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DIURNAL VARIATION OF BLOOD PRESSURE IN PATIENTS WITH TYPE 2 DIABETES MELLITUS WITH CARDIOVASCULAR AUTONOMIC NEUROPATHY

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Annotation: We examined 80 patients with type 2 diabetes mellitus. All patients underwent Holter ECG monitoring. Based on this data, patients were divided into two groups: DAN (-) and DAN (+). All patients underwent 24-hour blood pressure monitoring. The time index of systolic and diastolic blood pressure, as well as the variability of systolic and diastolic blood pressure, were higher in the DAN (+) group. A time index greater than 20% was found in 75% of patients with type 2 diabetes mellitus and DAN (+).

Keywords: Type 2 diabetes mellitus, cardiovascular diabetic autonomic neuropathy, ambulatory blood pressure monitoring, SBP time index, SBP variability.

Relevance. Diabetic autonomic neuropathy is a common but underdiagnosed complication of diabetes mellitus (DM). The low incidence is due to the disease being asymptomatic for a long time. It has now been proven that cardiac autonomic neuropathy is associated with an increased risk of acute myocardial infarction and death in patients with DM.[4,6]. Arterial hypertension (AH) is a common comorbidity in diabetes mellitus. In addition to controlling blood glucose levels, blood pressure (BP) control remains necessary for the treatment of micro- and macrovascular complications of diabetes mellitus [1,2,3]. Given this influence of blood pressure, 24-hour blood pressure monitoring (ABPM) was recommended for assessing AH [5,7]. This study makes it possible to monitor blood pressure during the day. Since an increase in BP at night increases the load on the heart and affects the development of cardiovascular complications in patients with type 2 diabetes mellitus [8,10]. However, at present, not all patients undergo 24-hour blood pressure monitoring (ABPM) [9,11].

The aim of our study The aim was to study the daily fluctuations in blood pressure using 24-hour blood pressure monitoring in patients with type 2 diabetes mellitus.

Materials and methods of research. The study included 80 patients with type 2 diabetes, including 48 women and 32 men. Their average age was 55.7±0.49 years, and their disease duration averaged 7.3±0.2 years. The patients were receiving DPP-4 inhibitors, SGLT2 inhibitors, and biguanides as hypoglycemic agents. All patients underwent carbohydrate

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metabolism testing (fasting blood sugar, 2 hours after meals, glycated hemoglobin), as well as lipid metabolism testing (cholesterol, LDL, HDL, and triglycerides).

To determine hemodynamics, all patients underwent 24-hour blood pressure monitoring (ABPM) using a CONTEC ABPM device (made in China). 24-hour Holter monitoring was also performed to determine cardiovascular diabetic autonomic neuropathy. Based on the results of the Ewing cardiovascular tests, all patients were divided into two groups: DAN (+) and DAN (-). Forty-four patients were in the DAN (-) group, and 36 in the DAN (+) group.

Research results. All patients examined had their fasting blood sugar and glycated hemoglobin levels checked, both 2 hours after eating. The data obtained revealed that patients with DAN (-) had fasting blood sugar levels of 6.8±2.1 mmol/L, while those with DAN (+) had fasting blood sugar levels of 7.2±2.4 mmol/L.

Glycated hemoglobin in the first group of patients was 7.6±1.2% and in the second group 8.2±1.3% (Table 1). There were no significant changes in carbohydrate metabolism parameters in either group. Both groups were comparable in age and disease duration.

Table 1.

Biochemical parameters of patients with type 2 diabetes mellitus depending on the presence of diabetic autonomic neuropathy

Indicators	DAN (-), n= 44	DAN(+), n= 36
Age, years	56.3±2.1	55.4±2.3
Duration of diabetes, years	7.6±1.3	7.8±2.2
Fasting blood sugar, mmol/L	6.8±2.1	7.2±2.4
Blood sugar 2 hours after eating, mmol/L	9.8±1.6	10.1±2.3
Glycated hemoglobin, %	7.6±1.2	8.2±1.3
LDL, µmol/L	4.2±0.5	5.3±0.7
Triglycerides, µmol/L	1.8±1.4	1.9±0.9

All patients with type 2 diabetes underwent ABPM. Blood pressure measurements were taken automatically at 15-minute intervals during waking hours and 30-minute intervals at night. The daily blood pressure profile was assessed using the arithmetic mean values of SBP and DBP during the day and night, as well as the average pulse pressure (APP) over the course of 24 hours. The threshold blood pressure levels were considered to be 135/85 mmHg during the day and 120/70 mmHg at night. The time index of SBP and DBP (TI SBP, TI DBP) was used to quantitatively assess the magnitude of "pressure load." Persistent hypertension is characterized by a 24-hour TI greater than 50%, and greater than 30% during the day or night. The circadian rhythm was assessed using the daily index of SBP and DBP, reflecting the degree of nocturnal blood pressure decrease relative to daytime.

