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Atrial Fibrillation: Basic Concepts and Clinical Considerations

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Research Methodology

For the research methodology, Mesh Terms related to Atrial Fibrillation were used to search PubMed, obtaining 109,127 results.

Subsequently, the filters “Free Full Text”, “5 years”, “Review”, “Systematic Review” and “Human” were applied in order to reduce the search and obtain recent, accessible and synthesized results.

Eight articles were selected that contained complete and updated information on the pathology; specifying epidemiology, pathophysiology, diagnosis, classification and management.

Summary or Synopsis

The article covers various sections, including:

- Introduction: It explains that atrial fibrillation (AF) is very common and affects millions of people, having serious health implications as it is associated with strokes and other clinical and pathophysiological aspects.
- Presentation of the Topic: It emphasizes the importance of cardiovascular health and the presence of AF in any individual, especially those with risk factors such as age, heart disease, hypertension, among others.
- Etiology: It explains why AF is a multifactorial disease, associated with different conditions, and why it is important to identify related comorbidities.
- Pathophysiology: It discusses triggering factors such as structural and electrophysiological abnormalities and mentions some of the maintenance mechanisms that facilitate the creation of the

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arrhythmia.

- Epidemiology: It mentions the prevalence and incidence of the disease in people, whether or not they have related comorbidities.
- Manifestations: It defines whether most patients are symptomatic or not, as well as some of the symptoms that may be observed with the development of the arrhythmia and their impact on quality of life.
- Diagnosis: It explains the importance of early diagnosis, the studies and findings required for it, and the diagnostic tools commonly used.
- Classification of Atrial Fibrillation: It explains how to differentiate between solitary AF, idiopathic AF, a first episode and paroxysmal persistent, permanent or secondary AF.
- Treatment: It discusses key objectives for embolism prevention and arrhythmia control, as well as the use of anticoagulants and treatment directed at AF triggers.
- Examples and Metaphors: It explains AF in a more accessible way, comparing it to a common situation.

The relevance of publishing this article for the general public is to raise awareness of how AF can affect a large portion of the population and have very serious consequences. Therefore, people should recognize the importance of prevention, diagnosis, and appropriate treatment to improve the quality of life of those affected.

Introduction

Atrial fibrillation (AF) is a common cardiac condition that affects millions of people worldwide. The importance of understanding atrial fibrillation lies in its high prevalence and serious health implications. It affects 2-3% of the global population, with a rising trend due to aging. In addition to the risk of strokes, it is associated with chronic fatigue and other complications if not treated promptly. [1]

This article addresses clinical and pathophysiological aspects, available treatments, medical innovations, socioeconomic impact, and prevention strategies. Its aim is to provide a clear and updated understanding, not only for healthcare professionals but also for those who wish to better understand this cardiovascular condition and its impact on daily life.

Presentation of the Topic

Atrial fibrillation (AF) is a condition that affects the heart's rhythm. It is characterized by irregular and rapid heartbeats originating in the atria instead of a normal rhythm. In a person with AF, the electrical discharges in the atria that trigger heartbeats become asynchronous and disordered, leading to fibrillation. AF can be caused by various factors (age, previous heart conditions, high blood pressure, lung diseases, excessive alcohol consumption, genetic factors, etc.) and can increase the risk of severe complications,

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such as vascular diseases (stroke) due to the formation of blood clots within the heart, as well as heart failure and other heart diseases.

AF has significant relevance in the daily lives of individuals, both for those who suffer from it and for their families and society at large, for various reasons. It can affect the quality of life, as symptoms such as palpitations, fatigue, and shortness of breath (among others) can be debilitating and very uncomfortable. Additionally, the depression and anxiety that can accompany AF often have psychological repercussions. Patients are often advised to make lifestyle changes, such as reducing alcohol and tobacco consumption, adopting a healthier diet, and avoiding stressful situations, which require adjustments and modifications to routines that can be challenging to manage. Furthermore, AF has also raised awareness about cardiovascular health in society; people may become more conscious of the importance of controlling their blood pressure, maintaining a healthy weight according to their needs, and leading an active lifestyle to reduce the risk of developing AF or other heart conditions.

