are able to exercise to an adequate workload but have an uninterpretable ECG.97–102 (Level of Evidence: B)

Class IIb

1. CCTA may be reasonable for risk assessment in patients with SIHD who are able to exercise to an adequate workload but have an uninterpretable ECG.103,104 (Level of Evidence: B)

Class III: No Benefit

1. Pharmacological stress imaging (nuclear MPI, echocardiography, or CMR) or CCTA is not recommended for risk assessment in patients with SIHD who are able to exercise to an adequate workload and have an interpretable ECG. (Level of Evidence: C)

3.1.2.2. Risk Assessment in Patients Unable to Exercise

Class I

1. Pharmacological stress with either nuclear MPI or echocardiography is recommended for risk assessment in patients with SIHD who are unable to exercise to an adequate workload regardless of interpretability of ECG.93–96,105–108 (Level of Evidence: B)
Table 5. Using Stress Testing and Advanced Imaging for Patients With Known SIHD Who Require Noninvasive Testing for Risk Assessment

<table>
<thead>
<tr>
<th>Test</th>
<th>Exercise Status</th>
<th>ECG Interpretable</th>
<th>COR</th>
<th>LOE</th>
<th>References</th>
<th>Additional Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients able to exercise*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise ECG</td>
<td>X</td>
<td>X</td>
<td>I</td>
<td>B</td>
<td>(41, 45, 74–82)</td>
<td></td>
</tr>
<tr>
<td>Exercise with nuclear MPI or Echo</td>
<td>X</td>
<td>X</td>
<td>I</td>
<td>B</td>
<td>(83–87, 117–119)</td>
<td>Abnormalities other than LBBB or ventricular pacing</td>
</tr>
<tr>
<td>Exercise with nuclear MPI or Echo</td>
<td>X</td>
<td>X</td>
<td>Ila</td>
<td>B</td>
<td>(88–97)</td>
<td></td>
</tr>
<tr>
<td>Pharmacological stress CMR</td>
<td>X</td>
<td>X</td>
<td>Ila</td>
<td>B</td>
<td>(97–102)</td>
<td></td>
</tr>
<tr>
<td>CCTA</td>
<td>X</td>
<td>X</td>
<td>Ila</td>
<td>B</td>
<td>(103, 104)</td>
<td></td>
</tr>
<tr>
<td>Pharmacological stress imaging</td>
<td>X</td>
<td>X</td>
<td>Ila</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(nuclear MPI, Echo, CMR) or CCTA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients unable to exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmacological stress with nuclear MPI or Echo</td>
<td>X</td>
<td>Any</td>
<td>I</td>
<td>B</td>
<td>(83–86, 105–108)</td>
<td></td>
</tr>
<tr>
<td>Pharmacological stress CMR</td>
<td>X</td>
<td>Any</td>
<td>Ila</td>
<td>B</td>
<td>(98–102, 109)</td>
<td></td>
</tr>
<tr>
<td>CCTA</td>
<td>X</td>
<td>Any</td>
<td>Ila</td>
<td>C</td>
<td>(104)</td>
<td></td>
</tr>
<tr>
<td>Regardless of patient’s ability to exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Echo or pharmacological stress with nuclear MPI, Echo, or CMR</td>
<td>Any</td>
<td>X</td>
<td>I</td>
<td>B</td>
<td>(105–108, 110)</td>
<td>LBBB present</td>
</tr>
<tr>
<td>Exercise/pharmacological stress with nuclear MPI, Echo, or CMR</td>
<td>Any</td>
<td>Any</td>
<td>I</td>
<td>B</td>
<td>(84, 96, 111, 112)</td>
<td>Known coronary stenosis of unclear physiological significance being considered for revascularization</td>
</tr>
<tr>
<td>CCTA</td>
<td>Any</td>
<td>Any</td>
<td>Ila</td>
<td>C</td>
<td>N/A</td>
<td>Indeterminate result from functional testing</td>
</tr>
<tr>
<td>CCTA</td>
<td>Any</td>
<td>Any</td>
<td>Ila</td>
<td>C</td>
<td>N/A</td>
<td>Unable to undergo stress imaging or as an alternative to coronary catheterization when functional testing indicates moderate to high risk and angiographic coronary anatomy is unknown</td>
</tr>
<tr>
<td>Requests to perform multiple cardiac imaging or stress studies at the same time</td>
<td>Any</td>
<td>Any</td>
<td>Ila</td>
<td>C</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

CCTA indicates cardiac computed tomography angiography; CMR, cardiac magnetic resonance imaging; COR, class of recommendation; ECG, electrocardiogram; Echo, echocardiography; LBBB, left bundle-branch block; LOE, level of evidence; MPI, myocardial perfusion imaging; and N/A, not available.

*Patients are candidates for exercise testing if they are capable of performing at least moderate physical functioning (ie, moderate household, yard, or recreational work and most activities of daily living) and have no disabling comorbidity. Patients should be able to achieve 85% of age-predicted maximum heart rate.

**Class IIa**

1. Pharmacological stress CMR is reasonable for risk assessment in patients with SIHD who are unable to exercise to an adequate workload regardless of interpretability of ECG.98–102,109 (Level of Evidence: B)

2. CCTA can be useful as a first-line test for risk assessment in patients with SIHD who are being considered for revascularization of known coronary stenosis of unclear physiological significance.84,96,111,112 (Level of Evidence: B)

**Class IIb**

1. CCTA might be considered for risk assessment in patients with SIHD unable to undergo stress imaging or as an alternative to invasive coronary...
Coronary angiography when functional testing indicates a moderate- to high-risk result and knowledge of angiographic coronary anatomy is unknown. (Level of Evidence: C)

Class III: No Benefit

1. A request to perform either a) more than 1 stress imaging study or b) a stress imaging study and a CCTA at the same time is not recommended for risk assessment in patients with SIHD. (Level of Evidence: C)

### 3.2. Coronary Angiography

#### 3.2.1. Coronary Angiography as an Initial Testing Strategy to Assess Risk

**Class I**

1. Patients with SIHD who have survived sudden cardiac death or potentially life-threatening ventricular arrhythmia should undergo coronary angiography to assess cardiac risk. (Level of Evidence: B)

2. Patients with SIHD who develop symptoms and signs of heart failure should be evaluated to determine whether coronary angiography should be performed for risk assessment. (Level of Evidence: B)

