

Canadian Cardiovascular Society

2010 Atrial Fibrillation Guidelines

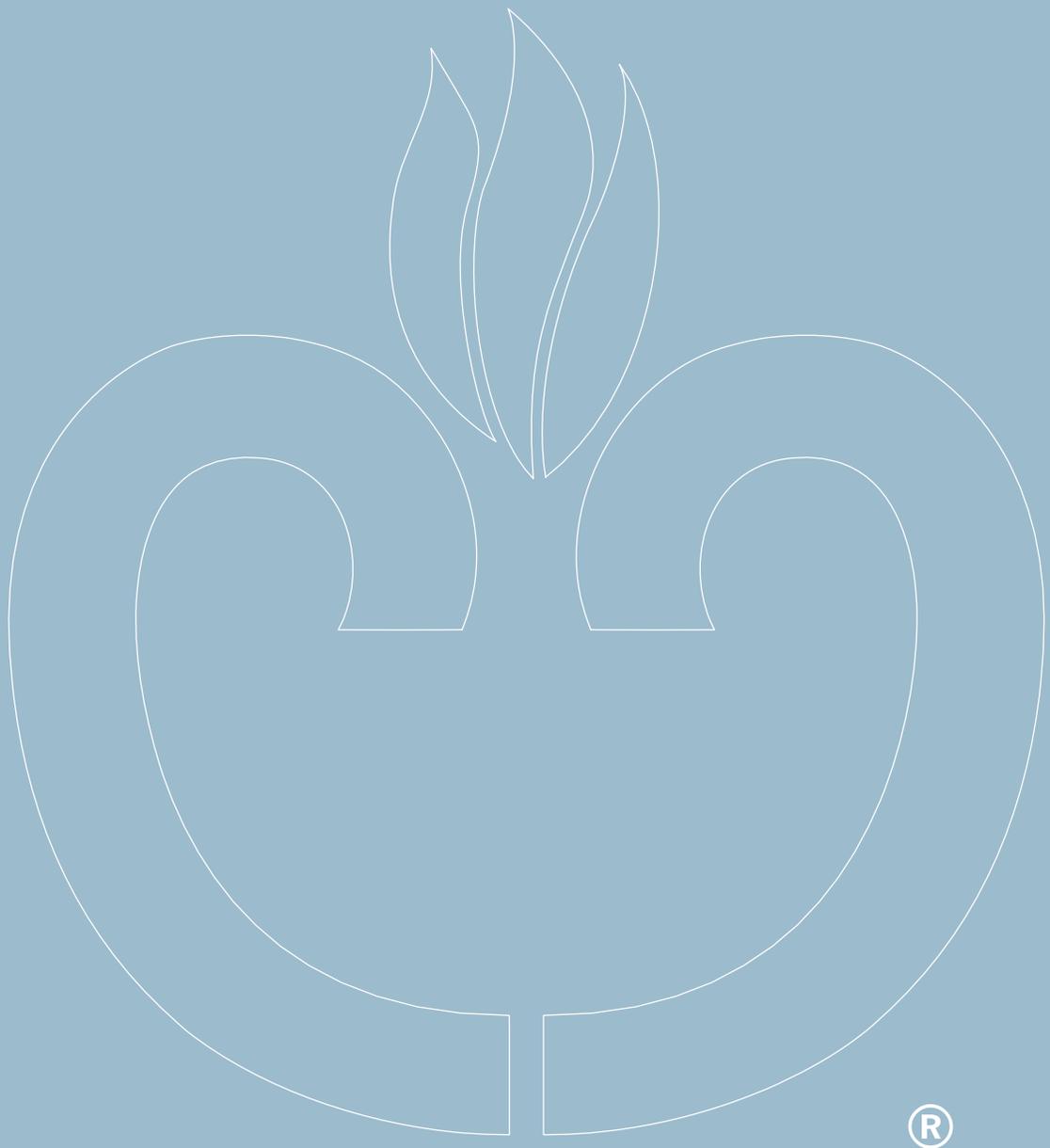


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Chapter 2: Atrial Fibrillation: Etiology and Initial Investigations

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Abstract

The initial evaluation of patients with atrial fibrillation (AF) should include a comprehensive history, physical examination, and initial investigations. The initial evaluation of patients with AF has several important purposes, including the identification of the etiology of AF, particularly the identification of reversible causes of AF; the description of the pattern of AF; the assessment of the degree of symptomatic impairment due to AF; the assessment of the thromboembolic risk of the patient; and the identification of common comorbidities. Additional investigations may then be undertaken, with the decision guided by the initial evaluation. A comprehensive and systematic initial evaluation forms the foundation for a patient-specific plan for the management of AF.

Recommendation

All patients with atrial fibrillation should have a complete history and physical examination, electrocardiogram, echocardiogram, basic laboratory investigations. Details are highlighted in Table 1. (Strong Recommendation; Low Quality Evidence)
Other ancillary tests should be considered under specific circumstances. Details included in Table 2. (Strong Recommendation; Low Quality Evidence)

Values and preferences.

This recommendation places a high value on a comprehensive evaluation of patients with AF and a lower value on initial costs to the health care system.

Recommendation

We recommend that the assessment of patient well-being, symptoms, and quality of life be part of the evaluation of every patient with AF (Strong Recommendation, Low-Quality Evidence).

We suggest that the quality of life of the AF patient be assessed in routine care using the CCS SAF scale (Conditional Recommendation, Low-Quality Evidence).

Values and preferences.

These recommendations recognize that improvement in quality of life is a high priority for therapeutic decision making

Recommendation

Underlying causes or precipitating factors for AF including hypertension should be identified and treated. Details are highlighted in Table 3. (Strong; High Quality of Evidence)

Values and preferences

This recommendation recognizes that therapy of underlying etiology can improve management of AF and that failure to recognize underlying factors may result in deleterious effects.

