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重度燒傷毒血症期間脈搏血壓的晝夜節律動態

DYNAMICS OF THE CIRCADIAN RHYTHM OF PULSE BLOOD PRESSURE DURING TOXEMIA IN SEVERE BURNS

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抽象。在第一天，PBP晝夜節律標誌與所有年齡組的標準指標均無差異。在毒血症期間，PBP晝夜節律的中膜變化呈波狀發生，第1　-　9,6,5,5,6,6組，第2 - 8,4組波動。第3天-5、4、4、5、6、5天。 PBP晝夜節律的每日變化在較晚的日期普遍存在（第14組在第14天后，第2組-在第8天，在第3組-在有毒血症的14天后），這表明導致血液動力學障礙的因素之一不夠有效的抗炎，糾正血液動力學功能的療法。最活躍的代償性血流動力學反應顯示在40歲以下。在燒傷疾病毒血症期的較晚日期（3-4週），發現超過61歲的患者出現最不穩定的血液動力學趨勢。

關鍵詞：脈搏血壓的晝夜節律，毒血症時期，嚴重燒傷

Abstract. *On the first day, the PBP circadian rhythm mesors did not differ from the normative indicators in all age groups. During the period of toxemia, changes in the mesor of the circadian rhythm of PBP occurred in a wave-like manner with a period of fluctuations in group 1 – 9,6,5,5,6 days, in group 2 – 8,4 days, in group 3 - 5,4,4,5,6,5 days. Daily changes in the PBP circadian rhythm prevailed at a later date (in group 1 after 14 days, in group 2 - on day 8, in group 3 - after 14 days of toxemia), which suggests that one of the factors leading to hemodynamic disturbances is insufficiently effective anti-inflammatory, correcting hemodynamic function therapy. The most active compensatory hemodynamic reactions were revealed at the age of up to 40 years. The most pronounced tendency to destabilize hemodynamics was found in patients over 61 years of age at a later date (3-4 weeks) of the period of burn disease toxemia.*

Keywords: *circadian rhythm of pulse blood pressure, period of toxemia, severe burns*

Relevance

Pulse blood pressure (PBP) should normally be between 30 and 50 mmHg. With the standard BP 120/80, the normal PP is 40 mmHg [1]. Pulse pressure is determined by the ratio of the value of the stroke volume to the reserve capacity of the arterial system. Any changes in hemodynamics that affect these two factors also affect the magnitude of the pulse pressure. With aortic stenosis, the opening diameter with open aortic valves is significantly reduced compared to the norm. The pulse pressure in the aorta also decreases, since there is a decrease in blood flow through the stenotic valves. In case of non-closure of the arterial (botallova) duct, about half of the stroke volume of blood, which should enter the aorta from the left ventricle, immediately enters the pulmonary artery and the pulmonary vascular system through the wide open duct. This is accompanied by a significant drop in diastolic pressure before each subsequent heartbeat. With aortic valve insufficiency, the aortic valves are absent or incompletely closed. Therefore, after each heartbeat, the blood that has entered the aorta immediately returns to the left ventricle. As a result, the aortic pressure drops to zero during diastole. Pathologies leading to a decrease in heart systole cause a decrease in PBP, and this is an alarming symptom. The causes of decreased PBP are directly related to the condition of the heart and kidneys and, as a rule, require immediate etiopathogenetically justified correction [1-3]. However, there are no data in the literature on changes in pulse blood pressure and its circadian rhythm in burn disease, which was the reason for studying the features of changes in the circadian rhythm of pulse blood pressure in severe burns in adults.

Purpose

Study the dynamics of the circadian rhythm of pulse blood pressure during toxemia in severe burns.

Material and research methods

The results of monitoring the PBP indicator of 25 patients admitted to the Department of Cambustiology of the Republican Scientific Center of Emergency Medicine due to burn injury were studied. After recovery from shock, anti-inflammatory, antibacterial, infusion therapy, correction of protein and water-electrolyte balance disorders, early surgical, delayed necrectomy, additional parenteral nutrition, syndromic, symptomatic therapy were performed. The dynamics of PBP was studied by monitoring the hourly continuous recording of the indicator in patients with severe thermal burns in three age groups - group 1, 12 patients aged 20-40 years, group 2 - 7 patients aged 41-60 years, group 3, 6 patients - 61-78 years. The division into groups was dictated by the well-known characteristics inherent in each age group, described in detail in the literature.

