2011 ACCF/AHA Guidelines for Coronary Artery Bypass Graft Surgery

Developed in Collaboration with and endorsed by the American Association for Thoracic Surgery, Society of Cardiovascular Anesthesiologists, and Society for Thoracic Surgeons

Helping Cardiovascular Professionals Learn. Advance. Heal.

American Heart Association®

Citation

This slide set was adapted from the 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery. Published on November 7th ahead of print, available at: http://circ.ahajournals.org/lookup/doi/10.1161/CIR.0b013e31823c074e.

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

Helping Cardiovascular Professionals
Learn. Advance. Heal.

American Heart Association.

Special Thanks To

Slide Set Editors

L. David Hillis, MD, FACC, Chair and Peter K. Smith, MD, FACC, Vice Chair

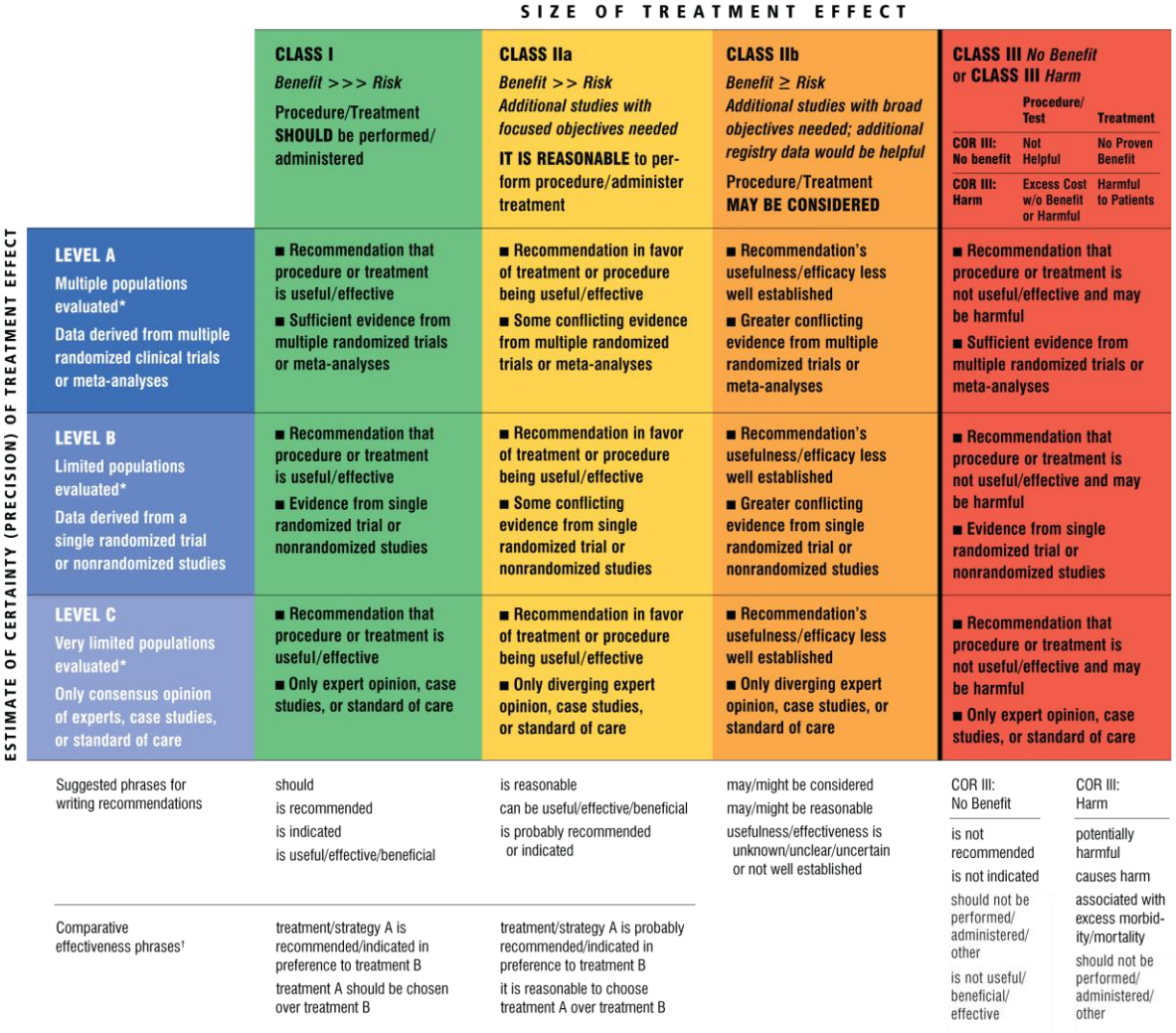
CABG Guideline Writing Committee Members

L. David Hillis, MD, FACC, Chair

Peter K. Smith, MD, FACC, Vice Chair

Jeffrey L. Anderson, MD, FACC
John A. Bittl, MD, FACC
Charles R. Bridges, MD, ScD, FACC, FAHA
John G. Byrne, MD, FACC
Joaquin E. Cigarroa, MD, FACC
Verdi J. DiSesa, MD, FACC
Loren F. Hiratzka, MD, FACC, FAHA
Adolph M. Hutter, Jr., MD, MACC, FAHA
Michael E. Jessen, MD, FACC
Ellen C. Keeley, MD, MS
Stephen J. Lahey, MD
Richard A. Lange, MD, FACC, FAHA
Martin J. London, MD
Michael J. Mack, MD, FACC
Manesh R. Patel, MD, FACC
John D. Puskas, MD, FACC
Joseph F. Sabik, MD, FACC
Ola Selnes, PhD
David M. Shahian, MD, FACC, FAHA
Jeffrey C. Trost, MD, FACC
Michael D. Winniford, MD, FACC

Classification of Recommendations and Levels of Evidence



SIZE OF TREATMENT EFFECT

ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT

	CLASS I *Benefit >>> Risk* Procedure/Treatment **SHOULD** be performed/ administered	CLASS IIa *Benefit >> Risk* *Additional studies with focused objectives needed* **IT IS REASONABLE** to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment **MAY BE CONSIDERED**	CLASS III *No Benefit* or CLASS III *Harm* Procedure/ Test / Treatment COR III: No benefit — Not Helpful / No Proven Benefit COR III: Harm — Excess Cost w/o Benefit or Harmful / Harmful to Patients
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
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.

