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CLINICAL CHARACTERISTICS OF THE TYPES OF DAILY BLOOD PRESSURE PROFILES IN PATIENTS WITH ARTERIAL HYPERTENSION DEPENDING ON THE SELECTED ABPM INDEX

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The frequency characteristics of the clinical signs of arterial hypertension (AH) according to the daily profile type of systolic (SBP), diastolic (DBP) and pulse (PP) blood pressure were studied. The data showed a significant difference in the frequency of occurrence of AH clinical signs, depending on the type of daily profile of SBP, DBP, and PP. It was concluded that in patients with AH determination only SBP daily profile of is not enough, it's necessary to take into account the types of DBP and PP daily profiles also.

KEY WORDS: ambulatory blood pressure monitoring, systolic blood pressure, diastolic blood pressure, pulse pressure, daily blood pressure profile

КЛІНІЧНА ХАРАКТЕРИСТИКА ТИПІВ ДОБОВОГО ПРОФІЛЮ АРТЕРІАЛЬНОГО ТИСКУ У ПАЦІЄНТІВ З ГІПЕРТОНІЧНОЮ ХВОРОБОЮ ЗАЛЕЖНО ВІД ОБРАНОГО ІНДЕКСУ ДМАТ

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Вивчено частотні характеристики клінічних ознак гіпертонічної хвороби (ГХ) залежно від типу добового профілю систолічного (САТ), діастолічного (ДАТ) та пульсового (ПАТ) артеріального тиску. Отримані дані виявили суттєву різницю частот зустрічаємості клінічних ознак ГХ в залежності від типу добового профілю САТ, ДАТ та ПАТ. Зроблено висновок про те, що у пацієнтів з ГХ визначення одного тільки добового профілю САД недостатньо, необхідно враховувати також і типи добового профілю ДАТ і ПАТ.

КЛЮЧОВІ СЛОВА: ambulatory blood pressure monitoring, systolic blood pressure, diastolic blood pressure, pulse pressure, daily blood pressure profile

КЛИНИЧЕСКАЯ ХАРАКТЕРИСТИКА ТИПОВ СУТОЧНОГО ПРОФИЛЯ АРТЕРИАЛЬНОГО ДАВЛЕНИЯ У ПАЦИЕНТОВ С ГИПЕРТОНИЧЕСКОЙ БОЛЕЗНЬЮ В ЗАВИСИМОСТИ ОТ ВЫБРАННОГО ИНДЕКСА СМАД

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Изучены частотные характеристики клинических признаков гипертонической болезни (ГБ) в зависимости от типа суточного профиля систолического (САД), диастолического (ДАД) и пульсового (ПАД) артериального давления. Полученные данные выявили существенное различие частот встречаемости клинических признаков ГБ в зависимости от типа суточного профиля САД, ДАД и ПАД. Сделан вывод о том, что у пациентов с ГБ определения одного только суточного профиля САД недостаточно, необходимо учитывать также и тип суточного профиля ДАД и ПАД.

КЛЮЧЕВЫЕ СЛОВА: суточное мониторирование артериального давления, систолическое артериальное давление, диастолическое артериальное давление, пульсовое давление, суточный профиль артериального давления

INTRODUCTION

Ambulatory blood pressure monitoring (ABPM) is increasingly used in clinical practice

for the diagnosis and prognosis of the arterial hypertension (AH) [1]. Circadian fluctuations in blood pressure (BP) estimated by the degree of its night fall – so-called «sleep-time relative BP

decline» [2], which in most cases is determined only for systolic BP (SBP) changes [3, 4], while the changes in diastolic BP (DBP) and, especially, the pulse pressure (PP), is given much less attention. At the same time it was proved that not only the SBP, but DBP and [5] and, moreover, PP [6] are important predictors of outcomes and success of BP control in AH.

We have previously shown that the distribution of occurrence frequency of the daily profile types of SBP, DBP and PP in patients with hypertension is significantly different [7].

