https://doi.org/10.23873/2074-0506-2022-14-1-45-57

The program of enteral correction of homeostasis disorders and its effect on intestinal permeability in acute poisoning

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Abstract

Background*. The problem of pathologically increased permeability of the intestinal wall is actualized with the accumulation of information about the correlation of this phenomenon with complications of an inflammatory nature and multiple organ failure in critical conditions, including acute poisoning.*

Aim of study. *To assess the effect of the program of enteral correction of homeostasis disorders on intestinal permeability in acute poisoning*

Material and methods: *40 patients (67.5% of women and 32.5% of men) admitted at the Intensive Care Unit as part of the Scientific Department of*

Acute Poisonings and Somatopsychiatric Disorders of the N.V. Sklifosovsky Research Institute for Emergency Medicine were examined, 20 of them (group I) with severe acute oral poisoning with corrosive substances: acetic acid 35.6% and alkali (sodium hydroxide) 64.4 %, as well as 20 patients (group II) with severe acute oral poisoning with psychopharmacological agents. Both groups were divided into two subgroups: I-a and II-a - (10 patients in each), in whom an enteral correction program was used in addition to the standard treatment, and I-b and II-b - comparison groups (10 patients in each each) who received only standard therapy.

Results. *It was found that in all observed patients with severe acute oral poisoning with corrosive substances, as well as psychopharmacological agents, the ratio of lactulose / mannitol concentration in urine as an indicator of intestinal permeability was increased before the start of treatment in relation to its reference value of 3.8-4.9 times.*

After 5 days, in patients who received the enteral correction program, the lactulose/mannitol ratio decreased by 15.4% in cases of poisoning with corrosive substances, and by 19.8% in cases of poisoning with psychopharmacological agents. At the same time, in patients with poisoning with corrosive substances, who received standard treatment, this parameter decreased by only 1%. Attention was drawn to the fact that in patients with psychopharmacological agents poisoning who received standard therapy, the intestinal permeability index after 5 days did not decrease, but continued to increase and exceeded the initial value by 11.4%.

Conclusion. *With the help of the enteral correction program, it is possible to reduce the permeability of the intestinal wall in acute poisoning with corrosive substances and psychopharmacological agents.*

Keywords: acute poisoning, increased intestinal permeability, enteral correction program

Conflict of interests Authors declare no conflict of interest

Financing The study was performed without external funding

For citation: Potskhveriya MM, Matkevich VA, Goldfarb YuS, Simonova AYu, Stolbova NE, Tyurin IA, et al. The program of enteral correction of homeostasis disorders and its effect on intestinal permeability in acute poisoning. *Transplantologiya. The Russian Journal of Transplantation.* 2022;14(1):45–57. (In Russ.). https://doi.org/10.23873/2074-0506-2022-14-1-45-57

CC, critical condition

ECP, enteral correction program

EN, enteral nutrition

ES, enteral solution

GES, glucosed enteral solution

GIT, gastrointestinal tract

HPLC, High Performance Liquid Chromatography

ICU, Intensive Care Unit

IL, intestinal lavage

L/M, the ratio of lactulose/mannitol concentrations in urine

LPS, lipopolysaccharides

MMWP, medium molecular weight peptides

PCS, poisoning with corrosive substances

PPA, psychopharmacological agents

PPPA, poisoning with psychopharmacological agents

SCFA, short-chain fatty acids

Introduction

In recent years, the issues of diagnostics of the state of increased intestinal permeability have been updated with the appearance of information in the scientific literature on the correlation of microbial

translocation and certain diseases [1-3]. In the problem of treating patients in critical conditions (CC), the topic of intestinal permeability is of interest to researchers in the aspect of studying the kinetics of toxicants and bacteria from the intestinal cavity to the internal environment of the body and the associated development of inflammatory complications and multiple organ failure [4, 5].