#### 3.2.2. Coronary Angiography to Assess Risk After Initial Workup With Noninvasive Testing

**Class I**

1. Coronary arteriography is recommended for patients with SIHD whose clinical characteristics and results of noninvasive testing indicate a high likelihood of severe IHD and when the benefits are deemed to exceed risk. (Level of Evidence: C)

**Class IIa**

1. Coronary angiography is reasonable to further assess risk in patients with SIHD who have depressed LV function (ejection fraction <50%) and moderate risk criteria on noninvasive testing with demonstrable ischemia. (Level of Evidence: C)

2. Coronary angiography is reasonable to further assess risk in patients with SIHD and inconclusive prognostic information after noninvasive testing or in patients for whom noninvasive testing is contraindicated or inadequate. (Level of Evidence: C)

3. Coronary angiography for risk assessment is reasonable for patients with SIHD who have unsatisfactory quality of life due to angina, have preserved LV function (ejection fraction >50%), and have intermediate risk criteria on noninvasive testing. (Level of Evidence: C)

**Class III: No Benefit**

1. Coronary angiography for risk assessment is not recommended in patients with SIHD who elect not to undergo revascularization or who are not candidates for revascularization because of comorbidities or individual preferences. (Level of Evidence: B)

2. Coronary angiography is not recommended to further assess risk in patients with SIHD who have preserved LV function (ejection fraction >50%) and low-risk criteria on noninvasive testing. (Level of Evidence: B)

3. Coronary angiography is not recommended to assess risk in patients who are at low risk according to clinical criteria and who have not undergone noninvasive risk testing. (Level of Evidence: C)

4. Coronary angiography is not recommended to assess risk in asymptomatic patients with no evidence of ischemia on noninvasive testing. (Level of Evidence: C)

### 4. Treatment: Recommendations

#### 4.1. Patient Education

**Class I**

1. Patients with SIHD should have an individualized education plan to optimize care and promote wellness, including:

   a. education on the importance of medication adherence for managing symptoms and retarding disease progression (Level of Evidence: C);

   b. an explanation of medication management and cardiovascular risk reduction strategies in a manner that respects the patient’s level of understanding, reading comprehension, and ethnicity (Level of Evidence: B);

   c. a comprehensive review of all therapeutic options (Level of Evidence: B);

   d. a description of appropriate levels of exercise, with encouragement to maintain recommended levels of daily physical activity (Level of Evidence: C);

   e. introduction to self-monitoring skills (Level of Evidence: C); and

   f. information on how to recognize worsening cardiovascular symptoms and take appropriate action. (Level of Evidence: C)

2. Patients with SIHD should be educated about the following lifestyle elements that could influence prognosis: weight control, maintenance of a body mass index of 18.5 to 24.9 kg/m², and maintenance of a waist circumference less than 102 cm (40 inches) in men and less than 88 cm (35 inches) in women (less for certain racial groups); blood pressure control; smoking cessation and avoidance of exposure to secondhand smoke; lipid management; and individualized medical, nutrition, and lifestyle changes for patients with diabetes mellitus to supplement diabetes treatment goals and education. (Level of Evidence: C)

**Class IIa**

1. It is reasonable to educate patients with SIHD about

   a. adherence to a diet that is low in saturated fat, cholesterol, and trans fat; high in fresh fruits, whole grains, and vegetables; and reduced in sodium intake, with cultural and ethnic preferences incorporated (Level of Evidence: B);

   b. common symptoms of stress and depression to minimize stress-related angina symptoms (Level of Evidence: C);
c. comprehensive behavioral approaches for the management of stress and depression (Level of Evidence: C); and

d. evaluation and treatment of major depressive disorder when indicated (Level of Evidence: B).

4.2. Guideline-Directed Medical Therapy

4.2.1. Risk Factor Modification

4.2.1.1. Lipid Management

Class I

1. Lifestyle modifications, including daily physical activity and weight management, are strongly recommended for all patients with SIHD (Level of Evidence: B).

2. Dietary therapy for all patients should include reduced intake of saturated fats (to <7% of total calories), trans fatty acids (to <1% of total calories), and cholesterol (to <200 mg/dl) (Level of Evidence: B).

3. In addition to therapeutic lifestyle changes, a moderate or high dose of a statin therapy should be prescribed, in the absence of contraindications or documented adverse effects (Level of Evidence: A).

Class IIa

1. For patients who do not tolerate statins, low-density lipoprotein-cholesterol-lowering therapy with bile acid sequestrants, niacin, or both is recommended (Level of Evidence: B).

4.2.1.2. Blood Pressure Management

Class I

1. All patients should be counseled about the need for lifestyle modification: weight control; increased physical activity; alcohol moderation; sodium reduction; and emphasis on increased consumption of fresh fruits, vegetables, and low-fat dairy products (Level of Evidence: B).

2. In patients with SIHD with blood pressure 140/90 mm Hg or higher, antihypertensive drug therapy should be instituted in addition to or after a trial of lifestyle modifications (Level of Evidence: A).

3. The specific medications used for treatment of high blood pressure should be based on specific patient characteristics and may include angiotensin-converting enzyme (ACE) inhibitors and/or beta blockers, with addition of other drugs, such as thiazide diuretics or calcium channel blockers, if needed to achieve a goal blood pressure of less than 140/90 mm Hg (Level of Evidence: B).

4.2.1.3. Diabetes Management

Class IIa

1. For selected individual patients, such as those with a short duration of diabetes mellitus and a long life expectancy, a goal hemoglobin A1c of 7% or less is reasonable (Level of Evidence: B).

2. A goal hemoglobin A1c between 7% and 9% is reasonable for certain patients according to age, history of hypoglycemia, presence of microvascular or macrovascular complications, or presence of coexisting medical conditions (Level of Evidence: C).

Class IIb

1. Initiation of pharmacotherapy interventions to achieve target hemoglobin A1c might be reasonable (Level of Evidence: A).

Class III: Harm

1. Therapy with rosiglitazone should not be initiated in patients with SIHD (Level of Evidence: C).

4.2.1.4. Physical Activity

Class I

1. For all patients, the clinician should encourage 30 to 60 minutes of moderate-intensity aerobic activity, such as brisk walking, at least 5 days and preferably 7 days per week, supplemented by an increase in daily lifestyle activities (eg, walking breaks at work, gardening, household work) to improve cardiorespiratory fitness and move patients out of the least-fit, inactive, high-risk cohort (bottom 20%) (Level of Evidence: B).

