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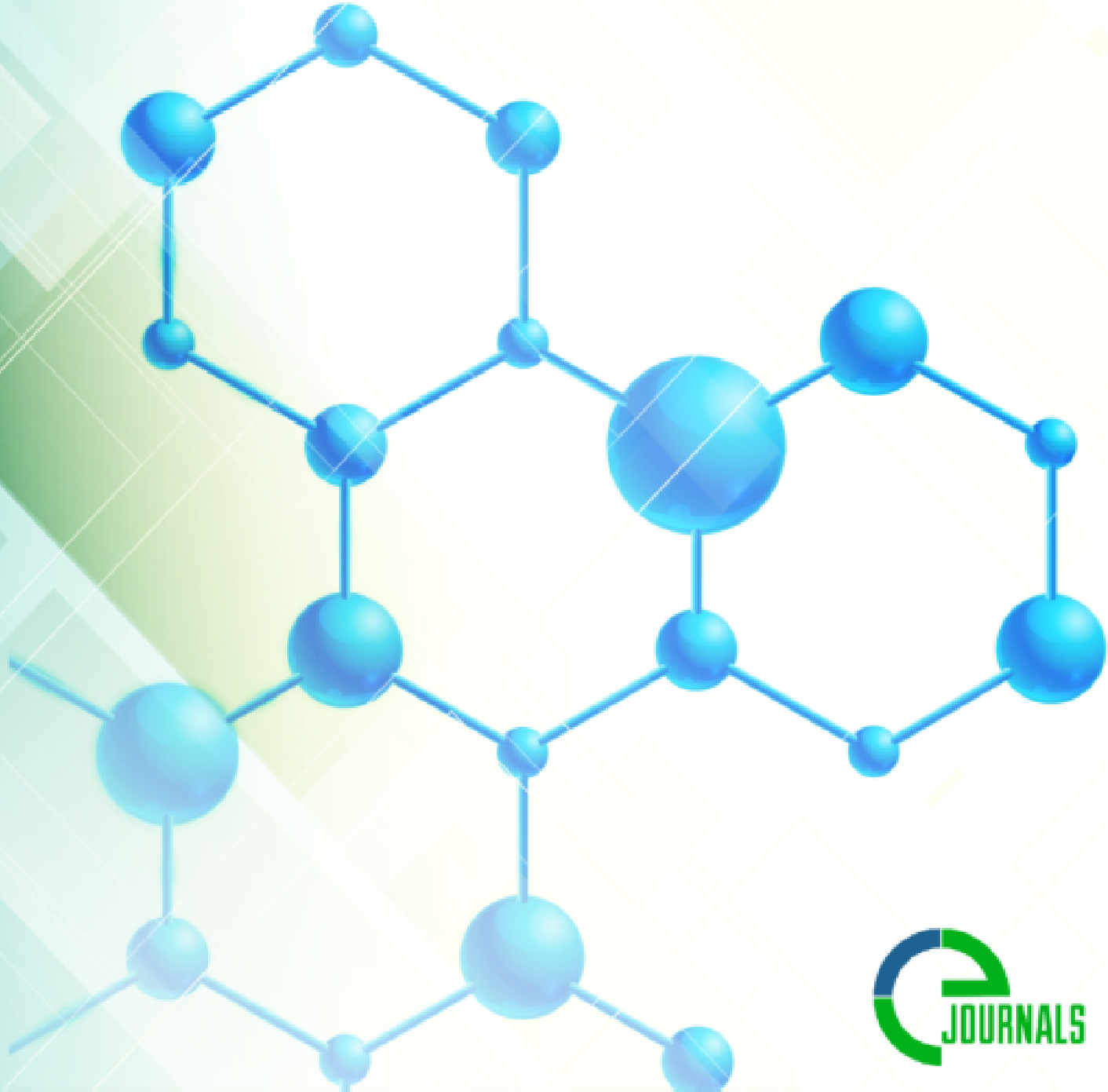

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# THE EFFECT OF HEMOSORPTION IN THE COMPLEX THERAPY OF PERITONITIS ON THE SEVERITY OF ENDOGENOUS INTOXICATION.

