Original Article

Predisposing factors of short paroxysmal atrial runs in the geriatric patients

🆔 Mustafa Ozan Çakır

Zonguldak Bülent Ecevit University Faculty of Medicine, Department of Cardiology, Zonguldak, Turkey.

Abstract

Objective: Atrial fibrillation (AF) is the most common arrhythmia in the elderly population, and it has various major complications. This study aimed to investigate the factors that may cause short paroxysmal atrial runs (SPARs) in the geriatric patients.

Methods: The study included patients aged over 65 years who visited the cardiology outpatient clinic and were diagnosed with SPAR by a 24-hour electrocardiogram holter (24-h ECG). All patients underwent echocardiography, and their plasma C-reactive protein (CRP) levels were measured. Their demographic data, chronic disease status, echocardiographic findings and CRP values were evaluated.

Results: The mean age of the 144 patients was 73 (65-90). Of the patients, 70.8% were female and 29.2% were male. There was no significant difference between the groups with and without SPAR in terms of age (p=0.362), sex (p=0.549), hypertension (p=0.345), congestive heart failure (0.668), diabetes mellitus (p=0.150), coronary artery disease (p=0.518), ejection fraction (p=0.577), or left atrial area (p=0.696). In the univariate regression analysis, diabetes mellitus and plasma CRP levels were associated with the risk of SPAR. In the multivariate logistic regression analysis model including diabetes mellitus (OR: 1.996; 95% CI: (0.616–6.472); p=0.249) and plasma CRP levels (OR: 0.325; 95% CI: (0.049–2.143); p=0.243), neither factor was found to be independently associated with the risk of SPAR.

Conclusion: Clinical conditions that are known to increase the risk of developing atrial fibrillation, such as hypertension and congestive heart failure, were not associated with the development of SPAR.

Keywords: Atrial ectopic tachycardia, atrial flutter, geriatrics.

INTRODUCTION

Atrial fibrillation (AF) is the most common arrhythmia in the elderly population, and the prevalence of AF increases in direct proportion to age (1). AF has major complications, including stroke, cardiomyopathy, and congestive heart failure (2).

Inflammation and oxidative stress play an important role in the etiology of AF. Lymphocyte infiltrations, myocyte necrosis, cell damage findings due to oxidative stress, and fibrosis were frequently observed in atrial biopsy specimens of patients with atrial fibrillation (3). Numerous clinical studies have shown that inflammatory markers such as C-reactive protein (CRP), IL-6, and transforming growth factor-B can cause AF. Elevated basal plasma CRP and IL-6 levels increase the likelihood of recurrence after atrial fibrillation catheter ablation (4).

AF and atrial remodeling are associated with inflammation and oxidative stress. Atrial fibrosis increases with aging and causes premature atrial complexes and short atrial run attacks (SPAR). Brief episodes of atrial run attacks are a risk marker for atrial fibrillation. Frequent premature atrial complexes or SPARs on 24–48-hour Holter electrocardiogram are significantly associated with first stroke and mortality in elderly patients with sinus rhythm (5,6).

In this study, we aimed to determine the predisposing factors of SPARs in geriatric population.

MATERIALS AND METHODS

The study was conducted prospectively. Ethical approval was obtained from the ethics committee of Zonguldak Bülent Ecevit University (ethical approval no: 2015-56-07/07). Informed consent was obtained from the patients.

The study included patients with sinus rhythm aged 65 and over who were admitted to the cardiology outpatient clinic of Zonguldak Atatürk State Hospital between 2015 and 2016. The patients were diagnosed with SPARs using a 24-hour ECG holter.

