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Review article

Atrial fibrillation and its relation to cardiac diseases and sudden cardiac death

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ABSTRACT

Atrial fibrillation (AF) is the most common arrhythmia in adults. Many studies have reported an association between atrial fibrillation and other cardiac diseases including sudden cardiac death (SCD). According to the literature, the prevalence and incidence of atrial fibrillation have been increasing and AF is associated with higher mortality and morbidity. An increased incidence of AF has been described in patients with ischemic heart disease, heart failure, and arterial hypertension. These conditions share some pathophysiological mechanisms with atrial fibrillation, which is, reciprocally, one of their risk factors. As a result, mortality is 2–4-fold higher in individuals with AF. Increased mortality from, and a higher incidence of, ventricular arrhythmias, including ventricular fibrillation (VF), have been found in patients with implantable cardiac defibrillators (ICD), as well as in the general population where AF has been independently related to an up to 3-fold increased risk of cardiac arrest due to VF. The mechanism of action is based on a direct proarrhythmogenic effect of atrial fibrillation, increased cardiac workload, tachycardia-induced ischemia, or heart failure. Risk stratification, optimization of therapy, and screening for subclinical structural heart disease play an important role in the care of patients with atrial fibrillation.

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Introduction

Atrial fibrillation (AF) is the most common arrhythmia afflicting the adult population with a structurally normal heart, as well as the population of those with heart disease. AF is related to increased morbidity and mortality related to initiation and progression of heart failure (HF), increased risk of acute myocardial infarction (MI), and cerebral stroke, both thromboembolic and hemorrhagic as it relates to anticoagulation therapy used in AF patients. Many reports have studied the incidence of AF following cardiac arrest. Patients with AF have increased risk of cardiac arrest, particularly patients with previous left ventricular dysfunction and signs of HF and in patients with a history of MI [1–4]. The risk of cardiac arrest may be 2–3-fold higher in patients with AF compared to the general population. The aim of this work was to summarize data supporting the theory of AF being an independent risk factor for sudden cardiac death (SCD) and ventricular fibrillation (VF), both in the population of those with predisposing heart disease as well as in the general population. Furthermore, it aims to find a potential link between these events.

Definition

In the studies mentioned below, AF is defined by a particular ECG pattern. AF is a supraventricular arrhythmia and it is characterized by rapid, uncoordinated atrial activity with a rate >300 beats/min. An ECG shows no P waves, instead there are rapid fibrillatory waves (best evaluated in the V1 lead). The ventricular rate depends on conduction of the atrioventricular (AV) node, sympathetic tone, and the administered medication. Usually the ventricular rate is irregular. AF is defined as an episode lasting 30 s or longer. SCD is an unexpected death related to an abrupt cardiac arrest without an obvious noncardiac cause. The phrase SCD can also be extended to cases of a potentially fatal congenital or acquired cardiac disease, or a cardiac cause of death that is confirmed during autopsy.

Epidemiology

AF is considered to be a new epidemic of the 21st century. It affects 1–2% of the general population and the incidence grows with the increasing age. Available data shows that in 2010 the prevalence of AF in the USA was estimated to be between 2.7 and 6.1 million and is expected to rise to 12.1 million by 2030. Likewise, in the European Union, the prevalence of AF in adults >55 years of age was estimated to be 8.8 million in 2010 and

was projected to rise to 17.9 million by 2060 (95% CI: 13.6–23.7 million) [5]. The prevalence and incidence of AF increase with age; a higher incidence in the male population has also been reported (a prevalence of 0.7% for those 55–59 years of age, which increased to 17.8% for those 85+ years of age; an incidence of 1.1/1000 person-years was reported for those 55–59 years, which increased to 20.7/1000 person-years for those 80–84 years, with an overall incidence rate of 9.9/1000 person-years) [6,7].

The incidence of “out of hospital” emergency medical service (EMS) assessed SCD in the USA in 2015 was 110.8 cases (of any age) per 100 000 persons (95% CI, 108.9–112.6), which translates into 347 000 of adult age (95% CI, 341 000–353 000). Out of these patients, only 23% had an initial shockable rhythm – VF or VT. The prognosis is more favorable for patients with VF as the first recorded rhythm, since survival-to-hospital-discharge in patients in VF was 38.6% (95% CI, 35.4–41.8%), compared to 12.0% (95% CI, 11.3–12.7%) for patients with any other first recorded rhythm [6].

AF is associated with higher mortality and morbidity. Patients without AF have one-half the mortality at the 10-year horizon, compared to patients with AF. Cerebral stroke does not represent the greatest threat to AF patients. According to the available data, strokes are only responsible for about 7% of deaths in patients with AF. Most patients with AF die of SCD (22.25%) related to ischemic heart disease (IHD) or acute MI (15%), HF (15%), and roughly 35.8% die of noncardiac causes [8,9].

Ischemic heart disease (IHD)

In a work by Soliman et al., from 2014, the relation between AF and the incidence of acute MI in a subpopulation from the REGARDS study was analyzed. Patients with a history of IHD and patients without valid data were excluded from the analysis. Data from 23 928 individuals were obtained, of which 1631 individuals had AF. During the 6.9 year follow-up (median 4.5 years) there were 648 acute MIs. In a socio-demographic model, the incidence of MI in the group with AF was double (HR 1.96; 95% CI: 1.52–2.52) and the risk remained elevated (HR 1.70; 95% CI: 1.26–2.30) after adjustment for common risk factors associated with IHD. On the other hand, there was no difference in the incidence of MI in patients with AF within various age groups [6,10]. An elevated risk of MI, in the group of patients with AF from ARIC study, was confirmed by further follow-up by Soliman et al. in 2015. During the follow-up (median 21.6 years) 1374 MIs occurred in 14 462 individuals, of which 829 were NSTEMI, 249 were STEMI, and 269 were unclassified acute coronary syndromes. AF (n = 1545) was associated with a 63% increased risk of MI (HR 1.63; 95% CI: 1.32–2.02). AF was associated with NSTEMI (HR 1.8; 95% CI:

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