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RISK FACTORS FOR ATRIAL FIBRILLATION: A REVIEW OF RECENT EVIDENCE

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Abstract: Atrial fibrillation (AF) is the most common sustained supraventricular arrhythmia, with a growing global incidence and prevalence, driven by population aging, increased obesity and longer survival of patients with concomitant cardiovascular diseases. In 2020, approximately 50 million people worldwide were affected by AF, with many cases remaining undiagnosed. AF is characterized by rapid and irregular atrial rhythms caused by ectopic electrical impulses or reentrant activity, usually originating in the pulmonary veins. The association between AF and decompensated heart failure results in worse clinical outcomes, such as increased mortality and prolonged hospitalizations. Treatment for AF includes electrical cardioversion, antiarrhythmics, catheter ablation and anticoagulation, all associated with high costs and risks. Therefore, preventive strategies focused on modifiable risk factors are essential. The main risk factors for AF include hypertension, obstructive sleep apnea (OSA), excessive alcohol consumption, obesity, sedentary lifestyle, smoking and diabetes mellitus. Evidence suggests that strict blood pressure control, regular moderate physical activity and treatment of OSA significantly reduce the risk of developing AF. Weight loss, especially in obese individuals, together with better glycemic control in patients with diabetes, also reduces the incidence of AF. This study highlights the importance of modifying lifestyle factors, such as weight control, regular physical activity, smoking cessation, glycemic control and OSA management, as effective preventive measures to reduce the occurrence and recurrence of AF. Early identification and intervention in modifiable risk factors are key to reducing the burden of AF and optimizing therapeutic strategies.

Keywords: Atrial Fibrillation, Risk Factors, Prevention, Hypertension, Obstructive Sleep Apnea, Physical Inactivity, Alcohol Consumption, Diabetes Mellitus, Weight Loss, Cardiovascular Health.

INTRODUCTION

Atrial fibrillation (AF) is the most common sustained supraventricular arrhythmia in clinical practice, with a growing global incidence and prevalence. It is estimated that in 2020 AF affected approximately 50 million individuals worldwide, with an upward trend attributed to population aging, increased obesity and the growing survival of patients with concomitant cardiovascular diseases. In the United States, the underestimated prevalence of AF diagnosed in the community indicates that a significant proportion of cases remain undiagnosed, which reinforces the need for preventive strategies and early screening (JOGLAR et al., 2024).

AF manifests itself as an atrial tachycardia with an irregular rhythm. Its pathophysiology is the generation of electrical impulses not by the sinoatrial node, but by ectopic structures, most commonly located in the pulmonary veins or presenting reentrant activity promoted by heterogeneous conduction due to interstitial fibrosis. (JOGLAR et al., 2024)

The association between AF and decompensated heart failure is a determining factor in adverse outcomes. The coexistence of these conditions can precipitate hemodynamic instability and increased mortality, with a prevalence of AF ranging from 25% to 40% in patients with acute decompensated heart failure (ADHF). The concomitant presence of AF and acute decompensated heart failure (ADHF) is associated with worse clinical outcomes, including prolonged hospitalization and increased 30-day mortality (NIFORATOS et al., 2023).

Given its high prevalence and significant clinical impact, AF represents a considerable therapeutic challenge. The management of this arrhythmia involves various approaches, such as electrical cardioversion, the use of antiarrhythmics, catheter ablation and anticoagulation, all of which are associated with high costs and potential risks (O'KEEFE et al., 2021). It is therefore essential to adopt effective preventive strategies focused on identifying and modulating modifiable risk factors.

