

## Evaluation of arrhythmia frequency with Holter electrocardiography in pregnant with palpitation complaints

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### ABSTRACT

**Objectives:** The aim of this study was to investigate the underlying etiology and the frequency of arrhythmia by Holter electrocardiography (ECG) in pregnant women with palpitations.

**Patients and methods:** Between January 2019 and March 2021, a total of 64 pregnant women (mean age: 29.1±5.3 years; range, 20 to 46 years) who were admitted to the cardiology outpatient clinic with the complaint of palpitations and had a Holter ECG were retrospectively analyzed. Data including demographic and clinical characteristics of the patients, Holter ECG records, imaging findings, and biochemical data were recorded.

**Results:** The mean systolic blood pressure was 118.7±16.4 mmHg and the mean heart rate was 96.2±18.2 bpm. There was an arrhythmia on Holter ECG in 32 (50%) of the patients. The most common arrhythmias were ventricular extrasystoles in 21.9% and supraventricular tachycardia in 14.1% of the patients. The frequency of paroxysmal atrial fibrillation was 4.7%. Non-sustained ventricular tachycardia (VT) was detected in two (3.1%) patients.

**Conclusion:** Identifying underlying arrhythmias in pregnant women with palpitation is of utmost importance for both the maternal and fetal health. The incidence of arrhythmias that should be treated in this patient group is too high to be ignored.

**Keywords:** Arrhythmia, holter electrocardiography, pregnancy.

Palpitations are common during pregnancy. Although this condition sometimes affects quality of life, it is usually benign in structurally normal hearts and requires treatment in only rare cases. Physiological changes during pregnancy may be the cause of palpitations. During pregnancy, blood volume increases by an average of 50%.<sup>[1,2]</sup> This can cause atrial stretch, which may be important for arrhythmogenesis.<sup>[1]</sup> The hormonal changes that occur during pregnancy can exert a proarrhythmic effect on myocardial tissue. The increased sympathetic outflow that occurs during pregnancy is also likely to contribute to proarrhythmic states.<sup>[1,3]</sup> Therefore, the risk of supraventricular and ventricular arrhythmias increases during pregnancy. Hormones, atrial stretch, and automatic tone alterations are the main mechanisms of arrhythmia.<sup>[2]</sup> Thus, pregnant patients can frequently apply to cardiology outpatient clinics with the complaint of palpitations.

In the present study, we aimed to investigate the underlying etiology and the frequency of arrhythmia

by Holter electrocardiography (ECG) in pregnant patients with palpitations.

### PATIENTS AND METHODS

This single-center, retrospective study was conducted at Silopi State Hospital, Cardiology outpatient clinic between January 2019 and March 2021. A total of 64 pregnant women (mean age: 29.1±5.3 years; range, 20 to 46 years) who applied to our clinic with the complaint of palpitations and had a Holter ECG were included in the study. Data including demographic and clinical characteristics of the patients, Holter ECG records, imaging findings,

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and biochemical data were obtained from the hospital database. Inclusion criteria were as follows: being >18 years old; being pregnant having the complaint of palpitation; having no signs of arrhythmia in baseline ECG; and having a 24-h Holter ECG record. Exclusion criteria were as follows: being younger than 18 years old; having severe kidney or liver failure; having known arrhythmia; being ineligible for an optimal echocardiographic examination; and having no evaluable Holter ECG. A written informed consent was obtained from each patient. The study protocol was approved by the Bakircay University Non-Invasive Clinical Research Ethics Committee (Date No: 13/10/2021-358). The study was conducted in accordance with the principles of the Declaration of Helsinki.

### Definitions

Supraventricular tachycardia (SVT) was defined as a narrow QRS complex rhythm with a rate of >100 bpm originating from or above the atrioventricular node. Paroxysmal atrial fibrillation (PAF) was defined as an atrial origin tachycardia attack with a duration of  $\geq 30$  sec on Holter ECG, with a narrow QRS complex and an irregular RR distance. Non-sustained ventricular tachycardia (NSVT) was defined as ventricular-derived tachycardia with a wide QRS complex lasting more than three consecutive beats and less than 30 sec.

### Statistical analysis

Statistical analysis was performed using the IBM SPSS for Windows Version 25.0 software (IBM Corp., Armonk, NY, USA). To confirm the normal distribution of the study variables, the Kolmogorov-Smirnov test was used. Continuous variables were expressed in mean  $\pm$  standard deviation (SD) or median (min-max) values, while categorical variables were expressed in number and frequency.

## RESULTS

Of the patients, the mean systolic blood pressure was  $118.7 \pm 16.4$  (range, 90 to 165) mmHg and the mean heart rate was  $96.2 \pm 18.2$  (range, 57 to 138) bpm. Nine (14.1%) of the patients were smokers. Hypertension was present in 11 (17.2%) patients, and seven (10.9%) of these hypertensive patients had gestational hypertension. Ten (15.6%) patients had thyroid disease and three (4.7%) patients had diabetes mellitus. Anemia, one of the etiologies of arrhythmia,

was detected in 34.4% of the study population. Demographic and clinical data of the patients are given in Table 1.

