2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction: Executive Summary

A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines

Developed in Collaboration With the American College of Emergency Physicians and Society for Cardiovascular Angiography and Interventions

WRITING COMMITTEE MEMBERS*

Patrick T. O’Gara, MD, FACC, FAHA, Chair†;
Frederick G. Kushner, MD, FACC, FAHA, FSCAI, Vice Chair*‡; Deborah D. Ascheim, MD, FACC†;
Donald E. Casey, Jr, MD, MPH, MBA, FACP, FAHA‡; Mina K. Chung, MD, FACC, FAHA*†;
James A. de Lemos, MD, FACC*‡; Steven M. Ettinger, MD, FACC*§; James C. Fang, MD, FACC, FAHA*‡;
Francis M. Fesmire, MD, FACEP*¶; Barry A. Franklin, PhD, FAHA†;
Christopher B. Granger, MD, FACC, FAHA*‡; Harlan M. Krumholz, MD, SM, FACC, FAHA†;
Jane A. Linderbaum, MS, CNP-BC†; David A. Morrow, MD, MPH, FACC, FAHA*‡;
L. Kristin Newby, MD, MHS, FACC, FAHA*‡; Joseph P. Ornato, MD, FACC, FAHA, FACP, FACEP*‡;
Naritl Ou, PharmD‡; Martha J. Radford, MD, FACC, FAHA†; Jacqueline E. Tamis-Holland, MD, FACC†;
Carl L. Tommaso, MD, FACC, FAHA, FSCAI#; Cynthia M. Tracy, MD, FACC, FAHA†;
Y. Joseph Woo, MD, FACC, FAHA†; David X. Zhao, MD, FACC*‡

ACCF/AHA TASK FORCE MEMBERS

Jeffrey L. Anderson, MD, FACC, FAHA, Chair;
Alice K. Jacobs, MD, FACC, FAHA, Immediate Past Chair;
Jonathan L. Halperin, MD, FACC, FAHA, Chair-Elect;
Nancy M. Albert, PhD, CCNS, CCRN, FAHA; Ralph G. Brindis, MD, MPH, MACC;
Mark A. Creager, MD, FACC, FAHA; David DeMets, PhD;
Robert A. Guyton, MD, FACC, FAHA; Judith S. Hochman, MD, FACC, FAHA;
Richard J. Korys, MD, FACC; Frederick G. Kushner, MD, FACC, FAHA**;
E. Magnus Ohman, MD, FACC; William G. Stevenson, MD, FACC, FAHA;
Clyde W. Yancy, MD, FACC, FAHA**

*Writing committee members are required to recuse themselves from voting on sections to which their specific relationships with industry may apply; see Appendix 1 for detailed information. †ACCF/AHA representative. ‡ACP representative. §ACCF/AHA Task Force on Practice Guidelines liaison. ¶ACCF/AHA Task Force on Performance Measures liaison. #SCAI representative. **Former Task Force member during this writing effort.

This document was approved by the American College of Cardiology Foundation Board of Trustees and the American Heart Association Science and Advisory Coordinating Committee in June 2012.

The online Only Data Supplement is available with this article at http://circ.ahajournals.org/lookup/suppl/doi:10.1161/CIR.0b013e3182742c84/-/DC1.

The online-only Comprehensive Relationships Table is available with this article at http://circ.ahajournals.org/lookup/suppl/doi:10.1161/CIR.0b013e3182742c84/-/DC2.


This article is copublished in the Journal of the American College of Cardiology and Catheterization and Cardiovascular Interventions.

Copyright 2012 by the American College of Cardiology Foundation and the American Heart Association, Inc. Circulation is available at http://circ.ahajournals.org DOI: 10.1161/CIR.0b013e3182742c84

© 2012 by the American College of Cardiology Foundation and the American Heart Association, Inc. Circulation is available at http://circ.ahajournals.org DOI: 10.1161/CIR.0b013e3182742c84

1
Table of Contents

Preamble ........................................... .000
1. Introduction ........................................... .000
   1.1. Methodology and Evidence Review ................. .000
   1.2. Organization of the Writing Committee ............. .000
   1.3. Document Review and Approval ..................... .000
2. Onset of Myocardial Infarction: Recommendations ................. .000
   2.1. Regional Systems of STEMI Care, Reperfusion Therapy, and Time-to-Treatment Goals ................. .000
   2.2. Evaluation and Management of Patients With STEMI and Out-of-Hospital Cardiac Arrest ................. .000
3. Reperfusion at a PCI-Capable Hospital: Recommendations ................. .000
   3.1. Primary PCI in STEMI ......................... .000
   3.2. Aspiration Thrombectomy ........................ .000
   3.3. Use of Stents in Patients With STEMI ............. .000
   3.4. Antiplatelet Therapy to Support Primary PCI for STEMI ................. .000
   3.5. Anticoagulant Therapy to Support Primary PCI ................. .000
4. Reperfusion at a Non–PCI-Capable Hospital: Recommendations ................. .000
   4.1. Fibrinolytic Therapy When There Is an Anticipated Delay to Performing Primary PCI Within 120 Minutes of FMC ................. .000
   4.2. Adjunctive Antithrombotic Therapy With Fibrinolysis ................. .000
      4.2.1. Adjunctive Antiplatelet Therapy With Fibrinolysis ................. .000
      4.2.2. Adjunctive Anticoagulant Therapy With Fibrinolysis ................. .000
4.3. Transfer to a PCI-Capable Hospital After Fibrinolytic Therapy ................. .000
   4.3.1. Transfer of Patients With STEMI to a PCI-Capable Hospital for Coronary Angiography After Fibrinolytic Therapy ................. .000
5. Delayed Invasive Management: Recommendations ................. .000
   5.1. Coronary Angiography in Patients Who Initially Were Managed With Fibrinolytic Therapy or Who Did Not Receive Reperfusion ................. .000
   5.2. PCI of an Infarct Artery in Patients Who Initially Were Managed With Fibrinolysis or Who Did Not Receive Reperfusion Therapy ................. .000
   5.3. PCI of a Noninfarct Artery Before Hospital Discharge ................. .000
   5.4. Adjunctive Antithrombotic Therapy to Support Delayed PCI After Fibrinolytic Therapy ................. .000
      5.4.1. Antiplatelet Therapy to Support PCI After Fibrinolytic Therapy ................. .000
      5.4.2. Anticoagulant Therapy to Support PCI After Fibrinolytic Therapy ................. .000
6. Coronary Artery Bypass Graft Surgery: Recommendations ................. .000
   6.1. CAGB in Patients With STEMI ................. .000
   6.2. Timing of Urgent CAGB in Patients With STEMI in Relation to Use of Antiplatelet Agents ................. .000
7. Routine Medical Therapies: Recommendations ................. .000
   7.1. Beta Blockers ................................. .000
   7.2. Renin-Angiotensin-Aldosterone System Inhibitors ................. .000
   7.3. Lipid Management .................................. .000
8. Complications After STEMI: Recommendations ................. .000
   8.1. Treatment of Cardiogenic Shock ................. .000
   8.2. Implantable Cardioverter-Defibrillator Therapy Before Discharge ................. .000
   8.3. Pacing in STEMI .................................. .000
   8.4. Management of Pericarditis After STEMI ................. .000
   8.5. Anticoagulation ................................ .000
9. Risk Assessment After STEMI: Recommendations ................. .000
   9.1. Use of Noninvasive Testing for Ischemia Before Discharge ................. .000
   9.2. Assessment of LV Function ......................... .000
   9.3. Assessment of Risk for Sudden Cardiac Death ................. .000
10. Posthospitalization Plan of Care: Recommendations ................. .000
References ........................................ .000
Appendix 1. Author Relationships With Industry and Other Entities (Relevant) ................. .000
Appendix 2. Reviewer Relationships With Industry and Other Entities (Relevant) ................. .000

Preamble

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

The American College of Cardiology Foundation (ACCF) and the American Heart Association (AHA) have jointly produced guidelines in the area of cardiovascular disease since 1980. The ACCF/AHA Task Force on Practice Guidelines (Task Force), charged with developing, updating, and revising practice guidelines for cardiovascular diseases and procedures, directs and oversees this effort. Writing committees are charged with regularly reviewing and evaluating all available evidence to develop balanced, patient-centric recommendations for clinical practice.