Studies show that several risk factors play a fundamental role in the pathogenesis of AF. Systemic arterial hypertension is one of the main determinants for the development of arrhythmia, and strict control of blood pressure, preferably with inhibitors of the renin-angiotensin-aldosterone system, is recommended as a preventive strategy. In addition, obstructive sleep apnea is strongly associated with the genesis of AF, and its treatment can significantly reduce arrhythmia episodes. Alcohol consumption is also correlated with the incidence of AF in a dose-dependent manner, with abstinence being a protective factor against recurrence. The risk of AF is 1 in 4 individuals over the age of 40 in the United States. It is also associated with the risk of ischemic cerebrovascular disease, affecting 1 in 3 individuals and directly impacting on the increase in early mortality rates; arrhythmia significantly affects quality of life, as well as increasing costs in health systems, an alternative to reducing incidences is prevention and direct action on the modifiable factors that predispose to AF such as diabetes mellitus (DM), alcoholism, smoking, sedentary lifestyle, obesity, as well as the associated quality of sleep, especially with regard to the early diagnosis and treatment of obstructive apnea (OSA). (O'KEEFE et al., 2021)

Lifestyle also directly influences the risk of developing AF. While sedentary behavior increases the risk of arrhythmias, regular moderate physical activity is associated with a lower risk of AF. However, high-intensity and prolonged exercise can paradoxically increase susceptibility to arrhythmia. Weight loss of at least 10% of initial body weight in overweight or obese individuals has been correlated with a significant reduction in the risk of AF. In

addition, recent pharmacological therapies, such as sodium-glucose cotransporter-2 inhibitors and glucagon-like peptide-1 agonists, have demonstrated a positive impact on AF prevention. (O'KEEFE et al., 2021)

Given the complexity of AF and its interaction with multiple clinical and environmental factors, this study aims to critically review the main risk factors involved in the genesis of arrhythmia, highlighting recent evidence on preventive and therapeutic strategies that can contribute to reducing the disease burden.

METHODOLOGY

This study consists of a literature review with the aim of synthesizing the most recent evidence on risk factors for atrial fibrillation. The search for articles was carried out in the PubMed database, considering publications from the last five years. To identify the relevant studies, the following descriptors were used: *Atrial Fibrillation; Risk factors; Treatment; Diagnosis*, combined using the appropriate Boolean operators.

Studies that addressed risk factors associated with atrial fibrillation were included. The exclusion criteria involved disregarding studies that did not meet the inclusion criteria, articles unavailable in the database consulted, publications in languages other than English and Portuguese and studies with unclear methodology.

RESULTS AND DISCUSSION

Atrial fibrillation (AF) has shown a significant increase in prevalence over the last few decades, as evidenced by the *Framingham Heart Study*, which revealed a four-fold increase in age-adjusted prevalence over the last 50 years. Currently, it is estimated that the lifetime risk of AF in the United States is 25% among individuals over the age of 40, consolidating this arrhythmia as one of the main contemporary cardiovascular challenges . In addition to its high prevalence, AF is strongly associated with serious complications, such as ischemic stroke, accounting for a third of these events. The risk of stroke is five times higher in individuals with AF, and premature mortality can be up to twice as high compared to those without the arrhythmia, significantly impacting quality of life and increasing healthcare costs (O'KEEFE et al., 2021).

Identifying and controlling modifiable risk factors plays a key role in reducing the incidence of AF and optimizing therapeutic strategies. The LEGACY study showed that rigorous management of these factors enabled 40% of patients to maintain sinus rhythm without the need for invasive interventions such as catheter ablation and pulmonary vein isolation. (O'KEEFE et al., 2021) Several clinical, genetic and environmental risk factors for AF are already well established, and predictive risk models have been widely studied and validated. Modifiable factors include obesity, physical inactivity, smoking, excessive alcohol consumption, hypertension and diabetes mellitus. Observational studies indicate that obesity and physical inactivity independently increase the risk of new-onset AF. However, excessive high-intensity exercise, especially above three hours a day, has also been associated with an increased risk of AF in men, suggesting a "J" curve effect, where both inactivity and extreme physical activity can be harmful (JOGLAR et al., 2024).

Alcohol consumption follows a linear risk pattern, with excessive consumption and episodes of *binge drinking* being particularly critical factors in increasing the incidence of AF. (O'KEEFE et al., 2021) There is still uncertainty about the risks or benefits of moderate consumption, defined as a standard daily dose. Smoking, both self-reported and verified by biomarkers, is consistently associated with a higher risk of AF, while quitting reduces the incidence of arrhythmia. In the case of diabe-

tes mellitus, both type 1 and type 2 diabetes increase the risk of AF, and poorer glycemic control is correlated with a greater likelihood of developing the arrhythmia (JOGLAR et al., 2024).