2. For all patients, risk assessment with a physical activity history and/or an exercise test is recommended to guide prognosis and prescription (Level of Evidence: B).

3. Medically supervised programs (cardiac rehabilitation) and physician-directed, home-based programs are recommended for at-risk patients at first diagnosis (Level of Evidence: A).

Class IIa

1. It is reasonable for the clinician to recommend complementary resistance training at least 2 days per week (Level of Evidence: C).

4.2.1.5. Weight Management

Class I

1. Body mass index and/or waist circumference should be assessed at every visit, and the clinician should consistently encourage weight maintenance or reduction through an appropriate balance of lifestyle physical activity, structured exercise, caloric intake, and formal behavioral programs when indicated to maintain or achieve a body mass index between 18.5 and 24.9 kg/m² and a waist circumference less than 90 cm (Level of Evidence: B).
102 cm (40 inches) in men and less than 88 cm (35 inches) in women (less for certain racial groups).154,233–241 (Level of Evidence: B)

2. The initial goal of weight loss therapy should be to reduce body weight by approximately 5% to 10% from baseline. With success, further weight loss can be attempted if indicated. (Level of Evidence: C)

4.2.1.6. Smoking Cessation Counseling

Class I

1. Smoking cessation and avoidance of exposure to environmental tobacco smoke at work and home should be encouraged for all patients with SIHD. Follow-up, referral to special programs, and pharmacotherapy are recommended, as is a stepwise strategy for smoking cessation (Ask, Advise, Assess, Assist, Arrange, Avoid).242–244 (Level of Evidence: B)

4.2.1.7. Management of Psychological Factors

Class IIa

1. It is reasonable to consider screening SIHD patients for depression and to refer or treat when indicated.162,165,169,245–248 (Level of Evidence: B)

Class IIb

1. Treatment of depression has not been shown to improve cardiovascular disease outcomes but might be reasonable for its other clinical benefits.165,173,249 (Level of Evidence: C)

4.2.1.8. Alcohol Consumption

Class IIb

1. In patients with SIHD who use alcohol, it might be reasonable for nonpregnant women to have 1 drink (4 ounces of wine, 12 ounces of beer, or 1 ounce of spirits) a day and for men to have 1 or 2 drinks a day, unless alcohol is contraindicated (such as in patients with a history of alcohol abuse or dependence or with liver disease).250–252 (Level of Evidence: C)

4.2.1.9. Avoiding Exposure to Air Pollution

Class IIa

1. It is reasonable for patients with SIHD to avoid exposure to increased air pollution to reduce the risk of cardiovascular events.253–256 (Level of Evidence: C)

4.2.2. Additional Medical Therapy to Prevent MI and Death

4.2.2.1. Antiplatelet Therapy

Class I

1. Treatment with aspirin 75 to 162 mg daily should be continued indefinitely in the absence of contraindications in patients with SIHD.257,258 (Level of Evidence: A)

2. Treatment with clopidogrel is reasonable when aspirin is contraindicated in patients with SIHD.259 (Level of Evidence: B)

Class IIb

1. Treatment with aspirin 75 to 162 mg daily and clopidogrel 75 mg daily might be reasonable in certain high-risk patients with SIHD.260 (Level of Evidence: B)

Class III: No Benefit

1. Dipyridamole is not recommended as antiplatelet therapy for patients with SIHD.261–263 (Level of Evidence: B)

4.2.2.2. Beta-Blocker Therapy

Class I

1. Beta-blocker therapy should be started and continued for 3 years in all patients with normal LV function after MI or ACS.264–266 (Level of Evidence: B)

2. Beta-blocker therapy should be used in all patients with LV systolic dysfunction (ejection fraction ≤40%) with heart failure or prior MI, unless contraindicated. (Use should be limited to carvedilol, metoprolol succinate, or bisoprolol, which have been shown to reduce risk of death.)267–271 (Level of Evidence: A)

Class IIb

1. Beta blockers may be considered as chronic therapy for all other patients with coronary or other vascular disease. (Level of Evidence: C)

4.2.2.3. Renin-Angiotensin-Aldosterone Blocker Therapy

Class I

1. ACE inhibitors should be prescribed in all patients with SIHD who also have hypertension, diabetes mellitus, LV ejection fraction 40% or less, or chronic kidney disease, unless contraindicated.113–116,120 (Level of Evidence: A)

2. Angiotensin-receptor blockers are recommended for patients with SIHD who have hypertension, diabetes mellitus, LV systolic dysfunction, or chronic kidney disease and have indications for, but are intolerant of, ACE inhibitors.272–274 (Level of Evidence: A)

Class IIa

1. Treatment with an ACE inhibitor is reasonable in patients with both SIHD and other vascular disease.275,276 (Level of Evidence: B)

2. It is reasonable to use angiotensin-receptor blockers in other patients who are ACE inhibitor intolerant.277 (Level of Evidence: C)

4.2.2.4. Influenza Vaccination

Class I

1. An annual influenza vaccine is recommended for patients with SIHD.278–282 (Level of Evidence: B)
4.2.2.5. Additional Therapy to Reduce Risk of MI and Death

Class III: No Benefit

1. Estrogen therapy is not recommended in postmenopausal women with SIHD with the intent of reducing cardiovascular risk or improving clinical outcomes.283–286 (Level of Evidence: A)
2. Vitamin C, vitamin E, and beta-carotene supplementation are not recommended with the intent of reducing cardiovascular risk or improving clinical outcomes in patients with SIHD.181,287–291 (Level of Evidence: A)
3. Treatment of elevated homocysteine with folate or vitamins B6 and B12 is not recommended with the intent of reducing cardiovascular risk or improving clinical outcomes in patients with SIHD.292–295 (Level of Evidence: A)
4. Chelation therapy is not recommended with the intent of improving symptoms or reducing cardiovascular risk in patients with SIHD.296–299 (Level of Evidence: C)
5. Treatment with garlic, coenzyme Q10, selenium, or chromium is not recommended with the intent of reducing cardiovascular risk or improving clinical outcomes in patients with SIHD. (Level of Evidence: C)

