Assessment of the function of biologically active points for monitoring the action drugs in real time

K.M. Reznikov, E.A. Borisova, B.A. Fedorov, Yu.S. Balashov (Voronezh State Medical Academy, Voronezh)

SUMMARY

The article presents new possibilities for controlling the action of drugs using the differential thermometry method and the results of using this method in an experiment on animals and in a clinical setting.Key words: microprocessor-based temperature recorder, anolyte, catholyte.

RESUME

In article new possibilities of monitoring of action of medical products by means of a method of differential thermometry and results of use of this method in experiment on animals and in clinical conditions are presented.

Keywords: microprocessor-based temperature recorder, anolyte, catholyte.

An important area of modern pharmacotherapy is monitoring the action of drugs in real time. An attempt has been made at the Voronezh State Medical Academy to solve this problem. For this, a gradient (differential) method for studying the electrical activity of BAP (biologically active points) was developed (Reznikov K.M. et al., 1994, patent No. 2119290). To obtain stable indicators, silver chloride electrodes must contact the skin in a drop of isotonic sodium chloride solution, which is extremely inconvenient in clinical conditions, therefore, for conducting such a study, we propose a device for recording the temperature difference (ΔT) between the BAP and the intact skin area.

Purpose: to justify the use of the differential thermometry methodBAP for assessing the effect of drugs in real time.

Materials and methods

The device for recording the temperature difference consists of a signal shaping unit connected to a recording and analysis unit, made on the basis of an analog-to-digital converter, a single-chip microcomputer and an indicator, characterized in that it has a memory unit and a serial interface for communication with a personal computer. ... The autonomous temperature recorder contains a differential thermocouple type T (copper - constantan) with a thermoelectric constant current amplifier and a digital thermogram recording unit. The presence of a volatile memory device in the recorder makes it possible to measure and store a thermogram every second for up to 7 days. The data recorded in the device memory via the RS 232C interface can be transferred to a personal computer for detailed analysis and storage in the database.

as a monitor for long-term monitoring of the patient's condition.

With the help of a special probe used in electropuncture according to the method of R. Voll, and on the basis of topographic and anatomical landmarks, BAP was determined. The main thermocouple sensor was installed on the point, and the second was placed on the intact skin area at a distance of 1.0–1.5 cm outside the vessel. The dynamics of ΔT was estimated during the time determined by the task. The data obtained were recorded in the form of graphs and tables on a computer screen and entered into formalized maps.

The research took place in two stages: the first stage was carried out on the basis of medical institutions in Voronezh and Lipetsk, the second - on the basis of the laboratory of the Department of Pharmacology of the V.G. N.N. Burdenko on animals. At the first stage, we investigated the possibility of assessing the dynamics of ΔT BAP depending on the action of drugs and their dosage. To clarify this possibility, we studied the effect of anaprilin (i / m - 20 mg) when administered to patients with essential hypertension (8 patients) and aminophylline (i / m - 240 mg) with chronic obstructive bronchitis (8 patients) according to the indicators of ΔT BAP P9, MC7 and C7. In addition, by the example of the action of the tricyclic antidepressant amitriptyline, the dependence of changes in ΔT BAP on the dose of the drug at points Gi 4 and P7 was traced.

At the second stage of the research, we made an attempt to describe and evaluate not the state, but the function of the meridians, on the BAPs of which the measurements were carried out. To do this, it was necessary to assess not the increase or decrease in ΔT BAP over time, but the rhythm of changes in this indicator during the observation process.

