

PHAGOCYTOLOGICAL ACTIVITY OF NEUTROPHILS AND PERIPHERAL BLOOD MONOCYTES IN PATIENTS WITH HBV INFECTION

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Introduction

Treatment of HBV infection is one of the global problems of modern medicine, which is confirmed by the extraordinary prevalence and high mortality of both fulminant hepatitis and HBV-associated liver cirrhosis (LC) and hepatocellular carcinoma (HCC).

Studies of recent years have shown the important role of primary immune responses in antiviral defense of the body. Phagocytosis refers to congenital, conservative and permanent immune processes in the human body. Phagocytosis is one of the first reactions of many cells in the body in response to the penetration of various environmental pathogens, including acute HBV infection. However, the only cells that have active phagocytosis are neutrophils and monocytes, which is why they are considered specialized professional phagocytes. Comparing the phagocytic capabilities of these cells, it turned out that the antimicrobial capacity of neutrophils is higher than that of macrophages [1].

In this regard, neutrophils acquire the progressive status of fundamental phagocytic immune cells [2]. However, it is believed that phagocytic microphage reactions are not involved in the antiviral defense of the organism, but are limited mainly by phagocytosis of bacteria and fungi [3]. It is possible that the granulocytes, which include polymorphonuclear neutrophils, are separated from other phagocytic cells forming a system of mononuclear phagocytes (SMP).

But at the same time, it is also known that the neutrophil granules contain up to 300 cytotoxic metabolites, whose action is directed at various microorganisms [4]. Including, it turned out that many of them are capable of destroying viruses.

One of the first cells that counteract viruses is monocytes of the blood and macrophages of the tissues of the body [5]. Monocytes "patrol" the vascular endothelium or are differentiated into mononuclear phagocytes, during the infection act as congenital effector and have the ability to penetrate through the blood into peripheral tissues [6]. Macrophages are differentiated into different populations, among which the most important value for HBV infection is Kupffer cells (QC) [7]. It is known that the CC are self-repairing, resident and mainly non-migratory phagocytes, which are at the disposal of liver homeostasis. It has now become apparent that macrophages of the liver play a central role in initiating a possible further progression or limitation of inflammation in the liver [8].

The study of functional reactions of SMP cells in viral infections has long attracted scientists. It has been shown that with HBV there is an increase in metabolic activity and a decrease in the phagocytic index of monocytes [9]. It is also known that when primary infection with HBV, the primary

immune response is not effective or develops late [10]. At the same time, probiotic microorganisms can stimulate phagocytic reactions [11]. Therefore, we decided to study the effect of the bifidum and lactic symbiotic - extra bifilactre (Be), Ariadna NDV, Ukraine in the treatment of patients with HBV. Given current data on the interaction of the mononuclear cell system with each other and with other components of the immune defense, research of these multifunctional cells is today relevant.

The purpose of the work – studying the functional state of polymorphonuclear neutrophils and indicators of phagocytic activity of monocytes in the blood of patients with HBV of varying degrees of severity in the dynamics of conventional treatment and after the appointment of a symbiotic.

Material & methods

Under supervision were 108 patients with HBV, from 18 to 69 years old, of which 56 were men and women 52, and the average age of patients was 34 ± 1.88 years. All infected people were treated at the Regional Clinical Infectious Disease Hospital in Kharkiv, among which there were 40 patients with mild severity and 68 patients with moderate severity. Diagnosis of HBV was established in accordance with standardized protocols for the diagnosis and treatment of infectious diseases based on anamnesis, clinical and instrumental (ultrasound diagnostics) examination, taking into account biochemical parameters that characterize the functional state of the liver. To confirm the viral lesion of the liver, the blood serum of patients was tested by immunoassay (ELISA) on specific markers of hepatitis B and other infectious diseases. When detected in the examined markers of hepatitis C, D, A, or mixed-infection, as well as antibodies to HIV, they were excluded from further research. The following criteria for the selection of GHB patients were: HBs Ag, anti-HBc IgM, anti-HBc, HBe Ag, anti-HBe. To further confirm the acute infection process, a qualitative analysis of PCR was used to detect HBV DNA. Patients who have been diagnosed with chronic HBV have also been discontinued from further research.

