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Changes in the Structural and Functional Albumin Properties in Patients with Decompensated Liver Cirrhosis

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Aim: to conduct a comparative analysis of serum albumin's structural and functional properties in decompensated cirrhotic patients by means of spin prob EPR spectroscopy.
Materials and methods. The main study group included 70 patients with decompensated liver cirrhosis and ascites. The control group consisted of 12 healthy volunteers, comparable in gender and age, without liver diseases. To assess the structural and functional ability, serum albumin was analyzed by EPR spectroscopy.
Results. Albumin levels within reference intervals were found in 37 patients (59.8 %). The native albumin index decrease in cirrhotic patients as the disease progressed with the lowest values in the Child – Pugh C group ($p < 0.001$). The binding efficiency of albumin decreased in accordance with the severity of cirrhosis with minimal albumin binding capacity in the Child – Pugh C (Me = 25.43 %; $n = 30$; $p < 0.001$). The transport activity of RTQ albumin decreased in patients with decompensated cirrhosis, the lowest transport ability was observed in the Child – Pugh C group (Me = 26.09 %). In patients with decompensated disease the detoxification potential was significantly reduced: Child – Pugh B — Me = 44.03 %; Child – Pugh C — Me =17.16 %. Despite the normal values of serum albumin in 72.5% of patients with cirrhosis B and in 26.7% in the cirrhosis C group, only 12.3% in the cirrhosis B group had normal albumin function and in cirrhosis C no patients had normal albumin function.
Conclusion. There were not only serum concentration depletion in cirrhotic patients, but also albumin physiological non-oncotic properties were violated. The severity of these changes increased with the progression of cirrhosis. Our data allow us to raise the question of the need to use the EPR test to determine indications for albumin replacement therapy in patients with cirrhosis and the presence of ascites, even at normal values of its serum concentration
Keywords: albumin, EPR spectroscopy, liver cirrhosis, native conformation (DR), properties of albumin
Conflict of interest: the authors declare no conflict of interest.

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Изменения структурных и функциональных свойств альбумина у пациентов с декомпенсированным циррозом печени

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Цель: провести сравнительный анализ структуры и функциональных свойств сывороточного альбумина у пациентов с декомпенсированным циррозом печени методом спектроскопии спинового зонда с применением электронного парамагнитного резонанса (ЭПР-спектроскопии).
Материалы и методы. В основную группу исследования вошли 70 пациентов с декомпенсированным циррозом печени (ЦП) и асцитом. Контрольную группу составили 12 здоровых добровольцев, сопоставимых по полу и возрасту, не имеющих заболеваний печени. Для оценки структурной и функциональной способности альбумина проводили анализ сывороточного альбумина методом ЭПР-спектроскопии.
Результаты. Уровень альбумина в пределах референсных интервалов обнаружен у 37 пациентов (59,8 %). При ЦП показатели нативного альбумина снижаются по мере прогрессирования заболевания с наименьшими значениями в группе ЦП класса С по шкале Чайлда – Пью ($p < 0,001$). Связывающая эффективность альбумина также снижалась в соответствии с тяжестью ЦП ($p < 0,001$) с минимальными показателями в группе пациентов с ЦП класса С (Me = 25,43 %; $n = 30$; $p < 0,001$). Транспортная активность альбумина снижалась у пациентов с декомпенсацией цирроза с минимальным показателем при ЦП класса С (Me = 26,09 %). У пациентов с декомпенсированным заболеванием детоксикационная эффективность альбумина значительно снижена (ЦП класса В Me = 44,03; ЦП класса С Me = 17,16). Несмотря на нормальные значения сывороточ-

ного альбумина у 72,5 % пациентов с ЦП класса B и у 26,7 % с ЦП класса C его нормальная функция была сохранной лишь у 12,3 % при ЦП класса B, а при ЦП класса C шкале Чайлда – Пью не соответствовала норме ни у одного пациента.
Выводы. У пациентов с циррозом печени не только снижается уровень сывороточного альбумина, но и нарушаются его физиологические неонкотические свойства. Выраженность данных нарушений возрастает по мере прогрессирования цирроза. Полученные нами данные позволяют ставить вопрос о необходимости использования ЭПР-теста для определения показаний к заместительной терапии альбумином у пациентов с ЦП и асцитом даже при нормальных значениях его сывороточной концентрации.
Ключевые слова: альбумин, ЭПР-спектроскопия, цирроз печени, нативная конформация (DR), свойства альбумина
Конфликт интересов: авторы заявляют об отсутствии конфликта интересов.

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Introduction

Albumin is the most abundant protein in the vascular bed, accounting for more than half of all plasma proteins [1]. Albumin is a heart-shaped molecule with a half-life of about 19 days [2]. Due to the negative charge and high molecular weight, albumin is the main modulator of the distribution of fluids between the intravascular and intercellular space and is involved in the maintenance of oncotic pressure [3].

Recently, more and more attention has been paid to its non-oncotic properties. It binds and transports various biological substances, participates in the detoxification of endogenous and exogenous compounds, and performs antioxidant, immunomodulatory, and endothelioprotective functions [4, 5].

