Current Guidelines On Atrial Fibrillation In The Emergency Department

This issue of EM Practice Guidelines Update reviews 2 guidelines that focus on the management of atrial fibrillation (AF) in the emergency department (ED). AF is the most common sustained cardiac rhythm disturbance in adults. It is a risk factor for thromboembolism and congestive heart failure (CHF), and it causes symptoms such as chest pain and shortness of breath. Prevalence increases with age, and it is predicted that by 2050, nearly 5.6 million people in the United States will be diagnosed with AF, doubling the current number of cases.1

Several key controversies exist in the management of AF, including rhythm versus rate control, electric versus pharmacological rhythm control, and if and when anticoagulation is indicated. Several key guidelines have been recently published to direct emergency clinicians in their care of patients with this most common arrhythmia.

Practice Guideline Impact

- Hemodynamically unstable patients require immediate direct-current cardioversion.
- Hemodynamically stable patients with onset of AF < 48 hours may undergo cardioversion without anticoagulation.
- If AF duration is ≥ 48 hours or an unknown period of time, the patient must be assessed for the need for thromboembolism prophylaxis.
- The patient’s risk of bleeding must be assessed prior to initiating anticoagulation.
- Only symptomatic patients or patients with insufficient rate control require hospital admission.
The Canadian Cardiovascular Society (CCS) convened a primary panel of experts to undertake a comprehensive review of current knowledge and management strategies in the field of AF and to develop an evidence-based set of recommendations on the diagnosis and management of patients with AF. The target is primary care physicians, emergency physicians, internists, and cardiologists. The working groups undertook a review of the English language literature, using Ovid MEDLINE® and Cochrane Library searches and a critical appraisal of the evidence, focusing predominantly on the results of randomized clinical trials and systematic reviews. In the absence of such data, recommendations were based on the results of large cohort studies or smaller clinical studies. Writing group disclosures were listed and revealed that most authors had an affiliation with a commercial organization that may have had a connection with the presented content. Evidence and recommendations were classified according to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system. This approach separates the quality of evidence from the strength of recommendations. Only recommendations pertinent to emergency clinicians are abstracted here.

Table 1. GRADE Classifications, Quality Of Evidence

<table>
<thead>
<tr>
<th>Classification</th>
<th>Evidence</th>
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<tbody>
<tr>
<td>High</td>
<td>Future research unlikely to change confidence in estimate of effect; eg, multiple well-designed, well-conducted clinical trials. Multiple populations evaluated. Data derived from multiple randomized controlled trials or meta-analyses.</td>
</tr>
<tr>
<td>Moderate</td>
<td>Further research likely to have an important impact on confidence in estimate of effect and may change the estimate; eg, limited clinical trials, inconsistency of results, or study limitations.</td>
</tr>
<tr>
<td>Low</td>
<td>Further research very likely to have a significant impact on the estimate of effect and is likely to change the estimate; eg, small number of clinical studies or cohort observations.</td>
</tr>
<tr>
<td>Very low</td>
<td>The estimate of effect is very uncertain; eg, case studies, consensus opinion.</td>
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Table 2. GRADE Classifications, Factors Determining Strength of Evidence

<table>
<thead>
<tr>
<th>Factors</th>
<th>Description</th>
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<tbody>
<tr>
<td>Quality of evidence</td>
<td>The higher the quality of evidence, the greater the probability that a strong recommendation is indicated; eg, strong recommendation that patients with AF at moderate to high risk of stroke be treated with oral anticoagulants.</td>
</tr>
<tr>
<td>Difference between desirable and undesirable effects</td>
<td>The greater the difference between desirable and undesirable effects, the greater the probability that a strong recommendation is indicated; eg, strong recommendation that patients with AF ≥ 48-hour duration receive oral anticoagulation therapy for at least 3 weeks prior to planned cardioversion and 4 weeks following.</td>
</tr>
<tr>
<td>Values and preferences</td>
<td>The greater the variation or uncertainty in values and preferences, the higher the probability that a conditional recommendation is indicated; eg, aspirin may be a reasonable alternative to oral anticoagulant therapy in patients at low risk of stroke.</td>
</tr>
<tr>
<td>Cost</td>
<td>The higher the cost, the lower the likelihood that a strong recommendation is indicated; eg, conditional recommendation for catheter ablation as first-line therapy for AF.</td>
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Abbreviation: AF, atrial fibrillation.
Overall Approach
1. We recommend that in stable patients with recent-onset AF/atrial flutter (AFL), a strategy of rate control or rhythm control could be selected (Strong Recommendation, High-Quality Evidence).
2. We recommend for patients with acute hemodynamic instability secondary to rapid recent-onset AF/AFL, immediate electrical conversion to sinus rhythm (Strong Recommendation, Low-Quality Evidence).