Experts in the subject under consideration are selected by the ACCF and AHA to examine subject-specific data and write guidelines in partnership with representatives from other medical organizations and specialty groups. Writing committees are asked to perform a literature review; weigh the strength of evidence for or against particular tests, treatments, or procedures; and include estimates of expected outcomes where such data exist. Patient-specific modifiers, comorbidities, and issues of patient preference that may influence the choice of tests or therapies are considered.
When available, information from studies on cost is considered, but data on efficacy and outcomes constitute the primary basis for the recommendations contained herein. In analyzing the data and developing recommendations and supporting text, the writing committee uses evidence-based methodologies developed by the Task Force.\(^1\) The Class of Recommendation (COR) is an estimate of the size of the treatment effect considering risks versus benefits in addition to evidence and/or agreement that a given treatment or procedure is or is not useful/effective or in some situations may cause harm. The Level of Evidence (LOE) is an estimate of the certainty or precision of the treatment effect. The writing committee reviews and ranks evidence supporting each recommendation with the weight of evidence ranked as LOE A, B, or C according to specific definitions that are included in Table 1. Studies are identified as observational, retrospective, prospective, or randomized where appropriate. For certain conditions for which inadequate data are available, recommendations are based on expert consensus and clinical experience and are ranked as LOE C. When recommendations at LOE C are supported by historical clinical data, appropriate references (including clinical reviews) are cited if available. For issues for which sparse data are available, a survey of current practice among the clinician members of the writing committee is the basis for LOE C recommendations and no references are cited. The schema for

![Table 1. Applying Classification of Recommendation and Level of Evidence](image)

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.
COR and LOE is summarized in Table 1, which also provides suggested phrases for writing recommendations within each COR.

A new addition to this methodology is separation of the Class III recommendations to delineate whether the recommendation is determined to be of “no benefit” or is associated with “harm” to the patient. In addition, in view of the increasing number of comparative effectiveness studies, comparator verbs and suggested phrases for writing recommendations for the comparative effectiveness of one treatment or strategy versus another are included for COR I and IIa, LOE A or B only.

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

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

The ACCF/AHA practice guidelines are intended to assist healthcare providers in clinical decision making by describing a range of generally acceptable approaches to the diagnosis, management, and prevention of specific diseases or conditions. The guidelines attempt to define practices that meet the needs of most patients in most circumstances. The ultimate judgment regarding care of a particular patient must be made by the healthcare provider and patient in light of all the circumstances presented by that patient. As a result, situations may arise for which deviations from these guidelines may be appropriate.

Clinical decision making should involve consideration of the quality and availability of expertise in the area where care is provided. When these guidelines are used as the basis for regulatory or payer decisions, the goal should be improvement in quality of care. The Task Force recognizes that situations arise in which additional data are needed to inform patient care more effectively; these areas are identified within each respective guideline when appropriate.

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

The Task Force makes every effort to avoid actual, potential, or perceived conflicts of interest that may arise as a result of relationships with industry and other entities (RWI) among the members of the writing committee. All writing committee members and peer reviewers of the guideline are required to disclose all current healthcare related relationships, including those existing 12 months before initiation of the writing effort. In December 2009, the ACCF and AHA implemented a new RWI policy that requires the writing committee chair plus a minimum of 50% of the writing committee to have no relevant RWI. (Appendix 1 includes the ACCF/AHA definition of relevance.) These statements are reviewed by the Task Force and all members during each conference call and/or meeting of the writing committee, and members provide updates as changes occur. All guideline recommendations require a confidential vote by the writing committee and must be approved by a consensus of the voting members. Members may not draft or vote on any text or recommendations pertaining to their RWI. Members who recused themselves from voting are indicated in the list of writing committee members, and specific section recusals are noted in Appendix 1. Authors’ and peer reviewers’ RWI pertinent to this guideline are disclosed in Appendixes 1 and 2, respectively. In addition, to ensure complete transparency, writing committee members’ comprehensive disclosure information—including RWI not pertinent to this document—is available as an online supplement. Comprehensive disclosure information for the Task Force is also available online at http://www.cardiosource.org/ACC/About-ACC/Who-We-Are/Leadership/Guidelines-and-Documents-Task-Forces.aspx. The work of writing committees is supported exclusively by the ACCF and AHA without commercial support. Writing committee members volunteered their time for this activity.

In an effort to maintain relevance at the point of care for practicing physicians, the Task Force continues to oversee an ongoing process improvement initiative. As a result, in response to pilot projects, several changes to these guidelines will be apparent, including limited narrative text, a focus on summary and evidence tables (with references linked to abstracts in PubMed), and more liberal use of summary recommendation tables (with references that support LOE) to serve as a quick reference.

In April 2011, the Institute of Medicine released 2 reports: Finding What Works in Health Care: Standards for Systematic Reviews and Clinical Practice Guidelines We Can Trust.2,3 It is noteworthy that the IOM cited ACCF/AHA practice guidelines as being compliant with many of the proposed standards. A thorough review of these reports and of our current methodology is under way, with further enhancements anticipated.

The recommendations in this guideline are considered current until they are superseded by a focused update or the full-text guideline is revised. The reader is encouraged to consult the full-text guideline1 for additional guidance and details about the care of the patient with ST-elevation myocardial infarction (STEMI), because the Executive Summary contains only the recommendations. Guidelines are official policy of both the ACCF and AHA.

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

1.1. Methodology and Evidence Review
The recommendations listed in this document are, whenever possible, evidence based. The current document constitutes a full revision and includes an extensive evidence review which was conducted through November 2010, with additional selected references added through August 2012. Searches were limited to studies conducted in human subjects and reviews and other evidence pertaining to human subjects; all were published in English. Key search words included but were not limited to: acute coronary syndromes, percutaneous coronary intervention, coronary artery bypass graft, myocardial infarction, ST-elevation myocardial infarction, coronary stent, revascularization, anticoagulant therapy, antiplatelet therapy, antithrombotic therapy, glycoprotein IIb/IIIa inhibitor therapy, pharmacotherapy, proton-pump inhibitor, implantable cardioverter-defibrillator therapy, cardiogenic shock, fibrinolytic therapy, thrombolytic therapy, nitrates, mechanical complications, arrhythmia, angina, chronic stable angina, diabetes, chronic kidney disease, mortality, morbidity, elderly, ethics, and contrast nephropathy. Additional searches cross-referenced these topics with the following subtopics: percutaneous coronary intervention, coronary artery bypass graft, cardiac rehabilitation, and secondary prevention. Additionally, the committee reviewed documents related to the subject matter previously published by the ACCF and AHA. References selected and published in this document are representative and not all inclusive.

The focus of this guideline is the management of patients with STEMI. Updates to the 2004 STEMI guideline were published in 2007 and 2009.5–7 Particular emphasis is placed on advances in reperfusion therapy, organization of regional systems of care, transfer algorithms, evidence-based antithrombotic and medical therapies, and secondary prevention strategies to optimize patient-centered care. By design, the document is narrower in scope than the 2004 STEMI guideline, in an attempt to provide a more focused tool for practitioners. References related to management guidelines are provided whenever appropriate, including those pertaining to percutaneous coronary intervention (PCI), coronary artery bypass graft (CABG), heart failure (HF), cardiac devices, and secondary prevention.

1.2. Organization of the Writing Committee
The writing committee was composed of experts representing cardiovascular medicine, interventional cardiology, electrophysiology, HF, cardiac surgery, emergency medicine, internal medicine, cardiac rehabilitation, nursing, and pharmacy. The American College of Physicians, American College of Emergency Physicians, and Society for Cardiovascular Angiography and Interventions assigned official representatives.

1.3. Document Review and Approval
This document was reviewed by 2 outside reviewers each nominated by the ACCF and the AHA, as well as 2 reviewers each from the American College of Emergency Physicians and Society for Cardiovascular Angiography and Interventions and 22 individual content reviewers (including members from the ACCF Interventional Scientific Council and ACCF Surgeons’ Scientific Council). All reviewer RWI information was distributed to the writing committee and is published in this document (Appendix 2).

This document was approved for publication by the governing bodies of the ACCF and the AHA and was endorsed by the American College of Emergency Physicians and Society for Cardiovascular Angiography and Interventions.