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*Abstract: In the pathogenesis of most diseases known to modern medicine, the leading place is given to intoxication syndrome (toxicosis), which is understood as the accumulation in tissues and body fluids of excess products of normal or perverted volume of substances and cellular response. We examined 36 patients with peritonitis who underwent hemosorption in the postoperative period along with ITT, PD, PL, CL. First, the etiology of peritonitis and the nature of its prevalence were studied. Hemosorption rapidly reduced the degree of endotoxemia, improved the functional state of the patient's organs and systems. At an earlier time, intestinal peristalsis was restored. Reducing the volume of lavage fluid reduced the loss of electrolytes and protein, the consumption of which for the correlation of dyselectrolythemia and hypoproteinemia was lower than on the first day. The positive dynamics of MSM in the postoperative period clearly showed that hemosorption can quickly reduce the level of peptide intoxication, there was a more progressive decrease in markers of endogenous intoxication.*

*Keywords. Intoxication, peritonitis, sepsis, mobilization of toxins, extracorporeal detoxification, infusion therapy, hemosorption.*

The relevance of the work. "Intoxication" is one of the most common conditions in clinical practice. It has to be encountered in modern various branches of medicine, among which, in addition to toxicology, purulent - septic surgery should be noted [1, 4]. Despite such a wide prevalence of this pathological process, its strict scientific outlines are not fully formulated to this day [3, 18]. This is due to many objective reasons: a variety of toxic factors, polymorphism of intoxication symptoms, features of interaction between the processes of toxin production and intoxication in the body, etc. In connection with this, the "intoxication syndrome" requires further study [3.15]. The urgency of this problem is evidenced by the high frequency of negative effects of treatment, and high mortality, which, of course, cannot satisfy clinicians [7, 13].

In the pathogenesis of most diseases known to modern medicine, the leading place is given to intoxication syndrome (toxicosis), which is understood as the accumulation in tissues and body fluids of excess products of normal or perverted volume of substances and cellular response. The source of endogenous intoxication can be foci of inflammation, zones of ischemia or destruction of tissues of any nature. Among the factors of endotoxicosis, 3 components are distinguished: microbiological, biochemical and immunological [5]. Peritonitis continues to be one of the most frequent causes of endogenous intoxication syndrome in surgical practice.

Despite the successes achieved in the treatment of surgical diseases of the abdominal cavity, the incidence of adverse outcomes continues to be high, and mortality in peritonitis varies from 13 to 40%. In the case of the development of severe forms of infectious-toxic shock and multiple organ failure, lethality reaches - 76 % [9, 12, 18, 22]. Multifactorial development of disorders in the body and emerging complex morphofunctional changes on the part of individual organs and systems create a number of difficulties in the treatment of acute diffuse peritonitis (ADP). Mortality in peritonitis has always remained one of the highest and reached in postoperative surgical peritonitis

55-90% [14, 16, 20.], thus presenting not only a serious medical and social, but also an economic problem. Despite the improvement of surgical techniques and the introduction of the latest complex methods of intensive therapy, this necessitates the development of an integrated approach to the diagnosis of manifestations, variants of the course and treatment of these conditions with varying severity of EIS, based on the determination of the phases of development of endogenous intoxication and the use of pathogenetically justified programs of differentiated elimination of endogenous toxic substances from the body in order to reduce their damaging effects on organs and life support systems.

The absolute majority of clinicians believe that infusion therapy (IT) always has a detoxifying effect. It is obvious that IT will have a detoxification effect only if there are opportunities to activate natural detoxification pathways with the help of IT. This is possible only when the toxin does not have a strong connection with plasma proteins and by its size overcomes the renal barrier, i.e. it is excreted from the body with an increase in diuresis. In the opposite cases, you can only count on the dilution effect, diluting the concentration of toxins in the blood, the effectiveness of which is very doubtful. The best effect in such cases is obtained from the use of extracorporeal detoxification methods.