In summary, atrial fibrillation is a pathology that impacts the physical and mental health of those who suffer from it. Therefore, it is important to understand the correct management and treatment of this disease, along with the complications it can entail, so that we can minimize its impact and improve patients' quality of life.

Development of the Topic
Etiology

Atrial fibrillation (AF) is considered a pathology of multifactorial origin, as its exact etiology is still not fully understood. However, certain factors are closely related to an increased risk of its incidence.

In developed countries, AF is associated with coronary artery disease and hypertensive heart disease. Hypertension is the most common underlying cause of atrial fibrillation, while coronary artery disease does not usually cause AF unless complicated by myocardial infarction (MI), which can lead to the pathology due to ischemia or atrial dilation secondary to heart failure.

Additionally, it has been observed that any valvular disease causing stenosis or regurgitation may be directly related to AF. Heart failure and atrial fibrillation can occur simultaneously, and the incidence of AF increases significantly in those with advanced-stage heart failure. AF is also associated with congenital heart diseases affecting the atria, but it can also be related to other conditions such as Ebstein's anomaly, pulmonary stenosis, and ventricular septal defects.

Patients with cardiopulmonary diseases

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such as COPD, dilated cardiomyopathies, pericarditis (idiopathic or uremic), or obstructive sleep apnea syndrome (OSA) have a higher risk of developing AF. Chronic kidney disease is a significant risk factor for the development of AF, as patients with a glomerular filtration rate between 30-59 ml/min have an approximately 32%[2] increased risk compared to those with normal renal function.

Another causal factor is diabetes mellitus, with an increased risk of 10% in men and 50% in women. [2]

There has been an observed increase in cases of AF in patients undergoing cardiac surgery, with combined coronary surgery posing the highest increased risk for AF (60%) [2]. In patients with AF of unknown cause, it is important to measure thyroid-stimulating hormone levels, as the incidence of atrial fibrillation in patients with hyperthyroidism can reach 10-20% in adults over 60 years old, with a higher frequency in men. [2]

In conclusion, the main comorbidities related to AF include hypertension, ischemic heart disease, heart failure, diabetes mellitus, chronic kidney disease, and chronic obstructive pulmonary disease.

Pathophysiology

Atrial fibrillation (AF) can occur in patients with or without structural heart disease.

The latter is primarily caused by electrical disease, with electrical triggers initiating the arrhythmia; these triggers are multiple foci of micro-reentry in the atrium.The pathogenesis is not fully understood and is considered multifactorial; however, there are two key components: a triggering factor and the anatomical substrate that favors the maintenance of the arrhythmia.

Triggering Factors

AF is associated with structural and electrophysiological abnormalities that promote the formation and propagation of abnormal impulses, essentially acting as "triggers." [3] Most initiating foci are located in the pulmonary veins. At the junction of the left atrium and the pulmonary veins, there is significant overlap of muscle fibers, making the veins thicker in the proximal portion and creating highly heterogeneous tissue. This results in a complex organization of muscle fibers, acting as a trigger. [3]

Maintenance Mechanism

Once AF is initiated, factors that maintain the arrhythmia include the persistence of arrhythmogenic discharge. In the absence of triggering foci, there may be remodeling of the conduction system and structural changes, leading to atrial dilation and shortening of the refractory period. These factors can be part of the natural history of the disease or act as triggers.

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Substrate

AF often accompanies other systemic diseases such as hypertension, ischemic heart disease, heart failure, and hyperthyroidism. These comorbidities trigger an adaptive response in the atrium to maintain homeostasis, with the main consequences being atrial dilation and fibrosis. These adaptive mechanisms are crucial in the development of AF.

The aging process alone causes changes in electrical conduction, which also contributes as a substrate for AF generation, a process accelerated by the aforementioned comorbidities.

Inflammation

There is evidence that myocardial tissue inflammation is key in the pathogenesis of AF [3]. Additionally, inflammation may be a consequence of AF, creating a vicious cycle where inflammation leads to AF and AF induces a greater inflammatory response.

