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## ACC/AHA Pocket Guideline

Based on the ACC/AHA/ESC Guidelines  
for the Management of Patients  
With Atrial Fibrillation

Management  
of Patients With

# Atrial Fibrillation

July 2007



# Management of Patients With Atrial Fibrillation

July 2007

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Journal* 2006; 27:1979-2030).

For a copy of the full report or published executive  
summary, visit our Web sites at <http://www.acc.org>,  
<http://www.americanheart.org> or <http://www.esccardio.org>  
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## I. Introduction

Atrial fibrillation is a supraventricular tachyarrhythmia characterized by uncoordinated atrial activation with consequent deterioration of mechanical function. Atrial fibrillation (AF) is the most common sustained cardiac rhythm disturbance, increasing in prevalence with age. AF is often associated with structural heart disease although a substantial proportion of patients with AF have no detectable heart disease. Hemodynamic impairment and thromboembolic events related to AF result in significant morbidity, mortality, and cost. Accordingly, the American College of Cardiology (ACC), the American Heart Association (AHA), and the European Society of Cardiology (ESC) created a committee to establish guidelines for optimum management of this frequent and complex arrhythmia.

The pocket guide is derived from the executive summary of the *ACC/AHA/ESC Guidelines for the Management of Patients With Atrial Fibrillation*. These guidelines were first published in 2001 and then revised in 2006. This text provides a more detailed explanation of the management of atrial fibrillation, along with appropriate caveats and levels of evidence. Both the full-text guidelines and the executive summary are available online, at <http://www.acc.org>, <http://www.americanheart.org> or <http://www.esccardio.org>. Users of this pocket guide should consult those documents for additional information.



## Scope of the Pocket Guide

The *2006 Guidelines for the Management of Patients With Atrial Fibrillation* cannot be reproduced in their entirety in a pocket guide format. For this reason, the pocket guide focuses on issues most frequently encountered in clinical practice:

- Newly Discovered AF
- Recurrent Paroxysmal AF
- Recurrent Persistent AF
- Permanent AF
- Maintenance of Sinus Rhythm

## Classification of Recommendations

A classification of recommendation and a level of evidence have been assigned to each recommendation. Classifications of recommendations and levels of evidence are expressed in the ACC/AHA format as described in more detail in *Table 1*.

**Table 1. Applying Classification of Recommendations and Level of Evidence<sup>†</sup>**

		SIZE OF TREATMENT EFFECT	
		CLASS I <i>Benefit &gt;&gt;&gt; Risk</i> Procedure/Treatment SHOULD be performed/ administered	CLASS IIA <i>Benefit &gt;&gt; Risk</i> <i>Additional studies with focused objectives needed</i> IT IS REASONABLE to per- form procedure/administer treatment
ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT	LEVEL A Multiple (3-5) population risk strata evaluated* General consistency of direction and magnitude of effect	<ul style="list-style-type: none"> <li>■ Recommendation that procedure or treatment is useful/effective</li> <li>■ Sufficient evidence from multiple randomized trials or meta-analyses</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommendation in favor of treatment or procedure being useful/effective</li> <li>■ Some conflicting evidence from multiple randomized trials or meta-analyses</li> </ul>
	LEVEL B Limited (2-3) population risk strata evaluated*	<ul style="list-style-type: none"> <li>■ Recommendation that procedure or treatment is useful/effective</li> <li>■ Limited evidence from single randomized trial or nonrandomized studies</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommendation in favor of treatment or procedure being useful/effective</li> <li>■ Some conflicting evidence from single randomized trial or nonrandomized studies</li> </ul>
	LEVEL C Very limited (1-2) population risk strata evaluated*	<ul style="list-style-type: none"> <li>■ Recommendation that procedure or treatment is useful/effective</li> <li>■ Only expert opinion, case studies, or standard-of-care</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommendation in favor of treatment or procedure being useful/effective</li> <li>■ Only diverging expert opinion, case studies, or standard-of-care</li> </ul>
Suggested phrases for writing recommendations <sup>†</sup>		should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated





<p><b>Class IIb</b>  <i>Benefit ≥ Risk</i>  <i>Additional studies with broad objectives needed; additional registry data would be helpful</i>  <b>Procedure/Treatment MAY BE CONSIDERED</b></p>	<p><b>Class III</b>  <i>Risk ≥ Benefit</i>  <i>No additional studies needed</i>  <b>Procedure/Treatment should NOT be performed/administered SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL</b></p>
<ul style="list-style-type: none"> <li>■ Recommendation's usefulness/efficacy less well established</li> <li>■ Greater conflicting evidence from multiple randomized trials or meta-analyses</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommendation that procedure or treatment is not useful/effective and may be harmful</li> <li>■ Sufficient evidence from multiple randomized trials or meta-analyses</li> </ul>
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may/might be considered  
 may/might be reasonable  
 usefulness/effectiveness is  
 unknown/unclear/uncertain  
 or not well established

is not recommended  
 is not indicated  
 should not  
 is not useful/effective/beneficial  
 may be harmful

\* Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as gender, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use. 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. Even though randomized trials are not available, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

† In 2003 the ACC/AHA Task Force on Practice Guidelines provided a list of suggested phrases to use when writing recommendations. All recommendations in this guideline have been written in full sentences that express a complete thought, such that a recommendation, even if separated and presented apart from the rest of the document (including headings above sets of recommendations), would still convey the full intent of the recommendation. It is hoped that this will increase readers' comprehension of the guidelines and will allow queries at the individual recommendation level.



## II. Classification of AF

Various classification systems have been proposed for AF based on the ECG pattern, epicardial or endocavitary recordings, mapping of atrial electrical activity or clinical features. Although the pattern of AF can change over time, it may be helpful to characterize the arrhythmia at a given moment. The classification scheme recommended here represents a consensus driven by a desire for simplicity and clinical relevance.

The clinician should distinguish a first-detected episode of AF, whether or not symptomatic or self-limited, recognizing the uncertainty about the actual duration of the episode and about previous undetected episodes (*Figure 1*). After two or more episodes, AF is considered recurrent. If the arrhythmia terminates spontaneously, recurrent AF is designated paroxysmal; when sustained beyond 7 days, it is termed persistent.

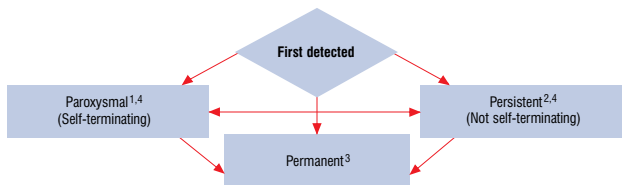
Termination with pharmacological therapy or direct-current cardioversion does not alter the designation. First detected AF may be either paroxysmal or persistent. The category of persistent AF also includes cases of long-standing AF (e.g., greater than one year), usually leading to permanent AF, in which cardioversion has failed or has been foregone.

