

**2012**

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

Developed in Partnership with American College of Cardiology Foundation, American Heart Association, American College of Physicians, American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons.

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# Citation

This slide set is adapted from the 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients with Stable Ischemic Heart Disease (*Journal of the American College of Cardiology*). Published ahead-of print on November 19, 2012], available at:

<http://content.onlinejacc.org/article.aspx?doi=10.1016/j.jacc.2012.07.013> and

<http://circ.ahajournals.org/lookup/doi/10.1161/CIR.0b013e318277d6a0>

The full-text guidelines are also available on the following Web sites: ACC ([www.cardiosource.org](http://www.cardiosource.org)) and AHA ([my.americanheart.org](http://my.americanheart.org)).



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# Classification of Recommendations and Levels of Evidence

		SIZE OF TREATMENT EFFECT				
		CLASS I <i>Benefit &gt;&gt;&gt; Risk</i> Procedure/Treatment <b>SHOULD</b> be performed/administered	CLASS IIa <i>Benefit &gt;&gt; Risk</i> Additional studies with <i>focused objectives needed</i> <b>IT IS REASONABLE</b> to perform procedure/administer treatment	CLASS IIb <i>Benefit ≥ Risk</i> Additional studies with <i>broad objectives needed; additional registry data would be helpful</i> Procedure/Treatment <b>MAY BE CONSIDERED</b>	CLASS III <i>No Benefit or CLASS III Harm</i>	
				Procedure/ Test	Treatment	
				COR III: No benefit	No Proven Benefit	
				COR III: Harm	Excess Cost w/o Benefit or Harmful	
ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT	LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	<ul style="list-style-type: none"> <li>Recommendation that procedure or treatment is useful/effective</li> <li>Sufficient evidence from multiple randomized trials or meta-analyses</li> </ul>	<ul style="list-style-type: none"> <li>Recommendation in favor of treatment or procedure being useful/effective</li> <li>Some conflicting evidence from multiple randomized trials or meta-analyses</li> </ul>	<ul style="list-style-type: none"> <li>Recommendation's usefulness/efficacy less well established</li> <li>Greater conflicting evidence from multiple randomized trials or meta-analyses</li> </ul>	<ul style="list-style-type: none"> <li>Recommendation that procedure or treatment is not useful/effective and may be harmful</li> <li>Sufficient evidence from multiple randomized trials or meta-analyses</li> </ul>	
	LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	<ul style="list-style-type: none"> <li>Recommendation that procedure or treatment is useful/effective</li> <li>Evidence from single randomized trial or nonrandomized studies</li> </ul>	<ul style="list-style-type: none"> <li>Recommendation in favor of treatment or procedure being useful/effective</li> <li>Some conflicting evidence from single randomized trial or nonrandomized studies</li> </ul>	<ul style="list-style-type: none"> <li>Recommendation's usefulness/efficacy less well established</li> <li>Greater conflicting evidence from single randomized trial or nonrandomized studies</li> </ul>	<ul style="list-style-type: none"> <li>Recommendation that procedure or treatment is not useful/effective and may be harmful</li> <li>Evidence from single randomized trial or nonrandomized studies</li> </ul>	
	LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	<ul style="list-style-type: none"> <li>Recommendation that procedure or treatment is useful/effective</li> <li>Only expert opinion, case studies, or standard of care</li> </ul>	<ul style="list-style-type: none"> <li>Recommendation in favor of treatment or procedure being useful/effective</li> <li>Only diverging expert opinion, case studies, or standard of care</li> </ul>	<ul style="list-style-type: none"> <li>Recommendation's usefulness/efficacy less well established</li> <li>Only diverging expert opinion, case studies, or standard of care</li> </ul>	<ul style="list-style-type: none"> <li>Recommendation that procedure or treatment is not useful/effective and may be harmful</li> <li>Only expert opinion, case studies, or standard of care</li> </ul>	
Suggested phrases for writing recommendations		should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	COR III: No Benefit  is not recommended is not indicated should not be performed/administered/other is not useful/beneficial/effective	COR III: Harm  potentially harmful causes harm associated with excess morbidity/mortality should not be performed/administered/other
Comparative effectiveness phrases†		treatment/strategy A is recommended/indicated in preference to treatment B treatment A should be chosen over treatment B	treatment/strategy 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.



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# Key Guideline Messages

- Management of SIHD should be based on strong scientific evidence and the patient's preferences.
- Patients presenting with angina should be categorized as stable vs. unstable. Those at moderate or high risk should be treated emergently for acute coronary syndrome.
- A standard exercise test is the first choice to diagnose IHD for patients with an interpretable ECG and able to exercise, especially if the likelihood is intermediate (10-90%).
  - Those who have an *un*interpretable ECG and can exercise, should undergo exercise stress test with nuclear MPI or echocardiography, particularly if likelihood of IHD is >10%. If unable to exercise, MPI or echocardiography with pharmacologic stress is recommended.



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# Key Guideline Messages

- Patients diagnosed with SIHD should undergo assessment of risk for death or complications.
  - For patients with an interpretable ECG and who are able to exercise, a standard exercise test is also the preferred choice for risk assessment.
  - Those who have an *un*interpretable ECG and are able to exercise, should undergo an exercise stress with nuclear MPI or echocardiography, while for patients unable to exercise, nuclear MPI or echocardiography with pharmacologic stress is recommended.



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# Key Guideline Messages

- Patients with SIHD should generally receive a “package” of GDMT that include lifestyle interventions and medications shown to improve outcomes which includes (as appropriate):
  - Diet, weight loss and regular physical activity;
  - If a smoker, smoking cessation;
  - Aspirin 75-162mg daily;
  - A statin medication in moderate dosage;
  - If hypertensive, antihypertensive medication to achieve a BP <140/90; If diabetic, appropriate glycemic control.



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# Key Guideline Messages

- Patients with angina should receive sublingual nitroglycerin and a beta blocker. When these are not tolerated or are ineffective, a calcium-channel blocker or long-acting nitrate may be substituted or added.
- Coronary arteriography should be considered 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.



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# Key Guideline Messages

- The relatively small proportion of patients who have “high-risk” anatomy (e.g., >50% stenosis of the left main coronary artery), revascularization with CABG should be considered to potentially improve survival. Most data showing improved survival with surgery compared to medical therapy are several decades old and based on surgical techniques and medical therapies that have advanced considerably. There are no conclusive data demonstrating improved survival following PCI.



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# Key Guideline Messages

- Most patients should have a trial of GDMT before considering revascularization to improve symptoms. Deferring revascularization is not associated with worse outcomes.
- Prior to revascularization to improve symptoms, coronary anatomy should be correlated with functional studies to ensure lesions responsible for symptoms are targeted.
- Patients with SIHD should be carefully followed to monitor progression of disease, complications and adherence.
  - Exercise and imaging studies should generally be repeated only when there is a change in clinical status (not annually).



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# Guideline for SIHD

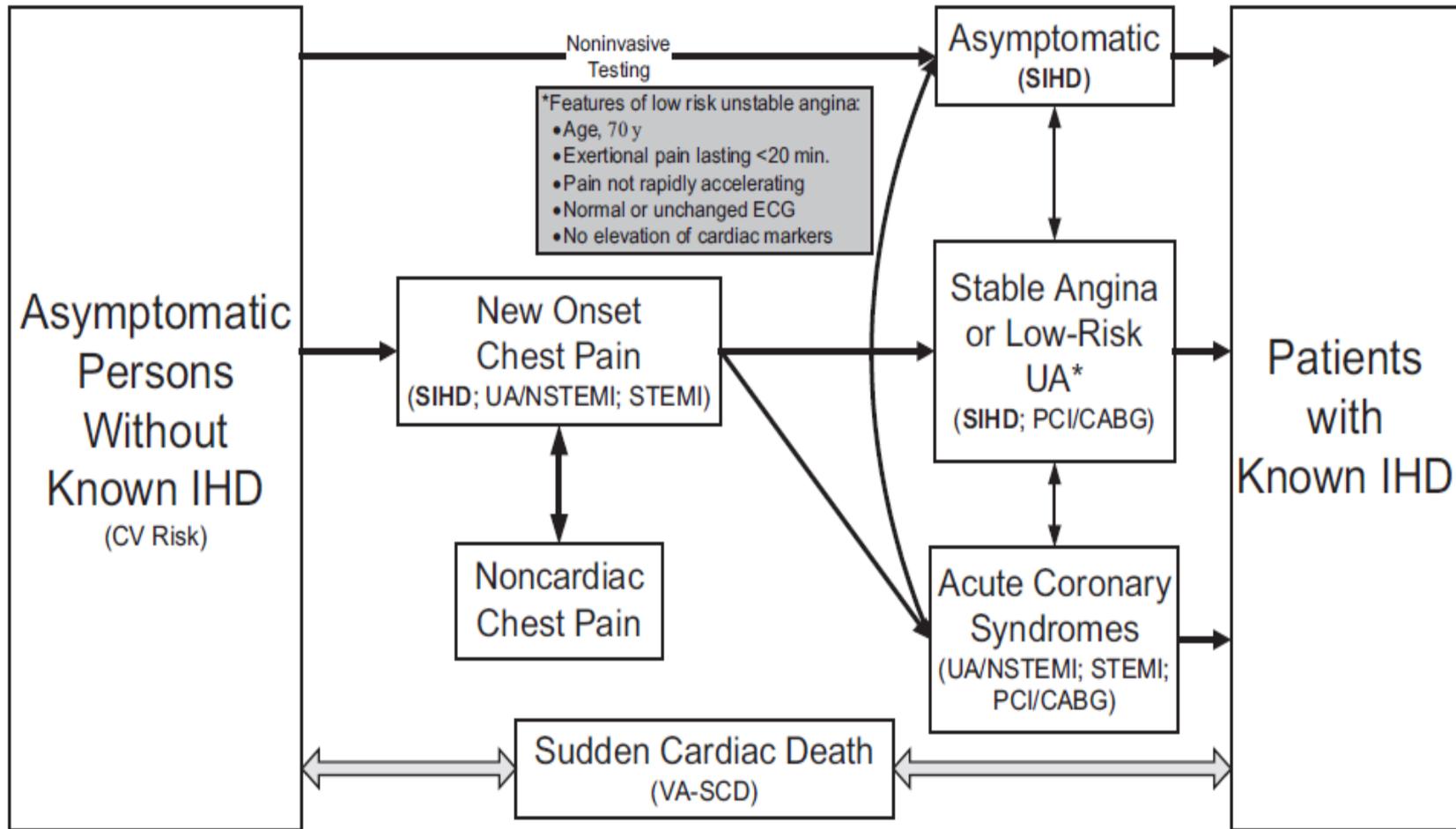
## Introduction



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# Spectrum of IHD



Guidelines relevant to the spectrum of IHD are in parentheses



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# Introduction

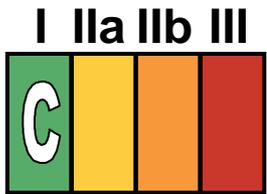
## Vital Importance of Involvement by an Informed Patient



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# Vital Importance of Involvement by an Informed Patient



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



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# Guideline for SIHD

## Diagnosis of SIHD



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# Diagnosis

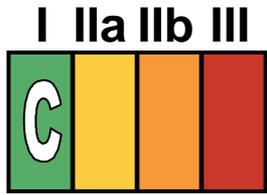
## Clinical Evaluation of Patients With Chest Pain



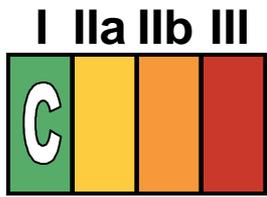
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# Clinical Evaluation of Patients With Chest Pain



Patients with chest pain should receive a thorough history and physical examination to assess the probability of IHD prior to additional testing.



