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REVIEW ARTICLE

Relationship between Ischemic Stroke and Atrial Fibrillation, Systematic Review

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ABSTRACT

Introduction: Atrial Fibrillation (AF) is not only one of the main causes of stroke, but it is also the most common sustained cardiac arrhythmia. As a result of population aging, an increase in the prevalence of AF and other associated chronic cardiovascular diseases, such as Systemic Arterial Hypertension (SAH) and Diabetes Mellitus (DM), is expected, contributing to a higher incidence of stroke. The magnitude of this fact reflects the reason why stroke is considered the second cause of death in the world, and the first cause of death in Brazil, in addition to being the second cause of cognitive losses. The main causes that favor the occurrence of ischemic stroke determine the situation of risk groups. Such factors can be classified as modifiable, non-modifiable and potential risk group.

Objective: The aim of this study was to systematically review the public health literature on the relationship between ischemic stroke and atrial Fibrillation.

Methods: Systematized literature review performed by searching the Web of Science database (Clarivates), Science Direct (Scopus), Wiley Online Library (John Wiley and Sons), Taylor and Francis (Taylor & Francis Group) and PubMed (NIH), using the descriptors Relationship between Ischemic Stroke and Atrial Fibrillation and other cardiovascular diseases in primary care, both in English and Portuguese. A total of 3860 articles were found, of which 64 were selected for the review by six evaluators independently. The articles surveyed are from the period 2015 to 2022.

Results: In addition to the epidemiological magnitude, AF is important for its clinical consequences, including thromboembolic occurrences, with an increase, on average, of 4 times the probability of a stroke, in addition to being correlated with the high risk of all-cause mortality and other circumstantial determinants, such as heart failure. Conclusion: The analyzed studies demonstrated that there may be an adjusted incidence of ischemic stroke associated with AF and other cardiovascular diseases by stroke age, being age dependent in men. Social factors may contribute to the late discovery of the association between stroke, AF and other cardiovascular diseases.

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Introduction

Cerebral Vascular Accident (CVA) is a common neurological syndrome among adults and the elderly, being the second cause of death in the world and one of the main reasons for hospitalization [1-3]. Together, stroke and coronary artery disease were responsible for 15.2 million deaths in 2015 [4,5], in addition to several motor and neurological sequelae [6].

Atrial Fibrillation (AF) is a supraventricular tachyarrhythmia identified by uncoordinated atrial activation, leading to worsening atrial mechanical function [7], which can affect up to 50% of adults and the number of patients is constantly growing [8].

There is a high risk of developing ischemic stroke after the diagnosis of AF, as there is a strong association between stroke and AF. AF is the most common cause of ischemic stroke, increasing the risk of stroke by five to eight times. Few circumstances in medicine are as significant as the finding of a risk factor, the probability of its repair and the improvements produced therefrom, and all of them must be conveniently addressed [9,10]. This event emphasizes the magnitude of a wide etiological investigation, aiming at an appropriate prevention of stroke in these patients who can take advantage of the precaution of anticoagulation [10].

Methods

This study constitutes a systematic review, classified as exploratory and descriptive. The elaboration of the research was bibliographical research in electronic databases on methods associated with RSL (Systematic Literature Review) and SMARTER applications (Simple Multi-Attribute Rating Technique using Exploiting Rankings). The work carried out is qualitative and quantitative. The qualitative analysis of the data is carried out intuitively and inductively during the survey of the theoretical framework. It is also quantitative by using the multicriteria method. In addition, there is also a numerical experimental study in order to simulate an article selection situation based on the observed criteria. From bibliographical research, located in the databases: Web of Science data (Clarivates), Science Direct (Scopus), Wiley Online Library (John Wiley and Sons), Taylor and Francis (Taylor & Francis Group), and PubMed (NIH).

The search in the databases was carried out using the terminologies registered in the Health Sciences Descriptors created by the Virtual Health Library developed from the Medical Subject Headings of the US National Library of Medicine, which allows the use of common terminology in English and Portuguese. The keywords used in Portuguese for the search in the databases were: 3860. As a tool to support decision in the selection and prioritization of articles, were considered a set of criteria as essential to represent the state of the art of the subject object of the research. This method has the following characteristics: (i) rigorous logic allows acceptance of the method as a decision support tool; (ii) simple to understand and apply with easily interpreted results. After all, the result obtained totaled 64 articles that contemplated the desired characteristics for the study.

Theoretical Reference

Stroke is a medical emergency characterized as a neurological syndrome, of sudden onset, resulting in the interruption of cerebral blood flow. It can be classified as stroke or hemorrhagic stroke [11].

It is the second leading cause of mortality and one of the leading causes of morbidity worldwide. The high incidence of sequelae after stroke determines an important social and economic impact. As the population ages, its signs increase, particularly in low - and middle - income countries. Stroke incidence and mortality vary across countries, geographic regions and ethnicities, and especially in high-income countries, prevention, intensive care and neurorehabilitation programs have led to a substantial reduction in the burden of stroke over the last 30 years [12].

Stroke can be classified into Hemorrhagic (HS) and Ischemic (IS). HS occurs due to the rupture of cerebral blood vessels, causing blood leakage in the brain or between the brain and the meninges, affecting 15% of the cases [13,14]. It includes subarachnoid hemorrhage, which is usually caused by the rupture of a congenital saccular aneurysm located in the polygonal artery of Willis, and intraparenchymal hemorrhage, which has as its basic cause the hyaline degeneration of the intraparenchymal arteries, and the main disease is related to systemic arterial hypertension (SAH) [15].

