

ACCF/AHA Practice Guideline

Management of Patients With Atrial Fibrillation (Compilation of 2006 ACCF/AHA/ESC and 2011 ACCF/AHA/HRS Recommendations)

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

*Developed in Partnership With the European Society of Cardiology; and in Collaboration With the
European Heart Rhythm Association and the Heart Rhythm Society*

ACCF/AHA TASK FORCE MEMBERS

Jeffrey L. Anderson, MD, FACC, FAHA, Chair; Jonathan L. Halperin, MD, FACC, FAHA, Chair-Elect;
Nancy M. Albert, PhD, CCNS, CCRN; Biykem Bozkurt, MD, PhD, FACC, FAHA;
Ralph G. Brindis, MD, MPH, MACC; Lesley H. Curtis, PhD; David DeMets, PhD;
Robert A. Guyton, MD, FACC; Judith S. Hochman, MD, FACC, FAHA;
Richard J. Kovacs, MD, FACC, FAHA; E. Magnus Ohman, MD, FACC;
Susan J. Pressler, PhD, RN, FAAN, FAHA; Frank W. Sellke, MD, FACC, FAHA;
Win-Kuang Shen, MD, FACC, FAHA

2011 WRITING COMMITTEE MEMBERS

L. Samuel Wann, MD, MACC, FAHA, Chair*; Anne B. Curtis, MD, FACC, FAHA*;
Kenneth A. Ellenbogen, MD, FACC, FHRS†; N. A. Mark Estes, III, MD, FACC, FHRS‡;
Michael D. Ezekowitz, MB, ChB, FACC*; Warren M. Jackman, MD, FACC, FHRS*;
Craig T. January, MD, PhD, FACC*; James E. Lowe, MD, FACC*; Richard L. Page, MD, FACC, FHRS†;
David J. Slotwiner, MD, FACC†; William G. Stevenson, MD, FACC, FAHA‖; Cynthia M. Tracy, MD, FACC*

2006 WRITING COMMITTEE MEMBERS

Valentin Fuster, MD, PhD, FACC, FAHA, FESC, Co-Chair;
Lars E. Rydén, MD, PhD, FACC, FESC, FAHA, Co-Chair;
David S. Cannom, MD, FACC; Harry J. Crijns, MD, FACC, FESC;
Anne B. Curtis, MD, FACC, FAHA; Kenneth A. Ellenbogen, MD, FACC;
Jonathan L. Halperin, MD, FACC, FAHA; Jean-Yves Le Heuzey, MD, FESC; G. Neal Kay, MD, FACC;
James E. Lowe, MD, FACC; S. Bertil Olsson, MD, PhD, FESC; Eric N. Prystowsky, MD, FACC;
Juan Luis Tamargo, MD, FESC; L. Samuel Wann, MD, FACC, FESC

See "2011 ACCF/AHA/HRS Focused Update on the Management of Patients With Atrial Fibrillation (Updating the 2006 Guideline)" and "2011 ACCF/AHA/HRS Focused Update on the Management of Patients With Atrial Fibrillation (Update on Dabigatran)" for respective writing committee member recusals information.

*ACCF/AHA Representative. †HRS Representative. ‡ACCF/AHA Task Force on Performance Measures Representative. ‖ACCF/AHA Task Force on Practice Guidelines Liaison.

This document was approved by the American College of Cardiology Foundation Board of Trustees and the American Heart Association Science Advisory and Coordinating Committee in July 2010; and by the Heart Rhythm Society in August 2010.

The American Heart Association requests that this document be cited as follows: Anderson JL, Halperin JL, Albert NM, Bozkurt B, Brindis RG, Curtis LH, DeMets D, Guyton RA, Hochman JS, Kovacs RJ, Ohman EM, Pressler SJ, Sellke FW, Shen W-K. Management of patients with atrial fibrillation (compilation of 2006 ACCF/AHA/ESC and 2011 ACCF/AHA/HRS guideline recommendations: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2013;127:000-000.

This article has been copublished in the *Journal of the American College of Cardiology*.

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

Expert peer review of AHA Scientific Statements is conducted by the AHA Office of Science Operations. For more on AHA statements and guidelines development, visit <http://my.americanheart.org/statements> and select the "Policies and Development" link.

Permissions: Multiple copies, modification, alteration, enhancement, and/or distribution of this document are not permitted without the express permission of the American Heart Association. Instructions for obtaining permission are located at http://www.heart.org/HEARTORG/General/Copyright-Permission-Guidelines_UCM_300404_Article.jsp. A link to the "Copyright Permissions Request Form" appears on the right side of the page.

(*Circulation*. 2013;127:00-00.)

© 2013 by American College of Cardiology Foundation and the American Heart Association, Inc.

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

DOI: 10.1161/CIR.0b013e318290826d

Table of Contents

Introduction	000
1. Management	000
1.1. Pharmacological and Nonpharmacological Therapeutic Options	000
1.1.1. Rate Control During AF	000
1.1.2. Preventing Thromboembolism	000
1.1.2.1. Antithrombotic Strategies for Prevention of Ischemic Stroke and Systemic Embolism	000
1.1.2.1.1. Combining Anticoagulant With Antiplatelet Therapy (2011 New Section)	000
1.1.2.1.2. Use of Oral Direct Thrombin Inhibitor Anticoagulant Agents (2011 New Section)	000
1.1.3. Cardioversion of AF	000
1.1.3.1. Dronedaron for the Prevention of Recurrent AF (2011 New Section)	000
1.2. Direct-Current Cardioversion of AF and Flutter	000
1.2.1. Pharmacological Enhancement of Direct-Current Cardioversion	000
1.2.2. Prevention of Thromboembolism in Patients With AF Undergoing Cardioversion	000
1.3. Maintenance of Sinus Rhythm	000
1.4. Special Considerations	000
1.4.1. Postoperative AF	000
1.4.2. Acute Myocardial Infarction	000
1.4.3. Wolff-Parkinson-White Preexcitation Syndromes	000
1.4.4. Hyperthyroidism	000
1.4.5. Pregnancy	000
1.4.6. Hypertrophic Cardiomyopathy	000
1.4.7. Pulmonary Diseases	000
Appendix 1. 2011 Author Relationships With Industry and Other Entities	000
Appendix 2. 2006 Author Relationships With Industry	000

