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Classification, Etiology and Clinical Evaluation of Atrial Fibrillation

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Introduction

Identificationof Atrial Fibrillation

Atrial fibrillation (AF) is a supraventricular tachyarrhythmiacharacterized by uncoordinated atrial activation. On the ECG fibrillatory (f) waves (rapid oscillations with variable amplitude, shape and timing) replacenormal P waves. Ventricular response becomes irregular and rapid depending ofthe intrinsic electrophysiological properties of the AV node1and the balance between vagal and sympathetic tone1.

The presence of an irregularly pulse is a clinical signthat can be quickly and reliably identified in any healthcare situation and,indicates AF with a high sensitivity and specificity (95% and 75%,respectively). If the irregularity last for more than 20 seconds thespecificity reaches 98%.[2-4] Identification of AF can be done by using manual pulse palpation in thosepresenting with a variety of symptoms. It is desirable to check the bloodpressure and pulse in all patients who present with breathlessness, dyspnea,palpitations, syncope, dizziness or chest discomfort. Furthermore, manypatients presenting with an acute stroke are found to be in AF albeitasymptomatic with respect to non-neurologic complaints.

The finding of a sustained irregular wide QRS complextachycardia may be suspicious of AF conducted with bundle brunch aberrancy orover an accessory pathway, and in patients with A-V sequential pacemakers canreflect an inadequate configuration with ventricular tracking of sensed atrialactivity.

Classificationof Atrial Fibrillation[1]

Although the pattern of AF can change over time, at themoment of diagnosis it may be helpful to characterizethearrhythmia.Thesearethedifferentpatterns: First-detected episode of AF. It can be self-limited or notand the symptoms can range from an ECG finding in absence of symptoms (up to30%5) to the development of heart failure orsyncope. In asymptomatic patients the uncertainty remains about the duration ofthe episode and the possibility of previous undetected episodes. Thepossibility of recurrent AF without significant symptoms must be taken intoaccount and ruled out. Recurrent AF. After 2 or more episodes, AF is considered recurrent.When the arrhythmia terminates spontaneously, recurrent AF is designated paroxysmal; when sustained beyond 7 days, itis termed persistent. This last type includes those cases of long-standing AF, usuallyleading to permanent AF, in which cardioversion has failed to terminate AF. It has been suggested that in most patients paroxysmal AFrepresents an earlier stage of the disease and that its natural history in theabsence of intervention is to progress to persistent/permanent types of AF.

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Etiologyof Atrial Fibrillation

Holter monitoring has shown that the majority of episodesof paroxysmal AF are triggered by atrial premature beats[6,7] while a small number of episodes are preceded by typicalatrial flutter or another supraventricular tachycardia7.Ectopic foci are most often located near the PVs6,which is the most common origin of the AF triggers.

Atrial fibrillation in patients with cardiovascular disease

AF isfrequently, but not uniformily, associated with underlying cardiovasculardisease or echocardiographic characteristic features. The most importantfactors that may contribute to AF in the setting of cardiovascular diseases areincluded in table 1.

Table 1 Risk Factors for Stroke in Elderly Patients With Atrial Fibrillation

Cardiovascular risk factors
Obesity (BMI>30Kg/m2)8*62
Hypertension **
Structural heart diseases
Valvular heart disease (most commonly mitral valve)[9]
Hypertensive heart disease[10]
Myocardial infarction12
Hypertrophic cardiomyopathy13
Restrictive cardiomyopathy
Constrictive pericarditis
Congenital heart diseases14
Cardiac tumors
Chronic myocarditis (e.g. peripartum, lupus, etc)
Chronic pericarditis (e.g. idiopathic, uremic, etc)15
Cor pulmonale
Echocardiographic parameters
Left ventricle hypertrophy
Left atrium enlargement
Mitral valve prolapse/calcification of mitral annulus16
Other risk factors
Sleep apnea syndrome17-21
Age

Atrial Fibrillation in patients without cardiovasculardisease

Up to 25-30% of cases of AF occur in young patientswithout demonstrable underlying disease1. This isthe reason why this pattern of AF is usually called lone AF. Patients with lone AF oftenassociate certain triggers with episodes of AF,[22] and in up to 39% of them a family history of AF is present, suggesting thatinheritance may be of great importance in lone AF. Table 2 shows the mostimportant causes of AF in patients without known cardiovascular risk factors orstructural heart disease.

