Voloshyna Olena, Samorukova Viktoriia, Dychko Tetiana, Balashova Iryna, Naidyonova Olena, Chaika Anna, Voloshyn Andrii, Gushcha Sergey. Adherence to home blood pressure monitoring depending on the frequency of blood pressure measurements during the day. Journal of Education, Health and Sport. 2020;10(3):34-41. eISSN 2391-8306. DOI http://dx.doi.org/10.12775/JEHS.2020.10.03.003
https://apcz.umk.pl/czasopisma/index.php/JEHS/article/view/JEHS.2020.10.03.003
https://zenodo.org/record/3709240

The journal has had 5 points in Ministry of Science and Higher Education parametric evaluation. § 8. 2) and § 12. 1. 2) 22.02.2019.
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The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 20.02.2020. Revised: 25.02.2020. Accepted: 13.03.2020.

Adherence to home blood pressure monitoring depending on the frequency of blood pressure measurements during the day

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Abstract

The article analyzes the adherence to home blood pressure monitoring (HBPM) with different measurement frequency during the day in 90 patients with hypertension. It was found that after 2 weeks of blood pressure monitoring the greatest was patients' adherence to blood pressure measurement at home once (96.7%) or 2 times a day (90.0%), the lowest - at home pressure measurement every 2– 3 hours during the day (76.6%).The adherence to frequent HBPM (2-3 hours during the day) appeared to be significantly less compared to HBPM once or twice daily, due to more frequent violations of HBPM. Regardless of the frequency of measurements at HBPM, adherence to monitoring is most commonly impaired in working men, compared with women of similar age and employment.

Key words: arterial hypertension, adherence to blood pressure, blood pressure.

Introduction. The effectiveness of the treatment of arterial hypertension (AH) depends to a certain extent on many factors, including the commitment to blood pressure measurement by

patients at home, that is, home blood pressure monitoring (HBPM) [1, 2, 3, 4]. According to the recommendations of the European Society of Hypertension (ESH, 2018) for the diagnosis of hypertension: measurement of office hypertension is recommended for the screening and diagnosis of arterial hypertension - the level of evidence I [5].

Studies show that HBPM allows you to obtain a large number of blood pressure measurements over several days or a longer period (within a week, a month), and in a patient-friendly environment [1, 2, 3, 4]. Compared to the daily (ambulatory) BP monitoring (AMBP), home monitoring of BP provides information on average and daily variability of BP, is cheaper, affordable and easy to conduct [2]. The main advantages of HBPM include: lack of patient response to "white coat", the possibility of long-term monitoring of blood pressure under normal conditions, as well as the prevention of manifestations and symptoms associated with increased blood pressure (headache, dizziness, weakness, etc.) [2, 3, 4].

However, HBPM is known to be limiting to the use of patients during normal daily activity and can cause difficulty in working patients [6, 7].

Purpose of the study: To study the adherence to HBPM depending on the frequency of blood pressure measurements during the day and to determine the causes of impaired adherence to HBPM.

Materials and methods. In 90 patients with stage II, I and II patients, complaints, anamnesis and objective clinical indicators, adherence to treatment and monitoring questionnaires, instrumental studies (level of office BP, HBPM, ABPM, echocardiography, electrocardiography) and laboratory data (general blood and urine analysis, blood plasma creatinine levels, lipid and carbohydrate metabolism, etc.).

The adherence to different frequency of blood pressure measuring techniques of HBPM in 90 patients with hypertension, which were divided into three groups (30 patients in each group) depending on the frequency of blood pressure measurements during the day, is analyzed in detail. Patients in group 1 performed HBPM once a day, 2 groups twice a day in the morning and evening with 1 - 12 hour intervals, 3 groups every 2-3 hours during the day.

Statistical processing of the results was performed using the statistical analysis package Microsoft Exel 2010 (Microsoft, USA, 2010) and Statistica 6.0 (StatSoft, 2006). Correspondence distribution of clinical trial data on the law of normal distribution was tested by the Shapiro-Wilk test.

Results and its discussion. The average patients were (57.6 ± 4.3) years. The duration of hypertension averaged (6.3 ± 2.4) years. At the beginning of the study, the average level of

office systolic blood pressure (SBP) was (162.1 ± 1.3) mm Hg. and diastolic (DBP) - (100.3 ± 0.9) mm Hg. (p> 0.5).

In HBPM, the average daily SBP values were different depending on the frequency of blood pressure measurements of patients. In patients of the 1st group, the SBP indicators were the highest - (157.8 ± 1.5) mm Hg. in patients of the 2nd group - (153,9 ± 1,0) mm Hg. (p> 0,5), in patients of the 3rd group - the lowest - (149,2 ± 1,1) mm Hg. (p <0.05).

