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Usefulness of ambulatory ECG monitoring for paroxysmal atrial fibrillation in patients presenting with palpitation

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Abstract

In this study, the focus was on exploring the prevalence of paroxysmal atrial fibrillation (AF) among patients presenting with palpitations, utilizing the method of 24-hour ambulatory electrocardiographic (ECG) monitoring. The research encompassed 248 participants, predominantly comprising females (75.8%), with an average age of 52.18 years, most of whom fell within the 50 - 59 age bracket. Prior to medical examination, the duration of palpitations ranged from 1 to 3 months for the majority of patients. The study's findings unveiled that 4.84% of the patients exhibited atrial fibrillation, while 1.61% showcased atrial flutter. Interestingly, the youngest individual diagnosed with AF was merely 43 years old. The investigation further delved into factors associated with a heightened prevalence of atrial fibrillation. Notably, advancing age was correlated with an increased risk of AF (odds ratio [OR] 1.064, 95% confidence interval [CI] 1.015 - 1.115, $p < 0.005$), along with the presence of valvular heart disease (OR 19.00, 95% CI 4.23 - 85.37, $p < 0.005$) and other structural heart diseases (OR 12.56, 95% CI 3.12 - 50.51, $p < 0.005$). This study underscores the significance of 24-hour ambulatory ECG monitoring in detecting a higher prevalence of atrial fibrillation compared to standard ECG testing. Additionally, it emphasizes the pivotal role of this monitoring technique in AF detection, particularly among older patients presenting with valvular or structural heart diseases, thus highlighting the importance of timely and accurate diagnosis in enhancing patient care and outcomes.

Keywords: Atrial fibrillation, 24-hour ambulatory ECG monitoring, Palpitation

Introduction

The 24-hour ambulatory electrocardiographic (ECG) monitoring constitutes a valuable tool for recording and evaluating the underlying causes of cardiovascular mortality, encompassing cardiac arrhythmias, coronary artery disease, myocardial infarction, heart block, and facilitating follow-up on cardiac arrhythmias.

Palpitations represent a prevalent clinical concern, typically benign, yet occasionally disruptive. Multiple factors contribute to palpitations, including cardiac arrhythmias originating from both atrial and ventricular sources, valvular heart disease, pericardial disease, stress, hyperthyroidism, hypoglycemia, pharmaceutical agents, among others, with idiopathic origins accounting for up to 16% of cases. [1]

Atrial fibrillation (AF) constitutes a common clinical issue, particularly prevalent among the elderly population. The incidence of AF stands at 19.2 per 1000 person-years, with a higher prevalence observed among Asians[2]. In individuals aged over 75 years, females exhibit twice the incidence compared to males, albeit with less severe manifestations[3]. Notably, in England, AF ranks as the most prevalent cardiac arrhythmia, exhibiting an age-related increase in incidence and a twofold increase in mortality compared to other cardiac arrhythmias[4]. In the United States, AF affects approximately 2.5 million individuals, with prevalence rates of 1.1% in males and 0.8% in females[5]. In Thailand, AF prevalence stands at around 0.36% among individuals over 30 years old, with a rising trend attributed to population aging[6].

Given its implications for morbidity and mortality, AF represents a significant clinical challenge. Risk factors for AF encompass a myriad of factors, including modifiable lifestyle elements and non-modifiable characteristics such as gender, advanced age (particularly over 70 years), genetic predisposition, and various structural heart diseases (e.g., rheumatic heart disease, congestive heart failure, valvular heart disease, coronary artery disease, and myocardial infarction), alongside hypertension, diabetes mellitus, pneumonia, obesity, smoking, electrolyte imbalances, thyrotoxicosis, and septicemia.

Clinical evaluation, including comprehensive history-taking and physical examination, aids in diagnosing AF, with confirmation typically achieved via 12-lead ECG. While many patients with AF are asymptomatic, some may present with palpitations or exertional dyspnea, while more severe cases may manifest as heart failure or stroke. Additionally, physical signs such as left ventricular hypertrophy, signs of heart failure, valvular heart disease, or indications of chronic lung disease or hyperthyroidism may be evident.

This study endeavors to ascertain the prevalence of paroxysmal AF, evaluated through 24-hour ambulatory ECG monitoring, among patients presenting with palpitations.