Table 1. Baseline Evaluation of Atrial Fibrillation for All Patients

History and Physical Exam
Establish Pattern (New Onset, Paroxysmal, Persistent or Permanent)
Establish Severity (including impact on quality of life)
Identify Etiology
Identify reversible causes (hyperthyroidism, ventricular pacing, supraventricular tachycardia, exercise, etc)
Identify risk factors whose treatment could reduce recurrent AF or improve overall prognosis (i.e. hypertension, sleep apnea, left ventricular dysfunction, etc)
Take social history to identify potential triggers (i.e. alcohol, intensive aerobic training, etc)
Elicit family history, to identify potentially heritable causes of AF (particularly in lone AF)
Determine thromboembolic risk
Determine bleeding risk to guide appropriate antiplatelet or antithrombotic therapy
Review prior pharmacologic therapy for AF, both for efficacy and adverse effects
Measure blood pressure and heart rate
Determine patient height and weight
Comprehensive precordial cardiac examination and assessment of jugular venous pressure, carotid and peripheral pulses to detect evidence of structural heart disease
12-Lead Electrocardiogram
Document presence of AF
Assess for structural heart disease (myocardial infarction, ventricular hypertrophy, atrial enlargement, congenital heart disease) or electrical heart disease (Ventricular pre-excitation, Brugada syndrome)
Identify risk factors for complications of therapy for AF (conduction disturbance, sinus node dysfunction or repolarization). Document baseline PR, QT or QRS intervals.
Echocardiogram
Document ventricular size, wall thickness and function
Evaluate left atrial size (if possible, left atrial volume)
Exclude significant valvular or congenital heart disease (particularly atrial septal defects)
Estimate ventricular filling pressures and pulmonary arterial pressure
Complete blood count, coagulation profile, renal function, thyroid and liver function
Fasting lipid profile, fasting glucose

Table 2. Additional Investigations Useful in Selected Cases

Investigation	Potential Role
Chest radiography	Exclude concomitant lung disease, heart failure, baseline in patients receiving amiodarone
Ambulatory electrocardiography (Holter monitor, event monitor, loop monitor)	Document AF, exclude alternative diagnosis (atrial tachycardia, atrial flutter, AVNRT/AVRT, ventricular tachycardia), symptom-rhythm correlation, assess ventricular rate control
Treadmill exercise test	Investigation of patients with symptoms of coronary artery disease, assessment of rate control,
Trans-esophageal echocardiography	Rule out left atrial appendage thrombus, facilitate cardioversion in patients not receiving oral anticoagulation, more precise characterization of structural heart disease (mitral valve disease, atrial septal defects, cor triatriatum, etc)
Electrophysiologic Study	Patients with documented regular supraventricular tachycardia (i.e. atrial tachycardia, AVNRT/AVRT, atrial flutter) that is amenable to catheter ablation
Serum calcium and magnesium	In cases of suspected deficiency (i.e. diuretic use, gastrointestinal losses) which could influence therapy (i.e. sotalol)
Sleep Study (ambulatory oximetry or polysomnography)	In patients with symptoms of obstructive sleep apnea or in select patients with advanced symptomatic heart failure
Ambulatory blood pressure monitoring	In cases of borderline hypertension
Genetic testing	In rare cases of apparent familial AF (particularly with onset at a young age) with additional features of conduction disease, Brugada syndrome or cardiomyopathy.

Table 3. Potential Causes of Atrial Fibrillation

Cardiac Causes
Hypertension
Heart failure *
Coronary artery disease with prior myocardial infarction
Left ventricular dysfunction (systolic and diastolic) *
Including hypertrophic, dilated and restrictive cardiomyopathies
Valvular heart disease
Congenital heart disease * (early repair of atrial septal defect)
Pericardial disease
Post-surgical (particularly cardiac surgery)
Sick sinus syndrome
Atrial fibrillation as a result of ventricular pacing *
Supraventricular tachycardia (including Wolf-Parkinson White syndrome, atrial tachycardia, atrial flutter or other) *
Genetic/Familial
Non-Cardiac Causes
Obstructive sleep apnea *
Obesity *
Excessive alcohol ingestion (acute or chronic) *
Hyperthyroidism *
Vagally-mediated (i.e. habitual aerobic training) *
Pulmonary disease (pneumonia, COPD, pulmonary embolism, pulmonary hypertension)
Lone (idiopathic) Atrial Fibrillation

* Denotes cause for which treatment may prevent the development or recurrence of atrial fibrillation

Chapter 3: Atrial Fibrillation: Rate and Rhythm Management

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Abstract

The goals of atrial fibrillation (AF) and atrial flutter (AFL) arrhythmia management are to alleviate patient symptoms, improve patient quality of life, and minimize the morbidity associated with AF and AFL. Arrhythmia management usually commences with drugs to slow the ventricular rate. The addition of class I or class III antiarrhythmic drugs for restoration or maintenance of sinus rhythm is largely determined by patient symptoms and preferences. For rate control, treatment of persistent or permanent AF and AFL should aim for a resting heart rate of <100 beats per minute. Beta-blockers or nondihydropyridine calcium channel blockers are the initial therapy for rate control of AF and AFL in most patients without a history of myocardial infarction or left ventricular dysfunction. Digoxin is not recommended as monotherapy for rate control in active patients. Digoxin and dronedarone may be used in combination with other agents to optimize rate control. The first-choice antiarrhythmic drug for maintenance of sinus rhythm in patients with non structural heart disease can be any one of dronedarone, flecainide, propafenone, or sotalol. In patients with abnormal ventricular function but left ventricular ejection fraction >35%, dronedarone, sotalol, or amiodarone is recommended. In patients with left ventricular ejection fraction <35%, amiodarone is the only drug usually recommended. Intermittent antiarrhythmic drug therapy (“pill in the pocket”) may be considered in symptomatic patients with infrequent, longer-lasting episodes of AF or AFL as an alternative to daily antiarrhythmic therapy. Referral for

ablation of AF may be considered for patients who remain symptomatic after adequate trials of antiarrhythmic drug therapy and in whom a rhythm control strategy remains desired.

