J Surg Med. 2019;3(9):659-662.
DOI: 10.28982/josam.610221

Research article
Araştırma makalesi

Journal of Surgery and Medicine
e-ISSN: 2602-2079

Clinical evaluation of paroxysmal and permanent atrial fibrillation patients in cardiac inpatient unit: Cross-sectional study

Paroksismal ve sürekli atriyal fibrilasyon hastalarının kardiyoloji servisinde klinik olarak değerlendirilmesi: Kesitsel çalışma

Ramazan Asoğlu [1], Mahmut Özdemir [2], Nesim Aladağ [3], Sevdegül Karadaş [4], Emin Asoğlu [5]

[1] Adıyaman University Training and Research Hospital, Department of Cardiology, Adıyaman, Turkey
[2] Bayrampasa Kolan Hospital, Department of Cardiology, İstanbul, Turkey
[3] Van Training and Research Hospital, Department of Cardiology, Van, Turkey
[4] Van University Faculty of Medicine, Department of Emergency Medicine, Van, Turkey
[5] Mardin Community Hospital, Department of Cardiology, Mardin, Turkey

ORCID ID of the author(s)

RA: 0000-0002-4777-1166
MÖ: 0000-0002-0021-3415
NA: 0000-0003-2346-1152
SK: 0000-0001-6686-0300
EA: 0000-0003-1302-1006

Corresponding author / Sorumlu yazar:
Ramazan Asoğlu
Address / Adres: Adıyaman Üniversitesi Eğitim ve Araştırma Hastanesi, Kardiyoloji Bölümü, Adıyaman, Türkiye
e-Mail: dr.asoglu@yahoo.com

Ethics Committee Approval: This study was approved by the local Ethics Committee of Van University Faculty of Medicine (No: 2013-20).
Etik Kurul Onayı: Bu çalışma, Van Üniversitesi Tıp Fakültesi Etik Komitesi tarafından onaylandı (No: 2013-20).

Conflict of Interest: No conflict of interest was declared by the authors.
Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Financial Disclosure: The authors declared that this study has received no financial support.
Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

Published: 9/16/2019
Yayın Tarihi: 16.09.2019

Abstract

Aim: Atrial fibrillation (AF), a supra-ventricular arrhythmia, is characterized by a rapid and irregular heart rate, for which electrocardiography is the diagnostic tool. Hypertension is the most common cause of AF. In this study, we aimed to evaluate the paroxysmal AF and permanent AF patients' symptoms, medical history, and clinical characteristics in the inpatient unit.

Methods: 115 patients (30 patients with paroxysmal AF and 85 patients with permanent AF) were enrolled in the study. All patients' detailed histories were taken; physical examination, routine biochemical tests, electrocardiographies, and transthoracic echocardiographies were performed. CHA2DS2-VASc (Congestive heart failure/left ventricular dysfunction, Hypertension, Age ≥75 years, Diabetes Mellitus, Stroke/transient ischemic attack/systemic embolism, Vascular Disease, Age 65-74 years, Sex Category) scores were recorded.

Results: Permanent AF patients were older (70.0 (10.5) vs 61.4 (15.8); *P*=0.01) and had a lower ejection fraction (41.0 (11.9) vs 53.3 (11.2); *P*=0.01) than paroxysmal AF patients. CHA2DS2-VASc scores were similar between the two groups (3.0 (1.5) vs 2.7 (1.3); *P*=0.24). In hematological analysis, prothrombin time (15.3(1.3-106.4) vs 13.6(11.0-75.5); *P*=0.03) and international normalized ratio (1.2(0.9-16.0) vs 1.1(0.9-6.0); *P*=0.01) values were higher in permanent AF patients compared to those with paroxysmal AF. Rhythm regulation was performed to paroxysmal AF patients. Rate regulation was performed significantly more frequently in permanent AF patients than paroxysmal AF patients (74(87%)) vs (12(40%)); *P*=0.01).

Conclusion: This study demonstrated that permanent AF patients had more comorbidities compared to paroxysmal AF patients. Rhythm control was the principal treatment strategy in paroxysmal AF, whereas rate control was the treatment of choice in permanent AF.