IS caused by local vascular occlusion, which leads to interruption of oxygen and glucose supply to the brain tissue and subsequently affects the metabolic process of the area in question. It is responsible for approximately 87% of cases of stroke [16].

Furthermore, stroke can be subdivided into atherothrombotic, cardioembolic, lacunar, and undetermined or cryptogenic.

The atherothrombotic is characterized by atherosclerotic pathology of the intracranial and cervical arteries and is the factor with the highest recurrence of ischemic stroke, corresponding to approximately 48% of the cases [17] Atherosclerosis is identified by loss of elasticity and thickening of the blood vessel wall and subsequent production of atheromas. Atherosclerotic lesions develop in response to inflammatory stimuli, reproduction of smooth muscle cells, release of several cytokines, synthesis of connective tissue matrix, calcification, concentration of lipids and macrophages [18].

The cardioembolic is the result of a cardiac embolism, being the second main cause of ischemic stroke, and responsible for approximately 15-30% of the cases [19]. A large number of heart diseases are considered potential sources of embolism. Among them, we can mention atrial fibrillation, recent myocardial infarction, artificial mechanical valves, mitral valve stenosis, atrial or left ventricular thrombosis and atrial myxoma, dilated cardiomyopathy, infectious and non-bacterial thrombotic endocarditis and ventricular aneurysm [20].

Stroke is characterized by small infarctions (2-20 mm in diameter) in the deep cerebral white matter, basal ganglia or pons, supposedly resulting from the occlusion of a single small perforating artery that irrigates the subcortical areas of the brain [21].

Lacunar stroke is caused by Cerebral Small Vessel Disease (cSVD), a term used for different pathological processes that affect the small vessels of the brain. Cerebral small vessels play a crucial role in cerebral lacunar infarction and deep or cortical hemorrhages. In addition to cognitive decline and dementia, gait problems are also frequently associated with cSVD [22].

Among all stroke events, 20-40% are identified as undetermined or cryptogenic [23,24]. This stroke subtype is defined as cerebral ischemia of unexplained or incomprehensible origin. The cause of this stroke subtype is still unknown for three reasons: [1] investigations may not address all known causes of stroke, [2] the case may be transient or reversible and the propaedeutic diagnosis may not be performed in a timely manner, and [3] there are some truly unknown causes of stroke. Therefore, the incidence of cryptogenic stroke depends on the performance and speed of the test [25,26].

Atrial Fibrillation (AF) is the most common sustained arrhythmia, and is characterized by uncoordinated atrial activation, with impairment of atrial function [27]. Of a dynamic and progressive nature, AF is a disease with multifactorial causes of epidemic proportions, with severe complications and a considerable negative effect on public health [28]. This damage caused by AF to the atrial mechanical function increases the possibility of formation of an intratrial thrombus, which may suffer embolism in the arterial circulation and generate an IS. Patients with AF have an annual incidence of ischemic stroke of approximately 5%, estimated by the presence of additional risk factors [29,30].

AF is intrinsically related to cardiovascular aging, with a 33% increase in the worldwide prevalence of AF observed over the past 20 years [31,32], and the worldwide prevalence of AF is expected to triple by the year 2050 [33].

AF is considered the most common cause of cardioembolic stroke, increasing the risk of stroke by five to eight times [34]. However, there are determining factors in the current evidence regarding AF screening, such as those linked to the individual and the environment, which directly influence the screening [35].

The threat of stroke in patients with AF is immediately associated with age, with a risk of 1.5% per year between 50 and 59 years old; for patients between 80 and 90 years of age, the risk increases to 23.5% per year [36]. Several comorbidities, such as diabetes, peripheral vascular disease, systemic arterial hypertension, heart failure and previous stroke, significantly increase the risk of stroke. Preventive intervention with anticoagulation has advantages at any age [37].

Results

The database search found a total combination of 3860 articles, of which 184 were selected for full text reading. Of these, 64 were selected using the SMARTER method (Simple Multi-Attribute Rating Technique using Exploiting Rankings), which were included for descriptive data analysis. In figure 1, the stages and indicators used in the selection are described.

