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The influence of microflora on the barrier function of the liver in widespread purulent peritonitis

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Objective: Study of some mechanisms and course of bacterial translocation and disruption of the liver barrier function with subsequent correction in widespread purulent peritonitis.

Patients and Methods: A retrospective and prospective study was conducted based on data obtained from the examination and treatment of 69 patients with widespread purulent peritonitis who were hospitalized in the surgical departments and the liver and pancreas surgery department of the Dushanbe City Emergency Medical Care Center. The study covered the period from 2014 to 2024.

Results: According to the microbiological analysis, a high prevalence of gram-negative bacteria was noted: Escherichia coli was detected in 59 cases (85.5%) as a monoinfection and in 7 cases (10.1%) in combination with other microorganisms; Streptococcus faecalis was detected in 18 cases (26.0%) as a monoinfection and in 5 cases (7.2%) in combination with other bacteria. The highest sensitivity of bacteria to the most frequently used antibacterial agents was noted for meropenem and imipenem - in 86.9% and 86.2% of cases, respectively. All patients with widespread purulent peritonitis developed severe visceral circulation disorders: blood flow in the superior mesenteric artery decreased by 47.1±2.8%, 351.20±18.59 ml/min, total hepatic blood flow – by 57.1±2.5%, 680.30±38.42 ml/min, portal blood flow – by 71.3±2.2%, 332.20±26.22 ml/min, hepatic arterial blood flow – by 18.3±4.0%, 348.10±16.71 ml/min compared to healthy individuals, which indicated a severe disorder of organ hemodynamics in the liver and small intestine.

Conclusion: In the pathogenesis of visceral function disorders in widespread purulent peritonitis, an important role is played by organ circulation disorders, massive translocation of intestinal microflora into the arteriovenous bed, and acute liver failure, manifested primarily by macrophage liver failure.

Key words:
bacterial translocation, widespread purulent peritonitis, organ circulation disorder, liver failure

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Влияние микрофлоры на барьерную функцию печени при распространённом гнойном перитоните

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Цель исследования. Изучить патогенетические механизмы бактериальной транслокации и нарушения барьерной функции печени с последующей коррекцией при распространённом гнойном перитоните.

Пациенты и методы. Ретроспективное и проспективное исследование было проведено на основе данных, полученных в результате обследования и лечения 69 больных с распространённым гнойным перитонитом, которые находились на стационарном лечении в хирургических отделениях и отделении хирургии печени и поджелудочной железы Городского центра экстренной медицинской помощи г. Душанбе. Исследование охватывало период с 2014 по 2024 год.

Результаты. По данным микробиологического анализа отмечена высокая распространённость грамотрицательных бактерий: Escherichia coli была обнаружена в 59 (85,5%) случаях как моноинфекция и в 7 (10,1%) – в сочетании с другими микроорганизмами; Streptococcus faecalis выявлен в 18 (26,0%) случаях как моноинфекция и в 5 (7,2%) – в сочетании с другими бактериями. Наибольшая чувствительность бактерий к наиболее часто используемым антибактериальным средствам отмечена к меропенему и имипенему — в 86,9% и 86,2% случаев соответственно.

У всех больных с обширным гнойным перитонитом развивались выраженные нарушения висцерального кровообращения: кровоток по верхней брыжеечной артерии снизился на 47,1±2,8%, 351,20±18,59 мл/мин, общий печёночный кровоток – на 57,1±2,5%, 680,30±38,42 мл/мин, портальный кровоток – на 71,3±2,2%, 332,20±26,22 мл/мин, печёночный артериальный кровоток – на 18,3±4,0%, 348,10±16,71 мл/мин по сравнению со здоровыми лицами, что свидетельствовало о выраженном нарушении органной гемодинамики печени и тонкой кишки.

Заключение. В патогенезе нарушения висцеральных функций при распространённом гнойном перитоните важную роль играют нарушения органного кровообращения, массивная транслокация кишечной микрофлоры в артериовенозное русло и острая печёночная недостаточность, проявляющаяся преимущественно макрофагальной печёночной недостаточностью.

