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ACC/AHA/ESC Pocket Guidelines

Management of Patients With Atrial Fibrillation

A Report of the American College of Cardiology/ American Heart Association Task Force on Practice Guidelines and the European Society of Cardiology Committee for Practice Guidelines and Policy Conferences (Committee to Develop Guidelines for the Management of Patients With Atrial Fibrillation)

Developed in Collaboration With the North American Society of Pacing and Electrophysiology

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The following material was adapted from the *ACC/AHA/ESC Guidelines for the Management of Patients With Atrial Fibrillation–Executive Summary (J Am Coll Cardiol,* 2002;38:1231-65; *Circulation* 2001; 104:2118-50) and Full-Text Guideline (*Eur Heart J,* 2001;22:1852-1923). For a copy of the full report or the Executive Summary, visit our World Wide Web sites at *http://www.acc.org, http://www.americanheart.org,* or *http://www.escardio.org* or call the ACC Resource Center at 1-800-253-4636, ext. 694.

Contents

I. Introduction

Atrial fibrillation (AF), the most common sustained cardiac rhythm disturbance, is increasing in prevalence as the population ages. Although it is often associated with heart disease, AF occurs in many patients with no detectable disease. Hemodynamic impairment and thromboembolic events 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 of experts to establish guidelines for management of this arrhythmia.

As with other ACC/AHA guidelines, this document uses ACC/AHA classifications I, II, and III as summarized, right.

Class I	Conditions for which there is evidence for and/or general agreement that the procedure or treatment is useful and effective.
Class II	Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment. **Class IIa** The weight of evidence or opinion is in favor of the procedure or treatment. **Class IIb** Usefulness/efficacy is less well established by evidence or opinion.
Class III	Conditions for which there is evidence and/or general agreement that the procedure or treatment is not useful/effective and in some cases can be harmful.

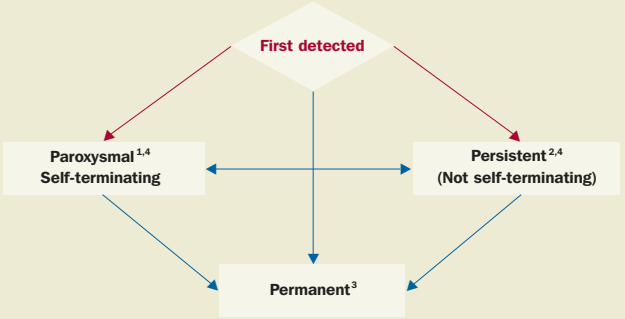
II. Classification

Atrial fibrillation has a heterogeneous clinical presentation, occurring in the presence or absence of detectable heart disease or related symptoms. For example, the term "lone AF" has been variously defined. The prognosis in terms of thromboembolism and mortality is most benign when applied to young individuals (aged less than 60 years) without clinical or echocardiographic evidence of cardiopulmonary disease. These patients have a favorable prognosis with respect to thromboembolism and mortality. By virtue of aging or the development of cardiac abnormalities, however, patients move out of the lone AF category over time, and the risks of thromboembolism and mortality rise. Lone AF is distinguished from idiopathic AF, which implies uncertainty about its origin without reference to the age of the patient or associated cardiovascular pathology. By convention, the term nonvalvular AF is restricted to cases in which the rhythm disturbance occurs in the absence of rheumatic mitral stenosis or a prosthetic heart valve.

The classification scheme recommended in this document 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 it is symptomatic or self-limited, recognizing that there can be uncertainty about the duration of the episode and about previous undetected episodes. When a patient has had 2 or more episodes, AF is considered recurrent. If recurrent AF terminates by itself, it is designated paroxysmal; but if it does not, it is termed persistent. Termination by pharmacological therapy or electrical cardioversion before expected

spontaneous termination does not change the designation paroxysmal. Permanent AF includes cases of long-standing AF (e.g., greater than 1 year), in which cardioversion has not been indicated or attempted. The terminology defined in the preceding paragraph applies to episodes of AF that last more than 30 seconds and that are unrelated to a reversible cause. Atrial fibrillation secondary to a precipitating condition such as acute myocardial infarction, cardiac surgery, myocarditis, hyperthyroidism, or acute pulmonary disease is considered separately. In these settings, treatment of the underlying disorder concurrently with management of the episode of AF usually eliminates the arrhythmia.

Figure 1. Patterns of Atrial Fibrillation



[1] *Episodes generally last less than or equal to 7 days (most less than 24 h);*
[2] *usually greater than 7 days;*
[3] *cardioversion failed or not attempted;*
[4] *either paroxysmal or persistent AF may be recurrent.*

III. Epidemiology

Atrial fibrillation is the most common clinically significant cardiac arrhythmia. The prevalence of AF is estimated at 0.4% of the general population, increasing with age.