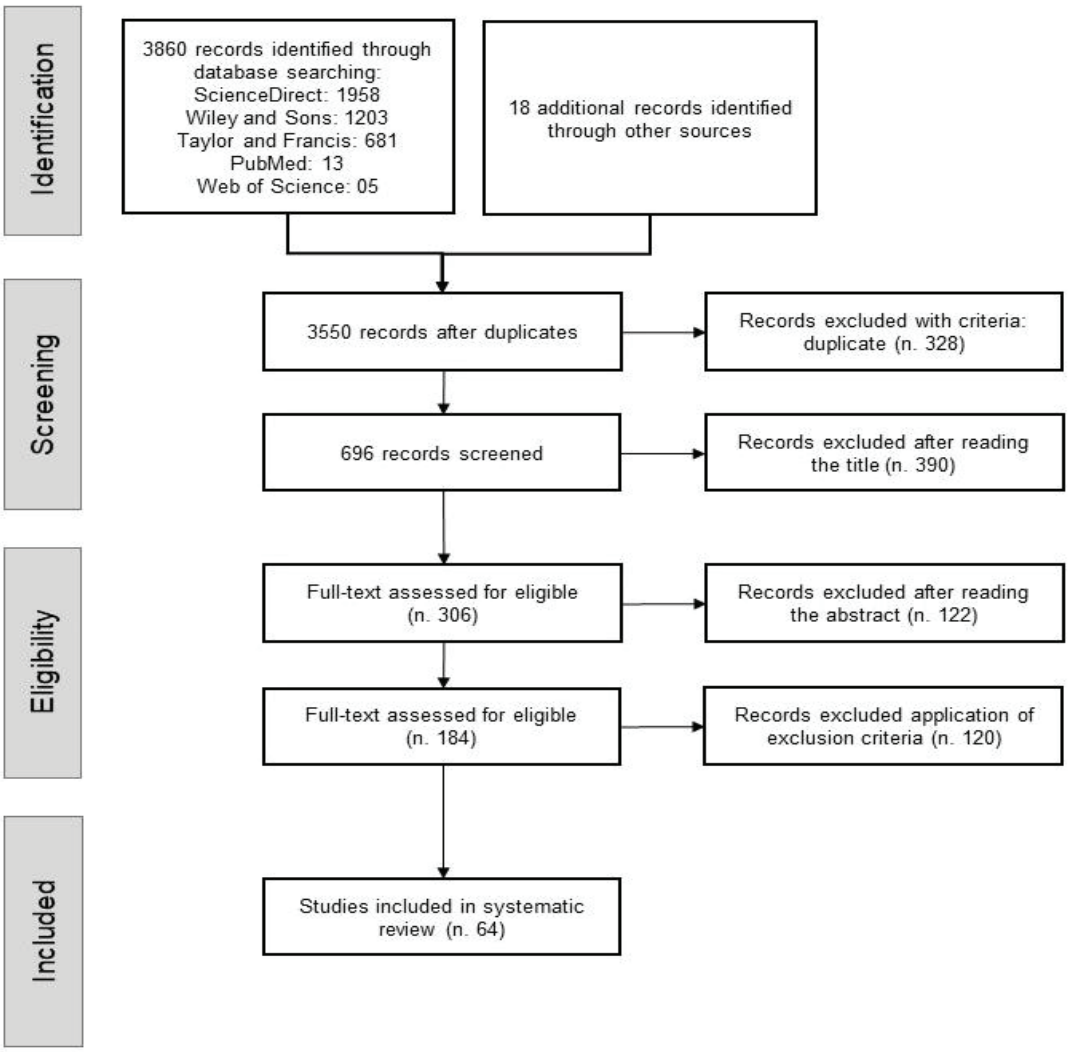

Figure 1 Number of articles identified as a possible relationship between ischemic stroke and atrial fibrillation and other cardiovascular diseases in primary care.

Discussion

Studies have shown an age-standardized reduction in strokes in many regions, but show an exception in East Asia and southern sub-Saharan Africa. Despite this, stroke is still prevalent and disabling, with over 80 million survivors worldwide and a growing absolute number of DALYs [38]. In Brazil, 80% of stroke cases are classified as CVA, demonstrating its epidemiological importance in the country, being the first cause of death, in addition to being the second cause of cognitive losses [39,40].

Although the age-adjusted incidence of stroke in men (mainly ischemic stroke is about 30% higher than in women) [41,42], a meta-analysis [43] from data stratified by age from 44 studies in 19 countries, demonstrated age heterogeneity, and the incidence of males for females is 45% higher from 45 to 64 years old, 21% higher from 75 to 84 years old and only 9 % higher in ages over 85 years. Although no numerical estimates are provided, graphical representations of gender-specific incidence rates in the Framingham Heart Study (involving white participants only) [44] and the Northern Manhattan Stroke Study (involving whites, blacks and Hispanics) [45] show that there are more men up to 74 years of age than women, but the incidence is higher in women over 74 years of age.

In Brazil, epidemiological data indicate that there were more than 700,000 cases of strokes (2010), representing more than 141,000 deaths. Although there are multiple potential causes of stroke, it is estimated that approximately 20% of strokes are attributed to AF, and it is frequently associated with worse outcomes [46].

According to data from primary care in Brazil, the total prevalence of AF in the population was 1.8%, and it is estimated that among octogenarians (8.4%) and nonagenarians (11.0%) it is higher. The prevalence of AF was strongly associated with higher mean age, being higher in men compared to women in all age groups. Hypertension was the most commonly associated disease, and Chagas disease was the comorbidity with the strongest association with AF. The use of warfarin is associated with only 1.5% of patients [47].

While the prevalence of AF in Brazil is estimated at 2-3% of the population, consistent with the Brazilian age pyramid [47-49], there is a serious limitation of data on risk factors and access to diagnostic means [49,50]. According to a study by the Joinville Stroke Registry (JOINVASC), the diagnosis of AF in patients with ischemic stroke -CE was performed only after the ischemic stroke in 47% of patients. Among the patients with a previous diagnosis of AF, only 27% of the patients were using oral anticoagulation, and most of these were using the prescribed medication irregularly [9,51].

In addition to the epidemiological magnitude, AF is important for its clinical consequences, including thromboembolic occurrences, with an increase, on average, of 4 times the probability of a stroke, in addition to being correlated with the high risk of mortality from all causes and other determinants circumstances, such as heart failure [52,53]. The incidence determined for age and the prevalence of AF is lower in females compared to males, however, it does not occur with morbidity and mortality. AF is correlated with a high relative risk of all-cause mortality: stroke, cardiovascular mortality, cardiac events and heart failure in women [54].