Echocardiography was performed on all patients. The VIVID 7 Cardiovascular Ultrasound System (Vingmed-General Electric, Horten, Norway) with a 3.5 MHz probe was used for echocardiographic evaluation. Echocardiographic measurements were made in the left supine position. Parasternal long and short axes and apical angle standard viewing windows were used. The ejection fraction was calculated by the modified Simpson's method. All echocardiographic images were evaluated by an experienced cardiologist. Plasma CRP values were measured using a Roche Diagnostics Cobas 8000 analyzer. Patients with AF in the basal ECG or with hyperthyroidism, using beta-blockers or calcium channel blockers, digoxin and any anti-arrhythmic drugs were excluded from the study. Demographic data such as age, sex, chronic disease status (hypertension, diabetes mellitus, coronary artery disease, congestive heart failure), echocardiographic findings such as left ventricular ejection fraction, left atrial area, and CRP values were recorded from hospital records or patient anamnesis.

Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 20.0 for Windows (IBM Corp., Armonk, NY, USA). The conformity of the variables to the normal distribution was examined using visual (histogram and probability graphs) and analytical (Kolmogorov–Smirnov/Shapiro–Wilk tests) tests. Descriptive analyses were given using the median (min-max) for non-normally distributed variables. Categorical data were given using frequency (n) and percentage (%). The Mann–Whitney U test was used for non-normally distributed variables. Categorical variables between the groups were compared using the chi-square test and Fisher's exact test as appropriate. Univariate logistic regression analyses were performed to estimate the proportion of possible risk factors for the development of AF. Clinical parameters that were analyzed at $p < 0.20$ in a univariate model were included in multivariate logistic regression analyses to identify independent risk factors related to AF. In our study, diabetes mellitus and CRP showed $P < 0.20$ in a univariate model. Multivariate logistic regression analyses were performed for diabetes mellitus and CRP. The backward stepwise method was used to determine the most appropriate model. Odds ratios with 95% confidence intervals were calculated for each variable, and $p < 0.05$ was considered significant for all comparisons.

RESULTS

The study employed a total of 144 patients who met the criteria. Of the patients, 70.8% (n=102) were female and 29.2% (n=42) were male. The mean age was 73 (65-90). Of the patients, 86.1% (n=124) had hypertension, 28.5% (n=41) had diabetes mellitus, 26.4% (n=38) had heart failure, 30.6% (n=44) coronary artery disease, and 70.8% (n=102) dyslipidemia. The median left atrial area measurement level of the patients was 23.65 (16.5-34), and the median left ventricular ejection fraction was 57 (23-71). When the patients were classified as those with and without SPAR, there was no significant difference in terms of age (p=0.362), sex (p=0.549), hypertension (p=0.345), congestive heart failure (p=0.668), diabetes mellitus (p=0.150), coronary artery disease (p=0.518), ejection fraction (p=0.577), or left atrial area (p=0.696) (Table 1).

Table 1. Baseline characteristics of patients according to the short atrial runs in 24-hour ECG monitoring

Parameters	Short Paroxysmal Atrial Run (+)	Short Paroxysmal Atrial Run (-)	p
	(n=25)	(n=119)	
Age (years)	72 (65-87)	73 (65-90)	0.362
Female	18 (12.5%)	84 (58.3%)	0.549
Hypertension	20 (13.9%)	104 (72.2%)	0.345
Congestive heart failure (%)	5 (3.5%)	33 (22.9%)	0.618
Diabetes mellitus	4 (2.8%)	37 (25.7%)	0.150
Coronary artery disease	8 (5.6%)	36 (25.0%)	0.518
Dyslipidemia	17 (11.8%)	85 (59%)	0.810
Left ventricular ejection fraction (%)	57 (35-65)	57(23-71)	0.577
Left atrial area (mm²)	21.2 (16.5-34.0)	24.0 (17.0-33.0)	0.696
C-reactive protein (mg/dl)	0.4 (0.0-3.3)	0.1 (0.0-1.3)	0.020

Numerical variables were presented as median and categorical variables were defined as number (percentage).