IV. Clinical Evaluation

Table 1. Minimum and Additional Clinical Evaluation of the AF Patient

Minimum Evaluation

1. History and physical examination, to define

- The presence and nature of symptoms associated with AF
- The clinical type of AF (first episode, paroxysmal, persistent, or permanent)
- The onset of the first symptomatic attack or date of discovery of AF
- The frequency, duration, precipitating factors, and modes of termination of AF
- The response to any pharmacological agents that have been administered
- The presence of any underlying heart disease or other reversible conditions (e.g., hyperthyroidism or alcohol consumption)

2. Electrocardiogram, to identify

- Rhythm (verify AF)
- LV hypertrophy
- P-wave duration and morphology or fibrillatory waves
- Pre-excitation
- Bundle-branch block
- Prior MI
- Other atrial arrhythmias
- To measure and follow the RR, QRS, and QT intervals in conjunction with antiarrhythmic drug therapy

3. Chest radiograph, to evaluate

- The lung parenchyma, when clinical findings suggest an abnormality
- The pulmonary vasculature, when clinical findings suggest an abnormality

Minimum Evaluation, continued

4. Echocardiogram, to identify

- Valvular heart disease
- Left and right atrial size
- LV size and function
- Peak RV pressure (pulmonary hypertension)
- LV hypertrophy
- LA thrombus (low sensitivity)
- Pericardial disease

5. Blood tests of thyroid function

- For a first episode of AF, when the ventricular rate is difficult to control or when AF recurs unexpectedly after cardioversion

Additional Testing

One or several tests may be necessary

Exercise testing

- If the adequacy of rate control is in question (permanent AF)
- To reproduce exercise-induced AF
- To exclude ischemia prior to 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
- Seeking sites for curative ablation or AV conduction block/modification

AF indicates atrial fibrillation; LA, left atrium; LV, left ventricular; MI, myocardial infarction; RV, right ventricular; Type IC refers to the Vaughan Williams Classification of antiarrhythmic drugs (See Table 2).

Table 2. Vaughan Williams Classification of Antiarrhythmic Drug Actions

Type IA
Disopyramide
Procainamide
Quinidine

Type IB
Lidocaine
Mexiletine

Type IC
Flecainide
Moricizine
Propafenone

Type II
Beta-blockers (e.g., propranolol)

Type III
Amiodarone
Bretylium
Dofetilide
Ibutilide
Sotalol

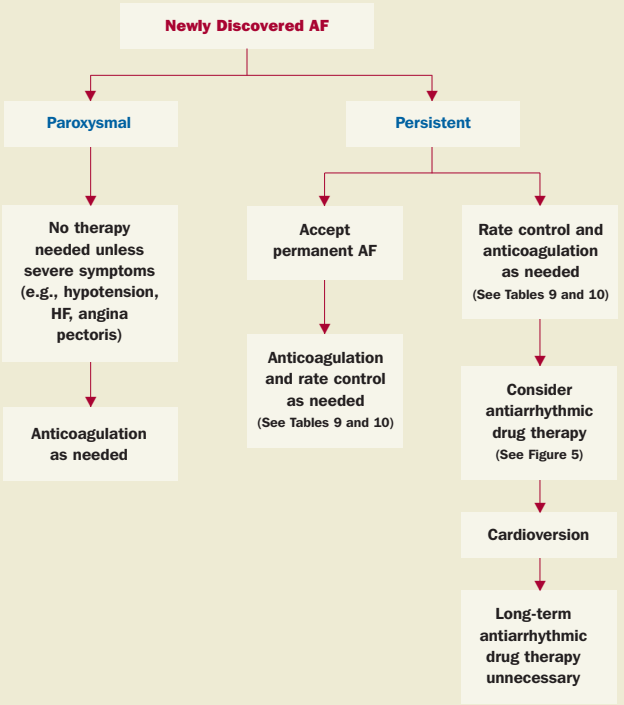
Type IV
Calcium-channel antagonists (e.g., verapamil and diltiazem)

Modified with permission from Vaughan Williams EM. J Clin Pharmacol *1984;24:129–47, © 1984 by Sage Publications Inc. to include compounds introduced after publication of the original classification.*

V. Overview of Algorithms for Management of Patients With AF (See Figures 2, 3, 4, and 5)

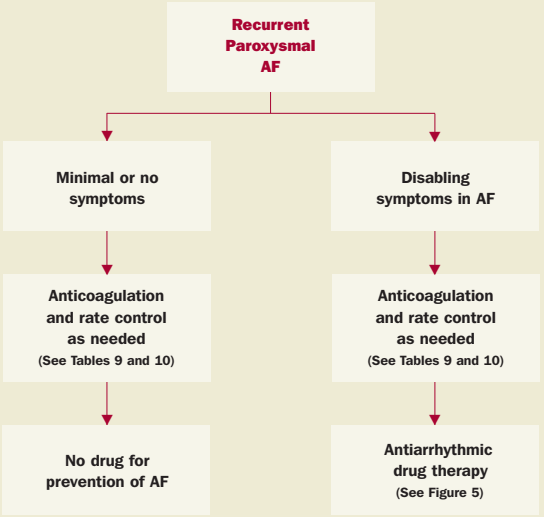
Management of patients with AF requires knowledge of its pattern of presentation (paroxysmal, persistent, or permanent) and decisions about restoration and maintenance of sinus rhythm, control of the ventricular rate, and anticoagulation. These issues are addressed in the various management algorithms for each presentation of AF.