According to the purpose of the study, all patients were divided into 4 groups depending on the severity of the course of the disease and the method of treatment. The first group consisted of 20 patients who had a mild degree of severity and were on standard treatment, and 2 groups - 20 patients with a mild degree of severity who in addition to standard treatment received additionally symbiotic. The similar distribution was among patients with moderate severity - 3 groups - 34 patients treated with standard therapy, and 4 groups of 34 patients receiving symbiotic. Patients taking symbiotic have formed the main group. Accordingly, the comparison group included patients who received basic treatment. The control group (5) was 17 healthy individuals.

Determination of parameters of phagocytosis was carried out in accordance with recommendations VG Perederij et al. [12]. We determined the neutrophil phagocytic index (NPI) and monocytes (MPI) and phagocytic neutrophil count (PNC) and monocytes (PMC). NPI and MPI - the number of phagocytic cells 100 units isolated from peripheral blood of patients (%). NPI and MPI characterize the intensity of phagocytosis. PNC / PMC - the average number of microbes absorbed one neutrophils / monocytes, which is in the process of phagocytosis. PNC and

PMC describes absorbing ability of cells (neutrophils or monocytes, respectively) and are calculated in conventional units (CU).

PAN and PAM were studied in patients with HBV in the dynamics of the disease in 2 stages: in the icteric period and after the appointment of a symbiotic (the period of reconvalescence). The first blood sample was carried out in the jaundice period in the jaundice. The term of symbiotic appointment in patients in groups 2 and 4 was 14 days. The second venous blood collection in the studied groups of patients was carried out 5-7 days after the abolition of the symbiotic, which coincided with the clinical phase of reducing the intensity of jaundice and the beginning of the period of convalescence.

Statistical analysis of the results was performed using Statistica 10. We used parametric analysis of variance (Fisher criterion), Scheff test for multiple comparisons posteriori mean values of parameters and criteria Student for related variables. Comparison of average values of a icteric period (Icter.) Was performed in groups that determined the severity of the disease (mild, medium, and control group). Comparison of average values of a convalescence period (Conval.) Was performed in groups

that determined the severity of the disease and treatment (standard - Standard), and using symbiotyka bifilakt extra (SRD "Ariadne", Ukraine) - (Be). Descriptive statistics are presented in the form of the arithmetic mean value of the indicator and its standard error ($M \pm m$). The difference was considered to be significant at $p < 0.05$.

Results & discussion

It was determined that the activity of phagocytosis of neutrophils in the icteric period was not statistically different in 1 and 2 groups of patients (light severity) and, accordingly, in the examined individuals in groups 3 and 4 (mean severity). But it turned out that during this period, HBVHPAN significantly differs depending on the severity of the disease. Significant increase in the level of NPI was determined in patients with mild severity (groups 1 and 2) compared with patients who had an average severity of the disease (groups 3 and 4), as well as with the control group (5) (Fig. 1). At the same time, analyzing the PAN indices in patients with moderate severity (group 3 and 4) and control group (5), a significant decrease in NPI in all intervals of incubation (30, 60 and 180 minutes) in patients with HBV infection was established, therefore $p < 0.00$ (Fig. 1).