However, the non-oncotic properties of albumin depend on its molecular structure, which changes under the influence of physiological and pathological processes [6]. The albumin molecule consists of thirty-five cysteine residues. They are involved in the formation of disulfide bonds [7]. However, the only cysteine residue at position 34 (Cys34) remained free [8]. Albumin can exist in three states, depending on Cys34 status: mercaptalbumin with reduced Cys34, reversibly oxidized non-mercaptalbumin-1; irreversibly oxidized non-mercaptalbumin-2 [9, 10]. Reversible and irreversible oxidation of Cys34, the main antioxidant site of the molecule, as well as non-oxidative changes (glycation, cysteinylation, sulfinylation, truncation of the C- and N-terminal part of the molecule) increase in decompensated cirrhosis and correlate with the severity of the disease and the patient's prognosis [11, 12]. In hospitalized patients, oxidized and N-terminally truncated isoforms have been independently associated with ascites, renal failure, and bacterial infection [12]. The data obtained formed the basis of the concept of "effective albumin concentration" (eAlb), which implies that the global function of albumin is associated not only with its serum concentration but also with the preservation of its structural integrity [13]. Therefore, in few modern works, it has been shown that in decompensated liver cirrhosis, along with a quantitative deficiency of circulating albumin, damage to its molecular structure occurs. It is associated with systemic inflammation and oxidative stress [12, 13]. Simultaneously, the singularity of such works creates prerequisites for further research in this area.

Materials and methods

The research is based on data from a survey of 82 participants hospitalized at the University Clinical Hospital N 2, Moscow, the Russian Federation. All patients who have decompensated cirrhosis and ascites (n = 70) made up the main group, divided into two subgroups according to the severity of cirrhosis (Child – Pugh B or C classes).

The control group included 12 healthy volunteers, comparable in sex and age, without laboratory and instrumental signs of liver disease and other pathologies that could affect the properties of albumin. The study was conducted from December 2020 to October 2022.

The inclusion criteria were: the patient's informed consent to participate in the clinical trial, the established diagnosis of decompensated liver cirrhosis based on clinical, instrumental and laboratory examinations; the presence of edematous-ascitic syndrome.

The exclusion criteria include the following conditions: age less than 18 years, hepatocellular cancer and other oncological conditions, exacerbation of chronic diseases, COVID-19 infection within the last 14 days, immunodeficiency (HIV, AIDS), decompensation of concomitant pathology, postoperative period (up to 14 days), sepsis, and septic shock.

The study protocol was approved by the local ethics committee, No. 31-20 of 11/11/2020.

All included patients underwent standard medical examinations. Disease severity was assessed using the Child – Pugh severity scale.

To assess the structural and functional properties of albumin, the method of spin probe spectroscopy using electron paramagnetic resonance (EPR spectroscopy) was used.

Measurements were made on an ESR-Analysator MMS 01-08 analyzer manufactured by MedInnovation GmbH, Germany. A set of reagents for *in vitro* determination of the functionality of albumin in blood serum using the MMS-kit-SA01 spin probe, manufactured by MedInnovation GmbH, Germany.

During the study, the following indicators were evaluated:

Determination Ratio (DR) — a parameter characterizing the albumin molecule, its conformational mobility, and the flexibility;

Binding Efficiency (BE) — physicochemical characteristics of fatty acid binding sites;

Real Transport Quality (RTQ) — transport efficiency;

Detoxification Efficiency (DTE) is a detoxification ability that characterizes the efficiency of binding and evacuation of endotoxins by albumin.

The values of albumin functionality are expressed as a percentage, and the indicator of native conformation is expressed in arbitrary units.

Description of statistical analysis methods

Statistical analysis was carried out using the StatTech v. 2.8.8 (developer — Stattech LLC, Russia).

Quantitative indicators were assessed for compliance with the normal distribution using the Shapiro — Wilk test (with the number of subjects less than 50) or the Kolmogorov — Smirnov criterion (with the number of subjects more than 50).

Quantitative indicators having a normal distribution were described using arithmetic means (M) and standard deviations (SD), boundaries of the 95 % confidence interval (95 % CI).

In the absence of a normal distribution, quantitative data were described using the median (Me) and the lower and upper quartiles (Q1—Q3).

Categorical data were described with absolute values and percentages.

A comparison of two groups in terms of a quantitative indicator having a normal distribution, provided that the variances were equal, was performed using Student's t-test.

A comparison of three or more groups in terms of a quantitative indicator having a normal distribution was performed using one-way analysis of variance, and post hoc comparisons were carried out using Tukey's test (under the condition of equality of variances), and the Games — Howell test (with unequal variances).

A comparison of two groups in terms of a quantitative indicator, the distribution of which differed from the normal one, was performed using the Mann — Whitney U-test.

A comparison of three or more groups in terms of a quantitative indicator, the distribution of which differed from the normal one, was performed using the Kruskal — Wallis test, and post hoc comparisons were performed using Dunn's test with Holm's correction.

Comparison of percentages in the analysis of four-field contingency tables was carried out using Pearson's chi-square test (with values of the expected phenomenon more than 10)

Comparison of percentages in the analysis of multifield contingency tables was performed using Pearson's chi-square test.