Recommendation

We recommend that the goals of ventricular rate control should be to improve symptoms and clinical outcomes which are attributable to excessive ventricular rates (Strong Recommendation, Low-Quality Evidence).

We recommend that the goals of rhythm control therapy should be to improve patient symptoms and clinical outcomes and that these goals do not necessarily imply the elimination of all AF (Strong Recommendation, Moderate-Quality Evidence).

Values and preferences.

These recommendations place a high value on the decision of individual patients to balance relief of symptoms and improvement in QOL and other clinical outcomes with the potentially greater adverse effects of class I or class III antiarrhythmic drugs compared with rate-control therapy

Recommendation

We recommend that ventricular rate be assessed at rest in all patients with persistent and permanent AF or AFL (Strong Recommendation, Moderate-Quality Evidence).

We recommend that heart rate during exercise be assessed in patients with persistent or permanent AF or AFL and associated exertional symptoms (Strong Recommendation, Moderate-Quality Evidence).

We recommend that treatment for rate control of persistent or permanent AF or AFL should aim for a resting heart rate of <100 bpm (Strong Recommendation, High-Quality Evidence).

Values and preferences.

These recommendations place a high value on the randomized clinical trials and other clinical studies demonstrating that ventricular rate control of AF is an effective treatment approach for many patients with AF.

Recommendation

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).

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).

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).

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).

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).

Values and preferences.

These recommendations recognize that selection of rate-control therapy needs to be individualized on the basis of the presence or absence of underlying structural heart disease, the activity level of the patient, and other individual considerations.

Recommendation

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).

Values and preferences.

This recommendation places a high value on the results of multiple randomized clinical trials reporting the benefit of beta-blockers to improve survival and decrease the risk of recurrent myocardial infarction and prevent new-onset heart failure following myocardial infarction, as well as the adverse effects of calcium channel blockers in the setting of heart failure.

Recommendation

We recommend AV junction ablation and implantation of a permanent pacemaker in symptomatic patients with uncontrolled ventricular rates during AF despite maximally tolerated combination pharmacologic therapy (Strong Recommendation, Moderate-Quality Evidence).

Values and preferences.

This recommendation places a high value on the results of many small randomized trials and one systematic review reporting significant improvements in QOL and functional capacity as well as a decrease in hospitalizations for AF following AV junction ablation in highly symptomatic patients.

Recommendation

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).

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).

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).

Values and preferences.

These recommendations place a high value on the decision of individual patients to balance relief of symptoms and improvement in QOL and other clinical outcomes with the potentially greater adverse effects of the addition of class I or class III antiarrhythmic drugs to rate-control therapy.

Recommendation

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 (see Figs. 4 and 5) (Strong Recommendation, Moderate-Quality Evidence).

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).

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 node disease (Strong Recommendation, Low-Quality Evidence).

Values and preferences.

These recommendations place a high value on the decision of individual patients to balance relief of symptoms and improvement in QOL and other clinical outcomes with the potentially greater adverse effects of class I and class III antiarrhythmic drugs compared with rate-control therapy.

Recommendation

We recommend intermittent antiarrhythmic drug therapy (“pill in the pocket”) in symptomatic patients with infrequent, longer-lasting episodes of AF or AFL as an alternative to daily antiarrhythmic therapy (Strong Recommendation, Moderate-Quality Evidence).

Values and preferences.

This recommendation places a high value on the results of clinical studies demonstrating the efficacy and safety of intermittent antiarrhythmic drug therapy in selected patients.

Recommendation

We recommend electrical or pharmacologic cardioversion for restoration of sinus rhythm in patients with AF or AFL who are selected for rhythm-control therapy and are unlikely to convert spontaneously (Strong Recommendation, Low-Quality Evidence).

We recommend pretreatment with antiarrhythmic drugs prior to electrical cardioversion in patients who have had AF recurrence postcardioversion without antiarrhythmic drug pretreatment (Strong Recommendation, Moderate-Quality Evidence).

Values and preferences.

These recommendations place a high value on the decision of individual patients to pursue a rhythm-control strategy for improvement in QOL and functional capacity.

Recommendation

We recommend radiofrequency ablation of AF in patients who remain symptomatic following adequate trials of antiarrhythmic drug therapy and in whom a rhythm-control strategy remains desired (Strong Recommendation, Moderate-Quality Evidence).

Values and preferences.

This recommendation places a high value on the decision of individual patients to balance relief of symptoms and improvement in QOL with the small but measurable risk of serious complication with catheter ablation.

Recommendation

We suggest that patients requiring pacing for the treatment of symptomatic bradycardia secondary to sinus node dysfunction, atrial or dual-chamber pacing be generally used for the prevention of AF (Conditional Recommendation, High-Quality Evidence).

We suggest that, in patients with intact AV conduction, pacemakers be programmed to minimize ventricular pacing for prevention of AF (Conditional Recommendation, Moderate-Quality Evidence).

Values and preferences.

These recommendations recognize a potential benefit of atrial or dual-chamber pacing programmed to minimize ventricular pacing to reduce the probability of AF development following pacemaker implantation.

Chapter 4: Catheter Ablation of Atrial Fibrillation and Flutter

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Abstract

Catheter ablation of atrial fibrillation (AF) offers a promising treatment for the maintenance of sinus rhythm in patients for whom a rhythm control strategy is desired. While the precise mechanisms of AF are incompletely understood, there is substantial evidence that in many cases (particularly for paroxysmal AF), ectopic activity most commonly located in and around the pulmonary veins of the left atrium plays a central role in triggering and/or maintaining arrhythmic episodes. Catheter ablation involves electrically disconnecting the pulmonary veins from the rest of the left atrium to prevent AF from being triggered. Further substrate modification may be required in patients with more persistent AF. Successful ablation of AF has never been shown to alter mortality or obviate the need for oral anticoagulation; thus, the primary indication for this procedure should be improvement of symptoms caused by AF. The success rate of catheter ablation for AF is superior to the efficacy of antiarrhythmic drugs, but success is still in the range of 75%-90% after 2 procedures. Ablation is also associated with a complication rate of 2%-3%. Thus, ablation should primarily be used as a second-line therapy after failure of antiarrhythmic drugs. In contrast to AF, catheter ablation of atrial flutter has a higher success rate with a smaller incidence of complications. Thus, catheter ablation for atrial flutter may be considered a first-line alternative to antiarrhythmic drugs.