OBJECTIVE

To compare occurrence frequency of the AH clinical characteristics depending on the daily profiles of SBP, DBP, and PP in patients with hypertension to clarify their values in AH diagnosis, prognosis and treatment.

MATERIALS AND METHODS

On the clinical base of the Kharkov city outpatient clinic № 24 53 patients with essential hypertension were examined. The study involved 22 men (42 %) and 31 women (58 %). Average age 57 ± 10 years. The average duration of AH 8 ± 6.5 years. Newly diagnosed AH was detected in 6 patients (11 %). AH of stage I was diagnosed in 11 patients (21 %), stage II – in 31 (58 %), stage III – in 11 (21 %). AH of 1 grade was determined in 21 patients (40 %), grade 2–27 (51 %), grade 3–5 (9 %). Heart failure (HF) was diagnosed in the 40 cases (75 %): HF stage I – 31 (58 %), HF stage IIA – in 8 (15 %), HF stage IIB – 1 (2 %), I functional class (FC) of HF was determined in 16 patients (30 %), II FC – 22 (41 %), III FC – 2 (4 %); coronary heart disease (CHD) – 42 cases (79 %): stable angina (I–III FC) – 8 (15 %), postinfarction atherosclerosis (PICS) – 3 (6 %), focal atherosclerotic atherosclerosis (ACS) – 33 (62 %). SBP profile of «dipper» type was set in 22 patients (42 %), «nondipper» – in 25 (47 %), «nightpicker» – in 3 (6 %) and «overdipper» in 3 patients (6 %). DBP daily profile of «dipper» type was defined in 17 cases (32 %), «nondipper» – 16 (30 %), according to «nightpicker» – in 2 (4%) and «overdipper» – in 18 cases (34 %). PP profile of «dipper» type was diagnosed in 4 patients (8 %), «nondipper» – in 18 (34 %), «nightpicker» – in 29 (55 %) and «overdipper» – in 2 patients (4 %).

Diagnosis of AH was made according to the recommendations of the Association of Cardiologists of Ukraine (2007), the European

Society of Hypertension and the European Society of Cardiology (2013), the Expert Committee of the World Health Organization (WHO) and the International Society of Hypertension (1999), generalized and stated in a Standardized Clinical Protocol of the primary, emergency and secondary (specialized) medical care «Arterial hypertension» (2012) [8].

CHD diagnosis, stage and functional class of HF was made on the basis of Ukrainian Heart Association recommendations on classification, diagnosis and treatment of cardiovascular diseases (2007) [9].

Exclusion criteria were secondary hypertension, hemodynamically significant valvular heart disease, cardiomyopathy of any genesis, heart failure stage III, FC IV by NYHA, any acute condition (infection, trauma, surgery) within the previous 3 months, chronic diseases in stage of decompensation or exacerbation, cancer, as well as any circumstances that hinder the conduction of ABPM.

To determine the daily BP profile the ABPM was performed using a computer system «Kardiosens» (HAI Medica, Ukraine) with the oscillometric method of blood pressure measurement. The monitoring was performed in the conditions of patient normal working day; the cuff was placed at the non-dominant arm using an appropriately sized cuff. According to Ambulatory Blood Pressure Monitoring International Recommendations 2013 [2], blood pressure was measured every 15 minutes during the day and 30 minutes at night. Daytime and night-time periods were defined based on a diary, in which participants were asked to record their activities and sleep times during the monitoring session. Editing ABPM, in accordance Ambulatory Blood Pressure Monitoring International Recommendations [2] if any value outside preset limits (see below) was detected during a recording, that measurement was rejected:

- systolic blood pressure (SBP) > 250 or < 70 mm Hg,
- diastolic blood pressure (DBP) > 150 or < 40 mm Hg,
- pulse pressure (PP) > 150 or < 20 mm Hg,
- heart rate (HR) > 200 or < 20 per minute.