Among the biochemical parameters, the mean hemoglobin value was  $11.7 \pm 1.7$  g/dL and the mean thyroid-stimulating hormone was  $1.3 \pm 0.8$  mU/mL. The mean ferritin was  $26.4 \pm 24.6$  ng/mL and the mean vitamin B12 was  $250.4 \pm 108.7$  pg/mL. The mean left ventricular ejection fraction was  $63.1 \pm 4.3\%$ . Of the patients, three (4.7%) had moderate-to-severe mitral regurgitation, one (1.6%) had moderate-to-severe mitral stenosis, and six (9.4%) had moderate-to-severe tricuspid regurgitation. Laboratory and echocardiographic features of the patients are presented in Table 2.

**Table 1**  
Demographic, clinical, and medication data of the study population (n=64)

Variables	n	%	Mean $\pm$ SD
Demographic and clinical			
Age (year)			29.1 $\pm$ 5.3
Hypertension	11	17.2	
Diabetes mellitus	3	4.7	
Hyperlipidemia	6	9.4	
Asthma	2	3.1	
Anemia	22	34.4	
Thyroid disease	10	15.6	
Parathyroid disease	2	3.1	
Stroke/TIA history	1	1.16	
PTE history	1	1.16	
Smoking	9	14	
Systolic BP (mmHg)			118.7 $\pm$ 16.4
Diastolic BP (mmHg)			69.8 $\pm$ 10.9
Mean pulse (per min)			96.2 $\pm$ 18.2
Medications			
Beta-blockers	15	23.4	
NDH-CCBs	4	6.3	
DHP-CCB	6	9.4	
Iron preparations	15	23.4	
Vitamin B12	12	18.8	

SD: Standard deviation; TIA: Trans ischemic attack; PTE: Pulmonary thromboembolism; BP: Blood pressure; NDH: Non-dihydropyridine; CCB: Calcium channel blocker; DHP: Dihydropyridine.

**Table 2**

Laboratory and echocardiographic characteristics of the patients (n=64)

Variables	n	%	Mean±SD
<b>Laboratory</b>			
WBC (10 <sup>9</sup> /L)			10.2±3.3
Hemoglobin (g/dL)			11.7±1.7
Platelet count (10 <sup>9</sup> /L)			253.0±61.6
Urea (mg/dL)			7.9±2.9
Creatinine (mg/dL)			0.6±0.1
Sodium (mEq/L)			138.9±2.3
Potassium (mg/dL)			4.1±0.3
Fasting blood glucose (mg/dL)			94.7±16.9
AST (U/L)			18.5±7.3
ALT (U/L)			19.5±8.1
Total cholesterol (mg/dL)			175.5±39.4
HDL-cholesterol (mg/dL)			44.2±12.1
LDL-cholesterol (mg/dL)			102.9±26.2
Plasma triglyceride (mg/dL)			157.6±97.1
TSH (mU/mL)			1.3±0.8
Ferritin (ng/mL)			26.4±24.6
B12 (pg/mL)			250.4±108.7
<b>Echocardiography</b>			
LVEF (%)			63.1±4.3
Moderate-severe MR	3	4.7	
Moderate-severe MS	1	1.6	
Moderate-severe TR	6	9.4	

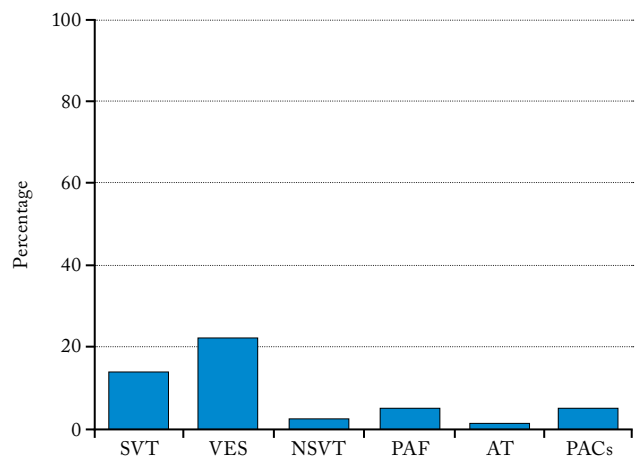
SD: Standard deviation; WBC: White blood cell; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; TSH: Thyroid-stimulating hormone; LVEF: Left ventricular ejection fraction; MR: Mitral regurgitation; MS: Mitral stenosis; TR: Tricuspid regurgitation.

