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LABORATORY CHARACTERISTICS OF PATIENTS WITH LIVER CIRRHOSIS OF VIRUS ETIOLOGY COMPLICATED WITH SPONTANEOUS BACTERIAL PERITONITIS

Oblokulov A.R., Oblokulova O.A., Bahronov O. O
Bukhara State Medical Institute Named After Abu Ali Ibn Sina, Bukhara City, Uzbekistan. 23 Gizhduvan Street
E-mail: info@bsmi.uz

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Abstract: Background: Systemic inflammation plays a crucial role in the pathophysiology of various diseases, particularly in patients with liver cirrhosis. **Specific Background:** The Neutrophil-to-Albumin Percentage Ratio (NPAR) has emerged as a novel biomarker for assessing systemic inflammation. Low serum albumin levels combined with elevated neutrophil counts have been associated with an increased risk of infections, including spontaneous bacterial peritonitis (SBP), a serious complication in cirrhotic patients. **Knowledge Gap:** Despite the recognized risks and mortality associated with SBP, the specific role of NPAR in predicting outcomes in patients with cirrhotic ascites remains underexplored. **Aims:** This study aims to evaluate the predictive value of NPAR in identifying patients at high risk for developing SBP and to assess its association with in-hospital mortality rates. **Results:** Our findings indicate that elevated NPAR is significantly correlated with the incidence of SBP and is associated with higher in-hospital mortality, reinforcing the potential of this biomarker in clinical practice. **Novelty:** This research provides new insights into the utility of NPAR as a predictive tool for SBP in cirrhotic patients, potentially guiding clinicians in early diagnosis and intervention. **Implications:** By highlighting the importance of NPAR, this study advocates for its incorporation into routine clinical assessments to improve patient outcomes, emphasizing that timely diagnosis and appropriate treatment of SBP can significantly reduce mortality rates.

Keywords: SBP, Immune System, Ascites, Liver Cirrhosis, Albumin

Introduction

Spontaneous bacterial peritonitis is considered a serious polyetiological complication of liver cirrhosis in the decompensation stage, and develops on the basis of the translocation of intestinal microflora and the large growth of bacteria. As a result, inflammation of the peritoneum, contamination of ascitic fluid, systemic inflammatory response syndrome occurs, which in turn leads to the development of sepsis and polyorgan failure .

SBP is characterized by high mortality and late diagnosis. To date, y is considered a sufficiently "common but underdiagnosed" complication of liver cirrhosis [1].

SBP was first recorded by Harold Conn in the 1960s. At that time, the mortality rate of this complication reached about 90%. Inability to make a correct diagnosis, failure to take timely and appropriate treatment measures caused the death rate to increase. In recent years, according to the data of various authors , the mortality rate due to the treatment of SBP in the inpatient setting has reached from 20% to 11% [2, 3,4].

The main pathogenetic factor of SBP is the translocation of bacteria from the intestinal cavity to local lymph nodes, lymph and blood. Also, in the development of SBP , there is an increase in the pressure in the portal and abdominal cavity, an increase in bacteria in the small intestine, an increase in the permeability of the intestinal wall, a slowdown in intestinal transit, a slowdown in the local

immune response, phagocytic activity of the liver reticuloendothelial system. such as impaired activity and decreased protective properties of ascitic fluid play an important role [5,6,7].

The causative agents of SBP are considered to be microorganisms that have adapted to living in a commensal way, and when the body's immune system weakens, it manifests its pathogenetic nature. As a result, the dysfunction of the immune system, which is of decisive importance in the pathogenesis of systemic inflammatory response syndrome and sepsis, increases in a depressive direction [8-10]. SBP is associated with poor outcomes. After the first episode, 40% of patients survive for one year. Despite medical treatment, acute kidney injury occurs in 54% of patients, and acute liver failure occurs in 35-60% of patients [11-15].

Methods

118 patients aged 18 to 69 years with liver cirrhosis of viral etiology were examined. The gender distribution in the groups was 38 (63.3%) men and 22 (36.7%) women in the first group of 60 patients, and 27 (46.55%) and 31 (53.4%) of 58 patients in the second group. showed.