These categories are not mutually exclusive. One patient may have several episodes of paroxysmal AF and occasional persistent AF, or the reverse. It is practical to categorize a given patient by their most frequent presentation. The definition of permanent AF is often arbitrary, and the duration refers both to individual episodes and to how long the diagnosis has been present in a given patient. Thus, in a patient with paroxysmal AF, episodes lasting seconds to hours may occur repeatedly for years.

This terminology applies to episodes lasting more than 30 seconds without a reversible cause. Secondary AF in the setting of acute myocardial infarction (MI), cardiac surgery, pericarditis, myocarditis, hyperthyroidism, or acute pulmonary disease is considered separately. Then AF is not the primary problem, and treatment of the underlying disorder usually terminates the arrhythmia. Conversely, when AF occurs in the course of a concurrent disorder like well-controlled hypothyroidism, the general principles for management of the arrhythmia apply.

The term lone AF applies to individuals under 60 years old without clinical or echocardiographic evidence of cardio-pulmonary disease, including hypertension. These patients have a favorable prognosis with respect to thromboembolism and mortality. Over time, patients move out of the lone AF category due to aging or development of cardiac abnormalities such as enlargement of the left atrium, and the risks of thromboembolism and mortality rise. The term nonvalvular AF refers to cases without rheumatic mitral valve disease, prosthetic heart valve or valve repair.

**Figure 1. Patterns of Atrial Fibrillation**



<sup>1</sup> Episodes that generally last less than or equal to 7 days (most less than 24 h);

<sup>2</sup> usually more than 7 days;

<sup>3</sup> cardioversion failed or not attempted; and

<sup>4</sup> both paroxysmal and persistent AF may be recurrent.



### III. Epidemiology and Prognosis

AF is the most common arrhythmia in clinical practice, accounting for approximately one-third of hospitalizations for cardiac rhythm disturbances. An estimated 2.3 million people in North America and 4.5 million in the European Union have paroxysmal or persistent AF. During the last 20 years, hospital admissions for AF have increased by 66% due to the aging of the population, a rising prevalence of chronic heart disease, more frequent diagnosis through use of ambulatory monitoring devices and other factors.





## IV. Clinical Evaluation

### A. Clinical History and Physical Examination

The diagnosis of AF requires confirmation by ECG, sometimes in the form of bedside telemetry or ambulatory Holter recordings. The initial evaluation involves characterizing the pattern of the arrhythmia as paroxysmal or persistent, determining its cause, and defining associated cardiac and extracardiac factors pertinent to the etiology, tolerability and management. The workup and therapy can usually be accomplished in a single outpatient encounter (*Table 2*), unless the rhythm has not been specifically documented and additional monitoring is necessary.

**Table 2. Clinical Evaluation in Patients With AF****Minimum evaluation**

- History and physical examination, to define
  - Presence and nature of symptoms associated with AF
  - Clinical type of AF (first episode, paroxysmal, persistent, or permanent)
  - Onset of the first symptomatic attack or date of discovery of AF
  - Frequency, duration, precipitating factors, and modes of termination of AF
  - Response to any pharmacological agents that have been administered
  - Presence of any underlying heart disease or other reversible conditions (e.g., hyperthyroidism or alcohol consumption)
- Electrocardiogram, to identify
  - Rhythm (verify AF)
  - LV hypertrophy
  - P-wave duration and morphology or fibrillatory waves
  - Preexcitation
  - Bundle-branch block
  - Prior MI
  - Other atrial arrhythmias
  - To measure and follow the R-R, QRS, and QT intervals in conjunction with antiarrhythmic drug therapy
- Transthoracic echocardiogram, to identify
  - Valvular heart disease
  - LA and RA atrial size
  - LV size and function
  - Peak RV pressure (pulmonary hypertension)
  - LV hypertrophy
  - LA thrombus (low sensitivity)
  - Pericardial disease
- Blood tests of thyroid, renal, and hepatic function
  - For a first episode of AF, when the ventricular rate is difficult to control

**Additional testing**

One or several tests may be necessary.

- Six-minute walk test
  - If the adequacy of rate control is in question
- Exercise testing
  - If the adequacy of rate control is in question (permanent AF)
  - To reproduce exercise-induced AF
  - To exclude ischemia before treatment of selected patients with a type IC antiarrhythmic drug
- Holter monitoring or event recording
  - If diagnosis of the type of arrhythmia is in question
  - As a means of evaluating rate control
- Transesophageal echocardiography
  - To identify LA thrombus (in the LA appendage)
  - To guide cardioversion
- Electrophysiological study
  - To clarify the mechanism of wide-QRS-complex tachycardia
  - To identify a predisposing arrhythmia such as atrial flutter or paroxysmal supraventricular tachycardia
  - To seek sites for curative ablation or AV conduction block/modification
- Chest radiograph, to evaluate
  - Lung parenchyma, when clinical findings suggest an abnormality
  - Pulmonary vasculature, when clinical findings suggest an abnormality

Type IC refers to the Vaughan Williams classification of antiarrhythmic drugs (see Table 14 in the executive summary).

**AF** indicates atrial fibrillation; **AV**, atrioventricular; **LA**, left atrial; **LV**, left ventricular; **MI**, myocardial infarction; **RA**, right atrial; and **RV**, right ventricular.



## V. Proposed Management Strategies

### A. Strategic Objectives

Management of patients with AF involves three, not mutually exclusive, objectives—rate control, prevention of thromboembolism and correction of the rhythm disturbance. The initial management involves primarily a rate or rhythm control strategy. Under the rate control strategy, the ventricular rate is controlled with no commitment to restore or maintain sinus rhythm while the rhythm control strategy attempts restoration and/or maintenance of sinus rhythm. The latter strategy also requires attention to rate control. Depending on the patient's course, the strategy initially chosen may prove unsuccessful and the alternate strategy is then adopted. Regardless of whether the rate control or rhythm control strategy is pursued, attention must also be directed to antithrombotic therapy for prevention of thromboembolism.