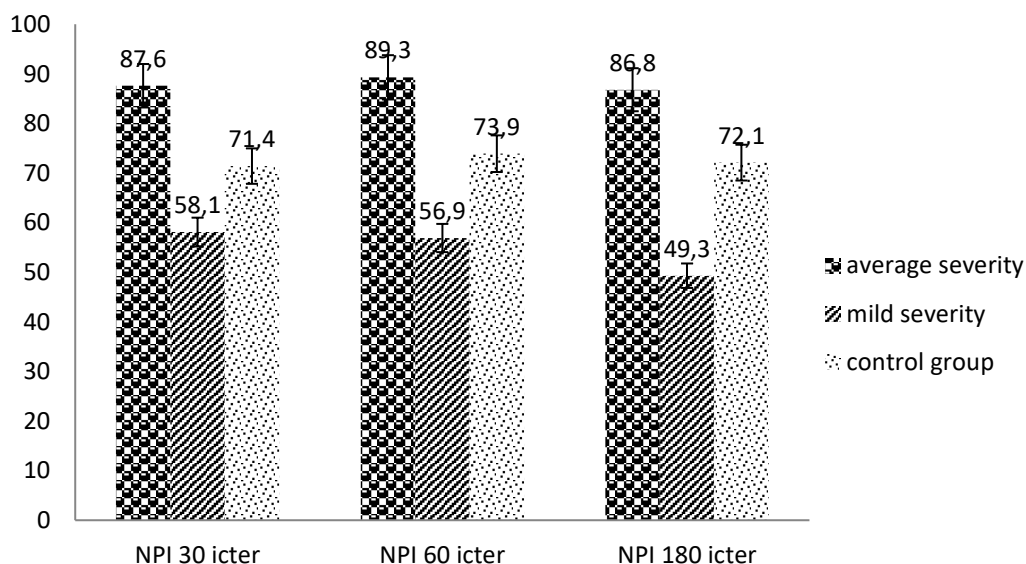


Fig. 1. NPI in patients with HBV in the icteric period

Indicators of the activity of phagocytosis in monocytes in different periods of HBV had opposite orientation. It turned out that the intensity of phagocytosis of monocytes did not correlate with the absorbing capacity of monocytes. Thus, it was found that in patients with mild to moderate severity in the icteric period, the MPI-30 and MPI-180 indices, in addition to MPI-60 (in patients with lung flow), were reduced by 1.2 - 1.3 times compared with the control group, respectively, $p < 0.03$ - $p < 0.00$. The number of monocytes in the blood of patients with mild gravity who

took part in phagocytosis, with an exposure of 60 minutes did not differ from the control group, $p < 0.13$ (Table 1). At the same time, comparing the indicators of MPI in patients with mild to moderate severity, it became clear that they were statistically homogeneous. Thus, characterizing the indicators of MPI in the icteric period of HBV infection, we can state that the intensity of phagocytosis in monocytes in patients with both mild and moderate severity is significantly reduced.

Table 1. PAM in patients with HBV of mild to moderate severity in the icteric period

PAM indicators	Mild gravity (n = 40)	Medium severity (n = 68)	Control group (K) (n = 17)	pp ¹	pp ²
MPI 30%	33,3±1,97*	31,0±1,42*	40,5±1,41	00,03	00,00
MPI 60%	37,3±1,75	35,7±1,27*	42,1±1,37	00,13	00,01
MPI 180%	30,9±1,34*	30,7±0,98*	41,7±1,26	00,00	00,00

PMC 30 mind unit	4,8±0,23	5,4±0,24*	4,4±0,13	00,58	00,02
PMC 60 mind unit	7,1±0,45*/**	5,2±0,34	5,2±0,25	00,01	10,00
PMC 180. unit	5,5±0,34	5,4±0,33	4,7±0,21	00,34	00,41

Notes: * - the difference between patients in the comparison group and control group, ** - the difference between the groups of patients. p¹ - significance between mild gravity and control group. p² - the significance among medium severity and control group.

Comparing the absorbent properties of phagocytes in patients with mild gravity (1 and 2 groups), and patients with moderate severity (groups 3 and 4) and control groups, it was found that the indexes of PHN were significantly higher in

the examined subjects who had a slight degree of severity illness (Fig. 2).

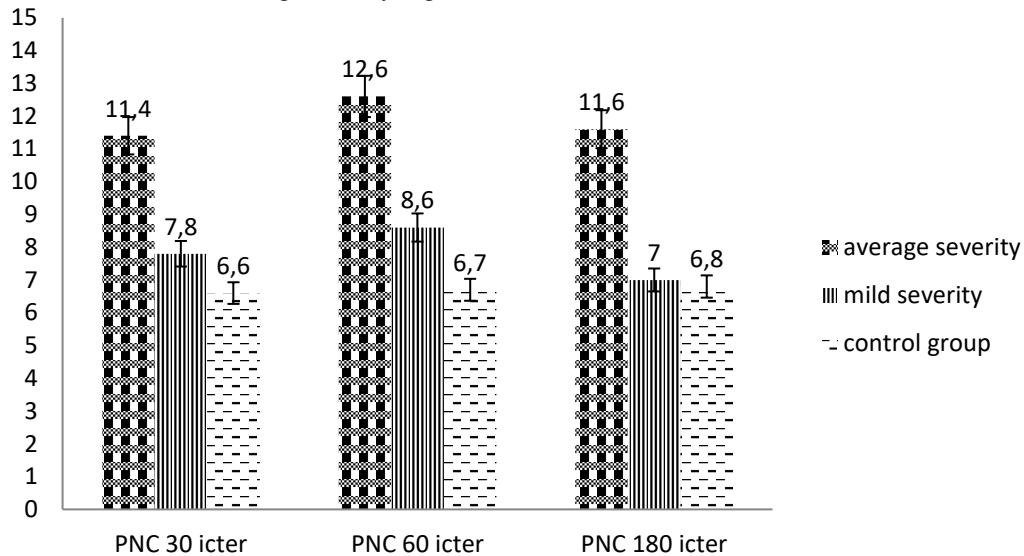


Fig. 2. PNC in patients with HBV in the icteric period

Levels of PNC-30 and PNC-180 in patients 3 and 4 were not statistically different from group 5, where PNC-30 - 6.6 ± 0.22 and PNC-180 - 6.8 ± 0.15 , so ($p < 0.36$) and ($p < 0.95$). While the values of PNC-60 - 8.6 ± 0.49 in patients with moderate severity significantly exceeds the level of control group, where FCN-60 is 6.7 ± 0.20 , so $p < 0.03$ (Fig. 2).