Introduction

This document is a compilation of the current American College of Cardiology Foundation/American Heart Association (ACCF/AHA) practice guideline recommendations for atrial fibrillation (AF) from the “ACC/AHA/ESC 2006 Guidelines for the Management of Patients With Atrial Fibrillation,”* the “2011 ACCF/AHA/HRS Focused Update on the Management of Patients With Atrial Fibrillation (Updating the 2006 Guideline)”† and the “2011 ACCF/AHA/HRS Focused Update on the Management of Patients With Atrial Fibrillation (Update on Dabigatran).”‡ Updated and new recommendations from

2011 are noted and outdated recommendations have been removed. No new evidence was reviewed, and no recommendations included herein are original to this document. The ACCF/AHA Task Force on Practice Guidelines chooses to republish the recommendations in this format to provide the complete set of practice guideline recommendations in a single resource.

1. Management

1.1. Pharmacological and Nonpharmacological Therapeutic Options

1.1.1. Rate Control During AF

Class I

1. Measurement of the heart rate at rest and control of the rate using pharmacological agents (either a beta blocker or nondihydropyridine calcium channel antagonist, in most cases) are recommended for patients with persistent or permanent AF. (*Level of Evidence: B*)
2. In the absence of preexcitation, intravenous administration of beta blockers (esmolol, metoprolol, or propranolol) or nondihydropyridine calcium channel antagonists (verapamil, diltiazem) is recommended to slow the ventricular response to AF in the acute setting, exercising caution in patients with hypotension or heart failure (HF). (*Level of Evidence: B*)
3. Intravenous administration of digoxin or amiodarone is recommended to control the heart rate in patients with AF and HF who do not have an accessory pathway. (*Level of Evidence: B*)
4. In patients who experience symptoms related to AF during activity, the adequacy of heart rate control should be assessed during exercise, adjusting pharmacological treatment as necessary to keep the rate in the physiological range. (*Level of Evidence: C*)
5. Digoxin is effective following oral administration to control the heart rate at rest in patients with AF and is indicated for patients with HF, left ventricular (LV) dysfunction, or for sedentary individuals. (*Level of Evidence: C*)

Class IIa

1. A combination of digoxin and either a beta blocker or nondihydropyridine calcium channel antagonist is reasonable to control the heart rate both at rest and during exercise in patients with AF. The choice of medication should be individualized and the dose modulated to avoid bradycardia. (*Level of Evidence: B*)
2. It is reasonable to use ablation of the atrioventricular (AV) node or accessory pathway to control heart rate when pharmacological therapy is insufficient or associated with side effects. (*Level of Evidence: B*)
3. Intravenous amiodarone can be useful to control the heart rate in patients with AF when other measures are unsuccessful or contraindicated. (*Level of Evidence: C*)
4. When electrical cardioversion is not necessary in patients with AF and an accessory pathway, intravenous procainamide or ibutilide is a reasonable alternative. (*Level of Evidence: C*)

*J Am Coll Cardiol. 2006;48:854-906. doi:10.1016/j.jacc.2006.07.009

†J Am Coll Cardiol. 2011;57:223-42. doi:10.1016/j.jacc.2010.10.001

‡J Am Coll Cardiol. 2011;57:1330-37. doi:10.1016/j.jacc.2011.01.010

Class IIb

1. When the ventricular rate cannot be adequately controlled both at rest and during exercise in patients with AF using a beta blocker, nondihydropyridine calcium channel antagonist, or digoxin, alone or in combination, oral amiodarone may be administered to control the heart rate. (*Level of Evidence: C*)
2. Intravenous procainamide, disopyramide, ibutilide, or amiodarone may be considered for hemodynamically stable patients with AF involving conduction over an accessory pathway. (*Level of Evidence: B*)
3. When the rate cannot be controlled with pharmacological agents or tachycardia-mediated cardiomyopathy is suspected, catheter-directed ablation of the AV node may be considered in patients with AF to control the heart rate. (*Level of Evidence: C*)

Class III

1. Digitalis should not be used as the sole agent to control the rate of ventricular response in patients with paroxysmal AF. (*Level of Evidence: B*)
2. Catheter ablation of the AV node should not be attempted without a prior trial of medication to control the ventricular rate in patients with AF. (*Level of Evidence: C*)
3. In patients with decompensated HF and AF, intravenous administration of a nondihydropyridine calcium channel antagonist may exacerbate hemodynamic compromise and is not recommended. (*Level of Evidence: C*)
4. Intravenous administration of digitalis glycosides or nondihydropyridine calcium channel antagonists to patients with AF and a preexcitation syndrome may paradoxically accelerate the ventricular response and is not recommended. (*Level of Evidence: C*)