However, extracorporeal detoxification, in particular, and hemosorption, affect only the toxins in the circulating blood, while the bulk of them are contained in the deposited and sequestered blood of the microcirculation system, in the so-called tissue depots [2, 21], thereby having a toxic effect on the body, which is the main the reason for the low efficiency of extracorporeal detoxification methods [10]. The above hinders the clear development of early and operative methods for the formation of endotoxins, the dynamics of their distribution in various body environments [64], in severe EIS caused by peritonitis, and hence the differentiated approach to the use of extracorporeal detoxification methods.

With varying severity of EIS, the development of a motivated approach to the early diagnosis of endotoxin formation, their differentiation, distribution in the body's biological environment, the possibility of mobilizing (leaching) them into the bloodstream and selectively selected corporeal and extracorporeal detoxification becomes particularly important [11, 19].

Despite a large number of papers devoted to EIS, issues related to the study of the accumulation and distribution of endotoxins, and, in particular, medium-molecular peptides (MMP), in various body environments in patients with acute respiratory infections against the background of the use of combined detoxification methods remain undeveloped [6, 8, 17].

To date, there is no consensus on the applicability of various combinations and methods of leaching toxins from the depot with methods of extracorporeal detoxification in this contingent of patients, as well as the use of methods of mobilizing toxins into the bloodstream for disorders of central and peripheral hemocirculation.In addition, there are no clear and differentiated indications for a particular detoxification method in various phases of endogenous intoxication.

In connection with the above, it seems that the study of endotoxin deposition processes based on the determination of their level in various biological environments in combination with the determination of the nature of hemodynamic disorders is an essential point in improving the effectiveness of extracorporeal detoxification.

Material and methods. At this stage of the work, we tried to determine the indications for hemosorption (HS) in patients with acute respiratory viral infections, depending on the severity of EIS, its role and significance in the complex of therapy in reducing peptide intoxication. We examined 36 patients with peritonitis who underwent hemosorption in the postoperative period along with ITT, PD, PL, CL. First, the

etiology of peritonitis and the nature of its prevalence were studied.

The main causes of peritonitis in this group were: acute appendicitis, perforated gastric ulcer and duodenal ulcer, and according to the prevalence of the process, only a diffuse form of peritonitis took place.

All patients, depending on the phase of peritonitis at admission, were divided as follows: toxic – in 19 (52.8%) and terminal – in 17 (47.2%) patients. Thus, all patients in this group had toxic and terminal phases of peritonitis. The duration of surgical interventions in the group of patients we studied ranged from 12 to 96 hours, averaging 38.2 ± 2.4 hours.

We found that the condition of the patients was the most severe. This caused a more severe course of the immediate postoperative period, 16 patients needed prolonged ventilation (for 28-96 hours after surgery) due to severe endogenous intoxication, inadequate spontaneous breathing, which was confirmed by decompensated respiratory acidosis, hypoxemia, significant hemodynamic disorders, hepatic–renal insufficiency syndrome, i.e., in patients there was endotoxicosis with a clear violation of the function of detoxifying organs. These severe complications required the use of extracorporeal detoxification methods and, in particular, HS.

Peritoneal and intestinal lavage, active decompression of the gastrointestinal tract and probe feeding of patients practically did not differ from those performed in the traditional style. Intestinal lavage lasted 4-8 days (on average 6.8 ± 0.4 days). It was discontinued after the appearance of active and stable intestinal peristalsis. Despite the severity of the patients' condition, the average duration of CL and enteral probe feeding turned out to be somewhat shorter – it was 5.8 ± 0.2 days.

The average duration of peritoneal lavage was 6.2±0.4 days, and the amount of fluid was 7.4±0.4 l/s.

**Results and their discussions**

In the next hours of the postoperative period, the absolute majority of patients had tachypnea on average - 27.6 ± 0.5 per minute, tachycardia - on average 124.8± 4.2, moderate arterial hypertension in 22 patients, in whom it averaged 155.8±14.1 by 96.4±6.2 mmHg.

