Assessment of Cardiac Electrical Activity in Lean and Obese Patients with Polycystic Ovary Syndrome

Mehmet Musa Aslan[1], Adem Atıcı[2], Arif Serhan Cevrioğlu[1]

[1]Department of Obstetrics and Gynecology, Sakarya University Training and Research Hospital, Sakarya, Turkey
[2]Department of Cardiology, Göztepe Training and Research Hospital, Istanbul, Turkey

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Abstract

Objective: Although there is an increased risk of cardiovascular disease in patients with polycystic ovary syndrome (PCOS), the results of arrhythmia in several studies are controversial. The aim of our study was to establish the effect of obesity on atrial and ventricular repolarization parameters in a larger group of patients with PCOS.

Methods: A total of 240 (128 lean and 112 obese) women with PCOS were included in the study. These patients were grouped as lean women (L-PCOS) with a body mass index (BMI) ≤25 kg/m2 and obese women (O-PCOS) with a BMI ≥30 kg/m2. P wave duration, QT interval, T peak-to-end interval, and the Tp–e/QT ratio were calculated from electrocardiogram.

Results: Although obese women with PCOS usually have higher blood pressure levels, blood pressure levels were in the normal ranges in our obese patients with PCOS. Glucose, fasting insulin, testosterone, and luteinizing hormone levels were higher in obese women with PCOS than in lean women with PCOS. There were no significant differences in atrial and ventricular repolarization parameters between the two groups. In the Pearson correlation test, BMI and testosterone levels were not correlated with atrial/ventricular repolarization parameters.

Conclusion: Atrial and ventricular repolarization parameters did not demonstrate differences between lean and obese women with PCOS. In addition, these parameters remained in the normal range between two groups.

Keywords: Polycystic ovary syndrome, atrial repolarization, ventricular repolarization, obese and lean patients

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Polikistik Over Sendromlu Zayıf ve Şişman Hastalarda Kardiyak Elektriksel Aktivitenin Değerlendirilmesi

Öz

Amaç: Polikistik over sendromlu (PKOS) hastalarda artmış kardiyovasküler hastalık riski olmasına rağmen, çalışmalarda aritmi sonuçları tartışmalıdır. Bu çalışmanın amacı, PKOS'lu hastalarda obezitenin atriyal ve ventriküler repolarizasyon parametreleri üzerindeki etkisini belirlemekti.

Yöntemler: Çalışmaya 128 zayıf ve 112 obez olmak üzere toplam 240 PKOS' lu kadın dahil edildi. Hastalar iki gruba ayrıldı: vücut kitle indeksi (VKİ) ≤25 kg / m2 olan zayıf ve VKİ ≥30 kg / m2 olan obez PKOS tanılı hasta. P dalgası süresi, QT aralığı, Tp-e ve Tp-e/QT oranı elektrokardiyogramdan hesaplandı.

Bulgular: PKOS'lu obez kadınlarda kan basıncı değerleri genellikle daha yüksek olmasına rağmen, çalışma grubumuzdaki PKOS'lu obez kadınların kan basıncı değerleri normal sınırlarda idi. Glukoz, açlık insülini, testosteron ve LH düzeyleri PKOS'lu obezlerde zayıflara göre daha yüksek saptandı. İki grup arasında atriyal ve ventriküler repolarizasüyon parametrelerinde anlamlı fark yoktu. Pearson korelasyon testinde VKİ ve testosteron düzeyleri atriyal/ventriküler repolarizasyon parametreleri ile korelasyon göstermedi.

Sonuç: Atriyal ve ventriküler repolarizasyon parametreleri, PKOS'lu zayıf ve obez kadınlar arasında farklılık göstermedi. Ayrıca bu parametreler normal sınırlarda kalmıştır.

Anahtar Sözcükler: Polikistik over sendromu, atrial repolarizasyon, ventriküler repolarizasyon, obez ve zayıf hasta

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Polycystic ovary syndrome (PCOS) is one of the most common hereditary endocrinological diseases characterized by a combination of signs and symptoms of androgen excess and ovarian dysfunction after excluding other specific diagnoses [1]. The risk of metabolic syndrome and type 2 diabetes mellitus has been increased in patients with PCOS. In addition, an increased risk of cardiovascular disease has been demonstrated [2, 3]. Several studies have shown that the signs of parameters of endothelial dysfunction and early atherosclerosis, such as carotid intima thickness and coronary calcium score, have increased in