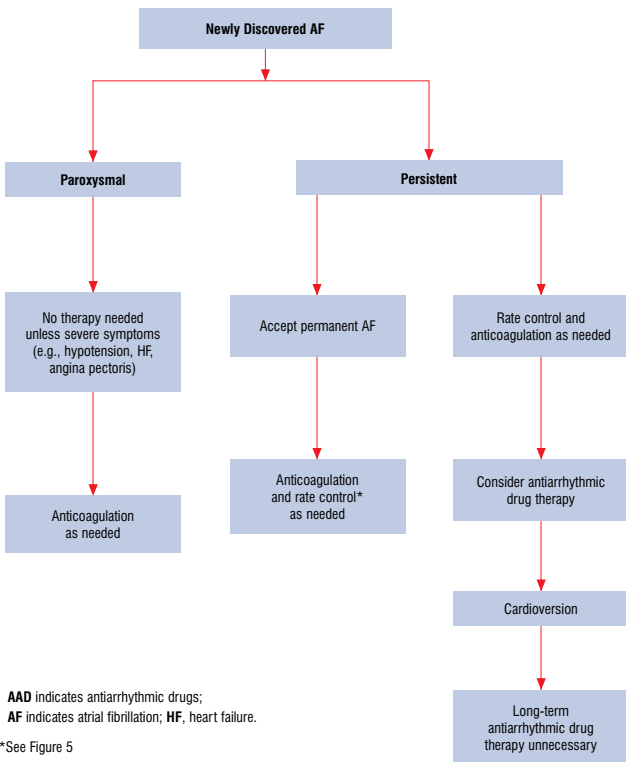
## **B. Overview of Algorithms for Management of Patients With AF**

Management of patients with AF requires knowledge of its pattern of presentation (paroxysmal, persistent, or permanent) underlying conditions and decisions about restoration and maintenance of sinus rhythm, control of the ventricular rate, and antithrombotic therapy. These issues are addressed in the various management algorithms for each presentation of AF (see *Figures 2, 3, 4, and 5*).

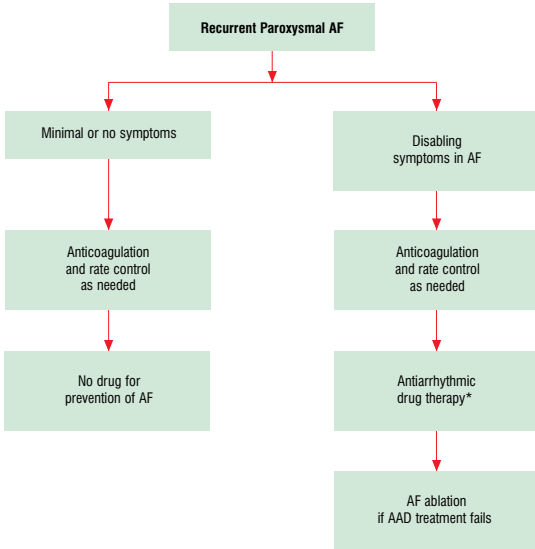
Due to scarcity of data from randomized trials of antiarrhythmic medications for treatment of patients with AF, the drug-selection algorithms were developed by consensus and are subject to revision as additional evidence emerges.



**Figure 2. Pharmacological Management of Patients With Newly Discovered Atrial Fibrillation**



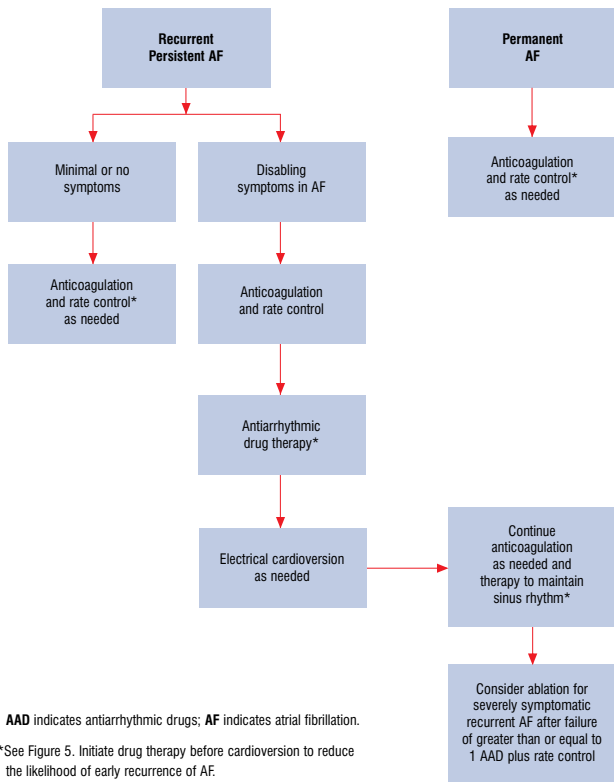
**Figure 3. Pharmacological Management of Patients With Recurrent Paroxysmal Atrial Fibrillation**



**AAD** indicates antiarrhythmic drugs; **AF** indicates atrial fibrillation.

\*See Figure 5

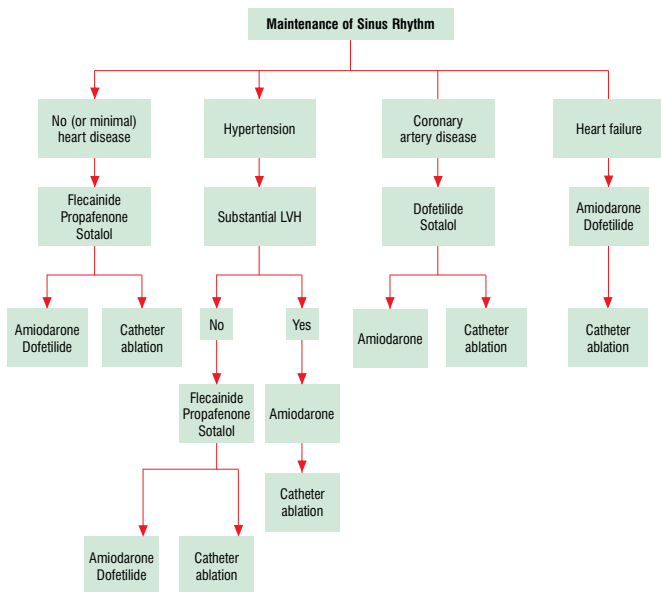
**Figure 4. Pharmacological Management of Patients With Recurrent Persistent or Permanent Atrial Fibrillation**



**AAD** indicates antiarrhythmic drugs; **AF** indicates atrial fibrillation.

\*See Figure 5. Initiate drug therapy before cardioversion to reduce the likelihood of early recurrence of AF.

**Figure 5. Antiarrhythmic Drug Therapy to Maintain Sinus Rhythm in Patients With Recurrent Paroxysmal or Persistent Atrial Fibrillation**



Within each box, drugs are listed alphabetically and not in order of suggested use. The vertical flow indicates order of preference under each condition. The seriousness of heart disease proceeds from left to right, and selection of therapy in patients with multiple conditions depends on the most serious condition present. See Section 8.3.3 in the full-text guidelines for details.