Figure 2. Pharmacological Management of Patients With Newly Discovered AF



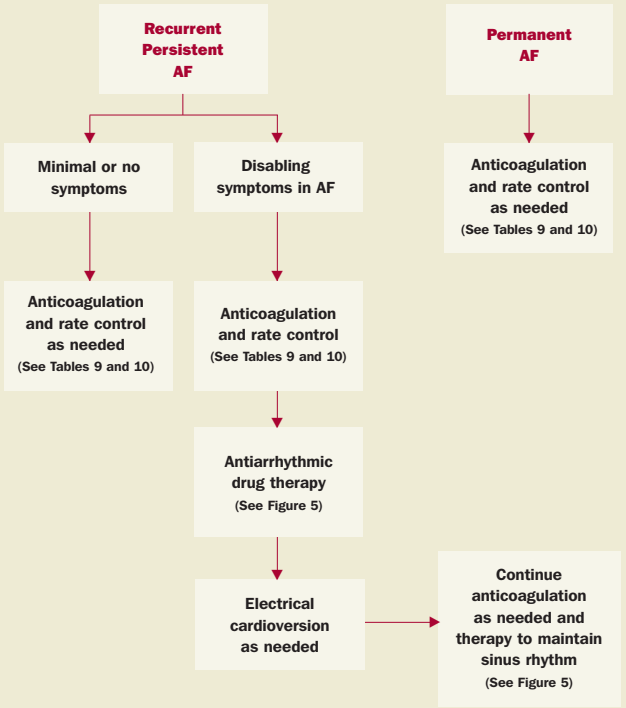
AF indicates atrial fibrillation; HF, heart failure.

Figure 3. Pharmacological Management of Patients With Recurrent Paroxysmal AF



AF indicates atrial fibrillation.

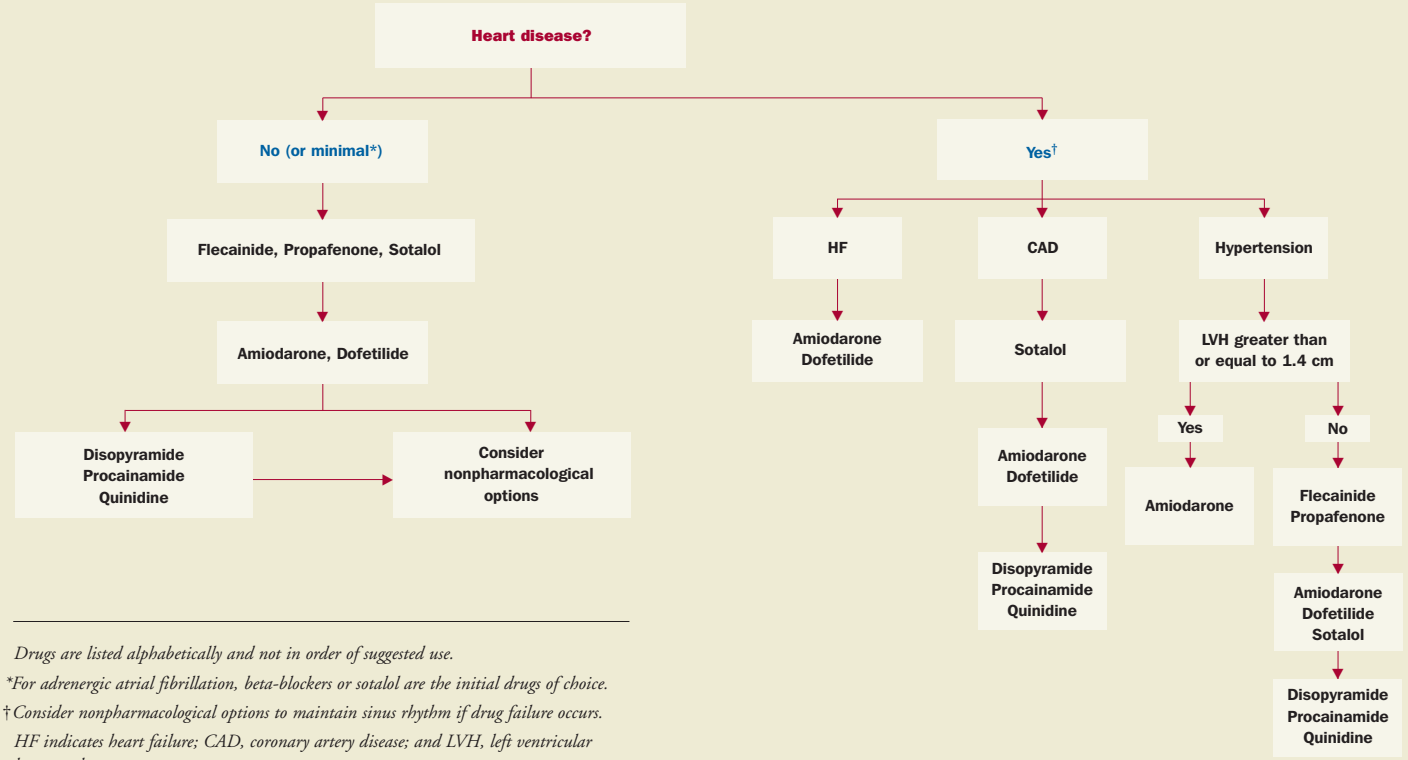
Figure 4. Pharmacological Management of Patients With Recurrent Persistent or Permanent AF



AF indicates atrial fibrillation.

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



Drugs are listed alphabetically and not in order of suggested use.

**For adrenergic atrial fibrillation, beta-blockers or sotalol are the initial drugs of choice.*

†Consider nonpharmacological options to maintain sinus rhythm if drug failure occurs.