Characteristics of the patients included in the study

When analyzing the data we received, the groups were comparable in terms of gender and age. The groups were predominantly women (p = 0.090) (*method used: Pearson's chi-square*). The mean age of patients with cirrhosis was 53 ± 13 years, of healthy individuals — 42 ± 16 years. There were no statistically significant differences (p = 0.082) (*method used: Fisher F-test*).

The distribution by sex and age of the study participants are presented in Table 1 and 2, respectively.

The predominant cause of liver cirrhosis was alcoholic etiology (69.5 %), viral and mixed genesis of the disease were less common (7.3 % and 6.1 %, respectively). The etiology of cirrhosis did not affect the severity of the disease according to the Child — Pugh scale. There were no statistically significant differences (p = 0.299) (*method used: Pearson's chi-square*).

IAC grade I ascites was recorded in 28 patients (34.1 %), grade II in 26 (31.7 %), and grade III in 16 (19.5 %). In the group of Child—Pugh B, grade I ascites was observed in 25 (62.5 %) patients, grade II — in 9 (22.5 %), and grade III — in 6 (15.0 %) patients.

Table 1. Distribution by sex depending on the groups being studied

Таблица 1. Распределение участников исследования по полу

Index Показатель	Categories Категории	Исследуемые группы Study Groups		p
		Liver cirrhosis group n (%) Группа ЦП n (%)	Control group n (%) Группа контроля n (%)	
Sex Пол	Women Женщины	45 (64.6)	8 (66.7)	0.090
	Men Мужчины	25 (35.4)	4 (33.3)	

Table 2. Age distribution depending on the groups under study
Таблица 2. Распределение участников исследования по возрасту

Index Показатель	Categories Категории	Age Возраст			*p*
		M ± SD	95% CI 95% ДИ	*n*	
Groups being studied Исследуемые группы	Child – Pugh B ЦП класса В по шкале Чайлда – Пью	53 ± 13	48–57	40	0.082
	Child – Pugh C ЦП класса С по шкале Чайлда – Пью	51 ± 9	48–55	30	
	Healthy volunteers Группа здоровых добровольцев	42 ± 16	32–53	12	

In the Child–Pugh C: I degree – 3 (10.0 %), II degree – 17 (56.7 %), III degree – 10 (33.3 %).

Albumin levels within reference intervals were found in 37 patients (59.8 %). Child – Pugh B was diagnosed in 29 patients (72.5 %), Child – Pugh C in 8 patients (26.7 %), p < 0.001.

During the EPR test, we obtained the following results.

Native conformation of serum albumin (DR)

In the group of volunteers, the DR index was higher than that in the groups of patients with liver cirrhosis (Me = 3.31). When analyzing data from patients with cirrhosis, attention was drawn to the decrease in the native albumin index as the disease progressed. Thus, the lowest values were recorded in the Child – Pugh C group. The median DR in the Child – Pugh B group was -0.89 ($p < 0.001$), and in Child – Pugh C group it was -2.42 ($p < 0.001$). The results of the analysis are presented in Table 3 and Figure 1.

The revealed differences between the groups being studied in the native albumin conformation were statistically significant ($p < 0.001$) (*method used: Kruskal – Wallis test*).

In our opinion, this fact, as well as a high degree of significance of differences, can convincingly testify in favor of the concept of violation of the normal conformation and functional properties of the albumin molecule in patients with cirrhosis. This fact is also

Table 3. Native conformation of albumin (DR) in patients with decompensated liver cirrhosis and healthy volunteers
Таблица 3. Нативная конформация альбумина (DR) у пациентов с декомпенсированным циррозом печени и здоровых добровольцев

Index Показатель	Categories Категории	DR (native albumin conformation) DR (нативность конформации альбумина)			*p*
		Me	Q1–Q3	*n*	
Groups being studied Исследуемые группы	Child – Pugh B ЦП класса В по шкале Чайлда – Пью	-0.89	-1.74÷ -0.19	40	*p* Child – Pugh C – Child – Pugh B < 0.001 < 0.001* *p* ЦП С – ЦП В < 0.001 *p* healthy – Child – Pugh B < 0.001 *p* здоровые – ЦП В < 0.001 *p* healthy – Child – Pugh C < 0.001 *p* здоровые – ЦП С < 0.001
	Child – Pugh C ЦП класса С по шкале Чайлда – Пью	-2.42	-2.54÷ -2.26	30	
	Healthy volunteers Группа здоровых добровольцев	3.31	2.19–3.80	12	

Note.* differences are statistically significant ($p < 0.05$).
Примечание.* различия показателей статистически значимы ($p < 0,05$).

