DOI: 10.26693/jmbs07.02.115
UDC 616.1-001-031.14-089.16-083.98
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THE EFFECT OF CHRONIC HEART FAILURE ON HEMIC PARAMETERS DURING POLYTRAUMA

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The purpose of the study was to carry out the examination of hemic indicators in patients during polytrauma with chronic heart failure without acute myocardium injury using ethylmethylhydroxypyridine succinate.

Materials and methods. The study included 96 patients in the polytrauma department. Patients were divided into 3 groups. The first group included 29 patients of the control group (C) aged 58.7±9.4 years. Group C patients showed no signs of chronic heart failure. The second group of standard (S) included 33 patients with the same injuries, but with confirmed chronic heart failure aged 60.0±9.6 years. Group C patients received intensive care according to the local protocol developed in accordance with the protocol of the Ministry of Healthcare of Ukraine. The third group E included 33 patients aged 62.8±8.8 years who received ethylmethylhydroxypyridine succinate during intensive care. Group E patients differed from patients of group S only by receiving ethylmethylhydroxypyridine succinate.

Results and discussion. The concentration of hemoglobin of group C patients during admission is 99.9±22.1 *g/l*, on the 3rd day – 100.3±15.0 *g/l*, on the 7th day – 111.1±9.2 *g/l*. The hemoglobin saturation of arterial blood (S_{aO2}) during admission in group C was 0.93±0.03, on the 3rd day – 0.96±0.02 (p <0.001), and on the 7th day – up to 0.97±0.01 (p <0.001). The hemoglobin saturation of venous blood (S_{vO2}): within admission – 0.70±0.04, on the 3rd day – 0.73±0.02 (p <0.001), on the 7th day – 0.77±0.02 (p <0.001). The oxygen tension dissolved in arterial blood (P_{aO2}) during admission of group C patients is 86.9±4.1 *mm Hg,* on the 3rd day – 89.2±3.2, on the 7th day – 91.6±2.8 *mm Hg*. The oxygen tension dissolved in venous blood (P_{vO2}) was 37.3±1.2, 38.9±0.7 and 40.0±0.6 *mm Hg,* according to the stages of the study. The hemoglobin concentration of group S patients was 109.7±23.3 *g/l*, then decreased to 100.7±10.4 *g/l* (p <0.05), and on the 7th day – 107.6±10.1 *g/l* (p >0.1 compared to the initial level). S_{aO2} during admission of group S was 0.92±0.03, on the 3rd day – 0.95±0.02 (p <0.001), on the 7th day – 0.96±0.03 (p >0.6). S_{vO2} was 0.68±0.03, 0.72±0.02 (p <0.001) and 0.73±0.03, respectively at the study stages. P_{aO2} within admission of group C patients amounted to 82.4±3.5, 89.2±3.6 (p <0.001) and 90.4±4.8 *mm Hg*. P_{vO2} was 36.8±1.0, 38.5±0.7 and 39.2±1.2 *mm Hg* in accordance with the research stages. The hemoglobin concentration during admission of group E patients was 110.2±24.6 *g/l*, on the 3rd day – 100.0±28.8 *g/l*, on the 7th day – 113.4±27.2 *g/l*. S_{aO2} during admission of group E was 0.92±0.03, on the 3rd day – 0.97±0.02 (p <0.001), did not change until the end of the study. S_{vO2} during admission was 0.68±0.05, on the 3rd day – 0.73±0.02 (p <0.001), on the 7th day – 0.75±0.02 (p <0.04). P_{aO2} during admission of group E patients was 82.5±3.6 *mm Hg*, on the 3rd day – 90.3±5.0 *mm Hg* (p <0.001), on the 7th day 90.9±5.8 *mm Hg* (p >0.6). The P_{vO2} dynamics was 36.5±0.6, 39.0±0.6 and 39.1±0.6 *mm Hg* in accordance with the research stages.

Conclusion. Hemoglobin level and blood gas indicators reflect a close relationship with chronic heart failure. Therefore, it is clear that these indicators level tends to increase especially on the 7th day. It can be concluded that ethylmethylhydroxypyridine succinate has a cumulative action.