Also ABPM data series were considered invalid for analysis in the following cases:

- absence of ≥ 30 % of the scheduled measurements,
- lack of data for > 2 consecutive hourly intervals,

– if patient maintained an irregular rest-activity schedule during consecutive 24-h periods of monitoring,

– if the nighttime sleep span was < 6 h or > 12 h [2].

To define the daily profile the nocturnal BP dip was quantified as the relative decline in mean BP from awake (daytime) to asleep (night-time) periods, and was calculated for SBP, DBP and PP separately using the following equation: $((\text{mean awake BP} - \text{mean asleep BP}) / \text{mean awake BP}) \times 100 \%$. Depending on the value of this ration the following types of daily BP profile were defined: «dipper» – physiological decrease in BP during the night – sleep-time relative BP decline 10–20 %; «overdipper» – an excessive fall in BP at night, sleep-time relative BP decline > 20 %; «nondipper» – the lack of BP reduction at night, sleep-time relative BP decline < 10 %; «night-peaker» – night-time BP more than during daily activity, sleep-time relative BP decline < 0 [2].

We determined the frequency ratio of the clinical characteristics of AH for each of the types of daily profile, depending on the selected index ABPM, and compared within the groups of SBP, DBP, and PP profiles.

Calculation of ABPM indices was performed using «Kardiosens» program. Data were analyzed with the software «Microsoft Office Excel 2010» and «STATISTICA», with the clinical signs frequency of occurrence assessment in percents (P) ± standard deviation of percent (Sd_p).

RESULTS AND DISCUSSION

In the SBP daily profile structure the dipper and nondipper types were dominated, similar in frequency and more than 6 times higher than the overdipper and night-peaker incidence.

AH 1 degree was more common among overdippers, and equally less frequently among the other types of daily profile of SBP. AH 2 degree prevailed among nondippers. AH 3 degree prevailed among night-peakers, it was about 4 times higher than among dippers and nondippers. Among overdippers AH 3 degree was absent.

AH stage I was met with equal frequency among dippers and overdippers, accounting about 1/3 of all observations, rarely – among nondippers and wasn't met among night-peakers. AH stage II prevailed among all types of SBP daily profile, amounting in most cases more than half of all observations. AH stage III

was met among dippers, nondippers and night-peakers, accounting no more than 1/3–1/5 of all observations.

Patients with HF, which accounted more than half of all observations, prevailed among dippers, nondippers and night-peakers. Among overdippers patients without HF were dominated.

More than half of all patients had HF stage I with the highest frequency of occurrence among night-peakers and the lowest – among overdippers. IIA stage of HF was more common among night-peakers, it was roughly more than twice among dippers and nondippers. Stage IIB was rare and observed only among nondippers.

The incidence of HF FC I prevailed among night-peakers, exceeding such index approximately 2-fold among dippers and overdippers and 3-fold among nondippers. The frequency of HF FC II was higher among nondippers, where it accounted for more than half of all cases. In groups of dippers and night-peakers it was met rarely and with with approximately the same frequency. HF FC III also was observed rarely and only in nondippers.

In the DBP daily profile structure dipper, overdipper and nondipper types were met with approximately the same frequency, whereas night-peaker type was extremely rare.

AH 1 degree absolutely prevailed among night-peakers and accounted for more than half of all cases among overdippers. The incidence of AH 2 degree was more common among dippers, in nondippers it amounted to half of all observations, in overdippers – a little more than 1/3, and in the night-peakers group AH 2 degree wasn't observed. AH 3 degree encountered rarely in all types of DBP daily profile.

AH stage 1 was observed only among dippers and overdippers with low frequency. AH stage 2 prevailed among all four groups, making up in dippers, nondippers and overdippers half or more of all cases, and night-peakers group – 100 %. AH stage 3 was not common among nondippers and even rarer among dippers and overdippers.

Patients with chronic heart failure predominated in all types of DBP daily profile, accounting for more than half of the patients in each group, peaking among nondippers and night-peakers.