According to the American Heart Association [55], the percentage of patients with AF reported in the United States of America (USA) benefiting from the government health insurance system (Medicare) in 2010 was 2% for those under 60 years of age and 9% for those over 65 years. The risk of developing AF after age 40 in individuals of European descent is 23% for women and 26% for men. Although risk factors for AF are more prevalent among African-Americans, a study in the USA demonstrated that the prevalence of AF is 32% lower in blacks than in whites [56].

In Australia, Europe and the US, the current estimated prevalence of AF is around 1-4%, with lower prevalence evident in Asia (0.49%-1.9%). The prevalence of AF is higher among whites. In Western Europe, Australia and North America, 70% of people with AF are > 65 years old, while the average age of patients with AF in other geographic regions is generally lower [32].

Medicare data from 2019 showed that in-hospital mortality was 25.3% for patients with AF and 16.0% for patients without AF. One-year mortality was 48.3% in patients with AF and 32.7% in patients without AF. Patients with AF had a higher rate of fatal or sequelae strokes (3.1%) than patients hospitalized for other reasons [57].

According to the US Centers for Disease Control and Prevention, this condition affects 2.7 million to 6.1 million adults in the US each year and that number is expected to double in the coming years. It is a fact that is quite expected in developed countries, generating great concern as it adds costs to the health system. However, it has the same impact in low- and middle-income countries due to the increase in non-communicable heart diseases worldwide [58].

A great impact of morbidity and mortality is associated with AF, with higher risks of hospitalization due to thromboembolic events or hemodynamic changes. In the US, it is estimated that the cost of treating patients with AF is $26 billion, adding about $8,700 per year in additional costs for this patient compared to individuals without the disease (2004-2006 estimates). Of the total annual hospitalizations in the US, 467,000 people have AF as their primary diagnosis, in addition to approximately 99,000 deaths each year [56,59].

In Brazil, epidemiological data indicate that there were more than 700,000 cases of strokes (2010), representing more than 141,000 deaths. Although there are multiple potential causes of stroke, it is estimated that approximately 20% of strokes are attributed to AF, and it is frequently associated with worse outcomes [46].

According to data from primary care in Brazil, the total prevalence of AF in the population was 1.8%, and it is estimated that among octogenarians (8.4%) and nonagenarians (11.0%) it is higher. The prevalence of AF was strongly associated with higher mean age, being higher in men compared to women in all age groups. Hypertension was the most commonly associated disease, and Chagas disease was the comorbidity with the strongest association with AF.

The use of warfarin is associated with only 1.5% of patients [47].

It is estimated that approximately one third of hospitalizations due to arrhythmias in Brazil are due to AF [60]. According to data from DATASUS, 656,740 people were hospitalized in Brazil for "conduction disorders and arrhythmias" and 41,771 died for "Flutter and AF" between January 2008 and April 2019. In the same period, 1,497,681 hospitalizations were recorded by stroke and non-specific stroke (hemorrhagic or ischemic), and 960,830 deaths between 1996 and 2017. Based on these data, AF data may be underestimated, given the significant association of AF data with stroke, its prevalence in the population and the majority of asymptomatic patients [61].

Particularly in Brazil, which has one of the highest rates of cerebrovascular disease in Latin America, being proportional to the increase in AF cases, which results in increased long-term mortality, high rates of cerebrovascular risk factors and lower survival rates, particularly in those participants with AF who were not on anticoagulant therapy for at least six months after an acute event [62].

Final Considerations

The analyzed studies demonstrated that there may be an adjusted incidence of stroke associated with AF and other cardiovascular diseases by age of stroke, being predominant in men, being age dependent. In Brazil, it is estimated that the prevalence of AF corresponds to approximately 2-3% of the population, consistent with the Brazilian age pyramid, strongly associated with risk factors, and with social class, which interferes with access to information and consequently the means of diagnosis available in the public health network.

These factors contribute to the discovery of the late association between stroke, AF and other cardiovascular diseases, which are often neglected. Based on these data, AF data may be underestimated, given the significant association of AF data with stroke, its prevalence in the population and the majority of asymptomatic patients.

References

1. de Carvalho JJ, Alves MB, Viana GÁ, Machado CB, dos Santos BF, Kanamura AH, Lottenberg CL, Neto MC, Silva GS. Stroke epidemiology, patterns of management, and outcomes in Fortaleza, Brazil: a hospital-based multicenter prospective study. Stroke. 2011 Dec;42(12):3341-6. doi: 10.1161/STROKEAHA.111.626523. Epub 2011 Nov 3. PMID: 22052521.

2. Battaglini D, Robba C, Lopes da Silva A, Dos Santos Samary C, Leme Silva P, Dal Pizzol F, Pelosi P, Rocco PRM. Brain-heart interaction after acute ischemic stroke. Crit Care. 2020 Apr 21;24(1):163. doi: 10.1186/s13054-020-02885-8. PMID: 32317013; PMCID: PMC7175494.

3. Ribeiro AL, Duncan BB, Brant LC, Lotufo PA, Mill JG, Barreto SM. Cardiovascular Health in Brazil: Trends and Perspectives. Circulation. 2016 Jan 26;133(4):422-33. doi: 10.1161/CIRCULATIONAHA.114.008727. PMID: 26811272.

4. GBD 2015 Neurological Disorders Collaborator Group. Global, regional, and national burden of neurological disorders during 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet Neurol. 2017;16(11):877-897.