Keywords: polytrauma, chronic heart failure, blood gases, hemoglobin, antioxidants.

Introduction. Around the world, it is believed that the frequency of cardiac pathology does not decrease, on the contrary progressively increases. In Ukraine, the cause of death due to the circulatory system diseases is no less than 68 %, which affects 52.5 % of the adult population, these are people of working age in 37 % of cases [1]. Chronic heart failure (CHF) seriously affects the course of other pathological processes, complicating diagnosis and disrupting reparation processes, which, in turn, reduces the effectiveness of treatment and can make it untimely [2]. Combined trauma is also the main of the most important medical and social problems in the world [3]. The injuries rank third among the causes of death in economically developed countries, the most of the deaths occurring in employable individuals. According to the World Health Organization, up to 12 million people die due to injury a year in the world. Recently, the death rate because of injuries has been progressively increasing in Ukraine, at least 40,000 people die annually as a result of injuries, and 250,000 become disabled [4].

A significant part falls on persons with a cardiac history among injured patients in such conditions. Thus, according to various sources, coronary heart disease, hypertension, arrhythmia, heart failure are found in 44-62 % of victims in our country [5].

Industrial and domestic injuries, combined injuries occupy a significant share in the structure, among which polysystemic damage with the development of shock conditions, including patients with a provoked cardiovascular system, are characterized by a particularly severe course [6].

Currently, great progress has been made in the diagnosis and treatment of conditions associated with traumatic illness, but the scientific literature does not sufficiently reflect studies of the traumatic illness course in the presence of a cardiac history. That is why the optimization of intensive care in this category of patients is an urgent medical problem [7].

The purpose of the study was to improve the effectiveness of traumatic disease treatment in patients with concomitant cardiac history in polytrauma without acute myocardial injury in order to optimize the energy efficiency of blood circulation by improving methods of intensive therapy.

To achieve this goal, the following tasks were determined:

1) to study the nature and features of blood circulation in patients without chronic heart failure in polytrauma without myocardial injury;
2) to study the nature and features of blood circulation in patients with chronic heart failure in polytrauma without myocardial injury;
3) to study the effect of ethylmethylhydroxypyridine succinate (EMHPS) on hemic and energy circulatory indicators in patients with concomitant cardiac history in polytrauma without myocardial injury;
4) to evaluate the effectiveness of the proposed treatment regimen for patients with a concomitant cardiac history in polytrauma without myocardial injury on the basis of the study of hemic indicators and circulatory energy.

Matherials and methods. The course of circulatory insufficiency in patients with CHF in polytrauma without traumatic or other acute myocardial injury was studied in 96 patients of the polytrauma department of the Municipal Non-Profit Enterprise «Kharkiv City Clinical Hospital of Emergency and Urgent Care named after prof. O. I. Meshchaninov» of Kharkiv City Council.

All experiments were conducted in accordance with the Council of Europe Convention "On the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine Application of Biological and Medicine Achievements (ETS No. 164)" dated 04.04.1997, and the Helsinki Declaration of the World Medical Association (2008). Each study patient signed an informed consent to participate in the study and all measures to ensure anonymity of patients were taken.

All patients were divided into 3 groups. The first group (group C – control) included 29 patients aged 58.7±9.4 years, of which 21 (72.4±8.3%) – men, 8 (27.6±8.3%) – women. Group C patients showed no signs of CHF. The second group (group S – standard) included 33 patients with the same injuries, but who had a cardiological history and confirmed CHF. In this group there were 25 (75.8±7.5%) men, 8 (24.2±7.5%) women. The patients age of group S was 60.0±9.6 years. The group S patients received intensive care according to the local protocol developed in accordance with the protocol of the Ministry of Healthcare of Ukraine. The third group patients – group E, who received EMHPS during the intensive care, included 33 patients aged 62.8±8.8 years, men – 25 (75.8±7.5%), women – 8 (24.2±7.5%). Patients of groups E differed from group S patients only by receiving EMHPS as a part of intensive care (**Table 1**).