2. Onset of Myocardial Infarction: Recommendations

2.1. Regional Systems of STEMI Care, Reperfusion Therapy, and Time-to-Treatment Goals
See Figure 1.

Class I

1. All communities should create and maintain a regional system of STEMI care that includes assessment and continuous quality improvement of emergency medical services and hospital-based activities. Performance can be facilitated by participating in programs such as Mission: Lifeline and the Door-to-Balloon Alliance.8–11 (Level of Evidence: B)

2. Performance of a 12-lead electrocardiogram (ECG) by emergency medical services personnel at the site of first medical contact (FMC) is recommended in patients with symptoms consistent with STEMI.11–15 (Level of Evidence: B)

3. Reperfusion therapy should be administered to all eligible patients with STEMI with symptom onset within the prior 12 hours.16,17 (Level of Evidence: A)

4. Primary PCI is the recommended method of reperfusion when it can be performed in a timely fashion by experienced operators.17–19 (Level of Evidence: A)

5. Emergency medical services transport directly to a PCI-capable hospital for primary PCI is the recommended triage strategy for patients with STEMI, with an ideal FMC-to-device time system goal of 90 minutes or less.8,13,14,15 (Level of Evidence: B)

6. Immediate transfer to a PCI-capable hospital for primary PCI is the recommended triage strategy for patients with STEMI who initially arrive at or are transported to a non–PCI-capable hospital, with an FMC-to-device time system goal of 120 minutes or less.8,18–21 (Level of Evidence: B)

7. In the absence of contraindications, fibrinolytic therapy should be administered to patients with STEMI at non–PCI-capable hospitals when the anticipated FMC-to-device time at a PCI-capable hospital exceeds 120 minutes because of unavoidable delays.16,22,23 (Level of Evidence: B)

8. When fibrinolytic therapy is indicated or chosen as the primary reperfusion strategy, it should be administered within 30 minutes of hospital arrival.8,24–28 (Level of Evidence: B)

Class IIa

1. Reperfusion therapy is reasonable for patients with STEMI and symptom onset within the prior 12 to 24 hours who have clinical and/or ECG evidence of ongo-
ing ischemia. Primary PCI is the preferred strategy in this population. (Level of Evidence: B)

2.2. Evaluation and Management of Patients With STEMI and Out-of-Hospital Cardiac Arrest

Class I

1. Therapeutic hypothermia should be started as soon as possible in comatose patients with STEMI and out-of-hospital cardiac arrest caused by ventricular fibrillation or pulseless ventricular tachycardia, including patients who undergo primary PCI. (Level of Evidence: B)

2. Immediate angiography and PCI when indicated should be performed in resuscitated out-of-hospital cardiac arrest patients whose initial ECG shows STEMI. (Level of Evidence: B)

3. Reperfusion at a PCI-Capable Hospital: Recommendations

3.1. Primary PCI in STEMI

See Table 2 for a summary of recommendations from this section.

Class I

1. Primary PCI should be performed in patients with STEMI and ischemic symptoms of less than 12 hours’ duration who have contraindications to fibrinolytic therapy, irrespective of the time delay from FMC. (Level of Evidence: B)

2. Primary PCI should be performed in patients with STEMI and ischemic symptoms of less than 12 hours’ duration who have contraindications to fibrinolytic therapy, irrespective of the time delay from FMC. (Level of Evidence: B)

3. Primary PCI should be performed in patients with STEMI and cardiogenic shock or acute severe HF, irrespective of time delay from myocardial infarction (MI) onset (Section 8.1). (Level of Evidence: B)

Class IIa

1. Primary PCI is reasonable in patients with STEMI if there is clinical and/or ECG evidence of ongoing ischemia between 12 and 24 hours after symptom onset. (Level of Evidence: B)

Table 2. Primary PCI in STEMI

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>17, 50, 51</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>52, 53</td>
</tr>
<tr>
<td>I</td>
<td>B</td>
<td>54–57</td>
</tr>
<tr>
<td>Ila</td>
<td>B</td>
<td>29, 30</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>58–60</td>
</tr>
</tbody>
</table>

COR indicates Class of Recommendation; FMC, first medical contact; HF, heart failure; LOE, Level of Evidence; MI, myocardial infarction; PCI, percutaneous coronary intervention; and STEMI, ST-elevation myocardial infarction.
Class III: Harm

1. PCI should not be performed in a noninfarct artery at the time of primary PCI in patients with STEMI who are hemodynamically stable.58–60 (Level of Evidence: B)

3.2. Aspiration Thrombectomy

Class IIa

1. Manual aspiration thrombectomy is reasonable for patients undergoing primary PCI.61–64 (Level of Evidence: B)

3.3. Use of Stents in Patients With STEMI

Class I

1. Placement of a stent (bare-metal stent or drug-eluting stent) is useful in primary PCI for patients with STEMI.65,66 (Level of Evidence: A)

2. Bare-metal stents† should be used in patients with high bleeding risk, inability to comply with 1 year of dual antiplatelet therapy (DAPT), or anticipated invasive or surgical procedures in the next year. (Level of Evidence: C)

Class III: Harm

1. Drug-eluting stents should not be used in primary PCI for patients with STEMI who are unable to tolerate or comply with a prolonged course of DAPT because of the increased risk of stent thrombosis with premature discontinuation of one or both agents.67–73 (Level of Evidence: B)

3.4. Antiplatelet Therapy to Support Primary PCI for STEMI

See Table 3 for a summary of recommendations from this section.

Class I

1. Aspirin 162 to 325 mg should be given before primary PCI.74–76 (Level of Evidence: B)

2. After PCI, aspirin should be continued indefinitely.77,78,80 (Level of Evidence: A)

3. A loading dose of a P2Y12 receptor inhibitor should be given as early as possible or at time of primary PCI to patients with STEMI. Options include
   a. Clopidogrel 600 mg78,81,82 (Level of Evidence: B); or
   b. Prasugrel 60 mg83 (Level of Evidence: B); or
   c. Ticagrelor 180 mg.84 (Level of Evidence: B)

4. P2Y12 inhibitor therapy should be given for 1 year to patients with STEMI who receive a stent (bare-metal or drug-eluting) during primary PCI using the following maintenance doses:
   a. Clopidogrel 75 mg daily83,85 (Level of Evidence: B); or
   b. Prasugrel 10 mg daily85 (Level of Evidence: B); or
   c. Ticagrelor 90 mg twice a day.84 (Level of Evidence: B)

Class IIa

1. It is reasonable to use 81 mg of aspirin per day in preference to higher maintenance doses after primary PCI.76,77,86,87 (Level of Evidence: B)

2. It is reasonable to start treatment with an intravenous glycoprotein (GP) IIb/IIIa receptor antagonist such as abciximab88–90 (Level of Evidence: A), high-bolus-dose tirofiban91,92 (Level of Evidence: B), or double-bolus eptifibatide93 (Level of Evidence: B) at the time of primary PCI (with or without stenting or clopidogrel pretreatment) in selected patients with STEMI who are receiving unfractionated heparin (UFH).

Class IIb

1. It may be reasonable to administer intravenous GP IIb/IIIa receptor antagonist in the precatheaterization laboratory setting (eg, ambulance, emergency department) to patients with STEMI for whom primary PCI is intended.91,94–101 (Level of Evidence: B)

2. It may be reasonable to administer intracoronary abciximab to patients with STEMI undergoing primary PCI.64,102–108 (Level of Evidence: B)

3. Continuation of a P2Y12 inhibitor beyond 1 year may be considered in patients undergoing drug-eluting stent placement. (Level of Evidence: C)

Class III: Harm

1. Prasugrel should not be administered to patients with a history of prior stroke or transient ischemic attack.83 (Level of Evidence: B)

3.5. Anticoagulant Therapy to Support Primary PCI

Class I

1. For patients with STEMI undergoing primary PCI, the following supportive anticoagulant regimens are recommended:
   a. UFH, with additional boluses administered as needed to maintain therapeutic activated clotting time levels, taking into account whether a GP IIb/IIIa receptor antagonist has been administered (Level of Evidence: C); or
   b. Bivalirudin with or without prior treatment with UFH.109 (Level of Evidence: B)

Class IIa

1. In patients with STEMI undergoing PCI who are at high risk of bleeding, it is reasonable to use bivalirudin monotherapy in preference to the combination of UFH and a GP IIb/IIIa receptor antagonist.109 (Level of Evidence: B)

Class III: Harm

1. Fondaparinux should not be used as the sole anticoagulant to support primary PCI because of the risk of catheter thrombosis.110 (Level of Evidence: B)

---

†Balloon angioplasty without stent placement may be used in selected patients.
‡The recommended maintenance dose of aspirin to be used with ticagrelor is 81 mg daily.
### Table 3. Adjunctive Antithrombotic Therapy to Support Reperfusion With Primary PCI

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Antiplatelet therapy

**Aspirin**
- 162- to 325-mg load before procedure  
  - I  
  - B  
  - 74–76
- 81- to 325-mg daily maintenance dose (indefinite)*  
  - I  
  - A  
  - 77, 78, 80
- 81 mg daily is the preferred maintenance dose*  
  - Ila  
  - B  
  - 76, 77, 86, 87

**P2Y₁₂ inhibitors**

- **Loading doses**
  - Clopidogrel: 600 mg as early as possible or at time of PCI  
    - I  
    - B  
    - 76, 81, 82
  - Prasugrel: 60 mg as early as possible or at time of PCI  
    - I  
    - B  
    - 83
  - Ticagrelor: 180 mg as early as possible or at time of PCI  
    - I  
    - B  
    - 84

- **Maintenance doses and duration of therapy**
  - DES placed: Continue therapy for 1 y with:
    - Clopidogrel: 75 mg daily  
      - I  
      - B  
      - 83, 85
    - Prasugrel: 10 mg daily  
      - I  
      - B  
      - 85
    - Ticagrelor: 90 mg twice a day*  
      - I  
      - B  
      - 84
  - BMS† placed: Continue therapy for 1 y with:
    - Clopidogrel: 75 mg daily  
      - I  
      - B  
      - 83, 85
    - Prasugrel: 10 mg daily  
      - I  
      - B  
      - 85
    - Ticagrelor: 90 mg twice a day*  
      - I  
      - B  
      - 84
  - DES placed:
    - Clopidogrel, prasugrel, or ticagrelor* continued beyond 1 y  
      - Iib  
      - C  
      - N/A
    - Patients with STEMI with prior stroke or TIA: prasugrel  
      - III: Harm  
      - B  
      - 83