Keywords: Paroxysmal atrial fibrillation, Permanent atrial fibrillation, Anticoagulation

Öz

Amaç: Atriyal fibrilasyon (AF) hızlı ve düzensiz kalp atım hızı ile karakterize supra-ventriküler bir aritmidir. Elektrokardiyografi AF için tanı koyma aracıdır. Hipertansiyon AF'nin en sık nedenidir. Bu çalışmada, paroksismal AF ve sürekli AF hastalarının semptomlarını, tıbbi öykülerini ve klinik özelliklerini yatan hasta ünitesinde değerlendirmeyi amaçladık.

Yöntemler: Çalışmaya toplam 115 hasta (paroksismal AF'li 30 hasta ve sürekli AF'li 85 hasta) dahil edildi. Tüm hastalar ayrıntılı öykü, klinik muayene, rutin biyokimya, elektrokardiyografi ve transtorasik ekokardiyografi ile değerlendirildi. CHA2DS2-VASc (Konjestif kalp yetmezliği/sol ventrikül disfonksiyonu, Hipertansiyon, Yaş ≥75 yıl, Diabetes mellitus, İnme/geçici iskemik atak/sistemik emboli, Vasküler hastalık, 65-74 yaş, Cinsiyet kategorisi) skorları kaydedildi.

Bulgular: Sürekli AF hastaları paroksismal AF hastalarından daha yaşlıydı (70.0 (10.5) vs 61.4 (15.8); *P*=0.01) ve daha düşük ejeksiyon fraksiyonuna sahipti (41.0 (11.9) ve 53.3 (11.2); *P*=0.01). CHA2DS2-VASc skorları çalışma grupları arasında benzerdi (3.0 (1.5) vs 2.7 (1.3); *P*=0.24). Hematolojik analizde, protrombin zamanı (15.3(1.3-106.4) vs 13.6(11.0-75.5); *P*=0.03) ve uluslararası normalleştirilmiş oranı (1.2(0.9-16.0) vs 1.1(0.9-6.0); *P*=0.01) paroksismal AF ile karşılaştırıldığında sürekli AF hastalarında daha yüksekti. Paroksismal AF hastalarına ritim kontrolü yapıldı. Hız kontrolü sürekli AF hastalarında paroksismal AF hastalarından anlamlı derecede yüksekti (74 (87%)) ve (12 (40%)); *P*=0.01).

Sonuç: Bu çalışma sürekli AF hastalarının paroksismal AF hastalarıyla karşılaştırıldığında daha fazla komorbiditeye sahip olduğunu gösterdi. Ritim kontrolü paroksismal AF'de, hız kontrolü ise kalıcı AF'de esas tedavi stratejisiydi.

Anahtar kelimeler: Paroksismal atriyal fibrilasyon, Sürekli atriyal fibrilasyon, Antikoagülasyon

How to cite / Atıf için: Asoğlu R, Özdemir M, Aladağ N, Karadaş S, Asoğlu E. Clinical evaluation of paroxysmal and permanent atrial fibrillation patients in cardiac inpatient unit: Cross-sectional study. J Surg Med. 2019;3(9):659-662.

Introduction

Atrial fibrillation (AF), a supraventricular arrhythmia characterized with a rapid and irregular heart rate, is associated with adverse events in the cardiac inpatient unit [1]. In electrocardiography (ECG), an RR interval with no discernible and distinct P wave is characteristic for AF. Hypertension is the most common cause of AF, and remodeling of the atrial tissue with inflammation and fibrosis is the primary pathophysiology in AF development [2,3]. Differentiating AF types is essential in clinical practice. Paroxysmal AF, which is the self-terminating form of arrhythmia, usually terminates within 48 hours. While AF paroxysms may last 7 days, the probability of spontaneous conversion to sinus rhythm is low after 48 hours. Cardioversion was not attempted in permanent AF, as this arrhythmia was not considered temporary by the physicians and the patients [4]. Paroxysmal AF patients are usually treated with anti-arrhythmic medications, while permanent AF patients receive rate control treatment.