**Table 3**

Types of arrhythmias on Holter ECG (n=64)

Variables	n	%
Ventricular extrasystole	14	21.9
Supraventricular tachycardia	9	14.1
Paroxysmal atrial fibrillation	3	4.7
Premature atrial contraction	3	4.7
Non-sustained VT	2	3.1
Atrial tachycardia	1	1.6

VT: Ventricular tachycardia.

**Figure 1.** Types and frequency of arrhythmia detected by Holter electrocardiography in pregnant women with palpitation.

Any arrhythmia on surface ECG could be detected in any of the patients. There was an arrhythmia on Holter ECG in 32 (50%) of the patients. The most common arrhythmias detected in Holter ECG were ventricular extrasystole in 21.9% and SVT in 14.1%. The frequency of PAF was 4.7%. Two (3.1%) patients had NSVT. Types of arrhythmias are presented in Table 3 and Figure 1.

Fifteen (23.4%) of the patients were using beta-blocker drugs. The rates of the use of iron and vitamin B12 supplements were 23.4% and 18.8%, respectively.

## DISCUSSION

In the current study, we investigated the underlying etiology and the frequency of arrhythmia by Holter ECG in pregnant patients with the complaint of palpitations. Our study showed an arrhythmia in half of the pregnant women as evidenced by the Holter ECG.

Cardiac arrhythmias are one of the most common cardiac complications encountered in pregnancy.<sup>[4]</sup> Pregnancy may trigger exacerbations of pre-existing arrhythmias in some patients, while in others, arrhythmias may occur for the first time.<sup>[5,6]</sup> Physiological alterations associated with normal pregnancy, such as increased heart rate, decreased peripheral resistance, increased stroke volume, hormonal changes, and psychological stresses, as well as increased sympathetic activity, are

considered the most common triggers of arrhythmias in pregnant women.<sup>[6-8]</sup>

Ectopic beats and non-sustained arrhythmias are encountered in more than half of pregnant women who undergo examinations for palpitations that are usually benign and do not require treatment.<sup>[9,10]</sup> Similarly, the frequency of arrhythmia in the current study was 50%.

In previous studies of pregnant women with arrhythmias, the ECG, Holter ECG test, or telemetry was often used to assess the presence of arrhythmias. Holter ambulatory monitors typically record the ECG continuously over a 24- to 48-h period, and document arrhythmias occurring during this time.<sup>[11]</sup> In the current study, we evaluated the presence and type of arrhythmia by 24-h Holter ECG in pregnant patients who did not have any arrhythmia on surface ECG.

Ventricular tachycardias (VT) may occur as a new-onset arrhythmia during pregnancy or may be exacerbated by pregnancy. This situation is worrisome for both the maternal and fetal health.<sup>[12]</sup> Ventricular tachycardia can occur at any time during pregnancy. In a study including 11 pregnant women with new-onset of VT during pregnancy, the onset of VT was evenly distributed in the three trimesters and completely disappeared in the postpartum period.<sup>[13]</sup> In another study including 96 pregnant patients who were referred to the cardiology clinic for palpitations, syncope or dizziness, Holter ECG recordings were obtained in 19 patients, and NSVT was detected in only one patient as severe arrhythmia in the Holter ECG recording.<sup>[11]</sup> In the current study, there were two patients with NSVT.

It is still unclear whether pregnancy increases the risk of new-onset of SVT.<sup>[5,14]</sup> Patients with pre-existing SVT may experience exacerbations during pregnancy. Paroxysmal SVT) is the most common tachyarrhythmia in pregnancy presenting with palpitations, dyspnea, and presyncope.<sup>[15]</sup> In our study, paroxysmal SVT was detected in 14.1% of the patients. It is usually well tolerated, whereas it may cause hemodynamic deterioration and impaired fetal blood flow in patients with structural heart disease.<sup>[14,16]</sup>

A routine 24- to 48-h Holter monitoring is helpful in detecting frequent paroxysmal arrhythmias.<sup>[8,12]</sup> Thyroid dysfunction, electrolyte imbalance, anemia, anxiety, toxic drug use, and thromboembolism should be ruled out before the diagnosis of paroxysmal SVT is made.<sup>[15]</sup> Anemia was observed in 34.4% of the

patients in our study, and thyroid disease was observed in 15.6%.

There are several limitations in this study. First, our sample size was relatively small. Second limitation is the retrospective nature of this study. Thirdly, it was not investigated whether arrhythmias in these patients continued after pregnancy.

In conclusion, identifying underlying arrhythmia in pregnant women with palpitation is of utmost importance for both the maternal and fetal health. The incidence of arrhythmias that should be treated in this patient group is too high to be ignored. Even if the ECG is normal, rhythm monitoring with Holter ECG is critical for the detection of silent underlying arrhythmias in pregnant women with palpitations.

#### Declaration of conflicting interests

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