**IV GP Ib/IIa receptor antagonists in conjunction with UFH or bivalirudin in selected patients**
- Abciximab: 0.25-mg/kg IV bolus, then 0.125 mcg/kg/min (maximum 10 mcg/min)  
  - Ila  
  - A  
  - 88–90
- Tirofiban: (high-bolus dose): 25-mcg/kg IV bolus, then 0.15 mcg/kg/min  
  - Ila  
  - B  
  - 91, 92
  - In patients with CrCl <30 mL/min, reduce infusion by 50%
- Eptifibatide: (double bolus): 180-mcg/kg IV bolus, then 2 mcg/kg/min; a second 180-mcg/kg bolus is administered 10 min after the first bolus  
  - Ila  
  - B  
  - 93
  - In patients with CrCl <30 mL/min, reduce infusion by 50%
  - Avoid in patients on hemodialysis
- Pre-catheterization laboratory administration of intravenous GP Ib/IIa receptor antagonist  
  - Iib  
  - B  
  - 91, 94–101
- Intracoronary abciximab 0.25-mg/kg bolus  
  - Iib  
  - B  
  - 64, 102–108

#### Anticoagulant therapy

**UFH:**
- With GP Ib/IIa receptor antagonist planned: 50- to 70-U/kg IV bolus to achieve therapeutic ACT‡  
  - I  
  - C  
  - N/A
- With no GP Ib/IIa receptor antagonist planned: 70- to 100-U/kg bolus to achieve therapeutic ACT§  
  - I  
  - C  
  - N/A
- Bivalirudin: 0.75-mg/kg IV bolus, then 1.75-mg/kg/h infusion with or without prior treatment with UFH. An additional bolus of 0.3 mg/kg can be given if needed.  
  - I  
  - B  
  - 109
  - Reduce infusion to 1 mg/kg/h with estimated CrCl <30 mL/min
  - Preferred over UFH with GP Ib/IIa receptor antagonist in patients at high risk of bleeding  
    - Ila  
    - B  
    - 109
- Fondaparinux: Not recommended as sole anticoagulant for primary PCI  
  - III: Harm  
  - B  
  - 110

*The recommended maintenance dose of aspirin to be used with ticagrelor is 81 mg daily.
†Balloon angioplasty without stent placement may be used in selected patients. It might be reasonable to provide P2Y₁₂ inhibitor therapy to patients with STEMI undergoing balloon angioplasty alone according to the recommendations listed for BMS. (LOE: C)
‡The recommended ACT with planned GP Ib/IIa receptor antagonist treatment is 200 to 250 s.
§The recommended ACT with no planned GP Ib/IIa receptor antagonist treatment is 250 to 300 s (HemoTec device) or 300 to 350 s (Hemochron device). ACT indicates activated clotting time; BMS, bare-metal stent; CrCl, creatinine clearance; COR, Class of Recommendation; DES, drug-eluting stent; GP, glycoprotein; IV, intravenous; LOE, Level of Evidence; N/A, not available; PCI, percutaneous coronary intervention; STEMI, ST-elevation myocardial infarction; TIA, transient ischemic attack; and UFH, unfractionated heparin.
4. Reperfusion at a Non–PCI-Capable Hospital: Recommendations

4.1. Fibrinolytic Therapy When There Is an Anticipated Delay to Performing Primary PCI Within 120 Minutes of FMC

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

Class I

1. In the absence of contraindications, fibrinolytic therapy should be given to patients with STEMI and onset of ischemic symptoms within the previous 12 hours when it is anticipated that primary PCI cannot be performed within 120 minutes of FMC.\(^ {16,111–116}\) (Level of Evidence: A)

Class IIa

1. In the absence of contraindications and when PCI is not available, fibrinolytic therapy is reasonable for patients with STEMI if there is clinical and/or electrocardiographic evidence of ongoing ischemia within 12 to 24 hours of symptom onset and a large area of myocardium at risk or hemodynamic instability. (Level of Evidence: C)

Class III: Harm

1. Fibrinolytic therapy should not be administered to patients with ST depression except when a true posterior (inferobasal) MI is suspected or when associated with ST-elevation in lead aVR.\(^ {16,117–120}\) (Level of Evidence: B)

4.2. Adjunctive Antithrombotic Therapy With Fibrinolysis

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

4.2.1. Adjunctive Antiplatelet Therapy With Fibrinolysis

Class I

1. Aspirin (162- to 325-mg loading dose) and clopidogrel (300-mg loading dose for patients ≤75 years of age, 75-mg dose for patients >75 years of age) should be administered to patients with STEMI who receive fibrinolytic therapy.\(^ {113,121,122}\) (Level of Evidence: A)

2. Aspirin should be continued indefinitely\(^ {113,121,122}\) (Level of Evidence: A) and clopidogrel (75 mg daily) should be continued for at least 14 days\(^ {121,122}\) (Level of Evidence: A) and up to 1 year (Level of Evidence: C) in patients with STEMI who receive fibrinolytic therapy.

Class IIa

1. It is reasonable to use aspirin 81 mg per day in preference to higher maintenance doses after fibrinolytic therapy.\(^ {77,80,86,87}\) (Level of Evidence: B)

4.2.2. Adjunctive Anticoagulant Therapy With Fibrinolysis

Class I

1. Patients with STEMI undergoing reperfusion with fibrinolytic therapy should receive anticoagulant therapy for a minimum of 48 hours, and preferably for the duration of the index hospitalization, up to 8 days or until revascularization if performed.\(^ {123,124}\) (Level of Evidence: A) Recommended regimens include

   a. UFH administered as a weight-adjusted intravenous bolus and infusion to obtain an activated partial thromboplastin time of 1.5 to 2.0 times control, for 48 hours or until revascularization (Level of Evidence: C);

   b. Enoxaparin administered according to age, weight, and creatinine clearance, given as an intravenous bolus, followed in 15 minutes by subcutaneous injection for the duration of the index hospitalization, up to 8 days or until revascularization (Level of Evidence: C);

   c. Fondaparinux administered with initial intravenous dose, followed in 24 hours by daily subcutaneous injections if the estimated creatinine clearance is greater than 30 mL/min, for the duration of the index hospitalization, up to 8 days or until revascularization.\(^ {110}\) (Level of Evidence: B)

4.3. Transfer to a PCI-Capable Hospital After Fibrinolytic Therapy

4.3.1. Transfer of Patients With STEMI to a PCI-Capable Hospital for Coronary Angiography After Fibrinolytic Therapy

See Table 6 for a summary of recommendations from this section; Online Data Supplement 4 for additional data on early catheterization and rescue PCI for fibrinolytic failure in the stent era; and Online Data Supplement 5 for additional data on early catheterization and PCI after fibrinolysis in the stent era.

Class I

1. Immediate transfer to a PCI-capable hospital for coronary angiography is recommended for suitable patients with STEMI who develop cardio-
genic shock or acute severe HF, irrespective of the
time delay from MI onset.128 (Level of Evidence: B)

Class IIa

1. Urgent transfer to a PCI-capable hospital for coro-
nary angiography is reasonable for patients with
STEMI who demonstrate evidence of failed reperfu-
sion or reocclusion after fibrinolytic therapy.129–132
(Level of Evidence: B)

2. Transfer to a PCI-capable hospital for coronary
angiography is reasonable for patients with
STEMI who have received fibrinolytic therapy
even when hemodynamically stable§ and with
clinical evidence of successful reperfusion. An-
giography can be performed as soon as logistically
feasible at the receiving hospital, and ideally
within 24 hours, but should not be performed
within the first 2 to 3 hours after administration of
fibrinolytic therapy.133–138 (Level of Evidence: B)

§Although individual circumstances will vary, clinical stability is defined by the
absence of low output, hypotension, persistent tachycardia, apparent shock, high-grade
ventricular or symptomatic supraventricular tachyarrhythmias, and spontaneous recur-
rent ischemia.

