

Diurnal changes of blood pressure values (24 h blood pressures) in women with polycystic ovary syndrome

Rytm dobowy ciśnienia tętniczego u kobiet z zespołem policystycznych jajników

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Summary

Background: More attention is being paid lately to polycystic ovary syndrome (PCOS) not only in the aspect of fertility but also according to long-term metabolic and cardiovascular abnormalities. Observations of women with PCOS show that the occurrence of blood hypertension is more frequent after the menopause. There are few articles concerning the predictable symptoms of blood hypertension. It seems that twenty-four hour blood pressure monitoring and assessment of changes of diurnal rhythm could be useful in this group of patients.

Aim of the study: The purpose of this study was to assess diurnal changes of blood pressure in women with polycystic ovary syndrome.

Material and methods: 26 women with PCOS diagnosed according to Rotterdam consensus criteria and Androgen Excess Society (AES) criteria were included in our study. The mean age of the examined women was 29.5 years and the mean BMI (body mass index) was 24.7 kg/m². The control group consisted of 12 age-matched women, without PCOS. Twenty-four hour Holter monitoring of ambulatory blood pressure was performed during normal daily activity in all patients. Halberg's cosinor method was used to analyse daily biorhythm.

Results: Results show the diurnal changes of systolic blood pressure in the preclinical phase in 30% and diastolic in 15% of PCOS women. In this group no physiological decrease of blood pressure at night time was observed.

Key words: polycystic ovary syndrome, hypertension, diurnal rhythm.

Streszczenie

Wstęp: W ostatnim czasie coraz więcej uwagi zwraca się na zespół policystycznych jajników (*polycystic ovary syndrome* – PCOS) – nie tylko w aspekcie niepłodności, ale również z punktu widzenia zachorowalności na przewlekłe choroby ogólnoustrojowe, w tym nadciśnienie tętnicze. Długofalowe obserwacje kobiet z PCOS wskazują na częstsze występowanie nadciśnienia tętniczego w późniejszym wieku. Nieliczne prace dotyczą poszukiwania czynników predykcyjnych wystąpienia nadciśnienia tętniczego. Wydaje się, że takim badaniem może być całodobowe monitorowanie ciśnienia tętniczego i ocena zmienności rytmu dobowego.

Cel pracy: Celem pracy była ocena dobowego rytmu ciśnienia tętniczego u kobiet z PCOS.

Materiał i metody: Do badań zakwalifikowano 26 kobiet, u których rozpoznano PCOS na podstawie kryteriów przyjętych w Rotterdamie w 2003 r., spełniały one również kryteria Towarzystwa ds. Nadmiaru Androgenów (*Androgen Excess Society* – AES). Średni wiek badanych kobiet wynosił 29,5 roku, średnia wartość wskaźnika masy ciała (*body mass index* – BMI) to 24,7 kg/m². Grupę kontrolną stanowiło 12 kobiet regularnie miesiączkujących, bez objawów androgenizacji, w podobnym wieku i z podobnym BMI. U wszystkich kobiet wykonywano ambulatoryjnie 24-godzinne monitorowanie ciśnienia metodą Holtera. Wyniki analizowano metodą cosinorową Halberga.

Wyniki: Wyniki badań wskazują na istnienie zaburzeń rytmu dobowego ciśnienia skurczowego w fazie przedklinicznej u ok. 30%, a rozkurczowego u 15% kobiet z PCOS.

Słowa kluczowe: zespół policystycznych jajników, nadciśnienie tętnicze, rytm dobowy.

Background

More attention is being paid lately to polycystic ovary syndrome (PCOS) not only in the aspect of fertility but also according to long-term metabolic and cardiovascular abnormalities [1]. Although the environmental conditioning in both syndromes is similar, it is unknown whether women with PCOS are more vulnerable to blood vessel illness [2]. Ambiguous values of blood pressure in women with PCOS result from different diagnostic criteria of this syndrome. The blood hypertension, like diabetes, may be present a long time before a definite diagnosis is made [3]. During this time a lot of disorders in blood vessels may occur. Early diagnosis and implementation of proper treatment significantly decreases the risk of serious complications such as cerebral stroke or coronary heart disease.

The diurnal changes of blood pressure may be responsible for the susceptibility to blood hypertension.

Aim

The purpose of this study was to assess the diurnal changes of blood pressure in women with PCOS.