Class III: No Benefit

1. *2011 New Recommendation:* Treatment to achieve strict rate control of heart rate (80 bpm at rest or 110 bpm during a 6-minute walk) is not beneficial compared to achieving a resting heart rate 110 bpm in patients with persistent AF who have stable ventricular function (LV ejection fraction 0.40) and no or acceptable symptoms related to the arrhythmia, though uncontrolled tachycardia may over time be associated with a reversible decline in ventricular performance. (*Level of Evidence: B*)

1.1.2. Preventing Thromboembolism**Class I**

1. Antithrombotic therapy to prevent thromboembolism is recommended for all patients with AF, except those with lone AF or contraindications. (*Level of Evidence: A*)
2. The selection of the antithrombotic agent should be based upon the absolute risks of stroke and bleeding and the relative risk and benefit for a given patient. (*Level of Evidence: A*)
3. For patients without mechanical heart valves at high risk of stroke, chronic oral anticoagulant therapy with a vitamin K antagonist is recommended in a dose

adjusted to achieve the target intensity international normalized ratio (INR) of 2.0 to 3.0, unless contraindicated. Factors associated with highest risk for stroke in patients with AF are prior thromboembolism (stroke, transient ischemic attack, or systemic embolism) and rheumatic mitral stenosis. (*Level of Evidence: A*)

4. Anticoagulation with a vitamin K antagonist is recommended for patients with more than 1 moderate risk factor. Such factors include age 75 y or greater, hypertension, HF, impaired LV systolic function (ejection fraction 35% or less or fractional shortening less than 25%), and diabetes mellitus. (*Level of Evidence: A*)
5. INR should be determined at least weekly during initiation of therapy and monthly when anticoagulation is stable. (*Level of Evidence: A*)
6. Aspirin, 81–325 mg daily, is recommended as an alternative to vitamin K antagonists in low-risk patients or in those with contraindications to oral anticoagulation. (*Level of Evidence: A*)
7. For patients with AF who have mechanical heart valves, the target intensity of anticoagulation should be based on the type of prosthesis, maintaining an INR of at least 2.5. (*Level of Evidence: B*)
8. Antithrombotic therapy is recommended for patients with atrial flutter as for those with AF. (*Level of Evidence: C*)

Class IIa

1. For primary prevention of thromboembolism in patients with nonvalvular AF who have just 1 of the following validated risk factors, antithrombotic therapy with either aspirin or a vitamin K antagonist is reasonable, based upon an assessment of the risk of bleeding complications, ability to safely sustain adjusted chronic anticoagulation, and patient preferences: age greater than or equal to 75 y (especially in female patients), hypertension, HF, impaired LV function, or diabetes mellitus. (*Level of Evidence: A*)
2. For patients with nonvalvular AF who have 1 or more of the following less well-validated risk factors, antithrombotic therapy with either aspirin or a vitamin K antagonist is reasonable for prevention of thromboembolism: age 65 to 74 y, female gender, or coronary artery disease. The choice of agent should be based upon the risk of bleeding complications, ability to safely sustain adjusted chronic anticoagulation, and patient preferences. (*Level of Evidence: B*)
3. It is reasonable to select antithrombotic therapy using the same criteria irrespective of the pattern (ie, paroxysmal, persistent, or permanent) of AF. (*Level of Evidence: B*)
4. In patients with AF who do not have mechanical prosthetic heart valves, it is reasonable to interrupt anticoagulation for up to 1 week without substituting heparin for surgical or diagnostic procedures that carry a risk of bleeding. (*Level of Evidence: C*)
5. It is reasonable to reevaluate the need for anticoagulation at regular intervals. (*Level of Evidence: C*)

Class IIb

1. In patients 75 y of age and older at increased risk of bleeding but without frank contraindications to oral anticoagulant therapy, and in other patients with moderate risk factors for thromboembolism who are unable to safely tolerate anticoagulation at the standard intensity of INR 2.0 to 3.0, a lower INR target of 2.0 (range 1.6 to 2.5) may be considered for primary prevention of ischemic stroke and systemic embolism. (*Level of Evidence: C*)
2. When surgical procedures require interruption of oral anticoagulant therapy for longer than 1 week in high-risk patients, unfractionated heparin may be administered or low-molecular-weight heparin given by subcutaneous injection, although the efficacy of these alternatives in this situation is uncertain. (*Level of Evidence: C*)
3. Following percutaneous coronary intervention or revascularization surgery in patients with AF, low-dose aspirin (less than 100 mg per d) and/or clopidogrel (75 mg per d) may be given concurrently with anticoagulation to prevent myocardial ischemic events, but these strategies have not been thoroughly evaluated and are associated with an increased risk of bleeding. (*Level of Evidence: C*)
4. In patients undergoing percutaneous coronary intervention, anticoagulation may be interrupted to prevent bleeding at the site of peripheral arterial puncture, but the vitamin K antagonist should be resumed as soon as possible after the procedure and the dose adjusted to achieve an INR in the therapeutic range. Aspirin may be given temporarily during the hiatus, but the maintenance regimen should then consist of the combination of clopidogrel, 75 mg daily, plus warfarin (INR 2.0 to 3.0). Clopidogrel should be given for a minimum of 1 mo after implantation of a bare metal stent, at least 3 mo for a sirolimus-eluting stent, at least 6 mo for a paclitaxel-eluting stent, and 12 mo or longer in selected patients, following which warfarin may be continued as monotherapy in the absence of a subsequent coronary event. When warfarin is given in combination with clopidogrel or low-dose aspirin, the dose intensity must be carefully regulated. (*Level of Evidence: C*)
5. In patients with AF younger than 60 y without heart disease or risk factors for thromboembolism (lone AF), the risk of thromboembolism is low without treatment and the effectiveness of aspirin for primary prevention of stroke relative to the risk of bleeding has not been established. (*Level of Evidence: C*)
6. In patients with AF who sustain ischemic stroke or systemic embolism during treatment with low-intensity anticoagulation (INR 2.0 to 3.0), rather than add an antiplatelet agent, it may be reasonable to raise the intensity of anticoagulation to a maximum target INR of 3.0 to 3.5. (*Level of Evidence: C*)