HF indicates heart failure; CAD, coronary artery disease; and LVH, left ventricular hypertrophy.

Algorithms

VI. Recommendations for Management of Patients With AF

Recommendations for Pharmacological and Electrical Cardioversion of AF

Class I

1. Immediate electrical cardioversion in patients with paroxysmal AF and a rapid ventricular response who have ECG evidence of acute myocardial infarction or symptomatic hypotension, angina, or heart failure that does not respond promptly to pharmacological measures.

2. Immediate electrical cardioversion to prevent ventricular fibrillation in patients with WPW in whom AF occurs with a rapid ventricular response associated with hemodynamic instability.

3. Cardioversion in patients without hemodynamic instability when symptoms of AF are unacceptable.

Class IIa

1. Pharmacological or electrical cardioversion to accelerate restoration of sinus rhythm in patients with a first-detected episode of AF. (See Tables 3, 4, and 5 for recommended drugs.)

2. Electrical cardioversion in patients with persistent AF when early recurrence is unlikely.

3. Repeated cardioversion followed by prophylactic drug therapy in patients who relapse to AF without antiarrhythmic medication after successful cardioversion.

Class IIb

1. Pharmacological agents for cardioversion to sinus rhythm in patients with persistent AF. (See Tables 6, 7, and 8 for recommended drugs.)

2. Out-of-hospital administration of pharmacological agents for cardioversion of first-detected, paroxysmal, or persistent AF in patients without heart disease or when the safety of the drug in the particular patient has been verified. (See Tables 6 and 8.)

Class III

1. Electrical cardioversion in patients who display spontaneous alternation between AF and sinus rhythm over short periods of time.

2. Additional cardioversion in patients with short periods of sinus rhythm who relapse to AF despite multiple cardioversion procedures and prophylactic antiarrhythmic drug treatment.

Table 3. Recommendations for Pharmacological Cardioversion of Atrial Fibrillation Less Than or Equal to 7 Days Duration*

(see Table 5 for dosages and adverse effects)

Drug*	Route of Administration	Type of Recommendation
Agents with proven efficacy		
Dofetilide	Oral	I
Flecainide	Oral or Intravenous	I
Ibutilide	Intravenous	I
Propafenone	Oral or Intravenous	I
Amiodarone	Oral or Intravenous	IIa
Quinidine	Oral	IIb
Less Effective or Incompletely Studied Agents		
Procainamide	Intravenous	IIb
Digoxin	Oral or Intravenous	III
Sotalol	Oral or Intravenous	III

**Drugs are listed alphabetically within each category of recommendation and level of evidence.*

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

(see Table 5 for dosages and adverse effects)

Drug*	Route of Administration	Type of Recommendation
Agents with proven efficacy		
Dofetilide	Oral	I
Amiodarone	Oral or Intravenous	IIa
Ibutilide	Intravenous	IIa
Flecainide	Oral	IIb
Propafenone	Oral or Intravenous	IIb
Quinidine	Oral	IIb
Less Effective or Incompletely Studied Agents		
Procainamide	Intravenous	IIb
Sotalol	Oral or Intravenous	III
Digoxin	Oral or Intravenous	III

**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 Admin.	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 per 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, torsade de pointes (rare), GI upset, constipation, phlebitis (IV)
	Intravenous/ oral	5 to 7 mg per 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: Dose: > 60 ml/min 500 mcg BID 40 to 60 ml/min 250 mcg BID 20 to 40 ml/min 125 mcg BID < 20 ml/min Contraindicated	QT prolongation; torsade de pointes; adjust dose for renal function, body size, and age
Flecainide	Oral	200 to 300 mg†	Hypotension, rapidly conducting atrial flutter
	Intravenous	1.5 to 3.0 mg per kg over 10 to 20 min†	
Ibutilide	Intravenous	1 mg over 10 min; repeat 1 mg when necessary	QT prolongation, torsade de pointes
Propafenone	Oral	450 to 600 mg	Hypotension, rapidly conducting atrial flutter
	Intravenous	1.5 to 2.0 mg per kg over 10 to 20 min†	
Quinidine‡	Oral	0.75 to 1.5 g in divided doses over 6 to 12 h, usually with a rate-slowing drug	QT prolongation, torsade 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.*

†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.

‡The use of quinidine loading to achieve pharmacological conversion of AF is controversial, and safer methods are available with the alternative agents listed in the table. Quinidine should be used with caution.

Management of AF

Table 6. Pharmacological Treatment Before Cardioversion in Patients With Persistent Atrial Fibrillation:

Effects of Various Antiarrhythmic Drugs on Acute and Subacute Outcome (and Maintenance of Sinus Rhythm) of Transthoracic Direct Current Shock (see Table 7 for dosages and adverse affects).