**LVH** indicates left ventricular hypertrophy.

## C. Pharmacological Cardioversion

A summary of recommendations concerning the use of pharmacological agents for cardioversion of AF is presented in *Tables 3, 4, 5, and 6*. *Table 7* lists dosages and adverse effects. Algorithms for pharmacological management of AF are given in *Figures 2, 3, 4 and 5*. Throughout this document, reference is made to the Vaughan Williams classification of antiarrhythmic drugs, modified to include drugs that became available after the original classification was developed (*Table 19* in the full text and *14* in the executive summary.) The recommendations given in this document are based on published data and do not necessarily adhere to the regulations and labeling requirements of governmental agencies.



**Table 3. Recommendations for Pharmacological Cardioversion of Atrial Fibrillation of up to 7 Days Duration**

Drug*	Route of Administration	Class of Recommendation	Level of Evidence
<b>Agents with proven efficacy</b>			
Dofetilide	Oral	I	A
Flecainide	Oral or intravenous	I	A
Ibutilide	Intravenous	I	A
Propafenone	Oral or intravenous	I	A
Amiodarone	Oral or intravenous	IIa	A
<b>Less effective or incompletely studied agents</b>			
Disopyramide	Intravenous	IIb	B
Procainamide	Intravenous	IIb	B
Quinidine	Oral	IIb	B
<b>Should not be administered</b>			
Digoxin	Oral or intravenous	III	A
Sotalol	Oral or intravenous	III	A

\* The doses of medications used in these studies may not be the same as those recommended by the manufacturers. Drugs are listed alphabetically within each category of recommendation and level of evidence.

**Table 4. Recommendations for Pharmacological Cardioversion of Atrial Fibrillation Present for More Than 7 Days Duration**

Drug*	Route of Administration	Class of Recommendation	Level of Evidence
<b>Agents with Proven Efficacy</b>			
Dofetilide	Oral	I	A
Amiodarone	Oral or intravenous	IIa	A
Ibutilide	Intravenous	IIa	A
<b>Less effective or incompletely studied agents</b>			
Disopyramide	Intravenous	IIb	B
Flecainide	Oral	IIb	B
Procainamide	Intravenous	IIb	C
Propafenone	Oral or intravenous	IIb	B
Quinidine	Oral	IIb	B
<b>Should not be administered</b>			
Digoxin	Oral or intravenous	III	B
Sotalol	Oral or intravenous	III	B

\* The doses of medications used in these studies may not be the same as those recommended by the manufacturers. Drugs are listed alphabetically within each category of recommendation and level of evidence.

**Table 5. Recommended Doses of Drugs Proven Effective for Pharmacological Cardioversion of Atrial Fibrillation**

Drug*	Route of Administration	Dosage**	Potential Adverse Effects	
Amiodarone	Oral	Inpatient: 1.2 to 1.8 g per day in divided dose until 10 g total, then 200 to 400 mg per day maintenance or 30 mg/kg as single dose  Outpatient: 600 to 800 mg per day divided dose until 10 g total, then 200 to 400 mg per day maintenance	Hypotension, bradycardia, QT prolongation, torsades de pointes (rare), GI upset, constipation, phlebitis (IV)	
	Intravenous/oral	5 to 7 mg/kg over 30 to 60 min, then 1.2 to 1.8 g per day continuous IV or in divided oral doses until 10 g total, then 200 to 400 mg per day maintenance		
Dofetilide	Oral	Creatinine clearance (mL/min)	QT prolongation, torsades de pointes; adjust dose for renal function, body size and age	
		>60		500
		40 to 60		250
		20 to 40		125
<20	Contraindicated			
Flecainide	Oral	200 to 300 mg <sup>†</sup>	Hypotension, atrial flutter with high ventricular rate	
	Intravenous	1.5 to 3.0 mg/kg over 10 to 20 min <sup>†</sup>		
Ibutilide	Intravenous	1 mg over 10 min; repeat 1 mg when necessary	QT prolongation, torsades de pointes	
Propafenone	Oral	600 mg	Hypotension, atrial flutter with high ventricular rate	
	Intravenous	1.5 to 2.0 mg/kg over 10 to 20 min <sup>†</sup>		
Quinidine <sup>‡</sup>	Oral	0.75 to 1.5 g in divided doses over 6 to 12 h, usually with a rate-slowing drug	QT prolongation, torsades de pointes, GI upset, hypotension	

GI indicates gastrointestinal; IV, intravenous; BID, twice a day.

\*Drugs are listed alphabetically

\*\*Dosages given in the table may differ from those recommended by the manufacturers.

<sup>†</sup> Insufficient data are available on which to base specific recommendations for the use of one loading regimen over

another for patients with ischemic heart disease or impaired left ventricular function, and these drugs should be used cautiously or not at all in such patients.

<sup>‡</sup> The use of quinidine loading to achieve pharmacological conversion of atrial fibrillation is controversial and safer methods are available with the alternative agents listed in the table. Quinidine should be used with caution.



**Table 6. Pharmacological Treatment Before Cardioversion in Patients With Persistent AF: Effects of Various Antiarrhythmic Drugs on Immediate Recurrence, Outcome of Transthoracic Direct-Current Shock, or Both**

Efficacy	Enhance Conversion by DC Shock and Prevent IRAF*	Recommendation Class	Level of Evidence	Suppress SRAF and Maintenance Therapy Class
<b>Known</b>	Amiodarone Flecainide Ibutilide Propafenone Sotalol	IIa	B	All drugs in recommendation Class I (except ibutilide) plus beta blockers
<b>Uncertain/unknown</b>	Beta-blockers Diltiazem Disopyramide Dofetilide Procainamide Verapamil	IIb	C	Diltiazem Dofetilide Verapamil

All drugs (except beta-blockers and amiodarone) should be initiated in the hospital.

**IRAF** indicates immediate recurrence of atrial fibrillation; **SRAF**, subacute recurrence of atrial fibrillation; and **DC**, direct-current.

\*Drugs are listed alphabetically within each class of recommendation.

**Table 7. Typical Doses of Drugs Used to Maintain Sinus Rhythm in Patients With Atrial Fibrillation\***

Drug**	Daily Dosage	Potential Adverse Effects
Amiodarone†	100 to 400 mg	Photosensitivity, pulmonary toxicity, polyneuropathy, GI upset, bradycardia, torsades de pointes (rare), hepatic toxicity, thyroid dysfunction, eye complications
Disopyramide	400 to 750 mg	Torsades de pointes, HF, glaucoma, urinary retention, dry mouth
Dofetilide‡	500 to 1000 mcg	Torsades de pointes
Flecainide	200 to 300 mg	Ventricular tachycardia, HF, conversion to atrial flutter with rapid conduction through the AV node
Procainamide	1000 to 4000 mg	Torsades de pointes, lupus-like syndrome, GI symptoms
Propafenone	450 to 900 mg	Ventricular tachycardia, HF, conversion to atrial flutter with rapid conduction through the AV node
Quinidine	600 to 1500 mg	Torsades de pointes, GI upset, enhanced AV nodal conduction
Sotalol‡	160 to 320 mg	Torsades de pointes, HF, bradycardia, exacerbation of chronic obstructive or bronchospastic lung disease

GI indicates gastrointestinal; AV, atrioventricular; HF, heart failure.