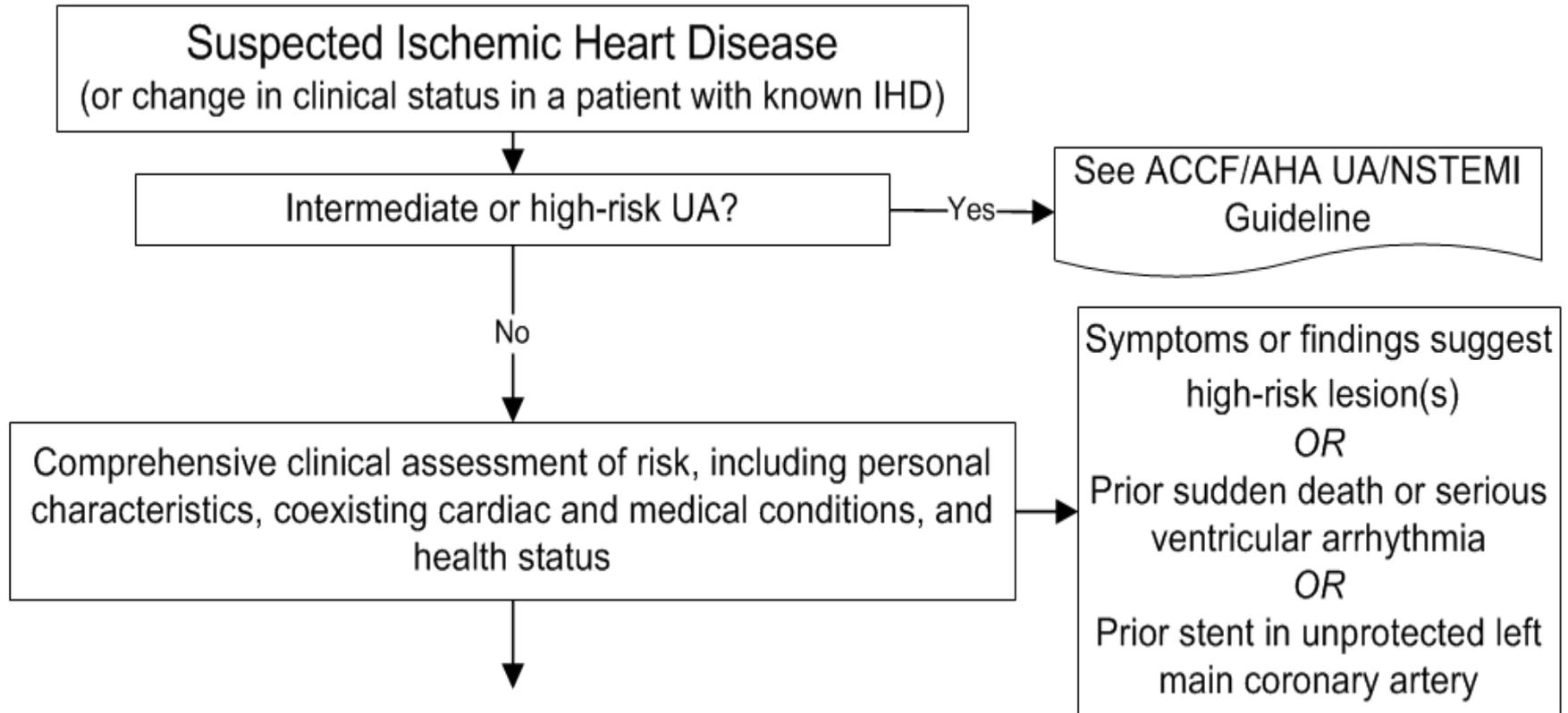
Patients who present with acute angina should be categorized as stable or unstable; patients with UA should be further categorized as high, moderate or low risk.



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# Diagnosis of Patients with Suspected Ischemic Heart Disease



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# Clinical Classification of Chest Pain

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<b>Typical angina</b> (definite)	<b>1) Substernal chest discomfort with a characteristic quality and duration that is 2) provoked by exertion or emotional stress and 3) relieved by rest or nitroglycerin</b>
<b>Atypical angina</b> (probable)	<b>Meets 2 of the above characteristics</b>
<b>Noncardiac chest pain</b>	<b>Meets 1 or none of the typical anginal characteristics</b>

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## Pretest Likelihood of CAD in Symptomatic Patients According to Age and Sex\* (Combined Diamond/Forrester and CASS Data)

Age, y	Nonanginal Chest Pain		Atypical Angina		Typical Angina	
	Men	Women	Men	Women	Men	Women
30-39	4	2	34	12	76	26
40-49	13	3	51	22	87	55
50-59	20	7	65	31	93	73
60-69	27	14	72	51	94	86

\*Each value represents the percent with significant CAD on catheterization.



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# Comparing Pretest Likelihood of CAD in Low-Risk Symptomatic Patients With High-Risk Symptomatic Patients (Duke Database)

Age, y	Nonanginal Chest Pain		Atypical Angina		Typical Angina	
	Men	Women	Men	Women	Men	Women
35	3-35	1-19	8-59	2-39	30-88	10-78
45	9-47	2-22	21-70	5-43	51-92	20-79
55	23-59	4-21	45-79	10-47	80-95	38-82
65	49-69	9-29	71-86	20-51	93-97	56-84

Each value represents the percentage with significant CAD. The first is the percentage for a low-risk, mid-decade patient without diabetes mellitus, smoking, or hyperlipidemia. The second is that of a patient of the same age with diabetes mellitus, smoking, and hyperlipidemia. Both high- and low-risk patients have normal resting ECGs. If ST-T-wave changes or Q waves had been present, the likelihood of CAD would be higher in each entry of the table.



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# Diagnosis

## Electrocardiography



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# Diagnosis

## Resting Electrocardiography to Assess Risk



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# Resting Electrocardiography to Assess Risk



A resting ECG is recommended in patients without an obvious, noncardiac cause of chest pain.



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# Diagnosis

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



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# Diagnosis

## Able to Exercise



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# Able to Exercise



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.



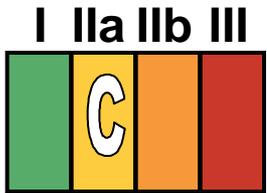
Exercise stress with nuclear MPI or echocardiography is recommended for patients with an intermediate to high pretest probability of IHD who have an *uninterpretable* ECG and at least moderate physical functioning or no disabling comorbidity.



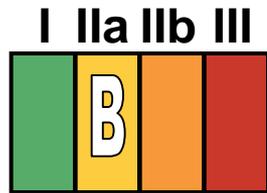
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# Able to Exercise (cont.)



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.



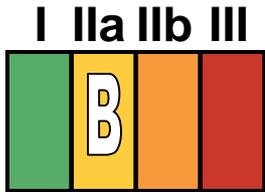
Exercise stress with nuclear MPI or echocardiography is reasonable for patients with an intermediate to high pretest probability of obstructive IHD who have an interpretable ECG and at least moderate physical functioning or no disabling comorbidity.



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# Able to Exercise (cont.)



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.



CCTA might be reasonable for patients with an intermediate pretest probability of IHD who have at least moderate physical functioning or no disabling comorbidity.



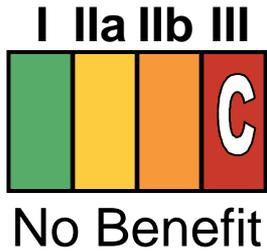
For patients with a low pretest probability of obstructive IHD who do require testing, standard exercise stress echocardiography might be reasonable, provided the patient has an interpretable ECG and at least moderate physical functioning or no disabling comorbidity.



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# Able to Exercise (cont.)



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.



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.



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# Diagnosis

## Unable to Exercise



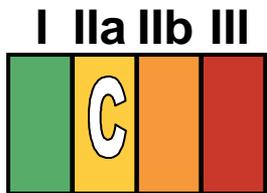
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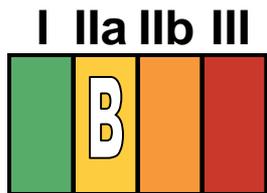
# Unable to Exercise



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.



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.



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.



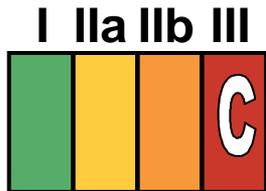
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# Unable to Exercise (cont.)



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.



No Benefit

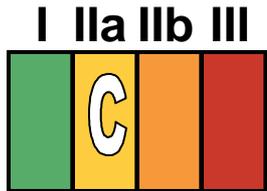
Standard exercise ECG testing is not recommended for patients who have an *uninterpretable* ECG or are incapable of at least moderate physical functioning or have disabling comorbidity.



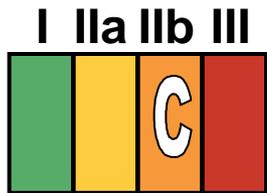
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# Other



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.



For patients with a low to intermediate pretest probability of obstructive IHD, noncontrast cardiac CT to determine the CAC score may be considered.



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# Guideline for SIHD

## Risk Assessment



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# Risk Assessment

## Advanced Testing: Resting and Stress Noninvasive Testing



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# Risk Assessment

## Resting Imaging to Assess Cardiac Structure and Function



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# Resting Imaging to Assess Cardiac Structure and Function



Assessment of resting 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.



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# Resting Imaging to Assess Cardiac Structure and Function (cont.)



Assessment of cardiac structure and function with resting echocardiography may be considered in patients with hypertension or diabetes mellitus and an abnormal ECG.