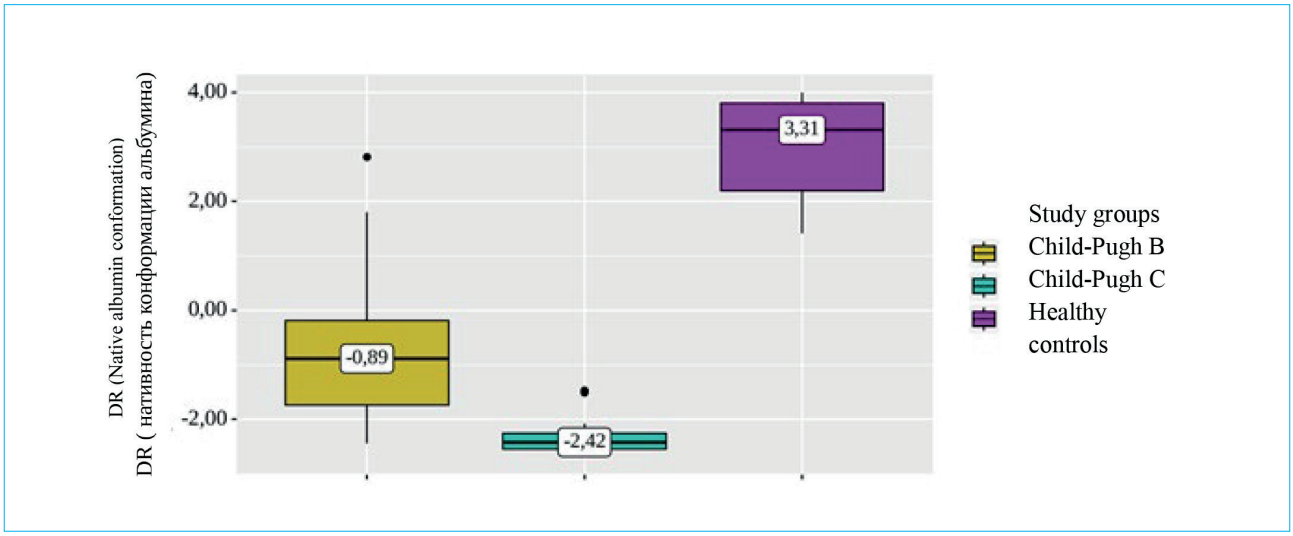

Fig. 1. Native albumin conformation (DR) in patients with decompensated liver cirrhosis and healthy controls

Рис. 1. Нативная конформация альбумина (DR) у пациентов с декомпенсированным циррозом печени и у здоровых добровольцев.

confirmed in the work of Italian authors [13]. However, their study was limited in terms of the number of parameters studied. This gap was filled in our work.

Binding efficiency of serum albumin (BE)

According to our data, the binding efficiency of albumin decreased in accordance with the severity of cirrhosis ($p < 0.001$). Minimal albumin binding capacity was found in the Child – Pugh C group (Me = 25.43 %; $n = 30$; $p < 0.001$) In the Child – Pugh B group, the albumin binding capacity was also significantly reduced (Me = 51.08 %) compared with the group of healthy individuals ($p < 0.05$). In a group of healthy volunteers, BE was within normal limits.

Analysis of the binding activity of BE albumin in the study groups is presented in Table 4 and Figure 2.

Table 4. Analysis of the binding efficacy of albumin (BE) in the studied groups

Таблица 4. Анализ связывающей эффективности альбумина (BE) у исследуемых групп

Index Показатель	Categories Категории	BE (binding efficacy) (%) BE (связывающая эффективность) (%)			*p*
		Me	Q1–Q3	*n*	
Groups being studied Исследуемые группы	Child – Pugh B ЦП класса В по шкале Чайлда – Пью	51.08	40.27–61.68	40	*p* Child – Pugh C – Child – Pugh B < 0.001 <0.001* *p* ЦП С – ЦП В < 0.001 *p* healthy – Child – Pugh B < 0.001 *p* здоровые – ЦП В < 0.001 *p* healthy – Child – Pugh C < 0.001 *p* здоровые – ЦП С < 0.001
	Child – Pugh C ЦП класса С по шкале Чайлда – Пью	25.43	20.40–32.18	30	
	Healthy volunteers Группа здоровых добровольцев	107.05	86.91–125.87	12	

Note.* differences are statistically significant ($p < 0.05$).

Примечание.* различия показателей статистически значимы ($p < 0,05$).