Procedural Considerations

Anesthetic Considerations

Anesthetic Considerations

Anesthetic management directed toward early postoperative extubation and accelerated recovery of low- to medium-risk patients undergoing uncomplicated CABG is recommended.

Multidisciplinary efforts are indicated to ensure an optimal level of analgesia and patient comfort throughout the perioperative period.

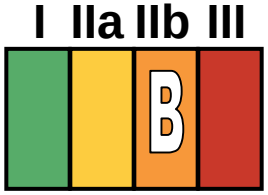
Anesthetic Considerations (cont.)

Efforts are recommended to improve interdisciplinary communication and patient safety in the perioperative environment (e.g., formalized checklist-guided multidisciplinary communication).

A fellowship-trained cardiac anesthesiologist (or experienced board-certified practitioner) credentialed in the use of perioperative TEE is recommended to provide or supervise anesthetic care of patients who are considered to be at high risk.

Anesthetic Considerations (cont.)

Volatile anesthestic-based regimens can be useful in facilitating early extubation and reducing patient recall.



The effectiveness of high thoracic epidural anesthesia/analgesia for routine analgesic use is uncertain.

Anesthetic Considerations (cont.)

Harm

Cyclooxygenase-2 inhibitors are not recommended for pain relief in the postoperative period after CABG.

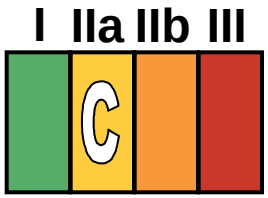
Harm

Routine use of early extubation strategies in facilities with limited backup for airway emergencies or advanced respiratory support is potentially harmful.

Bypass Graft Conduit

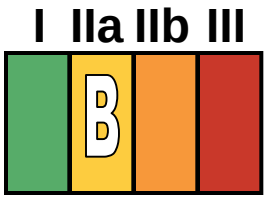
Bypass Graft Conduit

If possible, the LIMA should be used to bypass the LAD artery when bypass of the LAD artery is indicated.



The right IMA is probably indicated to bypass the LAD artery when the LIMA is unavailable or unsuitable as a bypass conduit.

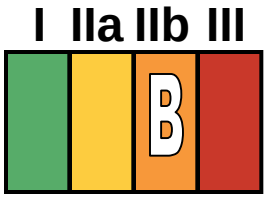
Bypass Graft Conduit (cont.)



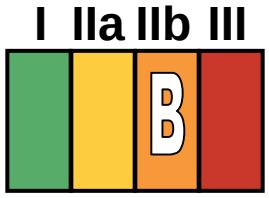
When anatomically and clinically suitable, use of a second IMA to graft the left circumflex or right coronary artery (when critically stenosed and perfusing LV myocardium) is reasonable to improve the likelihood of survival and to decrease reintervention.

Complete arterial revascularization may be reasonable in patients ≤60 years of age with few or no comorbidities.

Bypass Graft Conduit (cont.)



Arterial grafting of the right coronary artery may be reasonable when a critical (≥90%) stenosis is present.



Use of a radial artery graft may be reasonable when grafting left-sided coronary arteries with severe stenoses (>70% diameter) and right-sided arteries with critical stenoses (≥90%) that perfuse LV myocardium.

Bypass Graft Conduit (cont.)

An arterial graft should not be used to bypass the right coronary artery with less than a critical stenosis (<90%).

Harm

Intraoperative TEE

Intraoperative TEE

Intraoperative TEE should be performed for evaluation of acute, persistent, and life-threatening hemodynamic disturbances that have not responded to treatment.

Intraoperative TEE should be performed in patients undergoing concomitant valvular surgery.

Intraoperative TEE (cont.)

Intraoperative TEE is reasonable for monitoring of hemodynamic status, ventricular function, regional wall motion, and valvular function in patients undergoing CABG.

Preconditioning/Management of Myocardial Ischemia

Preconditioning/Management of Myocardial Ischemia

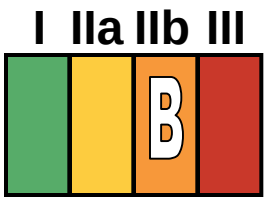
Management targeted at optimizing the determinants of coronary arterial perfusion (e.g., heart rate, diastolic or mean arterial pressure, and RV or LV end-diastolic pressure) is recommended to reduce the risk of perioperative myocardial ischemia and infarction.

Preconditioning/Management of Myocardial Ischemia (cont.)

Volatile-based anesthesia can be useful in reducing the risk of perioperative myocardial ischemia and infarction.

The effectiveness of prophylactic pharmacological therapies or controlled reperfusion strategies aimed at inducing preconditioning or attenuating the adverse consequences of myocardial reperfusion injury or surgically induced systemic inflammation is uncertain.

Preconditioning/Management of Myocardial Ischemia (cont.)



Mechanical preconditioning might be considered to reduce the risk of perioperative myocardial ischemia and infarction in patients undergoing off-pump CABG.

Remote ischemic preconditioning strategies using peripheral-extremity occlusion/reperfusion might be considered to attenuate the adverse consequences of myocardial reperfusion injury.

The effectiveness of postconditioning strategies to attenuate the adverse consequences of myocardial reperfusion injury is uncertain.

CABG in Patients With Acute MI

CABG in Patients With Acute MI

Emergency CABG is recommended in patients with acute MI in whom 1) primary PCI has failed or cannot be performed, 2) coronary anatomy is suitable for CABG, and 3) persistent ischemia of a significant area of myocardium at rest and/or hemodynamic instability refractory to nonsurgical therapy is present.