Ключевые слова: *бактериальная транслокация, распространённый гнойный перитонит, нарушение органного кровообращения, печёночная недостаточность*

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Relevance. Despite advancements in modern abdominal surgery techniques and the optimization of diagnostic and therapeutic measures for generalized purulent peritonitis, the mortality rate remains high and has not shown a tendency to decrease over several decades. Mortality due to abdominal sepsis with dysfunction of two or more organs remains alarming, ranging from 10% to 58%, according to recent data [1-3].

A significant aspect of generalized purulent peritonitis is the systemic dysfunction it causes in the body. One of the key factors contributing to this dysfunction is enteral insufficiency, which manifests as impaired motor, evacuatory, secretory, digestive, absorptive, barrier, endocrine, and immune functions of the small intestine. This is a major pathogenetic cause leading to the formation and progression of severe endotoxicosis [4-6].

A crucial and dominant role in the pathogenesis of endotoxicosis and peritoneal sepsis is played by the triggering mechanism that leads to persistent disruption of intestinal barrier function. This results in bacterial translocation from the intestinal lumen into the peritoneal cavity, as well as into the circulatory and lymphatic systems. Consequently, the depression of the liver's reticuloendothelial system occurs, leading to severe organ dysfunction [7-9].

At the same time, many unclear issues remain regarding the characteristics of bacterial translocation and methods for its correction in generalized purulent peritonitis [10-12]. This is especially relevant when considering the specific pathogenetic mechanisms of liver damage, as the liver serves as a strategic biological barrier between the mesenteric-portal and systemic circulation. These complexities significantly hinder the identification of the most effective approaches to rehabilitating liver function in generalized purulent peritonitis.

Research Objective – study of some mechanisms and course of bacterial translocation and disruption of the liver barrier function with subsequent correction in widespread purulent peritonitis.

Patients and Methods. The study was conducted based on the results of a retrospective and prospective examination, treatment, and analysis of 69 patients with generalized purulent peritonitis who were hospitalized in the surgical departments and the Department of Liver and Pancreatic Surgery at the City Center for Emergency Medical Care in Dushanbe. This institution serves as the clinical base for the Department of Surgical Diseases No. 1 named after Academician K.M. Kurbonov at Abuali ibn Sino Tajik State Medical University (TSMU). The study covered the period from 2014 to 2024 (Table 1).

Causes and Laboratory Investigations. In all examined patients, generalized purulent peritonitis was caused by various acute inflammatory and destructive diseases of the abdominal organs. Laboratory

Table 1. Stratification of Patients by Age

Age classification according to WHO	Patients	%
18-44 (young age)	24	34,7
45-59 (middle age)	35	50,7
60-74 (elderly age)	6	8,6
75-90 (senile age)	4	5,7
90+ (long-livers)	-	-
Total	69	100

investigations included comprehensive blood and urine tests, detailed biochemical blood analyses to determine total protein levels, bilirubin levels, liver function tests, and enzyme activity. In the main study group, additional tests were conducted to assess the intensity of lipid peroxidation (LPO) and the antioxidant system (AOS). The leukocyte intoxication index was determined using the method of Ya.Ya. Kalf-Kalif (1941). The study of opportunistic bacteria was performed in all patients of the main group (n=81) using traditional microbiological methods (Bergey, 1994) and the API test system (BioMerieux, France).Antimicrobial Sensitivity Testing. The antimicrobial susceptibility of isolated pathogens was assessed using the disk-diffusion method on Mueller-Hinton agar, employing a disk set with antibacterial agents. Disks from Bio-Rad™ and BD™ (USA) were used for this analysis.

Statistical Analysis. Statistical data processing was performed using the Statistica 10.0 software package (StatSoft Inc., USA):

- Absolute values were expressed as mean ± standard error (M±m).
- Qualitative indicators were expressed as relative values (P, %).
- Multiple comparisons of dependent group indicators were conducted using Friedman's ANOVA.
- Group differences based on qualitative features were assessed using the χ^2 test (Chi-square), including Yates' correction.
- Fisher's exact test was applied when the occurrence of any given feature was less than 5.
- Statistical significance was set at $p<0.05$.