Class III

1. Long-term anticoagulation with a vitamin K antagonist is not recommended for primary prevention of stroke in patients below the age of 60 y without heart disease

(lone AF) or any risk factors for thromboembolism. (*Level of Evidence: C*)

1.1.2.1. Antithrombotic Strategies for Prevention of Ischemic Stroke and Systemic Embolism

1.1.2.1.1. Combining Anticoagulant With Antiplatelet Therapy (2011 New Section)

Class IIb

1. *2011 New Recommendation:* The addition of clopidogrel to aspirin to reduce the risk of major vascular events, including stroke, might be considered in patients with AF in whom oral anticoagulation with warfarin is considered unsuitable due to patient preference or the physician's assessment of the patient's ability to safely sustain anticoagulation. (*Level of Evidence: B*)

1.1.2.1.2. Use of Oral Direct Thrombin Inhibitor Anticoagulant Agents (2011 New Section)

Class I

1. *2011 New Recommendation:* Dabigatran is useful as an alternative to warfarin for the prevention of stroke and systemic thromboembolism in patients with paroxysmal to permanent AF and risk factors for stroke or systemic embolization who do not have a prosthetic heart valve or hemodynamically significant valve disease, severe renal failure (creatinine clearance 15 mL/min) or advanced liver disease (impaired baseline clotting function). (*Level of Evidence: B*)

1.1.3. Cardioversion of AF

Class I

1. Administration of flecainide, dofetilide, propafenone, or ibutilide is recommended for pharmacological cardioversion of AF. (*Level of Evidence: A*)

Class IIa

1. Administration of amiodarone is a reasonable option for pharmacological cardioversion of AF. (*Level of Evidence: A*)
2. A single oral bolus dose of propafenone or flecainide (pill-in-the-pocket) can be administered to terminate persistent AF outside the hospital once treatment has proved safe in hospital for selected patients without sinus or AV node dysfunction, bundle-branch block, QT-interval prolongation, the Brugada syndrome, or structural heart disease. Before antiarrhythmic medication is initiated, a beta blocker or nondihydropyridine calcium channel antagonist should be given to prevent rapid AV conduction in the event atrial flutter occurs. (*Level of Evidence: C*)
3. Administration of amiodarone can be beneficial on an outpatient basis in patients with paroxysmal or persistent AF when rapid restoration of sinus rhythm is not deemed necessary. (*Level of Evidence: C*)

Class IIb

1. Administration of quinidine or procainamide might be considered for pharmacological cardioversion of AF, but the usefulness of these agents is not well established. (*Level of Evidence: C*)

Class III

1. Digoxin and sotalol may be harmful when used for pharmacological cardioversion of AF and are not recommended. (*Level of Evidence: A*)
2. Quinidine, procainamide, disopyramide, and dofetilide should not be started out of hospital for conversion of AF to sinus rhythm. (*Level of Evidence: B*)

1.1.3.1. Dronedaron for the Prevention of Recurrent AF (2011 New Section)

Class IIa

1. **2011 New Recommendation:** Dronedaron is reasonable to decrease the need for hospitalization for cardiovascular events in patients with paroxysmal AF or after conversion of persistent AF. Dronedaron can be initiated during outpatient therapy. (*Level of Evidence: B*)

Class III: Harm

1. **2011 New Recommendation:** Dronedaron should not be administered to patients with class IV heart failure or patients who have had an episode of decompensated heart failure in the past 4 weeks, especially if they have depressed left ventricular function (left ventricular ejection fraction <35%). (*Level of Evidence: B*)

1.2. Direct-Current Cardioversion of AF and Flutter**Class I**

1. When a rapid ventricular response does not respond promptly to pharmacological measures for patients with AF with ongoing myocardial ischemia, symptomatic hypotension, angina, or HF, immediate R-wave synchronized direct-current cardioversion is recommended. (*Level of Evidence: C*)
2. Immediate direct-current cardioversion is recommended for patients with AF involving preexcitation when very rapid tachycardia or hemodynamic instability occurs. (*Level of Evidence: B*)
3. Cardioversion is recommended in patients without hemodynamic instability when symptoms of AF are unacceptable to the patient. In case of early relapse of AF after cardioversion, repeated direct-current cardioversion attempts may be made following administration of antiarrhythmic medication. (*Level of Evidence: C*)

Class IIa

1. Direct-current cardioversion can be useful to restore sinus rhythm as part of a long-term management strategy for patients with AF. (*Level of Evidence: B*)
2. Patient preference is a reasonable consideration in the selection of infrequently repeated cardioversions for the management of symptomatic or recurrent AF. (*Level of Evidence: C*)

Class III

1. Frequent repetition of direct-current cardioversion is not recommended for patients who have relatively short periods of sinus rhythm between relapses of AF after

multiple cardioversion procedures despite prophylactic antiarrhythmic drug therapy. (*Level of Evidence: C*)

2. Electrical cardioversion is contraindicated in patients with digitalis toxicity or hypokalemia. (*Level of Evidence: C*)