4.2.3. Medical Therapy for Relief of Symptoms

4.2.3.1. Use of Anti-Ischemic Medications

Class I

1. Beta blockers should be prescribed as initial therapy for relief of symptoms in patients with SIHD.264,300,301 (Level of Evidence: B)
2. Calcium channel blockers or long-acting nitrates should be prescribed for relief of symptoms when beta blockers are contraindicated or cause unacceptable side effects in patients with SIHD.302–304 (Level of Evidence: B)
3. Calcium channel blockers or long-acting nitrates, in combination with beta blockers, should be prescribed for relief of symptoms when initial treatment with beta blockers is unsuccessful in patients with SIHD.304 (Level of Evidence: B)
4. Sublingual nitroglycerin or nitroglycerin spray is recommended for immediate relief of angina in patients with SIHD.305–307 (Level of Evidence: B)

Class IIa

1. Treatment with a long-acting nondihydropyridine calcium channel blocker (verapamil or diltiazem) instead of a beta blocker as initial therapy for relief of symptoms is reasonable in patients with SIHD.304 (Level of Evidence: B)
2. Ranolazine can be useful when prescribed as a substitute for beta blockers for relief of symptoms in patients with SIHD if initial treatment with beta blockers leads to unacceptable side effects or is ineffective or if initial treatment with beta blockers is contraindicated.309 (Level of Evidence: B)
3. Ranolazine in combination with beta blockers can be useful when prescribed for relief of symptoms when initial treatment with beta blockers is not successful in patients with SIHD.309,310 (Level of Evidence: A)

4.2.4. Alternative Therapies for Relief of Symptoms in Patients With Refractory Angina

Class IIb

1. Enhanced external counterpulsation may be considered for relief of refractory angina in patients with SIHD.311 (Level of Evidence: B)
2. Spinal cord stimulation may be considered for relief of refractory angina in patients with SIHD.312,313 (Level of Evidence: C)
3. Transmyocardial revascularization may be considered for relief of refractory angina in patients with SIHD.314–316 (Level of Evidence: B)

Class III: No Benefit

1. Acupuncture should not be used for the purpose of improving symptoms or reducing cardiovascular risk in patients with SIHD.317,318 (Level of Evidence: C)

5. CAD Revascularization: Recommendations

Table 6 and Table 7 provide summaries of recommendations from this section.

5.1. Heart Team Approach to Revascularization Decisions

Class I

1. A Heart Team approach to revascularization is recommended in patients with unprotected left main or complex CAD.319–321 (Level of Evidence: C)

Class IIa

1. Calculation of the STS and SYNTAX scores is reasonable in patients with unprotected left main and complex CAD.321–327 (Level of Evidence: B)

5.2. Revascularization to Improve Survival

Left Main CAD Revascularization

Class I

1. CABG to improve survival is recommended for patients with significant (≥50% diameter stenosis) left main coronary artery stenosis.328–334 (Level of Evidence: B)

Class IIa

1. PCI to improve survival is reasonable as an alternative to CABG in selected stable patients with significant (≥50% diameter stenosis) unprotected left main CAD with: 1) anatomic conditions associated with a low risk of PCI procedural complications and a high likelihood of good long-term outcome (eg, a low SYNTAX score [≤22], ostial or trunk left main CAD); and 2) clinical characteristics that predict a significantly increased risk of adverse surgical outcomes (eg, STS-predicted risk of operative mortality ≥5%).322,324,325,335–353 (Level of Evidence: B)
### Table 6. Revascularization to Improve Survival Compared With Medical Therapy

<table>
<thead>
<tr>
<th>Anatomic Setting</th>
<th>COR</th>
<th>LOE</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UPLM or complex CAD</strong></td>
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<tr>
<td>CABG and PCI</td>
<td>I</td>
<td>C</td>
<td>(319–321)</td>
</tr>
<tr>
<td>CABG and PCI</td>
<td>I–a</td>
<td>B</td>
<td>(321–327)</td>
</tr>
<tr>
<td><strong>UPLM</strong>*</td>
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<tr>
<td>CABG</td>
<td>I</td>
<td>B</td>
<td>(328–334)</td>
</tr>
<tr>
<td>PCI</td>
<td>I–a</td>
<td>B</td>
<td>(322, 324, 325, 335–353)</td>
</tr>
<tr>
<td><strong>IIa—</strong> For SIHD when both of the following are present:</td>
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<tr>
<td>● Anatomic conditions associated with a low risk of PCI procedural complications and a high likelihood of good long-term outcome (eg, a low SYNTAX score of (&lt;22), ostial or trunk left main CAD)</td>
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<tr>
<td>● Clinical characteristics that predict a significantly increased risk of adverse surgical outcomes (eg, STS-predicted risk of operative mortality (&gt;5%))</td>
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<tr>
<td><strong>IIa—</strong> For UA/STEMI if not a CABG candidate</td>
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<tr>
<td><strong>IIa—</strong> For STEMI when distal coronary flow is TIMI flow grade (&lt;3) and PCI can be performed more rapidly and safely than CABG</td>
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<tr>
<td><strong>IIb—</strong> For SIHD when both of the following are present:</td>
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<tr>
<td>● Anatomic conditions associated with a low to intermediate risk of PCI procedural complications and an intermediate to high likelihood of good long-term outcome (eg, low-intermediate SYNTAX score of (&lt;33), bifurcation left main CAD)</td>
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<tr>
<td>● Clinical characteristics that predict an increased risk of adverse surgical outcomes (eg, moderate—severe COPD, disability from prior stroke, or prior cardiac surgery; STS-predicted operative mortality (&gt;2%))</td>
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<tr>
<td><strong>IIb—</strong> For SIHD in patients (versus performing CABG) with unfavorable anatomy for PCI and who are good candidates for CABG</td>
<td></td>
<td></td>
<td>(222, 324, 325, 328–336)</td>
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<tr>
<td><strong>III: Harm</strong></td>
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<tr>
<td><strong>For SIHD in patients (versus performing CABG) with unfavorable anatomy for PCI and who are good candidates for CABG</strong></td>
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<tr>
<td><strong>3-vessel disease with or without proximal LAD artery disease</strong></td>
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<tr>
<td>CABG</td>
<td>I</td>
<td>B</td>
<td>(125, 330, 334, 358–360)</td>
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<tr>
<td>PCI</td>
<td>I–a</td>
<td>B</td>
<td>(125, 330, 334, 358–360)</td>
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<tr>
<td><strong>IIb—</strong> Of uncertain benefit</td>
<td></td>
<td></td>
<td>(363–366)</td>
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<tr>
<td><strong>2-vessel disease with proximal LAD artery disease</strong></td>
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<tr>
<td>CABG</td>
<td>I</td>
<td>B</td>
<td>(125, 330, 334, 358–360)</td>
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<tr>
<td>PCI</td>
<td>I–a</td>
<td>B</td>
<td>(125, 330, 334, 358–360)</td>
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<tr>
<td><strong>IIb—</strong> Of uncertain benefit</td>
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<td></td>
<td>(363–366)</td>
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<tr>
<td><strong>2-vessel disease without proximal LAD artery disease</strong></td>
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<tr>
<td>CABG</td>
<td>I–a</td>
<td>B</td>
<td>(125, 330, 334, 358–360)</td>
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<tr>
<td><strong>IIb—</strong> Of uncertain benefit</td>
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<td>(363–366)</td>
</tr>
<tr>
<td><strong>PCI</strong></td>
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<tr>
<td><strong>1-vessel proximal LAD artery disease</strong></td>
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<tr>
<td>CABG</td>
<td>I–a</td>
<td>B</td>
<td>(140, 330, 358, 360)</td>
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<tr>
<td><strong>IIb—</strong> Of uncertain benefit</td>
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<td>(140, 330, 358, 360)</td>
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<tr>
<td><strong>1-vessel disease without proximal LAD artery involvement</strong></td>
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<tr>
<td>CABG</td>
<td>I–a</td>
<td>B</td>
<td>(140, 330, 358, 360)</td>
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<tr>
<td><strong>IIb—</strong> Of uncertain benefit</td>
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<td>(140, 330, 358, 360)</td>
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<tr>
<td><strong>LV dysfunction</strong></td>
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<tr>
<td>CABG</td>
<td>I–a</td>
<td>B</td>
<td>(141, 334, 358, 363, 364, 369–372)</td>
</tr>
<tr>
<td><strong>IIb—</strong> Of uncertain benefit</td>
<td></td>
<td></td>
<td>(141, 334, 358, 363, 364, 369–372)</td>
</tr>
<tr>
<td>PCI</td>
<td>I–a</td>
<td>B</td>
<td>(141, 334, 373–376)</td>
</tr>
<tr>
<td><strong>IIb—</strong> Of uncertain benefit</td>
<td></td>
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<td>(127, 139, 334, 373–377)</td>
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<tr>
<td>Insufficient data</td>
<td></td>
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<td>N/A</td>
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(Continued)
Table 6. Continued

