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Improvement of Primary Prevention and Treatment of Complications of Spontaneous Bacterial Peritonitis in Liver Cirrhosis of Viral Etiology

Mukhammadieva Musharraf Ibrokhimovna

Assistant, Department of Infectious Diseases and Infectious Diseases of Children, Bukhara State Medical Institute named after Abu Ali ibn Sino, Bukhara, Uzbekistan

Abstract The article presents clinical and laboratory data of the examined patients. 120 patients were under observation. Main group I included 61 patients suffering from liver cirrhosis of viral etiology with SBP, main group II included 59 patients with liver cirrhosis. As a control, 30 practically healthy people were also examined. In all patients with SBP at the stage of decompensation of liver cirrhosis of viral etiology, the level of PCT was significantly higher by 10 times, amounting to 0.88±0.04, compared with patients with uncomplicated SBP, in which is equal to 0.08±0.02 (p=0.05). It was found that the level of CRP in the 1st group was 32.4±8.23 and increased by 3.75 times (p=0.05) compared with the 2nd group.

Keywords Liver cirrhosis, Spontaneous bacterial peritonitis, Procalcitonin, C-reactive protein, IL 4

1. Introduction

As reported by the World Health Organization (WHO), over 325 million individuals worldwide are infected with hepatitis B or C, leading to 1.4 million fatalities per year [1,2,3]. Hepatitis B and C rank second in mortality after tuberculosis, with 9 times more individuals infected with hepatitis than HIV [4,5,6]. However, over 80% of hepatitis cases lack access to adequate testing and therapy [7,8,9].

Despite medical advancements, chronic viral hepatitis (CVH) continues to be a pressing issue in Uzbekistan [10,11,12]. This disease predominantly impacts individuals of working age and frequently results in complications such as liver cirrhosis (LC) and hepatocellular carcinoma (HCC), contributing to increased medical and social expenses [13,14,15].

Procalcitonin has been proposed in studies as a potentially valuable serum biomarker for diagnosing bacterial infections in general and SBP in particular [20,21,22,23].

CRP is a prominent biochemical marker of inflammation caused by a variety of causes, including infectious and non-infectious inflammatory diseases, and has also been shown to be involved in several immunological functions [24,25,26,27].

Thus, infections are common in patients with cirrhosis of the liver, and SBP is one of the most common, with variable frequency but significant mortality [16,17,18,19]. One of the most important factors in the management of this significant consequence of decompensated liver cirrhosis is early detection. It is critical to find non-invasive, accessible, and easy-to-apply SBP-related parameters that play a predictive role [25,26,27,28]. However, it should be borne in mind that these methods cannot completely replace paracentesis; More research is needed to determine if non-invasive methods are accurate enough to detect the development of SBP in cirrhosis [28].

2. Purpose of the Research

The aim of this study is to improve the primary prevention and treatment strategies for spontaneous bacterial peritonitis (SBP) in patients with liver cirrhosis of viral etiology by evaluating the immunological and biochemical parameters associated with SBP risk, with a particular focus on the role of interleukins (IL-4 and IL-17A) and liver function indicators. The study seeks to identify potential immunological targets for modulating the immune response and reducing the incidence of SBP in this vulnerable patient population.

3. Materials and Methods

Clinical observations, laboratory and instrumental examinations of patients with liver cirrhosis of viral etiology were carried out in the Bukhara Regional Infectious Diseases Hospital, at the Research Institute of Virology of the Republican Specialized Scientific and Practical Medical Center for

* Corresponding author:
muxammadiyeva.musharraf@bsmi.uz (Mukhammadieva Musharraf Ibrokhimovna)
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Main group I included 61 patients suffering from liver cirrhosis of viral etiology with SBP, main group II included 59 patients with liver cirrhosis. As a control, 30 practically healthy people were also examined.

The diagnosis of cirrhosis with viral etiology was established on the basis of the epidemiological anamnesis, medical history, clinical data and on the basis of laboratory data.

In order to establish the viral etiology of the diagnosis of cirrhosis, an analysis was made to determine the markers of infection with the HBV, HDV viruses, HCV was determined by the polymerase chain reaction (PCR).

Among them, in the 1st group, HBV- infection was observed in 15 (25%) patients, HCV infection - in 25 (41.7%), HBV + HCV- infection - in 1 (1.67%), HBV + HDV- infection - in 19 (31.7%). In the second group, HBV infection was noted in 13 (22.4%) patients, HCV infection in 27 (46.6%) patients, HBV+HCV– infection in 1 (1.72%), HBV+HDV– infection in in 17 (29.3%).

4. Result

One of the main functions of interleukins is to regulate the immune response and inflammation, and to activate B and T lymphocytes. It is known that in patients with liver cirrhosis of viral etiology, the immune response is skewed toward the Th2 pathway. This is confirmed by the elevated level of IL-4, since IL-4 promotes the humoral immune response, which may not provide effective protection against infection. Due to the low level of IL-17A, the inflammatory mechanism mediated by neutrophils may not function efficiently, which increases the risk of developing spontaneous bacterial peritonitis (SBP).