Univariate logistic regression analyses were conducted to assess the proportion of possible risk factors for SPAR. In the univariate regression analysis including possible risk factors, diabetes mellitus and plasma CRP levels were found to be associated with the risk of SPAR (p<0.200). In the multivariate logistic regression analysis model, diabetes mellitus (OR: 1.996; 95% CI: (0.616–6.472); p=0.249) and plasma CRP levels (OR: 0.325; 95% CI: (0.049–2.143); p=0.243) were not independently associated with the risk of SPAR (Table 2).

Table 2. Univariate and multivariate logistic regression analyses indicating independent predictors of short atrial runs in 24-hour ECG

Parameters	Univariate Analyses		Multivariate Analyses	
	OR (95% CI)	p	OR (95% CI)	p
Diabetes Mellitus	2.369 (0.759–7.389)	0.137	1.996 (0.616–6.472)	0.249
CRP	0.228 (0.035–1.479)	0.121	0.325 (0.049–2.143)	0.243

Abbreviations: CRP: C-Reactive Protein, CI: Confidence Interval, OR: Odds Ratio.

DISCUSSION

Our study investigated the presence of clinical and laboratory parameters that can predict short atrial run attacks in 24-hour Holter ECG to anticipate possible atrial fibrillation risk in the geriatric patients within ECG in sinus rhythm at hospital admission. However, clinical conditions that are generally known to increase the risk of atrial fibrillation, such as hypertension and congestive heart failure, were not associated with the development of SPAR (7). Diabetes mellitus was associated with the development of SPAR in univariate analyses, but in multivariate regression analyses, it was not an independent risk factor for increasing short atrial run attacks. Additionally, left atrial dilatation, which increased the risk of atrial fibrillation in previous clinical studies, did not predict the development of SPAR in our study. Diabetes mellitus is known as an independent risk factor for AF. The underlying pathophysiology is related to structural and electrical remodeling. Glucose-lowering therapies may affect the development of AF. Patients with diabetes require optimal long-term rhythm control strategies (8). In geriatric population with comorbidities, AF often cannot be diagnosed until the first stroke occurs especially (9-12) Early detection of AF followed by initiation of oral anticoagulation has the potential to reduce these arrhythmia-associated strokes (13). Atrial high-rate episodes (AHRE) are atrial tachyarrhythmias detected by continuous rhythm monitoring by pacemakers, defibrillators, or implantable heart monitors, and there is increasing evidence in the literature that they increase the risk of atrial fibrillation, similar to SPAR episodes (14). Mizayawa et al. stated that advanced age and hypertension are risk factors for the long-term occurrence of AHRE (15). It was predicted that both arrhythmia attacks were related to atrial fibrosis. (5, 16) In addition to the data that can be obtained from cardiac implantable devices, many studies have been planned or carried out in recent years for the early diagnosis of atrial fibrillation due to the increasing availability of consumer electronics and wearable devices that can record and analyze heart rhythm (17,18). The Smart study included 882 people aged 65 and older who had no known AF, all patients were given a bracelet with a photoplethysmography sensor that connected to their smartphones. Atrial arrhythmias were detected in five percent of patients during the first four weeks of monitoring (19). Inflammation and fibrosis play an important role in the development of atrial cardiomyopathy (20). Atrial cardiomyopathy may cause atrial arrhythmias and SPAR attacks (21). There is increasing evidence that short supraventricular tachycardias seen on 24-hour ECG monitoring are associated with an increased risk of future atrial fibrillation and stroke (22-24). In a study by Johnson et al., which included 370 subjects with sinus rhythm attending an average of 13 years of follow-up, short SVT episodes detected during 24-hour ECG screening were associated with incident AF and ischemic stroke (25). The risk of high plasma CRP levels causing atrial fibrillation is confusing in the literature. In a meta-analysis including seven prospective studies, increased CRP levels were associated with a greater risk of AF recurrence after electrical cardioversion (26). In a clinical study by Lin, Yenn-Jiang et al., basal CRP levels before the atrial fibrillation catheter ablation procedure had an independent prognostic value indicating long-term recurrence (27). In contrast, in a clinical study conducted by Nicolas Lellouche et al., the basal CRP levels measured before atrial fibrillation catheter ablation were not associated with atrial fibrillation recurrence (28). Our study found no relationship between SPAR and diabetes mellitus, congestive heart failure or hypertension.