<table>
<thead>
<tr>
<th>Anatomic Setting</th>
<th>COR</th>
<th>LOE</th>
<th>References</th>
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<tbody>
<tr>
<td>Survivors of sudden cardiac death with presumed ischemia-mediated VT</td>
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<tr>
<td>CABG</td>
<td>I</td>
<td>B</td>
<td>(122, 378, 379)</td>
</tr>
<tr>
<td>PCI</td>
<td>I</td>
<td>C</td>
<td>(378)</td>
</tr>
</tbody>
</table>

No anatomic or physiological criteria for revascularization

| CABG | II: Harm | B | (141, 334, 358, 363, 364, 369–372) |
| PCI | II: Harm | B | (141, 334, 358, 363, 364, 369–372) |

*In patients with multivessel disease who also have diabetes mellitus, it is reasonable to choose CABG (with LIMA) over PCI. CABG indicates coronary artery bypass graft; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; COR, class of recommendation; EF, ejection fraction; LAD, left anterior descending; LIMA, left internal mammary artery; LOE, level of evidence; LV, left ventricular; N/A, not available; PCI, percutaneous coronary intervention; SIHD, stable ischemic heart disease; STEMI, ST-elevation myocardial infarction; STS, Society of Thoracic Surgeons; SYNTAX, Synergy between Percutaneous Coronary Intervention with TAXUS and Cardiac Surgery; TIMI, Thrombolysis In Myocardial Infarction; UA/NSTEMI, unstable angina/non–ST-elevation myocardial infarction; UPLM, unprotected left main disease; and VT, ventricular tachycardia.

2. PCI to improve survival is reasonable in patients with unstable angina/non–ST-elevation MI when an unprotected left main coronary artery is the culprit lesion and the patient is not a candidate for CABG. \( \text{Level of Evidence: B} \)

3. PCI to improve survival is reasonable in patients with acute ST-elevation MI when an unprotected left main coronary artery is the culprit lesion, distal coronary flow is less than TIMI (Thrombolysis In Myocardial Infarction) grade 3, and PCI can be performed more rapidly and safely than CABG. \( \text{Level of Evidence: C} \)

Class IIb

1. PCI to improve survival may be reasonable as an alternative to CABG in selected stable patients with significant (≥50% diameter stenosis) unprotected left main CAD with: a) anatomic conditions associated with a low to intermediate risk of PCI procedural complications and an intermediate to high likelihood of good long-term outcome (eg, low-intermediate SYNTAX score of <33, bifurcation left main CAD); and b) clinical characteristics that predict an increased risk of adverse surgical outcomes (eg, moderate-severe chronic obstructive pulmonary disease, disability from previous stroke, or previous cardiac surgery; STS-predicted risk of operative mortality >2%); \( \text{Level of Evidence: B} \)

Class III: Harm

1. PCI to improve survival should not be performed in stable patients with significant (≥50% diameter stenosis) unprotected left main CAD who have unfavorable anatomy for PCI and who are good candidates for CABG. \( \text{Level of Evidence: B} \)

Non-Left Main CAD Revascularization

Class I

1. CABG to improve survival is beneficial in patients with significant (≥70% diameter) stenoses in 3 major coronary arteries (with or without involvement of the proximal LAD artery) or in the proximal LAD artery plus 1 other major coronary artery. \( \text{Level of Evidence: B} \)

2. CABG or PCI to improve survival is beneficial in survivors of sudden cardiac death with presumed ischemia-mediated ventricular tachycardia caused by significant (≥70% diameter) stenosis in a major coronary artery. \( \text{Level of Evidence: C} \)

Class IIa

1. CABG to improve survival is reasonable in patients with significant (≥70% diameter) stenoses in 2 major coronary arteries with severe or extensive myocardial ischemia (eg, high-risk criteria on stress testing, abnormal intracoronary hemodynamic evaluation, or >20% perfusion defect by myocardial perfusion stress imaging) or target vessels supplying a large area of viable myocardium. \( \text{Level of Evidence: B} \)