1.2.1. Pharmacological Enhancement of Direct-Current Cardioversion**Class IIa**

1. Pretreatment with amiodarone, flecainide, ibutilide, propafenone, or sotalol can be useful to enhance the success of direct-current cardioversion and prevent recurrent atrial fibrillation. (*Level of Evidence: B*)
2. In patients who relapse to AF after successful cardioversion, it can be useful to repeat the procedure following prophylactic administration of antiarrhythmic medication. (*Level of Evidence: C*)

Class IIb

1. For patients with persistent AF, administration of beta blockers, disopyramide, diltiazem, dofetilide, procainamide, or verapamil may be considered, although the efficacy of these agents to enhance the success of direct-current cardioversion or to prevent early recurrence of AF is uncertain. (*Level of Evidence: C*)
2. Out-of-hospital initiation of antiarrhythmic medications may be considered in patients without heart disease to enhance the success of cardioversion of AF. (*Level of Evidence: C*)
3. Out-of-hospital administration of antiarrhythmic medications may be considered to enhance the success of cardioversion of AF in patients with certain forms of heart disease once the safety of the drug has been verified for the patient. (*Level of Evidence: C*)

1.2.2. Prevention of Thromboembolism in Patients With AF Undergoing Cardioversion**Class I**

1. For patients with AF of 48-hour duration or longer, or when the duration of AF is unknown, anticoagulation (INR 2.0 to 3.0) is recommended for at least 3 wk prior to and 4 wk after cardioversion, regardless of the method (electrical or pharmacological) used to restore sinus rhythm. (*Level of Evidence: B*)
2. For patients with AF of more than 48-h duration requiring immediate cardioversion because of hemodynamic instability, heparin should be administered concurrently (unless contraindicated) by an initial intravenous bolus injection followed by a continuous infusion in a dose adjusted to prolong the activated partial thromboplastin time to 1.5 to 2 times the reference control value. Thereafter, oral anticoagulation (INR 2.0 to 3.0) should be provided for at least 4 wk, as for patients undergoing elective cardioversion. Limited data support subcutaneous administration of low-molecular-weight heparin in this indication. (*Level of Evidence: C*)
3. For patients with AF of less than 48-h duration associated with hemodynamic instability (angina pectoris, myocardial infarction (MI), shock, or pulmonary edema), cardioversion

should be performed immediately without delay for prior initiation of anticoagulation. (*Level of Evidence: C*)

Class IIa

1. During the first 48 h after onset of AF, the need for anticoagulation before and after cardioversion may be based on the patient's risk of thromboembolism. (*Level of Evidence: C*)
2. As an alternative to anticoagulation prior to cardioversion of AF, it is reasonable to perform transesophageal echocardiogram in search of thrombus in the left atrium or left atrium appendage. (*Level of Evidence: B*)
 - 2a. For patients with no identifiable thrombus, cardioversion is reasonable immediately after anticoagulation with unfractionated heparin (eg, initiate by intravenous bolus injection and an infusion continued at a dose adjusted to prolong the activated partial thromboplastin time to 1.5 to 2 times the control value until oral anticoagulation has been established with a vitamin K antagonist (eg, warfarin), as evidenced by an INR equal to or greater than 2.0.) (*Level of Evidence: B*). Thereafter, continuation of oral anticoagulation (INR 2.0 to 3.0) is reasonable for a total anticoagulation period of at least 4 wk, as for patients undergoing elective cardioversion (*Level of Evidence: B*). Limited data are available to support the subcutaneous administration of a low-molecular-weight heparin in this indication. (*Level of Evidence: C*)
 - 2b. For patients in whom thrombus is identified by transesophageal echocardiogram, oral anticoagulation (INR 2.0 to 3.0) is reasonable for at least 3 wk prior to and 4 wk after restoration of sinus rhythm, and a longer period of anticoagulation may be appropriate even after apparently successful cardioversion, because the risk of thromboembolism often remains elevated in such cases. (*Level of Evidence: C*)
3. For patients with atrial flutter undergoing cardioversion, anticoagulation can be beneficial according to the recommendations as for patients with AF. (*Level of Evidence: C*)

1.3. Maintenance of Sinus Rhythm

Class I

1. Before initiating antiarrhythmic drug therapy, treatment of precipitating or reversible causes of AF is recommended. (*Level of Evidence: C*)
2. *2011 Updated Recommendation:* Catheter ablation performed in experienced centers[§] is useful in maintaining

[§]Refers to pulmonary vein isolation with catheter ablation. An *experienced center* is defined as one performing more than 50 AF catheter ablation cases per year. Evidence-based technical guidelines including operator training and experience necessary to maximize rates of successful catheter ablation are not available; each center should maintain a database detailing procedures; success and complications; engage strategies for continuous quality improvement, and participate in registries and other efforts pooling data in order to develop optimal care algorithms.

sinus rhythm in selected patients with significantly symptomatic, paroxysmal AF who have failed treatment with an antiarrhythmic drug and have normal or mildly dilated left atria, normal or mildly reduced LV function, and no severe pulmonary disease. (*Level of Evidence: A*)

Class IIa

1. Pharmacological therapy can be useful in patients with AF to maintain sinus rhythm and prevent tachycardia-induced cardiomyopathy. (*Level of Evidence: C*)
2. Infrequent, well-tolerated recurrence of AF is reasonable as a successful outcome of antiarrhythmic drug therapy. (*Level of Evidence: C*)
3. Outpatient initiation of antiarrhythmic drug therapy is reasonable in patients with AF who have no associated heart disease when the agent is well tolerated. (*Level of Evidence: C*)
4. *2011 Updated Recommendation:* In patients with AF without structural or coronary heart disease, initiation of propafenone or flecainide can be beneficial on an outpatient basis in patients with paroxysmal AF who are in sinus rhythm at the time of drug initiation. (*Level of Evidence: B*)
5. Sotalol can be beneficial in outpatients in sinus rhythm with little or no heart disease, prone to paroxysmal AF, if the baseline uncorrected QT interval is less than 460 ms, serum electrolytes are normal, and risk factors associated with class III drug-related proarrhythmia are not present. (*Level of Evidence: C*)
6. *2011 New Recommendation:* Catheter ablation is reasonable to treat symptomatic persistent AF. (*Level of Evidence: A*)