Table 1 – Distribution of examined patients into groups

Group	Age, years, M±σ	BSA, m^2, M±σ	IMT, kg/m^2, M±σ	Men n (%)	Women n (%)
C (n = 29)	58.7±9.4	2.06±0.18	24.5±2.4	21 (72.4±8.3)	8 (27.6±8.3)
S (n = 33)	60±9.6	2.09±0.15	26.9±1.0	25 (75.8±7.5)	8 (24.2±7.5)
E (n = 33)	62.8±8.8	2.05±0.12	26.8±4.1	25 (75.8±7.5)	8 (24.2±7.5)

The absence of traumatic or other acute myocardial injuries was confirmed during the polytrauma department admission at the level of TnI, which did not exceed 0.3 *ng/ml* during study in all patients.

The presence of CHF, in addition to anamnestic data, was confirmed by the NT-proBNP level which was more than 100 *pg/ml*, its absence – the level of NT-proBNP – less than 90 *pg/ml*, patients with a NT-proBNP concentration in the range of 90 to 100 *pg/ml*, were excluded from the study, since this limit level did not make it possible to definitely confirm or exclude the presence of CHF.

The study was done at three stages: 1) admission to the hospital; 2) the 3rd day after admission; 3) the 7th day after admission.

Body surface area (BSA) determined by Dubua formula:

$$S_b = 0.00718 \cdot M^{0,43} \cdot H^{0,73},$$

where M – body weight in *kg*, H – height in *cm*, BSA received in m^2; body mass index (BMI, M_{IB}) calculated in the generally accepted way for Quetelet (1835) as the ratio of body weight in *kg* to the square of growth in *m*.

The level of TnI was determined using the biochemical automatic analyzer “Cobas Integra 400” (Germany).

The central artery and vein were catheterized for the control of the oxygen budget. Oxygen budget indicators were examined on the analyzer “ABL800 Flex Series 835” (“Radiometer”, Denmark).

The oxygen content in the blood was calculated according to a modified formula.

$$C_{O2}\ [mole/ml] = K_H\ [mole/g] \cdot C_{Hb}\ [g/ml] \cdot S_{O2} +$$

$$+ K_B\ [mole/ml \cdot b] \cdot (1\text{-}C_{Ht}) \cdot p_{O2},$$

where $K_H = 5.98 \cdot 10^{-5}$ *mole/g* – Güfner constant, which reflects the mass of oxygen, which is bound by 1 gram of hemoglobin; C_{Hb} – concentration of hemoglobin, *g/ml*; S_{O2} – the proportion of oxygen-saturated hemoglobin; $K_B = 1.04 \cdot 10^{-11}$ *mole/ml·b* – Bunsen constant, reflecting the mass of dissolved oxygen per unit of plasma volume at a single partial pressure of oxygen in it; $(1\text{-}C_{Ht})$ – the proportion of the blood volume that comes to the plasma; p_{O2} – partial oxygen pressure in the plasma.

The authenticity degree of differences was estimated by the Student criterion, the degree of correlation – by Pearson correlation coefficient. Mathematical data processing was carried out on a personal computer using «Microsoft Excel’XP» and «Statistica v.6.0» (license numbers K 310528 AXCDX 09-70696 and K 892818 BJ, respectively).

Results. The concentration of hemoglobin (Hb) at the arrival of group C patient fluctuated widely (66-133 *g/l*), amounting to an average 99.9±22.1 *g/l*. Hemotransfusion was carried out before reaching the target level of Hb concentration of 90 *g/l*. By the 3rd day, there were no authentically changes (100.3±15.0 *g/l*), but the minimum level increased to 78 *g/l*. By the end of the study, Hb levels had risen to 111.1±9.2 *g/l*, with a minimum concentration of 94 *g/l*.