2. CABG to improve survival is reasonable in patients with mild-moderate LV systolic dysfunction (ejection fraction 35% to 50%) and significant (≥70% diameter stenosis) multivessel CAD or proximal LAD coronary artery stenosis, when viable myocardium is present in the region of intended revascularization. \( \text{Level of Evidence: B} \)

3. CABG with a left internal mammary artery graft to improve survival is reasonable in patients with significant (≥70% diameter) stenosis in the proximal LAD artery and evidence of extensive ischemia. \( \text{Level of Evidence: B} \)

4. It is reasonable to choose CABG over PCI to improve survival in patients with complex 3-vessel CAD (eg, SYNTAX score >22), with or without involvement of the proximal LAD artery who are good candidates for CABG. \( \text{Level of Evidence: B} \)

5. CABG is probably recommended in preference to PCI to improve survival in patients with multivessel CAD and diabetes mellitus, particularly if a left
internal mammary artery graft can be anastomosed to the LAD artery.365,380,381–386 (Level of Evidence: B)

Class IIb

1. The usefulness of CABG to improve survival is uncertain in patients with significant (≥70%) diameter stenoses in 2 major coronary arteries not involving the proximal LAD artery and without extensive ischemia.360 (Level of Evidence: C)

2. The usefulness of PCI to improve survival is uncertain in patients with 2- or 3-vessel CAD (with or without involvement of the proximal LAD artery) or 1-vessel proximal LAD disease.140,330,358,360 (Level of Evidence: B)

3. CABG might be considered with the primary or sole intent of improving survival in patients with SIHD with severe LV systolic dysfunction (ejection fraction <35%) whether or not viable myocardium is present.127,139,334,373–377 (Level of Evidence: B)

4. The usefulness of CABG or PCI to improve survival is uncertain in patients with previous CABG and extensive anterior wall ischemia on noninvasive testing.397–401,408–411 (Level of Evidence: B)

Class III: Harm

1. CABG or PCI should not be performed with the primary or sole intent to improve survival in patients with SIHD with 1 or more coronary stenoses that are not anatomically or functionally significant (eg, <70% diameter non–left main coronary artery stenosis, fractional flow reserve >0.80, no or only mild ischemia on noninvasive testing), involve only the left circumflex or right coronary artery, or subtend only a small area of viable myocardium.141,334,358,363,364,369–372 (Level of Evidence: B)

5.3. Revascularization to Improve Symptoms

Class I

1. CABG or PCI to improve symptoms is beneficial in patients with 1 or more significant (≥70% diameter) coronary artery stenoses amenable to revascularization and unacceptable angina despite GDMT.140,387–393,395,396,412 (Level of Evidence: A)

Class IIa

1. CABG or PCI to improve symptoms is reasonable in patients with 1 or more significant (≥70% diameter) coronary artery stenoses and unacceptable angina for whom GDMT cannot be implemented because of medication contraindications, adverse effects, or patient preferences. (Level of Evidence: C)

2. PCI to improve symptoms is reasonable in patients with previous CABG, 1 or more significant (≥70% diameter) coronary artery stenoses associated with ischemia, and unacceptable angina despite GDMT.397,399,400 (Level of Evidence: C)

3. It is reasonable to choose CABG over PCI to improve symptoms in patients with complex 3-vessel CAD (eg, SYNTAX score >22), with or without involvement of the proximal LAD artery, who are good candidates for CABG.363,365,366–368 (Level of Evidence: B)

Class IIb

1. CABG to improve symptoms might be reasonable for patients with previous CABG, 1 or more significant (≥70% diameter) coronary artery stenoses not amenable to PCI, and unacceptable angina despite GDMT.401 (Level of Evidence: C)

2. Transmyocardial revascularization performed as an adjunct to CABG to improve symptoms may be reasonable in patients with viable ischemic myocar-
dium that is perfused by arteries that are not amenable to grafting. Level of Evidence: B

Class III: Harm

1. CABG or PCI to improve symptoms should not be performed in patients who do not meet anatomic (≥50% diameter left main or ≥70% non–left main stenosis diameter) or physiological (eg, abnormal fractional flow reserve) criteria for revascularization. Level of Evidence: C

5.4. Dual Antiplatelet Therapy Compliance and Stent Thrombosis

Class III: Harm

1. PCI with coronary stenting (bare-metal stent or drug-eluting stent) should not be performed if the patient is not likely to be able to tolerate and comply with dual antiplatelet therapy for the appropriate duration of treatment based on the type of stent implanted. Level of Evidence: B

5.5. Hybrid Coronary Revascularization

Class IIa

1. Hybrid coronary revascularization (defined as the planned combination of left internal mammary artery-to-LAD artery grafting and PCI of ≥1 non-LAD coronary arteries) is reasonable in patients with 1 or more of the following: Level of Evidence: B

   a. Limitations to traditional CABG, such as heavily calcified proximal aorta or poor target vessels for CABG (but amenable to PCI);
   b. Lack of suitable graft conduits;
   c. Unfavorable LAD artery for PCI (ie, excessive vessel tortuosity or chronic total occlusion).

Class IIb

1. Hybrid coronary revascularization (defined as the planned combination of left internal mammary artery-to-LAD artery grafting and PCI of ≥1 non-LAD coronary arteries) may be reasonable as an alternative to multivessel PCI or CABG in an attempt to improve the overall risk-benefit ratio of the procedures. Level of Evidence: C

6. Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy: Recommendations

6.1. Clinical Evaluation, Echocardiography During Routine, Periodic Follow-Up

Class I

1. Patients with SIHD should receive periodic follow-up, at least annually, that includes all of the following: Level of Evidence: C

   a. Assessment of symptoms and clinical function;
   b. Surveillance for complications of SIHD, including heart failure and arrhythmias;

c. Monitoring of cardiac risk factors; and

d. Assessment of the adequacy of and adherence to recommended lifestyle changes and medical therapy.

2. Assessment of LV ejection fraction and segmental wall motion by echocardiography or radionuclide imaging is recommended in patients with new or worsening heart failure or evidence of intervening MI by history or ECG. Level of Evidence: C

Class IIb

1. Periodic screening for important comorbidities that are prevalent in patients with SIHD, including diabetes mellitus, depression, and chronic kidney disease might be reasonable. Level of Evidence: C

2. A resting 12-lead ECG at 1-year or longer intervals between studies in patients with stable symptoms might be reasonable. Level of Evidence: C

Class III: No Benefit

1. Measurement of LV function with a technology such as echocardiography or radionuclide imaging is not recommended for routine periodic reassessment of patients who have not had a change in clinical status or who are at low risk of adverse cardiovascular events. Level of Evidence: C

6.2. Noninvasive Testing in Known SIHD

6.2.1. Follow-Up Noninvasive Testing in Patients With Known SIHD: New, Recurrent, or Worsening Symptoms Not Consistent With Unstable Angina

See Table 8 for a summary of recommendations from this section.