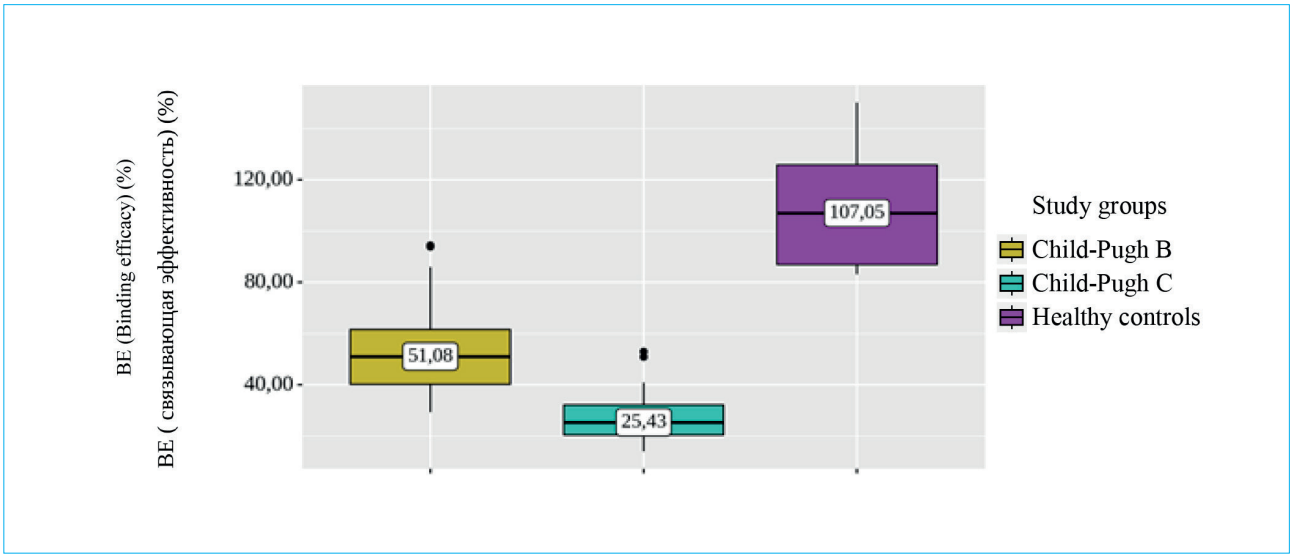

Fig. 2. Albumin binding efficacy (BE) in the groups under study

Рис. 2. Анализ связывающей эффективности альбумина (BE) у исследуемых групп.

When assessing differences in albumin binding capacity, we also obtained statistically significant differences ($p < 0.001$) between the study groups (method used: Kruskal – Wallis test). This result is fully consistent with our findings regarding other non-oncotic properties of albumin and indicates the complex nature of the violation of its properties. Apparently, this phenomenon can be clinically manifested by a decrease in the binding ability of albumin to a number of drugs and bilirubin.

Albumin transport quality (RTQ)

The transport activity of RTQ albumin also significantly depended on the severity of the underlying

Table 5. Analysis of albumin transport quality (RTQ) in patients with decompensated liver cirrhosis and in healthy individuals

Таблица 5. Анализ транспортной активности альбумина (RTQ) у пациентов с декомпенсированным циррозом печени и у здоровых лиц

Index Показатель	Categories Категории	RTQ (транспортная активность) (%) RTQ (transport activity) (%)			*p*
		Me	Q1–Q3	*n*	
Groups being studied Исследуемые группы	Child – Pugh B ЦП класса B по шкале Чайлда – Пью	52.30	40.94–64.50	40	< 0.001* *p* Child – Pugh C – Child – Pugh B < 0.001* *p* ЦП C – ЦП B < 0.001 *p* healthy – Child – Pugh B = 0.005 *p* здоровые – ЦП B = 0.005 *p* healthy – Child – Pugh C < 0.001 *p* здоровые – ЦП C < 0.001
	Child – Pugh C ЦП класса C по шкале Чайлда – Пью	26.09	21.20–33.45	30	
	Healthy volunteers Группа здоровых добровольцев	82.17	72.73–87.09	12	

Note.* differences are statistically significant ($p < 0.05$).

Примечание.* различия показателей статистически значимы ($p < 0,05$).

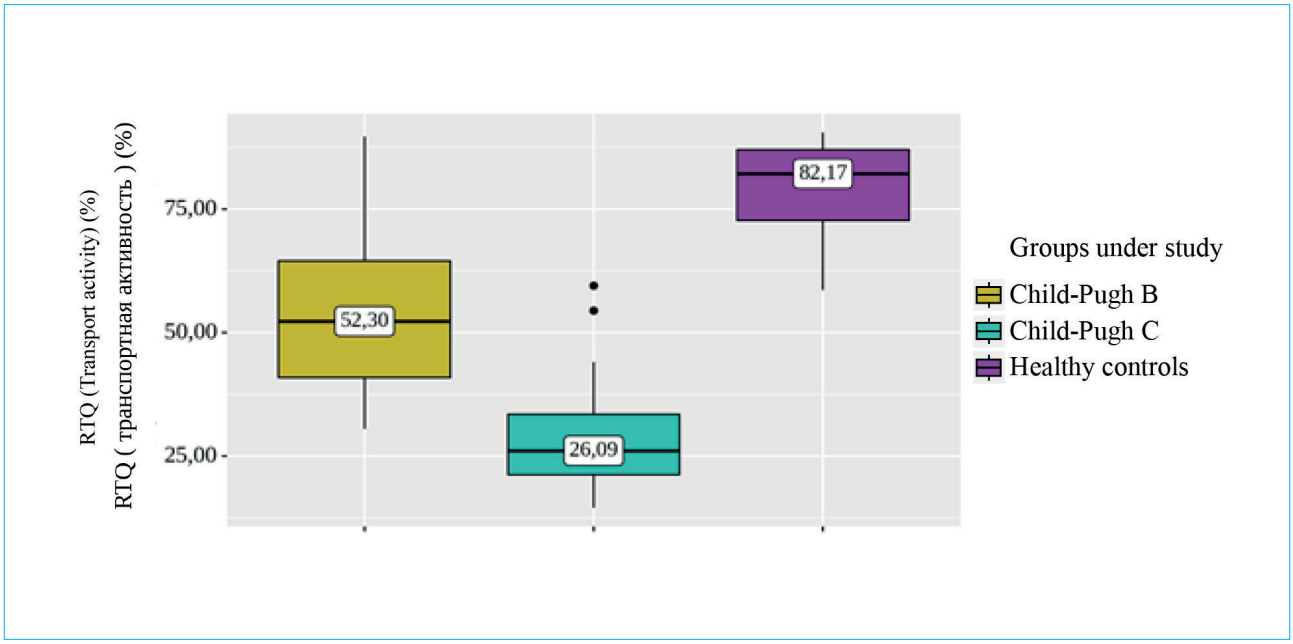

Fig. 3. Albumin transport quality (RTQ) in patients with decompensated liver cirrhosis and healthy volunteers