\*The drugs and doses given here have been determined by consensus based on published studies.

\*\*Drugs are listed alphabetically.

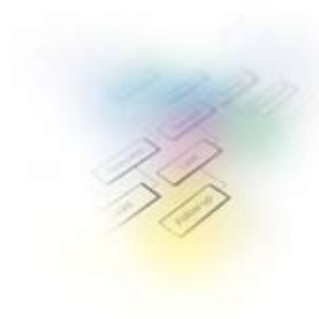
† A loading dose of 600 mg per day is usually given for one month or 1000 mg per day for 1 week.

‡ Dose should be adjusted for renal function and QT-interval response during in-hospital initiation phase.

When rapid control of the ventricular response of AF is required or oral administration is not feasible, medication may be administered parenterally. In hemodynamically stable patients negative chronotropic medication may be administered orally (*See Table 8*).

#### **D. Pharmacological Enhancement of Direct-Current Cardioversion**

When given in conjunction with direct-current cardioversion, the primary aims of antiarrhythmic medication therapy are to increase the likelihood of success and prevent early recurrence of AF. The risks of pharmacological treatment include the possibility of inducing ventricular arrhythmias.



**Table 8. Intravenous and Orally Administered Pharmacological Agents for Heart Rate Control in Patients With Atrial Fibrillation**

Drug	Class/LOE Recommendation	Loading Dose	Onset
<b>Acute Setting</b>			
<b>Heart Rate Control in patients without accessory pathway</b>			
Esmolol <sup>†</sup>	Class I, LOE C	500 mcg/kg IV over 1 min	5 min
Metoprolol <sup>†</sup>	Class I, LOE C	2.5 to 5 mg IV bolus over 2 min; up to 3 doses	5 min
Propranolol <sup>†</sup>	Class I, LOE C	0.15 mg/kg IV	5 min
Diltiazem	Class I, LOE B	0.25 mg/kg IV over 2 min	2 to 7 min
Verapamil	Class I, LOE B	0.075 to 0.15 mg/kg IV over 2 min	3 to 5 min
<b>Heart Rate Control in patients with accessory pathway<sup>§</sup></b>			
Amiodarone <sup>‡  </sup>	Class IIa, LOE C	150 mg over 10 min	Days
<b>Heart Rate Control in patients with heart failure and without accessory pathway</b>			
Digoxin	Class I, LOE B	0.25 mg IV each 2 h, up to 1.5 mg	60 min or more <sup>§</sup>
Amiodarone <sup>‡</sup>	Class IIa, LOE C	150 mg over 10 min	Days
<b>Non-Acute Setting and Chronic Maintenance Therapy<sup>¶</sup></b>			
<b>Heart Rate Control</b>			
Metoprolol <sup>†</sup>	Class I, LOE C	Same as maintenance dose	4 to 6 h
Propranolol <sup>†</sup>	Class I, LOE C	Same as maintenance dose	60 to 90 min
Diltiazem	Class I, LOE B	Same as maintenance dose	2 to 4 h
Verapamil	Class I, LOE B	Same as maintenance dose	1 to 2 h
<b>Heart Rate Control in patients with heart failure and without accessory pathway</b>			
Digoxin	Class I, LOE C	0.5 mg by mouth daily	2 days
Amiodarone <sup>‡</sup>	Class IIb, LOE C	800 mg daily for 1 wk, orally 600 mg daily for 1 wk, orally 400 mg daily for 4 to 6 wk, orally	1 to 3 wk

<sup>\*</sup>Onset is variable and some effect occurs earlier.

<sup>†</sup>Only representative members of the type of beta-adrenergic antagonist drugs are included in the table, but other, similar agents could be used for this indication in appropriate doses. Beta blockers are grouped in an order preceding the alphabetical listing of drugs.

<sup>‡</sup>Amiodarone can be useful to control the heart rate in patients with atrial fibrillation (AF) when other measures are unsuccessful or contraindicated.

Maintenance Dose	Major Side Effects
60 to 200 mcg/kg/min IV	↓BP, HB, ↓HR, asthma, HF
NA	↓BP, HB, HR, asthma, HF
NA	↓BP, HB, ↓HR, asthma, HF
5 to 15 mg/h IV	↓BP, HB, HF
NA	↓BP, HB, HF
0.5 to 1 mg/min IV	↓BP, HB, Pulmonary toxicity, skin discoloration, hypothyroidism, hyperthyroidism, corneal deposits, optic neuropathy, warfarin interaction, sinus bradycardia
0.125 to 0.375 mg daily IV or orally	Digitalis toxicity, HB, HR
0.5 to 1 mg/min IV	↓BP, HB, Pulmonary toxicity, skin discoloration, hypothyroidism, hyperthyroidism, corneal deposits, optic neuropathy, warfarin interaction, sinus bradycardia
25 to 100 mg twice a day, orally	↓BP, HB, ↓HR, asthma, HF
80 to 240 mg daily in divided doses, orally	↓BP, HB, ↓HR, asthma, HF
120 to 360 mg daily in divided doses; slow release available, orally	↓BP, HB, HF
120 to 360 mg daily in divided doses; slow release available, orally	↓BP, HB, HF, digoxin interaction
0.125 to 0.375 mg daily, orally	Digitalis toxicity, HB, ↓HR
200 mg daily, orally	↓BP, HB, Pulmonary toxicity, skin discoloration, hypothyroidism, hyperthyroidism, corneal deposits, optic neuropathy, warfarin interaction, sinus bradycardia

<sup>§</sup>Conversion to sinus rhythm and catheter ablation of the accessory pathway are generally recommended; pharmacological therapy for rate control may be appropriate in certain patients.

<sup>||</sup>If rhythm cannot be converted or ablated and rate control is needed, intravenous (IV) amiodarone is recommended.

<sup>†</sup>Adequacy of heart rate control should be assessed during physical activity as well as at rest.

**BP** indicates hypotension; **HR**, bradycardia; **HB**, heart block; **HF**, heart failure; **LOE**, level of evidence; and **NA**, not applicable.