Clinical Findings and Severity Assessment. All patients exhibited signs of severe abdominal sepsis and endotoxemia. The severity of their condition was assessed using the SAPS (Simplified Acute Physiology Score), with an average score of 13.5±1.3.

The severity of intoxication syndrome was evaluated based on a combination of clinical and laboratory criteria for endotoxemia. All admitted patients underwent a specialized diagnostic protocol, which included:

- Assessment of immunosecretory function
- Analysis of small intestinal microflora composition
- Detection of microorganisms in peritoneal exudate and systemic venous blood using standard microbiological methods

Central venous blood samples were obtained from the subclavian vein following catheterization. Hemodynamic and Doppler Studies Blood flow in the portal vein system was assessed using ultrasound Doppler imaging on Philips HD-11 XE equipment. The total hepatic blood flow was calculated by summing the portal and hepatic arterial fractions. As a control group, data from 13 healthy individuals were used, who underwent similar splanchnic blood flow studies. These assessments were performed at admission for all patients and again 3 to 7 days post-surgery. Preoperative and Intraoperative Measures. All patients underwent comprehensive intensive preoperative preparation in the intensive care and resuscitation unit. During surgery, liver biopsy samples were collected to assess the degree of endotoxemia-induced hepatic tissue damage.

Results and Discussion. Analysis of bacteriological studies of small intestinal contents revealed that the development of generalized purulent peritonitis (GPP) in all patients was accompanied by the formation and progression of excessive microbial colonization in the intestinal lumen.

This was primarily due to a sharp increase in the concentration of facultative opportunistic microflora, with a marked predominance of

gram-negative bacteria.

The leading microorganisms included enterobacteria such as Escherichia coli, Klebsiella spp., Proteus spp., Enterobacter spp., as well as Pseudomonas spp. and non-spore-forming anaerobes, particularly Bacteroides spp. Among gram-positive bacteria, the most abundant were enterococci, fecal streptococci, peptococci, and Clostridia spp.

In patients with the most severe forms of GPP, the average microbial count in the small intestine reached 10–12 lg CFU/mL, with fecal streptococci concentrations increasing to 7–8 lg CFU/mL, which was comparable to their numbers in the large intestine.

The results of microbiological studies demonstrated a broad spectrum of bacteria, identified both as monocultures and mixed infections. The most significant finding in microbiological analysis was the high prevalence of gram-negative bacteria.

Escherichia coli was detected in 59 cases (85.5%) as a monoinfection and in 7 cases (10.1%) in combination with other microorganisms; Streptococcus faecalis was found in 18 cases (26.0%) as a monoinfection and in 5 cases (7.2%) in combination with other bacteria (Table 2).

These findings highlight the dominance of gram-negative bacteria, particularly Escherichia coli, in postoperative complications of generalized purulent peritonitis.

We studied the sensitivity of the detected microbiota to the most commonly used antibacterial agents in patients of the main group. As can be seen, no 100% sensitivity of bacteria to any of the most frequently used antibiotics was detected. The highest sensitivity of bacteria was observed to Meropenem and Imipenem, in 86.9% and 86.2% of cases, respectively. According to the literature, antibacterial drugs with high activity against potential pathogens of purulent pathologies should be used at the early stages of treatment. It is worth noting the direct relationship between the level of bacterial contamination and the severity of local and general signs of the purulent process, which is why antibiotics must be applied strictly individually. The obtained data suggest that the syndrome of excessive bacterial growth (SIBR) is a risk factor for the development of purulent postoperative complications. Thus, in patients with RP (peritonitis), gram-negative microorganisms of both aerobic and anaerobic types were found in the highest concentrations in peritoneal exudate, with their quantitative content reaching 7.60±0.19 lg CFU/ml in severe forms of abdominal infection.