	Enhance Conversion by DC Shock and Prevent IRAF*	Suppress SRAF and Maintenance Therapy Class	Type of Recommendation
Effective	Amiodarone Flecainide Ibutilide Propafenone Propafenone + verapamil Quinidine Sotalol	All drugs in recommendation Class I (except ibutilide) plus beta-blockers	I
Uncertain/ Unknown	Beta-blockers Disopyramide Diltiazem Dofetilide Procainamide Verapamil	Diltiazem Dofetilide Verapamil	IIb

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

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

**Drugs are listed alphabetically within each category 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, torsade de pointes (rare), hepatic toxicity, thyroid dysfunction
Disopyramide	400 to 750 mg	Torsade de pointes, HF, glaucoma, urinary retention, dry mouth
Dofetilide‡	500 to 1000 mcg	Torsade de pointes
Flecainide	200 to 300 mg	Ventricular tachycardia, congestive HF, enhanced AV nodal conduction (conversion to atrial flutter)
Procainamide	1000 to 4000 mg	Torsade de pointes, lupus-like syndrome, GI symptoms
Propafenone	450 to 900 mg	Ventricular tachycardia, congestive HF, enhanced AV nodal conduction (conversion to atrial flutter)
Quinidine	600 to 1500 mg	Torsade de pointes, GI upset, enhanced AV nodal conduction
Sotalol‡	240 to 320 mg	Torsade de pointes, congestive HF, bradycardia, exacerbation of chronic obstructive or bronchospastic lung disease

GI indicates gastrointestinal; AV, atrioventricular; and 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/day is usually given for one month or 1000 mg/day over 1 week.

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

Table 8. Types of Proarrhythmia During Treatment With Various Antiarrhythmic Drugs for Atrial Fibrillation or Atrial Flutter According to the Vaughan Williams Classification

A. Ventricular proarrhythmia

- **Torsade de pointes (VW type IA and type III drugs)**
- **Sustained monomorphic ventricular tachycardia (usually VW type IC drugs)**
- **Sustained polymorphic ventricular tachycardia/VF without long QT (VW types IA, IC, and III drugs)**

B. Atrial proarrhythmia

- **Provocation of recurrence (probably VW types IA, IC, and III drugs)**
- **Conversion of AF to flutter (usually VW type IC drugs)**
- **Increase of defibrillation threshold (a potential problem with VW type IC drugs)**

C. Abnormalities of conduction or impulse formation

- **Acceleration of ventricular rate during AF (VW type IA and type IC drugs)**
- **Accelerate conduction over accessory pathway (digoxin, intravenous verapamil, or diltiazem)**
- **Sinus node dysfunction and atrioventricular block (almost all drugs)**

VW indicates the Vaughan Williams classification of antiarrhythmic drugs; VF, ventricular fibrillation; AF, atrial fibrillation.

Recommendations for Pharmacological Therapy to Maintain Sinus Rhythm

Class I

1. Base selection of pharmacological therapy to maintain sinus rhythm in patients with disabling or otherwise troublesome symptoms during AF predominantly on safety. (See Tables 6 and 8)
2. Treat precipitating or reversible causes of AF before initiating antiarrhythmic drug therapy.

Class IIa

1. Administer pharmacological therapy to maintain sinus rhythm to prevent progression of tachycardia-induced cardiomyopathy due to AF.
2. Infrequent and well-tolerated recurrence of AF may in some cases be deemed a successful outcome of antiarrhythmic drug therapy.
3. Outpatient initiation of antiarrhythmic drug treatment is appropriate in selected patients.

Class IIb

1. Administer pharmacological therapy to maintain sinus rhythm in asymptomatic patients to prevent atrial remodeling.
2. Administer pharmacological therapy to maintain sinus rhythm to prevent thromboembolism or heart failure in selected patients.
3. Administer combinations of antiarrhythmic agents to maintain sinus rhythm when single-drug therapy fails.

Class III

1. Use of a particular pharmacological agent to maintain sinus rhythm in patients with well-defined proarrhythmia risk factors for that agent.

2. Use of pharmacological therapy to maintain sinus rhythm in patients with advanced sinus node or AV node dysfunction in the absence of a functioning electronic cardiac pacemaker.

Recommendations for Heart Rate Control in Patients With AF (See Tables 9 and 10.)

Class I

1. Measure heart rate response both at rest and during exercise in patients with persistent or permanent AF and control the rate with pharmacological agents (using a beta-blocker or calcium channel antagonist in most cases) to the physiological range.

2. Administer intravenous beta-blockers or calcium channel antagonists (verapamil, diltiazem) in the acute setting to slow the ventricular response to AF in the absence of conduction over an accessory pathway, exercising caution in patients with hypotension or heart failure.

3. Perform immediate electrical cardioversion in patients with acute paroxysmal AF and a rapid ventricular response associated with acute myocardial infarction, symptomatic hypotension, angina, or cardiac failure that does not respond promptly to pharmacological measures.

4. Immediate electrical cardioversion to prevent ventricular fibrillation in patients with WPW in whom AF occurs with a rapid ventricular response associated with hemodynamic instability.

Class IIa

1. Administer a combination of digoxin and a beta-blocker or calcium channel antagonist to control the heart rate at rest and during exercise in patients with AF. The choice of medication should be individualized and the dose modulated to avoid bradycardia.

2. Employ nonpharmacological therapy to control heart rate when pharmacological therapy is insufficient.

Class IIb

1. Administer digoxin as the sole agent to control heart rate at rest in patients with persistent AF.

2. Administer intravenous quinidine, procainamide, disopyramide, ibutilide, or amiodarone to hemodynamically stable patients with AF involving conduction over an accessory pathway.

3. Immediate cardioversion is required when very rapid tachycardias or hemodynamic instability occurs in patients with AF involving conduction over an accessory pathway.

Class III

1. Administer digitalis as the sole agent to control a rapid rate of ventricular response to AF in patients with paroxysmal AF.

