ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Evaluation Of A 24-Hour Blood Pressure Profile In Persons With High Intensity Of Work And Shift Schedule Based On The Pre-Trip Medical Check-Ups.

Chibisov S.M*., Dementiev M.V., Meladze Z.A., Smirnova I.P., Miandina G.I., Blagonravov M.L., Syatkin S.P., Skorik A.S., Neborak E.V.

Federal State Autonomous Educational Institution of Higher Education "Russian Peoples' Friendship University"

ABSTRACT

Data of pre-trip monitoring are enough for assessing the daily blood pressure profile within the framework of FORM program. The analysis of the daily BP curve in persons with high intensity of work and shift schedule has revealed the significant signs of jetlag, and distortion of a daily profile. The implementation of this technique for train drivers will ensure monitoring of the state of health in the preclinical stage, when the absolute values of the physiological parameters are not yet exceed the limit of normal.

Keywords: arterial pressure, circadian, shift work, desynchronosis

ISSN: 0975-8585

INTRODUCTION

For more than 50 years, since the first long-term blood pressure monitoring devices appeared and 24-hour (ambulatory) blood pressure monitoring (ABPM) was implemented into clinical practice, this method has become the gold standard for the diagnosis and evaluation of treatment effectiveness of hypertension.

The European guidelines 2013 state for hypertension that the use of only the clinical measurement of blood pressure is not enough in view of a white-coat hypertension and the reverse state - a latent hypertension, an isolated night-time hypertension, as well as the lack of data about the blood pressure profile within 24 hours.

A key role is given to ambulatory BP monitoring: ABPM and self-control of blood pressure [6].

However, the method of ABPM has two main limitations:

- high cost
- insecure performance in terms of shift work, with high work intensity (machinists, pilots, traffic supervisors) because of its distracting effect while injecting the cuff.

Additional difficulties arise when one needs to get the profile of either blood pressure or heart rate.

7-days ABPM revealed in healthy volunteers that their daily blood pressure profile does not remain constant even for several consecutive days. [4,7]

Long-term monitoring of blood pressure and heart rate in hypertensive patients also confirmed the variability of daily curve upon maintaining their traditional way of life and against the ongoing antihypertensive therapy.

Therefore, when setting a task to reliably determine the daily blood pressure profile of the patient, we have to conduct the ABPM more than 24 hours that is significantly complicates, both technically and economically, the mass use of this technique.

In addition, each factory's sectorial doctor has a vast array of measurements such as data on patients' blood pressure self-monitoring and pre-shift monitoring, respectively.

However, these time series have non-equidistant and "dissipated" character.

Object of research

- To build a circadian profile of blood pressure without the use of ambulatory blood pressure monitoring

- To compare the results of this method with the traditional method of tracing the curve of daily physiological parameters based on ambulatory blood pressure monitoring

MATERIALS AND METHODS

Research materials were the pre-trip inspections of 50 train drivers in the period from 2005 to 2008, with the minimum number of individual inspections equal to 400; the study was conducted on the automated system of pre-trip medical examination of hardware and software system (KAPD-01-st "Sistemnye Tekhnologii" (System Technologies), Saint Petersburg).

Calculations were performed with the use of chronobiological program FORM, developed by G.S. Katinas [1,2,8].

ISSN: 0975-8585

The method is based on:

1) the epoch folding method (data, obtained in different days, overlap each other so that the phase of each oscillation could match, i.e., the combination of the measurements according to the time of day). See Fig. 1.