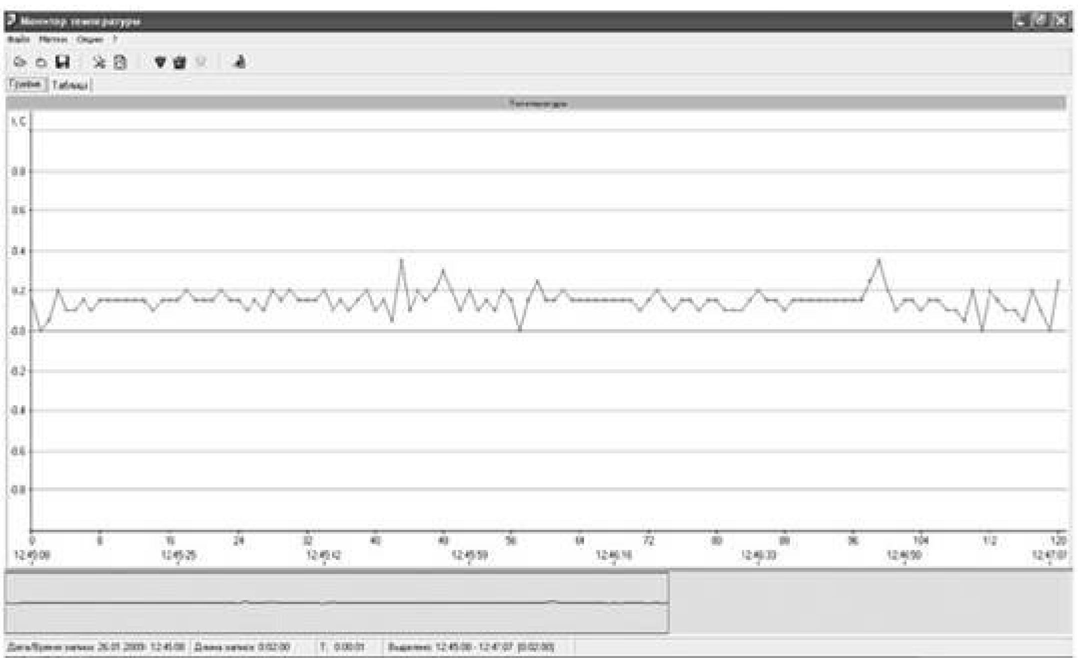
This study was carried out on 30 healthy rabbits of both sexes weighing 2.5–4.0 kg under standard conditions at a temperature of 18–20 degrees Celsius. The sought-for point of the heart meridian in the ear of a rabbit was found guided by the atlas of auricular representation of internal organs in rabbits (Portnov F.G., 1982). The dynamics of the temperature difference was assessed for 120 seconds with the fixation of the thermogram on the computer screen. We used electroactivated aqueous solutions (EAVR) as a model for the effect of low intensity. The animals were divided into three groups. The first group - control (10 animals) intramuscularly (into the muscles of the thigh) was injected with water, from which electroactivated aqueous solutions were prepared at the rate of 2 ml / kg. The second group of rabbits (10 animals) was injected intramuscularly with catholyte at the rate of 2 ml / kg. The third group (10 rabbits) was injected intramuscularly with anolyte (2 ml / kg). The assessment of changes in the temperature difference ΔT BAP was carried out according to the indicators specially developed by us, which formed the basis of a new computer program for processing graphic data in on-line mode. The baseline values before the study were taken as 100%; the indicators obtained 2 hours after the introduction of the EAVR were estimated as a percentage in relation to the initial value. The results were processed statistically using the Student's test (Afifi A., Eisen S., 1982). the indicators obtained 2 hours after the introduction of the EAVR were estimated as a percentage in relation to the initial value. The results were processed statistically using the Student's test (Afifi A., Eisen S., 1982). the indicators obtained 2 hours after the introduction of the EAVR were estimated as a percentage in relation to the initial value. The results were processed statistically using the Student's test (Afifi A., Eisen S., 1982).

Results

At the first stage of the study, the phase character of ΔT changes in all BAT. The introduction of anaprilin reduced the ΔT BAP index to the same level in all BAP, while the administration of aminophylline significantly increased it only in the BAP MC7. At the same time, the most pronounced difference in the studied indicator with the introduction of anaprilin under the control of thermometry was found in BAP C7 (heart meridian), and with the introduction of aminophylline - in the pericardial meridian MC. Therefore, by the change in ΔT of biologically active points over time, it is possible to track the effect of the drug.

It was also established that a single intravenous injection of 2 or 4 ml of amitriptyline to patients in a state of depression causes changes in ΔT BAP Gi 4, which are distinguished by the severity, but not the direction of the process. With the introduction of 4 ml of the drug, the rise in the BAP Gi 4 index occurs faster, and this increase lasts approximately twice as long as with the introduction of 2 ml of amitriptyline. In BAP P7, a multidirectional effect of ΔT dynamics is noted, which indicates a significant change in regulatory processes in the corresponding meridian. Consequently, the ΔT BAP index characterizes not only the effect of an antidepressant, but also the dependence of its effect on the dose of the drug.