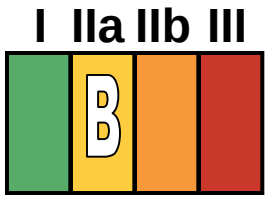
Emergency CABG is recommended in patients undergoing surgical repair of a postinfarction mechanical complication of MI, such as ventricular septal rupture, mitral valve insufficiency because of papillary muscle infarction and/or rupture, or free wall rupture.

CABG in Patients With Acute MI (cont.)

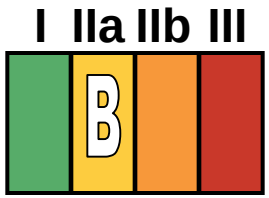
Emergency CABG is recommended in patients with cardiogenic shock and who are suitable for CABG irrespective of the time interval from MI to onset of shock and time from MI to CABG.

Emergency CABG is recommended in patients with life-threatening ventricular arrhythmias (believed to be ischemic in origin) in the presence of a left main stenosis ≥50% and/or 3-vessel CAD.

CABG in Patients With Acute MI (cont.)



The use of CABG is reasonable as a revascularization strategy in patients with multivessel CAD with recurrent angina or MI within the first 48 hours of STEMI presentation as an alternative to a more delayed strategy.



Early revascularization with PCI or CABG is reasonable for selected patients >75 years of age with ST-segment elevation or left bundle branch block who are suitable for revascularization irrespective of the time interval from MI to onset of shock.

CABG in Patients With Acute MI (cont.)

Harm

Emergency CABG should not be performed in patients with persistent angina and a small area of viable myocardium who are stable hemodynamically.

Harm

Emergency CABG should not be performed in patients with no-reflow (successful epicardial reperfusion with unsuccessful microvascular reperfusion).

Life-Threatening Ventricular Arrhythmias

Life-Threatening Ventricular Arrhythmias

CABG is recommended in patients with resuscitated sudden cardiac death or sustained ventricular tachycardia thought to be caused by significant CAD (≥50% stenosis of the left main coronary artery and/or ≥70% stenosis of 1, 2, or all 3 epicardial coronary arteries) and resultant myocardial ischemia.

CABG should not be performed in patients with ventricular tachycardia with scar and no evidence of ischemia.

Harm

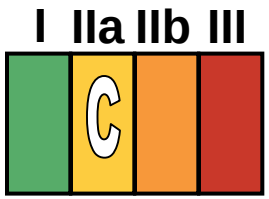
Emergency CABG After Failed PCI

Emergency CABG After Failed PCI

Emergency CABG is recommended after failed PCI in the presence of ongoing ischemia or threatened occlusion with substantial myocardium at risk.

Emergency CABG is recommended after failed PCI for hemodynamic compromise in patients without impairment of the coagulation system and without a previous sternotomy.

Emergency CABG After Failed PCI



Emergency CABG is reasonable after failed PCI for retrieval of a foreign body (most likely a fractured guidewire or stent) in a crucial anatomic location.

Emergency CABG can be beneficial after failed PCI for hemodynamic compromise in patients with impairment of the coagulation system and without a previous sternotomy.

Emergency CABG After Failed PCI (cont.)

Emergency CABG might be considered after failed PCI for hemodynamic compromise in patients with a previous sternotomy.

Emergency CABG After Failed PCI (cont.)

Harm

Emergency CABG should not be performed after failed PCI in the absence of ischemia or threatened occlusion.

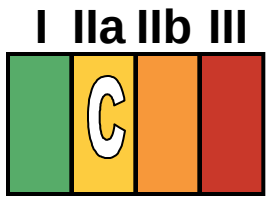
Harm

Emergency CABG should not be performed after failed PCI if revascularization is impossible because of target anatomy or a no-reflow state.

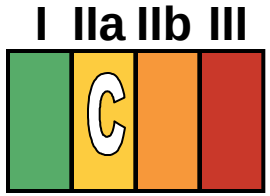
CABG in Association With Other Cardiac Procedures

CABG in Association With Other Cardiac Procedures

CABG is recommended in patients undergoing noncoronary cardiac surgery with ≥50% luminal diameter narrowing of the left main coronary artery ≥70% luminal diameter narrowing of other major coronary arteries.



The use of the LIMA is reasonable to bypass a significantly narrowed LAD artery in patients undergoing noncoronary cardiac surgery.



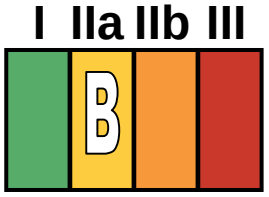
CABG of moderately diseased coronary arteries (>50% luminal diameter narrowing) is reasonable in patients undergoing noncoronary cardiac surgery.

CAD Revascularization

Heart Team Approach to Revascularization Decisions

Heart Team Approach to Revascularization Decisions

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

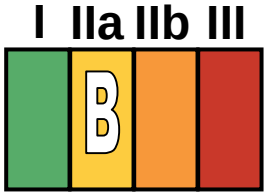


Calculation of the STS and SYNTAX scores is reasonable in patients with unprotected left main and complex CAD.

Revascularization to Improve Survival

Revascularization to Improve Survival: Left Main CAD Revascularization

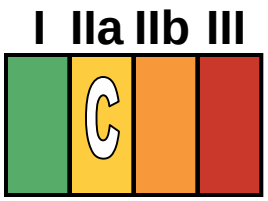
CABG to improve survival is recommended for patients with significant (≥50% diameter stenosis) left main CAD.



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 a good long-term outcome (e.g., 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 (e.g., STS-predicted risk of operative mortality ≥5%).

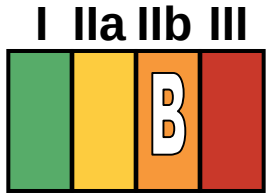
Revascularization to Improve Survival: Left Main CAD Revascularization (cont.)