Table 2 .

Indicators of daily blood pressure monitoring in patients with type 2 diabetes mellitus depending on the presence of diabetic autonomic neuropathy

indicator	DAN – n=44	DAN + n=36

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Average SBP (day) mmHg	116.7±3.6	132.2±4.6
Average DBP (day) mmHg	78.4±2.1	81.2±3.3
Average SBP (night) mmHg	105.6±3.2	127.5±3.4
Average DBP (night) mmHg	64.7±4.5	76.2±2.3
IV SAD (day) %	35.6±2.3	41.4±3.8
IV DBP (day)%	32.8±2.8	40.15±5.6
IV SAD (night)%	43.2±4.3	59.4±2.9*
IV DAD (night)%	47.6±2.2	57.0±1.2
IV SAD day >20%	100	(27) 75%
IV DBP day >15%	100	(14) 38.9%
IV SAD night >10%	100	(32) 88.9%
IV DBP night >10%	100	(28) 77.8%

Note: *p≤0.05 reliability between indicators

As can be seen from Table 2, in patients without DAN (-), the average SBP was 116.7 mmHg. In patients with DAN (+), this indicator was 132.2 mmHg. Also, the average DBP was higher in the group of patients with DAN (+) 81.2 mmHg. When comparing the nighttime average SBP and DBP, it was noted to be higher in the group of patients with DAN (+).The time index (TI) of hypertension or "proportion of elevated BP" allows one to estimate the time of increase in BP during the day.The normal blood pressure time index in healthy individuals: daily SBP TI less than 25%, daytime less than 20%, nighttime less than 10%, daily DBP TI less than 25%, daytime less than 15%, nighttime less than 10%. When examining the results of ABPM indicators, it was revealed that in patients with DAN(+), SBP TI was greater than 20% in 75%, while in patients in the DAN(-) group there was no such patient. DBP TI greater than 15% was in 38.9% of patients in the DAN(+) group. According to the indicators, nighttime SBP and DBP TI greater than 10% were, respectively, 88.9% and 77.8% in the group of patients with DAN(+). Thus, daytime and nighttime SBP and DBP TI were higher in the group of patients with type 2 diabetes mellitus with DAN(+) cardiovascular form.

Increased variability of systolic (SBP) and diastolic (DBP) blood pressure (BP) means that BP fluctuations during the day exceed physiological norms. Blood pressure variability is calculated as the standard deviation from the average value for both daytime and nighttime periods. Critical values for patients with arterial hypertension (HTN):

- for SBP - 15/15 mmHg (day/night);
- for DBP - 14/12 mmHg (day/night).

If at least one of these values is exceeded, we speak of increased blood pressure variability.

Table 3.

Blood pressure variability in patients with type 2 diabetes mellitus depending on the presence of diabetic autonomic neuropathy

Indicator	DAN (-), n=44	DAN (+), n=36
Var SBP (day), mmHg	10.5±3.1	13.9±3.4*
Var DBP (day), mmHg	6.8±2.1	17.1 ±2.2*
Var SAD (night), mmHg	7.6±3.2	9.0±4.2
Variation of DBP (night), mmHg	8.4±2.3	13.8±1.6*

Note: *p≤0.05 reliability between indicators among groups

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As shown by the results of ABPM for BP variability, the variability of SBP during the day in the group of patients with DAN (+) was 13.9 mm Hg compared to the group of patients with DAN (-) 10.5 mm Hg. Also, it was noted that there was a higher variability of DBP in the group of patients with DAN (+) and with DAN (-) 17.1 and 6.8 mm Hg, respectively. When considering the variability of SBP at night in the group of patients with DAN (+) it was 9.0 mm Hg and exceeded compared to the group of patients without DAN (-) by 15.6%. The indicators of variability of DBP at night were noted that in the group of patients with DAN (+) 13.8 mm Hg, and in the group without DAN (-) 8.4 mm Hg and was lower by 39%.

Thus, in the group of patients with type 2 diabetes, the day-night variability of SBP, as well as the day-night variability of DBP, were higher in the group of patients with DAN(+).

Conclusions. When conducting ABPM in patients with type 2 diabetes, depending on the presence of DAN(+), 75% of patients with DAN(+) had an IV SBP during the day greater than 20%, and 38.9% had an IV DBP during the day greater than 15%. The same trend was observed for the IV SBP at night and IV DBP at night: 88.9% and 77.8%, respectively. All indicators of blood pressure variability (SBP and DBP) were higher day and night compared to the group of patients with DAN(+). It was found that systolic BP (SBP) variability is a strong predictor of stroke and myocardial infarction, independent of changes in SBP levels over the entire observation period in the ASCOT study (approximately 5 years), age, and gender of the patients. Long-term variability (variability between visits) of diastolic BP (DBP) also had prognostic value, although less than variability of SBP.

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