The intestine, being a reservoir of infection and a mass of various toxic substances, is one of the organs with a constant intensive metabolism, requiring the delivery of an adequate amount of plastic material and energy to maintain a normal morphofunctional state. The high sensitivity of intestinal wall epithelial cells to hypoxia and ischemia determines early damage to the epithelial barrier separating the enteral environment from the internal one, in conditions accompanied by microcirculation disorders and hypoxemia (burns, trauma, surgery, poisoning, etc.), as well as in the case of an unfavorable course of any disease [5, 6].

It is known that the causes of increased permeability, in particular, of the intestinal epithelial barrier in various pathological conditions, are diverse in nature [7, 8]. Among them, trophoplastic insufficiency of epithelial cells, which occurs as a result of a decrease in their blood supply on the one hand, and, on the other hand, a decrease in the concentration of short-chain fatty acids (SCFAs), which are a food substrate for them, is more often referred to [8-10]. In stressful situations, including acute poisoning, there is a decrease in the number of lactic acid bacteria inhabiting the intestine - producers of SCFAs, which leads to a decrease in the concentration of SCFAs, starvation and death of epithelial cells, violation of the integrity of the epithelial barrier [10, 11].

Based on the thesis of the violation of the epithelial barrier as a key factor in increasing intestinal permeability, it follows that the measures

necessary for its restoration should be aimed at improving blood supply to the intestinal mucosa (hemodynamics, hemorheology and microcirculation, increased blood oxygenation), eliminating metabolic disorders (water-electrolyte balance, acid-base state, oxidative stress) and increasing the specific weight of lactic acid bacteria being the donors of SCFAs. In literature, we have not found any suggestions of such a comprehensive approach to solving the problem of reducing the pathological permeability of the intestinal epithelium in acute poisoning, which determined the purpose of this study.

The objective was to evaluate the effect of the program of enteral correction of homeostasis disorders on intestinal permeability in acute poisoning.

Material and methods

An open prospective randomized study was conducted at the Intensive Care Unit as part of the Scientific Department of Acute Poisonings and Somatopsychiatric Disorders of the N.V. Sklifosovsky Research Institute for Emergency Medicine in the period 2019-2021. Patients were selected according to the inclusion criteria (age up to 65 years, the time since the corrosive substance intake being no more than 6 hours, and the time since psychopharmacological agent (PPA) intake of 12 hours before the admission to the hospital. The presence of chemical burns of the oral mucosa, pharynx, esophagus of the 2^{nd}-3^{rd} degree and the stomach of the 2^{nd}-3^{rd} degree according to the classification of S. V. Volkov et al. was taken into account in poisoning with psychopharmacological agents (PPPA). (2005) [12]. Diagnosis of chemical burns and subsequent monitoring of the mucosa of the upper gastrointestinal tract (GIT) were performed using endoscopic examination

− esophagogastroduodenoscopy. PPA poisoning was classified as stage 2-b – 3 (scored 3-5 by Glasgow Coma Scale).

The study included 40 patients (67.5% of women and 32.5% of men), 20 of them (I group) with severe acute oral PCS (35.6% with acetic acid and 64.4% with alkali (sodium hydroxide) T 54.2 и T54.3 by ICD 10) and 20 patients (II group) with severe acute oral poisoning with PPA who stayed in the Intensive Care Unit (ICU). Both groups were divided into two subgroups: I-a and I-b; II-a and II-b.

In the target subgroups I-a and II-a (10 patients each), the patients received enteral correction program (ECP) in addition to a standard treatment. In the comparison subgroups I-b and II-b (also 10 patients each) the patients received only standard therapy, including enteral nutrition (EN); and in II-b group, hemodiafiltration was performed for detoxification.

Table 1 shows the characteristics of the observation groups by age, gender, and severity of PCS and PPPA.

