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Society Guidelines

Canadian Cardiovascular Society Atrial Fibrillation Guidelines 2010: 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.

RÉSUMÉ

L'évaluation initiale des patients présentant une fibrillation auriculaire (FA) devrait comprendre un questionnaire détaillé, un examen physique et un bilan sanguin de base. Cette première évaluation a pour but d'identifier l'étiologie (et particulièrement les causes réversibles) de la FA, de décrire le type de FA (paroxystique, persistante ou permanente), d'évaluer le degré de symptomatologie du patient, d'identifier ses co-morbidités et d'évaluer son risque thromboembolique. L'indication d'investigations supplémentaires et le plan de traitement spécifique au patient dépendent de cette évaluation initiale qui doit être complète et systématique.

Initial Evaluation of AF

The initial evaluation of a patient with atrial fibrillation (AF) should consist of a comprehensive history (including social, drug, and family history), physical examination, and initial investigations (Table 1). This evaluation has many important purposes, including assessing the degree of symptomatic impairment due to AF, developing a therapeutic strategy for symptom relief, assessing and managing thromboembolic risk, establishing prognosis, and, where possible, identifying the underlying etiology of AF. The identification of the etiology of AF during the initial investigation is particularly important for several reasons:

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This statement was developed following a thorough consideration of medical literature and the best available evidence and clinical experience. It represents the consensus of a Canadian panel comprised of multidisciplinary experts on this topic with a mandate to formulate disease-specific recommendations. These recommendations are aimed to provide a reasonable and practical approach to care for specialists and allied health professionals obliged with the duty of bestowing optimal care to patients and families, and can be subject to change as scientific knowledge and technology advance and as practice patterns evolve. The statement is not intended to be a substitute for physicians using their individual judgment in managing clinical care in consultation with the patient, with appropriate regard to all the individual circumstances of the patient, diagnostic and treatment options available and available resources. Adherence to these recommendations will not necessarily produce successful outcomes in every case.

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Table 1. Baseline evaluation of atrial fibrillation for *all* patients

History and physical examination
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 (ie, hypertension, sleep apnea, left ventricular dysfunction, etc)
Take social history to identify potential triggers (ie, 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 for adverse effects
Measure blood pressure and heart rate
Determine patient height and weight
Comprehensive precordial cardiac examination and assessment of jugular venous pressure and carotid and peripheral pulses to detect evidence of structural heart disease
12-Lead electrocardiogram
Document presence of AF by electrocardiography
Assess for structural heart disease (myocardial infarction, ventricular hypertrophy, atrial enlargement, congenital heart disease) or electrical heart disease (ventricular preexcitation, 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, thyroid, and liver function
Fasting lipid profile, fasting glucose

1. To identify risk factors for AF, which, if treated, could reduce or eliminate the occurrence of further AF
2. To identify important risk factors, which, if treated, could improve the overall outcome of the patient, independent of AF
3. To aid in assessing the prognosis of AF in the individual patient
4. To assist in the selection of optimal AF therapy in the individual patient

RECOMMENDATION

All patients with AF should undergo a complete history and physical examination, electrocardiogram, echocardiogram, and 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.

Documentation of AF and Its Characteristics

It is incumbent upon the physician to document AF in at least one electrocardiogram lead, as the perception of "irregularly irregular" palpitations may be the result of a variety of arrhythmias, including atrial tachycardia, atrial flutter, premature atrial and/or ventricular contractions, or nonarrhythmic causes.

The predominant pattern of AF should be determined, as this is helpful for directing therapy:[1]

1. First detected AF
2. Paroxysmal: AF is self-terminating within 7 days of recognized onset
3. Persistent: AF is not self-terminating within 7 days or is terminated electrically or pharmacologically *or*
4. Permanent: AF in which cardioversion has failed or in which clinical judgment has led to a decision not to pursue cardioversion

One may not be able to identify the pattern of AF at the time of initial presentation, and the pattern may change over time. An assessment of the nature and severity of symptoms and their impact on quality of life should also be performed. Symptoms associated with AF are highly variable and may include palpitations, dyspnea, dizziness, weakness, or chest pain.[2] The frequency and duration of symptoms vary, as can the severity, with some patients being truly asymptomatic and others having debilitating symptoms.[2] The impact of these symptoms on lifestyle as well as a record of emergency department visits, hospital admissions, and cardioversions should be made, along with a record of all prior interventions (eg, drug therapy, catheter ablation, etc) for AF.

