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The Effect of Single Use of Sorbilact and Its Combination with L-Arginine on the State of the Cardiovascular System in Endogenous Intoxication Syndrome of Purulent-Septic Genesis

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Abstract. The preparations of polyhydric alcohols, namely sorbitol-based ones, and their combination with adjuvant therapy, namely L-arginine are sufficiently promising for treatment of purulent-septic complications. The systemic nature of their action makes it appropriate to carry out studies of specific effect on the circulatory system, since their wide homeostatic and pharmacodynamic spectrum is beyond doubt for other systems and organs within the “efficiency-safety” algorithm.

The objective of the research was to study the effect of combined use of sorbilact and L-arginine on the cardiovascular system of patients with endogenous intoxication syndrome during the period of developing early secondary autoaggression.

Materials and methods. The study included 117 patients who were divided into the following groups: Group I consisted of 31 patients with systemic inflammatory response syndrome; Group II included 27 patients with endogenous intoxication syndrome treated according to 2016 Surviving Sepsis Campaign; Group III comprised 29 patients with endogenous intoxication syndrome who received sorbilact in addition to standard therapy; Group IV included 30 patients with systemic inflammatory response syndrome who received standard therapy as well as sorbilact and L-arginine.

Results. Co-administration of sorbilact and L-arginine was accompanied by an increase in stroke volume and cardiac output, activation of left ventricular minute work alongside with a moderate decrease in mean arterial pressure and systemic vascular resistance.

Conclusions. The application of sorbilact and L-arginine in patients with endogenous intoxication syndrome provides hemodynamic stability.

Keywords: *sorbilact; arginine; endotoxicosis.*

Problem statement and analysis of the recent research

Despite considerable progress, treatment of purulent-septic complications remains the focus of clinical medicine [1]. Purulent-septic complications, as well as sepsis, cause multiple organ dysfunction syndrome, the characteristic feature of which is accumulation of endotoxins and, accordingly, the development of toxemia [2, 5]. Fluid resuscitation is the basis of intensive therapy for toxemia of septic origin. In fluid resuscitation, various fluids are used: crystalloids, albumin, optionally colloids [3]. The preparations of polyhydric alcohols, namely sorbitol-based ones, and their combination with adjuvant therapy, namely L-arginine are sufficiently promising [4, 7]. The systemic nature of their action makes it appropriate to carry out studies of specific effect on the circulatory system, since their wide homeostatic and pharmacodynamic spectrum is beyond doubt for other systems and organs within the “efficiency-safety” algorithm [6].

The objective of the research was to study the effect of combined use of sorbilact and L-arginine on the cardiovascular system of patients with endogenous intoxication syndrome (EIS) during the period of developing early secondary autoaggression.

Materials and methods

The following groups of patients were included in our study:

- Group I, (the control group) consisted of 31 patients with systemic inflammatory response syndrome (SIRS) (ICD-10: R-65.2);

- Group II included 27 patients with EIS of purulent-septic genesis who were sorted by the level of cell-mediated and humoral intoxication index (CHII) [8] with 40-60 scores and treated according to 2016

Surviving Sepsis Campaign (standard therapy) [9];

- Group III comprised 29 patients with EIS of purulent-septic genesis with 40-60 CHII scores, who received sorbilact in addition to standard therapy;

- Group IV included 30 patients with EIS of purulent-septic genesis with 40-60 CHII scores, who received standard therapy as well as sorbilact and L-arginine.

Inclusion criterion in groups II-IV was acute purulent surgical infection of different localization associated with aerobic gram-positive and gram-negative flora with the subsequent development of secondary toxic autoaggression (stratified to scale of CHII of more than 40 scores).

All the patients received standard combination therapy according to 2016 Surviving Sepsis Campaign [9] (surgical sanitation of the focus of infection, antibiotic therapy, infusion therapy, rheological, metabolic and inotropic support, etc.). Medications affecting the cardiovascular system were not used in the period of the study. Sorbilact infusion to patients of Group III and Group IV was carried out at a rate of 6-7 ml/kg body weight intravenously with the administration rate of 7-8 ml/min. Then, patients of Group IV were intravenously infused with 4.2% solution of L-arginine (Tivortin); administration rate according to the instructions.