Table 1. General characteristics of observation groups in poisoning with corrosive substances and psychopharmacological agents

Parameters	Patient groups			
	PCS		PPPA	
	I-a (n=10)	I-b (n=10)	II-a (n=10)	II-b (n=10)
Age, years Me (Q_1 ;Q_3)	33.5 (27.5;53)	42 (35;55)	33 (21;51)	34 (25;53)
Men, n (%)	6 (30)	3 (15)	15)	3 (15)
Women, n (%)	4 (20)	7 (35)	9 (45)	7 (35)
Chemical burn degree: esophagus stomach	 2-3 2-3	 2-3 2-3	 -	 -

As can be seen from the table, patients were comparable in age, gender, and severity of poisoning in the groups of nosological forms of poisoning of the same name.

The ECP included 3 stages:

1. Intestinal lavage (IL) using enteral solution (ES) in the volume of 4.5-15 liters on the first day of treatment [13]

2. Fractional oral administration of 200 ml of glucosed enteral solution (GES) at approximately equal intervals in a total volume of 3-4 liters per day. Hylak forte 60 drops 3 times a day was added to GES, and pectovit 5.5 g was administered to patients 3 times a day.

3. EN patients were given "Isosource® Energy Fiber" nutrient formula (Nestle Health Science) 200 ml in fractions up to 1.6 liters per day.

The composition of the ES used for IL includes: sodium phosphate, sodium chloride, sodium acetate, potassium chloride, citric acid, disodium salt complex of ethylenediaminetetraacetic acid, as well as calcium chloride and magnesium sulfate, potable purified water. ES was prepared from a set of commercially available mineral-acid concentrate. To do this, the concentrate was dissolved in a pre-defined volume of water according to the manufacturer's instructions attached to the concentrate kit. The osmolarity of the solution is 290-310 mOsm/L (depends on the volume of water used to dissolve salts), pH≈5.8. GES is an ES that additionally contains 2 g of glucose in 1 liter. Depending on the patient's state of consciousness, IL was performed in two modifications [13]:

1. Fractional IL through a nasogastric tube for people with impaired consciousness (in PPPA) or impaired swallowing function (in PCS).

2. Tube-free IL in patients whose psychosomatic state allowed their self-intake solution in the form of drinking and hygienic self-care.

Patients with PCS (I-a subgroup) underwent IL using ES after administration of painkillers and antispasmodics and tube gastric lavage. For this purpose, they were given to drink 200 ml of the solution every 5

minutes, the solution temperature was 18-22^{o} C. After 1.5–2 hours, the patients developed diarrhea. GIT lavage was performed until light half-clear waters emerged from the rectum (they could be yellowish in color), after which the patient stopped drinking the solution. During the next 30-40 minutes, defecation continued, then stopped spontaneously. The total volume of the solution ranged about 4.5 liters. The IL procedure lasted for an average of 3 hours. Patients tolerated it satisfactorily, and there were no adverse reactions or complications. In cases where patients were initially unable to take ES on their own due to the severity of the condition, it was administered through a nasogastric tube.

Patients with PPPA (II-a subgroup) were treated with the following procedures upon admission to the department: IL using ES in the volume of 12-16 liters. To perform IL in patients after tracheal intubation and tube gastric lavage, a nasogastric two-channel tube was installed, the perfusion channel of which was connected to a gravity system with a capacity of 1.5–2 liters (used for EN) filled with ES, the temperature of which was 37–38 ^{o} C. The aspiration channel of the probe served to decompress the stomach and remove excess solution from it.