Material and methods

A preliminary study estimating diurnal changes of blood pressure was conducted. The experimental group

consisted of 26 women with PCOS diagnosed according to Rotterdam consensus criteria 2003 and Androgen Excess Society (AES) criteria: clinical and/or biochemical signs of hyperandrogenism, clinical symptoms e.g. anovulatory cycles, and typical appearance of ovaries in vaginal ultrasonography [4, 5]. They were chosen randomly from patients attending the outpatient clinic due to menstrual abnormalities. All women complained of irregular bleeding, range 35-180 days. The Ferriman Gallwey hirsutism scale score was above 7 in all patients. The control group consisted of 12 regularly menstruating women (range 26-30 days), without hyperandrogenaemia and without ultrasound evidence of polycystic ovaries. The study group consisted of women willing to get contraception, with no pregnancy record in the past. These women were selected according to age and body mass index (BMI). Women smoking cigarettes were excluded from the study. None of the women from either the study or control group were diagnosed with cardiac disease, primary hypertension, renal disorders or any health conditions potentially affecting the values of blood pressure. The family histories of these patients were also clean according to those conditions. The results of measurements performed in both groups are presented in Table I. The mean age in the study group was 29.5 years, and 30.8 years in the control group. The difference was not statistically significant. The mean BMI in the study group was 24.77 kg/m², and 25.01 kg/m² in the control group. The difference was not statistically significant. The blood samples for hormonal tests – FSH (follicle stimulating hormone), LH (luteinizing hormone), prolactin, oestradiol, testosterone, DHEAS (dehydroepiandrosterone sulfate), TSH (thyroid stimulating hormone), insulin, glucose, triglycerides (TG) and total cholesterol (TC) – were taken between day 3 and day 5 of the menstrual cycle from each patient.

Non-invasive blood pressure monitoring using an automatic recorder was performed in both groups, in all outpatient women every 15 min during a 24-hour study period.

The results were analysed statistically by Halberg's cosinor method. Systolic and diastolic blood pressure were analysed separately. The mean values of systolic and diastolic blood pressure were analysed in both groups, as well as the diurnal changes of blood pressure. Calculation was performed in three stages. Data describing daily variability were presented in the form of a graph. The next stage was verification of whether deviations from the mean value were accidental or statistically significant. The third stage was statistical evaluation of diurnal values according to cosinor analysis. Halberg's cosinor method on account of the possibility of graphic interpretation of the results clearly presents characteristics of periodic blood pressure changeability.

Tab. I. Age, body mass index, endocrine and biochemical characteristics in women with polycystic ovary syndrome and control group

	Women with PCOS	Control group
numbers of patients	26	12
age (years)	29.5 ±3.48	30.76 ±4.19
BMI (kg/m ²)	24.7 ±5.01	25.01 ±2.89
FSH (IU/l)	6.00 ±1.46	6.13 ±1.08
LH (IU/l)	9.85 ±6.00*	4.03 ±1.39
PRL (ng/ml)	17.06 ±8.93	20.16 ±7.40
E ₂ (pg/ml)	53.63 ±18.89	42.31 ±20.95
T (ng/ml)	1.21 ±0.92*	0.44 ±0.22
DHEA-S (µg/dl)	5.45 ±2.19	3.25 ±0.92
TSH (mU/l)	1.42 ±1.00	1.23 ±0.50
glucose (mg%)	87.67 ±5.09	78.00 ±9.90
insulin (µIU/ml)	17.15 ±10.53	6.35 ±2.05
glucose/insulin	8.5 ±2.53	11.2 ±4.45
triglyceride (TG) (mg/dl)	90.50 ±26.2	90.87 ±24.40
total cholesterol (TC) (mg/dl)	184.5 ±53.03	170.5 ±13.44

* $p < 0.01$.

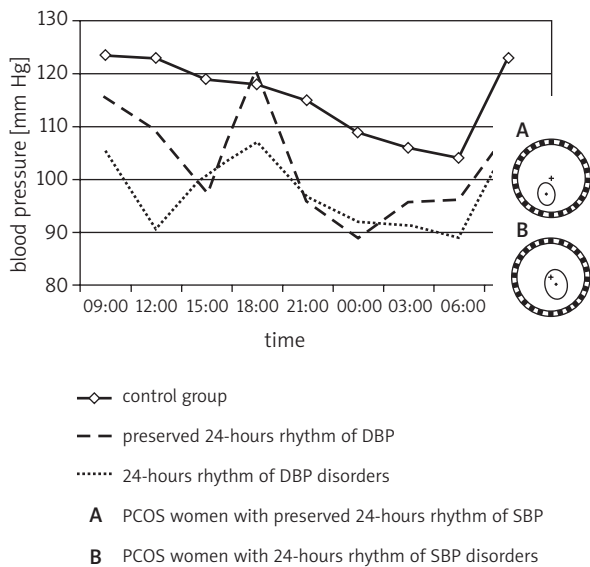


Fig. 1. Circadian rhythm of systolic blood pressure in women with polycystic ovary syndrome and in control group (mean values)