### Table 5. Adjunctive Antithrombotic Therapy to Support Reperfusion With Fibrinolytic Therapy

<table>
<thead>
<tr>
<th>Therapy</th>
<th>Class</th>
<th>LOE</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antiplatelet Therapy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Aspirin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● 162- to 325-mg loading dose</td>
<td>I</td>
<td>A</td>
<td>113, 121, 122</td>
</tr>
</tbody>
</table>
| ● 81- to 325-mg daily mainte-
ance dose (indefinite)         | I     | A    | 113, 121, 122 |
| ● 81 mg daily is the preferred
maintenance dose                | IIA   | B    | 77, 80, 86, 87 |
| **P2Y₁₂ receptor inhibitors** |       |      |            |
| ● Clopidogrel:                 |       |      |            |
| ● Age ≤75 y: 300-mg loading
dose                                    | I     | A    | 121, 122 |
| ● Followed by 75 mg daily for
at least 14 d and up to 1 y in
absence of bleeding                  | I     | A(14 d) | 121, 122 |
| ● Age >75 y: no loading dose, give
75 mg                                    | I     | C    | N/A |
| ● Followed by 75 mg daily for
at least 14 d and up to 1 y in
absence of bleeding                  | I     | A(14 d) | 121, 122 |

| **Anticoagulant Therapy**      |       |      |            |
| ● UFH:                         |       |      |            |
| ● Weight-based IV bolus and
infusion adjusted to obtain aPTT of
1.5 to 2.0 times control for 48 h or
until revascularization. IV bolus of
60 U/kg (maximum 4000 U) followed by
an infusion of 12 U/kg/h (maximum
1000 U) initially, adjusted to
maintain aPTT at 1.5 to 2.0 times control (approximately 50 to 70 s) for 48 h or
until revascularization.           | I     | C    | N/A |
| ● Enoxaparin:                  |       |      |            |
| ● If age <75 y: 30-mg IV bolus,
followed in 15 min by 1 mg/kg subcutaneously
every 12 h (maximum 100 mg for the first 2 doses) | I     | A    | 124–127 |
| ● If age ≥75 y: no bolus, 0.75 mg/kg subcutaneously every 12 h (maximum 75 mg
for the first 2 doses)           | I     | C    | N/A |
| ● Regardless of age, if CrCl <30 mL/min: 1 mg/kg subcutaneously every 24 h  | I     | A(14 d) | 121, 122 |
| ● Duration: For the index hospitalization, up to 8 d or until revascularization | I     | C    | N/A |
| ● Fondaparinux:                |       |      |            |
| ● Initial dose 2.5 mg IV, then 2.5 mg subcutaneously daily starting the following day,
for the index hospitalization up to 8 d or until revascularization | I     | B    | 110 |

aPTT indicates activated partial thromboplastin time; COR, Class of Recommendation; CrCl, creatinine clearance; IV, intravenous; LOE, Level of Evidence; N/A, not available; and UFH, unfractionated heparin.

### 5. Delayed Invasive Management: Recommendations

#### 5.1. Coronary Angiography in Patients Who Initially Were Managed With Fibrinolytic Therapy or Who Did Not Receive Reperfusion

See Table 7 for a summary of recommendations from this section.

### Class IIa

1. Urgent transfer to a PCI-capable hospital for coro-
nary angiography is reasonable for patients with
STEMI who demonstrate evidence of failed reperfu-
sion or reocclusion after fibrinolytic therapy.129–132
(Level of Evidence: B)

2. Transfer to a PCI-capable hospital for coronary
angiography is reasonable for patients with
STEMI who have received fibrinolytic therapy
even when hemodynamically stable§ and with
clinical evidence of successful reperfusion. An-
angiography can be performed as soon as logistically
feasible at the receiving hospital, and ideally
within 24 hours, but should not be performed
within the first 2 to 3 hours after administration of
fibrinolytic therapy.133–138 (Level of Evidence: B)
6. Indications for Transfer for Angiography After Fibrinolytic Therapy

<table>
<thead>
<tr>
<th>Indication</th>
<th>COR</th>
<th>LOE</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate transfer for cardiogenic shock or severe acute HF irrespective</td>
<td>I</td>
<td>B</td>
<td>128</td>
</tr>
<tr>
<td>of time delay from MI onset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urgent transfer for failed reperfusion or reocclusion</td>
<td>IIa</td>
<td>B</td>
<td>129–132</td>
</tr>
<tr>
<td>As part of an invasive strategy in stable* patients with PCI between 3</td>
<td>IIa</td>
<td>B</td>
<td>133–138</td>
</tr>
<tr>
<td>and 24 h after successful fibrinolysis</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Although individual circumstances will vary, clinical stability is defined by the absence of low output, hypotension, persistent tachycardia, apparent shock, high-grade ventricular or symptomatic supraventricular tachyarrhythmias, and spontaneous recurrent ischemia.

COR indicates Class of Recommendation; HF, heart failure; LOE, Level of Evidence; MI, myocardial infarction; N/A, not available; and PCI, percutaneous coronary intervention.

Class IIa

1. Coronary angiography with intent to perform revascularization is reasonable for patients with evidence of failed reperfusion or reocclusion after fibrinolytic therapy. Angiography can be performed as soon as logistically feasible 129–132 (Level of Evidence: B)

2. Coronary angiography is reasonable before hospital discharge in stable* patients with STEMI after successful fibrinolysis. Angiography can be performed as soon as logistically feasible, and ideally within 24 hours, but should not be performed within the first 2 to 3 hours after administration of fibrinolytic therapy. 133–138,143 (Level of Evidence: B)

5.2. PCI of an Infarct Artery in Patients Who Initially Were Managed With Fibrinolysis or Who Did Not Receive Reperfusion Therapy

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

7. Indications for Coronary Angiography in Patients Who Were Managed With Fibrinolytic Therapy or Who Did Not Receive Reperfusion Therapy

<table>
<thead>
<tr>
<th>Indication</th>
<th>COR</th>
<th>LOE</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiogenic shock or acute severe HF that develops after initial presentation</td>
<td>I</td>
<td>B</td>
<td>57, 128, 139, 140</td>
</tr>
<tr>
<td>Intermediate- or high-risk findings on predischARGE noninvasive ischemia testing</td>
<td>I</td>
<td>B</td>
<td>141, 142</td>
</tr>
<tr>
<td>Spontaneous or easily provoked myocardial ischemia</td>
<td>I</td>
<td>C</td>
<td>N/A</td>
</tr>
<tr>
<td>Failed reperfusion or reocclusion after fibrinolytic therapy</td>
<td>IIa</td>
<td>B</td>
<td>129–132</td>
</tr>
<tr>
<td>Stable* patients after successful fibrinolysis, before discharge and ideally between 3 and 24 h</td>
<td>IIa</td>
<td>B</td>
<td>133–138, 143</td>
</tr>
</tbody>
</table>

*Although individual circumstances will vary, clinical stability is defined by the absence of low output, hypotension, persistent tachycardia, apparent shock, high-grade ventricular or symptomatic supraventricular tachyarrhythmias, and spontaneous recurrent ischemia.

COR indicates Class of Recommendation; HF, heart failure; LOE, Level of Evidence; N/A, not available.
may be considered as part of an invasive strategy in stable§ patients,55,141–148 (Level of Evidence: B)

Class III: No Benefit

1. Delayed PCI of a totally occluded infarct artery greater than 24 hours after STEMI should not be performed in asymptomatic patients with 1- or 2-vessel disease if they are hemodynamically and electrically stable and do not have evidence of severe ischemia.55,146 (Level of Evidence: B)

5.3. PCI of a Noninfarct Artery Before Hospital Discharge

Class I

1. PCI is indicated in a noninfarct artery at a time separate from primary PCI in patients who have spontaneous symptoms of myocardial ischemia. (Level of Evidence: C)

Class IIa

1. PCI is reasonable in a noninfarct artery at a time separate from primary PCI in patients with intermediate- or high-risk findings on noninvasive testing.58,141,142 (Level of Evidence: B)

5.4. Adjunctive Antithrombotic Therapy to Support Delayed PCI After Fibrinolytic Therapy

See Table 9 for a summary of recommendations from this section.