The quality of life of an AF patient deteriorates due to AF-related symptoms such as shortness of breath, palpitations, and chest pain [7], which may lead to high rates of hospitalization [5,6]. These patients have the highest mortality rate in the first four months after diagnosis, for which sudden death, heart failure, and stroke are the primary reasons [8,9]. Oral anticoagulant reduces mortality and stroke risk in an AF patient [10]. Rate and rhythm control treatments improve AF-associated symptoms. Physicians should be aware of the diagnosis and treatment of AF types to decrease the mortality risk and hospitalization. In this study, we aimed to evaluate the paroxysmal and permanent AF patients' symptoms, medical history, and clinical characteristics in the cardiac inpatient unit.

Materials and methods

One-hundred and fifteen patients (30 paroxysmal and 85 permanent AF patients) who were admitted to our cardiac inpatient clinic between January 2014 and April 2015 were enrolled in this cross-sectional study. All patients' detailed histories were taken; physical examination, routine biochemical tests, ECG, and transthoracic echocardiographies were performed. All paroxysmal or permanent AF patients older than 18 years were included. Exclusion criteria included refusal to participate in the study, pericardial or pleural effusion on transthoracic echocardiography, severe hepatic dysfunction, defined by documented cirrhosis or serum amino-transferase levels at least five times the upper limit, known malignancy and bleeding disorders.

AF is divided into 5 types based on presentation, duration, and spontaneous termination: Newly diagnosed, paroxysmal, persistent, long-standing persistent, and permanent AF [4]. In the present study, we did not include patients with newly diagnosed, persistent, and long-standing persistent AF. Patients' CHA_2DS_2-VASc (Congestive heart failure/left ventricular dysfunction, Hypertension, Aged ≥ 75 years, Diabetes Mellitus, Stroke/transient ischemic attack/systemic embolism, Vascular Disease, Aged 65-74 years, Sex Category) scores were recorded [4].

Blood samples collected from the antecubital vein by an atraumatic needle were analyzed for white blood cell count, hemoglobin, platelet, mean platelet volume, prothrombin time, activated partial prothrombin time, international normalized ratio (INR), total cholesterol, triglyceride, low-density lipoprotein-cholesterol (LDL), high-density lipoprotein-cholesterol (HDL), aspartate transaminase, alanine transaminase, blood glucose and creatinine. Hematological parameters were analyzed with the LH 780 analyzer (Beckman Coulter Inc, Miami, Florida). In addition, patients' blood pressures, heart rates, 12-lead ECGs and smoking histories were recorded. Hypertension was defined with systolic blood pressure ≥140 mmHg, diastolic blood pressure ≥90 mmHg, or requirement for antihypertensive medication. Hyperlipidemia was defined with total cholesterol >220 mg/dL or triglycerides ≥150 mg/dl. Type-2 Diabetes mellitus (T2DM) was diagnosed according to the American Diabetes Association criteria [11]. Smoking included active or previous (>10 pack-years) tobacco use.

Each patient underwent complete transthoracic echocardiography in accordance with the American Society of Echocardiography measurement guidelines [12]. Left ventricular end-systolic and end-diastolic diameters (LVESD, LVEDD) were measured from the parasternal long-axis view in M-mode. The thicknesses of the posterior wall (PW), inter-ventricular septum (IVS), ejection fraction (EF) and left atrium diameter were recorded. Rheumatic valvular disease diagnosis was based on echocardiographic characteristics. Informed consent was obtained from all patients prior to the study. This study was performed in accordance with the Declaration of Helsinki principles and approved by the local Ethics Committee of our Hospital (No: 2013-20).

Statistical analysis

Data were analyzed with SPSS software version 20.0 for Windows (SPSS Inc, Chicago, Illinois). Kolmogorov-Smirnov test was used to verify that continuous variables were normally distributed. Normally distributed variables were expressed as mean (standard deviation (SD)), while non-normally distributed variables as median with interquartile range (IQR). The categorical variables were presented as percentages. Differences between two groups were evaluated with Student's unpaired t-test or the Mann–Whitney U test for parameters with a normal or non-normal distribution. The frequencies of nominal variables were compared using Fisher's exact test or chi-square test. $P<0.05$ was deemed statistically significant.