Table 1

Patient characteristics (25)

	Age, years	Height, cm	Weight, kg	Total burn area,%	Burn of 3B grade	IF, units	Days in the ICU
Group 1	27,3±5,6	174,9±5,7	73,0±22,2	59,4±13,5	21,3±13,3	119,4±38,4	22,4±14,6
Group 2	50,7±7,1	165,8±6,3	73,8±14,3	54,3±16,5	11,9±8,9	92,5±20,8	13,3±2,4
Group 3	71,3±7,0	165,3±8,4	73,3±8,9	40,8±5,8	21,7±6,7	86,7±12,8	18,8±9,5

As can be seen from Table 1, the age groups were significantly different and averaged 27.3 ± 5.6 years in group 1, 50.7 ± 7.1 years in the second, and 71.3 ± 7.0 years in the third. The total area and area of deep skin burn lesions did not differ significantly between the groups. The highest index of IF was revealed in group 1, which led to the longest intensive therapy in ICU conditions in the youngest group 1. Thus, the most pronounced burns in terms of area and depth were found in patients in group 1.

Results and discussion

Table 2

Dynamics of the mesor of the circadian rhythm of pulse pressure

Days	Group 1	Group 2	Group 3
1	45,0±1,9	49,6±2,5	47,4±3,1
2	45,4±1,7	47,5±1,6	48,6±2,7
3	48,0±1,9	46,7±1,6	54,1±3,0*
4	51,6±1,0**	49,4±2,3	53,2±2,1
5	51,6±1,1**	52,6±1,8	45,9±3,6*
6	52,9±2,0**	51,7±3,2	48,1±2,5
7	52,7±1,9**	53,5±2,4	52,5±1,7
8	53,4±2,0**	49,0±2,6	46,2±4,2
9	51,0±1,7**	50,9±1,5	46,9±3,5
10	51,6±1,5**	43,9±2,3	47,2±3,4
11	53,1±2,7**	50,1±3,3	53,5±3,1
12	52,1±1,6**	50,4±1,4	42,8±4,3*
13	50,5±2,1		51,1±3,6
14	56,5±3,4**		44,5±4,4*
15	49,9±2,9		43,3±4,8
16	55,0±2,5**		42,3±3,8*
17	55,9±2,6**		41,0±3,8*
18	55,3±3,5**		46,0±2,2*
19	56,9±1,7**		50,1±3,5

20	53,8±1,8**		51,9±3,1
21	55,4±3,4**		47,5±2,7
22	61,5±2,5**		48,1±5,6*
23	54,1±2,8**		44,3±5,6
24	55,3±3,7**		47,0±5,7
25	53,0±1,6**		45,6±7,3
26	49,1±3,2		46,7±4,8
27	52,1±2,0**		41,1±5,6
28	52,9±2,5**		42,7±4,3*
29	54,1±2,6**		45,8±4,5
30	50,3±2,6		42,8±4,7

*- reliable relative to the indicator in group 1

**- reliable relative to the indicator on the first day

As can be seen from the data presented in Table 2, on the first day, the PBP circadian rhythm mesor did not differ from the normative indicators. Group 1 showed a reliably significant increase in the mesor of the circadian rhythm PBP on days 4-12 of the toxemia period by 13-17% ($p < 0.05$), remaining elevated throughout the observation period up to a maximum increase on days 22 by 36% ($p < 0.05$) relative to PBP on day 1 of toxemia. Attention was drawn to the relative stability of the mesor of the circadian rhythm PBP in patients of group 2, which was most likely due to a smaller burn area of grade 3B than in groups 1 and 3, 11.9 ± 8.9%. Also, in group 3, the PBP mesor of the circadian rhythm did not differ from the indicator on the first day during the period of toxemia. However, comparative analysis made it possible to establish a reliably significant difference between the results of patients in group 3 and those in patients in group 1. So, on the 3rd day, the mesor of the circadian rhythm PBP of patients of group 3 was higher than in group 1 by 12.5%, on the 5th day less by 14%, on the 12th day less by 17%, on the 14th day by 21%, by 16 -18 days by 22%, 22 days by 21%, remaining less than the same indicator for 28 days less by 19% (table 2). Thus, despite the absence of a significant difference from the normative data in patients over 61 years old, it was revealed after a short-term increase in the PBP mesor on day 3 with a decrease in the PBP mesor of the circadian rhythm on day 5 and with a tendency to progression in the third week and the entire subsequent period of the toxemia period. burn disease. The revealed difference in the results of PBP monitoring in groups 1 and 3, apparently, is directly related to the state of the heart, respectively, required etiopathogenetically justified correction.