Rhythm Control
In hemodynamically stable patients with AF/AFL of known duration < 48 hours in whom a strategy of rhythm control has been selected:
1. We recommend that rate-slowing agents alone are acceptable while awaiting spontaneous conversion (Strong Recommendation, Moderate-Quality Evidence).
2. We recommend that synchronized electrical cardioversion or pharmacologic cardioversion may be used when a decision is made to cardiovert patients in the ED (Strong Recommendation, Moderate-Quality Evidence).
3. We suggest that antiarrhythmic drugs may be used to pretreat patients before electrical cardioversion in the ED in order to decrease early recurrence of AF and to enhance cardioversion efficacy (Conditional Recommendation, Low-Quality Evidence).

Electrical Cardioversion
1. We recommend that electrical cardioversion may be conducted in the ED with 150-200 joules biphasic waveform as the initial energy setting (Strong Recommendation, Low-Quality Evidence).

Rapid Pre-excitation During Atrial Fibrillation
We recommend, in patients with rapid ventricular pre-excitation during AF (Wolff-Parkinson-White syndrome):
1. Urgent electrical cardioversion if the patient is hemodynamically unstable (Strong Recommendation, Low-Quality Evidence).
2. Intravenous (IV) antiarrhythmic agents procainamide or ibutilide in stable patients (Strong Recommendation, Low-Quality Evidence).
3. Atrioventricular (AV) nodal blocking agents (digoxin, calcium channel blockers, beta-blockers, adenosine) are contraindicated (Strong Recommendation, Low-Quality Evidence).

Prevention Of Thromboembolism
We recommend that hemodynamically stable patients with AF/AFL of ≥ 48 hours' or uncertain duration for whom a strategy of rhythm control has been selected should have rate control optimized and receive therapeutic oral anticoagulant (OAC) therapy (warfarin [international normalized ratio (INR) 2-3] or dabigatran) for 3 weeks before and at least 4 weeks postcardioversion. Following attempted cardioversion:
1. If AF/AFL persists or recurs or if symptoms suggest that the presenting AF/AFL has been recurrent, the patient should have antithrombotic therapy continued indefinitely (using either OAC or aspirin as appropriate).
2. If sinus rhythm is achieved and sustained for 4 weeks, the need for ongoing antithrombotic therapy should be determined based on the risk of stroke, and, in selected cases, expert consultation may be required (Strong Recommendation, Moderate-Quality Evidence).
3. We recommend that hemodynamically stable patients with AF/AFL of known duration < 48 hours for whom a strategy of rhythm control has been selected may generally undergo cardioversion without prior or subsequent anticoagulation. However, if the patient is at particularly high risk of stroke (eg, mechanical valve, rheumatic heart disease, recent stroke, or transient ischemic attack [TIA]), cardioversion should be delayed and the patient should receive OAC for 3 weeks before and at least 4 weeks postcardioversion.

Disposition And Follow-Up
1. We recommend hospital admission for highly symptomatic patients with decompensated heart failure or myocardial ischemia (Strong Recommendation, Low-Quality Evidence).
2. We suggest limiting hospital admission to highly symptomatic patients in whom adequate rate control cannot be achieved (Conditional Recommendation, Low-Quality Evidence).
3. We suggest that after conversion to sinus rhythm has been achieved, whether antiarrhythmic drug therapy is indicated should be based on the estimated probability of recurrence and the symptoms during AF. Long-term therapy will need to be determined by
an appropriate outpatient consultation (Conditional Recommendation, Low-Quality Evidence).

**Canadian Cardiovascular Society Atrial Fibrillation Guidelines 2010: Rate And Rhythm Management**

**Drugs For Heart Rate Control**

1. We recommend beta-blockers or nondihydropyridine calcium channel blockers as initial therapy for rate control of AF or AFL in most patients without a past history of myocardial infarction or left ventricular dysfunction (Strong Recommendation, Moderate-Quality Evidence).

2. We suggest that digoxin not be used as initial therapy for active patients and be reserved for rate control in patients who are sedentary or who have left ventricular systolic dysfunction (Conditional Recommendation, Moderate-Quality Evidence).

3. We suggest that digoxin be added to therapy with beta-blockers or calcium channel blockers in patients whose heart rate remains uncontrolled (Conditional Recommendation, Moderate-Quality Evidence).

4. We suggest that dronedarone may be added for additional rate control in patients with uncontrolled ventricular rates despite therapy with beta-blockers, calcium channel blockers, or digoxin (Conditional Recommendation, Moderate-Quality Evidence).