Results

The demographic and clinical data of the patients are presented in Table 1. Age was higher in permanent AF group. Regarding the patients' history, chronic obstructive pulmonary disease (COPD) and heart failure were significantly higher in permanent AF group, whereas coronary artery disease (CAD) was higher in paroxysmal AF group. Urea levels were significantly higher in permanent AF group, unlike HDL levels, which were significantly higher in the paroxysmal AF group. Table 2 shows the hematological and echocardiographic data of the two groups. The white blood cell counts (WBC), platelet counts, and activated partial prothrombin times (aPTT) did not differ among the two groups. Hemoglobin levels were

significantly higher in the paroxysmal AF group, while prothrombin time (PT), INR and C-reactive protein were higher in the permanent AF group. Echocardiographic examination revealed that LVEDD and LVESD were significantly higher in the permanent AF group, and EF was significantly lower in permanent AF patients. Table 3 presents the rhythm and rate data of the AF patients. Paroxysmal AF patients received electrical or medical cardioversion, and rhythm regulation. The number of rate regulated patients was significantly higher in the permanent AF group. Figure 1 presents the mean CHA_2DS_2-VASc scores of the groups, which were not significantly different (P=0.24).

Table 1: The demographic and clinical data of the study population

	Paroxysmal AF	Permanent AF	*P*-value
Age (years)	61.4 (15.8)	70.0 (10.5)	0.01
Systolic blood pressure (mmHg)	119.3 (21.5)	121.0 (27.4)	0.76
Diastolic blood pressure (mmHg)	72.7 (9.8)	74.0 (16.3)	0.68
Heart rate (bpm)	117.0 (29.9)	110.8 (28.1)	0.31
Male n(%)	15(50%)	38(45%)	0.61
Smoking n(%)	8(26%)	27(32%)	0.60
Alcohol n(%)	3(10%)	2(2%)	0.07
Coronary artery disease n(%)	17(57%)	20(23%)	0.01
COPD n(%)	4(13%)	28(33%)	0.03
Diabetes mellitus n(%)	7(23%)	14(16%)	0.40
CVE n(%)	1(3%)	2(2%)	0.77
Hypertension n(%)	14(46%)	36(42%)	0.68
Hyperthyroidism n(%)	--	5(6%)	0.17
Heart failure n(%)	7(23%)	48(56%)	0.01
Valve operation n(%)	1(3%)	10(12%)	0.17
Rheumatic heart disease n(%)	2(7%)	6(7%)	0.94
Warfarin n(%)	5(17%)	25(29%)	0.17
ASA n(%)	26(86%)	73(86%)	0.91
Beta blocker n(%)	8(27%)	32(38%)	0.27
High density lipoprotein (mg/dl	42.1 (14.5)	33.6 (14.0)	0.01
Low density lipoprotein (mg/dl)	104.1 (32.4)	97.4 (36.1)	0.37
Triglyceride (mg/dl)	121.2 (50.9)	114.1 (49.7)	0.50
Total cholesterol (mg/dl)	169.1 (37.8)	153.1 (46.2)	0.09
Thyroxine 4 (µg/dL)	1.2 (0.3)	1.3 (0.3)	0.29
Thyroid stimulant hormone (mIU/L)	1.1(0.1-2.7)	1.1(0.1-8.4)	0.58
Serum glucose (mg/dl)	141.3 (64.0)	132.2 (51.7)	0.44
Sodium (mEq/L)	137.1 (4.5)	136.3 (5.1)	0.46
Potassium (mEq/L)	4.3 (0.9)	4.5 (0.7)	0.41
Calcium (mg/dL)	9.3 (0.5)	9.2 (0.9)	0.60
Urea (mg/dL)	20.5(12.0-94.0)	32.0(8.0-113.0)	0.01
Creatinine (mg/dl)	0.9(0.4-5.8)	1.1(0.5-4.5)	0.26
Aspartate transaminase (U/l)	21.5(9.0-111.0)	31.0(11.0-314.0)	0.18
Alanine transaminase (U/l)	22.0(10.0-95.0)	26.0(4.0-169.0)	0.52
CKMB (ng/ml)	27.0(13.0-313.0)	28.0(11.0-293.0)	0.48
Troponin (ng/ml)	0.01(0.01-10.7)	0.01(0.01-14.0)	0.26
CHA_2DS_2-VASc	2.7 (1.3)	3.0 (1.5)	0.24