Limitations:

Our study has some limitations. It was conducted with a small number of subjects, and it was a single-center study.

CONCLUSION

Early detection of AF followed by initiation of oral anticoagulation has the potential to reduce these arrhythmia-associated strokes. There are limited studies in the literature on short atrial run attacks. We found no relationship between SPAR and clinical conditions that are known to increase the risk of developing atrial fibrillation, such as hypertension and congestive heart failure. Plasma CRP values were not associated with the development of SPAR. As an atrial fibrillation precursor, future extensive and multicenter studies are needed on detection of SPAR.

References

1. Lip GYH, Proietti M, Potpara T, Mansour M, Savelieva I, Tse HF, et al. Atrial fibrillation and stroke prevention: 25 years of research at EP Europace journal. Europace. 2023;25:euad226.

2. Wolf PA, Abbott RD, Kannel WB. Atrial fibrillation as an independent risk factor for stroke: the Framingham Study. Stroke. 1991;22:983-8.

3. Frustaci A, Chimenti C, Bellocci F, Morgante E, Russo MA, Maseri A. Histological substrate of atrial biopsies in patients with lone atrial fibrillation. Circulation. 1997;96:1180-4.

4. Ömür SE, Zorlu Ç, Yılmaz M. Comparison of the Relationship Between Inflammatory Markers and Atrial Fibrillation Burden. Anatol J Cardiol. 2023;27:486-93.

5. Fredriksson T, Gudmundsdottir KK, Frykman V, Friberg L, Al-Khalili F, Engdahl J, et al. Brief episodes of rapid irregular atrial activity (micro-AF) are a risk marker for atrial fibrillation: a prospective cohort study. BMC Cardiovasc Disord. 2020;20:167.

6. Himmelreich JCL, Lucassen WAM, Heugen M, Bossuyt PMM, Tan HL, Harskamp RE, et al. Frequent premature atrial contractions are associated with atrial fibrillation, brain ischemia, and mortality: a systematic review and meta-analysis. Europace. 2019;21:698-707.

7. Benjamin EJ, Levy D, Vaziri SM, D'Agostino RB, Belanger AJ, Wolf PA. Independent risk factors for atrial fibrillation in a population-based cohort. The Framingham Heart Study. JAMA. 1994;271:840-4.

8. Preda A, Carbone F, Tirandi A, Montecucco F, Liberale L. Obesity phenotypes and cardiovascular risk: From pathophysiology to clinical management. Rev Endocr Metab Disord. 2023;24:901-19.

9. Grond M, Jauss M, Hamann G, Stark E, Veltkamp R, Nabavi D, et al. Improved detection of silent atrial fibrillation using 72-hour Holter ECG in patients with ischemic stroke: a prospective multicenter cohort study. Stroke. 2013;44:3357–64.

10. Haeusler KG, Kirchhof P, Kunze C, Tutuncu S, Fiessler C, Malsch C, et al. Systematic monitoring for detection of atrial fibrillation in patients with acute ischaemic stroke (MonDAFIS): a randomised, open-label, multicentre study. Lancet Neurol. 2021;20:426–36.

11. Noubiap JJ, Thomas G, Middeldorp ME, Fitzgerald JL, Harper C, Sanders P. Atrial fibrillation detection using insertable cardiac monitor after stroke: a real-world cohort study. J Cardiovasc Electrophysiol. 2023;34:142–6.

12. Gladstone DJ, Wachter R, Schmalstieg-Bahr K, Quinn FR, Hummers E, Ivers N, et al. Screening for atrial fibrillation in the older population: a randomized clinical trial. JAMA Cardiol. 2021;6:558–67.