5. We suggest that amiodarone for rate control should be reserved for exceptional cases in which other means are not feasible or are insufficient (Conditional Recommendation, Low-Quality Evidence).

6. We recommend beta-blockers as initial therapy for rate control of AF or AFL in patients with myocardial infarction or left ventricular systolic dysfunction (Strong Recommendation, High-Quality Evidence).

**Rhythm Control**

1. We recommend the optimal treatment of precipitating or reversible predisposing conditions of AF prior to attempts to restore or maintain sinus rhythm (Strong Recommendation, Low-Quality Evidence).

2. We recommend a rhythm control strategy for patients with AF or AFL who remain symptomatic with rate-control therapy or in whom rate-control therapy is unlikely to control symptoms (Strong Recommendation, Moderate-Quality Evidence).

3. We recommend that the goal of rhythm control therapy should be improvement in patient symptoms and clinical outcomes and not necessarily the elimination of all AF (Strong Recommendation, Moderate-Quality Evidence).

**Antiarrhythmic Drug Therapy To Maintain Sinus Rhythm**

1. We recommend use of maintenance oral antiarrhythmic therapy as first-line therapy for patients with recurrent AF in whom long-term rhythm control is desired (Strong Recommendation, Moderate-Quality Evidence).

2. We recommend that oral antiarrhythmic drug therapy should be avoided in patients with AF or AFL and advanced sinus or AV nodal disease unless the patient has a pacemaker or implantable defibrillator (Strong Recommendation, Low-Quality Evidence).

3. We recommend that an AV blocking agent should be used in patients with AF or AFL being treated with a class I antiarrhythmic drug (eg, propafenone or flecainide) in the absence of advanced AV nodal disease (Strong Recommendation, Low-Quality Evidence).

**Canadian Cardiovascular Society Atrial Fibrillation Guidelines 2010: Prevention Of Stroke And Systemic Thromboembolism In Atrial Fibrillation And Flutter**

**Assessing Risk**

1. We recommend that all patients with AF or AFL (paroxysmal, persistent, or permanent) should be stratified using a predictive index for stroke (eg, CHADS₂) and for the risk of bleeding (eg, HAS-BLED) and that most patients should receive antithrombotic therapy (Strong Recommendation, High-Quality Evidence).

2. We recommend that patients at very low risk of stroke (CHADS₂ = 0) should receive aspirin (75-325 mg/day) (Strong Recommendation, High-Quality Evidence).

3. We recommend that patients at low risk of stroke (CHADS₂ = 1) should receive OAC therapy (either warfarin [INR 2-3] or dabigatran) (Strong Recommendation, High-Quality Evidence).

4. We suggest, based on individual risk benefit considerations, that aspirin is a reasonable alternative for some (Conditional Recommendation, Moderate-Quality Evidence).
Emergency Cardioversion
We recommend that hemodynamically stable patients with AF or AFL of ≥ 48 hours’ or uncertain duration for whom electrical or pharmacologic cardioversion is planned should receive therapeutic OAC therapy (warfarin [INR 2-3] or dabigatran) for 3 weeks before and at least 4 weeks postcardioversion. Following attempted cardioversion:

1. If AF or AFL persists or recurs or if symptoms suggest that the presenting AF or AFL has been recurrent, the patient should have antithrombotic therapy continued indefinitely (using either OAC or aspirin, as appropriate).
2. If sinus rhythm is achieved and sustained for 4 weeks, the need for ongoing antithrombotic therapy should be determined on the basis of the risk of stroke, and, in selected cases, expert consultation may be required (Strong Recommendation, Moderate-Quality Evidence).

We recommend that hemodynamically stable patients with AF or AFL of known duration < 48 hours may undergo cardioversion without prior anticoagulation. However, if the patient is at particularly high risk of stroke (eg, mechanical valve, rheumatic heart disease, recent stroke, or TIA), cardioversion should be delayed, and the patient should receive OAC for 3 weeks before and at least 4 weeks postcardioversion. Following attempted cardioversion,

1. If AF or AFL persists or recurs or if symptoms suggest that the presenting AF or AFL has been recurrent, antithrombotic therapy (OAC or aspirin, as appropriate) should be commenced and continued indefinitely.
2. If normal sinus rhythm is achieved and sustained for 4 weeks, the need for ongoing antithrombotic therapy should be determined on the basis of the risk of stroke according to CHADS₂ score, and in selected cases expert consultation may be required (Strong Recommendation, Moderate-Quality Evidence).