Рис. 3. Анализ транспортной активности альбумина (RTQ) у пациентов с декомпенсированным циррозом печени и у здоровых лиц.

disease. RTQ did not change in the control group (Me = 82.17 %). At the same time, a significant decrease in this indicator was recorded in patients with decompensated cirrhosis, and the lowest transport ability was observed in the Child – Pugh C group (Me = 26.09 %).

Analysis of the transport activity of albumin RTQ is presented in the table 5 and in figure 3.

Differences in transport function between groups were also statistically significant ($p < 0.001$) (*method used: Kruskal – Wallis test*).

The identified violations of the transport function can explain the decrease in the ability of albumin to transport unconjugated bilirubin, as well as a number of toxins, which is combined with a decrease in the detoxification efficiency of albumin, which will be discussed below.

Albumin Detoxification Efficiency (DTE)

We analyzed data from patients with cirrhosis and healthy study participants. According to the data obtained, the ability to detoxify did not change in the group of healthy individuals, Me = 92.50 %. In patients with decompensated disease the detoxification potential was significantly reduced: Child – Pugh B, Me = 44.03 %; Child – Pugh C, Me =17.16 %. The results of the analysis are presented in Table 6 and Figure 4.

The observed differences between the groups were significant and significant ($p < 0.001$) (*method used: Kruskal – Wallis test*). Such dynamics of a pronounced decrease in the detoxification ability of albumin clearly reflects the severity of systemic intoxication processes in patients with decompensated liver cirrhosis.

Taking into account the revealed significant changes in the functional properties of albumin in patients with cirrhosis, we also decided to analyze to what extent these changes are a consequence of hypoalbuminemia, or whether they are associated with the underlying disease. For this purpose, we correlated the prevalence of these phenomena in the study groups and obtained the following results.

An analysis of the level of serum albumin in decompensated patients with ascites and in a healthy population is presented in Table 7 and in Figure 5.

It was found that despite the preservation of normal values of serum albumin in 72.5 % of patients with cirrhosis B and in 26.7 % in the cirrhosis C group, only 12.3 % of those examined in the cirrhosis B group had normal function and in cirrhosis C did not correspond to the norm in any patient (see Fig. 5, 6).

Our results convincingly show that, in addition to a decrease in albumin concentration, patients with liver cirrhosis develop a significant functional inferiority of circulating albumin itself. This certainly aggravates the course of the disease, disrupting the transport, detoxification and other functions of this molecule. The results obtained during the study are unique and, according to our data, have not been previously described in the literature in the study category of patients.

Among the discussed causes of protein damage in cirrhosis, a number of studies indicate such

Table 6. Analysis of detoxification efficacy (DTE) in patients with decompensated liver cirrhosis and in healthy individuals

Таблица 6. Анализ детоксикационной эффективности (DTE) у пациентов с декомпенсированным циррозом печени и у здоровых лиц

Index Показатель	Categories Категории	DTE (Detoxification Efficiency) (%) DTE (детоксикационная эффективность) (%)			*p*
		Me	Q1–Q3	*n*	
Groups being studied Исследуемые группы	Child – Pugh B ЦП класса B по шкале Чайлда – Пью	44.03	25.94–62.07	40	< 0.001* *p* Child – Pugh C – Child – Pugh B < 0.001
	Child – Pugh C ЦП класса C по шкале Чайлда – Пью	17.16	10.35–25.00	30	<0.001* *p* ЦП C – ЦП B < 0.001 *p* healthy – Child – Pugh B = 0.001 *p* здоровые – ЦП B = 0.001
	Healthy volunteers Группа здоровых добровольцев	92.50	81.86–156.59	12	*p* healthy – Child – Pugh C < 0.001 *p* здоровые – ЦП C < 0.001

Note.* differences are statistically significant ($p < 0.05$).
Примечание.* различия показателей статистически значимы ($p < 0,05$).