Recommendation

We recommend catheter ablation of AF in patients who remain symptomatic following adequate trials of anti-arrhythmic drug therapy and in whom a rhythm control strategy remains desired (Strong Recommendation, Moderate-Quality Evidence).

Values and preferences.

This recommendation recognizes that failure of multiple antiarrhythmic drugs results in few alternative strategies if maintenance of sinus rhythm is preferred based on symptom burden reduction and quality of life improvement.

Recommendation

We suggest catheter ablation to maintain sinus rhythm in select patients with symptomatic atrial fibrillation and mild-moderate structural heart disease who are refractory or intolerant to ≥ 1 antiarrhythmic medication (Conditional Recommendation, Moderate-Quality Evidence).

Values and preferences.

This recommendation recognizes that the balance of risk with ablation and benefit in symptom relief and improvement in quality of life must be individualized. It also recognizes that patients may have relative or absolute cardiac or noncardiac contraindications to specific medications.

Recommendation

We suggest catheter ablation to maintain sinus rhythm as first-line therapy for relief of symptoms in highly selected patients with symptomatic, paroxysmal atrial fibrillation (Conditional Recommendation, Low-Quality Evidence).

Values and preferences.

This recommendation recognizes that individual patients may have a strong intolerance or aversion to antiarrhythmic drugs such that the risk of ablation is deemed warranted.

Recommendation

We recommend curative catheter ablation for symptomatic patients with typical atrial flutter as first line therapy or as a reasonable alternative to pharmacologic rhythm or rate control therapy (Strong Recommendation, Moderate-Quality Evidence).

Values and preferences.

This recommendation recognizes the high efficacy, low complication rate of catheter ablation and low efficacy of pharmacologic therapy, whether rate or rhythm control.

Recommendation

In patients with evidence of ventricular preexcitation during AF, we recommend catheter ablation of the accessory pathway, especially if AF is associated with rapid ventricular rates, syncope, or a pathway with a short refractory period (Strong Recommendation, Low-Quality Evidence).

Values and preferences.

This recommendation places a high value on the prevention of sudden cardiac death in patients at high risk and a low value on the small complication rate of catheter ablation of the accessory pathway.

Recommendation

In young patients with lone, paroxysmal AF, we suggest an electrophysiological study to exclude a reentrant tachycardia as a cause of AF; if present, we suggest curative ablation of the tachycardia (Conditional Recommendation, Very Low-Quality Evidence).

Values and preferences.

This recommendation recognizes that supraventricular tachycardia can initiate AF when the substrate for AF is present and can be ablated with a high success rate and minimal risk.

Chapter 5: Prevention of Stroke and Systemic Thromboembolism in Atrial Fibrillation and Flutter

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Abstract

The stroke rate in atrial fibrillation is 4.5% per year, with death or permanent disability in over half. The risk of stroke varies from under 1% to over 20% per year, related to the risk factors of congestive heart failure, hypertension, age, diabetes, and prior stroke or transient ischemic attack (TIA). Major bleeding with vitamin K antagonists varies from about 1% to over 12% per year and is related to a number of risk factors. The CHADS₂ index and the HAS-BLED score are useful schemata for the prediction of stroke and bleeding risks. Vitamin K antagonists reduce the risk of stroke by 64%, aspirin reduces it by 19%, and vitamin K antagonists reduce the risk of stroke by 39% when directly compared with aspirin. Dabigatran is superior to warfarin for stroke prevention and causes no increase in major bleeding. We recommend that all patients with atrial fibrillation or atrial flutter, whether paroxysmal, persistent, or permanent, should be stratified for the risk of stroke and for the risk of bleeding and that most should receive

antithrombotic therapy. We make detailed recommendations as to the preferred agents in various types of patients and for the management of antithrombotic therapies in the common clinical settings of cardioversion, concomitant coronary artery disease, surgical or diagnostic procedures with a risk of major bleeding, and the occurrence of stroke or major bleeding. Alternatives to antithrombotic therapies are briefly discussed.

Recommendations

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).

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

We recommend that patients at low risk of stroke (CHADS₂ = 1) should receive *OAC* therapy (either warfarin [INR 2 to 3] or Dabigatran) (Strong Recommendation, High-Quality Evidence). We suggest, based on individual risk-benefit considerations, that aspirin is a reasonable alternative for some (Conditional Recommendation, Moderate-Quality Evidence).

Values and preferences.

This recommendation places relatively greater weight on the absolute reduction of stroke risk with both warfarin and dabigatran compared with aspirin and less weight on the absolute increased risk for major hemorrhage with an OAC compared with aspirin.

Recommendations

We recommend that patients at moderate risk of stroke (CHADS₂ ≥2) should receive *OAC* therapy (either warfarin [INR 2-3] or Dabigatran) (Strong Recommendation, High-Quality Evidence).

We suggest that when OAC therapy is indicated, most patients should receive dabigatran in preference to warfarin. In general, the dose of *dabigatran 150 mg* by

mouth twice a day is preferable to a dose of *110 mg* by mouth twice a day (exceptions discussed in text) (Conditional Recommendation, High-Quality Evidence).

Values and preferences.

This recommendation places a relatively high value on the greater efficacy of dabigatran during a relatively short time of follow-up, particularly among patients who have not previously received an OAC; the lower incidence of intracranial hemorrhage; and its ease of use—and less value on the long safety experience with warfarin.

Recommendations

We recommend that hemodynamically stable patients with AF or AFL of ≥ 48 hours or uncertain duration for whom electrical or pharmacological cardioversion is planned should receive therapeutic OAC therapy (warfarin [INR 2-3] or dabigatran) for 3 weeks before and at least 4 weeks post cardioversion.