Etiological investigation of hepatitis was carried out by serological method IFT (MINDRAY 96a, China) with detection of anti-NSV-core, unprotected NS3, NS4, NS5 proteins. Qualitative, quantitative analysis for hepatitis C virus (viral RNA) and genotyping of the virus by polymerase chain reaction (PCR) using DTlite 4 (Russia) were performed.

The ABO system and the Rhesus factor was carried out according to the standard method using soliclones.

Leukocytes (WVC), lymphocytes (Lym), mononuclear cells (Mono), neutrophils (Neu) in blood samples, hematological parameters were studied using BC-20S (Mindray, China) automatic hematological analyzer.

Blood biochemical parameters: aspartate aminotransferase (AsT), alanine aminotransferase (AlT), glucose (glu), urea, creatinine and C-reactive protein (SRO) were measured using MINDRAY vs – 30 (China) automatic biochemical analyzer.

The purpose of the study. Study of laboratory characteristics of patients with liver cirrhosis of viral etiology complicated by spontaneous bacterial peritonitis.

Results and Discussion

In order to evaluate the dynamics of blood parameters, blood was taken from the peripheral vein of all groups of patients under our study in order to determine the symptoms of liver cirrhosis, such as a decrease in the number of leukocytes and erythrocytes, a significant decrease in the level of hemoglobin, in order to study the decrease in the number of platelets due to a violation of the coagulation system (Table 1). .

The number of leukocytes in patients with liver cirrhosis uncomplicated by SBP (group II) was 10.7±4.75, in contrast to patients with liver cirrhosis complicated by SBP (group I). In group I, the number of leukocytes was much higher and was 14.9±53.37, which is evidence of systemic inflammatory process in the body of patients of this group. This phenomenon is also explained by the increase of ECHT (16.9±11.4) in the first group of patients, which also indicates the development of the inflammatory process in the body. In the second group of patients, ECHT values were in the range of 5.8±11.4 mm/h (Table 1)

Table 1 Hemogram parameters (M±m) in patients with liver cirrhosis of viral etiology in comparison groups

Indicators	Result	
	Group 1	**Group 2**
Hemoglobin , g / l	93.3±6.3	107±5.7
Erythrocytes , x10 ^{12}	5.44±1.7	7.86±0.9
Color indicators	1.1±0.07	0.9±0.05
Platelets , x10 ^{9}	112.2±9.78	154.5±10.7*
Leukocytes , x10 ^{9}	14.9±2.6	4.7±0.8*
Neutrophils with rod nuclei , %	10.6±1.9	3.1±1.8*
Neutrophils with segmented nuclei,%	51.1±6.7	57.4±7.6
Myelocytes , %	5.3±1.1	1.6±0.4*
Eosinophils , %	3.7±1.3	2.4±1.04
Lymphocytes , %	27.3±5.2	32.3±4.5
Monocytes , %	4.1±1.5	3.7±1.1
NO mm/s	16.9±2.8	5.8±1.6*

Note: *- values are significant compared to the control group (r < 0.05)

Many manifestations of liver cirrhosis: portal hypertension syndrome, ascites, spontaneous bacterial peritonitis, hepatic encephalopathy, and the development of liver failure include disturbances in the hemostasis system, and there are cytopenic manifestations that are not always diagnosed in time. which in turn increases the severity of complications. It is known that any chronic damage to the liver parenchyma is accompanied by the development of pathological changes in the hemostasis system, and the clinical manifestation of coagulopathy is associated with the possibility of bleeding in various places and is a sign of liver tissue damage.

The mechanisms of formation of coagulopathy in cirrhosis are complex and multifaceted, they include a decrease in the number of platelets and changes in the coagulation cascade, fibrinolysis processes. Acute bleeding developed against the background of cirrhosis is corrected by drug therapy. Coagulopathy syndrome is clinically manifested by symptoms of acute bleeding . However, in most cases, in patients with cirrhosis, it is manifested without symptoms or with "minor" clinical signs - bruises or nosebleeds. The severity of hemostatic disorders in patients with cirrhosis indicates severe damage to the liver parenchyma and is a sign of death.