Dynamics of PBP mesor during toxemia depending on age

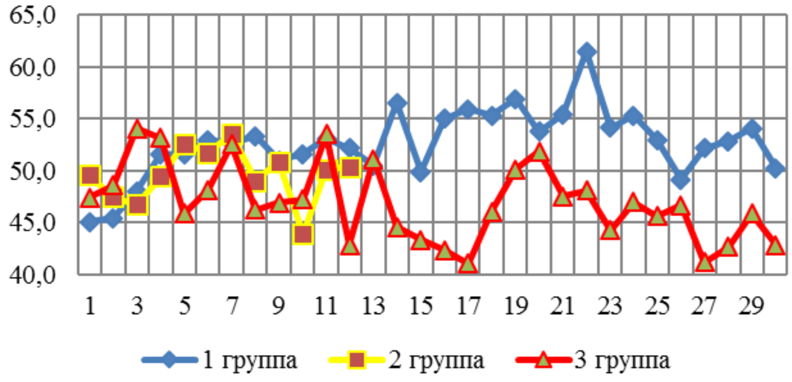

Fig.1

Changes in the mesor of the PBP circadian rhythm occurred in waves with a period of fluctuations in the 1st group - 9,6,5,5,6 days, in the 2nd group – 8,4 days, in the 3rd group - 5,4,4,5,6,5 days. That is, in the process of adaptation, the stress response of the PBP circadian rhythm was also expressed in a change in the wavelength of PBP around-week fluctuations, fitting into the 4,5,9 days sinusoids (fig. 1).

Changes in PBP in acrophase during toxemia

Fig.2

Also, the PBP parameters in acrophase (fig. 2) and bathiphase (fig. 3) changed in waves.

There was no synchronicity in fluctuations in the PBP values of the mesor with those in the acrophase and bathiphase.

PBP dynamics in the bathyphase of the toxemia period

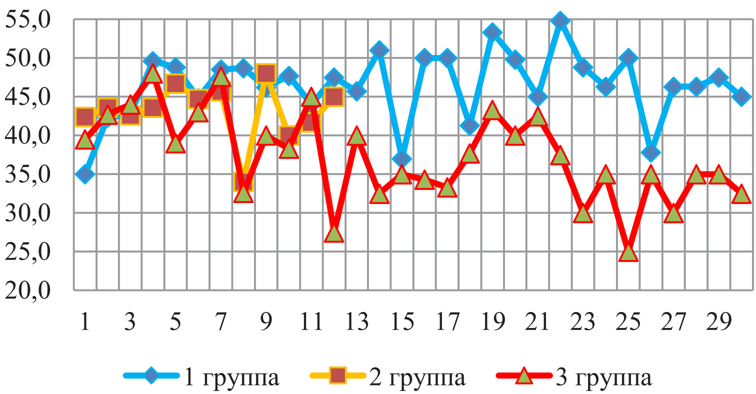

Fig.3

Correlation links of parameters of the circadian rhythm of pulse pressure during toxemia