At the second stage of the study, the changes in the temperature difference ΔT BAP were observed in healthy animals. The graphic representation of changes in time ΔT BAP in rabbits is as follows (Fig. 1). The data obtained are presented in table 1.



Rice. 1. ΔT BAP of the rabbit is normal

With the graphic registration of the thermogram, every second changes in ΔT BAP are noted. To describe and assess changes in the temperature difference BAP we have developed the following indicators: 1 - the total number of positive and negative changes; 2 - the number of positive and negative changes in 1 minute; 3 - the number of positive changes in 1 minute (frequency); 4 - the number of negative changes in 1 minute (frequency); 5 - the ratio of positive and negative changes in 1 minute in frequency (the difference between indicators 3 and 4); 6 - the duration of positive changes in 1 minute; 7 - the duration of negative changes in 1 minute; 8 - the ratio of positive and negative changes in 1 minute in duration (the difference between indicators 6 and 7); 9 - frequency regulation index (ratio indicator obtained by dividing indicator 3 by indicator 4); 10 - index of regulation by duration (ratio indicator obtained by dividing indicator 6 by indicator 7).

Table 1

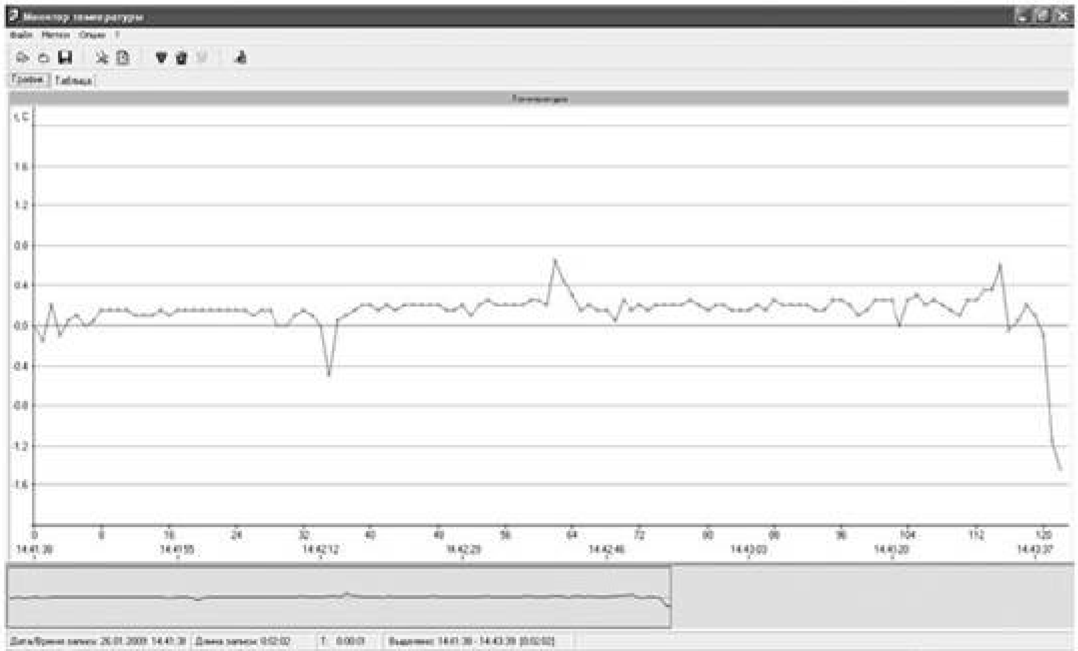
Average values of ΔT BAP indicators in rabbits before and 2 hours after introduction of EAVR