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Address for Correspondence/Yazışma Adresi: Mehmet Musa Aslan; Department of Obstetrics and Gynecology, Sakarya University Training and Research Hospital, Sakarya, Turkey
E-mail/E-posta: Jinopdrmma@gmail.com
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premenopausal women with PCOS. Moreover, myocardial infarction was more frequent in patients with PCOS [4-7]. However, the relationship between PCOS and cardiac arrhythmia is controversial. Previous studies have shown that QT dispersion, which is one of the ventricular repolarization parameters, did not increase, even decrease in patients with PCOS [8, 9]. On the other hand, many studies found that intra- and interatrial conduction durations prolonged and frequency of atrial fibrillation (AF) increased in patients with PCOS [10, 11]. In a study investigating the atrial and ventricular repolarization parameters in obese patients, P and QT dispersions were determined to be increased [12]. In another study, it was shown that the duration of intra- and interatrial conduction in patients with PCOS was prolonged, especially in obese patients with PCOS [13].

The aim of our study was to evaluate whether obesity has an effect on atrial and ventricular repolarization parameters in a larger group of patients with PCOS.

Material and Methods

Study population

The study protocol was approved by the Muş Alparslan University Scientific Research and ethics committee (79236777-050.04.04). Informed consent was obtained from each patient at the beginning of the study. All consecutive patients who applied at the Department of Obstetrics and Gynecology of our hospital were considered eligible for the study. A total of 240 (128 lean and 112 obese) PCOS women were included in the study.

The exclusion criteria of our study were as follows: hypertension, diabetes mellitus, pregnancy or lactation, preeclampsia, eclampsia, atherosclerotic heart disease, congestive heart failure, valvular heart disease, renal or hepatic dysfunction, abnormal thyroid function tests, any immunologic or rheumatologic disease, electrolyte imbalance, atrial arrhythmias, left or right bundle branch block, ST segment abnormalities, and drugs usage that could affect repolarization parameters on electrocardiogram (ECG).

After the exclusion of related disorders, PCOS was diagnosed according to the Rotterdam criteria, if at least two of the three of the following were present: (1) polycystic ovaries (presence of ≥12 follicles 2–9 mm across in each ovary or ovarian volume of >10 mL on ultrasound), (2) oligo- or anovulation, and (3) clinical (hirsutism (Ferriman–Gallwey score >7)) and biochemical hyperandrogenism tests. Height and weight of patients were directly measured. Body mass index (BMI) was determined by dividing weight (as kilograms) by the square of the height (as meters). Normal weight was defined as ≤25 kg/m^2 of BMI. Obesity was defined as ≥30 kg/m^2 of BMI.

Assessment of 12-lead ECG

The 12-lead ECG (AT-102; Schiller AG, Baar, Switzerland) was recorded from each patient at rest and in supine position. ECGs were obtained at a paper speed of 50 mm/s, with 1 mV/cm standardization. To increase accuracy, calipers and magnifying lenses were used. All repolarization parameter measurements were evaluated by cardiologists who did not know the clinical status of the patient. First atrial deflection from the isoelectric line, and offset was the return of the atrial signal to baseline, was determined as P wave. After measuring minimum and maximum P wave durations, the difference between these durations was determined as P dispersion. QT interval was considered from the onset of the QRS complex to the end of the T wave, and corrected QT was determined by using the Bazett formula: cQT=QT$\surd$ (R–R interval). The interval between the peak and the end of the T wave was defined as Tp–e interval. Tp–e interval was measured from precordial derivations. Tp–e/QTc ratio was calculated from these measurements.

Statistical Analysis

Variables in groups were analyzed by using the Statistical Package for the Social Sciences version 21 (IBM Corp.; Armonk, NY, USA) program. Normality analysis was performed using the Kolmogorov–Smirnov test. Numeric variables were presented as mean±SD, whereas nominal variables were presented as frequency and percentages. Continuous variables with normal distribution were evaluated by Student's *t* test, and Mann–Whitney U test was used for continuous variables that did not show normal distribution to test whether there were any differences between the two groups. Nominal parameters were analyzed by the chi-square test or Fisher's exact test, as appropriate. Whether there is a correlation between BMI and repolarization parameters was evaluated by using Spearman correlation test. Multivariate regression analysis was used to detect predictors of repolarization parameters. A p value <0.05 (two-tailed) was considered statistically significant.