AF: atrial fibrillation, COPD: chronic obstructive pulmonary disease, CVE: cerebrovascular event, ASA: acetylsalicylic acid, CKMB: Creatine Kinase-MB, CHADS-VASc: Congestive heart failure, Hypertension, Age, Diabetes mellitus, Stroke, Vascular disease, Sex

Table 2: The hematologic and echocardiographic data of the study population

	Paroxysmal AF	Permanent AF	*P*-value
White blood cell count (10^3/mm^3)	10.7 (3.7)	10.1 (5.7)	0.64
Hemoglobin (g/dL)	14.5 (1.8)	13.3 (2.1)	0.01
Hematocrit (%)	40.8 (8.8)	40.0 (6.3)	0.58
Platelet count (10^3/mm^3)	229.3 (67.5)	215.7 (85.3)	0.43
Mean platelet volume. fL	8.7 (1.2)	8.8 (1.2)	0.53
Prothrombin time (sec)	13.6(11.0-75.5)	15.3(1.3-106.4)	0.03
Activated partial prothrombin time (sec)	33.2 (6.1)	34.2 15.7	0.74
International normalized ratio	1.1(0.9-6.0)	1.2(0.9-16.0)	0.01
C-reactive protein (mg/L)	3.55(2.97-92.0)	13.6(2.0-170.0)	0.01
LVEDD (cm)	4.90 (0.70)	5.48 (0.73)	0.01
LVESD (cm)	3.3 (0.8)	4.3 (0.9)	0.01
Ejection Fraction (%)	53.3 (11.2)	41.0 (11.9)	0.01
Left atrial diameter (mm)	4.4 (0.8)	4.9 (0.8)	0.01
IVS (cm)	1.1 (0.1)	1.2 (0.2)	0.57
PWD (cm)	1.1 (0.1)	1.1 (0.1)	0.73

LVEDD: left ventricular end-diastolic diameter, LVESD: left ventricular end-systolic diameter, IVS: interventricular septum, PWD: posterior wall diameter

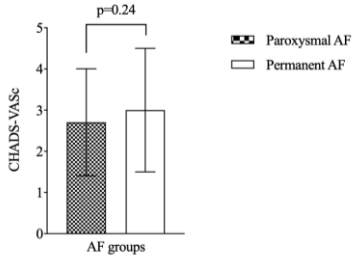

Figure 1: CHA_2DS_2-VASc scores between study groups. (CHA_2DS_2-VASc: Congestive heart failure, Hypertension, Age, Diabetes mellitus, Stroke, Vascular disease, Sex)

Table 3: Rhythm and rate data of the study population

	Paroxysmal AF	Permanent AF	*P*-value
Electrical cardioversion n(%)	4(13%)	--	0.01
Medical cardioversion n(%)	20(67%)	--	0.01
Rhythm regulation n(%)	16(53%)	--	0.01
Rate regulation n(%)	12(40%)	74(87%)	0.01
Exitus n(%)	2(7%)	11(13%)	0.35
Inpatient Duration (days)	4.0(1.0-12.0)	3.0(1.0-32.0)	0.11

Discussion

This study demonstrated three major findings in patients with paroxysmal and permanent AF hospitalized in the cardiac inpatient clinic: First, permanent AF patients were older than paroxysmal AF patients. Second, the ejection fractions of permanent AF patients were significantly lower. Third, CHA_2DS_2-VASc scores did not differ between the two groups. Management of AF patients depends on AF-associated symptoms and duration of AF. AF patients should undergo a detailed clinical evaluation that includes determination of AF type, stroke risk, AF-associated symptoms, and thromboembolism or left ventricular dysfunction assessment. AF patients exhibit a variety of symptoms, such as palpitations, dyspnea, and chest tightness [13]. Rhythm or rate control might be preferred as treatment. Symptoms should be taken into consideration, especially in older patients [4,14]. In AF treatment, rhythm control is not proven to exhibit better outcomes than rate control after five years [15]. However, rhythm control by antiarrhythmic drugs, electrical cardioversion, or ablation, better improves symptoms and functional status compared to rate control [16].