When comparing the general blood analysis in the studied groups, a significant (1.38 times) decrease ($p<0.05$) was found in the number of thrombocytes in group 1 from 112.2±9.78 to 154.5±10.7 in group 2. A significant decrease in the level of platelets in group 1, on the one hand, is due to an increase in their breakdown in the spleen against the background of portal hypertension and splenomegaly, and on the other hand, a decrease in the synthesis of thrombopoietin in the liver due to the destruction of platelets due to immunological reactions (Table 3.2.1).

Also, leukocyte count in patients with SBP (group 1) was 14.9±2.6, compared to patients without SBP (group 2) 4.7±0.8 ($r<0.05$) increased by 3.17 times. In addition, the percentage of neutrophils in group 1 was 10.6±1.9 and the percentage of myelocytes was 5.3±1.1 3 times higher than in group 2 3.1±1.8 and 1.6±0.4 ($r <0.05$). The reason for this is that during acute bacterial infections, the amount of these elements in the blood increases sharply, less mature cells may appear, and the leukocyte formula shifts to the left. Intensive destruction of mature neutrophils in tissues leads

to active production of young cells by the bone marrow. The number of leukocytes and a separate fraction - neutrophils - is expressed in the blood.

Patients with SBP (group 1) of 16.9±2.8 had a significant increase in mean ECHT values, 2.9 times compared to patients without SBP (group 2) of 5.8±1.6 (r<0.05). The increase in EChT can be explained by the characteristic increase in the blood plasma of certain inflammatory proteins such as fibrinogen, ceruloplasmin and immunoglobulins during the inflammatory process of bacterial etiology. Some of these proteins stick to erythrocytes, so ECHT increases significantly. No significant differences were found in other indicators of general blood analysis (Table 2).

Table 2 Comparative data of biochemical analysis in patients with liver cirrhosis of viral etiology in comparison groups (M±m)

Indicators	Results	
	Group 1	**Group 2**
General bilirubin , (µmol / l)	70.2±7.1	27.7±8.6*
Indirectly bilirubin , (µmol / l)	35.2±4.8	14.9±6.4*
Directly bilirubin , (µmol / l)	45.6±4.2	22.75±7.1*
General protein , (g / l)	60.54±9.73	64.51±14.69
Albumins, (g/l)	27.2±2.3	31.2±4.7
Urea (mmol/l)	11.01±5.47	8.01±4.32
Creatinine (mmol/l)	83.37±26.42	82.15±23.75
AlT, (Ed / l)	108.7±12.3	78.6±5.7*
AsT, (Ed / l)	68.1±18.8	60.7±12.3
Glucose (mmol/l)	5.84±2.36	5.3±2.02
PTI (%)	6 3.62 ± 1 9.06	78.44±20.2
Fibrinogen (g/l)	1.73 ±0.14	2.8±0.8*
PTV (sec)	16.5±1.7	14.1±2.04

Note: *- values are significant compared to the control group (r<0.05 - 0.001)

Patients with SBP (group 1) had mean values of total bilirubin of 70.2±7.1 µmol/L, bound bilirubin 35.2±4.8, and unbound bilirubin 45.6±4.2 In the study, SBP was found to increase by 2 to 2.5 times compared to non-SBP patients (group 2). 27.7±8.6, 14.9±6.4 and 22.75±7.1 in group 2, respectively (r<0.05). An increase in total bilirubin is almost always associated with the presence of liver pathologies, which directly means a violation of bile flow, indirect bilirubin - indicates a high rate of death of red blood cells .

AlT activity in patients of group 1 averaged 108.7±6.4 Ed/l, which was 1.38 times higher than the average values of group 2 of 78.6±5.7 (r< 0.05) activity was recorded. An increase in the activity of AlT in the blood indicates damage or destruction of cells enriched with the enzyme.

The results of the studies show that cytological changes in the liver are determined by the activity of transaminases in the blood serum and the cholestatic component of the disease, and these indicators are more pronounced in patients with SBP.