Atrialfibrillation due to temporary causes

FAF can be related to temporary causes, including some ofthe conditions appearing in both tables above. In such cases, successfultreatment of underlying condition often eliminates AF. Some examples aredescribed below:

SleepApnea Syndrome (OSA)

Several lines of evidence support a possible causalrelationship between OSA and AF. Observational studies have noted asignificantly larger proportion of patients with OSA between patients in AFundergoing cardioversion compared with controls without AF referred for generalcardiology evaluation (49% vs 32%).[17] Thisobservation has been prospectively confirmed in patients undergoing coronaryartery bypass surgery, in whom preoperative sleep studies and postoperative AFincidence were assessed (39 % in OSA patients vs 18% in non-OSA patients).[18]

The risk of cardiac arrhythmias with OSA appears to berelated to severity of the disease, such that the great majority of OSApatients presenting with significant arrhythmias have moderate or severe formsof the disease.[20] In a heart susceptible toatrial fibrillation, the presence of OSA would predispose to the subsequentdevelopment of atrial fibrillation. Furthermore, the frequent presence ofatrial fibrillation in OSA may contribute to the increased risk for stroke andheart failure in this patient population.[21] Ithas been speculated that factors directly related to OSA, such as repetitivehypoxemia, autonomic nervous system imbalance, systemic inflammation,fluctuations in intrathoracic hemo-

dynamic, and diastolic dysfunction may serveas a trigger for atrial fibrillation and may favor the perpetuation of theatrial arrhythmia by altering the atrial substrate. Finally patients receiving-treatment with continuous positive pressure ventilation have a lower incidenceof AF recurrence at 12 months (42 vs 82%).[19]

Hyperthyroidism

Patients with hyperthyroidism have an increased risk ofdeveloping AF,[28] and this risk is gender and age related.Thus AF due to hyperthyroidism is more likely to occur in men than in women(12,1 vs 7,6%) and in patients over age 60 (up to 10 to 20% of patients overage 60), while patients under age 40 have little or no increase in fold risk.[29] Even patients with subclinical hyperthyroidism(normal serum thyroid hormone –T4- concentrations and low serum thyroidstimulating hormone –TSH-) represent a population with increased risk ofAF, similar to patients with clinical hyperthyroidism.[30]

SIncreased beta-adrenergic tone may be in part responsiblefor the development of AF in these patients, and certainly contribute to arapid ventricular response. In addition, excess thyroid hormone increases thelikelihood of AF in experimental animals.[31] Ithas been hypothesized that ectopic beats initiating AF may be increased byenhanced automaticity or triggered activity.[32]

Treatment consists of a beta-blocker to control theventricular rate, and correction of the hyperthyroid state. Spontaneousreversion to sinus rhythm occur within six weeks in patients under age 60 whoare rendered euthyroid.[28] Older patients show adecline in the frequency of spontaneous reversion. Cardioversion, eitherelectric or pharmacologic, is not indicated while the patient is thyrotoxic,since AF usually recurs.[28]

Table 2 Risk factors for AF in patients without cardiovascular disease

Autonomic influenced AF
Vagal or sleeping related23, 24
Sympathetic or exercise related23, 24
Related to temporary causes AF
Alcohol intake25
Other substances/medications (e.g. caffeine, theophylline, adenosine, digitalis)
Cardiac or thoracic postoperative period 26
Electrocution
Inflammation (elevated CPR)27
Acute pericarditis
Myocarditis
Acute pulmonary diseases (e.g. pulmonary embolism)
Metabolic disorders (e.g. hyperthyroidism28-32)
Familiar AF
Polygenic inhetirance33
Monogenic inheritance –channelopaties- (e.g. KCNQ1, encoding IKs current34; SCN5A, encoding INa current35)
Supraventricular arrhythmias
Typical atrial flutter36
Paroxysmal supraventricular tachycardias37

Clinical evaluation of Atrial Fibrillation

Etiologicdiagnostic

A detailed history and clinical examination will providehelpful information. Other tests, including thyroid function and complete bloodcount, are routine.[38] A serum TSH should bemeasured as part of the initial evaluation in all patient with AF, whetherthere are symptoms suggestive of thyrotoxicosis or not. A transthoracicechocardiogram may provide useful information, identifying the presence ofstructural heart disease and an increase risk of thromboembolism[39](e.g. significant left ventricular dysfunction, severe valvular disease orsevere myocardial hypertrophy). Such information may influence subsequenttherapeutic management including the need for anticoagulation treatment. Insome of the patients transoesophageal echocardiography may be needed in orderto rule out the presence of left atrial appendage thrombus, especially in thosepatients considering cardioversion without an adequate period of oral anticoagulation.