Estimating the PCM in patients with mild to moderate severity in the icteric period of GHB, it turned out that the absorption capacity of monocytes is at the level of or exceeds healthy individuals. So in patients with mild severity, the PMC-30 and PMC-180 rates did not differ statistically from the control group, respectively, $p < 0.58$ and $p < 0.34$. However, PMC-60 in patients with mild gravity exceeds a similar indicator in the control group and in patients with moderate severity of 1.4 times, $p < 0.01$ (Table 1).

The PMC-30 index in patients with moderate severity was 1.2 times higher than the control group, $p < 0.02$. Other indicators of PMC-60 and PMC-180 did not differ from the control group, $p < 1.0$ and $p < 0.41$ (Table 1).

Observing phagocytosis in the dynamics of the disease and after the appointment of a symbiotic, it became clear that the phagocytic reaction of neutrophils has a certain tendency,

which is determined by the severity of hepatitis and is associated with the administration of the symbiotic. That is why in our study we separately considered the response of the congenital nonspecific immunity, taking into account the severity of the course of the disease.

Comparing the PAN, in patients with mild gravity, in the period of reconvalescence, who were on standard treatment (group 1) and a group of patients after the appointment of a symbiotic (group 2) and a group of healthy persons (5) found that neutrophilic phagocytosis was more intense in patients, who took the symbiotic. In particular, NPI-30 - $92.5 \pm 1.29\%$; NPI-60 - $94 \pm 0.50\%$; NPI-180 - $91.1 \pm 1.25\%$ in patients of the 2nd group statistically differed from the levels of NPI-30 - $78.7 \pm 4.71\%$; NPI-60 - $81.5 \pm 3.99\%$ and NPI-180 - $78.4 \pm 3.89\%$ of the comparison group, and control groups, respectively, $p < 0.01$ (Fig. 3).

Indicators of PNC in patients, group 1 and patients in group 2 in the period of convalescence were as follows: PNC-30 - 10.2 ± 0.60 ; PNC-60 - 11.8 ± 0.84 ; PNC-180 - 10.7 ± 1.08 and FCN-30 - 10.3 ± 0.43 ; PNC-60 - 13 ± 0.71 ; PNC - 180 - 11.2 ± 0.56 , they did not differ statistically between them ($p = 1$, $p < 0.3$, $p < 0.9$), but their level significantly exceeded the control group ($p < 0.00$) (Fig. 3).