In summary, in AF, the atrium loses its ability to contract due to the triggering foci that cause atrial fibrillation. Over time, dilation and fibrosis further modify the myocardium and electrical conduction, favoring the maintenance of the pathology. The absence of normal contraction promotes a prothrombotic state due to blood stasis within the cardiac cavities, thereby promoting the formation of clots that can subsequently embolize into the systemic circulation, leading to ischemic events. This is mentioned because stroke is the main complication of AF, and preventing it is a cornerstone of the disease's treatment.

Epidemiology

Atrial fibrillation (AF) is the most common sustained arrhythmia in adults and is associated with significant morbidity and mortality, making it important for both patients and healthcare systems.The prevalence of AF in adults is 2-4%, and it is expected to increase 2-3 times. [2] Aging is a risk factor for AF, as are the presence of other comorbidities such as hypertension, diabetes mellitus, heart failure (HF), coronary artery disease (CAD), chronic kidney disease (CKD), obesity, and obstructive sleep apnea (OSA). The incidence, prevalence, and lifetime risk of AF are lower in women compared to men. The lifetime risk of developing AF is estimated to be 1 in 3 for individuals of

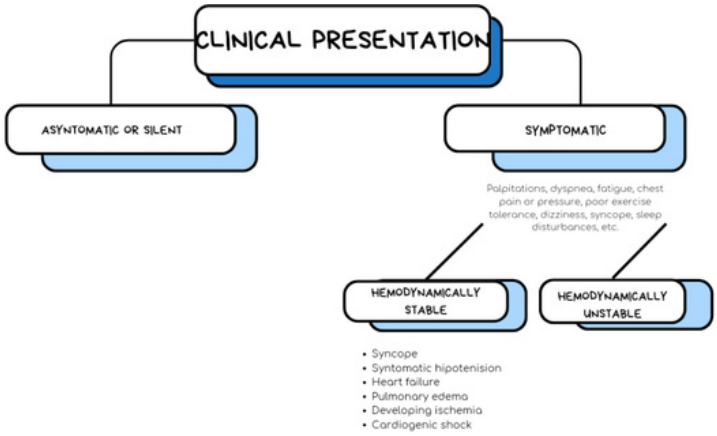

Figure 1. Clinical Presentation of Atrial Fibrillation. Source: ESC 2020 Guidelines on the Diagnosis and Treatment of Atrial Fibrillation, developed in collaboration with the European Association of Cardio-Thoracic Surgery (EACTS). (2021). *REVISTA ESPAÑOLA DE CARDIOLOGÍA*, 74(5), 3–6. https://doi.org/10.1016/j.recesp.2020.10.022.

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European descent by the age of 55. The impact of AF and its association with other comorbidities suggests that early intervention and management of risk factors could reduce the incidence of AF.

Manifestations

Between 50-87% of patients with atrial fibrillation (AF) are asymptomatic initially, which can delay timely diagnosis and make the prognosis less favorable. Those who do present signs and symptoms commonly experience:

- Palpitations
- Shortness of breath
- Fatigue
- Chest pain or pressure
- Poor exercise tolerance
- Dizziness
- Syncope
- Sleep disturbances
- Anxiety and depression
-

More than 60% of patients with atrial fibrillation (AF) experience significant deterioration in their quality of life, although only 17% suffer from disabling

Figure 2. ECG showing absent P waves and irregular R-R intervals.

Diagnostic Tools

Medical History	Collects the patient's medical history, symptoms, risk factors, triggers, and type of AF.
Physical Examination	Looks for pulse irregularities, presence of heart murmurs, edema, or signs of heart failure.
Holter Monitor	A portable ECG that continuously records the heart's electrical activity for 24 to 48 hours or more. It helps detect episodes of irregular heart rhythm.
Event Recorder	Records specific episodes. Unlike continuous recording, it is manually activated. Useful for patients with infrequent episodes.
Implantable Loop Recorder	Implanted under the skin, it continuously monitors heart activity for up to 3 years. It automatically activates when it detects changes in heart rhythm.
Echocardiogram	An imaging method that can show structural abnormalities, cardiac function, and the presence of blood clots in the atria.
Physical Stress Test	Evaluates the heart's response to physical exertion. Helps determine if AF manifests or worsens with exercise.
Chest X-Ray	Findings may vary, and there are no pathognomonic findings for AF. However, in some patients, it may reveal: atrial enlargement, signs of heart failure, visible clots as opacities, and areas of pulmonary consolidation.