The patient was placed on his back with an elevated position of the upper half of the body. The solution was administered in portions of 150-200 ml every 5 minutes. After the introduction of 1.5–2.5 liters of the solution, loose stools appeared, and later on, the watery discharge without inclusions (intestinate). In the absence of stool after administration of 2.5 liters of the solution, a single dose of the solution was halved, an enema was made with the same solution in a volume of approximately 1.5 liters (25-30 ml per 1 kg of body weight); and the stimulation of intestinal motor function was started, following the recommendation of V.A. Matkevich (2012): “From drugs, preference should be given to antispasmodics (papaverine, drotaverine, platifillin, baralgin, spazgan, etc., excluding atropine), one of

which is optionally administered intravenously in a single dose. Another effective remedy in these cases (excluding poisoning with antidepressants) is serotonin adipinate, which is administered at 10–20 mg intramuscularly or intravenously (diluted in 400 ml of saline sodium chloride solution) at a rate of 80 drops/min, repeated after 1 hour until diarrhea appears" [13].

At 6-12 hours after IL, patients of subgroups I-a and II-a began fractional (150-200 ml each) oral administration of GES, interspersed with EN at a rate of 3-4 liters with a regular distribution of this volume during the day with the addition of hylak forte and pectovit. In this mode, patients took GES for 3-5 days, until getting out of CC.

The study timepoints were: before the treatment start and after 5 days of stay in the ICU. The lactulose/mannitol index (L/M) was evaluated at the study stages. According to the results of treatment, the frequency of complications, the length of stay in the ICU, the total period of hospitalization in the Acute Poisoning Department, and mortality were compared between groups I and II, respectively.

The study of intestinal wall permeability was performed according to the following method.

After a single dose of a solution containing 1 g of lactulose and 5 g of mannitol in 120 ml of water, their concentration in a single portion of urine was determined by high-performance liquid chromatography with tandem mass spectrometry (HPLC-MS/MS) using Agilent 1260 (chromatograph) and Sciex 6500+ (MS/MS spectrometer) equipment. The concentration of lactulose and mannitol was expressed in mg/L. The L/M concentration ratio was calculated, the reference value of which was obtained in the study of 20 healthy volunteers by Simon D Johnston et al. (2000) was defined as 0.024 [14]. The degree of permeability was estimated by the L/M value. A total of 80 tests were performed. The

mannitol and lactulose substances used to prepare the solution were of pharmacopoeia quality.

Statistical processing of the material was performed using the IBM SPSS Statistics 27.0 program. The normality of the data distribution was evaluated using the Shapiro-Wilk test ($n \leq 50$). Due to the fact that the distribution of features differed from the normal one, the median (Me), the 25th and 75th percentiles were determined. The data are represented as Me (Q1-Q3). Quantitative data were compared between groups by using the Mann-Whitney test (M-W t), and between the study stages by using the Wilcoxon test. To compare categorical data between groups, the Pearson's χ^2 test was used. The level of statistically significant differences was assumed at $p<0.05$.

Results

Table 2 shows the results of an intestinal permeability study in patients with PCS and PPPA and the effect of ECP and standard treatment on it.

Table 2. Lactulose/mannitol index before the treatment start and on day 5 in the groups of patients with poisoning with corrosive substances and psychopharmacological agents

Parameters	Reference value	Study stages	Patient groups			
			PCS		PPPA	
			I-a (n=10)	I-b (n=10)	II-a (n=10)	II-b (n=10)
L/M	0.024	Before the treatment start	0.104 (0.096-0.111)	0.105 (0.092-0.114)	0.091 (0.073-0.099)	0.105 (0.093-0.119)**
		On day 5	0.088 (0.074-0.092)*	0.104 (0.089-0.19)**	0.073 (0.063-0.078)*	0.117 (0.111-0.133)*;**
Δ,%			-15.4%	-one%	-19.8%	+11.4%

Note: * − statistically significant difference from the baseline value ($p<0.05$);
** − statistically significant difference between groups; Δ, % - the difference between the values before the treatment start and on day 5.

Table 2 shows that in all observed patients, the L/M ratio before treatment was increased relative to the reference value. Moreover, this excess was 4.3 and 3.8 times in subgroups I-a and II-a, and 4.4 times in subgroups I-b and II-b each, respectively. Based on the results of the intestinal wall permeability study of the in PCS and PPPA, it can be concluded that it was significantly increased with a statistically significant difference versus the reference value ($p<0.05$).