Evaluation of stroke risk and using an appropriate oral anticoagulant is more important than rhythm and rate control strategies in the management of AF patients [17]. Oral anticoagulant (OAC) should be started regardless of the final rhythm in AF patients with a high stroke risk score. OAC treatment could prevent most of the ischemic strokes and prolong life in AF patients [18]. According to the guidelines using the CHA_2DS_2-VASc risk score, a score of 2 needs OAC therapy [4,14]. The ESC guideline suggests administering direct OACs rather than vitamin K antagonist (e.g., warfarin), unlike the AHA guidelines, which recommend both [4,14]. Direct OACs include the direct thrombin inhibitor (dabigatran) and factor Xa inhibitors (apixaban, edoxaban, and rivaroxaban). Clinicians should use vitamin K antagonists in patients with a mechanical valve, rheumatic valve disease, or moderate to severe non-rheumatic mitral stenosis [4,14].

AF is commonly asymptomatic, and paroxysmal AF patients are rarely symptomatic [19]. Recent studies demonstrated that the risks of stroke and thromboembolism of paroxysmal AF patients are similar to that of non-paroxysmal AF patients [20,21]. However, some research showed that stroke and thromboembolic events were lower in paroxysmal AF patients compared to non-paroxysmal AF patients [22,23]. Similarly, Boriani et al. [24] reported that paroxysmal AF patients had a lower stroke risk than permanent AF patients in a meta-analysis, and that non-paroxysmal AF patients had worse outcomes for all-cause mortality than paroxysmal AF patients at one-year follow-up. Vanassche et al. [25] found that age ≥75 years, gender, history of stroke or transient ischemic attack (TIA), and AF patterns were independent predictors of stroke.

Hypertension is a major risk factor for the development of AF [26]. Blum et al. [27] demonstrated a higher prevalence of hypertension was related to a higher AF-progression rate. Also, Padfield et al. [28] reported that aging, mitral regurgitation, aortic stenosis, left ventricular hypertrophy, and left atrial dilatation were related to AF progression. AF patients generally develop sustained forms, and only a small proportion remains in paroxysmal AF during long-term follow-up [29]. A previous study revealed that patients with non-paroxysmal AF were older than paroxysmal AF patients [30]. Persistent AF patients had a larger left atrial volume index compared to paroxysmal AF patients. Structural and electrophysiological changes occur in atrial tissue with aging, which promotes AF progression.

In this study, we evaluated paroxysmal and permanent AF patients in the inpatient clinic. Similar to the studies in the literature, our permanent AF patients were older, had lower ejection fractions and higher COPD ratios compared to paroxysmal AF patients. These findings support the previous studies with respect to the relationship between permanent AF and comorbidities, such as heart failure. Also, left atrial diameters of permanent AF patients were higher, which correlated with permanent AF patients' reported echocardiographic findings in the literature. We showed that CHA_2DS_2-VASc scores were similar between study groups, due to higher CAD ratios in paroxysmal AF. In accordance with the guidelines, we managed rhythm control with electrical and pharmacological cardioversion in paroxysmal AF patients. In permanent AF patients, however, rate control was an essential treatment strategy. Before discharge, we treated almost all patients with oral anticoagulants and rhythm or rate control.

Limitations

This study has some limitations. First of all, this was a single-center study and based on a relatively small group of patients. The new OACs were not common at the time of the study in our country, so the lack of these drugs was another study limitation on AF management. Also, we did not evaluate the HAS-BLED (Hypertension, Abnormal liver/renal function, Stroke history, Bleeding history or predisposition, Labile INR, Elderly, Drug/alcohol usage) scores because of insufficient data associated with label INR levels. We managed the patients in inpatient clinical settings, and the results of this study may not apply to outpatient clinics or emergency settings.

Conclusion

This study demonstrates that permanent AF patients had more comorbidities compared with paroxysmal AF patients. We evaluated stroke risk and treated AF patients with oral anticoagulants according to guidelines. Rhythm control was an essential treatment strategy in paroxysmal AF, whereas rate control was preferred in permanent AF.