When conducting the analysis of variance of the obtained results, the highest statistical significance of the differences between the SBP indices in HBPM was in patients of group 1 (t = 6.4; p <0.001). However, the levels of DBP in the patients of the three groups were not statistically significantly different: in patients of the 1st group (95.3 ± 0.7) mm Hg. in patients of the 2nd group (94.1 ± 0.8) mm Hg. (p> 0.5), in patients of the 3rd group (92.0 ± 0.9) mm Hg. When comparing the average levels of SBP obtained with ABMP and different measurement frequency of the HBMP techniques, it was found that the average daily level of SBP at ABPM (148.9 ± 1.3) mm Hg. was closest to the SDP indices for HBPM with frequent measurement of BP (149.2 ± 1.2) mm Hg. (p> 0.5), and differed most in HBPM with the measurement of blood pressure once a day - (157,8 ± 1,5) mm Hg. (p <0.05).

The Kulbak method of informativeness I (x) was the highest - 1.8 for the HBPM method every 2-3 hours during the day, the lowest - 0.7 for the HBPM method once a day.

An analysis of the diary data and the results of the interview with the patients showed that patients' attachment to the HBPM was dependent on the frequency of blood pressure measurements (Table 1).It was found that in the course of HBPM with frequent measurement of BP during the day after 2 weeks the adherence to measurement of BP significantly worsened, compared with other in frequency methods of HBPM.

Table 1. Adherence to the measurement of blood pressure in HBPM with different frequency of blood pressure measurements, abs,%

Indicators	Adherencepatients							
	Thefirstgroup, n=30		The secondgroup, n=30		P_1	The thirdgroup, n=30		P_2
	n	%	n	%		n	%	
Thefirst week	30	100	29	96,7	p>0,5	28	93,3	p>0,5
The second week	29	96,7	27	90,0	p>0,5	23	76,7	p<0,05

Note. The significance of the difference between group 1 and group 2 is P_1, P_2 is marked between group 1 and group 3.

The adherence to blood pressure measurements during the first week was 93.3% and decreased to 76.7% (p <0.05) at the end of the second week. With HBPM 2 times a day, adherence to self-measurements of blood pressure remained at a rather high level for 2 weeks and was 96.7% in the first week and 90.0% after 2 weeks (p> 0.5). With HBPM, once a day, adherence to blood pressure measurement remained at its highest for 2 weeks, 100.0% for the first week, 96.7% (p> 0.5) for the second week.

The adherence to measuring blood pressure in HBPM depended not only on the frequency of blood pressure measurement, but also on patients' age and gender.

By gender and age, 46 (51.1%) women and 44 (48.9%) men participated in the study. Women aged 45-59 years - 25 (27.8%) patients, 60-75 years - 21 (23.3%) patients. Men aged 45-59 years - 24 (26.6%) patients, 60-75 years - 20 (22.2%) patients. The composition of the groups by gender and age, was as follows (Table 2)

Among the patients of the first group adherent to the method of HBPM once a day were 26 (86.7%) patients, among the patients of group 2, to the method of HBPM twice a day - 21 (70, 0%) patient, among the patients of group 3 to the technique HBPM every 2-3 hours during the day - 18 (60%) patients.

Table 2. Composition of patients in the study groups by age and sex, abs, %

Patients by age and sex	The first group, n=30		The second group, n=30		P_1	The third group, n=30		P_2
	n	%	n	%		n	%	
Women 45-59 years	9	30,0	7	23,3	p>0,5	9	30,0	p>0,5
Women 60-75 years	6	20,0	8	26,7	p>0,5	7	23,3	p>0,5
Men 45-59 years	8	26,7	10	33,3	p>0,5	6	20,0	p>0,5
Men 60-75 years	7	23,3	5	16,7	p>0,5	8	26,7	p>0,5

Note. The significance of the difference between group 1 and group 2 is denoted P_1, between group 1 and group 3 is denoted by P_2

In more detail, age and gender composition of eligible and non-eligible patients is presented in Table 3.

By gender, the overall percentage of women adherents to HBPM, regardless of methodology, was greater - 35 (76.1%) of 46 women than the percentage of men adherent to HBPM - 30 (68.2%) of 44 men.

Regardless of the frequency of HBPM measurements, a greater commitment to self-measurement of BP was observed in women than in men. It was highest in middle-aged women, with HBPM 1 time per day - 1 group, and the lowest in middle-aged men with HBPM every 2-3 hours during the day (group 3). However, adherence to measuring blood pressure in HBPM, regardless of patients' age and sex, was lowest in group 3, which required frequent blood pressure measurement throughout the day.