2. Catheter ablation without prior medical therapy to control AF.

Table 9. Intravenous Pharmacological Agents for Heart Rate Control in Patients With Atrial Fibrillation

Drug*	Loading Dose	Onset	Maintenance Dose	Major Side Effects	Class Recommendation
Diltiazem	0.25 mg/kg IV over 2 min	2 to 7 min	5 to 15 mg per hour infusion	Hypotension, heart block, HF	I**
Esmolol†	0.5 mg/kg over 1 min	5 min	0.05 to 0.2 mg • kg^{-1} • min^{-1}	Hypotension, heart block, bradycardia, asthma, HF	I
Metoprolol†	2.5 to 5 mg IV bolus over 2 min; up to 3 doses	5 min	NA	Hypotension, heart block, bradycardia, asthma, HF	I**
Propranolol†	0.15 mg/kg IV	5 min	NA	Hypotension, heart block, bradycardia, asthma, HF	I**
Verapamil	0.075 to 0.15 mg/kg IV over 2 min	3 to 5 min	NA	Hypotension, heart block, HF	I**
Digoxin	0.25 mg IV each 2 h, up to 1.5 mg	2 h	0.125 to 0.25 mg daily	Digitalis toxicity, heart block, bradycardia	IIb‡

HF indicates heart failure.

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

***Type IIb in congestive HF.*

† 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.

‡Type I in congestive HF.

Management of AF

Table 10. Recommendations for Use of Orally Administered Pharmacological Agents for Heart Rate Control in Patients With Atrial Fibrillation

Drug*	Loading Dose	Onset	Usual Maintenance Dose**	Major Side Effects	Class Recommendation
Digoxin	0.25 mg PO each 2 h; up to 1.5 mg	2 h	0.125 to 0.375 mg daily	Digitalis toxicity, heart block, bradycardia	I
Diltiazem	NA	2 to 4 h	120 to 360 mg daily in divided doses; slow release available	Hypotension, heart block, HF	I
Metoprolol†	NA	4 to 6 h	25 to 100 mg BID	Hypotension, heart block, bradycardia, asthma, HF	I
Propranolol†	NA	60 to 90 min	80 to 240 mg daily in divided doses	Hypotension, heart block, bradycardia, asthma, HF	I
Verapamil	NA	1 to 2 h	120 to 360 mg daily in divided doses; slow release available	Hypotension, heart block, HF, digoxin interaction	I
Amiodarone	800 mg daily for 1 wk 600 mg daily for 1 wk 400 mg daily for 4 to 6 wk	1 to 3 wk	200 mg daily	Pulmonary toxicity, skin discoloration, hypothyroidism, corneal deposits, optic neuropathy, warfarin interaction, proarrhythmia	IIb

HF indicates heart failure; PO, by mouth; NA, not applicable; HF, heart failure; and BID, twice a day.

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

***Recommended maintenance dosages are the usual ones necessary, but higher doses may be appropriate in some patients.*

†The table includes representative members of the type of beta-blocker drugs, but other, similar agents could be used for this indication in appropriate doses.

Management of AF

Recommendations for Antithrombotic Therapy in Patients With AF

Class I

See Tables 11 and 12

1. Administer antithrombotic therapy (oral anticoagulation or aspirin) to all patients with AF, except those with lone AF, to prevent thromboembolism.

2. Individualize the selection of the antithrombotic agent based on assessment of the absolute risks of stroke and bleeding and the relative risk and benefit for a particular patient.

3. Chronic oral anticoagulant therapy in a dose adjusted to achieve a target intensity of international normalized ratio (INR) 2 to 3 in patients at high risk of stroke, unless contraindicated.

a. The need for anticoagulation should be reevaluated at regular intervals.

b. INR should be determined at least weekly during the initiation of oral anticoagulation therapy and monthly when the patient is stable.

4. Aspirin in a dose of 325 mg daily as an alternative in low-risk patients or in those with certain contraindications to oral anticoagulation.

5. Oral anticoagulation for patients with AF who have rheumatic mitral valve disease or prosthetic heart valves (mechanical or tissue valves).

a. Base the target intensity of anticoagulation on the particular type of prosthesis, but it should not be less than INR 2 to 3.

Class IIa

1. Target a lower INR of 2 (range 1.6 to 2.5) for primary prevention of ischemic stroke and systemic embolism in patients over 75 years old considered at increased risk of bleeding complications but without frank contraindications to oral anticoagulant therapy.

2. Manage antithrombotic therapy for patients with atrial flutter, in general, as for those with AF.

3. Select antithrombotic therapy by the same criteria irrespective of the pattern of AF (i.e., for patients with paroxysmal, persistent, or permanent AF).

Class IIb

1. Interrupt anticoagulation for a period of up to 1 week for surgical or diagnostic procedures that carry a risk of bleeding, without substituting heparin in patients with AF who do not have mechanical prosthetic heart valves.

2. Administer unfractionated or low-molecular-weight heparin intravenously or subcutaneously, respectively, in selected high-risk patients or when a

series of procedures requires interruption of oral anticoagulant therapy for a period longer than 1 week.

3. Manage patients with coronary artery disease with anticoagulation (INR 2 to 3) based on the same criteria used for patients without coronary artery disease.

a. A low dose of aspirin (less than 100 mg per day) or clopidogrel (75 mg per day) may be given concurrently with anticoagulation, but these strategies have not been evaluated sufficiently and may be associated with an increased risk of bleeding.