Symptoms at the termination of paroxysms should be sought and if present, symptom–rhythm correlation can be made using an ambulatory electrocardiogram (Holter monitor, event monitor, or loop recorder). Patients with sick sinus syndrome often have sinus pauses, particularly following the termination of AF, which may limit the use of rate- or rhythm-controlling medications and may require the use of permanent pacing. Any supraventricular tachycardia (SVT), including atrial tachycardia and atrial flutter, can lead to the development of AF, and successful ablation of the underlying SVT may eliminate the associated AF.[3,4] Therefore, it is important to elicit and investigate any history of regular palpitations. This can be further explored using ambulatory electrocardiographic monitoring.

Evaluation of the Impact of AF on Quality of Life

AF causes a greater degree of impairment of quality of life in most patients than is generally appreciated. Although rarely life threatening, AF can cause moderate and sometimes severe distress and substantially alter everyday functioning. In a referral practice, a majority of patients have a quality of life that is similar to that of patients following

Table 2. Evaluation of quality of life (QOL) using the CCS SAF scale*

SAF score	Impact on quality of life
Class 0	Asymptomatic
Class 1	Minimal effect on QOL
Class 2	Minor effect on QOL
Class 3	Moderate effect on QOL
Class 4	Severe effect on QOL

*The intent of the CCS SAF scale is to capture AF-*related* symptoms and QOL. However, the scale evaluates not only symptoms that occur during episodes of AF but also the consequences of ongoing treatment for AF (ie, medication-related side effects).

myocardial infarction. Impaired quality of life is primarily the result of symptoms from AF but is also influenced by side effects from the AF therapies, illness perceptions, and patient factors such as depression. In the absence of a gold standard method to treat AF patients, improving quality of life and relieving symptoms are often the primary goals in the management of AF patients.

Making treatment plans and assessing treatment effectiveness require a consistent and standardized approach to measuring the impact of overall quality of life of the AF syndrome. In 2005, the Canadian Cardiovascular Society Atrial Fibrillation Guidelines Committee set out to create and validate a standard approach to assessing overall quality of life in AF patients, by developing the Severity in Atrial Fibrillation (SAF) scale (Table 2). This semiquantitative scale ranges from 0 (no impact of AF or its treatment on overall quality of life and patient functioning) to SAF 4 (resulting in a severe impairment of functioning and overall quality of life). A multicentre Canadian study has shown that the results of this scale correlate well with previously validated symptom scores and generic measures of quality of life and that it can be easily applied by a variety of caregivers at the beside with minimal training.[2,5,6]

An increasing recognition that the presence of AF on an electrocardiogram or the frequency and duration of episodes of AF ("the AF burden") are poorly correlated with long-term morbidity and overall quality of life has led to an increasing emphasis on subjective patient-defined outcomes to most effectively assess the usefulness of overall management and specific treatments in AF. An explicit assessment of the effect of AF on QOL, preferably using a scale such as the SAF scale in every patient seen with AF, is recommended and can be used as a baseline to assess the effects of new or changed therapy in individual patients (Table 3). Patients vary widely with respect to severity of symptoms and overall quality of life related to AF. It is difficult to give appropriate counsel and weigh risks and benefits of therapy without an explicit understanding of the consequences of AF and its treatment on the patient's well-being.

Such an approach serves to emphasize that simply slowing the ventricular rate under the strategy of rate control or restoring and maintaining sinus rhythm using a strategy of rhythm control may not necessarily improve patient well-being and quality of life. Careful evaluation and ongoing reevaluation of the impact of the disorder and its treatment on overall patient well-being are required.[2]

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).

Table 3. 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
Transesophageal 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)
Electrophysiological study	Patients with documented regular supraventricular tachycardia (ie, atrial tachycardia, AVNRT/AVRT, atrial flutter) that is amenable to catheter ablation
Serum calcium and magnesium	In cases of suspected deficiency (ie, diuretic use, gastrointestinal losses), which could influence therapy (ie, 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

AVNRT/AVRT, atrioventricular nodal reentrant tachycardia/atrioventricular reentrant tachycardia.

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

Identification of the Etiology of AF

AF is a disease of advancing age, whose prevalence increases from 0.1% in patients under age 50 to 10%-15% in those >80 years old.[7] This has important public health implications for the aging Canadian population. In most cases, AF is associated with underlying heart disease–most commonly, hypertension, heart failure, left ventricular systolic dysfunction, and valvular heart disease.[8-11] Although these conventional risk factors are present in >70% of North American patients,[12,13] there are important additional considerations.