Among the gram-positive microbiota, enterococci and anaerobic non-spore-forming cocci were found in the highest concentrations in peritoneal exudate. In patients with the most severe forms of RP, portal bacteremia

Table 2. Frequency of Pathogens Isolated from Infected Postoperative Abdominal Wall Wounds in Patients with Generalized Purulent Peritonitis

Pathogen	Patients			
	Monoculture		Mixed Infection	
	Abs.	%	Abs.	%
Escherichia coli	59	85,5	7	10,1
Streptococcus faecalis	18	26,0	5	7,2
Staphylococcus spp.	28	40,5	16	23,1
Proteus mirabilis	5	7,2	3	4,3
Enterobacter spp.	7	10,1	-	-
P.aeruginosa	3	4,3	-	-

was detected in 68.9% of cases, and systemic bacteremia in 36.1%. Most often, both aerobic and anaerobic gram-negative microbiota were found in the portal and systemic venous systems: Escherichia, Klebsiella, Pseudomonas, Bacteroides. In some patients, the number of microorganisms in portal blood reached 3-4 lg CFU/ml, indicating a very high degree of translocation from the intestinal tract. Ultrastructural studies of the liver in patients with RP showed a marked increase in dystrophic processes as the abdominal infection progressed and endotoxicosis severity increased. Moreover, severe disruption of intrahepatic circulation, portal bacteremia, and endotoxicosis played a leading role in the pathogenesis of damage to the two main liver functions—metabolic and phagocytic—carried out by different types of cells: hepatocytes and stellate reticuloendothelial cells (liver macrophages or Kupffer cells), functioning as a unified cellular system. At the same time, the nature of ultrastructural changes in hepatocytes and stellate reticuloendothelial cells in RP was far from equivalent.

Dystrophic and destructive changes in hepatocytes varied in severity, even in neighboring cells, had a "mosaic" pattern, and varied considerably depending on the distance of cells from the central zone of the acinus and their location relative to the sinusoid. In some hepatocytes, there was marked swelling of mitochondria, up to vacuolization, focal autolysis of individual organelles and areas of cytoplasm. In contrast, the ultrastructure of mitochondria in neighboring hepatocytes could be well-preserved. The nature of the changes detected in hepatocytes allowed them to be primarily linked to hypoxic liver damage, and to a lesser extent, to excessive intake of toxic products from the sinusoidal lumen.

Detailed biochemical blood tests revealed significant endotoxemia, hypoproteinemia, elevated bilirubin levels up to 47.8±3.0 ($p<0.05$) due to the development of hepatodepression, and increased ALT to 0.42±0.1 ($p>0.05$) and AST to 0.41±0.1 ($p>0.05$), indicating

Table 3. Dynamics of biochemical blood parameters in patients with widespread purulent peritonitis

Biochemical parameters	Days of research					p
	On admission	3rd day	7th day	11th day	15th day	
Total protein (g/L)	49,0±2,8	51,1±4,7	51,9±2,1	53,1±1,1	54,1±1,2	>0,05
Total bilirubin (μmol/L)	47,8±3,0	39,8±2,7	27,7±1,9	25,4±1,1	25,1±0,6	<0,05
Thymol-veronal (units)	4,8±1,0	4,7±1,3	4,6±1.2	4,5±0,9	4,5±0,7	>0,05
Iodine	1,6±0,4	1,4±0,3	1,2±0,2	1,2±0,3	1,2±0,9	>0,05
Sulphur (mL)	2,7±0,3	2,4±0,6	2,5±0,9	2,6±0,2	2,5±0,1	>0,05
Urea (mmol/L)	17,1±1,0	15,2±0,9	15,1±0,9	13,0±0,8	11,9±0,7	<0,05
Creatinine (mmol/L)	49,8±4,4	49,4±3,1	48,4±3,2	47,4±3,1	45,0±2,0	>0,05
ALT (mmol/hour/L)	0,42±0,1	0,42±0,2	0,41±0,1	0,41±0,1	0,40±0,1	>0,05
AST (mmol/hour/L)	0,41±0,1	0,39±0,1	0,38±0,06	0,37±0,03	0,38±0,01	>0,05
Amylase	327,0±8,6	327,1±6,2	319,0±4,3	199,1±1,2	183,5±0,9	<0,001
Beta-lipoproteins	45,4±2,7	44,7±4,1	42,1±4,3	42,0±4,1	39,5±3,1	<0,05
Alkaline phosphatase (pH)	27,9±3,4	26,6±3,3	26,9±2,9	23,3±1,7	19,9±1,7	<0,05
Blood glucose	14,9±2,4	12,1±2,7	7,3±1,1	7,0±1,1	5,5±0,5	<0,001

Note: p – statistical significance of differences in parameters over time (Friedman's test).