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 TIMI (Thrombolysis In Myocardial Infarction) grade <3, and PCI can be performed more rapidly and safely than CABG.

Revascularization to Improve Survival: Left Main CAD Revascularization (cont.)



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: 1) 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 2) 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%).

Revascularization to Improve Survival: Left Main CAD Revascularization (cont.)

Harm

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.

Revascularization to Improve Survival: Non-Left Main CAD Revascularization

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 plus 1 other major coronary artery.

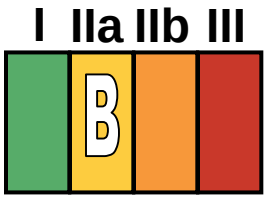
Revascularization to Improve Survival: Non-Left Main CAD Revascularization (cont.)

CABG

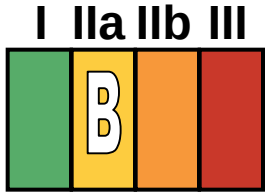
PCI

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

Revascularization to Improve Survival: Non-Left Main CAD Revascularization (cont.)

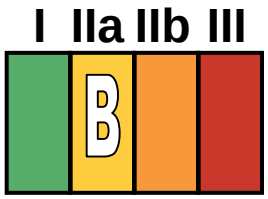


CABG to improve survival is reasonable in patients with significant (≥70% diameter) stenoses in 2 major coronary arteries with severe or extensive myocardial ischemia (e.g., high-risk criteria on stress testing, abnormal intracoronary hemodynamic evaluation, or >20% perfusion defect by myocardial perfusion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

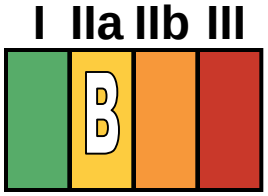


CABG to improve survival is reasonable in patients with mild-moderate left ventricular systolic dysfunction (ejection fraction 35% to 50%) and significant (≥70% diameter stenosis) multivessel CAD or proximal LAD coronary artery stenosis, when viable myocardium is present in the region of intended revascularization.

Revascularization to Improve Survival: Non-Left Main CAD Revascularization (cont.)



CABG with a LIMA graft to improve survival is reasonable in patients with a significant (≥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.

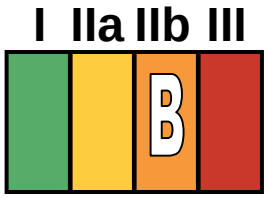
Revascularization to Improve Survival: Non-Left Main CAD Revascularization (cont.)

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.

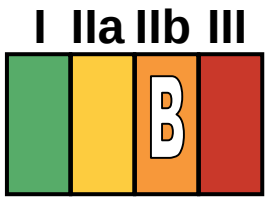
The usefulness of CABG to improve survival is uncertain in patients with significant (≥70%) stenoses in 2 major coronary arteries not involving the proximal LAD artery and without extensive ischemia.

Revascularization to Improve Survival: Non-Left Main CAD Revascularization (cont.)

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.



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

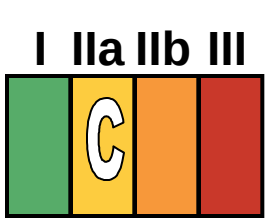
Revascularization to Improve Survival: Non-Left Main CAD Revascularization (cont.)

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, 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.

Revascularization to Improve Symptoms

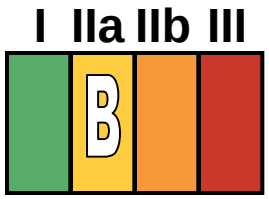
CABG or PCI to improve symptoms is beneficial in patients with 1 or more significant (≥70% diameter) coronary artery stenoses amenable to revascularization and unacceptable angina despite GDMT.



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.

Revascularization to Improve Symptoms (cont.)

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.



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.

Revascularization to Improve Symptoms (cont.)

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.

Transmyocardial laser revascularization 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.

Revascularization to Improve Symptoms (cont.)

Harm

CABG or PCI to improve symptoms should not be performed in patients who do not meet anatomic (≥50% left main or ≥70% non–left main stenosis) or physiologic (e.g., abnormal fractional flow reserve) criteria for revascularization.

Dual Antiplatelet Therapy Compliance and Stent Thrombosis

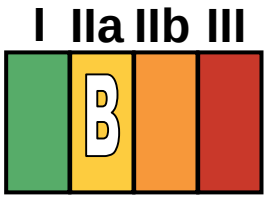
Dual Antiplatelet Therapy Compliance and Stent Thrombosis

Harm

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 dual antiplatelet therapy for the appropriate duration of treatment based on the type of stent implanted.

Hybrid Coronary Revascularization

Hybrid Coronary Revascularization



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:

a. Limitations to traditional CABG, such as a 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 (cont.)

Hybrid coronary revascularization (defined as the planned combination of LIMA-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.

Guideline for CABG

Perioperative Management

Helping Cardiovascular Professionals
Learn. Advance. Heal.

American Heart Association®

Preoperative Antiplatelet Therapy

Preoperative Antiplatelet Therapy

Aspirin (100 mg to 325 mg daily) should be administered to CABG patients preoperatively.

Clopidogrel & Ticagrelor

In patients referred for elective CABG, clopidogrel and ticagrelor should be discontinued for at least 5 days before surgery and prasugrel for at least 7 days to limit blood transfusions.

Prasugrel

Preoperative Antiplatelet Therapy (cont.)

In patients referred for urgent CABG, clopidogrel and ticagrelor should be discontinued for at least 24 hours to reduce major bleeding complications.

In patients referred for CABG, short-acting IV glycoprotein IIb/IIIa inhibitors (eptifibatide or tirofiban) should be discontinued for at least 2 to 4 hours before surgery and abciximab for at least 12 hours beforehand to limit blood loss and transfusions.

Preoperative Antiplatelet Therapy (cont.)