We suggest that hemodynamically unstable patients with AF or AFL who require emergency cardioversion be managed as follows:

1. If the AF or AFL is of known duration < 48 hours, the patient may generally undergo cardioversion without prior anticoagulation. However, if the patient is at particularly high risk of stroke (eg,
This is a focused update to the 2006 guidelines. The guidelines were created by a committee composed of members representing the American College of Cardiology (ACC), the American Heart Association (AHA), the European Society of Cardiology (ESC), the European Heart Rhythm Association (EHRA), and the Heart Rhythm Society (HRS). This document was reviewed by 2 official reviewers nominated by the ACC, 2 official reviewers nominated by the AHA, and 2 official reviewers nominated by the ESC, as well as by the American College of Cardiology Foundation (ACCF) Clinical Electrophysiology Committee, the AHA ECG and Arrhythmias Committee, the AHA Stroke Review Committee, the EHRA, the HRS, and numerous additional content reviewers nominated by the writing committee. The document was approved for publication by the governing bodies of the ACC, AHA, and ESC and officially endorsed by the EHRA and the HRS. The ACC/AHA/ESC Writing Committee to Revise the 2001 Guidelines for the Management of Patients With Atrial Fibrillation conducted a comprehensive review of the relevant literature from 2001 to 2006.

Literature searches were conducted in the PubMed/MEDLINE® database and the Cochrane Library (including the Cochrane Database of Systematic Reviews and the Cochrane Controlled Trials Registry). In an effort to respond promptly to new evidence, the ACCF/AHA Task Force on Practice Guidelines has created a “focused update” process to revise the existing guideline recommendations that are affected by evolving data or opinion. Evidence will be reviewed at least twice per year, and updates will be initiated on an as-needed basis. All authors disclosed conflicts of interest and relationships with industry; authors were recused from voting on recommendations for which they had a relevant conflict.

Recommendations were sorted into 4 classes based on predefined categories representing their benefit-to-risk ratios (I, IIa, IIb, III). In addition, the level of evidence for each of these recommendations was evaluated for quality and graded based on predefined criteria (A, B, C). (See Table 3.)

Only recommendations pertinent to emergency medicine are excerpted here. Section numbering has been retained from the original guidelines.

### Table 3. American Heart Association Classification Of Levels And Classes Of Evidence

<table>
<thead>
<tr>
<th>Levels of Evidence</th>
<th>Class I</th>
<th>Benefit &gt;&gt; Risk; procedure SHOULD be performed/administered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level A</td>
<td>Class IIa</td>
<td>Benefit &gt;&gt; Risk; IT IS REASONABLE to perform procedure/administration</td>
</tr>
<tr>
<td>Level B</td>
<td>Class IIb</td>
<td>Benefit ≥ Risk; procedure/treatment MAY BE CONSIDERED</td>
</tr>
<tr>
<td>Level C</td>
<td>Class III</td>
<td>No proven benefit/harmful to patients</td>
</tr>
</tbody>
</table>

This is a focused update to the 2006 guidelines.6-9 The guidelines were created by a committee composed of members representing the American College of Cardiology (ACC), the American Heart Association (AHA), the European Society of Cardiology (ESC), the European Heart Rhythm Association (EHRA), and the Heart Rhythm Society (HRS). This document was reviewed by 2 official reviewers nominated by the ACC, 2 official reviewers nominated by the AHA, and 2 official reviewers nominated by the ESC, as well as by the American College of Cardiology Foundation (ACCF) Clinical Electrophysiology Committee, the AHA ECG and Arrhythmias Committee, the AHA Stroke Review Committee, the EHRA, the HRS, and numerous additional content reviewers nominated by the writing committee. The document was approved for publication by the governing bodies of the ACC, AHA, and ESC and officially endorsed by the EHRA and the HRS. The ACC/AHA/ESC Writing Committee to Revise the 2001 Guidelines for the Management of Patients With Atrial Fibrillation conducted a comprehensive review of the relevant literature from 2001 to 2006.
8.1.3.1 Pharmacological Rate Control During Atrial Fibrillation

Recommendations:

Class I
2. In the absence of pre-excitation, IV administration of beta-blockers (esmolol, metoprolol, or propranolol) or nondihydropyridine calcium channel antagonists (verapamil, diltiazem) is recommended to slow the ventricular response to AF in the acute setting, exercising caution in patients with hypotension or heart failure (HF). *(Level of evidence: B)*
3. IV 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)*
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, LV dysfunction, or for sedentary individuals. *(Level of evidence: C)*