Hb saturation of arterial blood (S_{aO2}) during admission of the group C was 0.93±0.03, on the 3rd day it authentically increased to 0.96±0.02 (p <0.001), and on the 7th – to 0.97±0.01 (p <0.001). The same trendency was observed in relation to the Hb saturation of venous blood (S_{vO2}): within admission, it was 0.70±0.04, on the 3rd day – 0.73±0.02 (p <0.001), on the 7th – 0.77±0.02 (p <0.001).

The oxygen tension dissolved in arterial blood (P_{aO2}) during the admission of group C patients was 86.9±4.1 *mm Hg.* In subsequent stages of *the study,* (P_{vO2}) significantly increased to 89.2±3.2 and 91.6±2.8 *mm Hg respectively.* The same dynamics took place with respect to the oxygen tension dissolved in venous blood (P_{vO2}): 37.3±1.2, 38.9±0.7 and 40.0±0.6 *mm Hg* in accordance with the study stages.

The dynamics of measured hemic indicators is presented in **Table 2.**

Table 2 – Measured hemic indicators of group C patients (M±σ)

Indicator	Research stage		
	Admission	3rd day	7th day
Hb, *g/l*	99.9±22.1	100.3±15.0	111.1±9.2
Ht	0.34±0.05	0.35±0.02	0.36±0.02
S_{aO_2}	0.93±0.03	0.96±0.02	0.97±0.01
S_{vO_2}	0.70±0.04	0.73±0.02	0.77±0.02
p_{aO_2}, *mm Hg*	86.9±4.1	89.2±3.2	91.6±2.8
p_{vO_2}, *mm Hg*	37.3±1.2	38.9±0.7	40.0±0.6

The concentration of Hb of group S patients was 109.7±23.3 *g/l*, then decreased to 100.7±10.4 *g/l* (p <0.05), and on the 7th day returned to the original values (107.6±10.1 *g/l*, p >0.1 compared to the original level).

S_{aO2} during admission of group S was 0.92±0.03, by the 3rd day it authentically increased to 0.95±0.02 (p <0.001), remaining at this level on the 7th day too (0.96±0.03, p >0.6). S_{aO2} changes were the same: 0.68±0.03, 0.72±0.02 (p <0.001) and 0.73±0.03, according to the stages of the study.

P_{aO2} within group S patients amounted to 82.4±3.5, 89.2±3.6 (p <0.001) and 90.4±4.8 *mm H*g. P_{vO2} varied as follows: 36.8±1.0, 38.5±0.7 and 39.2±1.2 *mm Hg* in accordance with the stages of research.

The dynamics of measured gemic indicators is presented in **Table 3.**

Table 3 – Measured hemic indicators of group S patients (M±σ)

Indicator	Research stage		
	Admission	3rd day	7th day
Hb, *g/l*	109.7±23.3	100.7±10.4	107.6±10.1
Ht	0.37±0.07	0.34±0.03	0.34±0.02
S_{aO_2}	0.92±0.03	0.95±0.02	0.96±0.03
S_{vO_2}	0.68±0.03	0.72±0.02	0.73±0.03
p_{aO_2}, *mm Hg*	82.4±3.5	89.2±3.6	90.4±4.8
p_{vO_2}, *mm Hg*	36.8±1.0	38.5±0.7	39.2±1.2

The concentration of Hb during admission of group E patients was 110.2±24.6 *g/l*, by the 3rd day it decreased to 100.0±28.8 *g/l*, by the 7th day it increased to 113.4±27.2 *g/l*.

S_{aO2} during admission of group E was at the level of 0.92±0.03, by the 3rd day it authentically increased to 0.97±0.02 (p <0.001), remaining until the end of the study. S_{vO2} showed a tendency to constantly increase. It was 0.68±0.05 within admission, on the 3rd day it

authentically increased to 0.73±0.02 (p <0.001), on the 7th day it reached the level of 0.75±0.02 (p <0.04).

P_{aO2} during admission of group E patients was 82.5±3.6 *mm Hg*, on the 3rd day it authentically increased to 90.3±5.0 *mm Hg* (p <0.001), it was almost unchanged until the 7th day (90.9±5.8 *mm Hg*, p >0.6). The dynamics of P_{vO2} was the same: 36.5±0.6, 39.0±0.6 and 39.1±0.6 *mm Hg* in accordance with the stages of research.