In patients referred for urgent CABG, it may be reasonable to perform surgery <5 days after clopidogrel or ticagrelor has been discontinued and <7 days after prasugrel has been discontinued.

Postoperative Antiplatelet Therapy

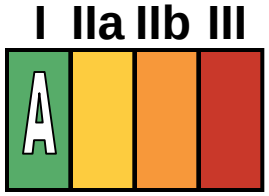
Postoperative Antiplatelet Therapy

If aspirin (100 mg to 325 mg daily) was not initiated preoperatively, it should be initiated within 6 hours postoperatively and then continued indefinitely to reduce the occurrence of SVG closure and adverse cardiovascular events.

For patients undergoing CABG, clopidogrel 75 mg daily is a reasonable alternative in patients who are intolerant of or allergic to aspirin.

Management of Hyperlipidemia

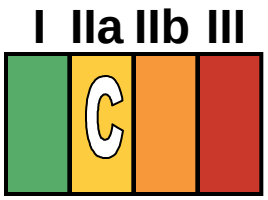
Management of Hyperlipidemia



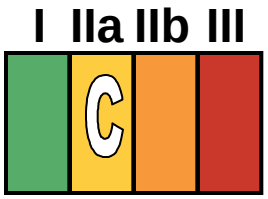
All patients undergoing CABG should receive statin therapy, unless contraindicated.

In patients undergoing CABG, an adequate dose of statin should be used to reduce LDL cholesterol to <100 mg/dL and to achieve at least a 30% lowering of LDL cholesterol.

Management of Hyperlipidemia (cont.)



In patients undergoing CABG, it is reasonable to treat with statin therapy to lower the LDL cholesterol to <70 mg/dL in very high-risk patients.



For patients undergoing urgent or emergency CABG who are not taking a statin, it is reasonable to initiate high-dose statin therapy immediately.

Management of Hyperlipidemia (cont.)

Harm

Discontinuation of statin or other dyslipidemic therapy is not recommended before or after CABG in patients without adverse reactions to therapy.

Hormonal Manipulation

Hormonal Manipulation

Use of continuous IV insulin to achieve and maintain an early postoperative blood glucose concentration ≤180 mg/dL while avoiding hypoglycemia is indicated to reduce the incidence of adverse events, including DSWI, after CABG.

The use of continuous IV insulin designed to achieve a target intraoperative blood glucose concentration <140 mg/dL has uncertain effectiveness.

Hormonal Manipulation (cont.)

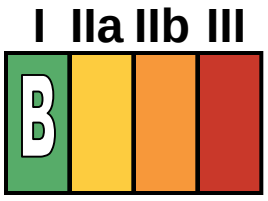
Harm

Postmenopausal hormonal therapy (estrogen/ progesterone) should not be administered to women undergoing CABG.

Perioperative Beta Blockers

Perioperative Beta Blockers

Beta blockers should be administered for at least 24 hours before CABG to all patients without contraindications to reduce the incidence or clinical sequelae of postoperative AF.

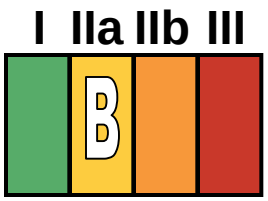


Beta blockers should be reinstituted as soon as possible after CABG in all patients without contraindications to reduce the incidence or clinical sequelae of AF.

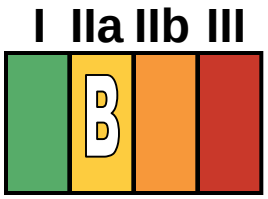
Perioperative Beta Blockers (cont.)

Beta blockers should be prescribed to all CABG patients without contraindications at the time of hospital discharge.

Perioperative Beta Blockers (cont.)

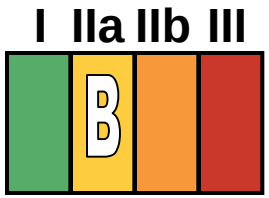


Preoperative use of beta blockers in patients without contraindications, particularly in those with an LVEF >30%, can be effective in reducing the risk of in-hospital mortality.

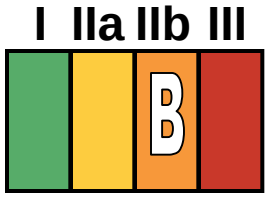


Beta blockers can be effective in reducing the incidence of perioperative myocardial ischemia.

Perioperative Beta Blockers (cont.)



Intravenous administration of beta blockers in clinically stable patients unable to take oral medications is reasonable in the early postoperative period.



The effectiveness of preoperative beta blockers in reducing in-hospital mortality rates in patients with LVEF <30% is uncertain.

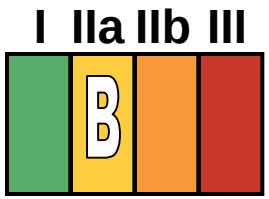
Angiotensin-Converting Enzyme Inhibitors and Angiotensin-Receptor Blockers

Angiotensin-Converting Enzyme Inhibitors and Angiotensin-Receptor Blockers

ACE inhibitors and ARBs given before CABG should be reinstituted postoperatively once the patient is stable, unless contraindicated.

ACE inhibitors or ARBs should be initiated postoperatively and continued indefinitely in CABG patients who were not receiving them preoperatively, who are stable, and who have an LVEF ≤40%, hypertension, diabetes mellitus, or chronic kidney disease, unless contraindicated.

Angiotensin-Converting Enzyme Inhibitors and Angiotensin-Receptor Blockers (cont.)



It is reasonable to initiate ACE inhibitors or ARBs postoperatively and to continue them indefinitely in all CABG patients who were not receiving them preoperatively and are considered to be at low risk (i.e., those with a normal LVEF in whom cardiovascular risk factors are well controlled), unless contraindicated.

Angiotensin-Converting Enzyme Inhibitors and Angiotensin-Receptor Blockers (cont.)

The safety of the preoperative administration of ACE inhibitors or ARBs in patients on chronic therapy is uncertain.