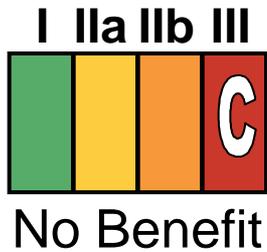
Measurement of LV function with radionuclide imaging may be considered in patients with a prior MI or pathological Q waves, provided there is no need to evaluate symptoms or signs suggestive of heart failure, complex ventricular arrhythmias, or an undiagnosed heart murmur.



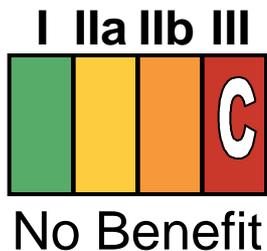
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# Resting Imaging to Assess Cardiac Structure and Function (cont.)



Echocardiography, radionuclide imaging, CMR, and cardiac CT 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.



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



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# Risk Assessment

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



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# Risk Assessment

## Risk Assessment in Patients Able to Exercise



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# Risk Assessment in Patients Able to Exercise



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.



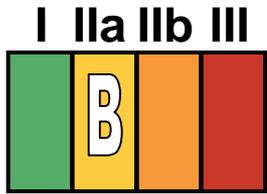
The addition of either nuclear MPI or echocardiography to standard exercise ECG testing is recommended for risk assessment in patients with SIHD who are able to exercise to an adequate workload but have an *uninterpretable* ECG not due to LBBB or ventricular pacing.



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# Risk Assessment in Patients Able to Exercise (cont.)



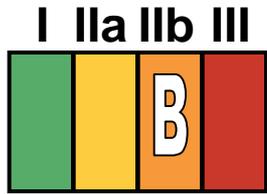
The addition of either nuclear MPI or echocardiography to standard exercise ECG testing is reasonable for risk assessment in patients with SIHD who are able to exercise to an adequate workload and have an interpretable ECG.



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.



# Risk Assessment in Patients Able to Exercise (cont.)



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.



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.



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# Risk Assessment

## Risk Assessment in Patients Unable to Exercise



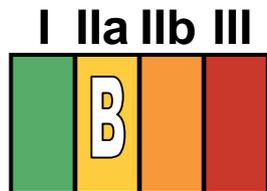
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# Risk Assessment in Patients Unable to Exercise



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.



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 .



CCTA can be useful as a first-line test for risk assessment in patients with SIHD who are unable to exercise to an adequate workload regardless of interpretability of ECG.



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# Risk Assessment

## Risk Assessment Regardless of Patients' Ability to Exercise



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# Risk Assessment Regardless of Patients' Ability to Exercise



Pharmacological stress with either nuclear MPI or echocardiography is recommended for risk assessment in patients with SIHD who have LBBB on ECG, regardless of ability to exercise to an adequate workload.



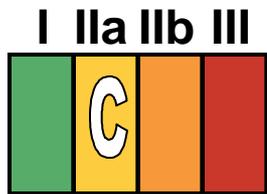
Either exercise or pharmacological stress with imaging (nuclear MPI, echocardiography, or CMR) is recommended for risk assessment in patients with SIHD who are being considered for revascularization of known coronary stenosis of unclear physiological significance.



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# Risk Assessment Regardless of Patients' Ability to Exercise (cont.)



CCTA can be useful for risk assessment in patients with SIHD who have an indeterminate result from functional testing .



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



No Benefit

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.



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# Noninvasive Risk Stratification

## High risk (>3% annual death or MI)

1. Severe resting LV dysfunction (LVEF <35%) not readily explained by noncoronary causes
2. Resting perfusion abnormalities  $\geq 10\%$  of the myocardium in patients without prior history or evidence of MI
3. Stress ECG findings including  $\geq 2$  mm of ST-segment depression at low workload or persisting into recovery, exercise-induced ST-segment elevation, or exercise-induced VT/VF
4. Severe stress-induced LV dysfunction (peak exercise LVEF <45% or drop in LVEF with stress  $\geq 10\%$ )
5. Stress-induced perfusion abnormalities encumbering  $\geq 10\%$  myocardium or stress segmental scores indicating multiple vascular territories with abnormalities
6. Stress-induced LV dilation
7. Inducible wall motion abnormality (involving >2 segments or 2 coronary beds)
8. Wall motion abnormality developing at low dose of dobutamine ( $\leq 10$  mg/kg/min) or at a low heart rate (<120 beats/min)
9. CAC score >400 Agaston units
10. Multivessel obstructive CAD ( $\geq 70\%$  stenosis) or left main stenosis ( $\geq 50\%$  stenosis) on CCTA

## Intermediate risk (1% to 3% annual death or MI)

1. Mild/moderate resting LV dysfunction (LVEF 35% to 49%) not readily explained by noncoronary causes
2. Resting perfusion abnormalities in 5% to 9.9% of the myocardium in patients without a history or prior evidence of MI
3.  $\geq 1$  mm of ST-segment depression occurring with exertional symptoms
4. Stress-induced perfusion abnormalities encumbering 5% to 9.9% of the myocardium or stress segmental scores (in multiple segments) indicating 1 vascular territory with abnormalities but without LV dilation
5. Small wall motion abnormality involving 1 to 2 segments and only 1 coronary bed
6. CAC score 100 to 399 Agaston units
7. One vessel CAD with  $\geq 70\%$  stenosis or moderate CAD stenosis (50% to 69% stenosis) in  $\geq 2$  arteries on CCTA

## Low risk (<1% annual death or MI)

1. Low-risk treadmill score (score  $\geq 5$ ) or no new ST segment changes or exercise-induced chest pain symptoms; when achieving maximal levels of exercise
2. Normal or small myocardial perfusion defect at rest or with stress encumbering <5% of the myocardium\*
3. Normal stress or no change of limited resting wall motion abnormalities during stress
4. CAC score <100 Agaston units
5. No coronary stenosis >50% on CCTA

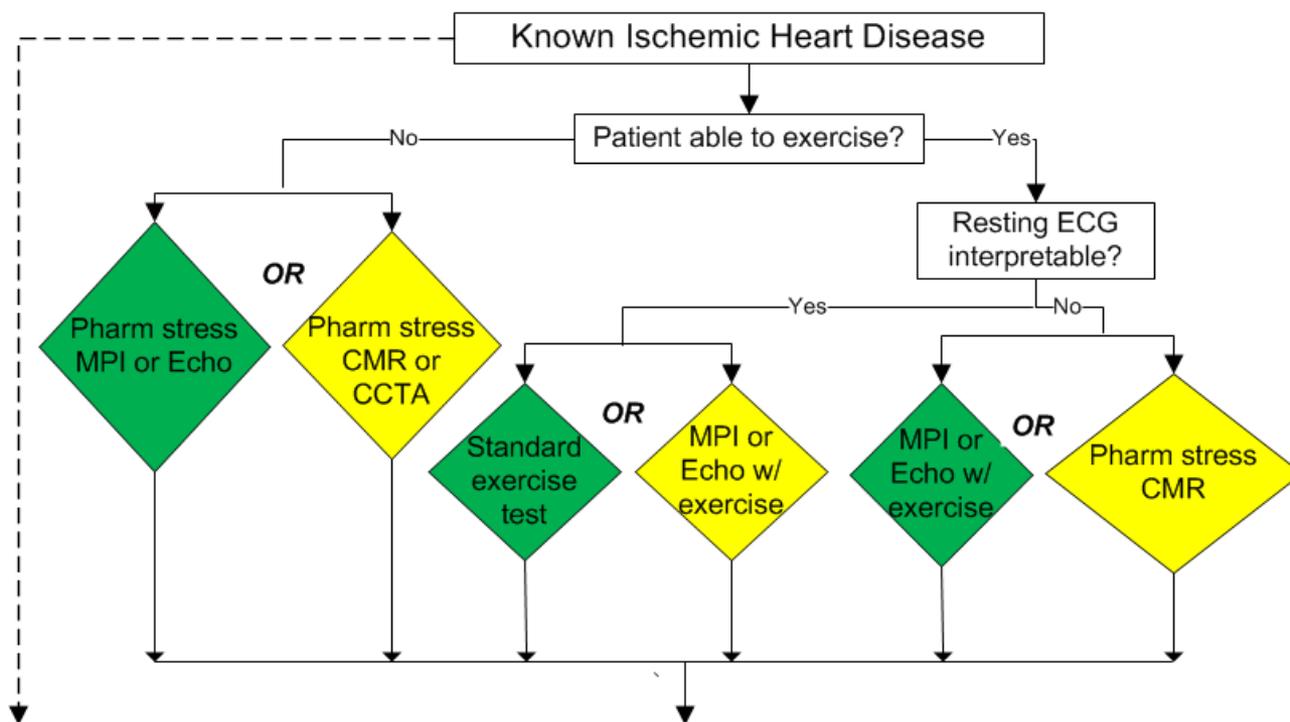
\*Although the published data are limited; patients with these findings will probably not be at low risk in the presence of either a high-risk treadmill score or severe resting LV dysfunction (LVEF <35%).



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# Algorithm for Risk Assessment of Patients With SIHD\*