Class IIb

1. *2011 New Recommendation:* Catheter ablation may be reasonable to treat symptomatic paroxysmal AF in patients with significant left atrial dilatation or with significant LV dysfunction. (*Level of Evidence: A*)

Class III: Harm

1. Antiarrhythmic therapy with a particular drug is not recommended for maintenance of sinus rhythm in patients with AF who have well-defined risk factors for proarrhythmia with that agent. (*Level of Evidence: A*)
2. Pharmacological therapy is not recommended for maintenance of sinus rhythm in patients with advanced sinus node disease or AV node dysfunction unless they have a functioning electronic cardiac pacemaker. (*Level of Evidence: C*)

1.4. Special Considerations

1.4.1. Postoperative AF

Class I

1. Unless contraindicated, treatment with an oral beta blocker to prevent postoperative AF is recommended for patients undergoing cardiac surgery. (*Level of Evidence: A*)

- Administration of AV nodal blocking agents is recommended to achieve rate control in patients who develop postoperative AF. (*Level of Evidence: B*)

Class IIa

- Preoperative administration of amiodarone reduces the incidence of AF in patients undergoing cardiac surgery and represents appropriate prophylactic therapy for patients at high risk for postoperative AF. (*Level of Evidence: A*)
- It is reasonable to restore sinus rhythm by pharmacological cardioversion with ibutilide or direct-current cardioversion in patients who develop post-operative AF as advised for nonsurgical patients. (*Level of Evidence: B*)
- It is reasonable to administer antiarrhythmic medications in an attempt to maintain sinus rhythm in patients with recurrent or refractory postoperative AF, as recommended for other patients who develop AF. (*Level of Evidence: B*)
- It is reasonable to administer antithrombotic medication in patients who develop postoperative AF, as recommended for nonsurgical patients. (*Level of Evidence: B*)

Class IIb

- Prophylactic administration of sotalol may be considered for patients at risk of developing AF following cardiac surgery. (*Level of Evidence: B*)

1.4.2. Acute Myocardial Infarction

Class I

- Direct-current cardioversion is recommended for patients with severe hemodynamic compromise or intractable ischemia, or when adequate rate control cannot be achieved with pharmacological agents in patients with acute MI and AF. (*Level of Evidence: C*)
- Intravenous administration of amiodarone is recommended to slow a rapid ventricular response to AF and improve LV function in patients with acute MI. (*Level of Evidence: C*)
- Intravenous beta blockers and nondihydropyridine calcium antagonists are recommended to slow a rapid ventricular response to AF in patients with acute MI who do not display clinical LV dysfunction, bronchospasm, or AV block. (*Level of Evidence: C*)
- For patients with AF and acute MI, administration of unfractionated heparin by either continuous intravenous infusion or intermittent subcutaneous injection is recommended in a dose sufficient to prolong the activated partial thromboplastin time to 1.5 to 2.0 times the control value, unless contraindications to anticoagulation exist. (*Level of Evidence: C*)

Class IIa

- Intravenous administration of digitalis is reasonable to slow a rapid ventricular response and improve

LV function in patients with acute MI and AF associated with severe LV dysfunction and HF. (*Level of Evidence: C*)

Class III

- The administration of class IC antiarrhythmic drugs is not recommended in patients with AF in the setting of acute MI. (*Level of Evidence: C*)

1.4.3. Wolff-Parkinson-White Preexcitation Syndromes

Class I

- Catheter ablation of the accessory pathway is recommended in symptomatic patients with AF who have Wolff-Parkinson-White Preexcitation syndrome, particularly those with syncope due to rapid heart rate or those with a short bypass tract refractory period. (*Level of Evidence: B*)
- Immediate direct-current cardioversion is recommended to prevent ventricular fibrillation in patients with a short anterograde bypass tract refractory period in whom AF occurs with a rapid ventricular response associated with hemodynamic instability. (*Level of Evidence: B*)
- Intravenous procainamide or ibutilide is recommended to restore sinus rhythm in patients with Wolff-Parkinson-White Preexcitation in whom AF occurs without hemodynamic instability in association with a wide QRS complex on the electrocardiogram (greater than or equal to 120-ms duration) or with a rapid pre-excited ventricular response. (*Level of Evidence: C*)

Class IIa

- Intravenous flecainide or direct-current cardioversion is reasonable when very rapid ventricular rates occur in patients with AF involving conduction over an accessory pathway. (*Level of Evidence: B*)

Class IIb

- It may be reasonable to administer intravenous quinidine, procainamide, disopyramide, ibutilide, or amiodarone to hemodynamically stable patients with AF involving conduction over an accessory pathway. (*Level of Evidence: B*)

Class III

- Intravenous administration of digitalis glycosides or nondihydropyridine calcium channel antagonists is not recommended in patients with WPW syndrome who have preexcited ventricular activation during AF. (*Level of Evidence: B*)

1.4.4. Hyperthyroidism

Class I

- Administration of a beta blocker is recommended to control the rate of ventricular response in patients with

AF complicating thyrotoxicosis, unless contraindicated. (*Level of Evidence: B*)