## E. Echocardiography and Risk Stratification

The relative risk of ischemic stroke associated with specific clinical features, derived from a collaborative analysis of participants given no antithrombotic therapy in the control groups of five randomized trials is displayed in Table 8 of the executive summary.

The CHADS<sub>2</sub> (Cardiac Failure, Hypertension, Age, Diabetes, Stroke [Doubled]) stroke risk index integrates elements from several of these schemes. It is based on a point system in which two points are assigned for a history of stroke or transient ischemic attack (TIA), and one point each for age over 75 years, a history of hypertension, diabetes, or recent heart failure (HF) (Table 9).

In patients with nonvalvular AF, prior stroke or TIA is the strongest independent predictor of stroke, significantly associated with stroke in all six studies in which it was evaluated, with incremental relative risk between 1.9 and 3.7 (averaging approximately 3.0). All patients with prior stroke or TIA require anticoagulation unless contraindications exist in a given patient. Patient age is a consistent independent predictor of stroke, but older people are also at increased risk for anticoagulant-related bleeding. Special consideration of these older patients is therefore a critical aspect of effective stroke prophylaxis.

**Table 9. Stroke Risk in Patients With Nonvalvular AF Not Treated With Anticoagulation According to the CHADS<sub>2</sub> Index**

CHADS <sub>2</sub> Risk Criteria	Score
Prior stroke or TIA	2
Age >75 years	1
Hypertension	1
Diabetes mellitus	1
Heart failure	1

Patients (N=1733)	Adjusted Stroke Rate (%/year)* (95% CI)	CHADS <sub>2</sub> Score
120	1.9 (1.2-3.0)	0
463	2.8 (2.0-3.8)	1
523	4.0 (3.1-5.1)	2
337	5.9 (4.6-7.3)	3
220	8.5 (6.3-11.1)	4
65	12.5 (8.2-17.5)	5
5	18.2 (10.5-27.4)	6

\*The adjusted stroke rate was derived from multivariate analysis assuming no aspirin usage. Data from van Walraven C, Hart RG, Wells GA, et al. A clinical prediction rule to identify patients with atrial fibrillation and a low risk for stroke while taking aspirin. *Arch Intern Med* 2003; 163:936-43, et al. and Gage BF, Waterman AD, Shannon W, Boechler M, Rich MW, Radford MJ. Validation of clinical classification schemes for predicting stroke: results from the National Registry of Atrial Fibrillation. *JAMA* 2001; 285:2864-70.

**AF** indicates atrial fibrillation; **CHADS<sub>2</sub>**; Cardiac Failure, Hypertension, Age, Diabetes, and Stroke (Doubled); **CI**, confidence interval; and **TIA**, transient ischemic attack.

## F. Risk Stratification

Although these schemes for stratification of stroke risk identify patients who benefit most and least from anticoagulation, the threshold for use of anticoagulation is still controversial. Our recommendations for antithrombotic therapy are summarized in *Table 10*.

Anticoagulation is recommended for 3 wk prior to and 4 wk after cardioversion for patients with AF of unknown duration or with AF for longer than 48 h. Although left atrial thrombus and systemic embolism have been documented in patients with AF of shorter duration, the need for anticoagulation is less clear. When acute AF produces hemodynamic instability in the form of angina pectoris, MI, shock, or pulmonary edema, immediate cardioversion should not be delayed to deliver therapeutic anticoagulation, but intravenous unfractionated heparin or subcutaneous injection of a low-molecular-weight heparin should be initiated before cardioversion by direct-current countershock or intravenous antiarrhythmic medication.



**Table 10. Antithrombotic Therapy for Patients With Atrial Fibrillation**

Risk Category	Recommended Therapy
No risk factors	Aspirin, 81-325 mg daily
One moderate risk factor	Aspirin, 81-325 mg daily or Warfarin (INR 2.0 to 3.0, target 2.5)
Any high risk factor or more than 1 moderate risk factor	Warfarin (INR 2.0 to 3.0, target 2.5)*

**Less validated**

**or weaker risk factors**

- Female gender
- Age 65-74 years
- Coronary artery disease
- Thyrotoxicosis

**Moderate risk factors**

- Age  $\geq 75$  years
- Hypertension
- Heart failure
- LV ejection fraction  $\leq 35\%$
- Diabetes mellitus

**High risk factors**

- Previous stroke, TIA or embolism
- Mitral stenosis
- Prosthetic heart valve\*

\* indicates if mechanical valve, target INR greater than 2.5.

**INR** indicates international normalized ratio; **LV**, left ventricular; **TIA**, transient ischemic attack.

## G. Catheter Ablation

Catheter-directed ablation of AF represents a substantial achievement that promises better therapy for a large number of patients presently resistant to pharmacological or electrical conversion to sinus rhythm. The limited available studies suggest that catheter-based ablation offers benefit to selected patients with AF, but these studies do not provide convincing evidence of optimum catheter positioning or absolute rates of treatment success. Identification of patients who might benefit from ablation must take into account both potential benefits and short- and long-term risks. Rates of success and complications vary, sometimes considerably, from one study to another because of patient factors, patterns of AF, criteria for definition of success, duration of follow-up, and technical aspects.

## VI. Recommendations

### Recommendations

#### A. Pharmacological Rate Control During Atrial Fibrillation

- 
- Class I**
1. Measurement of the heart rate at rest and control of the rate using pharmacological agents are recommended for patients with persistent or permanent AF. (*Level of Evidence: B*)
  2. In the absence of pre-excitation, intravenous administration of a beta blocker, diltiazem, or verapamil is recommended to slow the ventricular

response to AF in the acute setting, exercising caution in patients with hypotension or 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 or LV dysfunction or for sedentary individuals.

*(Level of Evidence: C)*

---

## **Class IIa**

1. A combination of digoxin and either a beta blocker, diltiazem, or verapamil is reasonable to control the heart rate both at rest and during exercise in patients with AF. *(Level of Evidence: B)*

2. It is reasonable to use ablation of the arterioventricular (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 are reasonable alternatives. *(Level of Evidence: C)*

---

### **Class IIb**

1. When the rate of ventricular response to AF cannot be adequately controlled using a beta blocker, diltiazem, verapamil 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 of ventricular response to AF cannot be controlled with pharmacological agents or tachycardia-mediated cardiomyopathy is suspected, catheter-directed ablation of the AV node may be considered. *(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 lidocaine, beta blockers, or nondihydropyridine calcium channel antagonists to patients with AF and pre-excitation may accelerate the ventricular response and is not recommended. *(Level of Evidence: C)*

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## **B. Preventing Thromboembolism**

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### **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 antithrombotic agent should be chosen 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 at high risk of stroke, chronic oral anticoagulant therapy with a vitamin K antagonist (INR 2.0 to 3.0) is recommended, unless contraindicated. Factors associated with highest risk for stroke in patients with AF are prior stroke, TIA, or systemic embolism, rheumatic mitral stenosis and a mechanical heart valve. *(Level of Evidence: A)*.