Clinical and biochemical blood parameters were more pronounced leukocytosis and hemoconcentration, increased levels of nitrogenous slags, serum enzymes, decreased total protein and A/G coefficient. On the 3rd day of treatment, the indicators of endogenous intoxication in patients remained high (Table 1).

**Table 1**

**Dynamics of MSM concentration and plasma toxicity in patients with acute respiratory viral infections during therapy, M±m**

| Indicators | Research stages, days | | | |
|---|---|---|---|---|
| | 1 | 3 | 5 | 7 |
| | (n=36) | | | |
| MWM, mg/ml | 0,811±0,016***^^^ | 0,72±0,01***^^ | 0,418±0,017 | 0,29±0,01** |
| PMLT, min | 2,3±0,1***^^^ | 2,9±0,1***^^ | 11,6±0,6** | 16,1±0,6 |
| BC, % | 48,3±1,0***^^ | 42,5±0,9***^^ | 26,2±0,7***^ | 20,1±0,3** |
| BFM, $om^{-1}$ $см^{-2}\cdot10^{-8}$ | 10,3±0,1***^^ | 8,9±0,2***^^ | 5,8±0,1^^ | 3,2±0,1*** |

Note: * - differences relative to 1 day data (* - P <0.05, ** - P <0.01, *** - P <0.001); ^ - differences relative to the data of 3 days are significant (^ - P <0.05, ^^ - P <0.01, ^^^ - P <0.001).

Indicators of ABS on the first day after surgery in 36 patients indicated significant metabolic disorders. 29 patients had metabolic acidosis of varying severity, 11 of them had decompensated harcter (pH=7,220±0.008, pCO2 = 6.9± 0.3 kPa, VE=-16.31±0.74 mmol/L), while 7 patients had subcompensated metabolic alkalosis (pH = 7,540±0.004, pCO2 = 7.2±0.6 kPa, VE = + 12.8±0.6 mmol/l).

The parameters of central hemodynamics and volemia were interesting (Table 2).

First of all, hypovolemia should be noted, the CBV in patients was reduced from the norm by 17.2%, mainly due to plasma volume. A 38.2% decrease in the CPI from the norm was confirmed by the hematocrit index (52.2±2.7%).

**Table 2**
**Indicators of central hemodynamics of TPVR and volemia on 1 day after surgery (n=36)**

| Indicator | Reference value | 1st day after surgery |
|---|---|---|
| SO, ml | 62,0±4,4 | 30,3±2,1 |
| SI, ml/m$^2$ | 42,0±8,0 | 16,6±1,2 |
| HR, bpm | 60 - 80 | 124,8±4,9 |
| MBV, l/min | 3,65±7,0 | 3,78±0,22 |
| CI, l/min m$^2$ | 3,1±0,7 | 2,06±0,11 |
| KR - | 10,2±0,1 | 0,65±0,04 |
| CIT - | 77,1±1,6 | 80,6±1,5 |
| TPVR, dyn c.cm$^{-5}$ | - | 2257,4±123,5 |
| CBV, ml/kg | | 62,4±1,8 |
| CPV, ml/kg | | 26,8±0,7 |
| HO, ml/kg | | 35,6±1,0 |
| VBV, % | | 14,2±0,4 |

The determination of volemia indicators allowed us to better understand the pathogenesis of the occurring disorders, to determine the optimal options for their therapy and prevention of complications.

First of all, we drew attention to a significant decrease in the indicators of one-time and minute heart performance, tachycardia, a significant increase in CIT, which indicated a distinct tendency to centralize blood circulation. This was consistent with the existing arterial hypertension. A significant decrease in CD in patients indicated a decrease in the reserve capabilities of the circulatory system.

One of the compensatory reactions aimed at improving hemodynamic parameters is increased breathing. A statistically significant (P <0.01) increase in CDI in patients of this group, in our opinion, is a reflection of a compensatory reaction aimed at increasing the IOC, the implementation of which consists in increasing venous inflow to the right parts of the heart due to the suction action of the pleural cavity.