Class IIa
1. A combination of digoxin and either a beta-blocker or a nondihydropyridine calcium channel antagonist is reasonable to control the heart rate both at rest and during exercise in patients with AF. The choice of medication should be individualized and the dose modulated to avoid bradycardia. *(Level of evidence: B)*
3. IV 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, IV procainamide or ibutilide is a reasonable alternative. *(Level of evidence: C)*

Class IIb
1. When the ventricular rate cannot be adequately controlled both at rest and during exercise in patients with AF using a beta-blocker, nondihydropyridine calcium channel antagonist, or digoxin, alone or in combination, amiodarone may be administered to control the heart rate. *(Level of evidence: C)*
2. IV procainamide, disopyramide, ibutilide, or amiodarone may be considered for hemodynamically stable patients with AF involving conduction over an accessory pathway. *(Level of evidence: B)*

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)*
3. In patients with decompensated HF and AF, IV administration of a nondihydropyridine calcium channel antagonist may exacerbate hemodynamic compromise and is not recommended. *(Level of evidence: C)*
4. IV administration of digitalis glycosides or nondihydropyridine calcium channel antagonists to patients with AF and pre-excitation syndrome may paradoxically accelerate the ventricular response and is not recommended. *(Level of evidence: C)*
[Editor’s note: beta-blockers should also be avoided in this setting.]

8.1.4 Preventing Thromboembolism

Recommendations:

Class I
1. Antithrombotic therapy to prevent thromboembolism is recommended for all patients with AF, except those with lone AF or contraindications. *(Level of Evidence: A)*
2. The selection of the antithrombotic agent should be based upon the absolute risks of stroke and bleeding and the relative risk and benefit for a given patient. *(Level of Evidence: A)*
3. For patients without mechanical heart valves at high risk of stroke, chronic oral anticoagulant therapy with a vitamin K antagonist is recommended in a dose adjusted to achieve the target intensity INR of 2.0 to 3.0, unless contraindicated. Factors associated with highest risk for stroke in patients with AF are prior thromboembolism (stroke, TIA, or systemic embolism) and rheumatic mitral stenosis. *(Level of Evidence: A)*
4. Anticoagulation with a vitamin K antagonist is recommended for patients with more than 1 moderate risk factor. Such factors include age 75 years or greater, hypertension, HF, impaired left ventricle systolic function (ejection fraction 35% or less or fractional shortening less than 25%), and diabetes mellitus. *(Level of Evidence: A)*
6. Aspirin, 81 to 325 mg daily, is recommended as an alternative to vitamin K antagonists in low-risk patients or in those with contraindications to oral anticoagulation. *(Level of Evidence: A)*
2. When surgical procedures require interruption of oral anticoagulant therapy for longer than 1 week in high-risk patients, UFH may be administered or LMWH given by subcutaneous injection, although the efficacy of these alternatives in this situation is uncertain. (Level of Evidence: C)

4. In patients undergoing percutaneous coronary intervention, anticoagulation may be interrupted to prevent bleeding at the site of peripheral arterial puncture, but the vitamin K antagonist should be resumed as soon as possible after the procedure and the dose adjusted to achieve an INR in the therapeutic range. Aspirin may be given temporarily during the hiatus, but the maintenance regimen should then consist of the combination of clopidogrel, 75 mg daily, plus warfarin (INR 2.0 to 3.0). Clopidogrel should be given for a minimum of 1 month after implantation of a bare metal stent, at least 3 months for a sirolimus-eluting stent, at least 6 months for a paclitaxel-eluting stent, and 12 months or longer in selected patients, following which warfarin may be continued as monotherapy in the absence of a subsequent coronary event. When warfarin is given in combination with clopidogrel or low-dose aspirin, the dose intensity must be carefully regulated. (Level of Evidence: C)

Class III
Long-term anticoagulation with a vitamin K antagonist is not recommended for primary prevention of stroke in patients below the age of 60 years without heart disease (lone AF) or any risk factors for thromboembolism. (Level of Evidence: C)

8.1.5 Cardioversion Of Atrial Fibrillation

Recommendations For Pharmacological Cardioversion Of Atrial Fibrillation:

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

Class IIa
1. Administration of amiodarone is a reasonable option for pharmacological cardioversion of AF. (Level of Evidence: A)
3. Administration of amiodarone can be beneficial on an outpatient basis in patients with paroxysmal or persistent AF when rapid restoration of sinus rhythm is not deemed necessary. (Level of Evidence: C)

Class IIb
Administration of quinidine or procainamide might be considered for pharmacological cardioversion of AF, but the usefulness of these agents is not well established. (Level of Evidence: C) [Editor’s note: there are high-quality data attesting to the safety and efficacy of procainamide for pharmacologic cardioversion of AF.2]