After 5 days, the increased intestinal permeability in patients treated with ECP decreased by 15.4% in patients with PCS, and by 19.8% in patients with PPPA. While in patients with PCS who received standard treatment, the excess intestinal permeability decreased by only 1%. Attention is drawn to the fact that in the patients poisoned with PPA who received the standard therapy, the intestinal permeability index continued to increase, and after 5 days it exceeded the baseline value by 11.4%.

Clinical parameters of the treatment results in patients in the target and comparison groups are presented in Table 3.

Table 3. Clinical parameters of the treatment results in the patients with the use of the enteral correction program and comparison groups

Parameters	Patient groups			
	PCS		PPPA	
	I-a (n=10)	I-b (n=10)	II-a (n=10)	II-b (n=10)
Pneumonia incidence, n(%)	0	5 (50)*	0	1(10)
Length of stay in the ICU	3 (3-5)	5.5 (3-9)	2 (1.5-3)	5 (3.5-10.5) *
Total length of hospital stay	9 (6.5-11.5)	13 (5.5-20)	6 (4.5-8)	10 (6.5-20.5) *
Mortality, %	0	0	0	1(10)

Note: * − statistically significant difference in values in the subgroups with the same types of poisoning

Analysis of the clinical results of treatment of patients showed that in the subgroups in which ECP was used (I-a and II-a), pneumonia was not observed, while in the comparison subgroups (I-b and II-b), it was a complication of poisoning in 50% and 10% of cases, respectively. The length of ICU stay and total hospital stay in the comparison group with PCS exceeded the values of the corresponding parameters in the target group by 1.4 and 1.7 times, respectively. In PPPA, the values of the same parameters in the comparison group were 2.5 and 1.67 times higher, respectively.

Among the observed patients, there was 1 fatal outcome in the comparison group with PPPA.

Discussion

The results of studying the intestinal permeability state in PCS and PPPA showed that it was significantly increased, which was consistent with the data obtained by I.N. Leiderman et al., (2012) in cases of moderate and severe poisonings with cauterizing fluids [15]. In addition, we found that in poisoning with PPA, a pathologically excessive intestinal permeability by 3.8-4.4 times is also detected versus the reference value.

ECP contributes to a certain reduction in the severity of this pathological process, but for 5 days, during which the study was conducted, it was not possible to achieve the recovery of the intestinal barrier function within normal range of values. In this regard, it is advisable to pay attention to another phenomenon the PEC brings, or rather, the IL does that is the part of it. The problem of pathological permeability of the intestinal wall worries researchers not by itself as such, but by the fact that when it is disturbed, intestinal contents rush into the internal environment. In this regard, there is a need to look at the

problem precisely from the position of preventing intestinal translocation through the "leaky" intestine by removing its contents. This "mission" is exactly what IL copes with, which at first reduces the leakage of pathological substances from the GIT into the systemic bloodstream. This situation was demonstrated earlier by the example of a decrease in the blood level of medium molecular weight peptides (MMWP) and lipopolysaccharides (LPS) after IL in PPPA [16]. Specifically, for the purpose of the gastrointestinal tract rehabilitation, IL was included as the first stage of ECP. During IL, in addition to detoxification by purifying the gastrointestinal tract, the impaired water-electrolyte balance, acid-base state, hemorheology, microcirculation, pro - and antioxidant balance, intestinal microbiocenosis, and gastrointestinal motor function are corrected [13]. All these factors are absolutely necessary to restore the integrity of the intestinal epithelial layer in case of inflammation and damage. The use of other components of PEC, such as nutritional support with GES, meta- and prebiotics is aimed at restoring the integrity of the mucosa and the physiological permeability of the intestinal wall as soon as possible, which we observed when comparing the results of intestinal permeability testing between the main and comparison groups.