6.2.1.1. Patients Able to Exercise

Class I

1. Standard exercise ECG testing is recommended in patients with known SIHD who have new or worsening symptoms not consistent with UA and who have a) at least moderate physical functioning and no disabling comorbidity and b) an interpretable ECG. Level of Evidence: B

2. Exercise with nuclear MPI or echocardiography is recommended in patients with known SIHD who have new or worsening symptoms not consistent with UA and who have a) at least moderate physical functioning or no disabling comorbidity but b) an uninterpretable ECG. Level of Evidence: B

Class IIa

1. Exercise with nuclear MPI or echocardiography is reasonable in patients with known SIHD who have new or worsening symptoms not consistent with UA and who have a) at least moderate physical functioning and no disabling comorbidity, b) previously
required imaging with exercise stress, or c) known multivessel disease or high risk for multivessel disease.\textsuperscript{436,437} (Level of Evidence: B)

Class III: No Benefit

1. Pharmacological stress imaging with CMR is reasonable in patients with known SIHD who have new or worsening symptoms not consistent with UA and who are incapable of at least moderate physical functioning or have disabling comorbidity.\textsuperscript{98,99,101} (Level of Evidence: B)

Class IIa

1. Pharmacological stress imaging with CMR is reasonable in patients with known SIHD who have new or worsening symptoms not consistent with UA and who are incapable of at least moderate physical functioning or have disabling comorbidity.\textsuperscript{98,99,101} (Level of Evidence: B)

Class III: No Benefit

1. Standard exercise ECG testing should not be performed in patients with known SIHD who have new or worsening symptoms not consistent with UA and who a) are incapable of at least moderate physical functioning or have disabling comorbidity or b) have an uninterpretable ECG. (Level of Evidence: C)

Class IIb

1. CCTA for assessment of patency of CABG or of coronary stents 3 mm or larger in diameter might be

---

### Table 8. Follow-Up Noninvasive Testing in Patients With Known SIHD: New, Recurrent, or Worsening Symptoms Not Consistent With UA

<table>
<thead>
<tr>
<th>Test</th>
<th>Exercise Status</th>
<th>ECG Interpretable</th>
<th>COR</th>
<th>LOE</th>
<th>References</th>
<th>Additional Considerations</th>
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<td>Patients able to exercise*</td>
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<td>X</td>
<td>X</td>
<td>I</td>
<td>B</td>
<td>(39–42)</td>
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<td>Exercise with nuclear MPI or Echo</td>
<td>X</td>
<td>X</td>
<td>I</td>
<td>B</td>
<td>(69, 95, 96, 102, 141, 364, 426–435)</td>
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<tr>
<td>Exercise with nuclear MPI or Echo</td>
<td>X</td>
<td>Any</td>
<td>Ila</td>
<td>B</td>
<td>(436, 437)</td>
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<tr>
<td>Pharmacological stress nuclear MPI/Echo/CMR</td>
<td>X</td>
<td>X</td>
<td>III: No Benefit</td>
<td>C</td>
<td>(438)</td>
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<td>Pharmacological stress nuclear MPI or Echo</td>
<td>X</td>
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<td>I</td>
<td>B</td>
<td>(43, 46, 47, 49–53)</td>
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<td>Ila</td>
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<td>III: No Benefit</td>
<td>C</td>
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<td>Irrespective of ability to exercise</td>
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<tr>
<td>CCTA</td>
<td>Any</td>
<td>Any</td>
<td>Ila</td>
<td>B</td>
<td>(439–443)</td>
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<td>Patency of CABG or coronary stent $\geq$3 mm diameter</td>
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<tr>
<td>CCTA</td>
<td>Any</td>
<td>Any</td>
<td>Ila</td>
<td>B</td>
<td>(55, 58, 439)</td>
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<td>In the absence of known moderate or severe calcification and intent to assess coronary stent $&lt;3$ mm in diameter</td>
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<tr>
<td>CCTA</td>
<td>Any</td>
<td>Any</td>
<td>III: No Benefit</td>
<td>B</td>
<td>(439–443)</td>
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<tr>
<td>Known moderate or severe native coronary calcification or assessment of coronary stent $&lt;3$ mm in diameter in patients who have new or worsening symptoms not consistent with UA</td>
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*Patients are candidates for exercise testing if they are capable of performing at least moderate physical functioning (ie, moderate household, yard, or recreational work and most activities of daily living) and have no disabling comorbidity. Patients should be able to achieve 85% of age-predicted maximum heart rate.

CABG indicates coronary artery bypass graft surgery; CCTA, cardiac computed tomography angiography; CMR, cardiac magnetic resonance; COR, class of recommendation; ECG, electrocardiogram; Echo, echocardiography; LOE, level of evidence; MPI, myocardial perfusion imaging; N/A, not available; SIHD, stable ischemic heart disease; and UA, unstable angina.
Table 9. Noninvasive Testing in Known SIHD: Asymptomatic (or Stable Symptoms)

<table>
<thead>
<tr>
<th>Test</th>
<th>Exercise Status</th>
<th>ECG Interpretable</th>
<th>Pretest Probability of Ischemia</th>
<th>COR</th>
<th>LOE</th>
<th>References</th>
<th>Additional Considerations</th>
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<tr>
<td>Exercise or pharmacological stress with nuclear MPI, Echo, or CMR at ( \geq 2)-y intervals</td>
<td>X</td>
<td>X</td>
<td>Prior evidence of silent ischemia or high risk for recurrent cardiac event. Meets criteria listed in additional considerations</td>
<td>IIa</td>
<td>C</td>
<td>(10, 13, 20)</td>
<td>a) Unable to exercise to adequate workload or b) Uninterpretable ECG or c) History of incomplete coronary revascularization</td>
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<td>Exercise ECG at ( \geq 1)-y intervals</td>
<td>X</td>
<td>X</td>
<td>Any</td>
<td>IIb</td>
<td>C</td>
<td>N/A</td>
<td>a) Prior evidence of silent ischemia OR b) At high risk for recurrent cardiac event</td>
</tr>
<tr>
<td>Exercise ECG</td>
<td>X</td>
<td>X</td>
<td>No prior evidence of silent ischemia and not at high risk of recurrent cardiac event</td>
<td>IIb</td>
<td>C</td>
<td>N/A</td>
<td>For annual surveillance</td>
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<td>Exercise or pharmacological stress with nuclear MPI, Echo, or CMR</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
<td>III: No Benefit</td>
<td>C</td>
<td>(10, 13, 20)</td>
<td>a) (&lt;5)-y intervals after CABG, or b) (&lt;2)-y intervals after PCI</td>
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</table>

*Patients are candidates for exercise testing if they are capable of performing at least moderate physical functioning (ie, moderate household, yard, or recreational work and most activities of daily living) and have no disabling comorbidity. Patients should be able to achieve 85% of age-predicted maximum heart rate.