Table. 1.

The incidence of AH clinical characteristics depending on the daily BP profile and the selected index of ABPM

ABPM index	BP daily profile	The relative number of patients, P (%) ± standard deviation of percent, Sd _p (%)													
		AH degree			AH stage			No HF	HF FC			HF stage			
		1	2	3	I	II	III		I	II	III	I	II A	II Б	
SBP	dipper	42 ± 49,27*	45 ± 49,8*	45 ± 49,8*	9 ± 28,7	32 ± 46,6*	50 ± 50,0*	18 ± 38,6*	27 ± 44,5*	36 ± 48,1*	36 ± 48,1*	0	55 ± 49,8*	18 ± 36,8*	0
	nondipper	47 ± 49,92*	32 ± 46,6*	60 ± 49,0*	8 ± 27,1	12 ± 32,5**	64 ± 48,0*	24 ± 42,7*	20 ± 40,0*	20 ± 40,0*	52 ± 50,0*	8 ± 27,1	60 ± 49,0*	16 ± 36,7*	4 ± 19,6
	night-peaker	6 ± 23,11**	33 ± 47,1	33 ± 47,1	33 ± 47,1	0	67 ± 47,1	33 ± 47,1	0	67 ± 47,1	33 ± 47,1	0	67 ± 47,1	33 ± 47,1	0
	overdipper	6 ± 23,11**	67 ± 47,1	33 ± 47,1	0	33 ± 47,1	67 ± 47,1	0	67 ± 47,1	33 ± 47,1	0	0	33 ± 47,1	0	0
DBP	dipper	32 ± 46,68*	67 ± 47,1	33 ± 47,1	0	0	33 ± 47,1	0	35 ± 47,8*	29 ± 45,6*	24 ± 42,4*	12 ± 32,2	47 ± 49,9*	12 ± 32,2	6 ± 23,5
	nondipper	30 ± 45,91*	31 ± 46,4*	50 ± 50,0*	19 ± 39,0**	0	63 ± 48,4*	38 ± 48,4*	6 ± 24,2	19 ± 39,0**	75 ± 43,3*	0	63 ± 48,4*	31 ± 46,4*	0
	night-peaker	4 ± 19,06	100 ± 0	0	0	0	100 ± 0	0	0	50 ± 50,0	50 ± 50,0	0	100 ± 0	0	0
	overdipper	34 ± 47,36*	56 ± 49,7*	39 ± 48,7*	17 ± 37,3**	39 ± 48,7*	50 ± 50,0*	11 ± 31,4	33 ± 47,1*	39 ± 48,7*	28 ± 44,8	0	56 ± 49,7*	11 ± 31,4	0
PP	dipper	8 ± 26,42*	75 ± 43,3*	25 ± 43,3	0	25 ± 43,3	50 ± 50,0	25 ± 43,3	25 ± 43,3	25 ± 43,3	50 ± 50,0	0	50 ± 50,0	25 ± 43,3	0
	nondipper	34 ± 47,36*	50 ± 50,0*	33 ± 47,1*	17 ± 37,3**	22 ± 41,6*	61 ± 48,7*	17 ± 37,3**	28 ± 44,8*	39 ± 48,7*	28 ± 44,8*	6 ± 22,9	56 ± 49,7*	17 ± 37,3**	0
	night-peaker	55 ± 49,78*	28 ± 44,7*	66 ± 47,5*	7 ± 25,3	21 ± 40,5*	59 ± 49,3*	21 ± 40,5*	21 ± 40,5*	28 ± 44,7*	48 ± 50,0*	3 ± 18,2	62 ± 48,5*	14 ± 34,5*	3 ± 18,5
	overdipper	4 ± 19,06	50 ± 50,0	50 ± 50,0	0	0	50 ± 50,0	50 ± 50,0	50 ± 50,0	0	50 ± 50,0	0	50 ± 50,0	0	0

* p < 0.05

** p < 0.1

In all groups patients with HF clinical stage I dominated, while a clinical stage IIA was much rarer, and IIB – only in the group of dippers and with a very low frequency.