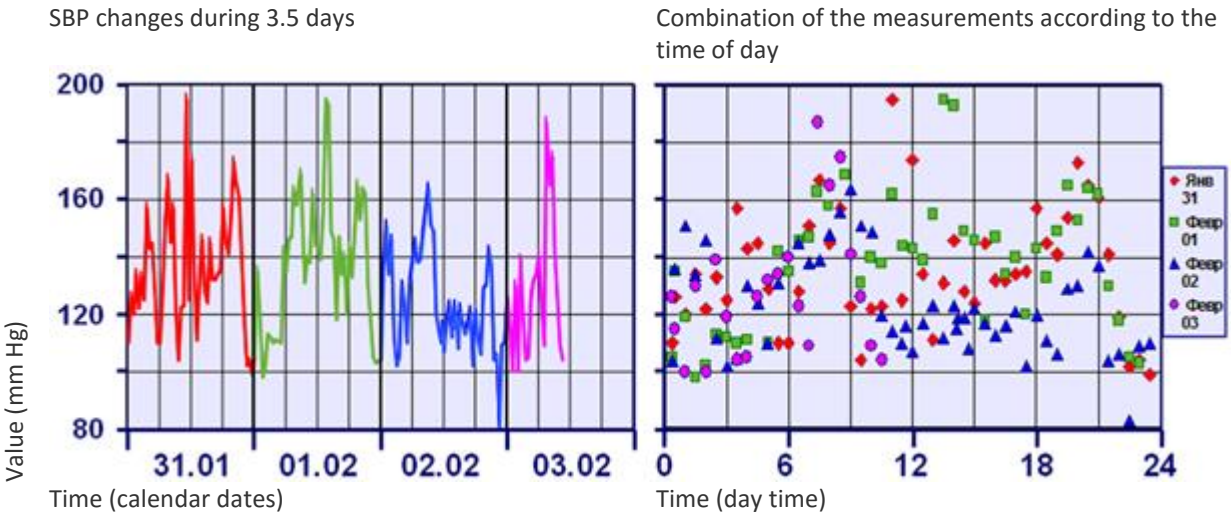

Fig. 1. The process of combining the data on systolic blood pressure, measured for 3.5 days

2) vibrations filtering through degree 3 polynomial approximation (Savitzky-Golay filter), which eliminates the high-frequency vibrations and noise. See Fig. 2

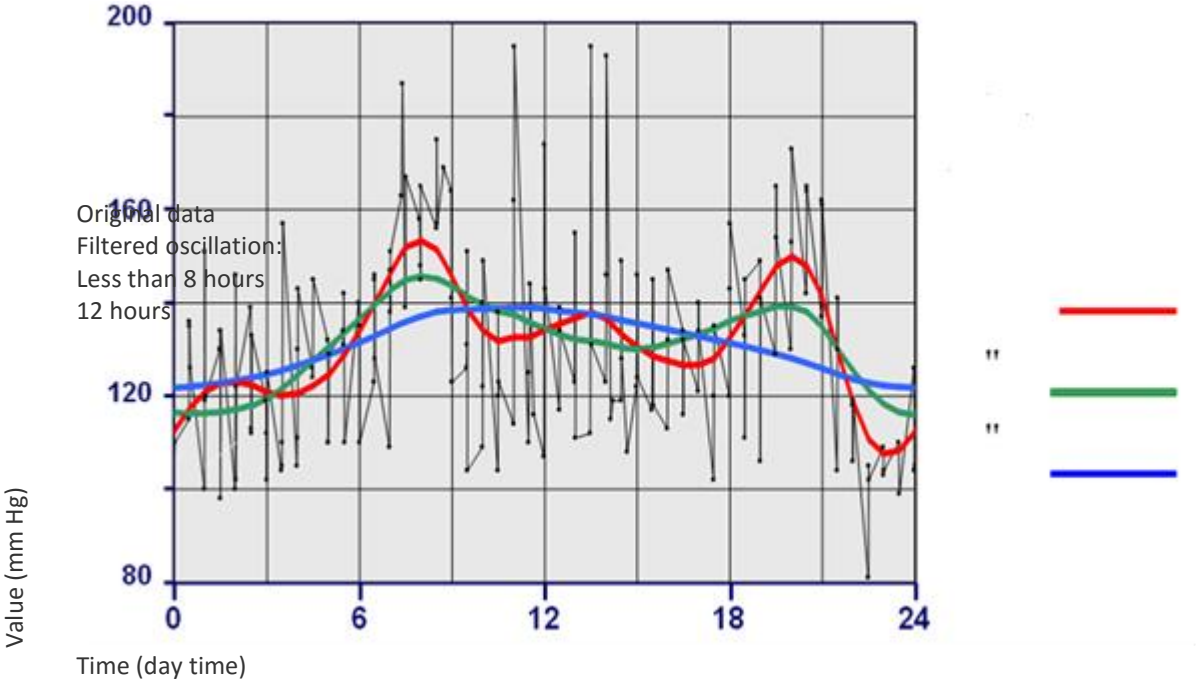

Fig.2. The time of day along the abscissa; along the ordinate - the value of systolic blood pressure in mm Hg. in male patient K., measured for three days

Further, the parameters of the curve are calculated: the average level for a day, time of onset of increases and decreases, the scope of observation, a maximum and a minimum value, confidence limits, as well as the determination coefficient.