References

1. Kannel WB, Abbott RD, Savage DD, McNamara PM. Epidemiologic features of chronic atrial fibrillation: the Framingham study. N Engl J Med. 1982;306(17):1018–22.
2. Chugh SS, Havmoeller R, Narayanan K, Singh D, Rienstra M, Benjamin EJ, et al. Worldwide epidemiology of atrial fibrillation: a Global Burden of Disease 2010 Study. Circulation. 2014;129(8):837–47.
3. Burstein B, Nattel S. Atrial fibrosis: mechanisms and clinical relevance in atrial fibrillation. J Am Coll Cardiol. 2008;51(8):802–9.
4. Kirchhof P, Benussi S, Kotecha D, Ahlsson A, Atar D, Casadei B, et al. 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS. Eur Heart J. 2016 07;37(38):2893–962.
5. Steinberg BA, Kim S, Fonarow GC, Thomas L, Ansell J, Kowey PR, et al. Drivers of hospitalization for patients with atrial fibrillation: Results from the Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF). Am Heart J. 2014;167(5):735–42.
6. Atzema CL, Austin PC, Miller E, Chong AS, Yun L, Dorian P. A population-based description of atrial fibrillation in the emergency department, 2002 to 2010. Ann Emerg Med. 2013;62(6):570–7.
7. Atzema CL, Dorian P, Fang J, Tu JV, Lee DS, Chong AS, et al. A clinical decision instrument for 30-day death after an emergency department visit for atrial fibrillation: the Atrial Fibrillation in the Emergency Room (AFTER) study. Ann Emerg Med. 2015;66(6):658–68.
8. Bassand J-P, Accetta G, Camm AJ, Cools F, Fitzmaurice DA, Fox KA, et al. Two-year outcomes of patients with newly diagnosed atrial fibrillation: results from GARFIELD-AF. Eur Heart J. 2016;37(38):2882–9.
9. Marijon E, Le Heuzey J-Y, Connolly S, Yang S, Pogue J, Brueckmann M, et al. Causes of death and influencing factors in patients with atrial fibrillation: a competing-risk analysis from the randomized evaluation of long-term anticoagulant therapy study. Circulation. 2013;128(20):2192–201.
10. Ruff CT, Giugliano RP, Braunwald E, Hoffman EB, Deenadayalu N, Ezekowitz MD, et al. Comparison of the efficacy and safety of new oral anticoagulants with warfarin in patients with atrial fibrillation: a meta-analysis of randomised trials. The Lancet. 2014;383(9921):955–62.
11. American Diabetes Association. American College of Endocrinology and American Diabetes Association consensus statement on inpatient diabetes and glycemic control: a call to action. Diabetes Care. 2006;29(8):1955–62.
12. Schiller NB, Shah PM, Crawford M, DeMaria A, Devereux R, Feigenbaum H, et al. Recommendations for quantitation of the left ventricle by two-dimensional echocardiography. J Am Soc Echocardiogr. 1989 Mar;2(5):358–67.
13. Thrall G, Lane D, Carroll D, Lip GY. Quality of life in patients with atrial fibrillation: a systematic review. Am J Med. 2006;119(5):448-e1.
14. January CT, Wann LS, Alpert JS, Calkins H, Cigarroa JE, Cleveland JC, et al. 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 Practice Guidelines and the Heart Rhythm Society. J Am Coll Cardiol. 2014;64(21):e1–76.
15. Van Gelder IC, Hagens VE, Bosker HA, Kingma JH, Kamp O, Kingma T, et al. A comparison of rate control and rhythm control in patients with recurrent persistent atrial fibrillation. N Engl J Med. 2002;347(23):1834–40.
16. Chung MK, Shemanski L, Sherman DG, Greene HL, Hogan DB, Kellen JC, et al. Functional status in rate-versus rhythm-control strategies for atrial fibrillation: results of the Atrial Fibrillation Follow-Up Investigation of Rhythm Management (AFFIRM) Functional Status Substudy. J Am Coll Cardiol. 2005;46(10):1891–9.
17. Authors/Task Force Members, Camm AJ, Lip GY, De Caterina R, Savelieva I, Atar D, et al. 2012 focused update of the ESC guidelines for the management of atrial fibrillation: an update of the 2010 ESC guidelines for the management of atrial fibrillation developed with the special contribution of the European Heart Rhythm Association. Eur Heart J. 2012;33(21):2719–47.