Figure 3. Diagnostic Tools for Atrial Fibrillation (AF).

symptoms. This deterioration is worse for women, younger individuals, and those with comorbidities. Patients who are hemodynamically unstable, in addition to presenting the typical signs and symptoms, may have more significant clinical presentations such as:

- Symptomatic hypotension
- Acute heart failure, pulmonary edema
- Developing myocardial ischemia
- Cardiogenic shock

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Diagnosis

Early diagnosis of atrial fibrillation is important, as the condition can be asymptomatic or present with mild symptoms. Some individuals experience palpitations, shortness of breath, fatigue, or dizziness, while in other cases, AF may not present any symptoms until a complication arises. Therefore, early diagnosis allows for appropriate treatment to prevent complications and, in some cases, even reverse the arrhythmia.

According to ESC guidelines, diagnosis requires documentation on an ECG of an episode of AF that must last at least 30 seconds and show the absence of P waves and irregular R-R intervals.

Although ECG is the primary method for confirming the diagnosis of atrial fibrillation, it is important to consider the following additional tools:

Classification of AF

According to the European Society of Cardiology (ESC) guidelines, atrial fibrillation (AF) is complex and presents in various forms, both in patients with heart disease and in apparently healthy individuals.

The classification of AF involves terms such as "lone AF" and "idiopathic AF." Lone AF refers to the occurrence of arrhythmia in individuals under 60 years of age who do not exhibit clinical or

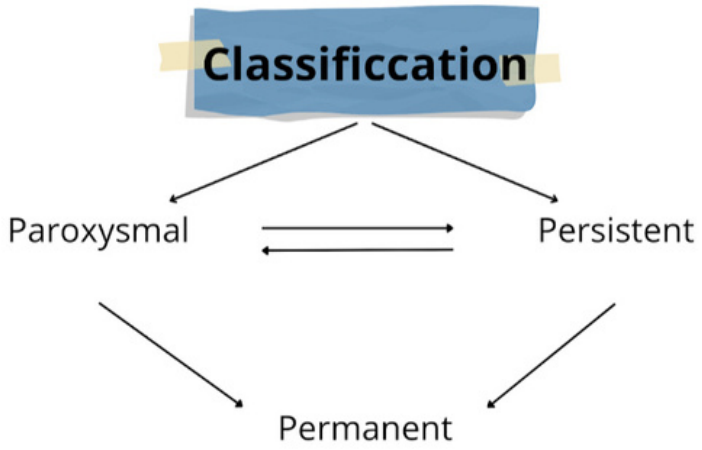

Figure 4. Classification of Atrial Fibrillation. Source: ESC 2020 Guidelines on the Diagnosis and Treatment of Atrial Fibrillation, developed in collaboration with the European Association of Cardio-Thoracic Surgery (EACTS). (2021). *REVISTA ESPAÑOLA DE CARDIOLOGÍA*, 74(5), 3–6. https://doi.org/10.1016/j.recesp.2020.10.022.

echocardiographic manifestations of any disease. These individuals generally have a more favorable prognosis regarding common AF complications, such as the risk of blood clots and mortality. However, over time, or if signs of heart disease develop, these patients will no longer be classified as having lone AF, thus increasing the risk of complications.

Idiopathic AF implies a lack of certainty regarding its origin, regardless of age or the presence of any cardiovascular issues.