4. Treatment with aspirin is optional for primary prevention of stroke in patients under 60 years of age without heart disease or risk factors for thromboembolism (lone AF).

Class III Long-term anticoagulation for stroke prevention in patients under 60 years of age without heart disease (lone AF) and without risk factors for thromboembolism.

Table 11. Risk Factors for Ischemic Stroke and Systemic Embolism in Patients with Nonvalvular Atrial Fibrillation

Risk Factors (Control Groups)	Relative Risk
Previous stroke or TIA	2.5
History of hypertension	1.6
Congestive heart failure	1.4
Advanced age (continuous, per decade)	1.4
Diabetes mellitus	1.7
Coronary artery disease	1.5

TIA indicates transient ischemic attack. Relative risk refers to comparison with atrial fibrillation patients without these risk factors. As a group, patients with nonvalvular atrial fibrillation have about a 6-fold increased risk of thromboembolism compared with patients in normal sinus rhythm. Data derived from collaborative analysis of 5 primary prevention trials.

Table 12. Recommendations for Antithrombotic Therapy in Patients With Atrial Fibrillation Based on Thromboembolic Risk Stratification

Patient Features	Antithrombotic Therapy	Class Recommendation
Age less than 60 years – No heart disease (lone AF)	Aspirin (325 mg per day) or no therapy	I
Age less than 60 years – Heart disease but no risk factors*	Aspirin (325 mg per day)	I
Age greater than or equal to 60 years – No risk factors*	Aspirin (325 mg per day)	I
Age greater than or equal to 60 years – with diabetes mellitus or CAD	Oral anticoagulation (INR 2 to 3) Addition of aspirin, 81 to 162 mg per day is optional	I IIb
Age greater than or equal to 75 years – especially women	Oral anticoagulation (INR approx. equal to 2)	I
HF	Oral anticoagulation (INR 2 to 3)	I
LV ejection fraction less than or equal to 0.35	Oral anticoagulation (INR 2 to 3)	I
Thyrotoxicosis	Oral anticoagulation (INR 2 to 3)	I
Hypertension	Oral anticoagulation (INR 2 to 3)	I
Rheumatic heart disease (mitral stenosis)	Oral anticoagulation (INR 2.5 to 3.5 or higher may be appropriate)	I
Prosthetic heart valves	Oral anticoagulation (INR 2.5 to 3.5 or higher may be appropriate)	I
Prior thromboembolism	Oral anticoagulation (INR 2.5 to 3.5 or higher may be appropriate)	I
Persistent atrial thrombus on TEE	Oral anticoagulation (INR 2.5 to 3.5 or higher may be appropriate)	I

**Risk factors for thromboembolism: HF, LV ejection fraction less than 0.35, and history of hypertension.*

AF indicates atrial fibrillation; CAD, coronary artery disease; HF, heart failure; INR, international normalized ratio; LV, left ventricular; and TEE, transesophageal echocardiography.

Management of AF

Recommendations for Antithrombotic Therapy to Prevent Ischemic Stroke and Systemic Embolism in Patients With AF Undergoing Cardioversion

Class I

1. Administer anticoagulation therapy regardless of the method (electrical or pharmacological) used to restore sinus rhythm.

2. Anticoagulate patients with AF lasting more than 48 h or of unknown duration for at least 3 to 4 weeks before and after cardioversion (INR 2 to 3).

3. Perform immediate cardioversion in patients with acute (recent-onset) AF accompanied by symptoms or signs of hemodynamic instability resulting in angina pectoris, myocardial infarction, shock, or pulmonary edema, without waiting for prior anticoagulation.

a. If not contraindicated, administer heparin concurrently by an initial intravenous bolus injection followed by a continuous infusion in a dose adjusted to prolong the activated partial thromboplastin time at 1.5 to 2 times the reference control value.

b. Next, provide oral anticoagulation (INR 2 to 3) for a period of at least 3 to 4 weeks, as for patients undergoing elective cardioversion.

c. Limited data from recent studies support subcutaneous administration of low-molecular-weight heparin in this indication.

4. Screening for the presence of thrombus in the left atrium or left atrium appendage by transesophageal echocardiography is an alternative to routine preanticoagulation in candidates for cardioversion of AF.

a. Anticoagulate patients in whom no thrombus is identified with intravenous unfractionated heparin by an initial bolus injection before cardioversion, followed by a continuous infusion in a dose adjusted to prolong the activated partial thromboplastin time at 1.5 to 2 times the reference control value.

b. Next, provide oral anticoagulation (INR 2 to 3) for a period of at least 3 to 4 weeks, as for patients undergoing elective cardioversion.

c. Limited data are available to support the subcutaneous administration of low-molecular-weight heparin in this indication.

d. Treat patients in whom thrombus is identified by transesophageal echocardiography with oral anticoagulation (INR 2 to 3) for at least 3 to 4 weeks before and after restoration of sinus rhythm.

Class IIb

1. Cardioversion without transesophageal echocardiography guidance during the first 48 h after the onset of AF.

a. In these cases, anticoagulation before and after cardioversion is optional, depending on assessment of risk.