Material and method

Study Design and Protocol:

A descriptive cross-sectional study, conducted at a single center, was undertaken. This retrospective study analyzed previously collected data from the center's records. Patients presenting with palpitations were enrolled, and their cardiac activity was assessed using 24-hour ambulatory electrocardiographic (ECG) monitoring. The DigiTrak XT and SEER 1000 devices, featuring a full-disclosure ECG recorder with 3 channels, were employed for the monitoring process. Data interpretation was facilitated through ECG data analysis software. The monitoring device was affixed to a shoulder strap worn by the patient. Two Cardiologists (S.J and A.P) meticulously analyzed the 24-hour ambulatory ECG monitoring reports for arrhythmias and other pertinent findings.

Atrial fibrillation (AF) was defined as any episode lasting longer than 30 seconds. The study protocol received approval from the Medical Ethics Committee of Rajavithi Hospital.

Study Population:

Eligible participants were aged 18 years or older and had experienced at least one episode of palpitation recorded via 24-hour ambulatory ECG monitoring at Rajavithi Hospital between January 2017 and January 2019. The data collected from patients encompass baseline information, including age, sex, BMI, underlying diseases, duration of palpitation. Additionally, laboratory data such as blood sugar, thyroid function, and renal function is also collected. Exclusion criteria encompassed evidence of myocardial ischemia or cardiac arrhythmias, including a history of atrial fibrillation, prior to study enrollment.

The sample size was determined referencing the study by Badri and Klara Paudel, which anticipated a prevalence of atrial fibrillation (AF) at 7.8%. Accordingly, a total study population of 120 participants, accounting for potential dropouts, was deemed necessary for this investigation.

Patients with other identifiable medical etiologies for their symptoms, such as those with a confirmed diagnosis of arrhythmias on ECG that aligns with their symptoms, or those currently using anti-arrhythmic drugs, were also excluded from the study.

Endpoints:

The primary endpoint was the determination of the prevalence of paroxysmal atrial fibrillation. Secondary endpoints included identifying factors associated with the prevalence of paroxysmal atrial fibrillation and atrial flutter.

Statistical Analysis:

Descriptive statistics were employed to analyze baseline demographic data. Categorical variables, such as sex or underlying diseases, were compared using the Chi-square test or Fisher's exact test and presented as percentages. Continuous variables, such as BMI or age, were assessed using the Independent t-test or the Mann-Whitney U test and expressed as mean ± standard deviation (S.D.) or median ± interquartile range (IQR). Logistic regression analysis was utilized to identify factors associated with paroxysmal atrial fibrillation and atrial flutter, with results presented as odds ratios (OR). All statistical analyses were two-tailed, with a p-value < 0.05 considered statistically significant. The Statistical Package for Social Scientists (SPSS version 23.0) was used for all data analyses.

Results

A total of 248 patients participated in the study, with approximately 75% being females. The mean age of the participants was 52.18 years, with a mean body mass index (BMI) of 24.09 kg/m2. Roughly one-third of the patients had a normal BMI. The majority of patients experienced palpitations for a duration of 1-3 months before seeking investigation. The most prevalent underlying diseases among the patients were hypertension (37.5%) and dyslipidemia (22.2%). Table 1 displays the baseline characteristics of the study population.

Arrhythmias detected by 24-hour ambulatory ECG monitoring are outlined in Figure 1. Atrial fibrillation was identified in 4.84% of the population, while atrial flutter was found in 1.61%. Overall, 71.37% of patients exhibited arrhythmias, with 28.63% demonstrating normal sinus rhythm. Other observed arrhythmias included ventricular ectopic beats (27.82%), atrial ectopic beats (18.55%), atrial tachycardia (8.06%), supraventricular tachycardia (3.23%), sick sinus syndrome (2.82%), AV block (2.42%), Wolf Parkinson's White (1.61%), and ventricular tachycardia (0.4%).

Table 2 elucidates that advanced age, valvular heart disease, and other structural heart diseases were associated with paroxysmal atrial fibrillation and atrial flutter.