18. Kim MH, Johnston SS, Chu B-C, Dalal MR, Schulman KL. Estimation of total incremental health care costs in patients with atrial fibrillation in the United States. Circ Cardiovasc Qual Outcomes. 2011;4(3):313–20.
19. Page RL, Wilkinson WE, Clair WK, McCarthy EA, Pritchett E. Asymptomatic arrhythmias in patients with symptomatic paroxysmal atrial fibrillation and paroxysmal supraventricular tachycardia. Circulation. 1994;89(1):224–7.
20. Friberg L, Hammar N, Rosenqvist M. Stroke in paroxysmal atrial fibrillation: report from the Stockholm Cohort of Atrial Fibrillation. Eur Heart J. 2009;31(8):967–75.
21. Banerjee A, Taillandier S, Olesen JB, Lane DA, Lallemand B, Lip GY, et al. Pattern of atrial fibrillation and risk of outcomes: the Loire Valley Atrial Fibrillation Project. Int J Cardiol. 2013;167(6):2682–7.
22. Al-Khatib SM, Thomas L, Wallentin L, Lopes RD, Gersh B, Garcia D, et al. Outcomes of apixaban vs. warfarin by type and duration of atrial fibrillation: results from the ARISTOTLE trial. Eur Heart J. 2013;34(31):2464–71.
23. Steinberg BA, Hellkamp AS, Lokhnygina Y, Patel MR, Breithardt G, Hankey GJ, et al. Higher risk of death and stroke in patients with persistent vs. paroxysmal atrial fibrillation: results from the ROCKET-AF Trial. Eur Heart J. 2014;36(5):288–96.
24. Boriani G, Laroche C, Diemberger I, Fantecchi E, Popescu MI, Rasmussen LH, et al. 'Real-world'management and outcomes of patients with paroxysmal vs. non-paroxysmal atrial fibrillation in Europe: the EURObservational Research Programme–Atrial Fibrillation (EORP-AF) General Pilot Registry. Ep Eur. 2016;18(5):648–57.
25. Vanassche T, Lauw MN, Eikelboom JW, Healey JS, Hart RG, Alings M, et al. Risk of ischaemic stroke according to pattern of atrial fibrillation: analysis of 6563 aspirin-treated patients in ACTIVE-A and AVERROES. Eur Heart J. 2014;36(5):281–8.
26. Conen D, Tedrow UB, Koplan BA, Glynn RJ, Buring JE, Albert CM. Influence of systolic and diastolic blood pressure on the risk of incident atrial fibrillation in women. Circulation. 2009;119(16):2146.
27. Blum S, Meyre P, Aeschbacher S, Berger S, Auberson C, Briel M, et al. Incidence and predictors of atrial fibrillation progression: A systematic review and meta-analysis. Heart Rhythm. 2019;16(4):502–10.
28. Padfield GJ, Steinberg C, Swampillai J, Qian H, Connolly SJ, Dorian P, et al. Progression of paroxysmal to persistent atrial fibrillation: 10-year follow-up in the Canadian Registry of Atrial Fibrillation. Heart Rhythm. 2017;14(6):801–7.
29. Developed with the special contribution of the European Heart Rhythm Association (EHRA), Endorsed by the European Association for Cardio-Thoracic Surgery (EACTS), Authors/Task Force Members, Camm AJ, Kirchhof P, Lip GY, et al. Guidelines for the management of atrial fibrillation: the Task Force for the Management of Atrial Fibrillation of the European Society of Cardiology (ESC). Eur Heart J. 2010;31(19):2369–429.
30. Hohnloser SH, Pajitnev D, Pogue J, Healey JS, Pfeffer MA, Yusuf S, et al. Incidence of stroke in paroxysmal versus sustained atrial fibrillation in patients taking oral anticoagulation or combined antiplatelet therapy: an ACTIVE W Substudy. J Am Coll Cardiol. 2007;50(22):2156–61.

This paper has been checked for language accuracy by JOSAM editors.
The National Library of Medicine (NLM) citation style guide has been used in this paper.

Suggested citation: Patrias K. Citing medicine: the NLM style guide for authors, editors, and publishers [Internet]. 2nd ed. Wendling DL, technical editor. Bethesda (MD): National Library of Medicine (US); 2007-[updated 2015 Oct 2; cited Year Month Day]. Available from: http://www.nlm.nih.gov/citingmedicine