5. Saidi O, O'Flaherty M, Zoghlami N, Malouche D, Capewell S, Critchley JA, Bandosz P, Ben Romdhane H, Guzman Castillo M. Comparing Strategies to Prevent Stroke and Ischemic Heart Disease in the Tunisian Population: Markov Modeling Approach Using a Comprehensive Sensitivity Analysis Algorithm. Comput Math Methods Med. 2019 Jan 29;2019:2123079. doi: 10.1155/2019/2123079. PMID: 30838048; PMCID: PMC6374861.

6. Maida CD, Norrito RL, Daidone M, Tuttolomondo A, Pinto A. Neuroinflammatory Mechanisms in Ischemic Stroke: Focus on Cardioembolic Stroke, Background, and Therapeutic Approaches. Int J Mol Sci. 2020 Sep 4;21(18):6454. doi: 10.3390/ijms21186454. PMID: 32899616; PMCID: PMC7555650.

7. January CT, Wann LS, Alpert JS, Calkins H, Cigarroa JE, Cleveland JC Jr, Conti JB, Ellinor PT, Ezekowitz MD, Field ME, Murray KT, Sacco RL, Stevenson WG, Tchou PJ, Tracy CM, Yancy CW; ACC/AHA Task Force Members. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines and the Heart Rhythm Society. Circulation. 2014 Dec 2;130(23):2071-104. doi: 10.1161/CIR.0000000000000040. Epub 2014 Mar 28. Erratum in: Circulation. 2014 Dec 2;130(23):e270-1. PMID: 24682348.

8. Gumprecht J, Domek M, Lip GYH, Shantsila A. Invited review: hypertension and atrial fibrillation: epidemiology, pathophysiology, and implications for management. J Hum Hypertens. 2019 Dec;33(12):824-836. doi: 10.1038/s41371-019-0279-7. Epub 2019 Nov 5. PMID: 31690818.

9. de Almeida Franzoi AE, de Souza Moreira BB, Patti MM, Amaral CH. Use of anticoagulants in patients with atrial fibrillation in a first stroke event and in relapses. Arq Catarinenses Med [Internet]. 2018;53–63.

10. European Heart Rhythm Association; Heart Rhythm Society; Fuster V, Rydén LE, Cannom DS, Crijns HJ, Curtis AB, Ellenbogen KA, Halperin JL, Le Heuzey JY, Kay GN, Lowe JE, Olsson SB, Prystowsky EN, Tamargo JL, Wann S, Smith SC Jr, Jacobs AK, Adams CD, Anderson JL, Antman EM, Hunt SA, Nishimura

R, Ornato JP, Page RL, Riegel B, Priori SG, Blanc JJ, Budaj A, Camm AJ, Dean V, Deckers JW, Despres C, Dickstein K, Lekakis J, McGregor K, Metra M, Morais J, Osterspey A, Zamorano JL; American College of Cardiology; American Heart Association Task Force on Practice Guidelines; European Society of Cardiology Committee for Practice Guidelines; Writing Committee to Revise the 2001 Guidelines for the Management of Patients With Atrial Fibrillation. ACC/AHA/ESC 2006 guidelines for the management of patients with atrial fibrillation--executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Revise the 2001 Guidelines for the Management of Patients With Atrial Fibrillation). J Am Coll Cardiol. 2006 Aug 15;48(4):854-906. doi: 10.1016/j.jacc.2006.07.009. Erratum in: J Am Coll Cardiol. 2007 Aug 7;50(6):562. PMID: 16904574.

11. Carvalho MA, Coutinho AP de O, Carvalho GDA de, Taynã D, Queiróz G, Santos SR dos. Epidemiology Of Stroke Treatment Assisted Through The Mobile Emergency Care Service. Rev enferm UFPE line. 2015;1015–21.

12. Katan M, Luft A. Global Burden of Stroke. Semin Neurol. 2018 Apr;38(2):208-211. doi: 10.1055/s-0038-1649503. Epub 2018 May 23. PMID: 29791947.

13. Yoshida HM, Barreira J, Fernandes PT. Motor skill, depressive symptoms and cognitive function in post-stroke patients. Physioter and Research. 2019 Mar;26(1):9–14.

14. Macêdo JLC de, Rodrigues LRS, Rodrigues AP de CP, Alencar FJ, Lopes LAMR, Moura CR de B, et al. Influence of virtual reality on balance of hemiparetic patients after stroke Brazilian J Heal Rev. 2020;3(4):10674–84.

15. Melo LS, Emerick LMS, Alves PNM, Rocha TB, Goveia VR, Guimarães GL, et al. STROKE: CLINICAL FINDINGS AND MAIN COMPLICATIONS. Rev Aten Saúde. 2016;14(48):48–53.

16. Lakhan SE, Kirchgessner A, Hofer M. Inflammatory mechanisms in ischemic stroke: therapeutic approaches. J Transl Med. 2009 Nov 17;7:97. doi: 10.1186/1479-5876-7-97. PMID: 19919699; PMCID: PMC2780998.

17. Soler EP, Ruiz VC. Epidemiology and risk factors of cerebral ischemia and ischemic heart diseases: similarities and differences. Curr Cardiol Rev. 2010 Aug;6(3):138-49. doi: 10.2174/157340310791658785. PMID: 21804773; PMCID: PMC2994106.

18. Crowther MA. Pathogenesis of atherosclerosis. Hematol Am Soc Hematol Educ Progr. 2005;436–41.

19. Arboix A, Alio J. Acute cardioembolic cerebral infarction: answers to clinical questions. Curr Cardiol Rev. 2012 Feb;8(1):54-67. doi: 10.2174/157340312801215791. PMID: 22845816; PMCID: PMC3394108.