ISSN: 0975-8585

RESULTS AND DISCUSSIONS

All train drivers participating in the study undergo medical examination each year and do not have severe somatic pathology.

The average level of SBP was 122.7 mm Hg and diastolic blood pressure was 75 mm Hg, standard deviation was 9.5 mm Hg for SBP, and 7.9 mm Hg for DBP, respectively.

The assessment of the absolute values of blood pressure and its dispersion gives us an impression of normal. When building the daily profile of arterial pressure, we detected in the train drivers the prominent features of desynchronization.

All train drivers surveyed were characterized by "flattening" of the daily curve of SBP, and of DBP in particular. Confidence limits of the time of increases and decreases, calculated by the Bingham method [5], overlap each other, which confirms the absence of significant peaks and decays in the daily profile. See Fig. 3.

The determination coefficient, indicating the power of the extracted signal with respect to the components and the filtered noise, was very low for both systolic and diastolic blood pressure; it did not exceed 0.1 in all train drivers.

All of the above changes in the daily blood pressure profile of the train drivers of locomotive crews reflect a pronounced jetlag caused by shift working schedule with a high work intensity. [3]

For comparison, we used the data of the patient K, keeping a normal way of life, with no shift work, who was undergoing ABPM for 4 years. In order to make the data comparable, we intentionally decimated the original ABPM data to “thin them out" in the same way as the pre-shift measurements were taken from the train drivers.

The patient K. is characterized by a pronounced daily BP profile with a peak at 13:00 and a natural blood pressure reduction at night. Confidence limits of the time of peaks and decreases do not overlap; there is a significant peak and decrease, see. Fig. 4. The determination coefficient is large enough and equal to 0.4.

The daily blood pressure curves were built for the patient K., based on both original and decimated data; the resulted form of signal and the presence of the daily rhythm were comparable in both cases [1].

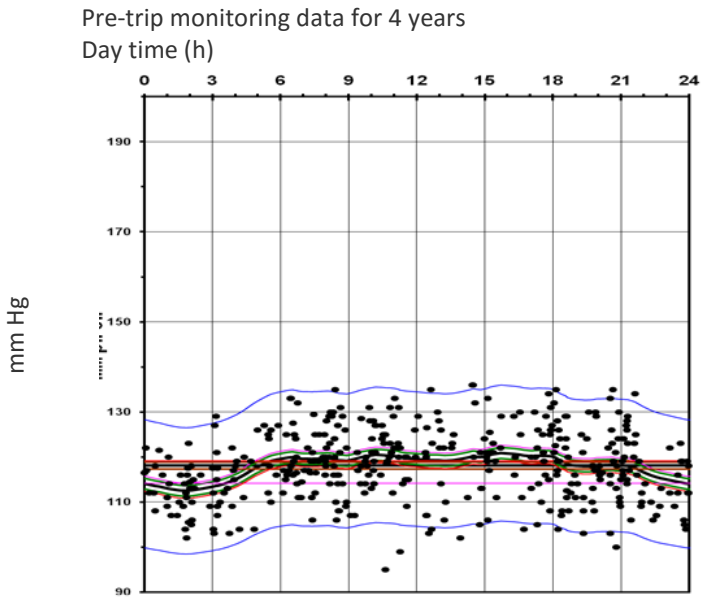

Fig. 3. The time of day along the abscissa; along the ordinate - the value of systolic blood pressure in mm Hg. in the train driver R.