2. In circumstances when a beta blocker cannot be used, administration of a nondihydropyridine calcium channel antagonist (diltiazem or verapamil) is recommended to control the ventricular rate in patients with AF and thyrotoxicosis. (*Level of Evidence: B*)
3. In patients with AF associated with thyrotoxicosis, oral anticoagulation (INR 2.0 to 3.0) is recommended to prevent thromboembolism, as recommended for AF patients with other risk factors for stroke. (*Level of Evidence: C*)
4. Once a euthyroid state is restored, recommendations for antithrombotic prophylaxis are the same as for patients without hyperthyroidism. (*Level of Evidence: C*)

1.4.5. Pregnancy

Class I

1. Digoxin, a beta blocker, or a nondihydropyridine calcium channel antagonist is recommended to control the rate of ventricular response in pregnant patients with AF. (*Level of Evidence: C*)
2. Direct-current cardioversion is recommended in pregnant patients who become hemodynamically unstable due to AF. (*Level of Evidence: C*)
3. Protection against thromboembolism is recommended throughout pregnancy for all patients with AF (except those with lone AF and/or low thromboembolic risk). Therapy (anticoagulant or aspirin) should be chosen according to the stage of pregnancy. (*Level of Evidence: C*)

Class IIb

1. Administration of heparin may be considered during the first trimester and last month of pregnancy for patients with AF and risk factors for thromboembolism. Unfractionated heparin may be administered either by continuous intravenous infusion in a dose sufficient to prolong the activated partial thromboplastin time to 1.5 to 2 times the control value or by intermittent subcutaneous injection in a dose of 10 000 to 20 000 units every 12 h, adjusted to prolong the mid-interval (6 h after injection) activated partial thromboplastin time to 1.5 times control. (*Level of Evidence: B*)
2. Despite the limited data available, subcutaneous administration of low-molecular-weight heparin may be considered during the first trimester and last month of pregnancy for patients with AF and risk factors for thromboembolism. (*Level of Evidence: C*)
3. Administration of an oral anticoagulant may be considered during the second trimester for pregnant

patients with AF at high thromboembolic risk. (*Level of Evidence: C*)

4. Administration of quinidine or procainamide may be considered to achieve pharmacological cardioversion in hemodynamically stable patients who develop AF during pregnancy. (*Level of Evidence: C*)

1.4.6. Hypertrophic Cardiomyopathy

Class I

1. Oral anticoagulation (INR 2.0 to 3.0) is recommended in patients with hypertrophic cardiomyopathy who develop AF, as for other patients at high risk of thromboembolism. (*Level of Evidence: B*)

Class IIa

1. Antiarrhythmic medications can be useful to prevent recurrent AF in patients with hypertrophic cardiomyopathy. Available data are insufficient to recommend one agent over another in this situation, but (a) disopyramide combined with a beta blocker or nondihydropyridine calcium channel antagonist or (b) amiodarone alone is generally preferred. (*Level of Evidence: C*)



1.4.7. Pulmonary Diseases

Class I


1. Correction of hypoxemia and acidosis is the recommended primary therapeutic measure for patients who develop AF during an acute pulmonary illness or exacerbation of chronic pulmonary disease. (*Level of Evidence: C*)
2. A nondihydropyridine calcium channel antagonist (diltiazem or verapamil) is recommended to control the ventricular rate in patients with obstructive pulmonary disease who develop AF. (*Level of Evidence: C*)
3. Direct-current cardioversion should be attempted in patients with pulmonary disease who become hemodynamically unstable as a consequence of AF. (*Level of Evidence: C*)

Class III

1. Theophylline and beta-adrenergic agonist agents are not recommended in patients with bronchospastic lung disease who develop AF. (*Level of Evidence: C*)
2. Beta blockers, sotalol, propafenone, and adenosine are not recommended in patients with obstructive lung disease who develop AF. (*Level of Evidence: C*)

KEY WORDS: AHA Scientific Statements ■ atrial fibrillation ■ pacing ■ cardioversion

Appendix 1. Author Relationships With Industry and Other Entities—2011 ACCF/AHA/HRS Focused Update on the Management of Patients With Atrial Fibrillation