The recommended classification for AF focuses on clinical relevance. It distinguishes between the first detected episode of AF, whether symptomatic or brief, and recurrent episodes. Recurrent episodes are divided into paroxysmal AF, when the arrhythmia resolves on its own or with intervention within 7 days of onset,

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and persistent AF, when it lasts more than 7 days and requires cardioversion to resolve. Persistent AF can be the initial presentation or the result of uncontrolled recurrent episodes. Additionally, long-standing persistent AF is when it continues for more than 1 year even after rhythm control strategies have been attempted, while permanent AF is when the arrhythmia persists long-term without attempts at reversion. It is crucial to differentiate secondary AF, which occurs as a result of a triggering condition, such as a heart attack, heart surgery, or other diseases. Treating the underlying condition, along with controlling the AF, usually leads to the resolution of AF.

As noted, the ESC classification is based on the duration of episodes and the presence or absence of triggers and is extremely important for managing AF, as treatment must be individualized.

Treatment

Pharmacological treatment of atrial fibrillation (AF) is based on two key objectives: preventing embolism through anticoagulation and controlling the arrhythmia.

Pharmacological Treatment Focused on Thromboembolism Prevention

Regarding the first objective, vitamin K antagonists (VKAs) have been shown to be more effective in reducing the embolic risk, while acetylsalicylic acid (ASA) lacks significant benefits.

New oral anticoagulants (NOACs) such as Dabigatran, Rivaroxaban, Apixaban, and Edoxaban have proven to be favorable options for prophylactic treatment of patients with atrial fibrillation.
VKAs have been a key element in reducing embolic strokes in patients with all types of AF. However, NOACs present a promising outlook in the current context, with factors such as reduced incidence of cerebral bleeding (estimated to be 2 to 3 times lower than with VKAs) and higher treatment adherence rates being determining factors for starting anticoagulation with a NOAC instead of a VKA as the first choice.

Antiarrhythmic Treatment

The appropriate choice of an antiarrhythmic drug is a fundamental pillar in managing patients with atrial fibrillation. This decision should consider relevant factors such as the type of arrhythmia, disease progression, associated heart conditions, patient's medical history, comorbidities, and the safety profile of the antiarrhythmic drug.
The *Revista Española de Cardiología* provides an overview of recommended drugs based on some of the aforementioned criteria.

Examples and Metaphors

To better understand what happens

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during atrial fibrillation, imagine the heart as a group of people dancing a choreography. Just like in any dance group, there is a choreographer guiding everyone on how to move so that everything goes well and everyone follows the correct steps. The choreographer is the sinus node. However, in atrial fibrillation, the choreographer is sick and cannot tell the dancers how to move or where to go, so they start dancing without coordination. Some dancers move ahead, others fall behind, and some make mistakes. As a result, the choreography becomes disorganized, uncoordinated, full of errors, and turns into chaos.

Another example is to think of the heart as a person driving a manual car and trying to maintain a constant speed. To do this, the driver must first press the clutch and then the accelerator pedal. In atrial fibrillation, the driver starts releasing the clutch pedal while simultaneously pressing the accelerator, then presses both pedals at the same time, or doesn't press either. This causes the car to lose a constant speed and might even stall.

Key Points and Conclusion

Atrial fibrillation (AF) is a common cardiac condition affecting approximately 2-3% of the global population. Understanding AF is crucial due to its high prevalence and serious health implications, which include chronic fatigue and an increased risk of stroke.

AF is characterized by irregular and rapid heartbeats originating in the atria instead of a normal rhythm. Electrical impulses in the atria become asynchronous and disorganized, leading to fibrillation. Various risk factors and predisposing conditions include previous heart disease, hypertension, lung disease, age, and modifiable factors like excessive alcohol consumption.

AF is considered a multifactorial condition with an uncertain exact etiology. However, several agents are closely associated with an increased risk of AF, including hypertension, ischemic heart disease, heart failure, diabetes mellitus, chronic kidney disease, and chronic obstructive pulmonary disease.

Early diagnosis allows for appropriate treatment to prevent complications and, in some cases, reverse the arrhythmia. Although ECG is the primary method for diagnosing AF, additional tools such as medical history, physical examination, Holter monitoring, echocardiogram, and chest X-ray support the confirmation of the diagnosis.

Atrial fibrillation is the most common sustained arrhythmia in adults, associated with significant morbidity and mortality. It impacts both physical and mental health, making it crucial to understand proper management and treatment to minimize its impact and improve patient quality of life.

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