Following attempted cardioversion:

- a) 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.
- b) If sinus rhythm is achieved and sustained for 4 weeks, the need for ongoing antithrombotic therapy should be based upon 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 or subsequent anticoagulation.

However, if the patient is at particularly high risk of stroke (e.g. 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 post cardioversion.

Following attempted cardioversion:

- a) 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.

b) If NSR is achieved and sustained for 4 weeks, the need for ongoing antithrombotic therapy should be based on the risk of stroke according to CHADS₂ score and, in selected cases, expert consultation may be required. (Strong recommendation, Low Quality Evidence)

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

- a. If the AF or AFL is known duration < 48 hours, the patient may generally undergo cardioversion without prior anticoagulation. However, if the patient is at particularly high risk of stroke (e.g. mechanical valve, rheumatic heart disease, recent stroke or TIA), the patient should receive IV UFH or LMWH before cardioversion if possible, or immediately thereafter if even a brief delay is unacceptable, and then be converted to OAC for at least 4 weeks post cardioversion.
- b. If the AF or AFL is of \geq 48 hours or uncertain duration, we suggest the patient receive IV UFH or LMWH before cardioversion if possible, or immediately thereafter if even a brief delay is unacceptable. Such a patient should then be converted to OAC for at least 4 weeks post cardioversion. Following attempted cardioversion, the guidelines for subsequent antithrombotic therapy are identical to those for the management of hemodynamically stable patients undergoing cardioversion. (Conditional Recommendation, Low Quality Evidence).

We suggest that hemodynamically stable patients with AF or AFL of duration \geq 48 hours or uncertain duration, may undergo cardioversion guided by TEE, following the protocol from the ACUTE trial. (Conditional Recommendation, High Quality Evidence).

We suggest that patients with AF or AFL who have stable CAD should receive antithrombotic therapy selected based upon their risk of stroke (aspirin for CHADS₂ = 0 and OAC for CHADS₂ \geq 1). Warfarin is preferred over dabigatran for those at high risk of coronary events. (Conditional Recommendation, Moderate Quality Evidence).

We suggest that patients with AF or AFL who have experienced ACS or who have undergone PCI, should receive antithrombotic therapy selected based on a balanced assessment of their risks of stroke, of recurrent coronary artery events and of

hemorrhage associated with the use of combinations of antithrombotic therapies, which in patients at higher risk of stroke may include aspirin plus clopidogrel plus OAC. (Conditional Recommendation, Low Quality Evidence).

We suggest that patients with AF or AFL who are receiving aspirin, clopidogrel, or OAC and are scheduled for a surgical or diagnostic procedure carrying a risk of major bleeding be stratified by their risk of stroke:

a) If there is a very low to moderate risk of stroke ($\text{CHADS}_2 \leq 2$), the patient should have their antithrombotic agent discontinued before the procedure (aspirin or clopidogrel for 7-10 days, warfarin for 5 days if the INR was in the range 2- 3, and dabigatran for 2 days). Once post-procedure hemostasis is established (about 24 hours) the antithrombotic therapy should be reinstated. (Conditional Recommendation, Low Quality Evidence)

b) If there is a particularly high risk of stroke (e.g. prosthetic valve, recent stroke or TIA, rheumatic valve disease, $\text{CHADS}_2 \geq 3$) or of other thromboembolism (e.g. Fontan procedure), further consideration should be given to the risk of major bleeding from the procedure:

i) If there is an acceptable perioperative bleeding risk (i.e. risk of stroke outweighs risk of bleeding) the patient should have OAC therapy continued peri-operatively or have their OAC discontinued before the procedure and be bridged with LMWH or UFH perioperatively. (Conditional Recommendation, Low Quality Evidence)

ii) If there is a substantial risk of major and potentially problematic bleeding (i.e. risk of bleeding and risk of stroke are both substantial) the patient should have their OAC discontinued before the procedure with LMWH or UFH bridging until 12-24 hours pre-procedure. Once post-procedure hemostasis is established (about 24 hours) the OAC should be reinstated with LMWH or UFH bridging. (Conditional Recommendation, Low Quality Evidence)

We recommend that patients with AF or AFL who experience a stroke be managed acutely according to the published guidelines of the American Heart and American Stroke Associations (Strong Recommendation, Moderate Quality Evidence).

We suggest that patients with AF or AFL who experience hemorrhage while on OAC be managed according to the published practice guidelines of the American College of Chest Physicians. (Conditional Recommendation, Low Quality Evidence)

Chapter 6: Management of Recent-Onset Atrial Fibrillation and Flutter in the Emergency Department

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Abstract

Atrial fibrillation (AF) is the most common arrhythmia managed by emergency physicians. There is increasing evidence that most patients with recent-onset AF or atrial flutter (AFL) can be safely managed in the emergency department (ED) without the need for hospital admission. The priorities for ED management of recent-onset AF/AFL include rapid assessment of potential hemodynamic instability and identification and treatment of the underlying or precipitating cause. A careful evaluation of the patient's history should be performed to determine the time of onset of the arrhythmia. All patients should be stratified using a predictive index for the risk of stroke (eg, CHADS₂). For stable patients with recent-onset AF/AFL, a strategy of either rate control or rhythm control could be selected based on multiple factors including the duration of AF and the severity of symptoms. If a strategy of rhythm control has been selected, either electrical or pharmacologic cardioversion may be used. Before proceeding to cardioversion in the absence of systemic anticoagulation, physicians must be confident that the duration of AF/AFL is clearly <48 hours and that the patient is not at a particularly high risk of stroke. When the duration of AF/AFL is >48 hours or uncertain, rate control should be optimized first and the patients should receive therapeutic anticoagulation for 3 weeks before and 4 weeks after planned cardioversion. Adequate follow-up of patients with recent-onset AF/AFL is recommended to identify structural heart disease and evaluate the need for long-term antithrombotic or antiarrhythmic therapy.