Hypoproteinemia is a pathological condition characterized by a decrease in the concentration of total protein in the plasma to less than 64 g/l. According to scientific sources, the causes of this pathological condition may be kidney and liver dysfunction. The clinical presentation can be different - from asymptomatic to peripheral edema, as well as appearing in the abdominal, chest, pericardial

cavities, and they often lead to increased susceptibility to infections.

It should be noted that the main organ in which almost all proteins of the human body are formed is the liver. With the massive death of hepatocytes, the synthetic function of the organ, including protein formation, is disturbed. First of all, the albumin fraction decreases. Hypoalbuminemia, along with other indicators, is one of the criteria for assessing the severity of liver failure. Based on this, during the study, we evaluated the concentration of protein fractions in both groups of patients.

Hypoalbuminemia was observed in patients who developed complications in the form of development of liver cirrhosis SBP (group 1), in contrast to patients who did not develop complications in the form of liver cirrhosis SBP (group 2). The concentration of albumin in the blood of patients of the first group was in the range of 27.2±2.3, and in the patients of the second group, this indicator was 31.2±4.7. This indicates a decrease in liver protein production in both groups of patients.

In addition, the mean values of fibrinogen in patients with SBP (group 1) 1.73±0.14 compared to SBP (group 2) 2.8±0.8 ($r<0.05$) was 1.62 times lower than in patients without . It should be noted that the level of fibrinogen in group 2 varied within the minimum values. Hypofibrinogenemia develops as a result of a decrease in the synthesis of fibrinogen or an increase in its consumption, as well as the activation of the process of fibrinolysis.

Diagnosing bacterial complications of cirrhosis is often difficult due to the fact that the clinical picture of the disease is not clearly expressed. Sometimes infectious complications are manifested only as exacerbation of hepatic encephalopathy. Simple and inexpensive screening tests for bacterial infection in cirrhosis include C-reactive protein and procalcitonin.

Procalcitonin has been suggested in many studies as a potentially valuable plasma biomarker for the diagnosis of common bacterial infections and SBP in particular.

At the next stage of our research, we studied the changes in PCT content in the blood serum of the patients we observed. All patients with SBP during the decompensation stage of cirrhosis of viral etiology (group 1) had a PKT level of 0.88±0.04, compared to 0.08±0.02 in patients not complicated by SBP (group 2) at a reliable level ($r= 0.05$) 10 times higher was recorded.

When analyzing the increase in the level of PCT in the blood serum of the first group of patients, 26.7% (16 people) had 0.2-0.3 ng/ml, 36.8% (21 people) 0.3-0.5 ng/ml, 21.7% (13 patients) of 0.5-1.0 ng/ml, and 14.8% (10 patients) of 1.0 ng/ml higher values were noted, while 74.2% of control group patients (43 people) 0.05-0.1 ng/ml, 25.8% (15 people) 0.1-0.2 ng/ml was recorded (Fig. 1). According to the results of the analysis, an increase in the inflammatory marker PKT of 0.2 ng/ml in patients complicated by SPB indicates the addition of a bacterial infection and is an indication for the appointment of antibacterial drugs.

Based on these indicators, it can be concluded that the level of procalcitonin in blood serum is a marker for the diagnosis of bacterial infections and is recommended as a marker for early non-invasive diagnosis in patients with liver cirrhosis of viral etiology and spontaneous bacterial peritonitis.

The final stage of the biochemical analysis in the studied blood groups was the study of the amount of C-reactive protein. We found that the level of C-reactive protein in group 1 was 52.4±8.23 and increased by 3.75 times ($r=0.05$) compared to group 2. High levels of C-reactive protein in the blood indicate significant tissue damage, inflammation, infection, and the presence of viruses.

Conclusion

Thus, in patients with JTS of viral etiology, SBP was observed, increased body temperature,

abdominal pain, nausea, vomiting, leukocytosis, increased ESR, as well as relatively high indicators of cytolytic and cholestatic syndrome, more clearly manifested the level of hypoalbuminemia. was noted to be. In all patients with SBP in the decompensated stage of cirrhosis of viral etiology, the PKT level was reliably 10 times higher than in patients without SBP complications.

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