The safety of initiating ACE inhibitors or ARBs before hospital discharge is not well established.

Smoking Cessation

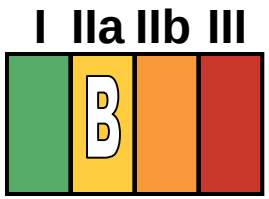
Smoking Cessation

All smokers should receive in-hospital educational counseling and be offered smoking cessation therapy during CABG hospitalization.

The effectiveness of pharmacological therapy for smoking cessation offered to patients before hospital discharge is uncertain.

Emotional Dysfunction and Psychosocial Considerations

Emotional Dysfunction and Psychosocial Considerations



Cognitive behavior therapy or collaborative care for patients with clinical depression after CABG can be beneficial to reduce objective measures of depression.

Cardiac Rehabilitation

Cardiac Rehabilitation

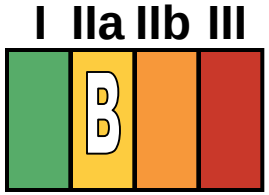
Cardiac rehabilitation is recommended for all eligible patients after CABG.

Perioperative Monitoring

Electrocardiographic Monitoring

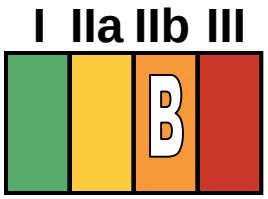
Electrocardiographic Monitoring

Continuous monitoring of the electrocardiogram for arrhythmias should be performed for at least 48 hours in all patients after CABG.



Continuous ST-segment monitoring for detection of ischemia is reasonable in the intraoperative period for patients undergoing CABG.

Electrocardiographic Monitoring (cont.)

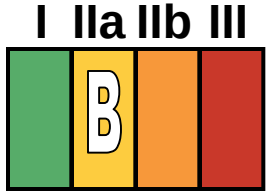


Continuous ST-segment monitoring for detection of ischemia may be considered in the early postoperative period after CABG.

Pulmonary Artery Catheterization

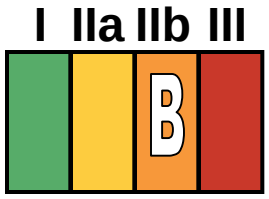
Pulmonary Artery Catheterization

Placement of a PAC is indicated, preferably before the induction of anesthesia or surgical incision, in patients in cardiogenic shock undergoing CABG.



Placement of a PAC can be useful in the intraoperative or early postoperative period in patients with acute hemodynamic instability.

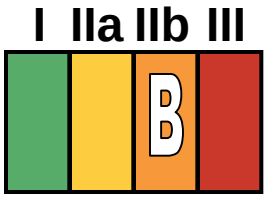
Pulmonary Artery Catheterization (cont.)



Placement of a PAC may be reasonable in clinically stable patients undergoing CABG after consideration of baseline patient risk, the planned surgical procedure, and the practice setting.

Central Nervous System Monitoring

Central Nervous System Monitoring



The effectiveness of intraoperative monitoring of the processed electroencephalogram to reduce the possibility of adverse recall of clinical events or for detection of cerebral hypoperfusion in CABG patients is uncertain.

The effectiveness of routine use of intraoperative or early postoperative monitoring of cerebral oxygen saturation via near-infrared spectroscopy to detect cerebral hypoperfusion in patients undergoing CABG is uncertain.

CABG-Associated Morbidity and Mortality: Occurrence and Prevention

CABG-Associated Morbidity and Mortality: Occurrence and Prevention

Public Reporting of Cardiac Surgery Outcomes

Public Reporting of Cardiac Surgery Outcomes

Public reporting of cardiac surgery outcomes should use risk-adjusted results based on clinical data.

CABG-Associated Morbidity and Mortality: Occurrence and Prevention

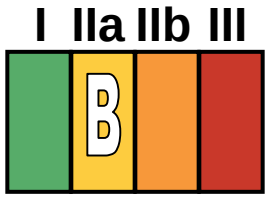
Use of Outcomes or Volume as CABG Quality Measures

Helping Cardiovascular Professionals Learn. Advance. Heal.

American Heart Association®

Use of Outcomes or Volume as CABG Quality Measures

All cardiac surgery programs should participate in a state, regional, or national clinical data registry and should receive periodic reports of their risk-adjusted outcomes.



When credible risk-adjusted outcomes data are not available, volume can be useful as a structural metric of CABG quality.

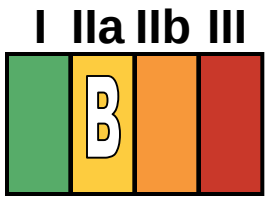
Use of Outcomes or Volume as CABG Quality Measures (cont.)

Affiliation with a high-volume tertiary center might be considered by cardiac surgery programs that perform fewer than 125 CABG procedures annually.

CABG-Associated Morbidity and Mortality: Occurrence and Prevention

Adverse Events

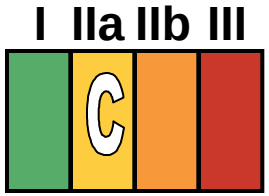
Use of Epiaortic Ultrasound Imaging to Reduce Stroke Rates



Routine epiaortic ultrasound scanning is reasonable to evaluate the presence, location, and severity of plaque in the ascending aorta to reduce the incidence of atheroembolic complications.

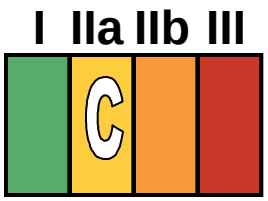
The Role of Preoperative Carotid Artery Noninvasive Screening in CABG Patients

A multidisciplinary team approach (consisting of a cardiologist, cardiac surgeon, vascular surgeon, and neurologist) is recommended for patients with clinically significant carotid artery disease for whom CABG is planned.



Carotid artery duplex scanning is reasonable in selected patients who are considered to have high-risk features (i.e., age >65 years, left main coronary stenosis, PAD, history of cerebrovascular disease [TIA, stroke, etc.], hypertension, smoking, and diabetes mellitus).