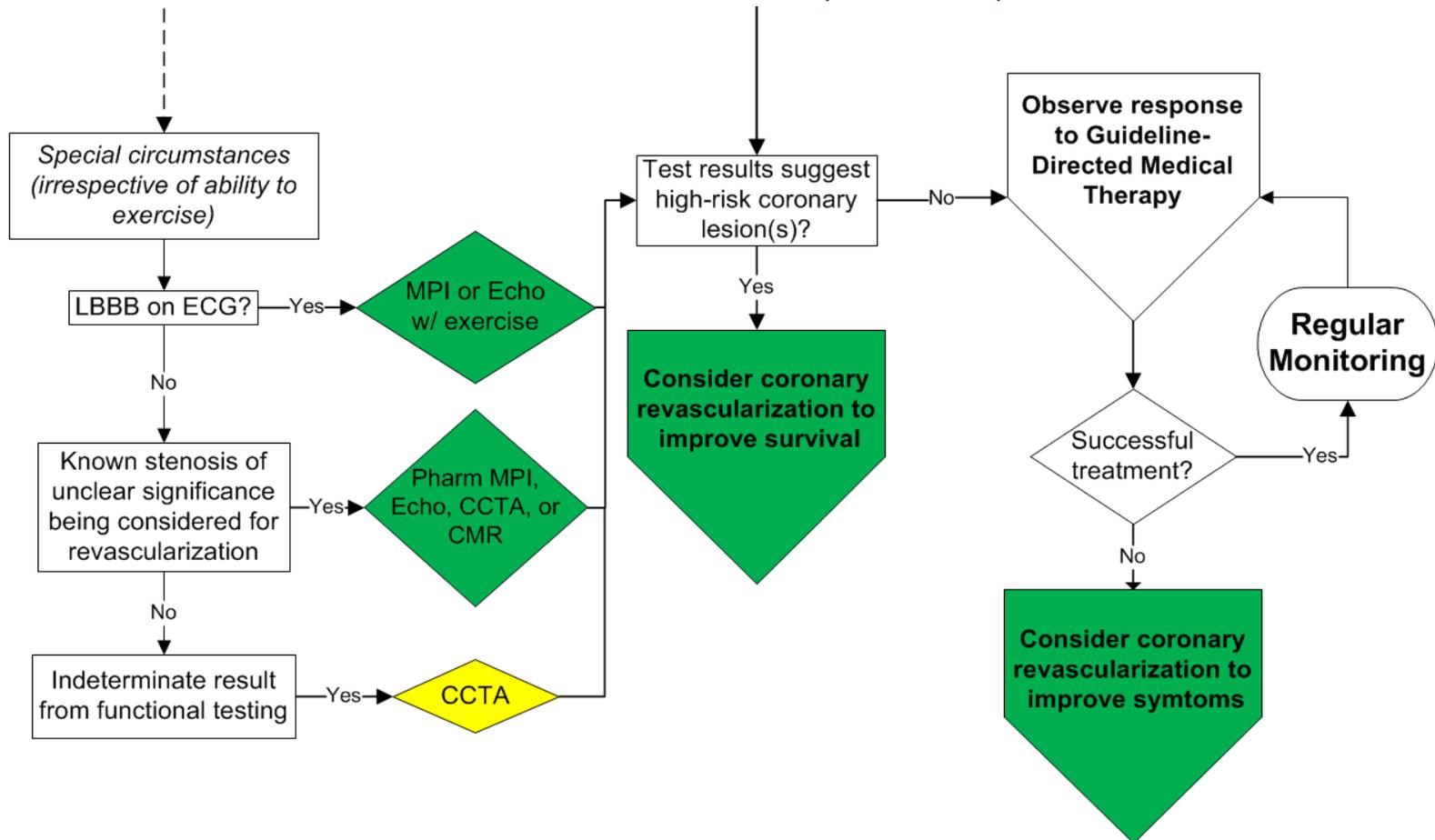
\*Colors correspond to the ACCF/AHA Classification of Recommendations and Levels of Evidence Table.



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# Algorithm for Risk Assessment of Patients With SIHD (cont.)\*



\*Colors correspond to the ACCF/AHA Classification of Recommendations and Levels of Evidence Table.



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# Risk Assessment

## Coronary Angiography



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# Risk Assessment

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



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# Coronary Angiography as an Initial Testing Strategy to Assess Risk



Patients with SIHD who have survived sudden cardiac death or potentially life-threatening ventricular arrhythmia should undergo coronary angiography to assess cardiac risk.



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.



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# CAD Prognostic Index

Extent of CAD	Prognostic Weight (0–100)	5-Year Survival Rate (%)*
1-vessel disease, 75%	23	93
1-vessel disease, 50% to 74%	23	93
1-vessel disease, $\geq 95\%$	32	91
2-vessel disease	37	88
2-vessel disease, both $\geq 95\%$	42	86
1-vessel disease, $\geq 95\%$ proximal LAD artery	48	83
2-vessel disease, $\geq 95\%$ LAD artery	48	83
2-vessel disease, $\geq 95\%$ proximal LAD artery	56	79
3-vessel disease	56	79
3-vessel disease, $\geq 95\%$ in $\geq 1$ vessel	63	73
3-vessel disease, 75% proximal LAD artery	67	67
3-vessel disease, $\geq 95\%$ proximal LAD artery	74	59

\*Assuming medical treatment only.

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# Risk Assessment

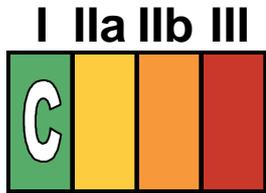
## Coronary Angiography to Assess Risk After Initial Workup With Noninvasive Testing



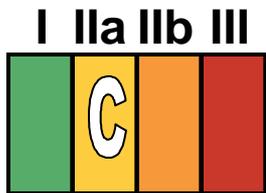
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# Coronary Angiography to Assess Risk After Initial Workup With Noninvasive Testing



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.



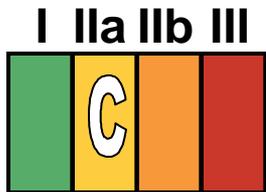
Coronary angiography is reasonable to further assess risk in patients with SIHD who have depressed LV function (EF <50%) and moderate risk criteria on noninvasive testing with demonstrable ischemia.



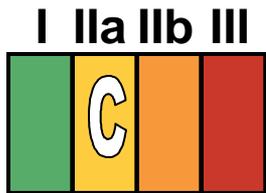
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# Coronary Angiography to Assess Risk After Initial Workup With Noninvasive Testing (cont.)



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.



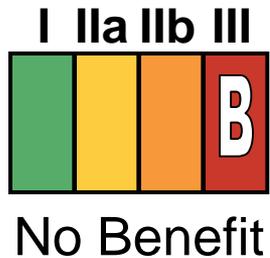
Coronary angiography for risk assessment is reasonable for patients with SIHD who have unsatisfactory quality of life due to angina, have preserved LV function (EF >50%), and have intermediate risk criteria on noninvasive testing.



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# Coronary Angiography to Assess Risk After Initial Workup With Noninvasive Testing (cont.)



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 .



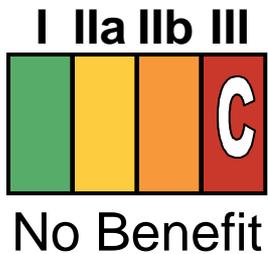
Coronary angiography is not recommended to further assess risk in patients with SIHD who have preserved LV function (EF >50%) and low-risk criteria on noninvasive testing.



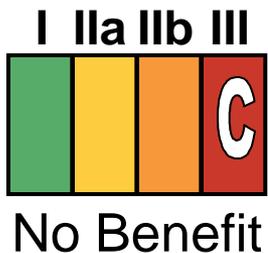
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# Coronary Angiography to Assess Risk After Initial Workup With Noninvasive Testing (cont.)



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.



Coronary angiography is not recommended to assess risk in asymptomatic patients with no evidence of ischemia on noninvasive testing.



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# Guideline for SIHD

## Treatment



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# Treatment

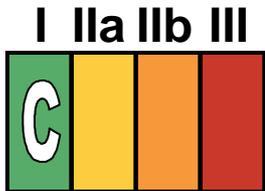
## Patient Education



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# Patient Education



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

- education on the importance of medication adherence for managing symptoms and retarding disease progression ;



- 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;



- comprehensive review of all therapeutic options;

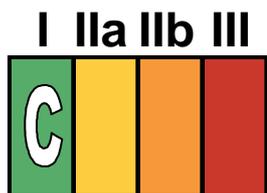


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# Patient Education (cont.)

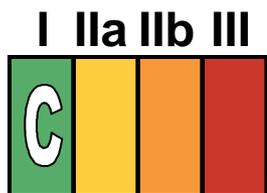
Patients with SIHD should have an individualized education plan to optimize care and promote wellness, including:



d. a description of appropriate levels of exercise, with encouragement to maintain recommended levels of daily physical activity;



e. introduction to self-monitoring skills; and



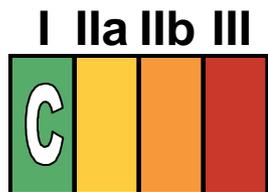
f. information on how to recognize worsening cardiovascular symptoms and take appropriate action.



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# Patient Education (cont.)



Patients with SIHD should be educated about the following lifestyle elements that could influence prognosis: weight control, maintenance of a BMI of 18.5 to 24.9 kg/m<sup>2</sup>, 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); lipid management; BP control; smoking cessation and avoidance of exposure to secondhand smoke; and individualized medical, nutrition, and life-style changes for patients with diabetes mellitus to supplement diabetes treatment goals and education.



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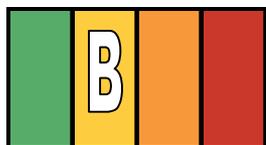
# Patient Education (cont.)

It is reasonable to educate patients with SIHD about:

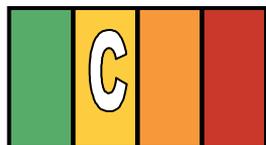
a. adherence to a diet that is low in saturated fat, cholesterol, and trans fat; high in fresh fruits, whole grains, and vegetables; and reduced in sodium intake, with cultural and ethnic preferences incorporated;

b. common symptoms of stress and depression to minimize stress related angina symptoms;

I IIa IIb III



I IIa IIb III



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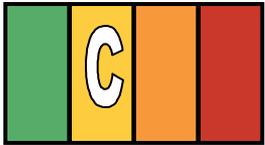
# Patient Education (cont.)

It is reasonable to educate patients with SIHD about:

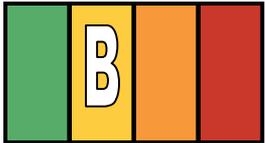
c. comprehensive behavioral approaches for the management of stress and depression; and

d. evaluation and treatment of major depressive disorder when indicated.

I IIa IIb III



I IIa IIb III



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# Treatment

## Guideline-Directed Medical Therapy



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# Treatment

## Risk Factor Modification



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# Treatment

## Lipid Management



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# Lipid Management



Lifestyle modifications, including daily physical activity and weight management, are strongly recommended for all patients with SIHD.



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/d).



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# Lipid Management (cont.)



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.



For patients who do not tolerate statins, LDL cholesterol–lowering therapy with bile acid sequestrants,\* niacin,† or both is reasonable.

\*The use of bile acid sequestrant is relatively contraindicated when triglycerides are  $\geq 200$  mg/dL and is contraindicated when triglycerides are  $\geq 500$  mg/dL.

†Dietary supplement niacin must not be used as a substitute for prescription niacin.



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# Treatment

## Blood Pressure Management



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# Blood Pressure Management



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.



In patients with SIHD with BP 140/90 mm Hg or higher, antihypertensive drug therapy should be instituted in addition to or after a trial of lifestyle modifications.



The specific medications used for treatment of high BP should be based on specific patient characteristics and may include 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 BP of less than 140/90 mm Hg.



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# Treatment

## Diabetes Management



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# Diabetes Management



For selected individual patients, such as those with a short duration of diabetes mellitus and a long life expectancy, a goal HbA1c of 7% or less is reasonable.



A goal HbA1c 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.



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# Diabetes Management (cont.)



Initiation of pharmacotherapy interventions to achieve target HbA1c might be reasonable.



Therapy with rosiglitazone **should not be initiated** in patients with SIHD.