The severe condition of patients due to late hospital admission, the prevalence of the pathological process, the phase of peritonitis, impaired kidney and liver function, as well as high rates of endogenous intoxication, ascertained by the Lowry express methods and the paramecium test testified to profound disorders of natural detoxifying systems, which made the inclusion of hemosorption in complex detoxification therapy justified.

Starting from the 5th day, MWM indicators were 98% higher than normal values. The indicators of HW increased by 2.2 min.

On the 7th day, the concentration of MWM was 48.8% lower than the initial one. VPJP - increased by 1.3 min.

Hemosorption was performed mainly 8-26 hours after surgery. A total of 104 hemosorption sessions were performed (5 patients had one session, 8 had two, 17 had three, 1 had four, 3 had five and 3 patients had six hemosorption sessions).

The average perfusion volume per hemosorption was 4257.0±13.4 ml.

Complex therapy improved almost all clinical and biochemical blood parameters by 5 days, and by 7 days they were approaching normal values. With CL, the amount of lavage fluid in 1-2 days was 3250-4500 ml / day, in 3-4 days – 2850-3200 ml / day, respectively. With peritoneal lavage, the amount of fluid during the procedure decreased daily from 14.6 to 5.1 liters/day. A similar pattern was observed with intestinal lavage.

Interesting, in our opinion, was the fact that hemosorption, in addition to reducing the period of endogenous intoxication, reduced the total amount of liquid media for PL and CL. So, the amount of fluid for PL and CL, in the first 2-3 days in patients was almost the same, but further, the volume of lavage fluid was lower. The criteria for the duration of PL and CL were: the nature of the effusion and the spread of the process, the severity and degree of endogenous intoxication, electrolyte disorders, indicators of total protein and fractions, data from bacterioscopy of lavage fluid.

**Table 3**
**Dynamics of changes in the amount of fluid during peritoneal and intestinal lavage, M ± n**

| Indicators | Research Day | | |
|---|---|---|---|
| | 1st | 2nd | 3rd |
| CL, ml/sec | 3526,4±342,6 | 4461,2±313,4 | 4246,8±327,6 |
| PL, ml/sec | 14,6±0,5 | 12,7±0,3 | 10,6±0,3 |
| | 4th | 5th | 6th |
| CL, ml/sec | 3597,8±314,2 | 2986,4±263,5 | 2459,2±248,4 |
| PL, ml/sec | 8,2±0,2* | 6,8±0,6 | 5,1±0,3* |

Note: * - a significant difference from the indicator of the 1st day, P<0.01 are significant

Hemosorption rapidly reduced the degree of endotoxemia, improved the functional state of the patient's organs and systems. At an earlier time, intestinal peristalsis was restored. The reduction in the volume of lavage fluid reduced the loss of electrolytes and protein, the consumption of which for the correlation of dyselectrolythemia and hypoproteinemia was lower than on the first day.

**Conclusion.**

Thus, it can be concluded that complex therapy with the inclusion of HS improves the indicators of protein metabolism.

The study of plasma toxicity in dynamics showed a significant decrease in intoxication, and satisfactory values of clinical and biochemical parameters of blood, and improvement in the well-being of patients.

Conducted ITT with stimulation of diuresis, PL, CL and HS in the postoperative period in patients had a positive effect on EBV.

The duration of stay of patients in the hospital was 7-10 days, (on average - 8.2 ± 1.1 days).

The positive dynamics of MWM in the postoperative period clearly showed that hemosorption can quickly reduce the level of peptide intoxication, there was a more progressive decrease in markers of endogenous intoxication.

Hemosorption in the complex therapy of peritonitis, accelerating the decrease in the level of intoxication, improved the functional state of the kidneys and hemodynamics, which was expressed in an improvement in the water-electrolyte balance, an increase in diuresis, a progressive decrease in the level of nitrogenous slags in the blood.

This clearly indicates the high role of hemosorption in complex detoxification in the treatment of peritonitis in the postoperative period.

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