In clinical toxicology, the topic of intestinal permeability is of interest to researchers in the aspect of studying the toxicokinetics of both exo- and endotoxicants. Earlier, as a result of our own research, we found that even at the initial stage of acute oral poisoning with PPA, when patients still had no inflammatory complications, their blood level of medium molecular weight peptides (MMWP) considered as markers of endotoxicosis, exceeded the reference values by 3-4 times, and the level of lipopolysaccharides (LPS) of gram-negative bacteria did up to 10 times. The results of those studies indirectly suggested that high blood levels of MMWP and LPS are associated with an increase in the

permeability of natural barriers on their way from the intestinal cavity to the systemic circulation [16, 17]. To block the pathological flow, cellular elements of the immune system accumulate in the intestinal mucosa at the sites of the breakthrough, which can restrain its further progress into the parenteral environment (post-epithelial lymphocyte barrier). If this barrier breaks through, toxicants and bacteria enter the liver through the portal vein where they meet with macrophages that block their further passage in the blood flow. Hypoxia of intestinal cells, LPS of gram-negative bacteria coming from the intestine activate liver macrophages that release inflammatory mediators [5]. If this protection system fails, the endothelium of the pulmonary capillaries and endothelial pulmonary macrophages are the next barrier along the blood flow. Some of the toxicants, microbial toxins and microbial cells, biologically and immunologically active substances coming from the intestinal cavity through the lymphatic vessels are blocked in the mesentery lymph nodes, and when this barrier breaks, they enter the thoracic lymphatic duct into the superior vena cava system and then enter the lungs with the blood flow, where they are blocked by pulmonary (endothelial) macrophages [18]. This translocation process can be stopped by the body's defenses at any of the listed stages. Otherwise, the failure of natural physiological filters, organs and detoxification systems of the body leads to dissemination of the process with the development of enterogenic toxemia and bacteremia with multiple organ infection [19, 20]. For example, V. A. Mikhailovich and co-authors (1995) report that in an experimental work: "... it was possible to record a 5-fold increase in the permeability of the colon wall against the background of severe toxemia… Meantime, intestinal toxins accumulated most intensively in the tissues of the lungs, liver, and kidneys" [cit. by 19].

Thus, a decrease in the body's immunoreactivity can promote translocation of opportunistic and pathogenic microorganisms into the

systemic circulation with the development of a toxic-septic state [20]. When the intestinal barrier function fails, LPS of gram-negative bacteria causes the activation of endotheliocytes and macrophages of the intestinal wall, liver, and lungs, which release inflammatory mediators that trigger the immune response [21]. However, at various critical states, polymorphonuclear cells (neutrophils, basophils, granulocytes) and endotheliocytes go into an aggressive state of "oxygen explosion" [21, 22]. The result of this transformation is a powerful chaotic release of a huge amount of substances into the bloodstream by these cells, which have multidirectional effects and are mediators of a systemic inflammatory reaction and subsequent multiple organ failure [5, 22].

The concept of the impairment of the intestine barrier function gives rise to at least two tasks. The first one is related to the diagnosis of this condition, the second one is related to the development of therapeutic means and methods that would reduce the flow of pathological agents from the intestine. However, in the literature on the topic of intestinal permeability in acute poisoning, only few studies have been found, from which it follows that in acute poisoning, the permeability through the natural barriers of all three classes of substances: low-, medium- and high-molecular ones increases [15, 16, 23].