CABG indicates coronary artery bypass graft surgery; CCTA, cardiac computed tomography angiography; CMR, coronary magnetic resonance; COR, class of recommendation; CCTA, computed tomography angiography; CMR, cardiac magnetic resonance; ECG, electrocardiogram; Echo, echocardiography; LOE, level of evidence; MPI, myocardial perfusion imaging; N/A, not available; PCI, percutaneous coronary intervention; and SIHD, stable ischemic heart disease.

reasonable in patients with known SIHD who have new or worsening symptoms not consistent with UA, irrespective of ability to exercise.439–443 (Level of Evidence: B)

2. CCTA might be reasonable in patients with known SIHD who have new or worsening symptoms not consistent with UA, irrespective of ability to exercise, in the absence of known moderate or severe calcification or if the CCTA is intended to assess coronary stents less than 3 mm in diameter.55,58,439 (Level of Evidence: B)

Class III: No Benefit

1. CCTA should not be performed for assessment of native coronary arteries with known moderate or severe calcification or with coronary stents less than 3 mm in diameter in patients with known SIHD who have new or worsening symptoms not consistent with UA, irrespective of ability to exercise.439–443 (Level of Evidence: B)

6.2.2. Noninvasive Testing in Known SIHD—Asymptomatic (or Stable Symptoms)
See Table 9 for a summary of recommendations from this section.

Class IIa

1. Nuclear MPI, echocardiography, or CMR with either exercise or pharmacological stress can be useful for follow-up assessment at 2-year or longer intervals in patients with SIHD with prior evidence of silent ischemia or who are at high risk for a recurrent cardiac event and a) are unable to exercise to an adequate workload, b) have an uninterpretable ECG, or c) have a history of incomplete coronary revascularization.10,13,20 (Level of Evidence: C)

Class IIb

1. Standard exercise ECG testing performed at 1-year or longer intervals might be considered for follow-up assessment in patients with SIHD who have had prior evidence of silent ischemia or are at high risk for a recurrent cardiac event and are able to exercise to an adequate workload and have an interpretable ECG. (Level of Evidence: C)

2. In patients who have no new or worsening symptoms or no prior evidence of silent ischemia and are not at high risk for a recurrent cardiac event, the usefulness of annual surveillance exercise ECG testing is not well established. (Level of Evidence: C)

Class III: No Benefit

1. Nuclear MPI, echocardiography, or CMR, with either exercise or pharmacological stress or CCTA, is not recommended for follow-up assessment in patients with SIHD, if performed more frequently than at a) 5-year intervals after CABG or b) 2-year intervals after PCI.10,13,20 (Level of Evidence: C)

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References


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172. Deleted in proof.


185. Deleted in proof.


188. Effects of weight loss and sodium reduction intervention on blood pressure and hypertension incidence in overweight people with high-normal blood pressure. The Trials of Hypertension Prevention, phase II.


Key Words: AHA Scientific Statements | cardiac and vascular diagnostic techniques | coronary artery disease | coronary stenosis | minimally invasive surgical procedures | myocardial ischemia | myocardial revascularization | prognosis | risk factors | stable angina

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## Appendix 1. Author Relationships With Industry and Other Entities (Relevant): 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guidelines for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease

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<thead>
<tr>
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<th>Ownership/Partnership/Principal</th>
<th>Personal Research</th>
<th>Institutional, Organizational, or Other Financial Benefit</th>
<th>Expert Witness</th>
<th>Voting Recusals by Section*</th>
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<td>Alan L. Hinderliter</td>
<td>University of North Carolina: Division of cardiology—Associate Professor</td>
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<td><strong>Spencer B. King III</strong></td>
<td>Saint Joseph’s Heart and Vascular Institute—President; Saint Joseph’s Health System—Executive Director Academic Affairs</td>
<td>● Medtronic (Expired June 2007)†</td>
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<td><strong>Mark A. Munger</strong></td>
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<td><strong>Craig R. Smith, Jr</strong></td>
<td>Columbia University—Chairman, Department of Surgery</td>
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<td>● GlaxoSmithKline (DSMB) (Expired March 2009)</td>
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CV indicates cardiovascular; DSMB, data safety and monitoring board; and SAQ, Seattle Angina Questionnaire.

Appendix 2. Reviewer Relationships With Industry and Other Entities (Relevant): 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guidelines for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease

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Circulation. 2012;126:3097-3137; originally published online November 19, 2012;
doi: 10.1161/CIR.0b013e3182776f83
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

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1. On page 3106, in Figure 3, the green diamond-shaped box associated with the “LBBB on ECG” box read, “MPI or Echo w/ exercise.” It has been changed to read, “Exercise Echo or Pharm Stress MPI/Echo.” The correct figure has been updated in the online article.

2. On page 3111, Table 5, Row 14, Column 1 “Test,” the sentence read, “Pharmacological stress with nuclear MPI or Echo.” It has been changed to read, “Exercise Echo or pharmacological stress with MPI or Echo.”

3. On page 3111, first column, in Section 3.1.2.3, the Class 1, Recommendation 1 read, “Pharmacological stress with either nuclear....” It has been changed to read, “Exercise echo or pharmacological stress with either nuclear....”

These corrections have been made to the current online version of the article, which is available at http://circ.ahajournals.org/content/126/25/3097.
## ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Management of Patients With Stable Ischemic Heart Disease (Comprehensive)—ONLINE AUTHOR LISTING OF COMPREHENSIVE RELATIONSHIPS WITH INDUSTRY AND OTHERS (August 2012)

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