The dynamics of measured hemic indicators is presented in **Table 4**.

Table 4 – Measured hemic indicators of group E patients (M±σ)

Indicator	Research stage		
	Admission	3rd day	7th day
Hb, *g/l*	110.2±24.6	100.0±28.8	113.4±27.2
Ht	0.37±0.08	0.34±0.10	0.37±0.11
S_{aO_2}	0.92±0.03	0.97±0.02	0.97±0.01
S_{vO_2}	0.68±0.05	0.73±0.02	0.75±0.02
p_{aO_2}, *mm Hg*	82.5±3.6	90.3±5.0	90.9±5.8
p_{vO_2}, *mm Hg*	36.5±1,1	39.0±0.6	39.1±0.6

Discussion. According to the long-known laws of mathematical statistics, there is a high probability of polytraumatic damage of persons with chronic heart failure, and even if the myocardium is not directly injured, it is damaged secondarily, as a result, an unfavorable combination of acute hypovolemia, CHF and secondary injure of the myocardium is observed. According to literature data, inflammatory response and oxidative stress reduces the antioxidant capacity of cells, including cardiomyocytes [8]. It is natural to hope that the use of antioxidant drugs will significantly increase the effectiveness of diseases treatment in which there is a pronounced and poorly managed inflammatory reaction [9]. At present, an important class of drugs has been created that can optimize the metabolism of cardiomyocytes and even restore hibernating myocardium, reducing the level of oxidative stress. One of the groups of this drugs class include metabolitotropic drugs, including antioxidant. These drugs prevent the development of irreversible processes in the myocardium [10]. Antioxidants are powerful absorbers of free radicals [11].

One of these drugs is ethylmethylhydroxypyridine succinate, the effects of which have been studied by many researchers [12]. Their work convincingly shows that the use of EMHPS authentically increases myocardial contractility (MC) during chronic heart failure. The effect of EMHPS on the Gamkergic system has been proved, which facilitates the experience of hypoxia by the cell [13]. The effects of EMHPS are not organospecific, it has a beneficial effect on both neurocytes and cardiomyocytes, kidney, liver, intestines and lung cells [14]. Antioxidants, including EMHPS, inhibit apoptosis in cardiomyocytes [15].

Conclusion and prospect of future research. During admission, the concentration of hemoglobin (Hb) in group C ranged widely (66-133 *g/l*), amounting to an average of 99.9±22.1 *g/l*. Hemotransfusion was carried out until the target level of hemoglobin concentration of 90 *g/l*. On the 3rd day, there were no authentical changes (100.3±15.0 *g/l*), but the minimum level increased to 78 *g/l*. By the end of the study, hemoglobin levels had risen to 111.1±9.2 *g/l*, with a minimum concentration of 94 *g/l*. S_{aO2} within admission of the group amounted to 0.93±0.03, on the 3rd day increased to 0.96±0.02 (p <0.001), and on the 7th – to 0.97±0.01 (p <0.001). The same tendency was observed in relation to the saturation of hemoglobin of venous blood (S_{vO2}): during admission, it was 0.70±0.04, on the 3rd day – 0.73±0.02 (p <0.001), on the 7th – 0.77±0.02 (p <0.001). P_{aO2} during admission of group C patients amounted to 86.9±4.1 *mm Hg*, in the following stages – 89.2±3.2 and 91.6±2.8 *mm Hg.* P_{vO2} was equal to 37.3±1.2, 38.9±0.7 and 40.0±0.6 *mm Hg* according to the stages of the study.