4. Anticoagulation with a vitamin K antagonist is recommended for patients with more than 1 moderate risk factor (age greater than 75 years, hypertension, diabetes mellitus, HF, or impaired LV systolic function [ejection fraction 35% or less or fractional shortening less than 25%]). *(Level of Evidence: A)*
  5. INR should be determined at least weekly during initiation of therapy and monthly when stable. *(Level of Evidence: A)*
  6. Aspirin, 81-325 mg daily, is recommended 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 AF. *(Level of Evidence: C)*
- 

## **Class IIa**

1. For primary prevention of thromboembolism in patients with nonvalvular AF who have just 1 of the validated risk factors (age greater than 75 years (especially in female patients), hypertension, diabetes mellitus, HF, or impaired LV function), 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 anticoagulation, and patient preferences. *(Level of Evidence: A)*

2. For patients with nonvalvular AF who have 1 or more of the less well-validated risk factors (age 65-74 years, female gender, or CAD), treatment with either aspirin or a vitamin K antagonist is reasonable. *(Level of Evidence: B)*

3. It is reasonable to select antithrombotic therapy using the same criteria irrespective of the pattern (paroxysmal, persistent, or permanent) of AF. *(Level of Evidence: B)*

4. In patients with AF without a mechanical heart valve, it is reasonable to interrupt anticoagulation for up to 1 week for procedures that carry a risk of bleeding. *(Level of Evidence: C)*

5. It is reasonable to re-evaluate the need for anticoagulation at regular intervals. *(Level of Evidence: C)*

---

**Class IIb**

1. In patients 75 years of age and older at risk of bleeding but without contraindications to anticoagulant therapy, and in patients who unable to safely tolerate standard anticoagulation (INR 2.0 to 3.0), a lower INR target (2.0; range 1.6 to 2.5) may be considered for primary prevention of stroke and systemic embolism. *(Level of Evidence: C)*

2. When interruption of oral anticoagulant therapy for longer than 1 week is necessary in high-risk patients, unfractionated or low-molecular-weight heparin may be given by injection, although efficacy is uncertain. *(Level of Evidence: C)*

3. Following coronary revascularization in patients with AF, low-dose aspirin (less than 100 mg daily) and/or clopidogrel (75 mg daily) may be given concurrently with anticoagulation, but these strategies are associated with an increased risk of bleeding. *(Level of Evidence: C)*

4. In patients undergoing coronary revascularization, anticoagulation may be interrupted to prevent bleeding, but should be resumed as soon as possible after the procedure and the dose adjusted to achieve a therapeutic INR. Aspirin may be given during the hiatus. For patients undergoing percutaneous intervention, the maintenance regimen should consist of clopidogrel, 75 mg daily, plus warfarin (INR 2.0 to 3.0). Clopidogrel should be given for a minimum of 1 mo after 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, followed by warfarin alone.

*(Level of Evidence: C)*

5. In patients with AF who sustain ischemic stroke or systemic embolism during treatment with anticoagulation (INR 2.0 to 3.0), it may be reasonable to raise the intensity of anticoagulation up to a target INR of 3.0 to 3.5. *(Level of Evidence: C)*

---

**Class III**

1. Long-term anticoagulation is not recommended for primary stroke prevention in patients below age 60 years without heart disease (lone AF). *(Level of Evidence: C)*

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## C. Cardioversion of Atrial Fibrillation

### 1. Pharmacological Cardioversion

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

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**Class IIa** 1. Administration of amiodarone is reasonable for pharmacological cardioversion of AF.  
(*Level of Evidence: A*)

2. A single oral dose of propafenone or flecainide (“pill-in-the-pocket”) can be used to terminate persistent AF out of hospital for selected patients once treatment has proved safe in hospital. Before antiarrhythmic medication is initiated, a beta blocker, diltiazem or verapamil should be given to prevent rapid AV conduction. (*Level of Evidence: C*)

3. Amiodarone can be beneficial on an outpatient basis in patients with paroxysmal or persistent AF when rapid restoration of sinus rhythm is unnecessary. (*Level of Evidence: C*)

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**Class IIb** 1. Quinidine or procainamide might be considered for cardioversion of AF, but their usefulness is not well established. (*Level of Evidence: C*)

- 
- Class III**
1. Digoxin and sotalol are not recommended for pharmacological cardioversion of AF. *(Level of Evidence: A)*
  2. Quinidine, procainamide, disopyramide, and dofetilide should not be started out of hospital for conversion of AF. *(Level of Evidence: B)*
- 

## 2. Direct-Current Cardioversion

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- Class I**
1. When a rapid ventricular response to AF does not respond promptly to pharmacological measures, immediate direct-current cardioversion is recommended for patients with myocardial ischemia, symptomatic hypotension, angina, or HF. *(Level of Evidence: C)*
  2. Immediate direct-current cardioversion is recommended for patients with pre-excitation when AF occurs with extreme tachycardia or hemodynamic instability. *(Level of Evidence: B)*
  3. Cardioversion is recommended when symptoms of AF are unacceptable to the patient. In case of relapse, direct-current cardioversion may be repeated 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)*

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**Class III**

1. Frequent direct-current cardioversion is not recommended for patients with relatively short periods of sinus rhythm 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)*
- 

### **3. Pharmacological Enhancement of Direct-Current Cardioversion**

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**Class IIa**

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

#### **4. Prevention of Thromboembolism in Patients With Atrial Fibrillation Undergoing Cardioversion**

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- Class I**
1. For patients with AF of 48-h duration or longer, or when the duration of AF is unknown, anticoagulation (INR 2.0 to 3.0) is recommended for at least 3 weeks prior to and 4 weeks after cardioversion, regardless of the method 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 by an initial intravenous injection followed by a continuous infusion (aPTT 1.5 to 2 times control). Thereafter oral anticoagulation (INR 2.0 to 3.0) should be provided for at least 4 weeks, as for elective cardioversion. Limited data support subcutaneous low-molecular-weight heparin. *(Level of Evidence: C)*

3. For patients with AF of less than 48-h duration associated with hemodynamic instability, cardioversion should be performed immediately without anticoagulation. *(Level of Evidence: C)*

---

**Class IIa**

1. During the 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 echocardiography in search of thrombus. *(Level of Evidence: B)*

2a. For patients with no identifiable thrombus, cardioversion is reasonable immediately after anticoagulation. *(Level of Evidence: B)*