Exclusion criterion was the emergence of one or more circumstances that were not included in inclusion criteria, namely supplementing intensive therapy with hemodialysis, plasmapheresis, artificial ventilation, hyperbaric oxygenation; a significant deterioration of the general condition due to the activation of comorbid diseases or the progression of complications, which required the use of intensive care measures that did not meet inclusion criteria.

The statistical analysis of the data was performed using Student's t-test for independent samples by means of the IBM Packs SPSS Statistics 8. The determination of hemodynamic parameters was carried out 3 hours (± 10 min) after sorbilact infusion. Central venous pressure (CVP) was measured using the Waldman phlebotonometer. To measure stroke volume (SV), the portable ultrasound system “High Technology PU-2200” was used.

Results and discussion

Acute endogenous intoxication triggers disregulatory changes in the circulatory system manifesting themselves as increased systemic vascular resistance (SVR) and left ventricular minute work (LVMW) (Table 1). These changes are accompanied by baroreflex regulation inhibition of blood circulation, which is characterized by an increase in the pressure adjusted heart rate (PAR) and reduced cardiac pumping capacity index (CPCI).

Three hours (± 10 min) after sorbilact infusion, LVMW was found to be reduced (by 7-8%, $p < 0.05$) mainly due to chronotropic regulation factor effect (HR reduced by 6%, $p < 0.05$) and SVR (reduced by 7%, $p < 0.05$). At the same time, despite the increase in CVP (by 7-8%, $p < 0.05$), the PAR and CPCI remained at the control level as compared to patients with EIS.

Co-administration of sorbilact and L-arginine was accompanied by activation of LVMW and CPCI. Mean arterial pressure and SVR were moderately reduced by 7-8% ($p \leq 0.05$) and 15-16% ($p \leq 0.05$), respectively.

Conclusions

1. The use of standard therapy in patients with EIS provides

Table 1. Complex of circulatory system indicators during development of early secondary toxic autoaggression (M±m)

Indicator, units of measure	Groups			
	Group I, SIRS (31 patients)	Group II, EIS+s.t. (27 patients)	Group III, EIS+s.t. sorbilact (29 patients)	Group IV, EIS + s.t.+sorbilact+ arginine (30 patients)
HR, <i>bpm</i>	92.2±1.9	99.8±2.1*	93.1±2.2*	99.7±2.1*
SP, <i>mmHg</i>	131.8±2.4	136.2±2.5	139.3±2.7	131.4±2.5*
DP, <i>mmHg</i>	73.3±1.4	79.4±1.5*	77.6±1.4	72.3±1.1**
MAP, <i>mmHg</i>	92.5±2.1	98.7±2.3*	97.3±2.0	90.9±1.7**
SV, <i>mL</i>	71.1±1.7	67.3±1.7	70.9±1.4	74.6±1.3**
CO, <i>L/min</i>	6.47±0.14	6.60±0.15	6.71±0.12	7.35±0.11**
SVR, <i>dyn·s/cm⁵</i>	1140.5±22.1	1244.2±23.7*	1158.7±21.0*	980.1±19.7**
LVS _W , <i>gM</i>	87.4±1.7	91.1±1.8	93.5±1.6	91.7±1.5
LVM _W , <i>kgM</i>	8.1±0.11	9.2±0.10*	8.6±0.09*	9.0±0.08*
CVP, <i>mmHg</i>	5.3±0.13	6.4±0.15*	6.9±0.13*	6.5±0.12*
CPCI, <i>cond.un.</i>	15.9±0.35	12.8±0.32*	12.4±0.31	14.2±0.29***

Notes: * – statistically significant difference between parameters of Groups I-II, Groups II-III and Groups III-IV;

** – statistically significant difference between parameters of Groups II-IV; s.t. – standard therapy; HR – heart rate, SP – systolic pressure, DP – diastolic pressure, MAP – mean arterial pressure, CO – cardiac output, LVS_W – left ventricular stroke work

sufficient hemodynamic stability.

2. Sorbilact infusion at a dose of 6-7 ml/kg body weight at a rate of 7-8 ml/min was found to have a fairly moderate effect on hemodynamic regulatory factors.

3. Co-administration of sorbilact and L-arginine is accompanied by an increase in SV and CO, activation of LVM_W alongside with a moderate decrease in MAP and SVR.

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