5.4.1. Antiplatelet Therapy to Support PCI After Fibrinolytic Therapy

Class I

1. After PCI, aspirin should be continued indefinitely.76,77,80,82,121,122 (Level of Evidence: A)

2. Clopidogrel should be provided as follows:
   a. A 300-mg loading dose should be given before or at the time of PCI to patients who did not receive a previous loading dose and who are undergoing PCI within 24 hours of receiving fibrinolytic therapy (Level of Evidence: C);
   b. A 600-mg loading dose should be given before or at the time of PCI to patients who did not receive a previous loading dose and who are undergoing PCI more than 24 hours after receiving fibrinolytic therapy (Level of Evidence: C); and
   c. A dose of 75 mg daily should be given after PCI,83,85,121,122 (Level of Evidence: C)

Class IIa

1. After PCI, it is reasonable to use 81 mg of aspirin per day in preference to higher maintenance doses.76,82,86,87 (Level of Evidence: B)

2. Prasugrel, in a 60-mg loading dose, is reasonable once the coronary anatomy is known in patients who did not receive a previous loading dose of clopidogrel at the time of administration of a fibrinolytic agent, but prasugrel should not be given sooner than 24 hours after administration of a fibrin-specific agent or 48 hours after administration of a non–fibrin-specific agent.83,85 (Level of Evidence: B)

3. Prasugrel, in a 10-mg daily maintenance dose, is reasonable after PCI.83,85 (Level of Evidence: B)

Class III: Harm

1. Prasugrel should not be administered to patients with a history of prior stroke or transient ischemic attack.83 (Level of Evidence: B)

5.4.2. Anticoagulant Therapy to Support PCI After Fibrinolytic Therapy

Class I

1. For patients with STEMI undergoing PCI after receiving fibrinolytic therapy with intravenous UFH, additional boluses of intravenous UFH should be administered as needed to support the procedure, taking into account whether GP IIb/IIIa receptor antagonists have been administered. (Level of Evidence: C)

2. For patients with STEMI undergoing PCI after receiving fibrinolytic therapy with enoxaparin, if the last subcutaneous dose was administered within the prior 8 hours, no additional enoxaparin should be given; if the last subcutaneous dose was administered between 8 and 12 hours earlier, enoxaparin 0.3 mg/kg IV should be given.127,149 (Level of Evidence: B)

Class III: Harm

1. Fondaparinux should not be used as the sole anticoagulant to support PCI. An additional anticoagulant with anti-IIa activity should be administered because of the risk of catheter thrombosis.110 (Level of Evidence: C)

6. Coronary Artery Bypass Graft Surgery: Recommendations

6.1. CABG in Patients With STEMI

Class I

1. Urgent CABG is indicated in patients with STEMI and coronary anatomy not amenable to PCI who have ongoing or recurrent ischemia, cardiogenic shock, severe HF, or other high-risk features.150–152 (Level of Evidence: B)

2. CABG is recommended in patients with STEMI at time of operative repair of mechanical defects.153–157 (Level of Evidence: B)

Class IIa

1. The use of mechanical circulatory support is reasonable in patients with STEMI who are hemodynamically unstable and require urgent CABG. (Level of Evidence: C)

Class IIb

1. Emergency CABG within 6 hours of symptom onset may be considered in patients with STEMI who do not
have cardiogenic shock and are not candidates for PCI or fibrinolytic therapy. (Level of Evidence: C)

6.2. Timing of Urgent CABG in Patients With STEMI in Relation to Use of Antiplatelet Agents

Class I

1. Aspirin should not be withheld before urgent CABG.\textsuperscript{138} (Level of Evidence: C)

2. Clopidogrel or ticagrelor should be discontinued at least 24 hours before urgent on-pump CABG, if possible.\textsuperscript{139–163} (Level of Evidence: B)

3. Short-acting intravenous GP IIb/IIIa receptor antagonists (eptifibatide, tirofiban) should be discontinued at least 2 to 4 hours before urgent CABG.\textsuperscript{164,165} (Level of Evidence: B)

4. Abciximab should be discontinued at least 12 hours before urgent CABG.\textsuperscript{137} (Level of Evidence: B)

Class IIb

1. Urgent off-pump CABG within 24 hours of clopidogrel or ticagrelor administration might be considered, especially if the benefits of prompt revascularization outweigh the risks of bleeding.\textsuperscript{160,166–168} (Level of Evidence: B)

2. Urgent CABG within 5 days of clopidogrel or ticagrelor administration or within 7 days of prasugrel administration might be considered, especially if the benefits of prompt revascularization outweigh the risks of bleeding. (Level of Evidence: C)
7. Routine Medical Therapies: Recommendations

7.1. Beta Blockers

Class I

1. Oral beta blockers should be initiated in the first 24 hours in patients with STEMI who do not have any of the following: signs of HF, evidence of a low-output state, increased risk for cardiogenic shock, or other contraindications to use of oral beta blockers (PR interval more than 0.24 seconds, second- or third-degree heart block, active asthma, or reactive airways disease). (Level of Evidence: B)

2. Beta blockers should be continued during and after hospitalization for all patients with STEMI and with no contraindications to their use. (Level of Evidence: B)

3. Patients with initial contraindications to the use of beta blockers in the first 24 hours after STEMI should be reevaluated to determine their subsequent eligibility. (Level of Evidence: C)

Class IIa

1. It is reasonable to administer intravenous beta blockers at the time of presentation to patients with STEMI and no contraindications to their use who are hypertensive or have ongoing ischemia. (Level of Evidence: B)

7.2. Renin-Angiotensin-Aldosterone System Inhibitors

Class I

1. An angiotensin-converting enzyme inhibitor should be administered within the first 24 hours to all patients with STEMI with anterior location, HF, or ejection fraction less than or equal to 0.40, unless contraindicated. (Level of Evidence: A)

2. An angiotensin receptor blocker should be given to patients with STEMI who have indications for but are intolerant of angiotensin-converting enzyme inhibitors. (Level of Evidence: A)

3. An aldosterone antagonist should be given to patients with STEMI and no contraindications who are already receiving an angiotensin-converting enzyme inhibitor and beta blocker and who have an ejection fraction less than or equal to 0.40 and either symptomatic HF or diabetes mellitus. (Level of Evidence: B)

Class IIa

1. Angiotensin-converting enzyme inhibitors are reasonable for all patients with STEMI and no contraindications to their use. (Level of Evidence: A)

7.3. Lipid Management

Class I

1. High-intensity statin therapy should be initiated or continued in all patients with STEMI and no contraindications to its use. (Level of Evidence: B)

Class IIa

1. It is reasonable to obtain a fasting lipid profile in patients with STEMI, preferably within 24 hours of presentation. (Level of Evidence: C)

8. Complications After STEMI: Recommendations

8.1. Treatment of Cardiogenic Shock

Class I

1. Emergency revascularization with either PCI or CABG is recommended in suitable patients with cardiogenic shock due to pump failure after STEMI irrespective of the time delay from MI onset. (Level of Evidence: B)

2. In the absence of contraindications, fibrinolytic therapy should be administered to patients with STEMI and cardiogenic shock who are unsuitable candidates for either PCI or CABG. (Level of Evidence: B)

Class IIa

1. The use of intra-aortic balloon pump counterpulsation can be useful for patients with cardiogenic shock after STEMI who do not quickly stabilize with pharmacological therapy. (Level of Evidence: B)

Class IIb

1. Alternative left ventricular (LV) assist devices for circulatory support may be considered in patients with refractory cardiogenic shock. (Level of Evidence: C)

8.2. Implantable Cardioverter-Defibrillator Therapy Before Discharge

Class I

1. Implantable cardioverter-defibrillator therapy is indicated before discharge in patients who develop sustained ventricular tachycardia/ventricular fibrillation more than 48 hours after STEMI, provided the arrhythmia is not due to transient or reversible ischemia, reinfarction, or metabolic abnormalities. (Level of Evidence: B)

8.3. Pacing in STEMI

Class I

1. Temporary pacing is indicated for symptomatic bradyarrhythmias unresponsive to medical treatment. (Level of Evidence: C)
8.4. Management of Pericarditis After STEMI

Class I

1. Aspirin is recommended for treatment of pericarditis after STEMI.\(^{201}\) (Level of Evidence: B)

Class IIb

1. Administration of acetaminophen, colchicine, or narcotic analgesics may be reasonable if aspirin, even in higher doses, is not effective. (Level of Evidence: C)

Class III: Harm

1. Glucocorticoids and nonsteroidal antiinflammatory drugs are potentially harmful for treatment of pericarditis after STEMI.\(^{202,203}\) (Level of Evidence: B)

8.5. Anticoagulation[

Class I

1. Anticoagulant therapy with a vitamin K antagonist should be provided to patients with STEMI and atrial fibrillation with CHADS2# score greater than or equal to 2, mechanical heart valves, venous thromboembolism, or hypercoagulable disorder. (Level of Evidence: C)

2. The duration of triple-antithrombotic therapy with a vitamin K antagonist, aspirin, and a P2Y\(_{12}\) receptor inhibitor should be minimized to the extent possible to limit the risk of bleeding.\(^{59}\) (Level of Evidence: C)

Class IIa

1. Anticoagulant therapy with a vitamin K antagonist is reasonable for patients with STEMI and asymptomatic LV mural thromb. (Level of Evidence: C)

Class IIb

1. Anticoagulant therapy may be considered for patients with STEMI and anterior apical akinesis or dyskinesis. (Level of Evidence: C)

2. Targeting vitamin K antagonist therapy to a lower international normalized ratio (eg, 2.0 to 2.5) might be considered in patients with STEMI who are receiving DAPT. (Level of Evidence: C)

9. Risk Assessment After STEMI: Recommendations

9.1. Use of Noninvasive Testing for Ischemia Before Discharge

Class I

1. Noninvasive testing for ischemia should be performed before discharge to assess the presence and extent of inducible ischemia in patients with STEMI who have not had coronary angiography and do not have high-risk clinical features for which coronary angiography would be warranted.\(^{209–211}\) (Level of Evidence: B)