Thereafter, continuation of oral anticoagulation (INR 2.0 to 3.0) is reasonable for at least 4 weeks, as for elective cardioversion. *(Level of Evidence: B)*

Limited data are available to support subcutaneous low-molecular-weight heparin in this indication. *(Level of Evidence: C)*

2b. For patients in whom thrombus is identified, oral anticoagulation (INR 2.0 to 3.0) is reasonable for at least 3 weeks before and 4 weeks after restoration of sinus rhythm, and longer anticoagulation may be appropriate 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)*

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## **D. Maintenance of Sinus Rhythm**

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**Class I** 1. Before initiating antiarrhythmic drug therapy, treatment of precipitating or reversible causes of AF is recommended. *(Level of Evidence: C)*

**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. In patients with lone AF without structural heart disease, 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, electrolytes are normal, and risk factors associated with proarrhythmia are absent. *(Level of Evidence: C)*

6. Catheter ablation is a reasonable alternative to pharmacological therapy to prevent recurrent AF in symptomatic patients with little or no left atrial enlargement. *(Level of Evidence: C)*

---

**Class III**

1. Antiarrhythmic therapy with a particular drug is not recommended for maintenance of sinus rhythm in patients with AF who have 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 pacemaker. *(Level of Evidence: C)*

---

## E. Postoperative Atrial Fibrillation

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- Class I**
1. Unless contraindicated, an oral beta blocker is recommended to prevent postoperative AF for patients undergoing cardiac surgery. *(Level of Evidence: A)*
  2. AV nodal blocking agent is recommended for rate control in patients who develop postoperative AF. *(Level of Evidence: B)*
- 

- Class IIa**
1. Preoperative 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)*
  2. It is reasonable to restore sinus rhythm by pharmacological cardioversion with ibutilide or direct-current cardioversion in patients who develop postoperative AF. *(Level of Evidence: B)*
  3. Antiarrhythmic medication is reasonable to maintain sinus rhythm in patients with recurrent or refractory postoperative AF. *(Level of Evidence: B)*
  4. Antithrombotic medication is reasonable in patients who develop postoperative AF. *(Level of Evidence: B)*
- 

- Class IIb**
1. Prophylactic sotalol may be considered for patients at risk of developing AF following cardiac surgery. *(Level of Evidence: B)*
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## F. Acute Myocardial Infarction

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- Class I**
1. 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)*
  2. Intravenous amiodarone is recommended to slow a rapid ventricular response to AF and improve LV function in patients with acute MI. *(Level of Evidence: C)*
  3. 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 have LV dysfunction, bronchospasm, or AV block. *(Level of Evidence: C)*
  4. For patients with AF and acute MI, unfractionated heparin is recommended (aPTT 1.5 to 2.0 times control), unless contraindicated. *(Level of Evidence: C)*
- 

- Class IIa**
1. Intravenous 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**
1. Class IC antiarrhythmic drugs are not recommended in patients with AF and acute MI. *(Level of Evidence: C)*
-

## **G. Management of Atrial Fibrillation Associated With the Wolff-Parkinson-White Pre-excitation Syndrome**

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- Class I**
1. Catheter ablation of the accessory pathway is recommended in symptomatic patients with AF who have WPW syndrome, particularly those with syncope due to rapid rate or short bypass tract refractory period. *(Level of Evidence: B)*
  2. 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)*
  3. Intravenous procainamide or ibutilide is recommended to restore sinus rhythm in patients with WPW in whom AF occurs without hemodynamic instability in association with a wide QRS complex on the ECG ( $\geq 120$ -ms duration) or rapid pre-excited ventricular response. *(Level of Evidence: C)*
- 

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

- 
- Class IIb** 1. It may be reasonable to administer intravenous quinidine, procainamide, disopyramide, ibutilide, or amiodarone to hemodynamically stable patients with AF involving an accessory pathway.

*(Level of Evidence: B)*

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- Class III** 1. Intravenous beta-blocking agents, digitalis glycosides, diltiazem, or verapamil is not recommended in patients with WPW syndrome who have pre-excited ventricular activation during AF.

*(Level of Evidence: B)*

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## **H. Hyperthyroidism**

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- Class I** 1. A beta blocker is recommended to control the heart rate in patients with AF complicating thyrotoxicosis, unless contraindicated. *(Level of Evidence: B)*
2. When a beta blocker cannot be used, a nondihydropyridine calcium channel antagonist is recommended to control the ventricular rate in patients with AF and thyrotoxicosis.

*(Level of Evidence: B)*

3. In patients with AF and thyrotoxicosis, oral anticoagulation (INR 2.0 to 3.0) is recommended.

*(Level of Evidence: C)*

4. Once euthyroid state is achieved, antithrombotic prophylaxis is the same as for patients without hyperthyroidism. *(Level of Evidence: C)*
-

## I. Management of Atrial Fibrillation During Pregnancy

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- Class I**
1. Digoxin, a beta blocker, or nondihydropyridine calcium channel antagonist is recommended to control the ventricular rate 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 patients with AF except those at low thromboembolic risk. The choice of anticoagulant or aspirin should be chosen according to the stage of pregnancy. (*Level of Evidence: C*)
- 

- Class IIb**
1. During the first trimester and last month of pregnancy for patients with AF and risk factors for thromboembolism, consider administering unfractionated heparin by continuous intravenous infusion (aPTT 1.5 to 2 times control) or by subcutaneous injection (10 000 to 20 000 units every 12 h, adjusted to prolong the aPTT 6 h after injection to 1.5 times control). (*Level of Evidence: B*)

2. During the first trimester and last month of pregnancy subcutaneous low-molecular-weight heparin may be considered for patients with AF and risk factors for thromboembolism despite limited data. *(Level of Evidence: C)*

3. During the second trimester, consider oral anticoagulation for pregnant women with AF at high thromboembolic risk. *(Level of Evidence: C)*

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

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## **J. Management of Atrial Fibrillation in Patients With Hypertrophic Cardiomyopathy**

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**Class I** 1. Oral anticoagulation (INR 2.0 to 3.0) is recommended in patients with HCM who develop AF. *(Level of Evidence: B)*

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**Class IIa** 1. Antiarrhythmic medications can be useful to prevent recurrent AF in patients with HCM. Either disopyramide combined with a beta blocker or nondihydropyridine calcium channel antagonist or amiodarone alone is generally preferred. *(Level of Evidence: C)*

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## K. Management of Atrial Fibrillation in Patients With Pulmonary Disease

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- Class I**
1. For patients who develop AF during an acute pulmonary illness or exacerbation of chronic pulmonary disease, correction of hypoxemia and acidosis are the primary therapeutic measures. *(Level of Evidence: C)*
  2. 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)*
-