Table 1. Classification of patients in the study group based on pre-treatment immunological analysis

Interleukin	Main Group		Comparative Group	
	abs	%	abs	%
IL 4	16,13	96,5	16,42	96,42
IL 17 A	0,59	3,50	0,61	3,58

These results indicate the necessity of using agents that affect the immune system for primary prevention of SBP. In particular, medications that modulate IL-17A and methods that balance the Th2 immune response may be effective.

In the main group, the IL-4 level is high (96.5%), which may be associated with the dominance of the Th2 immune response and the activity of allergic mechanisms. This may indicate a likelihood of association with allergic diseases (such as asthma or atopic dermatitis). In addition, high IL-4 levels may stimulate the production of antibodies through B-cells.

The IL-17A level is 3.50%, indicating that neutrophil-mediated inflammation or autoimmune processes are not active. This is characteristic especially for patients without rheumatoid arthritis or other autoimmune diseases.

In the comparative group, the IL-4 level is also high (96.42%) and nearly identical to the main group. This indicates that the Th2-dominant immune response is also present in the comparative group. Additionally, the IL-17A level (3.58%) is very close to that of the main group, confirming that autoimmune and Th17-mediated inflammatory processes are not significantly pronounced.

Liver biochemical analysis plays an important role in assessing liver function. This analysis determines the degree of liver cell damage, bile secretion function, and protein synthesis capacity. The main indicators in biochemical analysis include.

Table 2. Liver biochemical analysis of patients in the study group

Biochemical Blood Test Parameters	Main Group		Comparative Group	
	abs	%	abs	%
Total Bilirubin	7.5	2.86	24.44	11.15
Conjugated Bilirubin	17.6	6.66	7.33	3.35
Unconjugated Bilirubin	5	1.91	17.11	7.81
Total Protein				
Albumin	33.5	12.70	32.97	15.04
ALT	111.8	42.47	56.00	25.54

In the main group, the total bilirubin level was 7.5 μmol/L (2.86%). Conjugated bilirubin was 17.6 μmol/L (6.66%), and unconjugated bilirubin was 5 μmol/L (1.91%). The albumin level was 33.5 g/L (12.70%). Among liver enzymes, ALT (alanine aminotransferase) was 111.8 U/L (42.47%).

5. Discussion

Spontaneous bacterial peritonitis (SBP) remains a significant and potentially life-threatening complication in patients with liver cirrhosis, particularly of viral etiology. The immune dysregulation commonly observed in these patients plays a crucial role in the development and progression of SBP. The findings from our study support previous evidence that cirrhotic patients often exhibit a skewed immune response favoring the Th2 pathway, as indicated by elevated levels of interleukin-4 (IL-4). This cytokine enhances humoral immunity but may hinder effective cellular immune responses necessary for the clearance of bacterial infections.

Our results revealed high IL-4 levels in both the main (96.5%) and comparative groups (96.42%), indicating a predominant Th2-type immune profile across the cirrhotic population under investigation. This persistent Th2 dominance may contribute to reduced neutrophil efficiency and impaired macrophage activation, thus increasing susceptibility to SBP. Additionally, the consistently low IL-17A levels (3.50% in the main group and 3.58% in the comparative group) suggest an insufficient Th17-mediated inflammatory response, which is vital for neutrophil recruitment and mucosal defense mechanisms. These findings highlight the potential role of immune modulation as a preventive strategy.

From a biochemical standpoint, abnormalities in liver function tests further underscore the vulnerability of these patients. Elevated ALT levels (111.8 U/L in the main group) and hypoalbuminemia (33.5 g/L) point to ongoing hepatocellular injury and impaired synthetic capacity, respectively—both of which are known risk factors for SBP. Interestingly, the conjugated bilirubin was notably higher in the main group (17.6 μmol/L), suggesting compromised bile excretion and a greater burden of hepatic dysfunction, potentially leading to bacterial translocation from the gut.

The combined immunological and biochemical profiles suggest that traditional prophylactic antibiotics alone may not be sufficient in preventing SBP. Instead, adjunctive therapies targeting immune restoration—particularly those enhancing Th17 activity or modulating the Th1/Th2 balance—could be more effective. Biologic agents or cytokine modulators that increase IL-17A production or suppress excessive IL-4 signaling may improve mucosal immunity and reduce bacterial translocation, thereby lowering the incidence of SBP.

Moreover, the similarities in immune markers between the main and comparative groups indicate a systemic issue inherent to cirrhosis itself rather than treatment exposure or disease severity alone. This further supports the need for early and individualized immunological assessment in cirrhotic patients to stratify SBP risk and tailor preventive interventions.

6. Conclusions

Based on these values, it can be concluded that the level of PCT and CRP in the blood serum has been proposed as a marker for early non-invasive diagnosis in patients with cirrhosis and SBP.

The results of our study show that the combined use of antibacterial drugs and silver water is more effective than traditional medicine for the prevention and treatment of spontaneous bacterial peritonitis in patients with liver cirrhosis of viral etiology. This method helped to eliminate inflammatory processes in patients more quickly and shortened the duration of treatment.

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