20. Murtagh B, Smalling RW. Cardioembolic stroke. Vol. 8, Current Atherosclerosis Reports. 2006. p. 310–6.

21. Wardlaw JM. What causes lacunar stroke? J Neurol Neurosurg Psychiatry. 2005 May;76(5):617–9.

22. Cuadrado-Godia E, Dwivedi P, Sharma S, Ois Santiago A, Roquer Gonzalez J, Balcells M, Laird J, Turk M, Suri HS, Nicolaides A, Saba L, Khanna NN, Suri JS. Cerebral Small Vessel Disease: A Review Focusing on Pathophysiology, Biomarkers, and Machine Learning Strategies. J Stroke. 2018 Sep;20(3):302-320. doi: 10.5853/jos.2017.02922. Epub 2018 Sep 30. PMID: 30309226; PMCID: PMC6186915.

23. Sacco RL, Ellenberg JH, Mohr JP, Tatemichi TK, Hier DB, Price TR, Wolf PA. Infarcts of undetermined cause: the NINCDS Stroke Data Bank. Ann Neurol. 1989 Apr;25(4):382-90. doi: 10.1002/ana.410250410. PMID: 2712533.

24. Saposnik G. What Is Certain When the Stroke Etiology Is Uncertain? Stroke. 2012 Nov;43(11):2841–2.

25. Altieri M, Troisi P, Maestrini I, Lenzi GL. Cryptogenic stroke: cryptic definition? Stroke. 2009 Aug;40(8):e530; author reply e531-e532. doi: 10.1161/STROKEAHA.109.553966. Epub 2009 Jun 18. PMID: 19542055.

26. Finsterer J. Management of cryptogenic stroke. Acta Neurol Belg. 2010 Jun;110(2):135-47. PMID: 20873443.

27. January CT, Wann LS, Alpert JS, Calkins H, Cigarroa JE, Cleveland JC Jr, Conti JB, Ellinor PT, Ezekowitz MD, Field ME, Murray KT, Sacco RL, Stevenson WG, Tchou PJ, Tracy CM, Yancy CW; ACC/AHA Task Force Members. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines and the Heart Rhythm Society. Circulation. 2014 Dec 2;130(23):2071-104. doi: 10.1161/CIR.0000000000000040. Epub 2014 Mar 28. Erratum in: Circulation. 2014 Dec 2;130(23):e270-1. PMID: 24682348.

28. Liu T, Korantzopoulos P, Xu G, Shehata M, Li D, Wang X, Li G. Association between angiotensin-converting enzyme insertion/deletion gene polymorphism and atrial fibrillation: a meta-analysis. Europace. 2011 Mar;13(3):346-54. doi: 10.1093/europace/euq407. Epub 2010 Nov 13. PMID: 21076147.

29. Friberg L, Hammar N, Ringh M, Pettersson H, Rosenqvist M. Stroke prophylaxis in atrial fibrillation: who gets it and who does not? Report from the Stockholm Cohort-study on Atrial Fibrillation (SCAF-study). Eur Heart J. 2006 Aug;27(16):1954-64. doi: 10.1093/eurheartj/ehl146. Epub 2006 Jul 17. PMID: 16847008.

30. Lip GYH, Nieuwlaat R, Pisters R, Lane DA, Crijns HJGM. Clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach. Chest [Internet]. 2010 Feb;137(2):263-72.

31. Lippi G, Sanchis-Gomar F, Cervellin G. Global epidemiology of atrial fibrillation: An increasing epidemic and public health challenge. Int J Stroke. 2021 Feb;16(2):217-221. doi: 10.1177/1747493019897870. Epub 2020 Jan 19. Erratum in: Int J Stroke. 2020 Jan 28;:1747493020905964. PMID: 31955707.

32. Zulkifly H, Lip GYHH, Lane DA. Epidemiology of atrial fibrillation. Int J Clin Pract [Internet]. 2018 Mar;72(3):e13070.

33. Colilla S, Crow A, Petkun W, Singer DE, Simon T, Liu X. Estimates of current and future incidence and prevalence of atrial fibrillation in the U.S. adult population. Am J Cardiol. 2013 Oct 15;112(8):1142-7. doi: 10.1016/j.amjcard.2013.05.063. Epub 2013 Jul 4. PMID: 23831166.

34. Cheung CC, Nattel S, Macle L, Andrade JG. Management of Atrial Fibrillation in 2021: An Updated Comparison of the Current CCS/CHRS, ESC, and AHA/ACC/HRS Guidelines. Can J Cardiol. 2021 Oct;37(10):1607-1618. doi: 10.1016/j.cjca.2021.06.011. Epub 2021 Jun 26. PMID: 34186113.

35. Sandhu RK, Albert C. Screening the Older Population for Atrial Fibrillation-Have We Moved the Needle Forward? JAMA Cardiol. 2021 May 1;6(5):495-496. doi: 10.1001/jamacardio.2021.0052. PMID: 33625482.

36. Marini C, De Santis F, Sacco S, Russo T, Olivieri L, Totaro R, Carolei A. Contribution of atrial fibrillation to incidence and outcome of ischemic stroke: results from a population-based study. Stroke. 2005 Jun;36(6):1115-9. doi: 10.1161/01.STR.0000166053.83476.4a. Epub 2005 May 5. PMID: 15879330.