Class IIb

1. Noninvasive testing for ischemia might be considered before discharge to evaluate the functional significance of a noninfarct artery stenosis previously identified at angiography. (Level of Evidence: C)

2. Noninvasive testing for ischemia might be considered before discharge to guide the postdischarge exercise prescription. (Level of Evidence: C)

9.2. Assessment of LV Function

Class I

1. LV ejection fraction should be measured in all patients with STEMI. (Level of Evidence: C)

9.3. Assessment of Risk for Sudden Cardiac Death

Class I

1. Patients with an initially reduced LV ejection fraction who are possible candidates for implantable cardioverter-defibrillator therapy should undergo reevaluation of LV ejection fraction 40 or more days after discharge.\(^{212–215}\) (Level of Evidence: B)

10. Posthospitalization Plan of Care: Recommendations

Class I

1. Posthospital systems of care designed to prevent hospital readmissions should be used to facilitate the transition to effective, coordinated outpatient care for all patients with STEMI.\(^{216–220}\) (Level of Evidence: B)

2. Exercise-based cardiac rehabilitation/secondary prevention programs are recommended for patients with STEMI.\(^{221–224}\) (Level of Evidence: B)

3. A clear, detailed, and evidence-based plan of care that promotes medication adherence, timely follow-up with the healthcare team, appropriate dietary and physical activities, and compliance with interventions for secondary prevention should be provided to patients with STEMI. (Level of Evidence: C)

4. Encouragement and advice to stop smoking and to avoid secondhand smoke should be provided to patients with STEMI.\(^{225–228}\) (Level of Evidence: A)
References


105. Iversen A, Galatius S, Jensen JS. The optimal route of administration of the glycoprotein IIb/IIIa receptor antagonist abciximab during percuta-


20 Circulation January 22, 2013


185. Deleted in press.

186. Deleted in press.


Key Words: AHA Scientific Statements ■ anticoagulants ■ antiplatelets ■ door-to-balloon ■ fibrinolysis ■ percutaneous coronary intervention ■ reperfusion ■ ST-elevation myocardial infarction
### Appendix 1. Author Relationships With Industry and Other Entities (Relevant)—2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

<table>
<thead>
<tr>
<th>Committee Member</th>
<th>Employment</th>
<th>Consultant</th>
<th>Speaker’s Bureau</th>
<th>Ownership/Partnership/Principal</th>
<th>Personal Research</th>
<th>Institutional, Organizational, or Other Financial Benefit</th>
<th>Expert Witness</th>
<th>Voting Recusals by Section*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patrick T. O’Gara, Chair</td>
<td>Harvard Medical School—Professor of Medicine</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Frederick G. Kushner, Vice Chair</td>
<td>Tulane University School of Medicine—Clinical Professor of Medicine; Heart Clinic of Louisiana—Medical Director</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Novartis†</td>
<td>8.1 8.2</td>
</tr>
<tr>
<td>Deborah D. Ascheim</td>
<td>Mount Sinai School of Medicine—Associate Professor; InCHOR—Clinical Director of Research</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Donald E. Casey, Jr</td>
<td>Atlantic Health—Chief Medical Officer and Vice President of Quality</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Mina K. Chung</td>
<td>Cleveland Clinic Foundation—Associate Professor of Medicine</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Biotronik†</td>
<td>4.4.1 5.1.4 7.2 9.5.2</td>
</tr>
<tr>
<td>James A. de Lemos</td>
<td>UT Southwestern Medical School—Professor of Medicine</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Bristol-Myers Squibb (DSMB)</td>
<td>None</td>
</tr>
<tr>
<td>Steven M. Ettinger</td>
<td>Penn State Heart &amp; Vascular Institute—Professor of Medicine and Radiology</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Medtronic§</td>
<td>None</td>
<td>None</td>
<td>4.3.1</td>
</tr>
<tr>
<td>James C. Fang</td>
<td>University Hospitals Case Medical Center—Director, Heart Transplantation</td>
<td>None</td>
<td>None</td>
<td>Novartis</td>
<td>Medtronic</td>
<td>None</td>
<td>None</td>
<td>9.5.4.1</td>
</tr>
<tr>
<td>Francis M. Fesmire</td>
<td>Heart Strike Center—Director</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Plaintiff, Missed ACS, 2010</td>
<td>8.3</td>
</tr>
<tr>
<td>Barry A. Franklin</td>
<td>William Beaumont Hospital—Director, Cardiac Rehabilitation and Exercise Laboratories</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Christopher B. Granger</td>
<td>Duke Clinical Research Institute—Director, Cardiac Care Unit; Assistant Professor of Medicine</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Asteias</td>
<td>4.4.1 6.4.2 8.7.1</td>
</tr>
</tbody>
</table>

(Continued)
<table>
<thead>
<tr>
<th>Committee Member</th>
<th>Employment</th>
<th>Consultant</th>
<th>Speaker’s Bureau</th>
<th>Ownership/Partnership/Principal</th>
<th>Personal Research</th>
<th>Institutional, Organizational, or Other Financial Benefit</th>
<th>Expert Witness</th>
<th>Expert Witness by Section*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harlan M. Krumholz</td>
<td>Yale University School of Medicine—Professor of Medicine</td>
<td>United HealthCare (Science Advisory Group)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Jane A. Linderbaum</td>
<td>Mayo Clinic—Assistant Professor of Medicine</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>David A. Morrow</td>
<td>Harvard Medical School—Associate Professor of Medicine</td>
<td>Beckman-Coulter, Boehringer Ingelheim, Daiichi-Sankyo, Eli Lilly, Genentech, Merck, Novartis, OrthoClinical Diagnostics/Johnson &amp; Johnson, Roche Diagnostics, Sanofi-aventis, Schering-Plough, Research Institute, Siemens Medical Solutions</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>3.2</td>
</tr>
<tr>
<td>L. Kristin Newby</td>
<td>Duke University Medical Center, Division of Cardiology—Professor of Medicine</td>
<td>Amgen, AstraZeneca, BioVascular, Johnson &amp; Johnson, Novartis</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>4.4.1</td>
</tr>
<tr>
<td>Joseph P. Ornato</td>
<td>Department of Emergency Medicine, Virginia Commonwealth University—Professor and Chairman</td>
<td>European Resuscitation Council, ZOLL Circulation</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>4.4.2</td>
</tr>
<tr>
<td>Narth Ou</td>
<td>Mayo Clinic—Pharmacology Coordinator, Cardiology</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>5.1</td>
</tr>
<tr>
<td>Martha J. Radford</td>
<td>NYU Langone Medical Center—Chief Quality Officer, NYU School of Medicine—Professor of Medicine (Cardiology)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>5.1.4.1</td>
</tr>
<tr>
<td>Jacqueline E. Tamis-Holland</td>
<td>St Luke’s-Roosevelt Hospital Center—Director, Interventional Cardiology Fellowship Program; Columbia University, College of Physicians and Surgeons—Assistant Professor of Clinical Medicine</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>6.4.1</td>
</tr>
</tbody>
</table>

(Continued)
### Appendix 1. Continued

<table>
<thead>
<tr>
<th>Committee Member</th>
<th>Employment</th>
<th>Consultant</th>
<th>Ownership/Partnership/Principal</th>
<th>Personal Research</th>
<th>Institutional, Organizational, or Other Financial Benefit</th>
<th>Expert Witness</th>
<th>Voting Recusals by Section*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carl L. Tommaso</td>
<td>Skokie Hospital—Director of Catheterization Laboratory; North Shore University Health Systems</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Cynthia M. Tracy</td>
<td>George Washington University Medical Center—Associate Director, Division of Cardiology</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Y. Joseph Woo</td>
<td>Hospital of the University of Pennsylvania—Associate Professor of Surgery</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>David X. Zhao</td>
<td>Vanderbilt University Medical Center—Director, Cardiac Catheterization and Interventional Cardiology</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>● Abbot Vascular ● Accumetrics ● AGA Medical ● Osiris ● Volcano</td>
<td>None</td>
<td>4.3.1</td>
</tr>
</tbody>
</table>

This table represents the relationships of committee members with industry and other entities that were determined to be relevant to this document. These relationships were reviewed and updated in conjunction with all meetings and/or conference calls of the writing committee during the document development process. The table does not necessarily reflect relationships with industry at the time of publication. A person is deemed to have a significant interest in a business if the interest represents ownership of \( \geq 5\% \) of the voting stock or share of the business entity, or ownership of \( \geq \$10,000 \) of the fair market value of the business entity; or if funds received by the person from the business entity exceed \( \geq 5\% \) of the person’s gross income for the previous year. Relationships that exist with no financial benefit are also included for the purpose of transparency. Relationships in this table are modest unless otherwise noted.