Class III
1. Digoxin and sotalol may be harmful when used for pharmacological cardioversion of AF and are not recommended. (Level of Evidence: A)

8.2 Direct-Current Cardioversion Of Atrial Fibrillation And Flutter
Recommendations:

Class I
1. When a rapid ventricular response does not respond promptly to pharmacological measures for patients with AF with ongoing myocardial ischemia, symptomatic hypotension, angina, or HF, immediate R-wave synchronized direct-current cardioversion is recommended. (Level of Evidence: C)

2. Immediate direct-current cardioversion is recommended for patients with AF involving pre-excitation when very rapid tachycardia or hemodynamic instability occurs. (Level of Evidence: B)

3. Cardioversion is recommended in patients without hemodynamic instability when symptoms of AF are unacceptable to the patient. In case of early relapse of AF after cardioversion, repeated direct-current cardioversion attempts may be made following administration of antiarrhythmic medication. (Level of Evidence: C)

Class IIa
1. Direct-current cardioversion can be useful to restore sinus rhythm as part of a long-term management strategy for patients with AF. (Level of Evidence: B)

2. Patient preference is a reasonable consideration in the selection of infrequently repeated cardioversions for the management of symptomatic or recurrent AF. (Level of Evidence: C)

Class III
1. Frequent repetition of direct-current cardioversion is not recommended for patients who have relatively short periods of sinus rhythm between relapses of AF after multiple cardioversion procedures despite prophylactic antiarrhythmic drug therapy. (Level of Evidence: C)

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

8.2.6 Pharmacological Enhancement Of Direct-Current Cardioversion
Recommendations:

Class IIa
1. Pretreatment with amiodarone, flecainide, ibutilide, propafenone, or sotalol can be useful to enhance the success of direct-current cardioversion and prevent recurrent AF. (Level of Evidence: B)

2. In patients who relapse to AF after successful cardioversion, it can be useful to repeat the procedure following prophylactic administration of antiarrhythmic medication. (Level of Evidence: C)

Class IIb
1. For patients with persistent AF, administration of beta-blockers, disopyramide, diltiazem, dofetilide, procainamide, or verapamil may be considered, although the efficacy of these agents to enhance the success of direct-current cardioversion or to prevent early recurrence of AF is uncertain. (Level of Evidence: C)

8.2.7 Prevention Of Thromboembolism In Patients With Atrial Fibrillation Undergoing Cardioversion
Recommendations:

Class I
1. For patients with AF of 48-hour duration or longer, or when the duration of AF is unknown, anticoagulation (INR 2.0 to 3.0) is recommended for at least 3 weeks prior to and 4 weeks after cardioversion.
b. For patients in whom thrombus is identified by TEE, oral anticoagulation (INR 2.0 to 3.0) is reasonable for at least 3 weeks prior to and 4 weeks after restoration of sinus rhythm, and a longer period of anticoagulation may be appropriate even after apparently successful cardioversion, because the risk of thromboembolism often remains elevated in such cases. (Level of Evidence: C)

3. For patients with AFL undergoing cardioversion, anticoagulation can be beneficial according to the recommendations as for patients with AF. (Level of Evidence: C)

8.3 Maintenance Of Sinus Rhythm

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

Class IIa
1. During the first 48 hours 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 (TEE) in search of thrombus in the left atrium or left atrium appendage. (Level of Evidence: B)

Class III
1. Antiarrhythmic therapy with a particular drug is not recommended for maintenance of sinus rhythm in patients with AF who have well-defined risk factors for proarrhythmia with that agent. (Level of Evidence: A)

2. Pharmacological therapy is not recommended for maintenance of sinus rhythm in patients with advanced sinus node disease or AV node dysfunction unless they have a functioning electronic cardiac pacemaker. (Level of Evidence: C)
8.4.2 Acute Myocardial Infarction

Recommendations:

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 myocardial infarction and AF. (Level of Evidence: C)

2. IV administration of amiodarone is recommended to slow a rapid ventricular response to AF and improve left ventricular (LV) function in patients with acute myocardial infarction. (Level of Evidence: C)

3. IV beta-blockers and nondihydropyridine calcium antagonists are recommended to slow a rapid ventricular response to AF in patients with acute myocardial infarction who do not display clinical LV dysfunction, bronchospasm, or atrioventricular block. (Level of Evidence: C)

4. For patients with AF and acute myocardial infarction, administration of UFH by either continuous IV infusion or intermittent subcutaneous injection is recommended in a dose sufficient to prolong the activated partial thromboplastin time to 1.5 to 2.0 times the control value, unless contraindications to anticoagulation exist. (Level of Evidence: C)