First, additional risk factors such as hyperthyroidism,[14] Wolff-Parkinson-White syndrome,[3,15] and unnecessary ventricular pacing,[16-19] although much less prevalent, are important to identify as they have additional deleterious effects and their treatment could eliminate further AF in affected patients. Second, because Canada is a country with a significant immigrant population, it is important to remember that in many patients, AF may be the result of conditions that are much less common among individuals born in North America, such as rheumatic heart disease, complicated hypertension, and pericarditis.[20] Third, there are emerging data identifying additional conditions such as obesity, sleep apnea. and alcohol intake as risk factors for the development of AF and its complications.[21-23] Finally, there are still approximately 15%-20% of AF patients who do not have identifiable comorbidities.[24] While these patients would be classified as having "lone" (idiopathic) AF, some may have a genetic predisposition to AF, an SVT that leads to the development of AF or have AF as a result of high vagal tone, such as secondary to intensive aerobic exercise.[25]

The underlying etiologic conditions associated with AF should be determined. In Canada, the most important of these risk factors is hypertension.[11,13] Careful blood pressure measurement should be conducted, as outlined by the Canadian Hypertension Education Program guidelines for the diagnosis of hypertension.[26,27] Clinicians should pursue a diagnosis of hypertension in patients with frequent borderline office readings, particularly those with significant left atrial enlargement or left ventricular hypertrophy. Ambulatory blood pressure monitoring may facilitate this in patients with paroxysmal AF; however, these devices are greatly influenced by the variable heart rate during AF, limiting their sensitivity and specificity in patients with persistent or permanent AF.

Particular effort should also be given to identify potentially reversible causes of AF (Table 4), such as hyperthyroidism and excessive alcohol. Although only 3.1% of AF patients have hyperthyroidism, it is still an important example of a treatable cause.[28] Identification of both of these disorders on the patient history may be particularly difficult in the elderly. Other common, conventional risk factors include coronary artery disease with prior myocardial infarction, left ventricular systolic dysfunction, and valvular heart disease. Identification of such structural heart disease is important, as it influences the prognosis of AF and may influence choices of therapy for both rate and rhythm control.

Table 4. 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
Postsurgical (particularly cardiac surgery)
Sick sinus syndrome
AF as a result of ventricular pacing*
Supraventricular tachycardia (including Wolff-Parkinson-White syndrome, atrial tachycardia, atrial flutter, or other)*
Genetic/familial
Noncardiac causes
Obstructive sleep apnea*
Obesity*
Excessive alcohol ingestion (acute or chronic)*
Hyperthyroidism*
Vagally mediated (ie, habitual aerobic training)*
Pulmonary disease (pneumonia, chronic obstructive pulmonary disease, pulmonary embolism, pulmonary hypertension)
Lone (idiopathic) AF

*Denotes cause for which treatment may prevent the development or recurrence of AF.

Screening history and physical evaluation for obstructive and nonobstructive sleep apnea should be performed in all patients, and further testing, such as ambulatory oximetry or polysomnography, or appropriate referral to a specialist in sleep medicine should be considered if the history is suggestive of sleep apnea.

RECOMMENDATION

Underlying causes or precipitating factors for AF including hypertension should be identified and treated. Details are highlighted in Table 3 (Strong Recommendation, High-Quality 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.

Determination of Cardiovascular Risk in AF

AF is associated with a 3- to 6-fold increased risk of stroke or non–central nervous system (CNS) systemic embolism.[10,29-34.] It is thought that ≈15% of all strokes are due to AF and that this increases to 25% for patients >80 years old.[10] Both oral anticoagulation and antiplatelet medication reduce the risk of stroke in patients with AF but are associated with an increased risk of bleeding.[33,35,36] For this reason, several risk stratification schemes have been developed to identify patients with the highest risk of stroke, in whom the benefit of oral anticoagulant therapy outweighs the risk of bleeding.[37,38] Initial investigation of patients with AF should identify risk factors for stroke, as this is necessary to help guide the appropriate use of antico-

agulant and antiplatelet medication. Risk factors include a history of stroke, transient ischemic attack, or non-CNS systemic embolism; hypertension; heart failure; left ventricular ejection fraction ≤35%; increasing age; and diabetes mellitus. Other moderate risk factors include female gender and peripheral vascular disease.[37] Many of these same conditions are also associated with an increased risk of bleeding. The initial evaluation of patients with AF should also elicit a bleeding history, prior antiplatelet and anticoagulant use, and degree of INR control[39] to aid in the determination of the ideal strategy for stroke prevention. For a full discussion, see Cairns et al.[40]