Results

The demographic characteristics and biochemical assays of the groups are shown in Table 1. The patients in group 1 were younger. Although blood pressure was higher in obese women with PCOS, their blood pressures were in the normal ranges. Glucose, fasting

Table 1. Characteristics of the study population

	Group 1 (n: 128)	Group 2 (n: 112)	p
Age (years)	22.3±5.0	24.3±5.7	0.006
Systolic blood pressure, mm Hg	109.9±10.0	112.59±10.4	0.046
Glucose (mg)	80.2±11.6	89.3±13.9	<0.001
Fasting insulin (mU/L)	11.2±1.8	16.8±2.7	<0.001
Estradiol (pg/mL)	59.02±15.4	61.54±25.4	0.34
Testosterone (nmol/L)	49.72±13.4	85.29±19.8	<0.001
FSH, µU/mL	3.6±1.1	3.7±1.1	0.40
LH, µU/Ml	3.8±1.1	9.7±2.2	<0.001
Creatinine (mg/dL)	0.5±0.06	0.49±0.07	0.06
Sodium (mg/dL)	138.1±1.7	138.4±1.6	0.09
Potassium (mg/dL)	3.8±0.2	3.9±0.2	0.02

Normal (group 1) and obese (group 2)
FSH: follicle-stimulating hormone; LH: luteinizing hormone

Table 2. The electrocardiographic findings of the groups

	Group 1 (n: 128)	Group 2 (n: 112)	p
P max (ms)	167.7±11.3	167.8±8.8	0.94
P min (ms)	133.3±10.8	132.8±9.7	0.83
P dispersion	34.4±6.41	34.96±6.5	0.85
Max. QTc (ms)	391.39±19.9	393.50±16.3	0.37
Min. QTc (ms)	358.06±17.0	362.30±17.7	0.06
QTc dispersion	33.44±10.4	31.23±8.9	0.08
Mean QTc	372.94±18.6	377.34±16.1	0.06
Tp–e interval	75.0±9.3	75.0±9.8	0.95
Tp–e/QTc ratio	0.191±0.02	0.190±0.02	0.74

insulin, testosterone, and luteinizing hormone levels were higher in obese women with PCOS than in lean women with PCOS. The electrocardiographic findings for atrial and ventricular repolarization parameters at admission are demonstrated in Table 2. No significant differences in atrial and ventricular repolarization parameters were observed between the two groups. In the Pearson correlation test, BMI and testosterone levels were not correlated with atrial/ventricular repolarization parameters (Table 3).

Table 3. Correlation analysis between electrocardiographic findings and clinical characteristics in PCOS

	BMI	Testosterone
QTc dispersion	r: 0.005	r: –0.115
	p: 0.397	p: 0.07
Mean QTc	r: 0.070	r: 0.005
	p: 0.283	p: 0.40
Tp–e interval	r: 0.003	r: –0.009
	p: 0.56	p: 0.89
Tp–e/QTc ratio	r: 0.041	r: 0.008
	p: 0.51	p: 0.90
P dispersion	r: 0.017	r: 0.042
	p: 0.79	p: 0.54

BMI: body mass index; PCOS: polycystic ovary syndrome

Discussion

In our study, no difference was found at atrial and ventricular repolarization parameters between lean and obese patients with PCOS. In addition, there was no correlation between BMI and repolarization parameters.

Although there is an increased risk of cardiovascular disease in patients with PCOS, the results of arrhythmia in several studies are controversial [4-7]. In a study of 60 patients, P wave dispersion was found to be longer in patients with PCOS than in normal healthy women. They suggested that this could be an independent risk factor for the development of AF [10]. In another study, it was suggested that P wave duration increased in patients with PCOS and this parameter could predict cardiovascular events [14]. In a study evaluating atrial conduction times in obese and lean patients with PCOS, atrial repolarization times were longer in the obese PCOS group than in the lean PCOS group [13]. In our study, there was no difference in atrial depolarization times between the two groups. Our study obtained different findings that may be related to the larger number of patients and the prolongation of atrial conduction times within normal limits.

While patients with PCOS had concordant results related to atrial conduction times, there are conflicting results related to ventricular repolarization times in the studies. In a previous study, the authors demonstrated that patients with PCOS had significantly higher dispersions of P and QT than age- and sex-matched healthy volunteers. They suggested that this situation was associated with increased levels of estradiol [14]. Alpaslan et al. [8] found that there are no significant differences in ventricular repolarization, such as QT dispersion, corrected QT, and corrected QT dispersion, in patients with PCOS compared with normal healthy women. Another study showed that QTc interval

was shorter and inversely associated with increased levels of testosterone and QTc interval duration was not associated with an adverse cardiac event in patients with PCOS [15]. However, there were no differences in QT interval between two PCOS groups in our study.

In conclusion, our study is the largest study evaluating the atrial and ventricular repolarization parameters that found no differences in dispersion of P and QT in lean and obese patients with PCOS. Although atrial and ventricular repolarization parameters were changed, it remained within normal limits in the studies performed with PCOS. Whether this condition is pathological should be investigated with follow-up studies.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Muş Alparslan University Scientific Research (79236777-050.04.04).

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