ISSN: 0975-8585

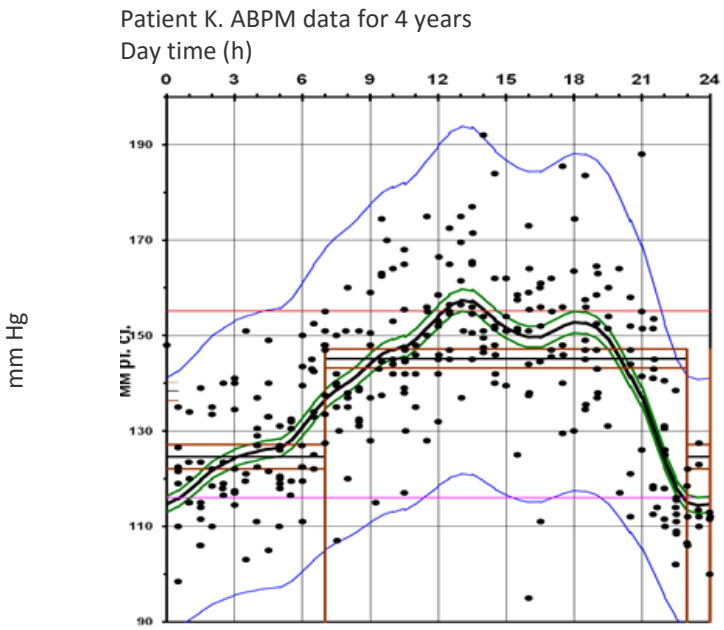

Fig. 4. The time of day along the abscissa; along the ordinate - the value of systolic blood pressure in mm Hg. in male patient K

SUMMARY

- Data of pre-trip monitoring are enough for assessing the daily blood pressure profile within the framework of FORM program.
- The analysis of the daily BP curve in persons with high intensity of work and shift schedule has revealed the significant signs of jetlag, and distortion of a daily profile.
- The implementation of this technique for train drivers will ensure monitoring of the state of health in the preclinical stage, when the absolute values of the physiological parameters are not yet exceed the limit of normal.

REFERENCES

[1] Dementiev M.V., Katinas G.S., Sorokin A.V. Ability to identify daily profile based on outpatient monitoring data // Proceedings of the Scientific-Practical Conference "Integration of science and practice: results, achievements, and prospects". Tyumen, 2013. p. 64.

[2] Karp V.P., Katinas G.S. Building the waveforms without specifying a mathematical model: Computational methods of analysis in medicine and chronobiology. St. Petersburg: Vostochnaia korona (East crown) 1997, p. 38-41.

[3] Chibisov S.M., Katinas G.S., Dementiev M.V., Kirichek A.A., Sorokin A.V., Kharlitskaia E.V., Eremina I.Z., Drogova G.M. Jetlag of the circulatory function circadian rhythm upon changing the labor routine // Modern problems of science and education. Medical sciences. - 2011, - No. 5, http://www.science-education.ru .

[4] Chibisov S.M., Katinas G.S., Ragulskaia M.V. Biorhythms and Space: cosmic-biospheric relations monitoring. - M .: Monograph, 2013 - p. 442.

[5] Bingham C., Cornelissen G., Halberg F. Testing period for single cosinor:extent of human 24-h cardiovascular 'synchronization' on ordinary rutine. Chronobiologia, 1984,11:263-274

[6] ESH/ESC Guidelines for the management of arterial hypertension. The Task Force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC) // J. Hypertens. - 2013. - Vol. 31. - P. 1281-1357.

[7] Halberg F, Cornelissen G, Wall D, Otsuka K, Halberg J, Katinas G, Watanabe Y, Halhuber M, Muller-Bohn T, Delmore P, Siegelova J, Homolka P, Fiser B, Dusek J, Sanchez de la Pena S, Maggioni C, Delyukov A, Gorgo Y, Gubin D, Carandente F, Schaffer E, Rhodus N, Borer K, Sonkowsky RP,

Schwartzkopff O. Engineering and governmental challenge: 7-day/24-hour chronobiologic blood pressure and heart rate screening: Part I. Biomedical Instrumentation & Technology 2002; 36: p. 89-122.

[8] Katinas G. S. , Dementyev M.V., Halberg F., Grambsch P., Sorokin A.V., Cornėlissen G. Evaluating the form of nonsinusoidal variations // World Health Journal – 2011; – 3(2) – C. 135-149.