Пока-затели	Группы животных					
	вода для ЭАВР		католит		анолит	
	до введения	после введения	до введения	после введения	до введения	после введения
1	59,9 ± 11,2	66,9 ± 5,42	61,7 ± 8,0	67,8 ± 8,40	58,1 ± 7,30	75,8 ± 9,5*
2	28,45 ± 6,89	33,45 ± 2,70	30,85 ± 4,04	33,9 ± 4,20	29,05 ± 3,69	37,9 ± 4,75*
3	14,85 ± 2,74	16,75 ± 1,29	15,5 ± 2,28	16,75 ± 2,15	14,65 ± 1,92	19,0 ± 2,51*
4	15,0 ± 2,91	16,7 ± 1,68	15,35 ± 1,85	17,15 ± 2,22	14,4 ± 1,84	18,8 ± 2,37*
5	0,35 ± 0,47	0,95 ± 0,83	0,65 ± 0,74	0,9 ± 0,84	0,55 ± 0,44	0,6 ± 0,81
6	22,5 ± 3,95	27,05 ± 2,06	23,3 ± 3,80	25,6 ± 3,39	21,3 ± 4,16	25,7 ± 2,74
7	27,45 ± 3,39	29,15 ± 2,96	24,45 ± 4,31	26,15 ± 2,50	20,65 ± 2,83	29,1 ± 3,66*
8	5,65 ± 3,62	4,1 ± 2,61	3,25 ± 1,98	2,8 ± 2,18	2,15 ± 1,92	3,4 ± 2,41
9	0,99 ± 0,03	1,0 ± 0,08	1,0 ± 0,06	0,97 ± 0,07	1,02 ± 0,04	1,0 ± 0,04
10	0,83 ± 0,16	0,94 ± 0,16	0,96 ± 0,16	0,98 ± 0,13	1,03 ± 0,14	0,89 ± 0,07

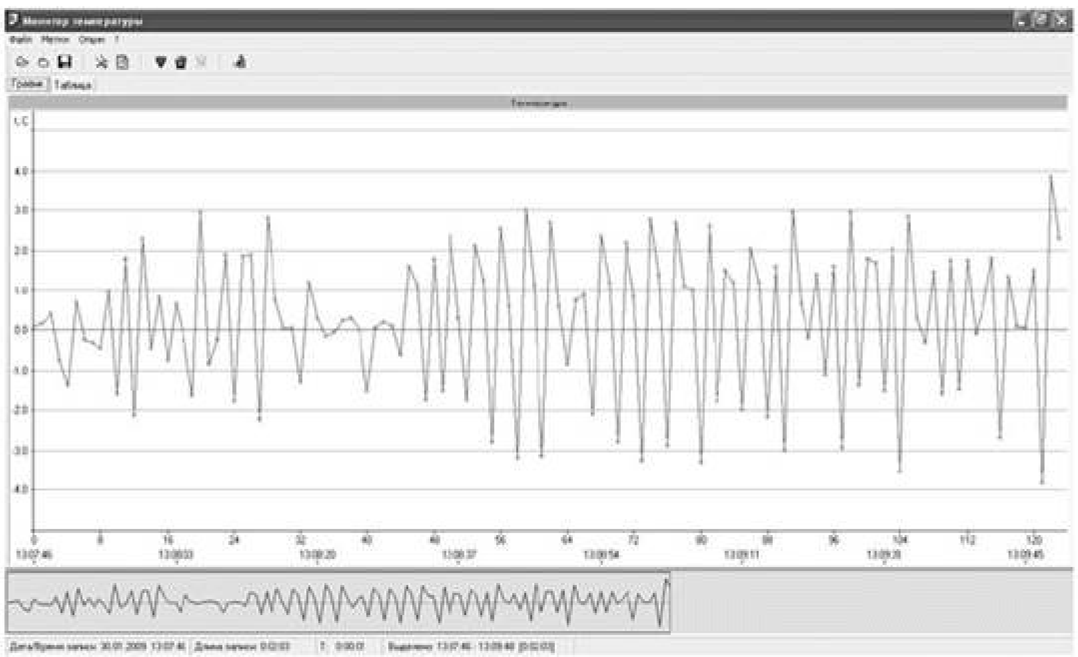
Примечание: * - $p < 0,05$

It turned out that in all groups of animals changes in ΔT BAP were observed, however, significant changes were noted only in the group of animals that received anolyte. They showed more noticeable changes in the temperature difference in terms of the total number of positive and negative changes ΔT BAP and the same indicator per unit time (1 min.) - they increased by 30.5% compared to the initial level; the number of positive changes ΔT BAP increased by 29.7%; the number of negative changes ΔT BAP - by 30.6% compared to the initial level; the duration of negative changes ΔT BAP increased by 41%. This approach to the analysis of changes in the BAP temperature difference made it possible to identify the most informative indicators.