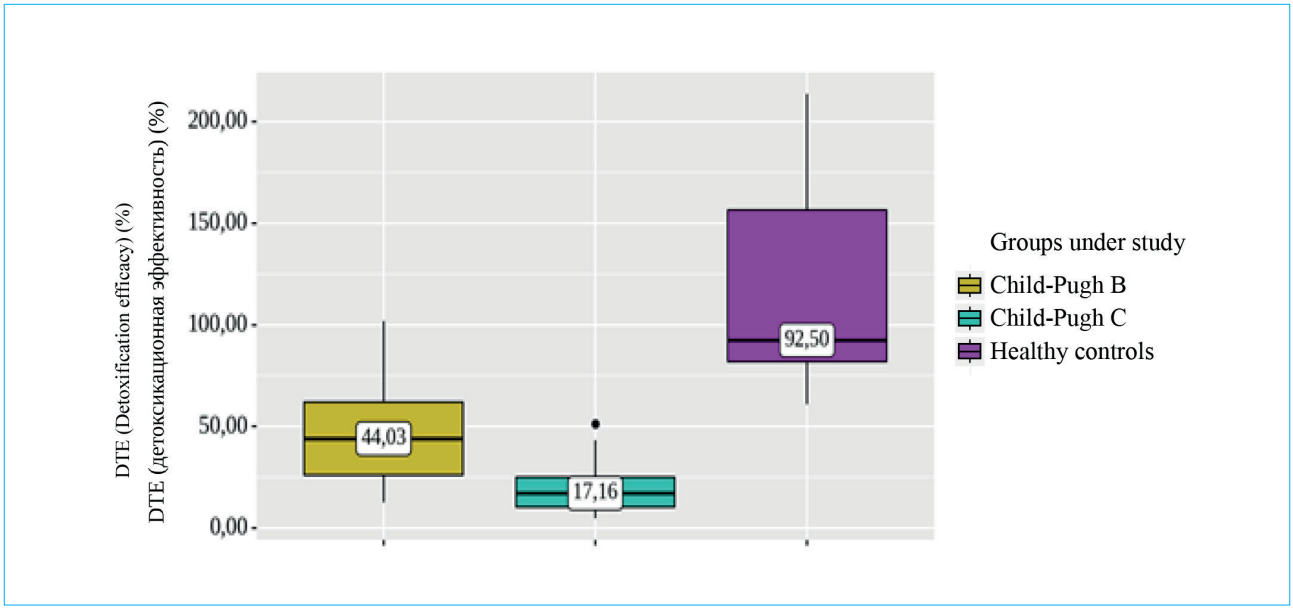

Fig. 4. Detoxification efficacy (DTE) in decompensated cirrhotic patients and in healthy controls

Рис. 4. Анализ детоксикационной активности альбумина (DTE) у пациентов с декомпенсированным циррозом печени и у здоровых лиц.

post-translational changes as oxidation, nitration, glycosylation, acetylation, and ubiquitination. Modified proteins with altered function contribute to the further progression of liver pathology [14].

In liver cirrhosis, the most common post-translational changes in albumin include reversible and irreversible oxidation of the cysteine-34 residue (Cys-34), the main antioxidant site of the molecule, as well as non-oxidative changes, including C- and N-terminal truncation or glycation. — these changes increase with the progression of

Table 7. Serum albumin levels in decompensated patients with ascites and in healthy volunteers
Таблица 7. Уровень сывороточного альбумина у декомпенсированных пациентов с наличием асцита и у здоровых добровольцев

Index Показатель	Categories Категории	Исследуемые группы Study Groups			*p*
		Child – Pugh B	Child – Pugh C	Healthy volunteers	
Serum albumin level (g/l) Уровень сывороточного альбумина (г/л)	Normal Норма	29 (72.5)	8 (26.7)	12 (100,0)	<0.001* *p* Child – Pugh C – Child – Pugh B < 0.001 < 0.001* *p* ЦП С – ЦП В < 0.001 *p* healthy – Child – Pugh B = 0.041 *p* здоровые – ЦП В = 0.041 *p* healthy – Child – Pugh C < 0.001 *p* здоровые – ЦП С < 0.001
	Hypoalbuminemia Гипоальбуминемия	11 (27.5)	22 (73.3)	0 (0,0)	

Note.* differences are statistically significant ($p < 0.05$).
Примечание. * различия показателей статистически значимы ($p < 0,05$).