Dynamics of Hb in group S patients was 109.7±23.3, 100.7±10.4 (p <0.05), 107.6±10.1 *g/l*, (p >0.1 compared to the baseline). S_{aO2} during admission of group S amounted to 0.92±0.03, by the 3rd day it authentically increased to 0.95±0.02 (p <0.001), remaining at this level up to the 7th day (0.96±0.03, p >0.6). S_{vO2} changes were the same: 0.68±0.03, 0.72±0.02 (p <0.001) and 0.73±0.03, according to the stages of the study. P_{aO2} within admission of group S patients amounted to 82.4±3.5, 89.2±3.6 (p <0.001) and 90.4±4.8 *mm Hg.* P_{vO2} varied as follows: 36.8±1.0, 38.5±0.7 and 39.2±1.2 *mmHg* in accordance with the stages of research.

Dynamics of Hb of group E patients was 110.2±24.6, 100.0±28.8, 113.4±27.2 *g/l*. S_{aO2} during admission of group E was at the level of 0.92±0.03, by the 3rd day it authentically increased to 0.97±0.02 (p <0.001), remaining so until the end of the study. S_{vO2} showed a tendency to a constant increase. Within admission, it was 0.68±0.05, on the 3rd day it authentically increased to 0.73±0.02 (p <0.001), on the 7th day it reached the level of 0.75±0.02 (p <0.04). P_{aO2} in patients of group E was 82.5±3.6 *mm Hg,* on the 3rd day it authentically increased to 90.3±5.0 *mm Hg* (p <0.001), it almost did not change until the 7th day (90.9±5.8 *mm Hg*, p >0.6). The dynamics of P_{vO2} was the same: 36.5±0.6,

39.0±0.6 and 39.1±0.6 *mmHg* in accordance with the stages of research.

Ethylmethylhydroxypyridine succinate optimizes the energy efficiency of blood circulation in patients with chronic heart failure during polytrauma without acute myocardial injury. This action develops slowly, during the week, but it is authentically, so the inclusion of ethylmethylhydroxypyridine succinate within the intensive care regimen in this category of patients is advisable.

During admission of polytrauma patients, it is recommended to determine the level of natriuretic peptide NT-proBNP and troponin I (TnI). Exceeding the concentration of TnI more than 0.3 *ng/ml* means the presence of acute myocardial traumatic injury. A concentration of NT-proBNP more than 90 *pg/ml* indicates chronic heart failure. The inclusion of ethylmethylhydroxypyridine succinate in the intensive care regimen of patients with chronic heart failure during polytrauma without myocardial injury gradually improves myocardial contractility. On the 3rd day after the patient's admission, a significant impact of EMHPS on the mechanics study and energy indicators was not observed. On the 7th day, NT-proBNP decreased by 40% (65.8±23.3 contrary to 109.1±8.5 *pg/ml*, p <0.001). Thus, the addition of EMHPS to the intensive care regimen of patients with CHF during polytrauma without acute myocardial injury optimizes blood circulation and its energy efficiency.

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УДК 616.1-001-031.14-089.16-083.98

ВПЛИВ ХРОНІЧНОЇ СЕРЦЕВОЇ НЕДОСТАТНОСТІ НА ГЕМІЧНІ ПАРАМЕТРИ ПРИ ПОЛІТРАВМІ

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Резюме. *Мета.* Провести дослідження гемічних показників у пацієнтів політравми з хронічною серцевою недостатністю без пошкодження міокарду з використанням етилметилгідроксипіридину.

Матеріали та методи. До дослідження було включено 96 пацієнта відділення політравми. Пацієнти були розділені на 3 групи. До першої групи увійшли 29 пацієнтів групи контроль (К) у віці 58,7±9,4 років. Пацієнти групи К не мали ознак ХСН. У другу групу стандарт (С) увійшли 33 пацієнта з такими ж ушкодженнями, але ті, що мають підтверджену ХСН, у віці 60,0±9,6 років. Хворі групи С отримували інтенсивну терапію згідно з локальним протоколом, розробленим відповідно до протокола МОЗ України. У третю групу Е увійшло 33 пацієнти, які отримували в процесі інтенсивної терапії етилметилгідроксипіридину сукцинат (ЕМГПС), у віці 62,8±8,8 років. Хворі груп Е відрізнялися від пацієнтів групи С тільки тим, що в складі інтенсивної терапії отримували ЕМГПС. Дослідження проводилося на трьох етапах: 1) надходження у стаціонар; 2) 3-я доба після надходження; 3) 7-а доба після надходження.