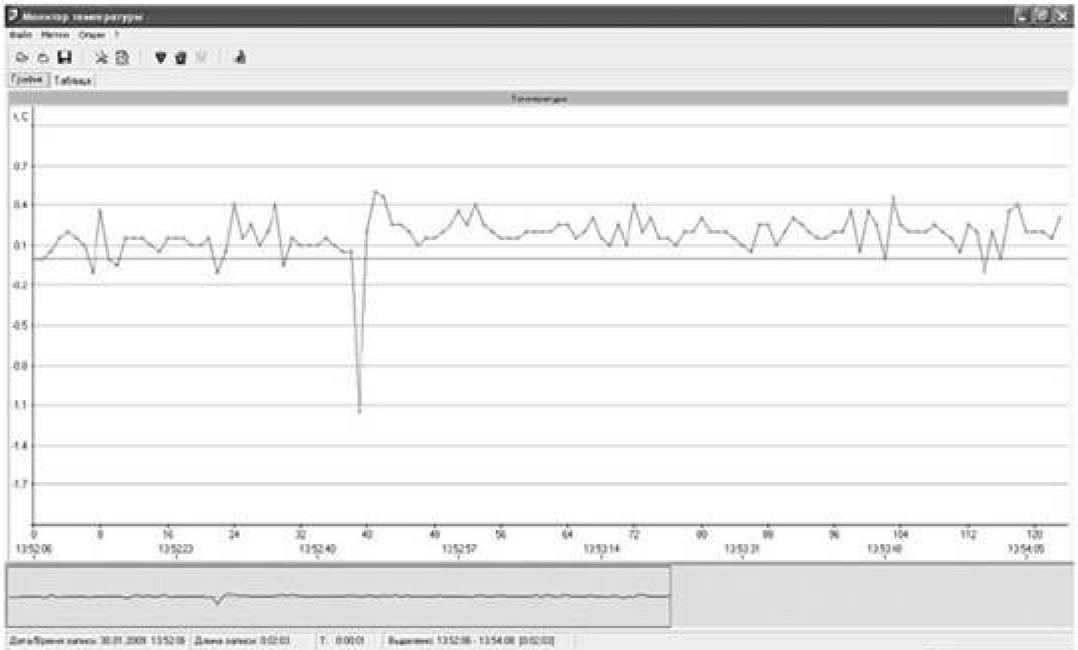
The graphs obtained by us clearly reflect the regulation processes taking place in the body of animals. All graphs are described by a developed computer program with on-line registration of indicators.



Rice. 2. ΔT BAP rabbit through2 hours after the introduction of EAVR (catholyte)



Rice. 3. ΔT BAP rabbit through2 hours after the introduction of EAVR (anolyte)



Rice. 4. ΔT BAP rabbit through2 hours after the introduction of water for EAVR

conclusions

1.Using differential thermometry, the temperature difference between BAP and intact skin area can control the action of drugs.

2. Administration of drugs (anaprilin, aminophylline, amitriptyline), as well as electroactivated aqueous solutions (catholyte and anolyte) causes individual changes in the value of ΔT BAP.

3. The use of the drug in different doses causes a change in ΔT BAP in to varying degrees, which characterizes the possibility of using differential thermometry to adjust the dose of the drug during treatment.

4. The developed indicators make it possible to assess not the state, but the function of the meridian corresponding to the BAP.

Literature

1. Afifi A., Eisen S. Statistical analysis. Approach using Computer / Per. from English - M .: Mir, 1982 .-- 286 p.

2. Reznikov K.M., et al., Patent “Method for assessing the effect of medicinal preparations "No. 2119296, 1998. Priority since 1994.

3. Fedorov B.A. Development and justification of the application of the method of increasing the effectiveness of treatment of depressive disorders with amitriptyline and cipramil based on thermopuncture monitoring // Abstract of the thesis. Diss ... Cand. Honey. Nauk, 2002 .-- 24 p.

4. Portnov F.G. Electro-acupuncture reflexology. - Riga: Knowledge, 1982. - S. 239–241.

Author's address
Doctor of Medical Sciences, Professor Reznikov
K.M. Head of the Department of Pharmacology, Voronezh state
Medical Academy. N.N. Burdenko
vrkm@vsma.ac.ru

Assessment of the function of biologically active points for monitoring the action of drugs in real time / K.M. Reznikov, E.A. Borisova, B.A. Fedorov, Yu.S. Balashov // Traditional medicine. - 2010. - No. 3 (22). - S.37-40.

To favorites