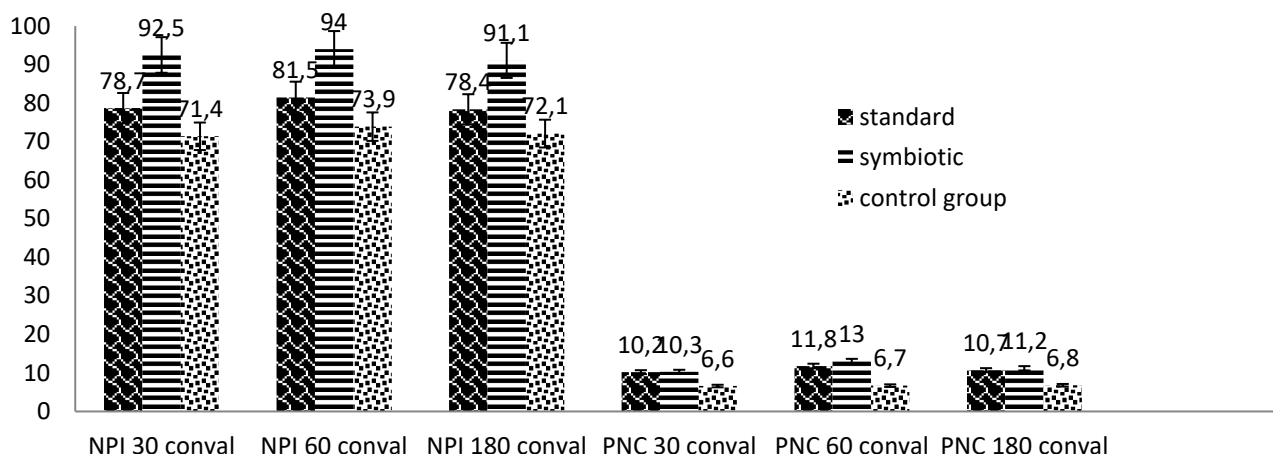


Fig. 3. PAN in patients with HBV of mild severity after treatment

Study of PAM after treatment (convalescence period) in patients with mild to moderate hepatitis showed no statistically significant difference between the values in the comparison groups (1 and 2) and the control group (5), except for the MPI-180 index in patients in group 1 who was in 1,2 times lower than in group 5, $p < 0,01$. However, it should be noted that despite the absence of a statistically significant difference between the MPI-30 and MPI-60 indices in the comparison groups, nevertheless, in patients taking symbiotic (group 2), the intensity of phagocytosis was higher than in patients in group 1 (Table. 2).

In general, the analysis of indicators of MPI and PCM indicates that in patients with mild gravity in the period of reconvalescence, the intensity of phagocytosis of monocytes and their absorption capacity is not different from healthy individuals. However, a sharp decrease in the intensity of phagocytosis with an exposure of 180 minutes. may indicate the instability of phagocytic function of monocytes, which is obviously due to deficiency of phagocytic monocytes in this period of exposure.

Table 2. PAM in patients with HBV of mild severity after treatment

PAM indicators	Standard (n = 34)	Symbiotic (n=34)	Control group (K) (n = 17)	pp ¹	pp ²	pp ³
MPI 30%	34,2±2,07	38,1±2,22	40,5±1,41	00,06	00,65	00,40
MPI 60%	37,4±2,15	40,3±1,78	42,1±1,37	00,55	00,75	00,55
MPI 180%	33,6±1,58*	35,5±2,69	41,7±1,26	00,01	00,05	00,80
PMC 30 mind unit	4,1±0,30	4,1±0,21	4,4±0,13	00,55	00,47	10,0
PMC 60 mind unit	5,4±0,36	5,0±0,27	5,2±0,25	00,90	00,89	00,70
PCM 180. unit	4,4±0,37	4,4±0,32	4,7±0,21	00,79	00,72	10,0

Notes: * - the difference between patients in the comparison group and the control group, ** - the difference between the groups of patients. p¹ - significance between standard and control group . p² - significance between standard treatment and control group. p³ - significance between standard and symbiotic treatment.

In patients with moderate severity, phagocytic neutrophil reactions had a further tendency. In all phagocytosis studies (30, 60 and 180 minutes), the NPI rates in patients receiving baseline therapy (group 3) were lower than the control group. In contrast, NPI rates in the group of patients receiving symbiotic (4) were significantly higher than in group 3 and correlated with a group of healthy individuals. Thus, in patients who were additionally receiving the NPI-30 symbiotic, it was $66.9 \pm 2.96\%$

compared with NPI-30 - $56 \pm 3.21\%$ of patients treated only with baseline therapy, respectively, $p < 0.03$. Indices of NPI-60 - $80,4 \pm 2,60\%$; NPI-180 - $67,4 \pm 1,67\%$ of group 4 also significantly differed from the 3 group, where NPI-60 - $63.1 \pm 3.30\%$ and NPI-180 - $48.3 \pm 3.00\%$ ago ($p < 0.00$). The difference between the indicators of neutrophil phagocytosis in group 3 in comparison with the group 5 corresponded to the following statistical NPIdings - $p < 0.00$, $p < 0.02$ and $p < 0.00$ (Fig. 4).