Harm



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# Treatment

## Physical Activity



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# Physical Activity



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 (e.g., walking breaks at work, gardening, household work) to improve cardiorespiratory fitness and move patients out of the least-fit, least-active, high-risk cohort (bottom 20%).



For all patients, risk assessment with a physical activity history and/or an exercise test is recommended to guide prognosis and prescription.



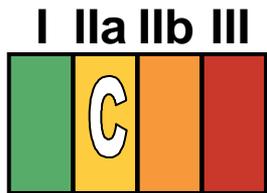
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# Physical Activity (cont.)



Medically supervised programs (cardiac rehabilitation) and physician-directed, home-based programs are recommended for at-risk patients at first diagnosis.



It is reasonable for the clinician to recommend complementary resistance training at least 2 days per week.



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# Treatment

## Weight Management



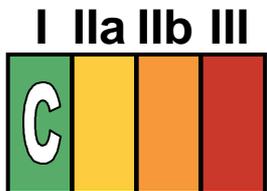
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# Weight Management



BMI 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 BMI between 18.5 and 24.9 kg/m<sup>2</sup> and 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).



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.



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# Treatment

## Smoking Cessation Counseling



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# Smoking Cessation Counseling



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).



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# Treatment

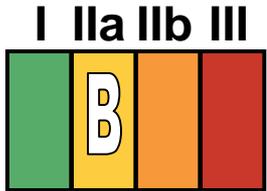
## Management of Psychological Factors



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# Management of Psychological Factors



It is reasonable to consider screening SIHD patients for depression and to refer or treat when indicated.



Treatment of depression has not been shown to improve cardiovascular disease outcomes but might be reasonable for its other clinical benefits.



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# Treatment

## Alcohol Consumption



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# Alcohol Consumption



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).



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# Treatment

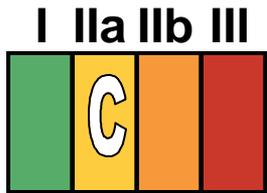
## Avoiding Exposure to Air Pollution



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# Avoiding Exposure to Air Pollution



It is reasonable for patients with SIHD to avoid exposure to increased air pollution to reduce the risk of cardiovascular events.



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# Treatment

## Additional Medical Therapy to Prevent MI and Death



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# Treatment

## Antiplatelet Therapy



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# Antiplatelet Therapy



Treatment with aspirin 75 to 162 mg daily should be continued indefinitely in the absence of contraindications in patients with SIHD.



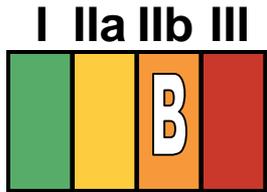
Treatment with clopidogrel is reasonable when aspirin is contraindicated in patients with SIHD .



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# Antiplatelet Therapy (cont.)



Treatment with aspirin 75 to 162 mg daily and clopidogrel 75 mg daily might be reasonable in certain high-risk patients with SIHD.



Dipyridamole is not recommended as antiplatelet therapy for patients with SIHD.

No Benefit



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# Treatment

## Beta-Blocker Therapy



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# Beta-Blocker Therapy



Beta-blocker therapy should be started and continued for 3 years in all patients with normal LV function after MI or ACS.



Beta-blocker therapy should be used in all patients with LV systolic dysfunction ( $EF \leq 40\%$ ) 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.)



Beta blockers may be considered as chronic therapy for all other patients with coronary or other vascular disease.



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# Treatment

## Renin-Angiotensin- Aldosterone Blocker Therapy



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# Renin-Angiotensin-Aldosterone Blocker Therapy



ACE inhibitors should be prescribed in all patients with SIHD who also have hypertension, diabetes mellitus, LVEF 40% or less, or CKD, unless contraindicated.



ARBs are recommended for patients with SIHD who have hypertension, diabetes mellitus, LV systolic dysfunction, or CKD and have indications for, but are intolerant of, ACE inhibitors.



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# Renin-Angiotensin-Aldosterone Blocker Therapy (cont.)



Treatment with an ACE inhibitor is reasonable in patients with both SIHD and other vascular disease.



It is reasonable to use ARBs in other patients who are ACE inhibitor intolerant.



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# Indications for Individual Drug Classes in the Treatment of Hypertension in Patients With SIHD\*

Indication	Recommended Drugs					
	Diuretic	Beta Blocker	ACE Inhibitor	ARB	Calcium-Channel Blocker	Aldosterone Antagonist
Heart failure	•	•	•	•		•
LV dysfunction			•	•		
After myocardial infarction		•	•	•		•
Angina		•			•	
Diabetes mellitus		•	•	•		
Chronic kidney disease			•	•		

\*Table indicates drugs that should be considered and does not indicate that all drugs should necessarily be prescribed in an individual patient (e.g., ACE inhibitors and ARB typically are not prescribed together).



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# Treatment

## Influenza Vaccination



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# Influenza Vaccination



An annual influenza vaccine is recommended for patients with SIHD.



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# Treatment

## Additional Therapy to Reduce Risk of MI and Death



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# Additional Therapy to Reduce Risk of MI and Death



No Benefit

Estrogen therapy is not recommended in postmenopausal women with SIHD with the intent of reducing cardiovascular risk or improving clinical outcomes.



No Benefit

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.



No Benefit

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.



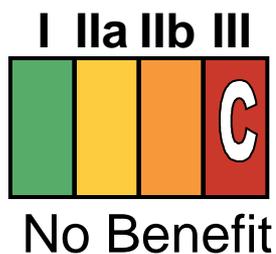
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# Additional Therapy to Reduce Risk of MI and Death (cont.)



Chelation therapy is not recommended with the intent of improving symptoms or reducing cardiovascular risk in patients with SIHD.



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.



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# Treatment

## Medical Therapy for Relief of Symptoms



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# Treatment

## Use of Anti-Ischemic Medications



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# Use of Anti-Ischemic Medications



Beta blockers should be prescribed as initial therapy for relief of symptoms in patients with SIHD.



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.



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.



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# Use of Anti-Ischemic Medications (cont.)



Sublingual nitroglycerin or nitroglycerin spray is recommended for immediate relief of angina in patients with SIHD.



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.



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.



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# Use of Anti-Ischemic Medications (cont.)



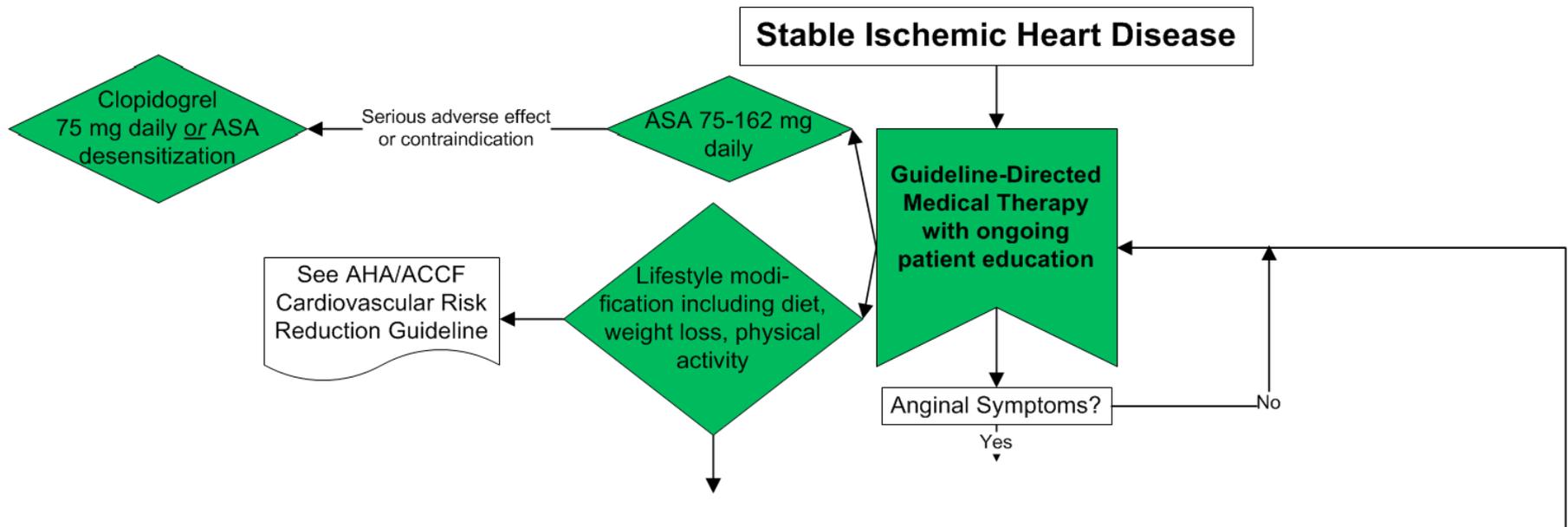
Ranolazine in combination with beta blockers can be useful when prescribed for relief of symptoms when initial treatment with beta blockers is not successful in patients with SIHD.



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# Algorithm for Guideline-Directed Medical Therapy for Patients With SIHD\*



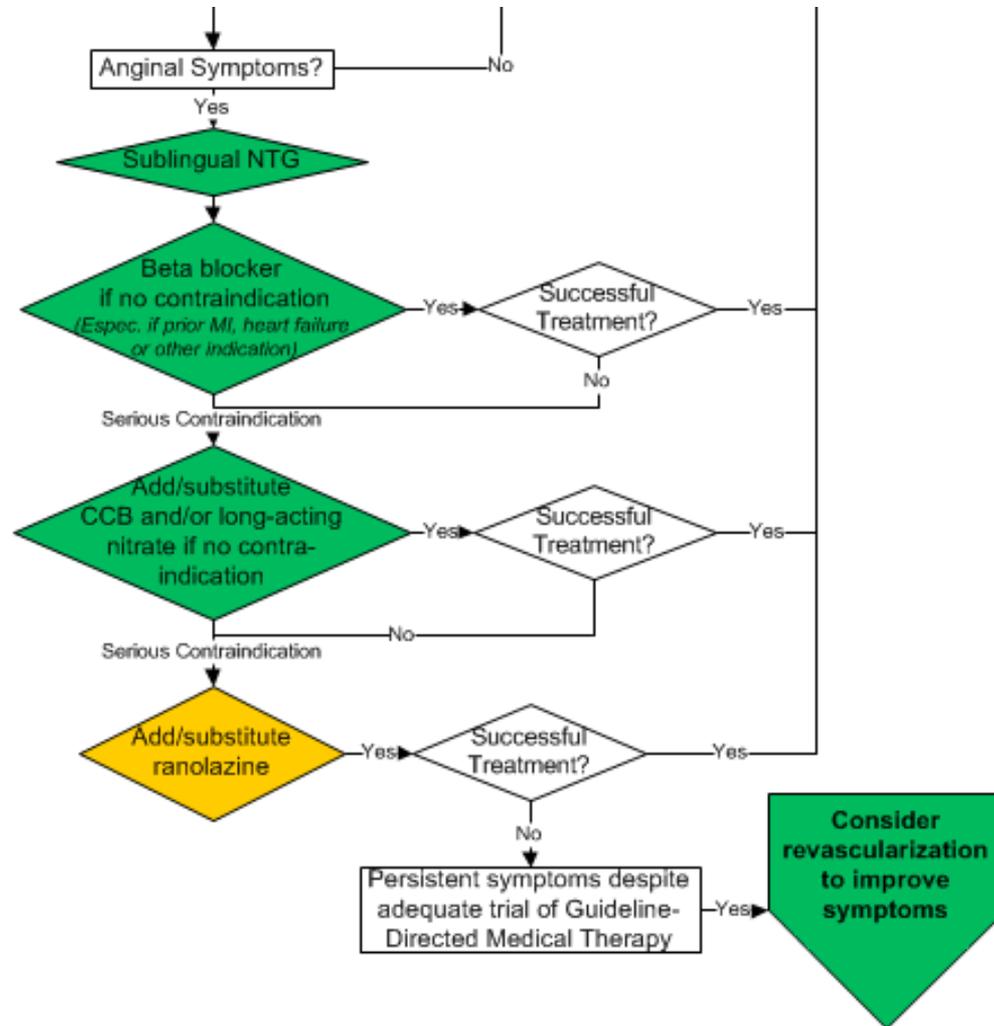
\*Colors correspond to the ACCF/AHA Classification of Recommendations and Levels of Evidence Table.