Class IIa
IV administration of digitalis is reasonable to slow a rapid ventricular response and improve LV function in patients with acute myocardial infarction and AF associated with severe LV dysfunction and heart failure. (Level of Evidence: C)

Class III
The administration of class IC antiarrhythmic drugs is not recommended in patients with AF in the setting of acute myocardial infarction. (Level of Evidence: C)

8.4.3 Wolff-Parkinson-White Pre-excitation Syndromes

Recommendations:

Class I
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. IV procainamide or ibutilide is recommended to restore sinus rhythm in patients with Wolff-Parkinson-White (WPW) syndromes in whom AF occurs without hemodynamic instability in association with a wide QRS complex on the electrocardiogram (ECG) (greater than or equal to 120-ms duration) or with a rapid pre-excited ventricular response. (Level of Evidence: C)

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

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

Class III
IV administration of digitalis glycosides or nondihydropyridine calcium channel antagonists is not recommended in patients with WPW syndromes who have pre-excited ventricular activation during AF. (Level of Evidence: B)
8.4.4 Hyperthyroidism

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

8.4.5 Pregnancy

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

8.4.7 Pulmonary Diseases

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

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

Unstable Patients
According to AHA/CCS/ESC/JCS, unstable patients (hypotension, heart failure, ischemic chest pain, altered mentation) not responding to pharmacotherapy should receive immediate R-wave synchronized direct-current cardioversion. Biphasic waveform is preferred for its lower energy requirement and greater success rates. Initial electrical doses should be 150 to 200 J for biphasic devices in order to increase likelihood of initial success and limit the cumulative dose from multiple attempts. These recommendations also apply to patients who are pregnant or have pulmonary disease, cardiomyopathy, or thyrotoxicosis. Both the AHA and CCS recommend that in unstable patients with AF of > 48 hours’ (or unknown) duration requiring prompt cardioversion, heparin should be administered concurrently with bolus followed by infusion to achieve prothrombin time (PTT) 2x reference control, with OAC started thereafter.

Electrical cardioversion is not as effective at converting AF to normal sinus rhythm as it is with other arrhythmias. Although electrical cardioversion is the recommended first-line therapy in the unstable patient, emergency clinicians should be prepared for failure of this modality and be prepared with other strategies, which may include vasopressors in combination with AV nodal blocking agents, calcium in combination with calcium channel blockers, amiodarone, and magnesium.

Rate Versus Rhythm Control
The decision regarding rate versus rhythm control is controversial. There is no evidence showing mortality benefit or decreased risk of thromboembolism using rhythm control over rate control. The decision should be based on onset of symptoms, severity of symptoms, comorbidities, results of past treatments (if applicable), and physician comfort and preference. The more confidently the onset of symptoms can be established to be < 48 hours, and the younger and more active the patient, the stronger is the indication for primary rhythm control over rate control.

Pharmacological Rate Control Of Atrial Fibrillation In The Absence Of Pre-excitation Syndrome
Rate-slowing agents such as beta-blockers or nondihydropyridine calcium channel antagonists are recommended for rate control of stable patients with AF or AFL. The CCS recommends beta-blockers as the initial agent in patient with myocardial infarction. If the patient has concomitant HF, digoxin or amiodarone is recommended. Digoxin can be given in combination with a calcium channel antagonist or beta-blocker; digoxin monotherapy is not recommended. If these agents fail to adequately control rate, amiodarone can be administered. This recommendation is similar across all societies except CCS, which recommends dronedarone instead of amiodarone when additional rate control is needed due to the ATHENA trial, which demonstrated that dronedarone was associated with reduced hospitalizations and cardiac mortality.

Preventing Thromboembolism
For patients with AF/AFL of an unknown period of time or > 48 hours, antithrombotic therapy to prevent thromboembolism is recommended. The selection of antithrombotic agent is based on risk of stroke using CHADS2 (cardiac failure, hypertension, age, diabetes, and prior stroke); the ESC/CCS recommends an expanded acronym CHA2DS2-VASc (congestive heart failure, hypertension, age > 75 years, diabetes, stroke, vascular disease, age 65-74, and female sex). Scoring is similar to CHADS2. Anticoagulation should be continued at least 3 weeks before and at least 4 weeks postcardioversion.

For patients with AF duration < 48 hours, CCS generally recommends cardioversion without prior or subsequent anticoagulation unless at significant risk, ie, mechanical valve, rheumatic heart disease, recent stroke, or TIA. The AHA has similar recommendations.