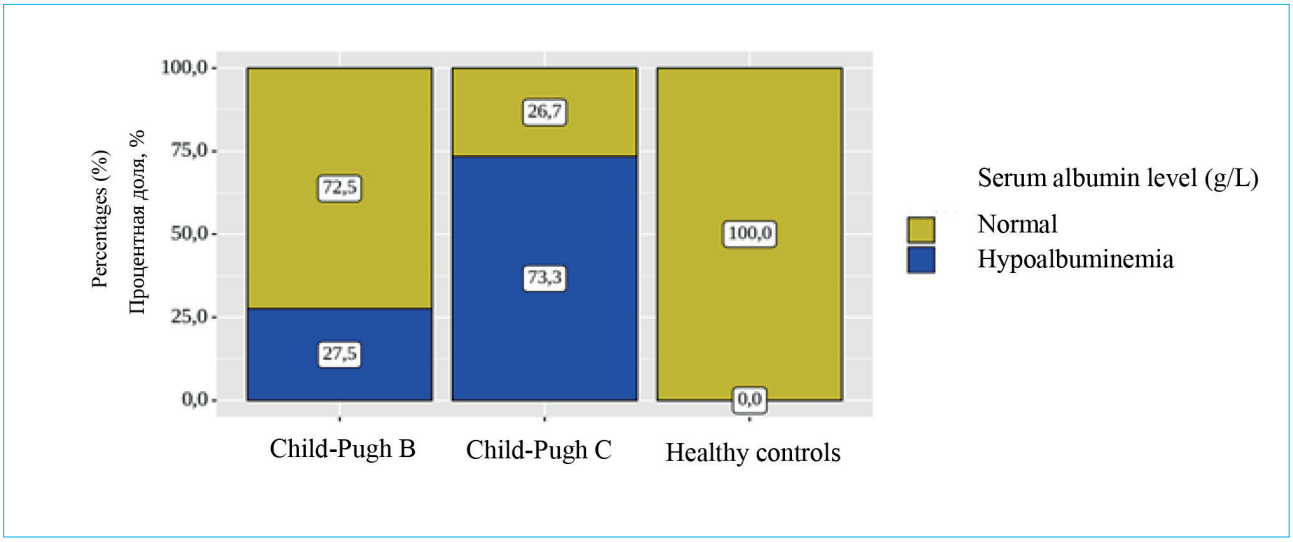

Fig. 5. Serum albumin levels depending on the study groups (Liver cirrhosis Child – Pugh C and B classes and healthy volunteers)

Рис. 5. Уровень сывороточного альбумина в зависимости от исследуемых групп.

liver cirrhosis and correlate with the severity of the disease [12].

Our data are confirmed by single work, which also describe changes in the properties of albumin in patients with liver cirrhosis [13, 14]. However, in the abovementioned works, the analysis of all four indicators and the interpretation of the effect of Child-Pugh on changes in the properties of albumin were not carried out. This data gap is filled in our work.

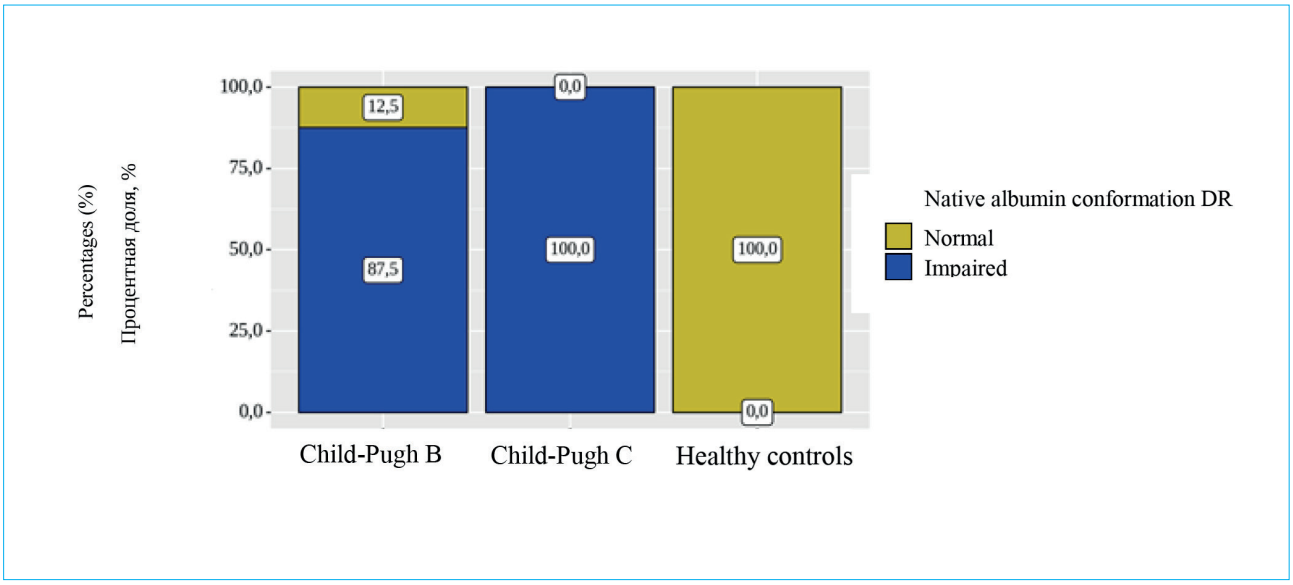

Fig. 6. The proportion of subjects in groups of patients and healthy volunteers with an impaired molecular structure of albumin

Рис. 6. Доля испытуемых в группах пациентов и здоровых добровольцев с нарушением молекулярной структуры альбумина.

Conclusion

In our work, we have shown that liver cirrhosis leads not only to a decrease in the concentration of albumin, but also to a significant violation of its functional properties. The prevalence of functional disorders of albumin occurs significantly more often than hypoalbuminemia per se in patients with cirrhosis. In class B, it can reach almost 90 %, and in class C it occurs in 100 % of patients. The presence of a normal concentration of serum albumin can create the effect of false well-being, which does not reflect the functional inferiority of the circulating molecule from the standpoint of detoxification, transport ability and other critical properties. In patients with decompensated liver cirrhosis and the presence of ascites, the structural configuration of the albumin molecule and its physiological functions are disturbed. Our data allow us to raise the question of the need to use the EPR test to determine indications for albumin replacement therapy in patients with cirrhosis and the presence of ascites, even at normal values of its serum concentration. Also of great interest is the use of this test for a more precise assessment of the severity of cirrhosis.

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