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# Algorithm for Guideline-Directed Medical Therapy for Patients With SIHD\* (cont.)



\*Colors correspond to the ACCF/AHA Classification of Recommendations and Levels of Evidence Table.



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# Algorithm for Guideline-Directed Medical Therapy for Patients With SIHD\* (cont.)



\*Colors correspond to the ACCF/AHA Classification of Recommendations and Levels of Evidence Table. †The use of bile acid sequestrant is relatively contraindicated when triglycerides are  $\geq 200$  mg/dL and is contraindicated when triglycerides are  $\geq 500$  mg/dL. ‡Dietary supplement niacin must not be used as a substitute for prescription niacin.



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# Treatment

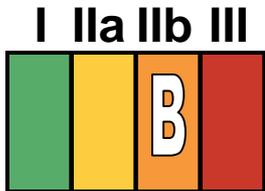
## Alternative Therapies for Relief of Symptoms in Patients With Refractory Angina



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# Alternative Therapies for Relief of Symptoms in Patients with Refractory Angina



EECP may be considered for relief of refractory angina in patients with SIHD.



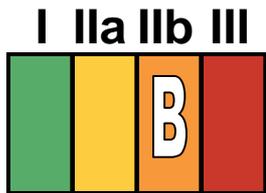
Spinal cord stimulation may be considered for relief of refractory angina in patients with SIHD.



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# Alternative Therapies for Relief of Symptoms in Patients with Refractory Angina (cont.)



TMR may be considered for relief of refractory angina in patients with SIHD.



Acupuncture should not be used for the purpose of improving symptoms or reducing cardiovascular risk in patients with SIHD.



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# SIHD Guideline

## CAD Revascularization



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# CAD Revascularization

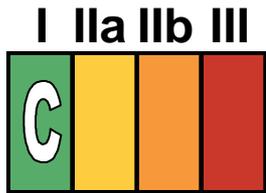
## Heart Team Approach to Revascularization Decisions



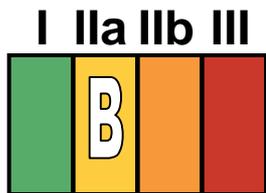
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# Heart Team Approaches to Revascularization Decisions



A Heart Team approach to revascularization is recommended in patients with unprotected left main or complex CAD.



Calculation of the STS and SYNTAX scores is reasonable in patients with unprotected left main and complex CAD.



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# CAD Revascularization

## Revascularization to Improve Survival



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# CAD Revascularization

## Left Main CAD Revascularization



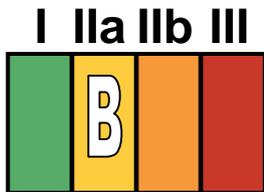
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# Left Main CAD Revascularization



CABG to improve survival is recommended for patients with significant ( $\geq 50\%$  diameter stenosis) left main coronary artery stenosis.



PCI to improve survival is reasonable as an alternative to CABG in selected stable patients with significant ( $\geq 50\%$  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 (e.g., a low SYNTAX score [ $\leq 22$ ], ostial or trunk left main CAD); *and* 2) clinical characteristics that predict a significantly increased risk of adverse surgical outcomes (e.g., STS-predicted risk of operative mortality 5%).



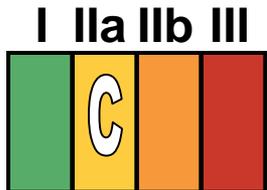
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# Left Main CAD Revascularization (cont.)



PCI to improve survival is reasonable in patients with UA/NSTEMI when an unprotected left main coronary artery is the culprit lesion and the patient is not a candidate for CABG.



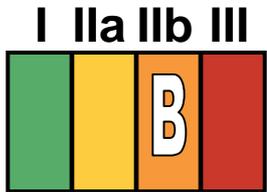
PCI to improve survival is reasonable in patients with acute STEMI when an unprotected left main coronary artery is the culprit lesion, distal coronary flow is less than TIMI grade 3, and PCI can be performed more rapidly and safely than CABG.



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# Left Main CAD Revascularization (cont.)



PCI to improve survival may be reasonable as an alternative to CABG in selected stable patients with significant ( $\geq 50\%$  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 (e.g., low–intermediate SYNTAX score of  $< 33$ , bifurcation left main CAD); and b) clinical characteristics that predict an increased risk of adverse surgical outcomes (e.g., moderate–severe chronic obstructive pulmonary disease, disability from previous stroke, or previous cardiac surgery; STS-predicted risk of operative mortality  $> 2\%$ ).



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# Left Main CAD Revascularization (cont.)



Harm

PCI to improve survival **should not be performed** in stable patients with significant ( $\geq 50\%$  diameter stenosis) unprotected left main CAD who have unfavorable anatomy for PCI and who are good candidates for CABG.



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# CAD Revascularization

## Non-Left Main CAD Revascularization



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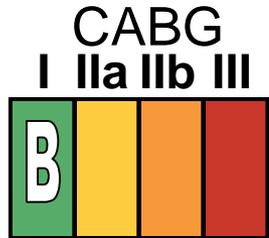


# Non-Left Main CAD

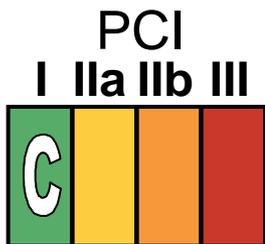
## Revascularization



CABG to improve survival is beneficial in patients with significant ( $\geq 70\%$  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.



CABG or PCI to improve survival is beneficial in survivors of sudden cardiac death with presumed ischemia-mediated ventricular tachycardia caused by significant ( $\geq 70\%$  diameter) stenosis in a major coronary artery.

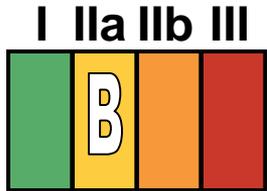


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# Non-Left Main CAD

## Revascularization (cont.)



CABG to improve survival is reasonable in patients with significant ( $\geq 70\%$  diameter) stenoses in 2 major coronary arteries with severe or extensive myocardial ischemia (e.g., 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.



CABG to improve survival is reasonable in patients with mild–moderate LV systolic dysfunction (EF 35% to 50%) and significant ( $\geq 70\%$  diameter stenosis) multivessel CAD or proximal LAD coronary artery stenosis, when viable myocardium is present in the region of intended revascularization.



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# Non-Left Main CAD

## Revascularization (cont.)



CABG with a LIMA graft to improve survival is reasonable in patients with significant ( $\geq 70\%$  diameter) stenosis in the proximal LAD artery and evidence of extensive ischemia.



It is reasonable to choose CABG over PCI to improve survival in patients with complex 3-vessel CAD (e.g., SYNTAX score  $> 22$ ), with or without involvement of the proximal LAD artery who are good candidates for CABG.



CABG is probably recommended in preference to PCI to improve survival in patients with multivessel CAD and diabetes mellitus, particularly if a LIMA graft can be anastomosed to the LAD artery.



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# Non-Left Main CAD

## Revascularization (cont.)



The usefulness of CABG to improve survival is uncertain in patients with significant ( $\geq 70\%$ ) diameter stenoses in 2 major coronary arteries not involving the proximal LAD artery and without extensive ischemia.



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.



CABG might be considered with the primary or sole intent of improving survival in patients with SIHD with severe LV systolic dysfunction (EF  $< 35\%$ ) whether or not viable myocardium is present.



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# Non-Left Main CAD Revascularization (cont.)



The usefulness of CABG or PCI to improve survival is uncertain in patients with previous CABG and extensive anterior wall ischemia on noninvasive testing.



Harm

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 (e.g., <70% diameter non-left main coronary artery stenosis, FFR >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.