Table 4. Specific markers of the inflammatory process in blood of patients with widespread purulent peritonitis

Indicators	Days of research					p
	On admission	3rd day	7th day	11th day	15th day	
CRP	23,1±1,4	22,1±2,0	20,9±1,6	19,1±1,4	17,0±1,0	<0,05
MDA	11,9 ± 0,4	10,3±0,6	9,7±0,4	9,3±0,1	8,9±0,5	<0,05
Procalcitonin	11,9±0,1	10,3±0,02	7,9±0,01	5,8±0,01	5,7±0,01	<0,001
Interleukin-6	19,1±1,1	18,1±1,2	17,1±1,2	15,9±1,0	15,0±0,8	<0,05

Note: p – statistical significance of differences in parameters over time (Friedman's test).

Table 5. Some hemostasis parameters in patients with widespread purulent peritonitis

Indicators	Days of research					p
	On admission	3rd day	7th day	11th day	15th day	
VSK (min)	9,81±0,37	9,81±0,36	9,69±0,30	9,55±0,30	9,37±0,28	>0,05
Platelets (thousand)	141,6±12,8	147,7±4,1	159,1±2,2	167,3±1,2	198,1±0,6	<0,01
Prothrombin index (%)	89,21±1,59	85,16±1,21	85,2±1,3	83,21±1,5	83,2±1,2	>0,05
Fibrinogen concentration (g/L)	2,9±0,10	2,5±0,10	2,4±0,14	2,3±0,16	2,3±0,10	>0,05
Recalcification time (sec)	139,1±5,4	135,1±5,0	131,0±4,4	130,1±2,4	117,1±2,2	<0,01
Heparin tolerance (sec)	385,1±18,2	379,1±12,0	399,1±8,2	402,1±10,2	405,0±8,2	<0,05

Note: p – statistical significance of differences in parameters over time (Friedman's test).

the presence of an infectious process. Also, increased iodine levels to 1.6±0.4 (p>0.05) and sulfonamide test results up to 2.7±0.3 (p>0.05), elevated amylase levels to 327.0±8.6 (p<0.001), and alkaline phosphatase levels to 27.9±3.4 (p>0.05) were noted (Table 3).

In the course of the study, to monitor the progression of widespread purulent peritonitis, the levels of CRP, MDA, Procalcitonin, and Interleukin-6 were investigated (Table 4).

High levels of C-reactive protein as a nonspecific marker of the inflammatory process reached 23.1±1.4 mg/L (p<0.05), and MDA indicated the presence of pronounced inflammatory and endogenous intoxication processes in the body. In this context, the levels of MDA (11.9±0.4 µmol/L, p<0.05), Procalcitonin (11.9±0.1 ng/mL, p<0.001), and Interleukin-6, a pro-inflammatory cytokine (19.1±1.1 pg/mL, p<0.05), suggested the presence of a significant inflammatory and purulent process.

When studying blood coagulation parameters in patients with widespread purulent peritonitis, coagulation factors interacted with various mediators of the inflammatory process. Coagulation profile studies showed noticeable hypercoagulation development (Table 5).