13. Hindricks G, Potpara T, Dagres N, Arbelo E, Bax JJ, Blomstrom-Lundqvist C, et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS): the Task Force for the diagnosis and management of atrial fibrillation of the European Society of Cardiology (ESC) developed with the special contribution of the European Heart Rhythm Association (EHRA) of the ESC. Eur Heart J. 2021;42:373–498.

14. Toennis T, Bertaglia E, Brandes A, Dichtl W, Fluschnik N, de Groot JR, et al. The influence of atrial high-rate episodes on stroke and cardiovascular death: an update. Europace. 2023;25:7:euad166.

15. Miyazawa K, Pastori D, Martin DT, Choucair WK, Halperin JL, Lip GYH, et al. Characteristics of patients with atrial high rate episodes detected by implanted defibrillator and resynchronization devices. Europace. 2022;24:375–83.

16. Takahashi Y, Yamaguchi T, Otsubo T, Nakashima K, Shinzato K, Osako R, et al. Histological validation of atrial structural remodeling in patients with atrial fibrillation. Eur Heart J. 2023;44:3339-53.

17. Lubitz SA, Faranesh AZ, Selvaggi C, Atlas SJ, McManus DD, Singer DE, et al. Detection of atrial fibrillation in a large population using wearable devices: the Fitbit heart study. Circulation. 2022;146:1415–24.

18. Rizas KD, Freyer L, Sappler N, von Stulpnagel L, Spielbichler P, Krasniqi A, et al. Smartphone-based screening for atrial fibrillation: a pragmatic randomized clinical trial. Nat Med. 2022;28:1823–30.

19. Fabritz LC, Czarnecki E, Dudek E, Guasch E, Haase D, Huebner T, et al. Smartphone and wearable detected atrial arrhythmias in Older Adults: results of a fully digital European Case finding study. Eur Heart J Digital Health. 2022;3:610–25.

20. Dzeshka MS, Lip GY, Snezhitskiy V, Shantsila E. Cardiac Fibrosis in Patients With Atrial Fibrillation: Mechanisms and Clinical Implications. J Am Coll Cardiol. 2015;66:943-59.

21. Farinha JM, Gupta D, Lip GYH. Frequent premature atrial contractions as a signaling marker of atrial cardiomyopathy, incident atrial fibrillation, and stroke. Cardiovasc Res. 2023;119:429-39.

22. Binici Z, Intzilakis T, Nielsen OW, Køber L, Sajadieh A. Excessive supraventricular ectopic activity and increased risk of atrial fibrillation and stroke. Circulation. 2010;121:1904-11.

23. Johnson LS, Juhlin T, Juul-Möller S, Hedblad B, Nilsson PM, Engström G. A prospective study of supraventricular activity and incidence of atrial fibrillation. Heart Rhythm. 2015;12:1898-904.

24. Engström G, Hedblad B, Juul-Möller S, Tydén P, Janzon L. Cardiac arrhythmias and stroke: increased risk in men with high frequency of atrial ectopic beats. Stroke. 2000;31:2925-9.

25. Johnson LSB, Persson AP, Wollmer P, Juul-Möller S, Juhlin T, Engström G. Irregularity and lack of p waves in short tachycardia episodes predict atrial fibrillation and ischemic stroke. Heart Rhythm. 2018;15:805-11.

26. Liu T, Li G, Li L, Korantzopoulos P. Association between C-reactive protein and recurrence of atrial fibrillation after successful electrical cardioversion: a meta-analysis. J Am Coll Cardiol. 2007;49:1642-8.

27. Lin YJ, Tsao HM, Chang SL, Lo LW, Tuan TC, Hu YF, et al. Prognostic implications of the high-sensitive C-reactive protein in the catheter ablation of atrial fibrillation. Am J Cardiol. 2010;105:495-501.

28. Lellouche N, Sacher F, Wright M, Nault I, Brottier J, Knecht S, et al. Usefulness of C-reactive protein in predicting early and late recurrences after atrial fibrillation ablation. Europace. 2009;11:662-4.