The use of stroke risk stratification schemes is undergoing a period of reevaluation. First, there is increasing appreciation that the same clinical characteristics that predict stroke also predict bleeding;[41] thus patients with a lower risk of stroke are also less likely to have bleeding complications of therapy. Second, there are 2 new therapies that have been shown to prevent stroke in patients with AF: clopidogrel (added to acetylsalicyclic acid [ASA])[34] and dabigatran.[42] These 2 agents have different bleeding profiles and are substantially easier for patients to take and have far fewer food and drug interactions than warfarin, thus changing the risk/benefit equation for stroke prevention in AF. Regardless of the specific agents used to prevent stroke and the threshold for their use, the identification of stroke risk factors remains vital to properly inform therapy. In contrast, it should be noted the pattern of AF (paroxysmal vs persistent or permanent) does not influence these decisions.[43] Furthermore, the AFFIRM trial strongly suggests that the apparent suppression of AF with antiarrhythmic medications does not obviate the need for oral anticoagulation in patients with AF and additional risk factors for stroke.[44]

Traditionally, the prevention of cardiovascular events in patients with AF has focused on the prevention of stroke and non-CNS systemic embolism. It should be noted, however, that in recent clinical trials, the most common adverse cardiovascular event in patients with AF is now the development of heart failure.[34,41,42] Patients with AF also frequently require hospitalization, and these patients have a particularly high subsequent mortality.[45] Thus, the appropriate identification and treatment of hypertension and asymptomatic left ventricular systolic dysfunction, as well as the appropriate evidence-based management of heart failure, are also important in the management of patients with AF.

The Physical Examination and Initial Investigations for AF

The physical findings suggestive of AF include an irregular pulse (that may not be rapid), an irregular jugular venous pulse with loss of a-wave, and variation in the intensity of the first heart sound. The physical examination may also uncover causes of AF, including hypertension, left ventricular systolic dysfunction, heart failure, valvular heart disease, congenital heart disease (ie, fixed-split S2 in patient with an atrial septal defect), or hyperthyroidism.

A number of routine investigations are warranted in all patients presenting with a history of AF (see Table 1). An electrocardiogram is useful both in AF and sinus rhythm. Evidence of left atrial enlargement, left ventricular hypertrophy, preexcitation, conduction disease, or myocardial infarction should be sought. A transthoracic echocardiogram is also invaluable and should be performed in all patients with AF. This will identify left ventricular hypertrophy or systolic dysfunction, significant valvular or congenital heart disease, and, rarely, complications such as left atrial appendage thrombus. All of these are necessary for making appropriate decisions regarding the use of rate- and rhythm-controlling agents and anticoagulant medications. An evaluation of left atrial size should also be conducted, as this provides important information about the likelihood of AF recurrence or the development of persistent or permanent AF, which can help guide optimal therapy for symptom improvement. In certain cases, such as the assessment of valvular or congenital heart disease or the exclusion of left atrial appendage thrombus, transesophageal echocardiography may be required.

Routine blood work should be performed at the time of the initial evaluation of patients with AF. A complete blood count and coagulation studies should be performed as they will inform decisions about the use of anticoagulant and antiplatelet medications. Serum electrolytes and creatinine should also be determined because antiarrhythmic and newer anticoagulant medications may be more likely to cause adverse effects in those with electrolyte disorders or renal insufficiency. Serum creatinine and a urinalysis may also identify chronic kidney disease, another common complication of hypertension, the most prevalent risk factor for AF. Liver function tests should also be performed at baseline, both to aid in the identification of excessive alcohol intake and as a baseline for potentially hepatotoxic medications, such as amiodarone, that are frequently administered in the treatment of AF. A lipid profile is recommended in most patients as part of an overall assessment of cardiovascular risk.

Ambulatory electrocardiography monitoring is not routinely required but has a number of important purposes, such as initial documentation of AF, identification of other forms of SCT, assessment of ventricular rate control, and the correlation of patient's symptoms with both rhythm and heart rate. Although not routinely recommended, exercise testing may supplement ambulatory monitoring in certain patients with exercise-related symptoms. Invasive electrophysiological studies should be considered in those patients with idiopathic AF at a young age, particularly in those with documented SVT other than AF or symptoms suggestive of such arrhythmias.

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