Результати. Концентрація гемоглобіну (Hb) при надходженні пацієнтів групи К - 99,9±22,1 *г/л*. На 3-ю добу 100,3±15,0 *г/л*, на 7-у добу 111,1±9,2 *г/л*. Насичення Hb артеріальної крові (S_{aO2}) при надходженні в групі К склало 0,93±0,03, на 3-ю 0,96±0,02 (p <0,001), а на 7-у – до 0,97±0,01 (p <0,001). Насичення Hb венозної крові (S_{vO2}): при надходженні воно дорівнювало 0,70±0,04, на 3-ю добу – 0,73±0,02 (p <0,001), на 7-у – 0,77±0,02 (p <0,001). Напруга розчиненого в артеріальній крові кисню (P_{aO2}) при надходженні пацієнтів групи К - 86,9±4,1 *мм рт. ст*. На 3-ю добу - 89,2±3,2, на 7-у добу 91,6±2,8 *мм рт. ст*. Напруга розчиненого у венозній крові кисню (P_{vO2}): 37,3±1,2, 38,9±0,7 і 40,0±0,6 *мм рт. ст*. відповідно до етапів дослідження. Концентрація Hb при надходженні пацієнтів групи С - 109,7±23,3 *г/л*, потім знизилась до 100,7±10,4 *г/л* (p < 0,05), а на 7-у добу - 107,6±10,1 *г/л* (p > 0,1 порівняно з вихідним рівнем). S_{aO2} при надходженні в групі С - 0,92±0,03, на 3-ю добу - 0,95±0,02 (p < 0,001), на 7-у добу (0,96±0,03, p > 0,6). S_{vO2}: 0,68±0,03, 0,72±0,02 (p < 0,001) і 0,73±0,03 відповідно етапам дослідження. P_{aO2} при надходженні пацієнтів групи С склало 82,4±3,5, 89,2±3,6 (p < 0,001) і 90,4±4,8 *мм рт. ст*. P_{vO2}: 36,8±1,0, 38,5±0,7 і 39,2±1,2 *мм рт. ст*. відповідно до етапів дослідження. Концентрація Hb при надходженні пацієнтів групи Е -110,2±24,6 *г/л*, на 3-ю добу - 100,0±28,8 *г/л*, на 7-у добу - 113,4±27,2 *г/л*. S_{aO2} при надходженні в групі Е - 0,92±0,03, на 3-ю добу - 0,97±0,02 (p < 0,001), не змінилось до кінця дослідження. S_{vO2} при наближенні - 0,68±0,05, на 3-ту добу - 0,73±0,02 (p < 0,001), на 7-у добу досягло рівня 0,75±0,02 (p < 0,04). P_{aO2} при надходженні у пацієнтів групи Е становило 82,5±3,6 *мм рт. ст*. на 3-тю добу - 90,3±5,0 *мм рт. ст*. (p < 0,001), на 7-у добу (90,9±5,8 *мм рт. ст*., p > 0,6). Динаміка P_{vO2} була: 36,5±0,6, 39,0±0,6 і 39,1±0,6 *мм рт. ст*. відповідно до етапів дослідження.

Висновки. Рівень гемоглобіну та газових показників крові відображають тісний взаємозв'язок з хронічною серцевою недостатністю. Тож із цих показників видно, що рівень має тенденцію до збільшення особливо на 7-у добу. Можно робити висновки, що етилметилгідроксипіридину сукцинат має накопичувальну дію.

Ключові слова: політравма, хронічна серцева недостатність, гази крові, гемоглобін, антиоксиданти.

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The authors of this study confirm that the research and publication of the results were not associated with any conflicts regarding commercial or financial relations, relations with organizations and/or individuals who may have been related to the study, and interrelations of coauthors of the article.

Стаття надійшла 09.02.2022 р.
Рекомендована до друку на засіданні редакційної колегії після рецензування