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# Revascularization to Improve Symptoms With Significant Anatomic ( $\geq 50\%$ Left Main or $\geq 70\%$ Non-Left Main CAD) or Physiological (FFR $\leq 0.80$ ) Coronary Stenoses

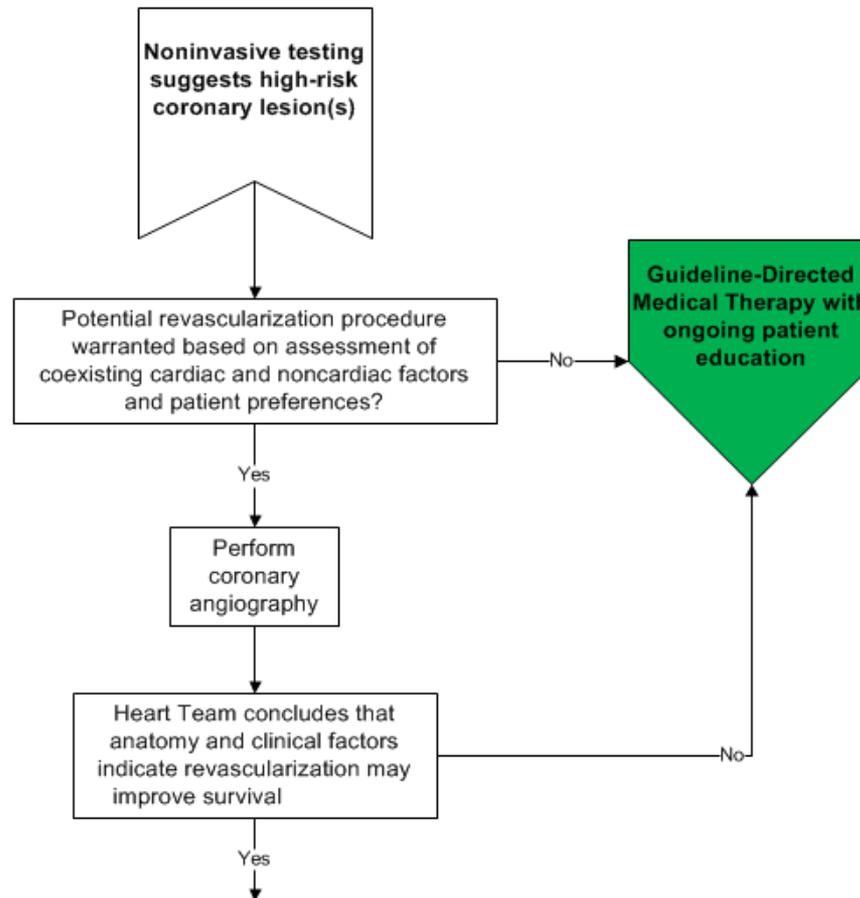
Clinical Setting	COR	LOE
$\geq 1$ significant stenoses amenable to revascularization and unacceptable angina despite GDMT	1—CABG	A
	1—PCI	
$\geq 1$ significant stenoses and unacceptable angina in whom GDMT cannot be implemented because of medication contraindications, adverse effects, or patient preferences	IIa—CABG	C
	IIa—PCI	C
Previous CABG with $\geq 1$ significant stenoses associated with ischemia and unacceptable angina despite GDMT	IIa—PCI	C
	IIb—CABG	C
Complex 3-vessel CAD (e.g., SYNTAX score $>22$ ) with or without involvement of the proximal LAD artery and a good candidate for CABG	IIa—CABG preferred over PCI	B
Viable ischemic myocardium that is perfused by coronary arteries that are not amenable to grafting	IIb—TMR as an adjunct to CABG	B
No anatomic or physiological criteria for revascularization	III: Harm—CABG	C
	III: Harm—PCI	C



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# Algorithm for Revascularization to Improve Survival of Patients With SIHD\*



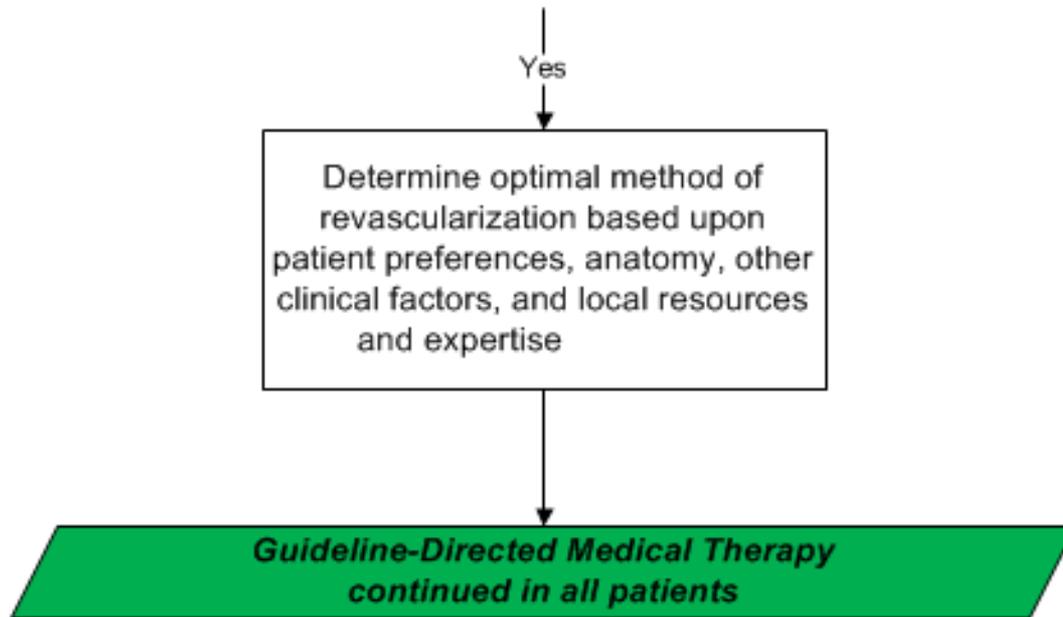
\*Colors correspond to the ACCF/AHA Classification of Recommendations and Levels of Evidence Table.



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# Algorithm for Revascularization to Improve Survival of Patients With SIHD (cont.)\*



\*Colors correspond to the ACCF/AHA Classification of Recommendations and Levels of Evidence Table.



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# CAD Revascularization

## Revascularization to Improve Symptoms



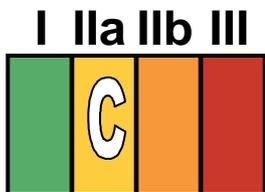
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# Revascularization to Improve Symptoms



CABG or PCI to improve symptoms is beneficial in patients with 1 or more significant ( $\geq 70\%$  diameter) coronary artery stenoses amenable to revascularization and unacceptable angina despite GDMT.



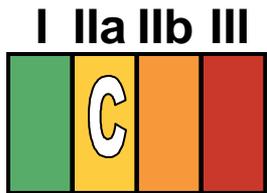
CABG or PCI to improve symptoms is reasonable in patients with 1 or more significant ( $\geq 70\%$  diameter) coronary artery stenoses and unacceptable angina for whom GDMT cannot be implemented because of medication contraindications, adverse effects, or patient preferences.



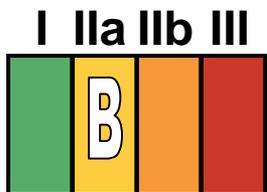
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# Revascularization to Improve Symptoms (cont.)



PCI to improve symptoms is reasonable in patients with previous CABG, 1 or more significant ( $\geq 70\%$  diameter) coronary artery stenoses associated with ischemia, and unacceptable angina despite GDMT.



It is reasonable to choose CABG over PCI to improve symptoms in patients with complex 3-vessel CAD (e.g., SYNTAX score  $> 22$ ), with or without involvement of the proximal LAD artery, who are good candidates for CABG.



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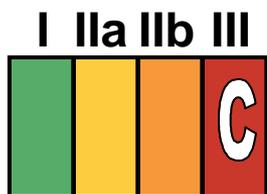
# Revascularization to Improve Symptoms (cont.)



CABG to improve symptoms might be reasonable for patients with previous CABG, 1 or more significant ( $\geq 70\%$  diameter) coronary artery stenoses not amenable to PCI, and unacceptable angina despite GDMT.



TMR performed as an adjunct to CABG to improve symptoms may be reasonable in patients with viable ischemic myocardium that is perfused by arteries that are not amenable to grafting.



Harm

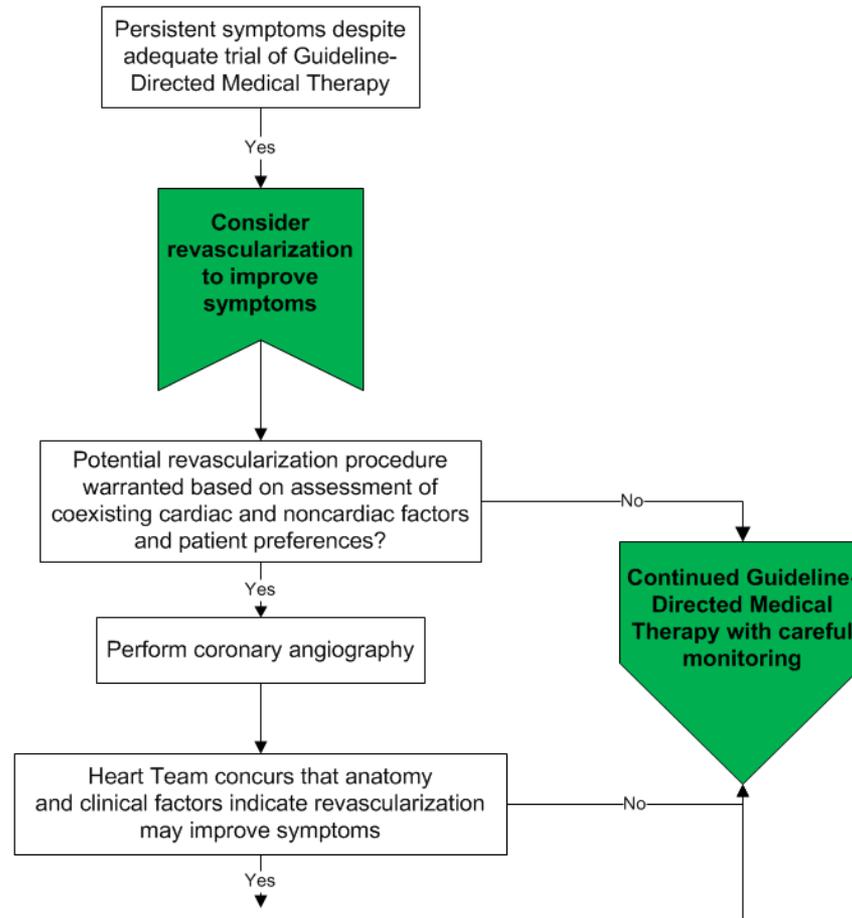
CABG or PCI to improve symptoms **should not be performed** in patients who do not meet anatomic ( $\geq 50\%$  diameter left main or  $\geq 70\%$  non-left main stenosis diameter) or physiological (e.g., abnormal FFR) criteria for revascularization.