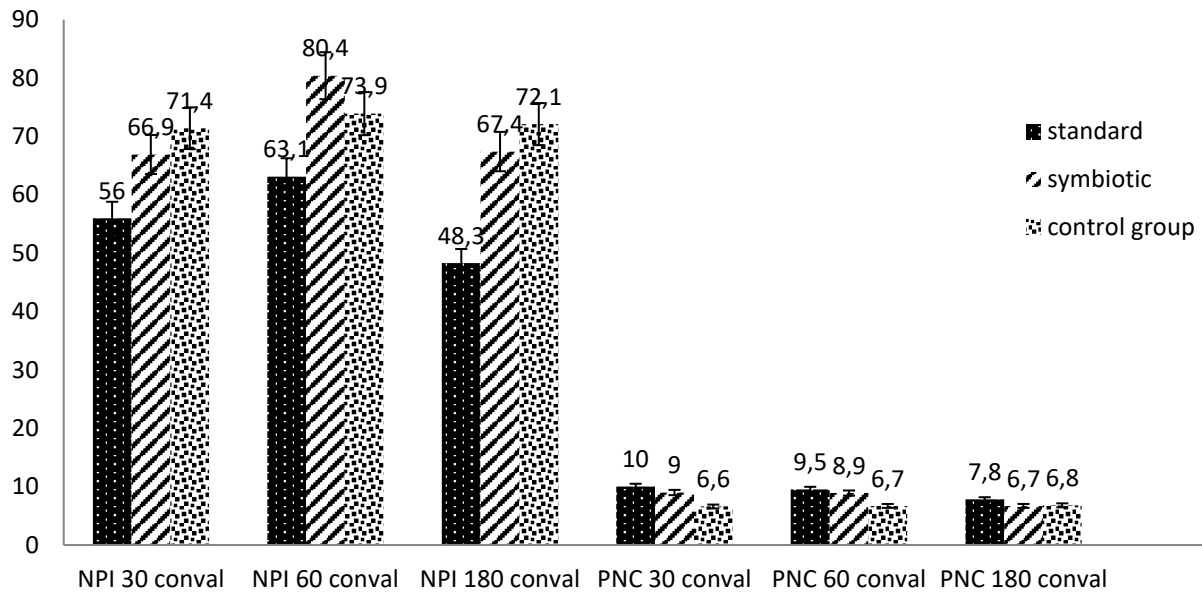


Fig. 4. PAN in patients with moderate HBV after treatment

Indicators of PNC-30 - 9 ± 0.47 ; FCN-60 - 8.9 ± 0.38 in patients receiving symbiotic (group 4) and FCN-30 - 10.6 ± 0.94 and FCN-60 - 9.5 ± 0.85 in patients who were on standard therapy (group 3) were not significantly different, but were statistically higher than in the control group (group 5), respectively $p < 0.03$ (comparing group 4 and group 5) and $p < 0.00$ (comparing group 3 and group 5). However, when examining the levels of PNC-180 in groups 4 and 3 and comparing them with group 5 (6.7 ± 0.62 ; 7.8 ± 0.70 ; 6.8 ± 0.15), no significant difference was found between them ($p = 1$, $p < 0,4$). It should be noted that the PNC indices in the main groups and comparison groups in the period of convalescence did not differ statistically (Fig. 4).

It was found that, in contrast to the mild GGW course with moderate severity, the intensity of phagocytosis of monocytes was significantly suppressed, especially in patients who were on standard treatment. Comparing indicators of MPI-30; 60 and 180 in patients receiving

standard treatment (group 3), with the control group (5), it was found that the intensity of phagocytosis in group 3 was significantly lower than group 2 in 2.7-3.2 times, $p < 0, 00$ (Table 3). The intensity of phagocytosis in monocytes in patients receiving symbiotic (group 4) was also reduced in all incubation periods by 1.5 – 1.7 times compared with the control group, $p < 0.00$. At the same time, the most significant difference between the indicators of MPI was found in the comparison groups (3 and 4), where MPI-30, MPI-60 and MPI-180 at 1.8; 2 and 1.9 times, respectively, were higher in the group of patients receiving symbiotic, $p < 0.00$ (Table 3). These data show that in patients with moderate severity in the period of convalescence there is a significant deficiency of monocytes that exhibit phagocytic activity. Instead, the use of symbiotic stimulates the intensity of phagocytosis of mononuclear cells in this category of patients, but their activity does not reach the levels of the control group.

Table 3. PAM in patients with HBV of moderate severity after treatment

PAM indicators	Standard (n=34)	Symbiotic (n=34)	Control group (K) (n = 17)	pp ¹	pp ²	pp ³
MPI 30%	15,0±1,37*/**	26,9±1,55*	40,5±1,41	00,00	00,00	00,00
MPI 60%	14,3±1,25*/**	29,0±1,83*	42,1±1,37	00,00	00,00	00,00
MPI 180%	13,1±1,08*/**	24,5±1,59*	41,7±1,26	00,00	00,00	00,00
PMC 30 mind unit	7,4±0,34*/**	4,6±0,23	4,4±0,13	00,00	00,84	00,00
PMC 60 mind unit	9,2±0,50*/**	5,1±0,23	5,2±0,25	00,00	00,98	00,00
PCM 180. unit	4±0,28	4,4±0,21	4,7±0,21	00,12	00,70	00,46

Notes: * - the difference between patients in the comparison group and the control group, ** - the difference between the groups of patients. p¹ - significance between standard and control group. p² - significance between symbiotic treatment and control group. p³ - significance between standard and symbiotic treatment.