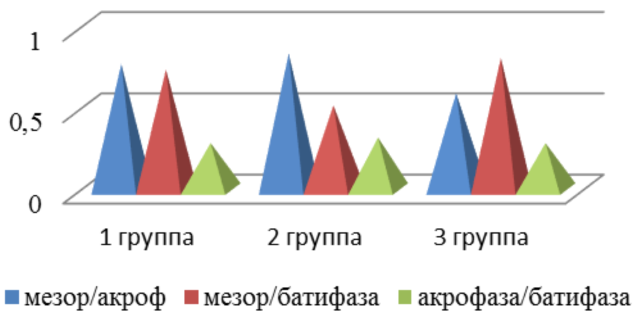

Fig.4

Thus, a reliably significant correlation was found between the parameters of the mesor and the PBP value in the acrophase in groups 1 and 2 (table 3), between the mesor and bathiphase in groups 1 and 3, while the correlation between the PBP indicator in the acrophase and bathiphase was insignificant in all three groups of patients (fig. 4).

Table 3

Correlations between PBP circadian rhythm parameters during toxemia

Parameters	Group 1	Group 2	Group 3
mesor/acrophase	0,7715	0,8341	0,5900
mesor/bathiphase	0,7361	0,5147	0,8072
acrophase/bathiphase	0,2831	0,3173	0,2831

Changes in the mesor of the PBP circadian rhythm occurred in waves with periods of fluctuations in group 1 – 9,6,5,5,6 days, in group 2 – 8,4 days, in group 3 – 5,4,4,5,6,5 days.

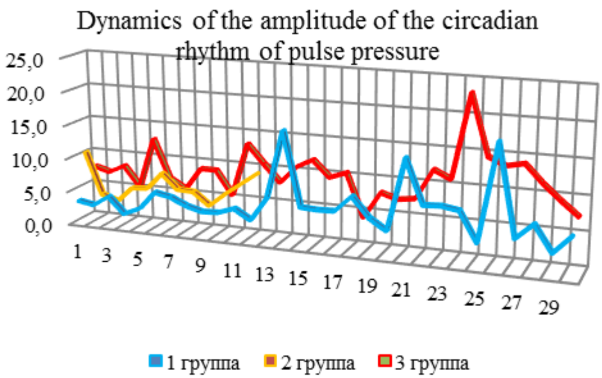

Fig.5

Changes in the amplitude of daily PBP fluctuations differed in group 1 by values (8-3 mmHg), increasing by 14, 19, 23 days to 16 mmHg, while the amplitude of diurnal fluctuations in group 2 was 4-10 mmHg, that is, PBP in group 2 was stable. And in group 3, a tendency towards the increase of the amplitude of the daily fluctuation of PBP was found on the 5, 11, 17th day with an increase on the 23rd day to 23 mmHg, which characterized the most pronounced instability of hemodynamics in elderly patients in the late periods of the toxemia of burn disease (fig. 5).

Dynamics of the range of daily fluctuations of pulse pressure

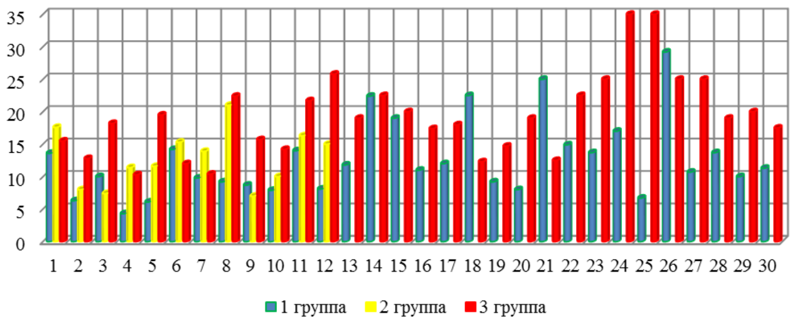

Fig.6

Changes in the daily range of fluctuations in the circadian rhythm of PBP in group 1 indicated the prevalence of more significant changes in PBP at 14 (22 mmHg), 18 (22 mmHg), 21 (24 mmHg), 26 (28 mmHg) days of the toxemia period. While the maximum range of the daily fluctuation of PBP was found only on day 8 (20 mmHg). In patients of group 3, the range of daily changes in PBP was detected on days 12 (20 mmHg), 24 and 25 days (34.8 mmHg). Thus, daily changes in the circadian rhythm of PBP prevailed at a later date (in group 1 after 14 days, in group 2 - on day 8, in group 3 - after 14 days of toxemia), which suggests that one of the factors leading to violation of hemodynamics is the lack of effectiveness of anti-inflammatory, correcting hemodynamic function of therapy, more pronounced in groups 1 and 3 of patients.