According to the ACCF/AHA, a person has a relevant relationship IF: a) The relationship or interest relates to the same or similar subject matter, intellectual property or asset, topic, or issue addressed in the document; or b) The company/entity (with whom the relationship exists) makes a drug, drug class, or device addressed in the document, or makes a competing drug or device addressed in the document; or c) The person or a member of the person’s household has a reasonable potential for financial, professional, or other personal gain or loss as a result of the issues/content addressed in the document.

*Writing committee members are required to recuse themselves from voting on sections to which their specific relationships with industry and other entities could apply. Section numbers apply to the full-text guideline.

†No financial benefit.

§Significant relationship.

\$Dr. Ettinger’s relationship with Medtronic was added just before balloting of the recommendations, so it was not relevant during the writing stage; however, the addition of this relationship makes the writing committee out of compliance with the minimum 50% no relevant RWI requirement.

ACS indicates acute coronary syndromes; DSMB, data safety monitoring board; NHLBI, National Heart, Lung, and Blood Institute; NIH, National Institutes of Health; and PI, principal investigator.
Appendix 2. Reviewer Relationships With Industry and Other Entities (Relevant)—2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

<table>
<thead>
<tr>
<th>Reviewer</th>
<th>Representation</th>
<th>Consultant</th>
<th>Speaker’s Bureau</th>
<th>Ownership/Partnership/Principal</th>
<th>Personal Research</th>
<th>Institutional, Organizational, or Other Financial Benefit</th>
<th>Expert Witness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elliott M. Antman</td>
<td>Official Reviewer—ACCF Board of Trustees</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>• Accumetrics • AstraZeneca • Beckman Coulter • Bristol-Myers Squibb Pharmaceutical Research Institute • Daiichi-Sankyo* • Eli Lilly* • GlaxoSmithKline • Merck • Millennium Pharmaceuticals • Novartis Pharmaceuticals • Ortho-Clinical Diagnostics • Sanofi-Synthelabo Recherche • Schering-Plough Research Institute</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Gary J. Balady</td>
<td>Official Reviewer—AHA</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Christopher P. Cannon</td>
<td>Official Reviewer—AHA</td>
<td>• Novartis†</td>
<td>None</td>
<td>None</td>
<td>• Novartis* • AstraZeneca* • Bristol-Myers Squibb† • GlaxoSmithKline • Merck*</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Judith S. Hochman</td>
<td>Official Reviewer—ACCF/AHA Task Force on Practice Guidelines</td>
<td>• BMS/Sanofi • Eli Lilly • GlaxoSmithKline</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>• Johnson &amp; Johnson Pharmaceutical Research &amp; Development (DSMB) • Merck/Schering Plough (DSMB)</td>
<td>None</td>
</tr>
<tr>
<td>Austin H. Kutscher</td>
<td>Official Reviewer—ACCF Board of Governors</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Charles J. Davidson</td>
<td>Organizational Reviewer—SCAI</td>
<td>• Abbott*</td>
<td>None</td>
<td>None</td>
<td>• Edwards Lifesciences* • Beckman Coulter† • Nanosphere†</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Deborah B. Diercks</td>
<td>Organizational Reviewer—ACEP</td>
<td>• Abbott Cardiovascular • Daiichi-Sankyo</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Jonathan M. Tobis</td>
<td>Organizational Reviewer—SCAI</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>• AGA Medical • The Medicines Company†</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Jeffrey L. Anderson</td>
<td>Content Reviewer—ACCF/AHA Task Force on Practice Guidelines</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>• Toshiba† • AstraZeneca (DSMB)</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>James C. Blankenship</td>
<td>Content Reviewer</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>• AstraZeneca† • Boston Scientific† • Novartis† • Schering-Plough†</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Jeffrey J. Cavendish</td>
<td>Content Reviewer—ACCF Prevention of Cardiovascular Disease Committee</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Harold L. Dauerman</td>
<td>Content Reviewer</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>• Abbott† • Medtronic† • The Medicines Company†</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>John S. Douglas, Jr.</td>
<td>Content Reviewer</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Stephen G. Ellis</td>
<td>Content Reviewer</td>
<td>• Abbott Vascular • Boston Scientific†</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Joseph Fredi</td>
<td>Content Reviewer—ACCF Surgeons’ Scientific Council</td>
<td>• AGA Medical†</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
Appendix 2. Continued

<table>
<thead>
<tr>
<th>Reviewer</th>
<th>Representation</th>
<th>Consultant</th>
<th>Speaker’s Bureau</th>
<th>Ownership/Partnership/Principal</th>
<th>Personal Research</th>
<th>Institutional, Organizational, or Other Financial Benefit</th>
<th>Expert Witness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthony Gershlick</td>
<td>Content Reviewer</td>
<td>● Abbott</td>
<td>None</td>
<td>None</td>
<td>Boehringer Ingelheim</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● AstraZeneca</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Boehringer Ingelheim</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Boston Scientific</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Cordis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Eli Lilly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Medtronic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Howard C. Herrmann</td>
<td>Content Reviewer</td>
<td>● AstraZeneca</td>
<td>None</td>
<td>None</td>
<td>Accutronics</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Merck Sharpe and Dohme</td>
<td></td>
<td></td>
<td>Boston Scientific*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Edwards Lifesciences*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>eValve</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Medtronic*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>St. Jude Medical</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The Medicines Company*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>James Bernard Herrin</td>
<td>Content Reviewer—ACCF Interventional Scientific Council</td>
<td>● Abbott</td>
<td>None</td>
<td>None</td>
<td>Eli Lilly</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Boston Scientific</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Eli Lilly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● St. Jude Medical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fred M. Kosumoto</td>
<td>Content Reviewer</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Glenn Levine</td>
<td>Content Reviewer</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Roxana Mehran</td>
<td>Content Reviewer</td>
<td>● Abbott Vascular</td>
<td>None</td>
<td>None</td>
<td>BMS/Sanofi-aventis*</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● AstraZeneca</td>
<td></td>
<td></td>
<td>The Medicines Company*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Ortho-McNeill</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M. Eugene Sherman</td>
<td>Content Reviewer—ACCF Board of Governors</td>
<td>None</td>
<td>Eli Lilly*</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Daniel I. Simon</td>
<td>Content Reviewer</td>
<td>● Cordis/Johnson &amp; Johnson</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Defendant, DES Intellectual Property Case, 2010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Daiichi-Sankyo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Eli Lilly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Medtronic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Sanofi-aventis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● The Medicines Company</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Richard W. Smalling</td>
<td>Content Reviewer—ACCF Interventional Scientific Council</td>
<td>● AGA Medical</td>
<td>None</td>
<td>None</td>
<td>AGA Medical*</td>
<td>AGA Medical</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cordis*</td>
<td>Cordis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>eValve*</td>
<td>eValve</td>
<td></td>
</tr>
<tr>
<td>William G. Stevenson</td>
<td>Content Reviewer—ACCF/AHA Task Force on Practice Guidelines</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>AstraZeneca</td>
<td>Merck/Schering-Plough</td>
<td>None</td>
</tr>
<tr>
<td>William A. Tansey III</td>
<td>Content Reviewer</td>
<td>● Bristol-Myers</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Sanofi-aventis (DSMB)</td>
<td>None</td>
</tr>
<tr>
<td>David D. Waters</td>
<td>Content Reviewer</td>
<td>● Squibb</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td></td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Pfizer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christopher J. White</td>
<td>Content Reviewer</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Boston Scientific</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>St. Jude Medical</td>
<td></td>
</tr>
<tr>
<td>Clyde W. Yancy</td>
<td>Content Reviewer—ACCF/AHA Task Force on Practice Guidelines</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Yerem Yeghiazarians</td>
<td>Content Reviewer</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

This table represents the relationships of reviewers with industry and other entities that were disclosed at the time of peer review and determined to be relevant. It does not necessarily reflect relationships with industry at the time of publication. A person is deemed to have a significant interest in a business if the interest represents ownership of ≥5% of the voting stock or share of the business entity, or ownership of ≥$10 000 of the fair market value of the business entity; or if funds received by the person from the business entity exceed 5% of the person’s gross income for the previous year. A relationship is considered to be modest if it is less than significant under the preceding definition. Relationships that exist with no financial benefit are also included for the purpose of transparency. Relationships in this table are modest unless otherwise noted. Names are listed in alphabetical order within each category of review.

According to the ACCF/AHA, a person has a relevant relationship if: a) The relationship or interest relates to the same or similar subject matter, intellectual property or asset, topic, or issue addressed in the document; or b) The company/entity (with whom the relationship exists) makes a drug, drug class, or device addressed in the document; or makes a competing drug or device addressed in the document; or c) The person or a member of the person’s household has a reasonable potential for financial, professional, or other personal gain or loss as a result of the issues/content addressed in the document.

*Significant relationship.
†No financial benefit.
ACCF indicates American College of Cardiology Foundation; ACEP, American College of Emergency Physicians; AHA, American Heart Association; DES, drug-eluting stent; DSMB, data safety monitoring board; and SCAI, Society for Cardiovascular Angiography and Interventions.