Recommendation

We recommend that in stable patients with recent-onset AF/AFL, a strategy of rate control or rhythm control could be selected (Strong Recommendation, High-Quality Evidence).

Values and preferences.

This recommendation places a high value on the randomized controlled trials investigating rate control as an alternative to rhythm control for AF/AFL, recognizing that these trials did not specifically address the ED environment.

Recommendation

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).

Values and preferences.

This recommendation places a high value on the immediate management of hemodynamic instability and a lower value on anticoagulation status under these circumstances. It is also recognized that this is a relatively rare circumstance and that, in most cases, stroke risk and anticoagulation status can be considered prior to immediate cardioversion.

Recommendation

In hemodynamically stable patients with AF/AFL of known duration <48 hours in whom a strategy of rhythm control has been selected:

We recommend that rate-slowing agents alone are acceptable while awaiting spontaneous conversion (Strong Recommendation, Moderate-Quality Evidence).

We recommend that synchronized electrical cardioversion or pharmacologic cardioversion may be used when a decision is made to cardiovert patients in the

emergency department. See Table 2 for drug recommendations (Strong Recommendation, Moderate-Quality Evidence).

We suggest that antiarrhythmic drugs may be used to pretreat patients before electrical cardioversion in ED in order to decrease early recurrence of AF and to enhance cardioversion efficacy (Conditional Recommendation, Low-Quality Evidence).

Values and preferences.

These recommendations place a high value on determination of the duration of AF/AFL as a determinant of stroke risk with cardioversion. Also, individual considerations of the patient and treating physician are recognized in making specific decisions about method of cardioversion.

Recommendation

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).

Values and preferences.

This recommendation places a high value on the avoidance of repeated shocks and the avoidance of ventricular fibrillation that can occur with synchronized cardioversion of AF at lower energy levels. It is recognized that the induction of VF is a rare but easily avoidable event.

Recommendation

We recommend, in patients with rapid ventricular preexcitation during AF (Wolff-Parkinson-White syndrome):

Urgent electrical cardioversion if the patient is hemodynamically unstable (Strong Recommendation, Low-Quality Evidence).

Intravenous antiarrhythmic agents procainamide or ibutilide in stable patients (Strong Recommendation, Low-Quality Evidence).

AV nodal blocking agents (digoxin, calcium channel blockers, beta-blockers, adenosine) are contraindicated (Strong Recommendation, Low-Quality Evidence).

Values and preferences.

These recommendations place a high value on avoidance of the degeneration of preexcited AF to ventricular fibrillation. It is recognized that degeneration can occur spontaneously or it can be facilitated by the administration of specific agents that in the absence of ventricular preexcitation would be the appropriate therapy for rate control of AF.

Recommendation

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 anticoagulants (OAC) therapy (warfarin [INR 2-3] or dabigatran) for 3 weeks before and at least 4 weeks postcardioversion.

Following attempted cardioversion:

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).

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).

Values and preferences.

These recommendations place a high value on minimizing stroke risk by rate control, appropriate anticoagulation and delayed cardioversion, and a lower value on symptomatic improvement associated with immediate cardioversion.

Recommendation

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), cardioversion should be delayed and the patient should receive OAC for 3 weeks before and at least 4 weeks postcardioversion.

Following attempted cardioversion:

If AF or AFL persists, recurs, or if symptoms suggest that the presenting AF/AFL has been recurrent, antithrombotic therapy (OAC or aspirin as appropriate) should be commenced and continued indefinitely.

If NSR is achieved, the need for ongoing antithrombotic therapy should be determined based on the risk of stroke according to CHADS₂ score and early consultant follow-up should be arranged (Strong Recommendation, Low-Quality Evidence).

Values and preferences.

These recommendations place a high value on minimizing stroke risk by appropriate anticoagulation prior to cardioversion in all patients except those at very low risk of stroke due to a short duration of AF/AFL. A lower value is placed on symptomatic improvement associated with immediate cardioversion in patients who are deemed not to be at very low risk of stroke despite an apparent short duration of AF/AFL.

Recommendation

When the duration of an episode of AF/AFL is uncertain, we suggest that patients may undergo cardioversion guided by transesophageal echocardiography, as an alternative to anticoagulation prior to cardioversion. However, anticoagulation needs to be simultaneously started and maintained for ≥ 4 weeks postcardioversion (Conditional Recommendation, High-Quality Evidence).

Values and preferences.

This recommendation places a higher value on the symptomatic improvement with immediate cardioversion as well as avoidance of precardioversion anticoagulation. A lower value is placed on the small risks associated with transesophageal echocardiography.

Recommendation

We recommend hospital admission for highly symptomatic patients with decompensated heart failure or myocardial ischemia (Strong Recommendation, Low-Quality Evidence).

We suggest limiting hospital admission to highly symptomatic patients in whom adequate rate control cannot be achieved (Conditional Recommendation, Low-Quality Evidence).

Values and preferences.

This recommendation places a high value on the need for monitoring of the response to therapy and its reassessment, as well as ancillary investigation and treatment not available in the ED in patients with complex medical conditions associated with AF/AFL. A lower value is placed on the attendant costs of admission to hospital in patients with complex medical conditions associated with AF/AFL.

Recommendation

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).

Values and preferences.

This recommendation places a high value on minimizing the risk of infrequent but serious side effects associated with long-term antiarrhythmic drugs. A high value is also placed on the appropriate use of specialty care to make patient-specific decisions to

minimize these risks. A lower value is placed on the avoidance of symptoms associated with subsequent episodes of AF/AFL if antiarrhythmic drugs cannot be avoided.