In the patients, signs of pronounced hypercoagulation were noted, primarily due to a decrease in fibrinogen levels to 2.9±0.10 (p>0.05), a reduction in the prothrombin index to 89.21±1.59 (p>0.05), and a decrease in tolerance to heparin to 385.1±18.2 (p<0.05), which indicated the

Table 6. Doppler flow characteristics and BVD indicators (M±m) in regional vessels of the liver in disseminated purulent peritonitis

Indicator BVD degree	I 10-15 mm Hg		II 15-25 mm Hg		III 25-35 mm Hg		IV >35 mm Hg
Before treatment	-		19,9±1,0 (p>0,01)		-		-
15 days after treatment	-		17,3±0,1 (p>0,01)		-		-
Vessel	**D см**	**Vmax м/с**	**Vmin м/с**	**Vm м/с**	**Ri**	**Pi**	**Vvol мл/мин**
Superior mesenteric artery	**0,67±0,05**	**1,27±0,012**	**0,38±0,04**	**0,65±0,12**	**0,71±0,05**	**1,35±0,13**	**1257±233**
7th day	0,70±0,08	1,31±0,013	0,40±0,04	0,69±0,10	0,75±0,03	1,39±0,10	1261±230
15th day	0,70±0,09	1,30±0,011	0,40±0,03	0,69±0,11	0,74±0,03	1,38±0,11	1262±231
Splenic artery	**0,52±0,03**	**0,99±0,13**	**0,37±0,09***	**0,58±0,09***	**0,67±0,06**	**1,20±0,21**	**691±148****
7th day	0,57±0,03	0,99±0,010	0,39±0,03	0,56±0,07	0,70±0,03	1,21±0,16	693±141
15th day	0,56±0,02	0,99±0,013	0,38±0,01	0,55±0,08	0,70±0,01	1,21±0,14	695±137
Hepatic artery	**0,49±0,03**	**0,97±0,17**	**0,23±0,07**	**0,50±0,09**	**0,74±0,03**	**1,67±0,21**	**693±135**
7th day	0,50±0,02	0,99±0,012	0,28±0,01	0,54±0,06	0,78±0,02	1,69±0,16	697±119
15th day	0,51±0,03	0,99±0,013	0,28±0,03	0,53±0,07	0,78±0,02	1,68±0,15	693±127
Splenic vein	**0,64±0,04**	**0,33±0,03**	**0,20±0,01**	**0,22±0,01**	**-**	**-**	**437±55****
7th day	0,68±0,04	0,36±0,02	0,24±0,03	0,27±0,09	-	-	436±42
15th day	0,66±0,01	0,38±0,01	0,22±0,01	0,26±0,07	-	-	435±139
Superior mesenteric vein	**0,67±0,03**	**0,41±0,05***	**0,25±0,04**	**0,30±0,04***	**-**	**-**	**609±91****
7th day	0,69±0,01	0,49±0,011	0,29±0,01	0,25±0,0,07	-	-	611±99*
15th day	0,67±0,01	0,48±0,010	0,28±0,03	0,23±0,05	-	-	611±103

Note: (p>0.01) – statistical significance of differences between groups (according to the χ2 criterion, with Yates' correction, according to Fisher's exact test).

presence of a severe purulent process. In 6 (7.1%) patients, during the first 3-5 days after hospitalization, a decrease in the number of platelets to 141.6±12.8 (p<0.01) was observed. Later, there was a tendency towards normalization of this indicator, which could be indirectly explained by the effect of complex treatment.

For further investigation, all patients underwent dynamic ultrasound studies using B-mode, CDK, and ED modes with stationary ultrasound machines following the aforementioned methodology. The liver contour and echostructure, presence of effusion in the abdominal cavity and pleura were examined. Additionally, the state of hemodynamics in the portal and inferior vena cava were studied. Ultrasound showed an increase in liver size and blurred contours. The liver echostructure in these patients was homogeneous or moderately heterogeneous, with infiltration observed. Doppler ultrasound showed a significant increase in the vascular pattern of the liver.