Table 1. Baseline characteristics of the study population

	Total (n = 248)		AF (n = 12)		No AF (n = 236)		p-value
	n	%	n	%	n	%	
Sex							**1.000**
Female	188	75.8%	9	75.0%	179	75.8%	
Male	60	24.2%	3	25.0%	57	24.2%	
Age (years)							**0.085**
< 30	28	11.3%	0	0%	28	11.9%	
30 - 39	31	12.5%	0	0%	31	13.1%	
40 - 49	39	15.7%	1	8.3%	38	16.1%	
50 - 59	61	24.6%	4	33.3%	57	24.2%	
60 - 69	54	21.8%	2	16.7%	52	22.0%	
70 - 79	30	12.1%	4	33.3%	26	11.0%	
≥ 80	5	2.0%	1	8.3%	4	1.7%	
Mean±SD	52.18	±15.89	64.33	±12.55	51.56	±15.82	0.006
BMI (kg/m^2)							**0.326**
Underweight < 18.5	10	4.0%	1	8.3%	9	3.8%	
normal 18.5 - 22.9	90	36.3%	4	33.3%	86	36.4%	
overweight 23 - 24.9	57	23.0%	1	8.3%	56	23.7%	
Obese I 25 - 29.9	73	29.4%	6	50.0%	67	28.4%	
Obese II ≥ 30	18	7.3%	0	0%	18	7.6%	
Mean ± SD	24.09	±3.73	24.09	±3.62	24.08	±3.74	0.994
Duration of palpitation							**0.825**
Below 1 month	65	26.2%	2	16.7%	63	26.7%	
1 - 3 months	111	44.8%	7	58.3%	104	44.1%	
3 - 6 months	27	10.9%	2	16.7%	25	10.6%	
6 - 12 months	12	4.8%	0	0%	12	5.1%	
Beyond 1 year	33	13.3%	1	8.3%	32	13.6%	
Underlying disease							
Diabetes	16	6.5%	0	0%	16	6.8%	0.351
Hypertension	74	29.8%	6	50.0%	68	28.8%	0.118
Dyslipidemia	55	22.2%	4	33.3%	51	21.6%	0.340
Chronic kidney disease	10	4.0%	0	0%	10	4.2%	0.467
ESRD on HD	1	0.4%	0	0%	1	0.4%	1.000
Kidney transplantation	2	0.8%	0	0%	2	0.8%	1.000

Table 1. Baseline characteristics of the study population (cont.)

	Total (n = 248)		AF (n = 12)		No AF (n = 236)		p-value
	n	%	n	%	n	%	
Previous stroke/TIA	3	1.2%	0	0%	3	1.3%	1.000
Coronary artery disease	11	4.4%	1	8.3%	10	4.2%	0.501
Valvular heart disease	8	3.2%	2	16.7%	6	2.5%	0.007
Underlying disease							
Others structural heart disease	10	4.0%	2	16.7%	8	3.4%	0.023
Arrhythmias	2	0.8%	0	0%	2	0.8%	1.000
Thyroid disease	9	3.6%	0	0%	9	3.8%	0.491
Liver disease	5	2.0%	0	0%	5	2.1%	1.000
Non hematologic malignancy	9	3.6%	1	8.3%	8	3.4%	0.372
Hematologic malignancy	1	0.4%	0	0%	1	0.4%	1.000
Hematologic disease	4	1.6%	0	0%	4	1.7%	1.000
Autoimmune disease	7	2.8%	0	0%	7	3.0%	0.545
HIV infection	5	2.0%	1	8.3%	4	1.7%	0.221
Mental disorder	6	2.4%	1	8.3%	5	2.1%	0.172
Others	25	10.1%	2	16.7%	23	9.7%	0.437

p-value from Fisher's Exact Test, Mann-Whitney U-test and Independent t-test, * Significant at the 0.05