Use of ECG monitoring to detect AF

Noninvasive ECG monitoring is used to detect AF[40] and to identify its characteristic pattern duringthe initial diagnosis. Such monitor may be important to assess the control ofthe rhythm and rate during

the follow up in patients under pharmacological-treatment or after an ablation procedure. Extended ECG monitoring will alsohelp document asymptomatic AF episodes and will held quantify the burden of AF.When symptoms are frequent a 24-h or 48-h Holter monitor may yield a diagnosisbut with less frequent episodes, a 7-days Holter or an event recorder, which iseither patient-triggered or auto-triggered, may be needed to document thearrhythmia. Implantable loop recorders and pacemakers can record continuousdata over prolonged periods. All monitoring modalities have limitations.Non-invasive ECG monitoring may provide useful information in only 10-40% ofcases, even with prolonged recordings.[41-43]

The current American College of Cardiology/ American HeartAssociation (ACC/AHA) guidelines for the use of Ambulatory ECG Monitoringestablish the following indications for Holter monitoring in the setting of AF:

Therefore in patients with suspected paroxysmal atrialfibrillation undetected by standard ECG, a 24–h ambulatory ECG monitorshould be used in those with suspected AF episodes less than 24 hours apart. Inpatients with symptomatic episodes more than 24 h apart an event-recorder ECGshould be used.

Monitoring can also help with embolism prevention. It isimportant to note that a 24 to 48-hour Holter monitoring identifies AF in 1 to5% of patients with previous stroke and undetected asymptomatic AF by initialbasal ECG assessment44. Increased duration ofmonitoring appears to be associated with increased rates of detection of AF.Certainly patients with risk factors for stroke with AF should undergo moreextensive monitoring to exclude the presence of asymptomatic AF. We routinelyencourage patient participation in monitoring with with frequent pulse takingto supplement ECG recording efforts.

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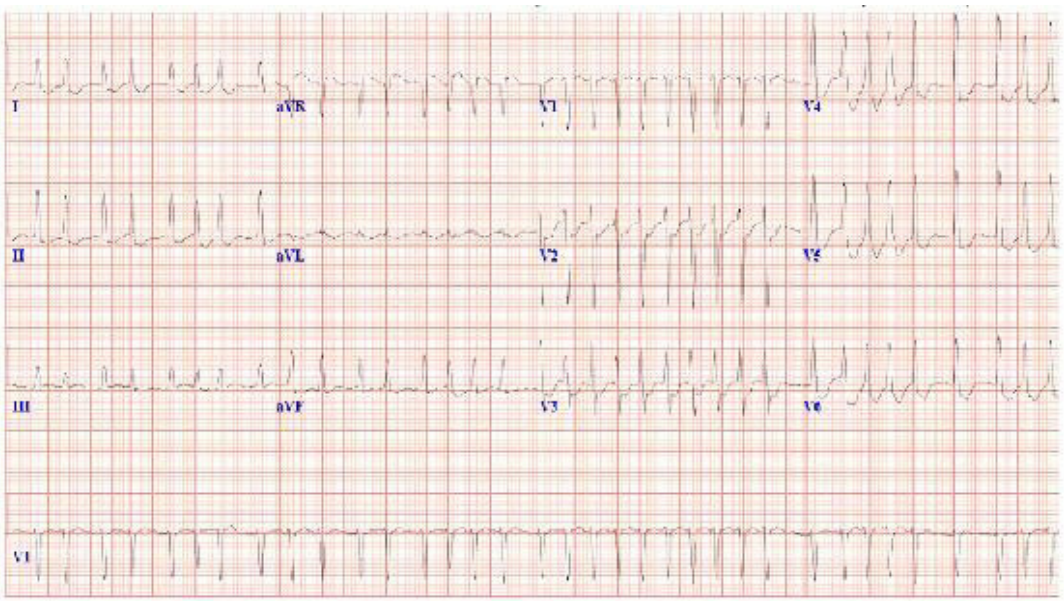
Figure 1: Twelve-lead ECG showing an atrial fibrillation with rapid ventricular response in relation to an hyperthyroid state.



Class I

- To assess antiarrhythmic drug response in individuals in whom baseline frequency of arrhythmia has been well characterized as reproducible and of sufficient frequency to permit analysis.

Class IIA

- To detect proarrhythmic response to antiarrhythmic therapy in high-risk patients.

Class IIB

- To assess rate control during atrial fibrillation.
- To document recurrent symptomatic or asymptomatic non-sustained arrhythmias during therapy in the outpatient setting.

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