According to patients' diaries, the recommended mode of measurement of blood pressure is often violated due to various reasons, including the inconvenience of frequent measurement of blood pressure and working conditions. An inverse correlation ($r = -0.98$; $p < 0.001$) was obtained between adherence to the HBPM technique and the multiplicity of blood pressure measurements.

Table 3. Number of adherent and non-adherent patients to different DBP techniques by age and gender, abs, %

Patients by age and sex	The first group, n=30				The second group, n=30				The third group, n=30			
	Adherence		Not adherence		Adherence		Not adherence		Adherence		Not adherence	
	n	%	n	%	n	%	n	%	n	%	n	%
Women 45-59 years	9	30,0	0	-	5	16,7	2	6,7	5	16,7	4	13,3
Women 60-75 years	5	16,7	1	3,3	6	20,0	2	6,7	5	16,7	2	6,7
Men 45-59 years	7	23,4	1	3,3	7	23,4	3	10	3	10,0	3	10,0
Men 60-75 years	5	16,7	2	6,7	3	9,9	2	6,7	5	16,7	3	10,0
Total	26	86,7	4	13,3	21	70,0	9	30,0	18	60,0	12	40,0

Analysis of the causes that affected the adherence to measurement of blood pressure showed that among the unfavorable patients of group 1 (4 (13.3%) patients) the most important reason for the violation of the mode of measurement of blood pressure was employment (2 (50%) patients), in including business trips - in 1 (25%) patient, household causes - 1 (25%) sick and mystic reasons also in 1 (25%) observation.

In unfavorable patients, 2 groups (9 (30%) patients) have a similar picture in terms of inconvenience. The most violated recommendations for measuring blood pressure were those patients who were employed at work - 6 (66.7%) patients, also due to household inconvenience - 2 (22.2%) patients and mystic reasons in 1 (11.1%) patient. Among the unfavorable patients of group 3 (12 (40.0%) patients) the most frequent causes of violation of the method of measurement of blood pressure every 2-3 hours during the day were also employment at work - 8 (66.7%) patients - the highest percentage compared to with 1 and 2 groups, among which trips were the cause in 4 (33.3%) patients, inability to measure at work - 4 (33.3%), other household reasons - in 3 (25%) patients and mystic reasons - in 1 (8.3%) patient.

Thus, the obtained data show that the most informative, compared to DBPM, is the technique of HBPM every 2–3 h (measure of informativeness by the Kulbak method - I (x) = 1,8). The average daily SBP levels at ABPM (148.3 ± 1.3) mm Hg.) are the least different from the average daily SBP values for HBPM every 2-3 hours during the day - (148.2 ± 1.1) mm Hg. ($p > 0.5$). However, with this technique, according to the diary analysis, the recommendations for measuring blood pressure at home were more violated.

The study showed that one of the most common causes of a violation of the adherence to monitoring BP was the high frequency of BP measurements throughout the day (every 2-3 hours). The adherence to monitoring blood pressure is also most commonly violated in working men, compared to women of similar age and employment, which should also be taken into account when choosing a HBPM technique.

Based on the data of the study of patients with hypertension, in the practice of a family doctor, it is recommended to use the method of HBPM every 2-3 hours during the day, to obtain more accurate average daily values of blood pressure, as close as possible to the values of blood pressure obtained at the ABPM, detection of fluctuations of blood pressure,during the day and during physiological loads, determination of individual sensitivity to antihypertensive drugs, when prescribing or correction treatment of hypertension.

It is recommended to administer the HBPM technique twice a day for patients who have already reached the target level of BP or at the stage of correction treatment of hypertension, as well as for patients for whom more frequent measurement of BP causes objective and subjective difficulties.

Conclusions.

1. A close correlation was found ($r = -0,98$; $p < 0,001$) between the adherence to home blood pressure monitoring and the multiplicity of blood pressure measurements, the more

frequent blood pressure measurements at home blood pressure monitoring , the worse the adherence.

2. The best adherence to home pressure monitoring, after 2 weeks, persists with blood pressure measurements once a day in – 96.7 % of patients, or twice a day in – 90.0 % of patients ($p < 0.005$), the worst – at frequent self- measurements of arterial pressure – at 76.6 % of patients ($p > 0.01$) .

3. Women, 76.0% more than men, 68.1% ($p > 0.001$) were more adherent to the HBPM regardless of the method.

4. Regardless of the frequency of measurement of blood pressure in HBPM, the tendency to monitor blood pressure is most commonly violated in working men, compared with women of similar age and employment, which in turn must be taken into account when using HBPM.

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