Committee Member	Employment	Consultant	Speaker	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness
L. Samuel Wann (<i>Chair</i>)	Wisconsin Heart and Vascular Clinics—Chairman, Department of Cardiovascular Medicine	None	None	None	None	None	None
Anne B. Curtis	University of Buffalo—Chair, Department of Medicine	<ul style="list-style-type: none"> • Medtronic • Sanofi-aventis • St. Jude Medical 	<ul style="list-style-type: none"> • Biotronik • Medtronic • Sanofi-aventis 	None	<ul style="list-style-type: none"> • Medtronic • St. Jude Medical 	None	<ul style="list-style-type: none"> • 2009, pacemaker case
Kenneth A. Ellenbogen	Virginia Commonwealth University Medical Center—Director, clinical Electrophysiology Laboratory	<ul style="list-style-type: none"> • Atritech • Biotronik • Boston Scientific • GlaxoSmithKline • Medtronic • Sanofi-aventis • St. Jude Medical 	<ul style="list-style-type: none"> • Biotronik • Boston Scientific • Medtronic • Sanofi-aventis • St. Jude Medical 	None	<ul style="list-style-type: none"> • Atritech • Biosense Webster • Boston Scientific • Medtronic • Sanofi-aventis • St. Jude Medical 	<ul style="list-style-type: none"> • Editor-in-chief, AfibProfessional.org 	None
N.A. Mark Estes III	New England Cardiac Arrhythmia Center, Tufts Medical Center—Director; Tufts University School of Medicine, Division of Cardiology—Professor of Medicine	<ul style="list-style-type: none"> • Boston Scientific 	<ul style="list-style-type: none"> • Boston Scientific • Medtronic 	None	None	 None	<ul style="list-style-type: none"> • 2008, Defendant, drug toxicity case
Michael D. Ezekowitz	Lankenau Institute for Medical Research—Vice President; Jefferson Medical College—Professor	<ul style="list-style-type: none"> • ARYx Therapeutics • AstraZeneca • Boehringer Ingelheim • Bristol-Myers Squibb • Daiichi Sankyo • Medtronic • Portola Pharmaceuticals • Sanofi-aventis • Wyeth 	<ul style="list-style-type: none"> • Boehringer Ingelheim 	None	<ul style="list-style-type: none"> • ARYx Therapeutics • Boehringer Ingelheim • Daiichi Sankyo • Portola Pharmaceuticals 	None	None
Warren M. Jackman	Heart Rhythm Institute, University of Oklahoma Health Sciences Center—G.L. Cross Research Professor Emeritus of Medicine (Cardiology)	<ul style="list-style-type: none"> • ACT • AtriCure • Biosense Webster • CardioFocus • Endosense • Rhythmia Medical 	<ul style="list-style-type: none"> • Biosense Webster • Biotronik • Boston Scientific • NCME • St. Jude Medical 	None	None	None	None

(Continued)

Appendix 1. Continued

Committee Member	Employment	Consultant	Speaker	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness
Craig T. January	University of Wisconsin, Madison—Professor of Medicine, Departments of Medicine (Division of Cardiovascular Medicine) and Physiology	None	None	None	None	None	None
James E. Lowe	Duke University School of Medicine—Professor of Surgery and Pathology	None	None	None	None	None	None
Richard L. Page	University of Wisconsin, Madison—Professor of Medicine and Chairman of the Department of Medicine	None	None	None	None	None	None
David J. Slotwiner	North Shore, Long Island Jewish Health Care System—Associate Director, Electrophysiology Laboratory	None	None	None	None	None	None
William G. Stevenson	Brigham and Women's Hospital, Cardiovascular Division—Director, Clinical Cardiac Electrophysiology Program	None	None	None	None	None	None
Cynthia M. Tracy	George Washington University Medical Center—Associate Director, Division of Cardiology; George Washington University Hospital—Director, Cardiac Service	None	None	None	None	None	None

This table represents the relevant relationships of committee members with industry that were reported orally at the initial writing committee meeting/conference call and updated in conjunction with all meetings and conference calls of the writing committee during the document development process. 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% or more of the voting stock or share of the business entity, or ownership of \$10 000 or more 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 noted in this table are modest unless otherwise noted.

ACCF indicates American College of Cardiology Foundation; AHA, American Heart Association; HRS, Heart Rhythm Society.

*Significant relationship.

Appendix 2. Author Relationships With Industry—2006 ACCF/AHA Committee to Update the 2001 Guideline for the Management of Patients With Atrial Fibrillation

Committee Member	Research Grant	Speakers Bureau	Stock Ownership	Board of Directors	Consultant/Advisory Member
David S. Cannom	• Guidant	• AstraZeneca L.P. • Guidant • Medtronic	None	None	• Cardionet • Cryden DSMB • Guidant
Harry J. Crijns	• AstraZeneca L.P. • Guidant • Medtronic • Sanofi-aventis	None	None	None	• AstraZeneca L.P. • Sanofi-aventis
Anne B. Curtis	• Medtronic • St. Jude	• Guidant • Medtronic • St. Jude Medical	None	None	• Medtronic
Kenneth A. Ellenbogen	• AstraZeneca • Bristol Myers Squibb/Sanofi Partnership • Guidant • Medtronic • Pfizer • St. Jude Medical	None	None	None	• Ablation Frontiers • Biosense Webster • Stereotaxis
Valentin Fuster	None	None	None	• GlaxoSmithKline	• GlaxoSmithKline • Kereos • Vasogen
Jonathan L. Halperin	None	None	None	None	• Astellas Pharama • AstraZeneca • Bayer AG Healthcare • Boehringer Ingelheim • Daiichi Medical Research • GlaxoSmithKline • Sanofi-aventis • Vasogen
Jean-Yves Le Heuzey	• Sanofi-aventis • Medtronic	None	None	None	• 3M • AstraZeneca L.P. • GlaxoSmithKline • Guidant
G. Neal Kay	None	None	None	None	None
James E. Lowe	None	None	None	None	None
S. Bertil Olsson	• AstraZeneca L.P.	None	• AstraZeneca L.P. • Upjohn	None	• AstraZeneca L.P. • Boehringer-Ingelheim
Eric N. Prystowsky	• Sanofi-aventis	• Reliant	• CardioNet	• CardioNet	• Bard • Guidant • Sanofi-aventis • Stereotaxis
Lars E. Ryden	• AFA Insurance • AstraZeneca • Pfizer • Sanofi-aventis • Swedish Heart Lung Foundation	• Occasional lectures at various meetings	None	• Chair SBU Alert (A governmental Swedish HTA organization evaluating new medical technology)	• Sanofi-aventis
Juan Luis Tamargo	None	None	None	None	None
L. Samuel Wann	None	None	None	None	None

DSMB, Data and Safety Monitoring Board.

This table represents the actual or potential relationships with industry that were reported at the initial writing committee meeting on August 27, 2004.

This table will be updated in conjunction with all meetings and conference calls of the writing committee.