The Role of Preoperative Carotid Artery Noninvasive Screening in CABG Patients (cont.)



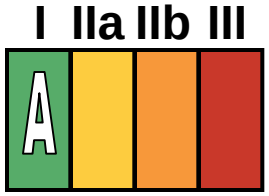
In the CABG patient with a previous TIA or stroke and a significant (50% to 99%) carotid artery stenosis, it is reasonable to consider carotid revascularization in conjunction with CABG. In such an individual, the sequence and timing (simultaneous or staged) of carotid intervention and CABG should be determined by the subject's relative magnitudes of cerebral and myocardial dysfunction.

In the patient scheduled to undergo CABG who has no history of TIA or stroke, carotid revascularization may be considered in the presence of bilateral severe (70% to 99%) carotid stenoses or a unilateral severe carotid stenosis with a contralateral occlusion.

CABG-Associated Morbidity and Mortality: Occurrence and Prevention

Mediastinitis/Perioperative Infection

Mediastinitis/Perioperative Infection



Preoperative antibiotics should be administered to all patients to reduce the risk of postoperative infection.

A second-generation cephalosporin is recommended for prophylaxis in patients without methicillin-resistant *Staphylococcus aureus* colonization.

Mediastinitis/Perioperative Infection (cont.)

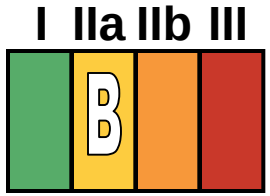
Vancomycin alone or in combination with other antibiotics to achieve broader coverage is recommended for prophylaxis in patients with proven or suspected methicillin-resistant *S. aureus* colonization.

A DSWI should be treated with aggressive surgical debridement in the absence of complicating circumstances. Primary or secondary closure with a muscle or omental flap is recommended. Vacuum therapy in conjunction with early and aggressive debridement is an effective adjunctive therapy.

Mediastinitis/Perioperative Infection (cont.)

Use of a continuous IV insulin protocol to achieve and maintain an early postoperative blood glucose concentration≤180 mg/dL while avoiding hypoglycemia is indicated to reduce the risk of DSWI.

Mediastinitis/Perioperative Infection (cont.)

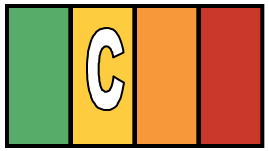


When blood transfusions are needed, leukocyte-filtered blood can be useful to reduce the rate of overall perioperative infection and in-hospital death.

The use of intranasal mupirocin is reasonable in nasal carriers of *S. aureus*.

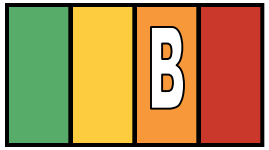
Mediastinitis/Perioperative Infection (cont.)

I IIa IIb III



The routine use of intranasal mupirocin is reasonable in patients who are not carriers of *S. aureus,* unless an allergy exists.

I IIa IIb III

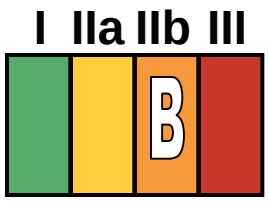


The use of bilateral IMAs in patients with diabetes mellitus is associated with an increased risk of DSWI, but it may be reasonable when the overall benefit to the patient outweighs this increased risk.

CABG-Associated Morbidity and Mortality: Occurrence and Prevention

Renal Dysfunction

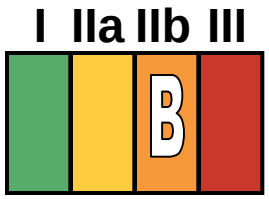
Renal Dysfunction



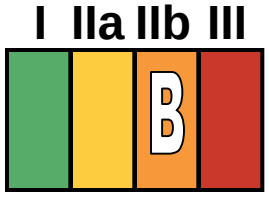
In patients with preoperative renal dysfunction (creatinine clearance <60 mL/min), off-pump CABG may be reasonable to reduce the risk of AKI.

In patients with preexisting renal dysfunction undergoing on-pump CABG, maintenance of a perioperative hematocrit >19% and mean arterial pressure >60 mm Hg may be reasonable.

Renal Dysfunction (cont.)



In patients with preexisting renal dysfunction, a delay of surgery after coronary angiography may be reasonable until the effect of radiographic contrast material on renal function is assessed.

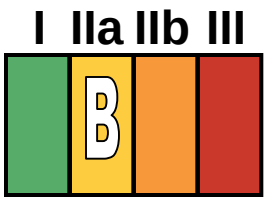


The effectiveness of pharmacological agents to provide renal protection during cardiac surgery is uncertain.

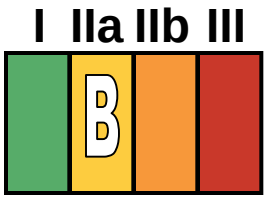
CABG-Associated Morbidity and Mortality: Occurrence and Prevention

Perioperative Myocardial Dysfunction

Perioperative Myocardial Dysfunction



In the absence of severe, symptomatic aorto-iliac occlusive disease or PAD, the insertion of an intraaortic balloon is reasonable to reduce the mortality rate in CABG patients who are considered to be at high risk (e.g., those who are undergoing reoperation or have LVEF <30% or left main CAD).



Measurement of biomarkers of myonecrosis (e.g., creatine kinase-MB, troponin) is reasonable in the first 24 hours after CABG.

CABG-Associated Morbidity and Mortality: Occurrence and Prevention

Transfusion

Transfusion

Aggressive attempts at blood conservation are indicated to limit hemodilutional anemia and the need for intraoperative and perioperative allogeneic red blood cell transfusion in CABG patients.