37. You JJ, Singer DE, Howard PA, Lane DA, Eckman MH, Fang MC, et al. Antithrombotic Therapy for Atrial Fibrillation. Chest. 2012 Feb;141(2):e531S- e575S.

38. Gorelick PB. The overall burden of stroke: persistent and disabling. Lancet Neurol. 2019 May;18(5):417–8.

39. Oliveira-Filho J, Martins SCO, Pontes-Neto OM, Longo A, Evaristo EF, de Carvalho JJF, et al. Guidelines for treatment of ischemic stroke - part I. Arq Neuropsiquiatr. 2012;70(8):621–9.

40. Vicente VS, Cabral NL, Nagel V, Guesser VV, Safanelli J. Prevalence of obesity among stroke patients in five Brazilian cities: a cross-sectional study. Arch Neuropsiquiatr. 2018 Jun;76(6):367–72.

41. Madsen TE, Khoury J, Alwell K, Moomaw CJ, Rademacher E, Flaherty ML, Woo D, Mackey J, De Los Rios La Rosa F, Martini S, Ferioli S, Adeoye O, Khatri P, Broderick JP, Kissela BM, Kleindorfer D. Sex-specific stroke incidence over time in the Greater Cincinnati/Northern Kentucky Stroke Study. Neurology. 2017 Sep 5;89(10):990-996. doi: 10.1212/WNL.0000000000004325. Epub 2017 Aug 9. PMID: 28794254; PMCID: PMC5589794.

42. Barker-Collo S, Bennett DA, Krishnamurthi RV, Parmar P, Feigin VL, Naghavi M, Forouzanfar MH, Johnson CO, Nguyen G, Mensah GA, Vos T, Murray CJ, Roth GA; GBD 2013 Writing Group; GBD 2013 Stroke Panel Experts Group. Sex Differences in Stroke Incidence, Prevalence, Mortality and Disability-Adjusted Life Years: Results from the Global Burden of Disease Study 2013. Neuroepidemiology. 2015;45(3):203-14. doi: 10.1159/000441103. Epub 2015 Oct 28. PMID: 26505984; PMCID: PMC4632242.

43. Appelros P, Stegmayr B, Terént A. Sex differences in stroke epidemiology: a systematic review. Stroke. 2009 Apr;40(4):1082-90. doi: 10.1161/STROKEAHA.108.540781. Epub 2009 Feb 10. PMID: 19211488.

44. Petrea RE, Beiser AS, Seshadri S, Kelly-Hayes M, Kase CS, Wolf PA. Gender differences in stroke incidence and poststroke disability in the Framingham heart study. Stroke. 2009 Apr;40(4):1032-7. doi: 10.1161/STROKEAHA.108.542894. Epub 2009 Feb 10. PMID: 19211484; PMCID: PMC2676725.

45. Sacco RL, Boden-Albala B, Gan R, Chen X, Kargman DE, Shea S, Paik MC, Hauser WA. Stroke incidence among white, black, and Hispanic residents of an urban community: the Northern Manhattan Stroke Study. Am J Epidemiol. 1998 Feb 1;147(3):259-68. doi: 10.1093/oxfordjournals.aje.a009445. PMID: 9482500.

46. Silva PGMBE, Sznejder H, Vasconcellos R, Charles GM, Mendonca-Filho HTF, Mardekian J, Nascimento R, Dukacz S, Fusco MD. Anticoagulation Therapy in Patients with Non-valvular Atrial Fibrillation in a Private Setting in Brazil: A Real-World Study. Arq Bras Cardiol. 2020 Mar;114(3):457-466. English, Portuguese. doi: 10.36660/abc.20180076. PMID: 32049154; PMCID: PMC7792730.

47. Marcolino MS, Palhares DM, Benjamin EJ, Ribeiro AL. Atrial fibrillation: prevalence in a large database of primary care patients in Brazil. Europace. 2015 Dec;17(12):1787-90. doi: 10.1093/europace/euv185. Epub 2015 Jun 7. PMID: 26056188; PMCID: PMC4700731.

48. Kawabata-Yoshihara LA, Scazufca M, Santos I de S, Whitaker A, Kawabata VS, Benseñor IM, et al. Atrial fibrillation and dementia: results from São Paulo aging & health study. Arq Bras Cardiol [Internet]. 2012 Dec;99(6):1108–14.

49. Santos IS, Lotufo PA, Brant L, Pinto Filho MM, Pereira ADC, Barreto SM, Ribeiro AL, Thomas GN, Lip GYH, Bensenor IM. Atrial Fibrillation Diagnosis using ECG Records and Self-Report in the Community: Cross-Sectional Analysis from ELSA-Brasil. Arq Bras Cardiol. 2021 Sep;117(3):426-434. English, Portuguese. doi: 10.36660/abc.20190873. PMID: 34550227; PMCID: PMC8462958.

50. Favarato D. Brazilian Population Presents Prevalence of Atrial Fibrillation Similar to Higher Income Countries, and a Low Use of Anticoagulation Therapy. Arq Bras Cardiol. 2021 Sep;117(3):435-436. English, Portuguese. doi: 10.36660/abc.20210562. PMID: 34550228; PMCID: PMC8462960.

51. Amaral CH do, Amaral AR, Nagel V, Venancio V, Garcia AC, Magalhaes PS, et al. Incidence and functional outcome of atrial fibrillation and non-atrial fibrillation-related cardioembolic stroke in Joinville, Brazil: a population-based study. Arq Neuropsiquiatr [Internet]. 2017 May;75(5):288–94.