Table 1. CHADS2 risk criteria for stroke in patients with nonvalvular atrial fibrillation if not treated with anticoagulation

Risk criteria	Score
Prior stroke or TIA	2
Age >75	1
Hypertension	1
Diabetes mellitus	1
Congestive heart failure	1

Data from Gage BF, et al⁵⁴ and Wang TJ, et al.⁵⁵

Table 2. Recommended intravenous drugs for heart rate control in the ED

Drug	Dose	Risks
Diltiazem*	0.25 mg/kg IV bolus over 10 min; repeat at 0.35 mg/kg IV	Hypotension, bradycardia
Metoprolol	2.5-5 mg IV bolus over 2 min; up to 3 doses	Hypotension, bradycardia
Verapamil*	0.075-0.15 mg/kg over 2 min	Hypotension, bradycardia
Digoxin	0.25 mg IV each 2 h; up to 1.5 mg	Bradycardia, digitalis toxicity

*Calcium-channel blockers should not be used in patients with heart failure or left ventricular dysfunction.

Table 3. Recommended Drugs for Pharmacological Conversion in the ED

Drug	Dose	Efficacy	Risks
Class IA Procainamide	15-17 mg/kg IV over 60 min	++	5% hypotension
Class IC*			
Propafenone	450-600 mg PO	+++	Hypotension, 1:1 flutter, bradycardia
Flecainide	300-400 mg PO	+++	Hypotension, 1:1 flutter, bradycardia
Class III Ibutilide	1-2 mg IV over 10-20 min Pre-treat with MgSO4 1-2 mg IV	++	2-3% Torsades de pointes

*Class IC drugs should be used in combination with AV nodal blocking agents (beta-blockers or calcium-channel inhibitors).

Chapter 7: Surgical Therapy for Atrial Fibrillation

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Abstract

Surgery for atrial fibrillation (AF) has been demonstrated as an effective treatment to restore and maintain sinus rhythm in patients for whom a rhythm control strategy is desired. It is usually offered to patients undergoing other types of cardiac surgery (eg, mitral valve repair or replacement, coronary artery bypass grafting, aortic valve surgery, intracardiac defects, ascending aortic surgery). It is also feasible as a stand-alone procedure, bearing a high success rate. In the past few years, less-invasive procedures have been described. AF is a triggered arrhythmia, resulting from ectopic activity most commonly located in and around the pulmonary veins of the left atrium. Therefore, electrical isolation of the pulmonary veins from the rest of the left atrium in order to prevent AF from being triggered is the rationale common to all surgical techniques. Further substrate modification may be required in patients with more persistent AF. This is done by adding ablation of the posterior left atrium with connecting lines of block between pulmonary veins, to the mitral valve annulus, as well as in specific sites in the right atrium. The left atrial appendage is resected or occluded at the same time. Despite patients' high rate of freedom from AF after surgery (70%–85% at 1 year), surgical ablation of AF has never been clearly shown to alter long-term mortality. The available literature supports the recommendation to stop oral anticoagulation therapy 6 months after surgery when sinus rhythm can be documented, because a very low rate of thromboembolic events is reported. However, there is no evidence-based data to support the safety of omitting long-term oral anticoagulation. Thus, surgery should be used primarily as a concomitant procedure during cardiac surgery for other diseased states or as a stand-alone procedure after failure of prior attempts of catheter ablation and antiarrhythmic drugs.

Recommendation

We recommend that a surgical AF ablation procedure be undertaken in association with mitral valve surgery in patients with AF when there is a strong desire to maintain sinus rhythm, the likelihood of success of the procedure is deemed to be high, and the additional risk is low (Strong Recommendation, Moderate-Quality Evidence).

Values and preferences.

This recommendation recognizes that individual institutional experience and patient considerations best determine for whom the surgical procedure is performed.

Recommendation

We recommend that patients with asymptomatic lone AF, in whom AF is not expected to affect cardiac outcome, should not be considered for surgical therapy for AF (Strong Recommendation, Low-Quality Evidence).

Values and preferences.

This recommendation recognizes that patients with lone AF are at low risk for stroke or other adverse cardiovascular outcomes. Thus, elimination of AF in the absence of a high number of symptoms is unlikely to result in an improvement in quality of life.

Recommendation

In patients with AF who are undergoing aortic valve surgery or coronary artery bypass surgery, we suggest that a surgical AF ablation procedure be undertaken when there is a strong desire to maintain sinus rhythm, the success of the procedure is deemed to be high, and the additional risk low (Conditional Recommendation, Low-Quality Evidence).

Values and preferences.

This recommendation recognizes that left atrial endocardial access is not routinely required for aortic or coronary surgery. This limits ablation to newer epicardial approaches.

Recommendation

We recommend that closure (excision or obliteration) of the left atrial appendage be undertaken as part of the surgical ablation of AF associated with mitral valve surgery (Strong Recommendation, Low-Quality Evidence).

We suggest that closure of the left atrial appendage be undertaken as part of the surgical ablation of persistent AF in patients undergoing aortic valve surgery or coronary artery bypass surgery if this does not increase the risk of the surgery (Conditional Recommendation, Low-Quality Evidence).

Values and preferences.

These recommendations place a high value on stroke reduction and a lower value on any concomitant loss of atrial transport with left atrial appendage closure.

Recommendation

We recommend that oral anticoagulant therapy be continued following surgical AF ablation in patients with a CHADS₂ score ≥ 2 (Strong Recommendation, Moderate-Quality Evidence).

We suggest that oral anticoagulant therapy be continued following surgical AF ablation in patients who have undergone mechanical or bioprosthetic mitral valve replacement (Conditional Recommendation, Low-Quality Evidence).

Values and preferences.

These recommendations place a high value on minimizing the risk of stroke and a lower value in the utility of long-term monitoring to document the absence of AF.