CABG-Associated Morbidity and Mortality: Occurrence and Prevention

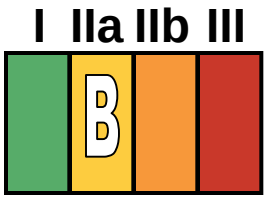
Perioperative Dysrhythmias

Perioperative Dysrhythmias

Beta blockers should be administered for at least 24 hours before CABG to all patients without contraindications to reduce the incidence or clinical sequelae of postoperative AF.

Preoperative administration of amiodarone to reduce the incidence of postoperative AF is reasonable for patients at high risk for postoperative AF who have contraindications to beta blockers.

Perioperative Dysrhythmias (cont.)



Digoxin and nondihydropyridine calcium channel blockers can be useful to control the ventricular rate in the setting of AF but are not indicated for prophylaxis.

CABG-Associated Morbidity and Mortality: Occurrence and Prevention

Perioperative Bleeding/Transfusion

Perioperative Bleeding/Transfusion

Lysine analogues are useful intraoperatively and postoperatively in patients undergoing on-pump CABG to reduce perioperative blood loss and transfusion requirements.

A multimodal approach with transfusion algorithms, point-of-care testing, and a focused blood conservation strategy should be used to limit the number of transfusions.

Perioperative Bleeding/Transfusion (cont.)

Clopidogrel & Ticagrelor

In patients taking thienopyridines (clopidogrel or prasugrel) or ticagrelor in whom elective CABG is planned, clopidogrel and ticagrelor should be withheld for at least 5 days and prasugrel for at least 7 days before surgery.

Prasugrel

It is recommended that surgery be delayed after the administration of streptokinase, urokinase, and tissue-type plasminogen activators until hemostatic capacity is restored, if possible. The timing of the recommended delay should be guided by the pharmacodynamic half-life of the involved agent.

Perioperative Bleeding/Transfusion (cont.)

Tirofiban or eptifibatide should be discontinued at least 2 to 4 hours before CABG and abciximab at least 12 hours before CABG.

It is reasonable to consider off-pump CABG to reduce perioperative bleeding and allogeneic blood transfusion.

Specific Patient Subsets

Anomalous Coronary Arteries

Anomalous Coronary Arteries

Coronary revascularization should be performed in patients with:

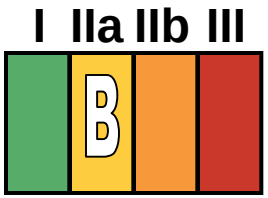
a. A left main coronary artery that arises anomalously and then courses between the aorta and pulmonary artery.
b. A right coronary artery that arises anomalously and then courses between the aorta and pulmonary artery with evidence of myocardial ischemia.

Coronary revascularization may be reasonable in patients with a LAD coronary artery that arises anomalously and then courses between the aorta and pulmonary artery.

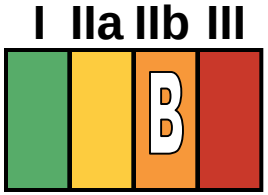
Specific Patient Subsets

Patients With Chronic Obstructive Pulmonary Disease/Respiratory Insufficiency

Patients With Chronic Obstructive Pulmonary Disease/Respiratory Insufficiency



Preoperative intensive inspiratory muscle training is reasonable to reduce the incidence of pulmonary complications in patients at high risk for respiratory complications after CABG.



After CABG, noninvasive positive pressure ventilation may be reasonable to improve pulmonary mechanics and to reduce the need for reintubation.

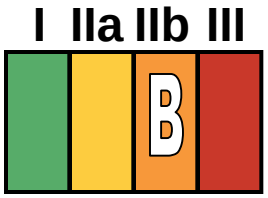
Patients With Chronic Obstructive Pulmonary Disease/Respiratory Insufficiency (cont.)

High thoracic epidural analgesia may be considered to improve lung function after CABG.

Patients With End-Stage Renal Disease on Dialysis

Patients With End-Stage Renal Disease on Dialysis

CABG to improve survival may be reasonable in patients with end-stage renal disease undergoing CABG for left main coronary artery stenosis of ≥50%.



CABG to improve survival or to relieve angina despite GDMT may be reasonable for patients with end-stage renal disease with significant stenoses (≥70% diameter) in 3 major vessels or in the proximal LAD artery plus 1 other major vessel, regardless of LV systolic function.

Patients With End-Stage Renal Disease on Dialysis (cont.)

Harm

CABG should not be performed in patients with end-stage renal disease whose life expectancy is limited by noncardiac issues.

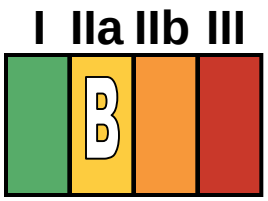
Patients With Concomitant Valvular Disease

Patients With Concomitant Valvular Disease

Patients undergoing CABG who have at least moderate aortic stenosis should have concomitant aortic valve replacement.

Patients undergoing CABG who have severe ischemic mitral regurgitation not likely to resolve with revascularization should have concomitant mitral repair or replacement at the time of CABG.

Patients With Concomitant Valvular Disease (cont.)

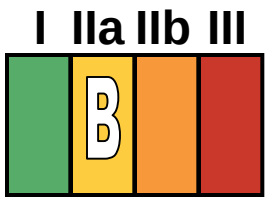


In patients undergoing CABG who have moderate ischemic mitral regurgitation not likely to resolve with revascularization, concomitant mitral repair or replacement at the time of CABG is reasonable.

Patients undergoing CABG who have mild aortic stenosis may be considered for concomitant aortic valve replacement when evidence (e.g., moderate–severe leaflet calcification) suggests that progression of the aortic stenosis may be rapid and the risk of the combined procedure is acceptable.

Patients With Previous Cardiac Surgery

Patients With Previous Cardiac Surgery



In patients with a patent LIMA to the LAD artery and ischemia in the distribution of the right or left circumflex coronary arteries, it is reasonable to recommend reoperative CABG to treat angina if GDMT has failed and the coronary stenoses are not amenable to PCI.