Before the study of regional hemodynamics, all patients with disseminated purulent peritonitis underwent measurement of the BVD using an indirect method via the urinary bladder. Against the background of a limited purulent focus in the pancreas, the BVD indicator was 19.9±1.0 mm Hg (p>0.01), corresponding to grade II elevation of BVD, as seen in infected pancreatic necrosis. Dopplerography revealed an increase in the

diameters of the common hepatic artery, pancreaticoduodenal artery, and superior mesenteric artery, while the diameters of the splenic artery, superior mesenteric vein, and splenic vein remained unchanged (Table 6). Additionally, there was an increase in blood flow velocity indicators in the hepatic artery and superior mesenteric artery, while these indicators in the splenic artery and superior mesenteric and splenic veins remained normal or were slightly reduced. The increase in the volume flow rate (Vvol) was observed in the hepatic artery (by 25-32%, p>0.01) and the superior mesenteric artery (p>0.01), while the values in the splenic artery and superior mesenteric and splenic veins decreased by 34% (p>0.01).

The conducted studies also showed that all patients with widespread purulent peritonitis developed significant disorders of visceral circulation. In patients with widespread purulent peritonitis, blood flow in the superior mesenteric artery decreased by (47.1±2.8)%, (351.20±18.59) ml/min, total hepatic blood flow decreased by (57.1±2.5)%, (680.30±38.42) ml/min, portal blood flow decreased by (71.3±2.2)%, (332.20±26.22) ml/min, and hepatic arterial blood flow decreased by (18.3±4.0)%, (348.10±16.71) ml/min compared to healthy individuals, which indicated a pronounced disorder of organ hemodynamics in the liver and small intestine.

Significant disturbances in visceral circulation in patients with widespread purulent peritonitis were primarily caused by a decrease in cardiac output, impaired blood rheology, hypovolemia with a significant plasma deficit, vasoconstriction of the splanchnic circulation, and also by progressing endotoxicosis. Suppression of immune factors, excessive bacterial colonization, impaired intestinal motility, and hypoxia of the intestinal wall played a key role in the pathogenesis of impaired barrier function of the small intestine and massive translocation of symbiotic microflora from the gastrointestinal tract to internal body environments (peritoneal cavity, portal and systemic circulatory systems) in widespread purulent peritonitis. In this case, the frequency of detecting microorganisms and their quantitative content in these environments distinctly increased as the abdominal infectious process progressed. In this situation, the microbiological structure of the peritoneal exudate and the systemic venous blood in patients was fully determined by microorganisms entering from the intestinal lumen.

Morphological studies of liver tissue showed that even with significant ischemic damage to hepatocytes, a severe form of acute hepatic cell failure, which could directly lead to a fatal outcome in this patient group, typically did not develop, which was apparently due to the enormous compensatory capabilities of the functioning liver parenchyma. At the same time, damage to a significant part of the stellate reticuloendothelial cells was noted, with the direction of destructive changes in these cells and the degree of their damage clearly correlating with the massive influx of microbes and their toxins into the liver through the portal circulation, leading to the development of a macrophage form of hepatic failure, accompanied by impaired liver barrier function, the breakthrough of infectious-toxic agents into the general bloodstream, and was confirmed by a high incidence of systemic bacteremia in the patients.

In most Kupffer cells, marked destructive changes were noted in the form of sharp swelling, vacuolization of the cytoplasm, and desquamation of cells into the sinusoidal lumen, which provided convincing evidence of their nonviability. The sinusoids were obstructed by cellular debris, in which bacterial microflora residues were clearly visible. In this case, the functional failure of

the reticuloendothelial barrier of the liver and the entry of infectious-toxic agents into the systemic circulation predetermined the development of abdominal sepsis, progressing endotoxicosis, and multiple organ failure in the patients.

Conclusion. In the pathogenesis of visceral function damage in widespread purulent peritonitis, an important role is played by disturbances in organ circulation, massive translocation of intestinal microflora into the arterio-venous circulation, and acute hepatic failure, which manifests predominantly as macrophage hepatic failure. The depletion of liver function and its progression should be considered the most severe form of liver failure, which largely determines the prognosis and outcome of the disease in patients with widespread purulent peritonitis. Mandatory components of intensive postoperative therapy should include enteral detoxification methods, microbial decontamination, closed nasointestinal intubation and drainage of the small and large intestines, intestinal lavage with correcting solutions, enterosorption, intraluminal therapy, and infusion correcting therapy.

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