HF I FC was more common among night-peakers, accounting for half of all cases, prevailed among dippers and overdippers, though rarely met here than in the group of night-peakers, and was rare among nondippers. FC II prevailed in the group of nondippers, met in half of the cases in the group night-peakers and was about $\frac{1}{4}$ of the groups of overdippers and dippers. FC III observed rarely and only in the dippers group.

In the structure of PP daily profile the night-peaker and nondipper incidence absolutely dominated and the incidence of dipper and overdipper types were rare.

AH 1 degree was more common among dippers, in nondippers and overdippers patients with AH 1 degree accounted for half of all cases, in the group of night-peakers – $\frac{1}{4}$. AH 2 degree was more common among night-peakers and overdippers, accounting for half and more of all cases, and about 2 times rarely observed among dippers and nondippers. AH 3 degree met rarely and only in groups of nondippers and night-peakers.

AH stage 1 met with low frequency in groups of dippers, night-peakers and nondippers and was absent in overdippers group. AH stage 2 prevailed in all groups of PP daily profile and was half and more of all cases of observation. AH stage 3 was more common in the overdippers and 2–3 times rarely in the other groups.

Patients with chronic heart failure predominated in all groups of PP daily profile, accounting for more than half of all cases in dippers, nondippers and night-peakers and a half – in overdippers group.

In all groups HF clinical stage I dominated, accounting for half and more of all cases. IIA stage occurred much less frequently and was at all absent in the overdippers. CHF IIB clinical stage was observed very rarely and only in night-peakers group.

HF IFC prevailed in the group of nondippers, was little rare in dippers and night-peakers and was absent in overdippers group. FC II of CHF prevailed among dippers, night-peakers and overdippers and was almost 2 times less common in nondippers. FC III met rarely, only in groups of nondippers and night-peakers.

The results obtained with regard to SBP circadian BP profile generally confirm the data that the pathological types of circadian BP profile result in the development of complications [10], but the AH clinical signs frequency characteristics, depending on the type of daily profile of SBP, DBP and PP have not previously been studied.

Thus, in this study we received the new data indicating that the frequency characteristics of AH clinical signs vary not only depending on the type of circadian blood pressure profile, but on the selected ABPM index also. Determination of daily profile of DBP and PP carries additional information about the course of the disease and should be performed in all patients with AH.

CONCLUSIONS

AH 1 degree was more common among SBP-overdippers, DBP-night-peakers and PP-dippers, and AH 2 degree – among SBP-nondippers, DBP-dippers and PP-night-peakers, which as a whole accounted for more than half of all cases. AH 3 degree met more common only among the SBP-night-peakers, where it accounted for 1/3 of the observations.

The highest incidence of AH stage I was noted in the group of DBP-overdippers. Stage II prevailed in all groups of patients, accounting for half and more of all cases, with minor differences between the groups. Stage III was more common among PP-overdippers.

Patients with chronic HF prevailed and accounted for more than half of all cases in the vast majority of patients groups, with the highest incidence among SBP- and DBP-night-peakers and DBP-nondippers. I stage of HF significantly prevailed in all groups, accounting for half and more of all cases. Stage IIA was more common among SBP-night-peakers and DBP-nondippers, III stage – among SAD-nondippers, DBP-dippers and PP-night-peakers and didn't exceed 1/10 of all cases. Chronic HF FC I met with the greatest frequency in groups of SBP- and DBP-night-peakers, II FC – in the group of DBP-nondippers, III FC - among DBP-dippers.

Different frequency ratio of AH clinical signs dependently of SBP, DBP and PP daily profiles requires that in AH diagnosis, prognosis and monitoring of treatment all their multitude should be taken into consideration, but not only SBP diurnal profiles alone.

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