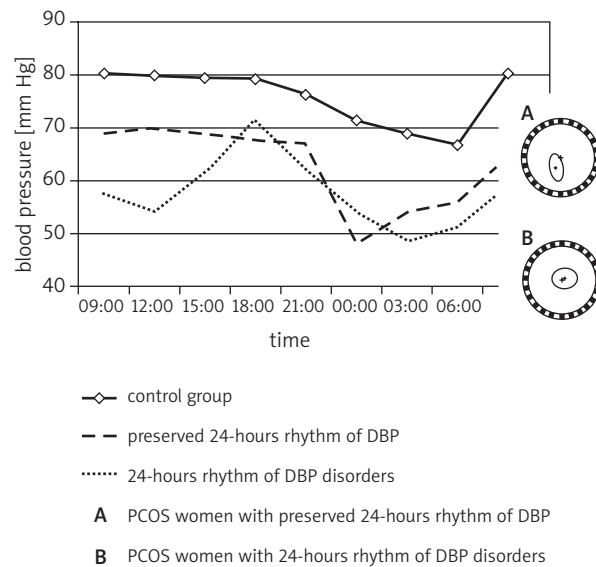


Fig. 2. Circadian rhythm of diastolic blood pressure in women with polycystic ovary syndrome and in control group (mean values)

Results

Clinical, endocrine and biochemical characteristics of women with PCOS and the control group are shown in Table I.

In the PCOS syndrome group in comparison with the control group there was a statistically significantly higher level of LH (9.85 ± 6.00 IU/l vs. 4.03 ± 1.39 IU/ml, respectively) and testosterone (1.21 ± 0.92 ng/ml vs. 0.44 ± 0.22 ng/ml, respectively). A relation of fasting insulin (17.15 ± 10.53 μ IU/ml vs. 6.35 ± 2.05 μ IU/ml, respectively), level of fasting glucose (87.67 ± 5.09 mg% vs. 78.0 ± 9.9 mg%, respectively) and glucose/insulin ratio was not found in any of the examined women.

A chronobiological analysis of the data was performed in order to test the whole-day blood pressure pattern. Halberg's single cosinor method was used to determine the values and the confidence limits of the following parameters of 24-hour rhythmic changes: mesor (rhythm-adjusted 24-hour average), amplitude (24-hour variability estimate), and acrophase (clock hour of maximum BP level).

The variation of the above parameters during the 24-hour periods was found to be within 9 mm Hg for the systolic mesor, 9.5 mm Hg for the diastolic mesor, 6 mm Hg for the systolic amplitude and 5 mm Hg for the diastolic amplitude. Diurnal rhythm of systolic and diastolic blood pressure is shown in Figures 1 and 2 respectively.

It was confirmed that in the PCOS group of women diurnal rhythm of blood pressure is retained, with average values of systolic and diastolic blood pressure

in the night time. None of the women was diagnosed with blood hypertension. Nevertheless, in 7 patients (27%) in the study group accidental measurements were above 135/85 mm Hg, and the same was found in 2 women (17%) from the control group.

Occasional increase of blood pressure occurring in some women made us analyse circadian rhythm for each woman in both groups. The detailed analysis of individual curves of blood pressure revealed single episodes of increase of systolic blood pressure in 8 (30.7%), and diastolic blood pressure in 4 (15.4%) PCOS women respectively. The curve during 24 hours is flat, indicating no physiological decrease in blood pressure in night hours.

Discussion

As yet it has not been specified how often women with PCOS suffer from cardiovascular diseases. There are a few studies confirming that the influence of periodic increase of blood pressure values in young women may be the first symptom of hypertension in older age in these women [6]. Hypertension is one of the most important risk factors of cardiovascular diseases. There are also a few studies in which the results show that women of middle age with PCOS have higher risk of hypertension, cardiovascular diseases and infarcts [7, 8]. Polycystic ovary syndrome women with hypertension often have insulin resistance and hyperinsulinaemia. These disorders have a negative influence on blood vessel flow, sympathetic nerve

system activation and sodium-potassium pump activation. These actions result in increased tension of vessel walls and impaired renal function, i.e. sodium excretion.

Women with PCOS and hyperinsulinaemia have higher risk of cardiovascular diseases than women with PCOS with normal levels of insulin. Accordingly, women with PCOS and normal levels of insulin have higher risk of cardiovascular diseases than women without PCOS (but with similar BMI values) [9]. In our study no significant differences in fasting glucose and insulin levels were found between the group with PCOS and controls. The glucose/insulin index was also not statistically different between those two groups (8.5 vs. 11.2, respectively). However, we found abnormal diurnal blood pressure values in 30% of women with PCOS. It has been claimed that one of the factors leading to onset of hypertension is lack of a physiological mechanism of decrease in blood pressure values during the night time [10].

Occurrence of hypertension in older age in women with PCOS may also be the result of hormonal disorders. It has been found that increased levels of testosterone, hyperinsulinaemia and insulin resistance may be risk factors of hypertension [10, 11]. Molecular and genetic studies show that enzymatic and gene disorders of steroidogenesis are the same in PCOS and hypertensive women [12-14]. The results of recent clinical studies show that early prevention of cardiovascular diseases by life style modification, and early diagnosis and treatment of hypertension as well as lipid metabolism disorders decrease the risk of coronary artery diseases and other vascular diseases, which are the most important cause of death in women [15, 16].

Conclusions

The results of the examination show the existence of a 24-hour rhythm of systolic blood pressure disorder in 30% and diastolic in 15% of women with PCOS in whom no physiological decrease of blood pressure in night hours was observed.

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