2. Anticoagulate patients with atrial flutter undergoing cardioversion in the same way as for patients with AF.

VII. Recommendations for Management of Patients With AF and Special Conditions

Recommendations for Prevention and Management of Postoperative AF

Class I

1. Treat patients undergoing cardiac surgery with an oral beta-blocker to prevent postoperative AF, unless contraindicated.

2. In patients who develop postoperative AF, achieve rate control by administration of AV nodal blocking agents.

Class IIa

1. Administer sotalol or amiodarone prophylactically to patients at increased risk of developing postoperative AF.

2. Restore sinus rhythm in patients who develop postoperative AF by pharmacological cardioversion with ibutilide or direct-current cardioversion, as recommended for nonsurgical patients.

3. In patients with recurrent or refractory postoperative AF, attempt maintenance of sinus rhythm by administration of antiarrhythmic medications, as recommended for patients with coronary artery disease who develop AF.

4. Administer antithrombotic medication in patients who develop postoperative AF, as recommended for nonsurgical patients.

Recommendations for Management of Patients With AF and Acute Myocardial Infarction

Class I

1. Electrical cardioversion for patients with severe hemodynamic compromise or intractable ischemia.

2. Intravenous administration of digitalis or amiodarone to slow a rapid ventricular response and improve left ventricular function.

3. Intravenous beta-blockers to slow a rapid ventricular response in patients without clinical left ventricular dysfunction, bronchospastic disease, or atrioventricular block.

4. Heparin for patients with AF and acute myocardial infarction, unless contraindications to anticoagulation are present.

Class III

1. Administer type IC antiarrhythmic drugs in patients with AF in the setting of acute myocardial infarction.

Recommendations for Management of AF and Ventricular Pre-excitation

Class I

1. Catheter ablation of the accessory pathway in symptomatic patients with AF who have Wolff-Parkinson-White (WPW) syndrome, particularly those with syncope due to rapid heart rate or those with a short bypass tract refractory period.

2. Immediate electrical cardioversion to prevent ventricular fibrillation in patients with WPW in whom AF occurs with a rapid ventricular response associated with hemodynamic instability.

3. Intravenous procainamide or ibutilide in an attempt 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 (greater than or equal to 120 ms in duration).

Class IIb

1. Administer intravenous quinidine, procainamide, disopyramide, ibutilide, or amiodarone to hemodynamically stable patients with AF involving conduction over an accessory pathway.

a. Immediate cardioversion is required when very rapid tachycardias or hemodynamic instability occurs in patients with AF involving conduction over an accessory pathway.

Class III

Intravenous administration of beta-blocking agents, digitalis glycosides, diltiazem, or verapamil in patients with WPW syndrome who have pre-excited ventricular activation in AF.

Recommendations for Management of AF in Patients With Hyperthyroidism

Class I

1. Administer a beta-blocker as necessary to control the rate of ventricular response in patients with AF complicating thyrotoxicosis, unless contraindicated.

2. In circumstances when a beta-blocker cannot be used, administer a calcium channel antagonist (diltiazem or verapamil) to control the ventricular rate.

3. In patients with AF associated with thyrotoxicosis, use oral anticoagulation (INR 2 to 3) to prevent thromboembolism, as recommended for AF patients with other risk factors for stroke.

a. Once a euthyroid state is restored, recommendations for antithrombotic prophylaxis are the same as for patients without hyperthyroidism.

Recommendations for Management of AF During Pregnancy

Class I

1. Control the rate of ventricular response with digoxin, a beta-blocker, or a calcium channel antagonist.

2. Electrical cardioversion in patients who become hemodynamically unstable due to the dysrhythmia.

3. Administer antithrombotic therapy (anticoagulant or aspirin) throughout pregnancy to all patients with AF (except those with lone AF).

Class IIb

1. Attempt pharmacological cardioversion by administration of quinidine, procainamide, or sotalol in hemodynamically stable patients who develop AF during pregnancy.

2. Administer heparin to patients with risk factors for thromboembolism during the first trimester and last month of pregnancy. 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 (reference) value or by intermittent subcutaneous injection in a dose of 10,000 to 20,000 U every 12 h, adjusted to prolong the mid-interval (6 h after injection) activated partial thromboplastin time to 1.5 times control.

a. Limited data are available to support the subcutaneous administration of low-molecular-weight heparin for this indication.

3. Administer an oral anticoagulant during the second trimester to patients at high thromboembolic risk.

Recommendations for Management of AF in Patients With Hypertrophic Cardiomyopathy

Class I	Treat patients with hypertrophic cardiomyopathy who develop AF with oral anticoagulation (INR 2 to 3), as recommended for other high-risk patients for prevention of thromboembolism.
Class IIa	Antiarrhythmic medications to prevent recurrences. Available data are insufficient to recommend one agent over another in this situation, but disopyramide and amiodarone are generally preferred.

Recommendations for Management of AF in Patients With Pulmonary Diseases

Class I	1. In 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. 2. In patients with obstructive pulmonary disease who develop AF, a calcium channel antagonist agent (diltiazem or verapamil) is preferred for ventricular rate control. 3. Attempt electrical cardioversion in patients with pulmonary disease who become hemodynamically unstable due to AF.
Class III	1. Use of theophylline and beta-adrenergic agonist agents in patients with bronchospastic lung disease who develop AF. 2. Use of beta-blockers, sotalol, propafenone, and adenosine in patients with obstructive lung disease who develop AF.