Analysis of absorbing properties of monocytes showed in patients with moderate severity another trend. Thus, PCM levels 30 in patients treated with the standard method (group 3) were higher in 1.7 and 1.6 times in the control group and in patients in group 4, respectively, $p < 0.00$. A similar pattern was observed in patients with 3 groups with an exposure of 60 minutes (exceeding the PCM level 1.8 times, $p < 0.00$). At the same time, the levels of IFM 180 in the comparison and control groups did not differ from each other (Table 3).

Discussing the results obtained, it is possible to state that polymorphonuclear neutrophils do not remain inert foreign cells in the antiviral process, they are involved in HBV infection. However, what role does neutrophils play - have a direct antiviral effect or indirectly participate in the elimination of viruses, or vice versa, HBV uses the functionality of phagocytes to replicate and spread, yet to be clarified.

It is known that in the process of absorption, a phagosome is formed, which is then connected to the

lysosomes of the cell, thus ensuring the implementation of monocytes as effective killing of microorganisms and the cleavage of antigens. Therefore, determining the duration and stability of contact of the object of phagocytosis with lysosomal enzymes monocytes, exhibiting an exposure of 180 minutes, is an important criterion for determining the reliable absorbing function of phagocytic monocytes.

Analyzing the absorbing function of monocytes in patients with moderate severity in the period of reconvalescence, it can be stated that the indicated ability of monocytes in patients of 3 groups is significantly increased in the period from 30 to 60 minutes, which presumably indicates significant compensatory reserves of monocytes. But in the future at an exposure of 180 minutes obviously there is a depletion of the functional capabilities of phagocytic cells, which manifests itself as a sharp decrease in absorbent capacity against the background of a decrease in the total number of phagocytic monocytes. Patients in the 4 groups taking symbiotic demonstrate stable levels of monocyte absorption capacity in all exposure periods that do not differ from healthy subjects. The use of a symbiotic increases both the intensity of phagocytosis and regulates the absorption capacity of microphages in patients with mild severity and especially in patients with moderate severity, thereby maintaining the PAN at HBV at an optimal level.

Conclusions

In patients with mild to moderate hepatitis, a significant activation of polymorphonuclear neutrophils during the active phase of HBV infection has been detected, which is characterized by an increase in the levels of NPI and AFN in 1.1-1.8 times and 1.5-1.9 times, respectively, in comparison with the control group. While indicators of MPI in HBV were reduced by 1.1-3.2 times compared with the control group, possibly due to a decrease in the number of phagocytic monocytes in the blood of patients with HBV infection. The intensity of reduction of phagocytic reactions of monocytes correlates with the degree of severity of HBV. It is possible to assume that a significant reduction in the number of phagocytes in the peripheral blood of infected persons is due to the redistribution of monocyte phenotypes and the recruitment of these immune cells in the inflammatory site.

In patients with moderate severity in different periods of the disease there is a significant inhibition of phagocytosis, which is manifested by a decrease in the number of neutrophils that are involved in phagocytic reactions (1.2-1.5 times compared with the control group). However, despite the significant inhibition of the intensity of phagocytosis, the absorption capacity of neutrophils in these patients is elevated or is at the level of healthy individuals. Increasing the PCM to 1.8 times in patients with HBV may indicate significant compensatory opportunities for monocytes by increasing their absorption capacity.

Thus, it is possible to assume that the patients with HBV infection of moderate severity increase the functionality of activated neutrophils by mobilizing the reserve properties of each eukaryotic immune cell that has undergone active phagocytosis. This suggests that there are significant compensatory possibilities of neutrophils that are capable of maintaining a general balance in the phagocytic system under intensive HBV loading.

The use of symbiotic in the complex therapy of patients with GHB increases the intensity of phagocytosis, as due to an increase in the number of monocytes (however, their level does not reach the values of the control group) and neutrophils (in 1,2 - 1,4 times).