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# Algorithm for Revascularization to Improve Symptoms of Patients With SIHD\*



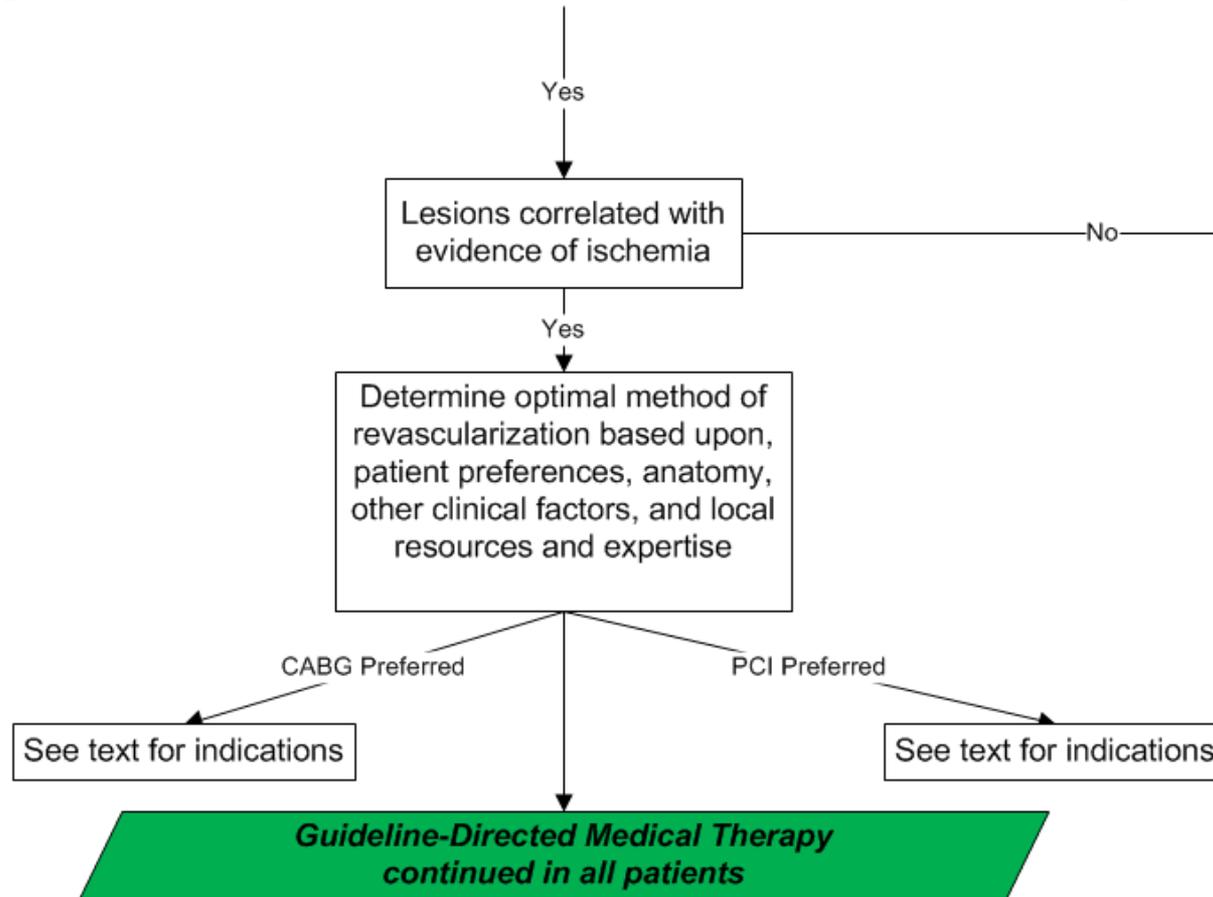
\*Colors correspond to the ACCF/AHA Classification of Recommendations and Levels of Evidence Table.



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# Algorithm for Revascularization to Improve Symptoms of Patients With SIHD (cont.)\*



\*Colors correspond to the ACCF/AHA Classification of Recommendations and Levels of Evidence Table.



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# CAD Revascularization

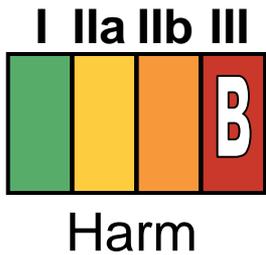
## Dual Antiplatelet Therapy Compliance and Stent Thrombosis



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# Dual Antiplatelet Therapy Compliance and Stent Thrombosis



PCI with coronary stenting (BMS or DES) **should not be performed** if the patient is not likely to be able to tolerate and comply with DAPT for the appropriate duration of treatment based on the type of stent implanted.



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# CAD Revascularization

## Hybrid Coronary Revascularization



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# Hybrid Coronary Revascularization



Hybrid coronary revascularization (defined as the planned combination of LIMA-to-LAD artery grafting and PCI of  $\geq 1$  non-LAD coronary arteries) is reasonable in patients with 1 or more of the following:

- 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 (i.e., excessive vessel tortuosity or chronic total occlusion).



Hybrid coronary revascularization (defined as the planned combination of LIMA-to-LAD artery grafting and PCI of  $\geq 1$  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.



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# Guideline for SIHD

## Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy



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# Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy

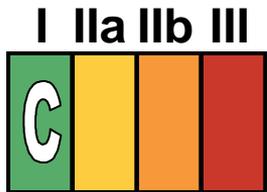
## Clinical Evaluation, Echocardiography During Routine, Periodic Follow-Up



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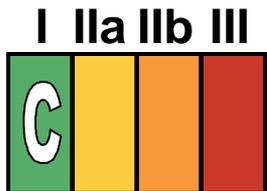


# Clinical Evaluation, Echocardiography During Routine, Periodic Follow-Up



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

- Assessment of symptoms and clinical function;
- Surveillance for complications of SIHD, including heart failure and arrhythmias;
- Monitoring of cardiac risk factors; and
- Assessment of the adequacy of and adherence to recommended lifestyle changes and medical therapy.



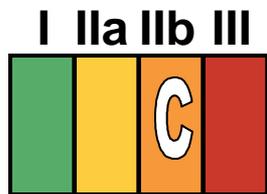
Assessment of LVEF and segmental wall motion by echocardiography or radionuclide imaging is recommended in patients with new or worsening heart failure or evidence of intervening MI by history or ECG.



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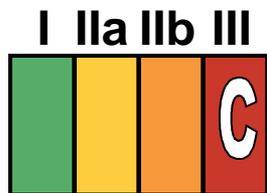
# Clinical Evaluation, Echocardiography During Routine, Periodic Follow-Up (cont.)



Periodic screening for important comorbidities that are prevalent in patients with SIHD, including diabetes mellitus, depression, and CKD, might be reasonable.



A resting 12-lead ECG at 1-year or longer intervals between studies in patients with stable symptoms might be reasonable.



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.



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# Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy

## Noninvasive Testing in Known SIHD



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# Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy

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



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# Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy

## Patients Able to Exercise



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# Patients Able to Exercise



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.



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.



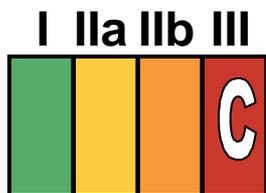
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# Patients Able to Exercise (cont.)



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.



No Benefit

Pharmacological stress imaging with nuclear MPI, echocardiography, or CMR is not recommended in patients with known SIHD who have new or worsening symptoms not consistent with UA and who are capable of at least moderate physical functioning or have no disabling comorbidity.



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# Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy

## Patients Unable to Exercise



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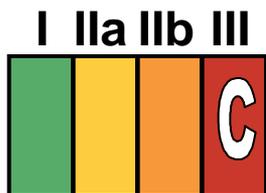
# Patients Unable to Exercise



Pharmacological stress imaging with nuclear MPI or echocardiography is recommended 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.



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.



No Benefit

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.



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# Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy

## Irrespective of Ability to Exercise



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# Irrespective of Ability to Exercise



CCTA for assessment of patency of CABG or of coronary stents 3 mm or larger in diameter might be reasonable in patients with known SIHD who have new or worsening symptoms not consistent with UA, irrespective of ability to exercise.



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.



No Benefit

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.



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# Patient Follow-Up: Monitoring of Symptoms and Antianginal Therapy

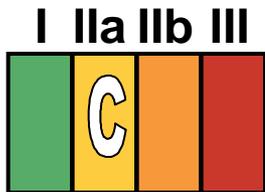
## Noninvasive Testing in Known SIHD—Asymptomatic (or Stable Symptoms)



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# Noninvasive Testing in Known SIHD— Asymptomatic (or Stable Symptoms)



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



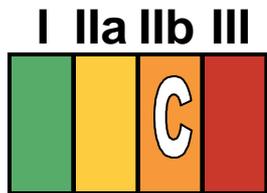
Standard exercise ECG testing performed at 1-year or longer intervals might be considered for follow-up assessment in patients with SIHD who have had prior evidence of silent ischemia or are at high risk for a recurrent cardiac event and are able to exercise to an adequate workload and have an interpretable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



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# Noninvasive Testing in Known SIHD—Asymptomatic (or Stable Symptoms) (cont.)



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.



No Benefit

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.



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

Test	Exercise Status		ECG Interpretable		COR	LOE	Additional Considerations
	Able	Unable	Yes	No			
Patients able to exercise*							
Exercise ECG	X		X		I	B	
Exercise with nuclear MPI or Echo	X			X	I	B	
Exercise with nuclear MPI or Echo	X		Any		IIa	B	<ul style="list-style-type: none"> <li>• Prior requirement for imaging with exercise</li> <li>• Known or at high risk for multivessel disease</li> </ul>
Pharmacological stress nuclear MPI/Echo/CMR	X		X		III: No Benefit	C	
Patients unable to exercise							
Pharmacological stress nuclear MPI or Echo		X	Any		I	B	
Pharmacological stress CMR		X	Any		IIa	B	
Exercise ECG		X		X	III: No Benefit	C	
Irrespective of ability to exercise							
CCTA	Any		Any		IIb	B	Patency of CABG or coronary stent $\geq 3$ mm diameter
CCTA	Any		Any		IIb	B	In the absence of known moderate or severe calcification and intent to assess coronary stent $< 3$ mm in diameter
CCTA	Any		Any		III: No Benefit	B	Known moderate or severe native coronary calcification or assessment of coronary stent $< 3$ mm in diameter in patients who have new or worsening symptoms not consistent with UA

\*Patients are candidates for exercise testing if they are capable of performing at least moderate physical functioning (i.e., 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.



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# Noninvasive Testing in Known SIHD: Asymptomatic (or Stable Symptoms)

Test	Exercise Status		ECG Interpretable		Pretest Probability of Ischemia	COR	LOE	Additional Considerations
	Able*	Unable	Yes	No				
Exercise or pharmacological stress with nuclear MPI, Echo, or CMR at $\geq 2$ -y intervals		X		X	Prior evidence of silent ischemia or high risk for recurrent cardiac event. Meets criteria listed in additional considerations.	IIa	C	a) Unable to exercise to adequate workload or b) Uninterpretable ECG or c) History of incomplete coronary revascularization
Exercise ECG at $\geq 1$ -y intervals	X		X		Any	IIb	C	a) Prior evidence of silent ischemia OR b) At high risk for recurrent cardiac event
Exercise ECG	X		X		No prior evidence of silent ischemia and not at high risk of recurrent cardiac event.	IIb	C	For annual surveillance
Exercise or pharmacological stress with nuclear MPI, Echo, or CMR or CCTA	Any		Any		Any	III: No Benefit	C	a) <5-y intervals after CABG, or b) <2-y intervals after PCI

\*Patients are candidates for exercise testing if they are capable of performing at least moderate physical functioning (i.e., 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.



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