Obstructive sleep apnea (OSA) is a modifiable risk factor, since individuals with it are 5 times more likely to develop AF. OSA is capable of stimulating vagal tone, as well as increasing negative intrathoracic pressure, which in turn causes regurgitation of ventricular blood into the atrial chambers, causing them to distend; stretch, sympathovagal activation, hypoxia/hypercapnia increase the likelihood and vulnerability of atrial. Obese patients are more likely to develop apnea. OSA is a modifiable factor that can be treated with continuous positive airway pressure (CPAP), which in itself is associated with a 42% relative risk reduction in cases of recurrent AF compared to untreated OSA. The use of assistive technologies, such as watches and devices that monitor heart rate (HR) during sleep, seem to help in the monitoring and surveillance of AF, especially in the population (O'KEEFE et al., 2021).

Some epidemiological data indicate that obesity is a predisposing factor, suggesting a causal relationship between body size and AF, although still speculative, obesity is associated with left ventricular (LV) diastolic dysfunction and remodeling of the electrical and structural conduction of the heart; Changing lifestyle habits in overweight and obese patients with DM, such as moderate physical activity, associated with an adequate diet, which favors sustained weight loss of ≥10%, can lead to a significant reduction in AF in the long term. (O'KEEFE et al,2021)

Among cardiovascular risk factors, hypertension presents the highest attributable risk for AF. The literature shows that intensive blood pressure control significantly reduces the incidence of arrhythmia, reinforcing the importance of adherence to hypertension management guidelines. The use of substances such as cannabis, cocaine, methamphetamine and opioids has also been associated with an increased incidence of AF, reinforcing the need for preventive approaches aimed at this risk group (JOGLAR et al., 2024).

The causes of AF are multifactorial, modifiable and interconnected. Apart from hypertension, other factors such as intense, strenuous and excessive physical exercise can be linked to a risk factor; on the other hand, regular moderate exercise within the recommended limits improves cardiorespiratory capacity and reduces the incidence of AF; Excessive alcohol consumption has direct cardiotoxic effects, especially in individuals who consume it on a daily basis, although just one dose, defined as 14g of ethanol, can increase the incidence; The Mediterranean diet evaluated by the PREDIMED study found that supplementation of extra virgin olive oil in the diet reduces the incidence of AF, while high sodium consumption is linked to its increase. (O'KEEFE et al,2021)

In this way, the intensive modification of risk factors, including body weight control, regular moderate physical activity, smoking cessation, responsible alcohol consumption, early screening for OSA, strict blood glucose control and adequate management of hypertension, emerges as a fundamental strategy in reducing the incidence and complications associated with AF. Interventions based on promoting cardiovascular health not only have an impact on the burden of AF, but also contribute to an overall improvement in the health of the population at risk.

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CONCLUSION

Atrial fibrillation (AF) is the most prevalent sustained supraventricular arrhythmia and the number of people affected by this condition has been growing progressively, driven by an ageing population, an increase in obesity and the greater survival of patients with concomitant cardiovascular diseases. In this context, clinical practice faces a significant challenge, given the consistent association of AF with serious complications, such as decompensated heart failure and stroke. Therefore, the identification and control of modifiable risk factors have proven to be effective strategies in both the prevention and management of the disease. Recent evidence shows that interventions such as strict control of hypertension, treatment of obstructive sleep apnea, reduction of alcohol consumption, smoking cessation, diabetes control, weight loss and regular moderate physical activity have a significant impact on reducing the incidence and recurrence of AF, often avoiding the need for invasive procedures.

Thus, recognizing and modulating risk factors is fundamental not only for reducing the burden of atrial fibrillation and optimizing therapeutic approaches, but also for promoting an overall improvement in health and minimizing the complications associated with the disease.

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