Regardless of the CC etiological factor, non-specific processes of microbiocenosis rearrangement are triggered in the intestine with increased virulence and invasiveness of opportunistic flora and breaking the protective function of the intestinal wall, leading to enterogenic intoxication and infection of the body inner environment. This complicates the patient's condition, increases the number of infectious complications and the duration of the disease, and serves as a prerequisite for the development of multiple organ failure [5, 22]. In the aspect of preventing or reducing the process of intestinal translocation, it is

important to stop or at least reduce the flow of dangerous components of intestinal contents into the internal environment. It would seem that theoretically, this can be achieved by closing the trans- and paracellular channels of the intestinal mucosa by using some means. And researchers are searching for such means. In order to eliminate increased intestinal permeability, enzymes, amino acids, in particular, glutamine, fish oil, flavonoids and antioxidants, lactobacilli, dietary fiber, sucromycetes (eubicor), etc. have been proposed. At the same time, the analysis of the causes inducing the syndrome of increased permeability, or "leaky" intestines, shows that there are many such causes and they are diverse in nature. To eliminate this syndrome, one should first eliminate its cause, and secondly, choose the necessary specific or universal tool for "plugging" gaps in the mucous membrane, which seems to be a very difficult task, and perhaps fundamentally impossible. An alternative solution to the problem of preventing or reducing intestinal translocation is to reduce the mass of potentially dangerous substances in the intestine that can be absorbed and enter the systemic circulation. The second way is quite feasible with the help of ECP, the idea of which is to sanitize the intestines by removing its contents naturally and creating favorable conditions for the speedy recovery of the integrity of the mucous membrane which is able to be renewed every 5-7 days. ECP is based on the therapeutic mechanisms of IL [24, 25]:

- Simultaneous detoxification of the enteric and humoral environments of the body.
- Autoregulation of water-electrolyte and acid-base blood compositions, parameters of hemorheology, microcirculation, immune status, pro-and antioxidant systems.
- Coping with functional disorders of the gastrointestinal tract, cardiovascular system.

- Correction of disorders of GIT microbiocenosis.

These mechanisms are universal and are etiopathogenetic in acute poisoning. Subsequent after IL nutritional support with the use of oral GES is aimed at maintaining the parameters of water-electrolyte, acid-base blood composition, hemorheology, and microcirculation at physiological levels. Correction of homeostasis disorders, restoration and stabilization of intestinal microbiocenosis, namely the lactoflora population being the donor of the SCFAs, by additional inclusion in the ECP of a metabiotic (hylak forte) and pectin, are aimed at the regeneration of intestinal epithelial cells and normalizing the intestinal barrier. The listed complex of ECP therapeutic mechanisms, which provide detoxification, correction of homeostasis disorders and restoration of organ and system functions, and above all, the function of the gastrointestinal tract, can be considered as an independent one, sufficient for non-severe conditions, and also as a preparatory one for EN, which additionally provides the patient with the energy and plastic material such necessary in CC. Thus, following the ECP, the tasks of the body detoxification and homeostasis recovery are gradually solved, contributing to the speedy getting the patient out of CC.

The introduction of ECP into the practice of the Department of Acute Poisonings and Somatopsychiatric Disorders of the N. V. Sklifosovsky Research Institute for Emergency Medicine allowed us to improve the clinical results of treating patients with PCS and PPPA by reducing the incidence of pneumonia by 50% and 10%, shortening the patient ICU length of stay by 1.83 and 2.5 times, and the total hospital length of stay by 44% and 67%, respectively.

Conclusions

1. In severe poisoning, the intestinal permeability was found to be increased, exceeding the norm by 4.3–4.4 times in cases of poisoning with corrosive substances, and by 3.8–4.9 times in cases of poisoning with psychopharmacological agents.

2. Standard treatment does not have a significant effect on the decrease in intestinal permeability in cases of poisoning with corrosive substances; and in cases of poisoning with psychopharmacological agents, the intestinal permeability even increases by 11.4% by the 5th day.

3. The use of a 5-day Enteral Correction Program for severe poisoning with corrosive substances and psychopharmacological agents reduces a pathologically excessive intestinal permeability by 15.4% and 19.8%, respectively.

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5%, an intellectual content assessment and manuscript approval

The article was received on November 15, 2021;
Approved after reviewing November 29, 2021;
Accepted for publication December 27, 2021