During the period of burn disease toxemia, a direct correlation of SBP and PBP mesor on body temperature (0.693; 0.598, respectively) was found only in group 1, a strong direct correlation between SBP and DBP in group 3 (0.689), as well as a strong direct correlation between PBP and SBP in Group 1 (0.7747), gradually weakening in 2 (0.6598) and 3 (0.5643) groups of patients.

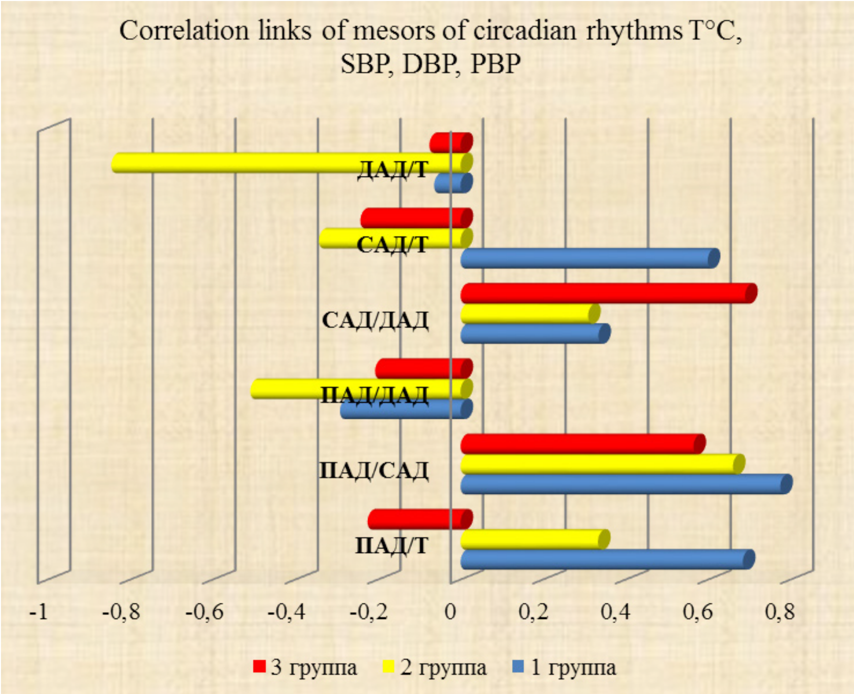

Fig.7

A strong negative correlation between DBP and body temperature (-0.8462) characterized a decrease in the tone of peripheral vessels in response to an increase in body temperature, which is characteristic of the physiological reaction of hemodynamics to the systemic inflammatory response of the body with burns with a total area of 54.3 ± 16.5%. 3 B degree 11.9 ± 8.9% and IF indicator 92.5 ± 20.8 units. Thus, the most active compensatory hemodynamic reactions were found in group 1. The most pronounced tendency to destabilize hemodynamics was found in patients over 61 years of age at a later date (3-4 weeks) of the period of burn disease toxemia.

Conclusions

On the first day, the PBP circadian rhythm mesors did not differ from the normative values. During toxemia, changes in the mesor of the circadian rhythm of PBP occurred in waves with a period of fluctuations in group 1 - 9,6,5,5,6 days, in group 2 – 8,4 days, in group 3 - 5,4,4,5,6, 5 days. Daily changes in PBP prevailed at a later date (in group 1 after 14 days, in group 2 - on day 8, in group

3 - after 14 days of the toxemia period), which suggests that one of the factors leading to hemodynamic disturbances is insufficient efficiency anti-inflammatory, corrective hemodynamic function of therapy, more pronounced in groups 1 and 3 of patients. The most active compensatory hemodynamic reactions were found in group 1. The most pronounced tendency to destabilize hemodynamics was found in patients over 61 years of age at a later date (3-4 weeks) of the period of burn disease toxemia.

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