Chapter 8: Prevention and Treatment of Atrial Fibrillation following Cardiac Surgery

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Abstract

Postoperative atrial fibrillation and atrial flutter (POAF) are the most common complications of cardiac surgery that require intervention or prolong intensive care unit and total hospital stay. For some patients, these tachyarrhythmias have important consequences including patient discomfort/anxiety, hemodynamic deterioration, cognitive impairment, thromboembolic events including stroke, exposure to the risks of antiarrhythmic treatments, longer hospital stay, and increased health care costs. We conclude that prevention of POAF is a worthwhile exercise and recommend that the dominant therapy for this purpose be β -blocker therapy, especially the continuation of β -blocker therapy that is already in place. When β -blocker therapy is contraindicated, amiodarone prophylaxis is recommended. If both of these therapies are contraindicated, therapy with either intravenous magnesium or biatrial pacing is suggested. Patients at high risk of POAF may be considered for first-line amiodarone therapy, first-line sotalol therapy, or combination prophylactic therapy. The treatment of POAF may follow either a rate-control approach (with the dominant therapy being β -blocking drugs) or a rhythm-control approach. Anticoagulation should be considered if persistent POAF lasts >72 hours and at the point of hospital discharge. The ongoing need for any POAF treatment (including anticoagulation) should be reconsidered 6-12 weeks after the surgical procedure.

Recommendations

We recommend that patients who have been receiving a beta-blocker before cardiac surgery have that therapy continued through the operative procedure in the absence of the development of a new contraindication (Strong Recommendation, High Quality Evidence).

We suggest that patients who have not been receiving a beta-blocker before cardiac surgery have beta-blocker therapy initiated immediately after the operative procedure in the absence of a contraindication (Conditional Recommendation, Low Quality Evidence).

Values and preferences.

These recommendations place a high value on reducing postoperative AF and a lower value on adverse hemodynamic effects of β -blockade during or after cardiac surgery. It is also noted that inherent to a strategy of prophylaxis, a number of patients will receive β -blocker therapy without personal benefit.

Recommendation

We recommend that patients who have a contraindication to β -blocker therapy before or after cardiac surgery be considered for prophylactic therapy with amiodarone to prevent postoperative AF (Strong Recommendation, High-Quality Evidence).

Values and preferences.

This recommendation places a high value on minimizing the patient population exposed to the potential adverse effects of amiodarone and a lower value on data suggesting that amiodarone is more effective than β -blockers for this purpose.

Recommendation

We suggest that patients who have a contraindication to β -blocker therapy and to amiodarone therapy before or after cardiac surgery be considered for prophylactic therapy to prevent postoperative AF with intravenous magnesium (Conditional Recommendation, Moderate-Quality Evidence) or with biatrial pacing (Conditional Recommendation, Low-Quality Evidence).

Values and preferences.

This recommendation places a high value on preventing postoperative AF using more novel therapies that are supported by lower quality data. A high value is placed on the low probability of adverse effects from magnesium. The use of biatrial pacing needs to be individualized by patient and institution, as the potential for adverse effects may outweigh potential benefit based on local expertise.

Recommendation

We suggest that patients at high risk of postoperative AF receive prophylactic therapy to prevent postoperative AF such as sotalol or combination therapy including ≥ 2 of a β -blocker, amiodarone, intravenous magnesium, or biatrial pacing (Conditional Recommendation, Low- to Moderate-Quality Evidence).

Values and preferences.

This recommendation recognizes that data confirming the superiority of combinations of prophylactic therapies are sparse.

Recommendation

We suggest that consideration be given to anticoagulation therapy if postoperative continuous AF persists for >72 hours. This consideration will include individualized assessment of the risks of a thromboembolic event and the risk of postoperative bleeding (Conditional Recommendation, Low-Quality Evidence).

Values and preferences.

This recommendation places a higher value on minimizing the risk of thromboembolic events and a lower value on the potential for postoperative bleeding. Because the risk of postoperative bleeding decreases with time, the benefit-to-risk ratio favours a longer period without anticoagulation in the postoperative setting than that suggested in other settings.

Recommendation

We recommend that temporary ventricular epicardial pacing electrode wires be placed at the time of cardiac surgery to allow for backup ventricular pacing as necessary (Strong Recommendation, Low-Quality Evidence).

Values and preferences.

This recommendation reflects the relative ease of placement of epicardial temporary pacing wires at the time of surgery as well as the potential for significant morbidity associated with postoperative bradycardia.

Recommendation

We recommend that postoperative AF with a rapid ventricular response be treated with a β -blocker, a non-dihydropyridine calcium antagonist, or amiodarone to establish ventricular rate control. In the absence of a specific contraindication, the order of choice is as listed (Strong Recommendation, High-Quality Evidence).

Values and preferences.

This recommendation places a high value on the randomized controlled trials investigating rate control as an alternative to rhythm control for AF, recognizing that these trials did not specifically address the postoperative period.

Recommendation

We suggest that postoperative AF may be appropriately treated with either a ventricular response rate-control strategy or a rhythm-control strategy (Conditional Recommendation, Low-Quality Evidence).

Values and preferences.

This recommendation places a high value on the randomized controlled trials investigating rate control as an alternative to rhythm control for AF, recognizing that these trials did not specifically address the postoperative period.

Recommendation

We recommend that, when anticoagulation therapy, rate-control therapy, and/or rhythm-control therapy has been prescribed for postoperative AF, formal reconsideration of the ongoing need for such therapy should be undertaken 6-12 weeks later (Strong Recommendation, Moderate-Quality Evidence).

Values and preferences.

This recommendation reflects the high probability that postoperative AF will be a self-limiting process that does not require long-term therapy.

Abbreviations:

AF	atrial fibrillation
AFL	atrial flutter
AV	atrioventricular
INR	International normalized ratio
OAC	oral anti-coagulant
TIA	transient ischemic attack
UFH	unfractionated heparin
LMWH	low-molecular weight heparin
CAD	coronary artery disease
ACS	acute coronary syndrome
PCI	percutaneous intervention
ED	Emergency Department
TEE	trans-esophageal echocardiogram
CHADS ₂	Acronym for thromboembolic risk scale: C ongestive heart failure, H ypertension, A ge ≥ 75 years, D iabetes mellitus, prior S troke or T IA
HAS-BLED	Acronym for bleeding risk scale: H ypertension, A bnormal liver or renal function, history of S troke or B leeding, L abile INR's, E lderly age (≥ 65 years), concomitant D rugs that promote bleeding or excess alcohol use