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Agents For Thromboembolism
Based on risk score, either a Vitamin K antagonist or aspirin can be used. CCS and ESC describe the use of newer agents for OAC, including dabigatran. CCS updated its guideline, giving dabigatran a Class I recommendation as an alternative to warfarin in patients who do not have a prosthetic heart valve, hemodynamically significant valve disease, severe renal failure (creatinine clearance < 15 mL/min), or advanced liver disease (impaired baseline clotting function).

Risk Of Bleeding
An assessment of bleeding risk should be made prior to starting anticoagulation. ESC/CCS discussed a newly derived risk score using a cohort of European patients with AF called HAS-BLED (hypertension, abnormal renal/liver function, stroke, bleeding history or predisposition, labile INR, elderly (> 65 years of age), and use of drugs/alcohol) where a score > 3 indicated high risk, and caution is needed when administering warfarin or aspirin.

Pharmacological Conversion Of Atrial Fibrillation In Absence Of Pre-excitation Syndrome
Propafenone or flecainide (Class I antiarrhythmic) are recommended for cardioversion in the absence of structural heart disease/AV nodal disease; as mentioned earlier, procainamide is also well-supported in this setting. Amiodarone should be considered if structural disease is present. This distinction is not discussed in AHA guidelines, but is recommended by the ESC/CCS.

Direct-Current Cardioversion
Antiarrhythmic drugs may be used to pretreat patients in order to decrease recurrence of AF and enhance cardioversion efficacy. If normal sinus rhythm is achieved, the need for OAC should be determined using aforementioned risk scores for thromboembolism and early consultant follow-up should be arranged. Electrical cardioversion is contraindicated in patients with digoxin toxicity or hypokalemia. Refer to the previous section on unstable patients for further comments on direct-current cardioversion.

Wolf-Parkinson-White Pre-excitation Syndromes
If hemodynamically unstable, direct-current cardioversion is recommended. IV procainamide or ibutilide is recommended for cardioversion in patients with WPW syndromes who have AF without hemodynamic instability, associated with wide QRS complex (> 120 ms) or rapid ventricular response. AV nodal blocking agents such as digoxin, beta-blockers, adenosine, or calcium channel antagonists are contraindicated, as these agents will increase atrial conduction through the accessory pathway, which, without the dromotropic effect of the AV node, will conduct to ventricles at unstainably high rates and potentially cause degeneration into ventricular fibrillation.

Disposition
Disposition from the ED is only discussed in CCS guidelines. CCS recommends that only symptomatic patients or patients with insufficient rate control be admitted. Otherwise, patients can be discharged in 6 to 12 hours with urgent cardiology follow-up. While this recommendation is primarily informed by a single trial and must be adapted to individual practice environments, this practice has the potential to reduce resource utilization in many American centers which routinely admit all patients with new AF.
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1. Immediate electrical cardioversion is most appropriate for which of the following patients presenting with rapid AF?
   a. 91-year-old man with improved symptoms after IV diltiazem
   b. 42-year-old woman with spontaneous conversion to normal sinus rhythm
   c. 68-year-old woman with unstable vital signs
   d. 53-year-old man with rate control achieved after IV metoprolol

2. Which of the following is indicated prior to initiating cardioversion in a hemodynamically stable patient with AF of > 48 hours’ duration?
   a. Rate control
   b. Anticoagulation for 3 weeks
   c. INR of 2 to 3
   d. All of the above
   e. None of the above

3. A 51-year-old man with no prior cardiac disease presents with rapid AF. His blood pressure is stable and he is asymptomatic. There is no accessory pathway indicated on ECG. Which of the following medications should be administered first in order to control the patient’s rate?
   a. Amiodarone
   b. Ibutilide
   c. Procainamide
   d. Verapamil

4. After multiple failed attempts at rate-controlling a patient’s AF, a strategy to convert the patient’s rhythm by pharmacological cardioversion is considered. Which of the following medications is most appropriate to administer in order to achieve conversion to sinus rhythm?
   a. Digoxin
   b. Diltiazem
   c. Dofetilide
   d. Dronedarone
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**Goals:** Upon completion of this article, you should be able to: (1) demonstrate medical decision-making based on the strongest clinical evidence, (2) cost-effectively diagnose and treat the most critical ED presentations, and (3) describe the most common medicolegal pitfalls for each topic covered.

**Objectives:** Upon completion of this article, you should be able to: (1) decide when electrical cardioversion is appropriate in patients with AF; (2) choose appropriate medications for pharmacological cardioversion of AF; (3) choose appropriate medications for rate control of AF; and (4) assess risk of thromboembolism and need for anticoagulation in AF.

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