52. Benjamin EJ, Wolf PA, D'Agostino RB, Silbershatz H, Kannel WB, Levy D. Impact of atrial fibrillation on the risk of death. Circulation [Internet]. 1998 Sep 8;98(10):946–52.

53. Krahn AD, Manfreda J, Tate RB, Mathewson FAL, Cuddy TE. The natural history of atrial fibrillation: Incidence, risk factors, and prognosis in the Manitoba follow-up study. Am J Med [Internet]. 1995 May;98(5):476–84.

54. Emdin CA, Wong CX, Hsiao AJ, Altman DG, Peters SAE, Woodward M, et al. Atrial fibrillation as a risk factor for cardiovascular disease and death in women compared with men: systematic review and meta-analysis of cohort studies. BMJ [Internet]. 2016 Jan 19;h7013.

55. Wann LS, Curtis AB, January CT, Ellenbogen KA, Lowe JE, Estes NA 3rd, Page RL, Ezekowitz MD, Slotwiner DJ, Jackman WM, Stevenson WG, Tracy CM; 2011 Writing Group Members; Fuster V, Rydén LE, Cannom DS, Le Heuzey JY, Crijns HJ, Lowe JE, Curtis AB, Olsson S, Ellenbogen KA, Prystowsky EN, Halperin JL, Tamargo JL, Kay GN, Wann L; 2006 Writing Committee Members; Jacobs AK, Anderson JL, Albert N, Hochman JS, Buller CE, Kushner FG, Creager MA, Ohman EM, Ettinger SM, Stevenson WG, Guyton RA, Tarkington LG, Halperin JL, Yancy CW; ACCF/AHA Task Force Members. 2011 ACCF/AHA/HRS focused update on the management of patients with atrial fibrillation (updating the 2006 guideline): a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2011 Jan 4;123(1):104-23. doi: 10.1161/CIR.0b013e3181fa3cf4. Epub 2010 Dec 20. Erratum in: Circulation. 2011 Aug 2;124(5):e173. PMID: 21173346.

56. Alonso A, Agarwal SK, Soliman EZ, Ambrose M, Chamberlain AM, Prineas RJ, Folsom AR. Incidence of atrial fibrillation in whites and African-Americans: the Atherosclerosis Risk in Communities (ARIC) study. Am Heart J. 2009 Jul;158(1):111-7. doi: 10.1016/j.ahj.2009.05.010. PMID: 19540400; PMCID: PMC2720573.

57. January CT, Wann LS, Calkins H, Chen LY, Cigarroa JE, Cleveland JC Jr, Ellinor PT, Ezekowitz MD, Field ME, Furie KL, Heidenreich PA, Murray KT, Shea JB, Tracy CM, Yancy CW. 2019 AHA/ACC/HRS Focused Update of the 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. J Am Coll Cardiol. 2019 Jul 9;74(1):104-132. doi: 10.1016/j.jacc.2019.01.011. Epub 2019 Jan 28. Erratum in: J Am Coll Cardiol. 2019 Jul 30;74(4):599. PMID: 30703431.

58. Ball J, Carrington MJ, McMurray JJ, Stewart S. Atrial fibrillation: profile and burden of an evolving epidemic in the 21st century. Int J Cardiol. 2013 Sep 1;167(5):1807-24. doi: 10.1016/j.ijcard.2012.12.093. Epub 2013 Feb 4. PMID: 23380698.

59. Chugh SS, Havmoeller R, Narayanan K, Singh D, Rienstra M, Benjamin EJ, Gillum RF, Kim YH, McAnulty JH Jr, Zheng ZJ, Forouzanfar MH, Naghavi M, Mensah GA, Ezzati M, Murray CJ. Worldwide epidemiology of atrial fibrillation: a Global Burden of Disease 2010 Study. Circulation. 2014 Feb 25;129(8):837-47. doi: 10.1161/CIRCULATIONAHA.113.005119. Epub 2013 Dec 17. PMID: 24345399; PMCID: PMC4151302.

60. Zimerman LI, Fenelon G, Martinelli-Filho M, Grupi C, Atié J, Lorga-Filho A. Brazilian Society of Cardiology. Brazilian Guidelines on Atrial Fibrillation. Arq Bras Cardiol. 2009;92(Supplement 1):1–39.

61. Silva AMG da. Regulation of non-coding RNAs in Atrial Fibrillation. Federal University of Rio Grande do Norte; 2020.

62. Goulart AC, Olmos RD, Santos IS, Tunes G, Alencar AP, Thomas N, et al. The impact of atrial fibrillation and long-term oral anticoagulant use on all-cause and cardiovascular mortality: A 12-year evaluation of the prospective Brazilian Study of Stroke Mortality and Morbidity. Int J Stroke [Internet]. 2022 Jan 25;17(1):48–58.

Ammar YE, Castilho Lopes CC, Lopes EB, Lopes LC, Castilho Lopes ME, Quintanilha CA, Nubile ES, Barbosa IC, Olanda GC, Silva SM, Porto WR, Da Costa MM, Dias TG, Ururahy Rodrigues KE, Dos Santos Borges LS, Junior JF, De Quadros E Silva H, Pitanga FH, Lemos M, dos Santos D, Vasconcelos Gonçalves MV. Relationship between Ischemic Stroke and Atrial Fibrillation, Systematic Review. 2023 Mar 30; 4(3): 546-554. doi: 10.37871/jbres1709, Article ID: JBRES1709, Available at: https://www.jelsciences.com/articles/jbres1709.pdf