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Introduction. Treatment of HBV infection is one of the global problems of modern medicine, which is confirmed by the extraordinary prevalence and high mortality from this disease. Elimination of acute hepatitis B (GHB) from

the human body cannot be achieved without an effective antiviral immune response. Infiltration into the body, infectious agents collide with the innate structures of the immune system, among which phagocytes are on the first line of defense. The purpose of the work – study of the functional state of polymorphonuclear neutrophils and indicators of phagocytic activity of monocytes in the blood of patients with HBV of varying degrees of severity in the dynamics of conventional treatment and after the appointment of a symbiotic. **Material & methods.** Under supervision were 108 patients with HBV, from 18 to 69 years, of which 56 men and 52 women, the overall average age of patients was 34 ± 1.88 years. The control group consisted of 17 healthy individuals. To evaluate phagocytic the activity of neutrophils (PAN) was determined by the neutrophils phagocytic index (NPI) and the phagocytic count of neutrophils (PCN). The monocytes phagocytic index of (MPI) and phagocytic count of monocytes (PCM) were determined for evaluation of phagocytic activity of monocytes (PAM). Three incubation periods of 30, 60 and 180 minutes were used. **Results & discussion.** Discussing the results obtained, it is possible to state that polymorphonuclear neutrophils do not remain inert foreign cells in the antiviral process, they are involved in HBV infection. However, what role does neutrophils play - have a direct antiviral effect or indirectly participate in the elimination of viruses, or vice versa, HBV uses the functionality of phagocytes to replicate and spread, yet to be clarified. It is known that in the process of absorption, a phagosome is formed, which is then connected to the lysosomes of the cell, thus ensuring the implementation of monocytes as effective killing of microorganisms and the cleavage of antigens. Therefore, determining the duration and stability of contact of the object of phagocytosis with lysosomal enzymes monocytes, exhibiting an exposure of 180 minutes, is an important criterion for determining the reliable absorbing function of phagocytic monocytes. Analyzing the absorbing function of monocytes in patients with moderate severity in the period of convalescence, it can be stated that the indicated ability of monocytes in patients of 3 groups is significantly increased in the period from 30 to 60 minutes, which presumably indicates significant compensatory reserves of monocytes. But in the future at an exposure of 180 minutes obviously there is a depletion of the functional capabilities of phagocytic cells, which manifests itself as a sharp decrease in absorbent capacity against the background of a decrease in the total number of phagocytic monocytes. Patients in the 4 groups taking symbiotic demonstrate stable levels of monocyte absorption capacity in all exposure periods that do not differ from healthy subjects. The use of a symbiotic increases both the intensity of phagocytosis and regulates the absorption capacity of microphages in patients with mild severity and especially in patients with moderate severity, thereby maintaining the PAN at HBV at an optimal level. **Conclusions.** In patients with mild to moderate hepatitis, a significant activation of polymorphonuclear neutrophils during the active phase of HBV infection has been detected, which is characterized by an increase in the levels of NPI and AFN in 1.1-1.8 times and 1.5-1.9 times, respectively, in comparison with the control group. While indicators of MPI in HBV were reduced by 1.1-3.2 times compared with the control group, DOI: 10.5281/zenodo.1456554

possibly due to a decrease in the number of phagocytic monocytes in the blood of patients with HBV infection. The intensity of reduction of phagocytic reactions of monocytes correlates with the degree of severity of HBV. It is possible to assume that a significant reduction in the number of phagocytes in the peripheral blood of infected persons is due to the redistribution of monocyte phenotypes and the recruitment of these immune cells in the inflammatory site. In patients with moderate severity in different periods of the disease, there is a significant inhibition of phagocytosis, which manifested by a decrease in the number of neutrophils that are involved in phagocytic reactions (1.2-1.5 times compared with the control group). However, despite the significant inhibition of the intensity of phagocytosis, the absorption capacity of neutrophils in these patients is elevated or is at the level of healthy individuals. Increasing the PCM to 1.8 times in patients with HBV may indicate significant compensatory opportunities for monocytes by increasing their absorption capacity. Thus, it is possible to assume that the patients with HBV infection of moderate severity increase the functionality of activated neutrophils by mobilizing the reserve properties of each eukaryotic immune cell that has undergone active phagocytosis. The use of symbiotic in the complex therapy of patients with GHB increases the intensity of phagocytosis, as due to an increase in the number of monocytes (however, their level does not reach the values of the control group) and neutrophils (in 1,2 - 1,4 times).

Keywords: HBV infection, immunity, neutrophils, phagocytosis