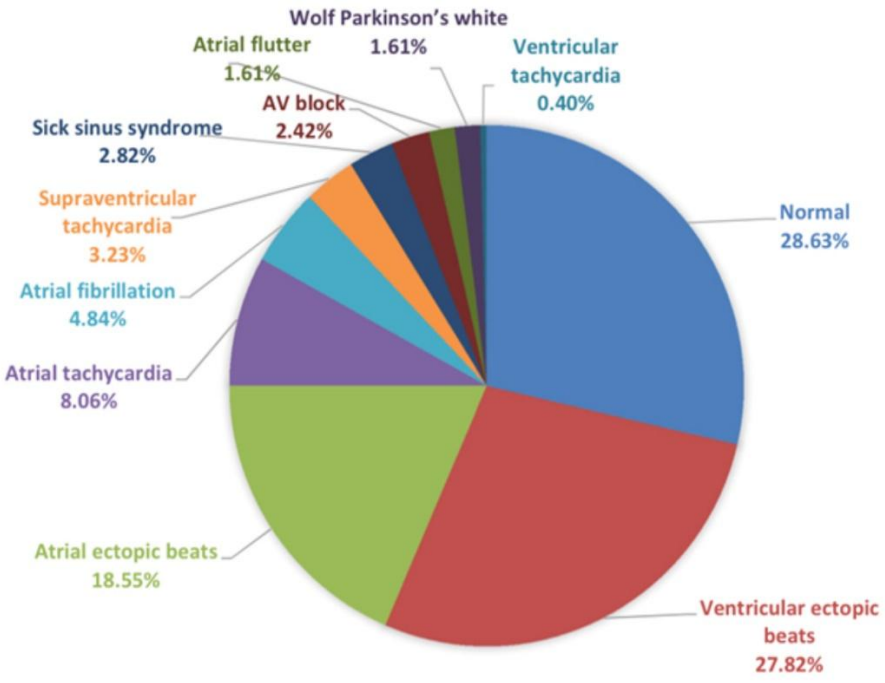

Figure 1 Cardiac arrhythmias detected by 24-hour ambulatory ECG monitoring

Table 2. Factors associated with the prevalence of paroxysmal AF and atrial flutter

	Crude OR	(95%CI)	p-value	Adjusted OR*	(95%CI)	p-value
Valvular heart disease	7.667	(1.371 - 42.857)	0.020	15.40	(1.589 - 149.136)	0.018
Age	1.064	(1.015 - 1.115)	0.009			
Other structural heart disease	5.700	(1.069 - 30.397)	0.042			

* Adjusted by age and other structural heart diseases

Discussion

Palpitations represent a common clinical complaint characterized by sensations of rapid, slow, or irregular heartbeats[7]. Given their varied etiologies, palpitations frequently prompt hospital visits. While routine 12-lead ECGs are often utilized for evaluation, portable ECG recorders capable of 24-hour monitoring have emerged to address diagnostic challenges. This study aims to assess the prevalence of paroxysmal atrial fibrillation among patients experiencing palpitations. Various studies have explored this topic, such as Badri and Klara Paudrel's investigation into the diagnostic significance of 24-hour ambulatory ECG monitoring in evaluating palpitations, which involved 335 symptomatic individuals undergoing monitoring and revealed a 7.8% prevalence of paroxysmal atrial fibrillation and atrial flutter[1].

Additionally, Joao Primo et al.'s study in Portugal, focusing on individuals over 40 years old, reported a prevalence of 12.4% for atrial fibrillation[2]. Notably, recent randomized trials comparing routine versus targeted population-based screening demonstrated similar rates of new case detection between systematic and opportunistic screening methods[8,9].

In our study, among 248 patients undergoing 24-hour ambulatory ECG monitoring for palpitations, 71.37% exhibited arrhythmias, with ventricular ectopic beats being the most common. The prevalence of atrial fibrillation was 4.84%, and atrial fibrillation/flutter combined was 6.45%, aligning with findings from previous investigations. Furthermore, our study identified a higher prevalence of atrial fibrillation among older patients and those with valvular or structural heart diseases compared to the general population.

While our study did not evaluate ST-T changes during ambulatory ECG monitoring, such monitoring could potentially detect episodes of silent myocardial infarction. However, current guidelines suggest limited evidence supporting the use of ambulatory ECG monitoring for asymptomatic patients without coronary artery disease[10].

However, several limitations should be acknowledged. Firstly, the retrospective nature of the study may introduce bias and confounding variables. Secondly, the relatively small sample size could impact the primary endpoint. Lastly, some patients with a history of palpitations declined 24-hour ambulatory ECG monitoring. The absence of data from patients who declined 24-hour ambulatory ECG monitoring may result in missing information regarding their symptoms, underlying conditions, and potential arrhythmias, limiting the comprehensiveness of the study and the ability to draw robust conclusions. Moreover, if patients with more severe symptoms or a higher likelihood of arrhythmias were more inclined to decline monitoring, this could lead to an underestimation of the true prevalence of arrhythmias in the study population.

In conclusion, our retrospective cross-sectional study aimed to assess the prevalence of paroxysmal atrial fibrillation among patients experiencing palpitations. While our findings indicated a prevalence of atrial fibrillation at 4.84% and a combined prevalence of atrial fibrillation/flutter at 6.45%, these figures exhibited a slight deviation from the rates reported in previous investigations by Badri and Klara Paudrel (7.8%) and Joao Primo et al. (12.4%). The observed differences may be attributed to variations in population demographics, diagnostic approaches, geographic factors, and temporal considerations. Nonetheless, our study provides valuable contributions to the understanding of atrial fibrillation prevalence in our study cohort.

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