



Original Research Article

Improvement of Rehabilitation Measures Based on the Analysis of Functional Impairments and Activity Limitations in Persons with Disabilities Due to Liver Cirrhosis in the Republic of Dagestan

Article History:

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Received: 28-11-2025

Revised: 05-12-2025

Accepted: 12-01-2026

Published: 28-01-2026

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Abstract: Liver cirrhosis is one of the most important problems of modern society. Currently, both in Russia and worldwide, there is a steady increase in the number of diffuse chronic liver diseases of viral and alcoholic etiology, 90% of which, as the disease progresses, develop into cirrhosis with the formation of portal hypertension syndrome. This pathology is characterized by a severe progressive course and is one of the leading causes of mortality and disability in economically developed countries. Liver cirrhosis ranks among the six leading causes of death in patients aged 35–60 years, accounting for 14 to 30 cases per 100,000 population, while global mortality averages about 2 million people annually. In the Russian Federation, liver cirrhosis accounts for approximately 30% of the total number of patients with chronic diffuse liver diseases. **Aim of the study.** To assess the degree of activity limitations in persons with disabilities due to liver cirrhosis based on clinical and functional impairments. **Materials and methods.** The study data were organized in Excel tables using documentary methods and data extraction (301 cases). The data prepared for analysis in xlsx format were uploaded into the R environment. For continuous variables with a normal distribution, the mean (M) and standard deviation (SD) were calculated; when comparing two groups, the t-test was used, and the p-value of Student's t-test (p_t) was determined. For continuous variables with a non-normal distribution, the median (Me), first (Q1), and third (Q3) quartiles were calculated; group comparisons were performed using the Mann–Whitney U test and its p-value (p_{mu}). If the compared variables were ordinal or numerical, Spearman's rank correlation coefficient and its p-value ($r(p)$) were calculated for each pair of variables. To identify associations between categorical variables, the chi-square test of the corresponding contingency table and its p-value ($p(\chi^2)$) were used. If the expected frequency in some cells of the table was <5 , Yates' continuity correction was applied. Hierarchical clustering with the "ward.D2" linkage method was used to demonstrate relationships between clinical symptoms. In comparative tests, the critical p-value was set at 0.05. Data processing and analysis were performed in the R environment (statistical computing environment; <https://www.r-project.org>). **Results.** It was noted that in persons with disabilities due to liver cirrhosis, the main clinical manifestations included portal hypertension syndrome (75%), malabsorption syndrome (49%), dyspeptic syndrome (49%), ascites (46%), encephalopathy (41%), and esophageal varices (38%). Impairments of digestive system function were moderate in 31% of cases, severe in 44%, and markedly severe in 22.0%. Impairments of neuromuscular, skeletal, and statodynamic functions related to movement were recorded as moderate in 1.3% of cases, severe in 1.3%, and markedly severe in

2.7%. Overall functional impairments were moderate in 33.0% of cases, severe in 45.0%, and markedly severe in 22.0%. A strong positive correlation was observed between digestive system dysfunction and limitations in work-related activities. A moderate positive correlation was found between digestive system dysfunction and limitations in self-care, as well as between digestive system dysfunction and limitations in mobility. Between overall functional impairments and self-care and mobility, a moderate positive correlation was identified, while a strong positive correlation was observed with limitations in work-related activities. **Conclusion.** Expert rehabilitation diagnostics of patients with liver cirrhosis who have undergone initial and repeated assessments at medical and social expertise bureaus contributes to the formation of data on the required scope of rehabilitation measures. This information base makes it possible to predict the volume of examinations, disease course, and the use of medical, sanitary, and rehabilitation care components to improve the rehabilitation potential and rehabilitation prognosis of individuals with this pathology.

Keywords: disability, liver cirrhosis, age groups, clinical and functional impairments, activity limitations of persons with disabilities.

INTRODUCTION

Liver cirrhosis is a polyetiologial disease characterized by a chronic, progressive course, involving damage to the parenchymal and interstitial tissues of the organ against the background of hepatocyte necrosis, followed by nodular regeneration and diffuse proliferation of connective tissue. These processes lead to disruption of the organ architectonics and the development of functional insufficiency [2].

Liver diseases remain a serious public health problem in Russia and worldwide. At present, they occupy one of the leading positions among the causes of population disability and are among the ten most frequent causes of death. In the age group of 20–40 years, mortality from liver cirrhosis exceeds that from ischemic heart disease. Despite modern advances in intensive care and transplantology, mortality rates associated with the development of liver failure remain high, and the World Health Organization predicts that mortality from liver diseases will double over the next 10–20 years. Currently, there are approximately 200 million patients with chronic liver diseases worldwide, about 30% of whom have liver cirrhosis [1].

According to a large international study on the global prevalence of liver cirrhosis across 195 countries from 1990 to 2017, cirrhosis accounted for more than 1.32 million deaths worldwide in 2017 (including 440,000 among women and 883,000 among men), representing 2.4% of all deaths [12,13]. Russia ranks fourth globally in terms of the increase in mortality from liver cirrhosis. Over the past 30 years, an

increase in the detection of decompensated cirrhosis has been observed [11,14,15,16,17]. Liver cirrhosis is a progressive pathology leading to persistent activity limitations and mortality among individuals of working age [8]. In the contemporary literature, the assessment of rehabilitation potential and rehabilitation prognosis in patients with liver cirrhosis who have undergone medical and social assessment remains insufficiently studied [3,4,5,6,7,9,10].

Aim of the study. To assess the degree of activity limitations in persons with disabilities due to liver cirrhosis based on clinical and functional impairments.

RESULTS.

To investigate the expert rehabilitation and clinical-functional aspects of disability due to liver cirrhosis, a sample of medical records and assessment protocols of individuals aged 18 years and older was analyzed. These individuals were examined at the Bureau of Medical and Social Expertise of the Federal State Institution “Main Bureau of Medical and Social Expertise of the Republic of Dagestan” of the Ministry of Labor of the Russian Federation, using Form No. 088/u-06, with a total sample size of 301 cases.

For the statistical processing of primary accounting documents, three data blocks were formed: socio-demographic and physical characteristics; clinical and functional data; and medical and social data, which were analyzed within the scope of the study.

The severity of persistent impairments of body functions in persons with disabilities was assessed

using four levels (mild, moderate, severe, and markedly severe). The main categories of activity and participation (ability for self-care, independent mobility, orientation, communication, ability to control one's behavior, learning, and work activity), as well as the degree of their limitation (first, second, and third), were evaluated in accordance with Order of the Ministry of Labor of the Russian Federation No. 585n dated August 27, 2019, "Classifications and criteria used in conducting medical and social expertise of citizens by federal state institutions of medical and social expertise."

The study data were organized in Excel tables using documentary methods and data extraction (301 cases). The data prepared for analysis in xlsx format were uploaded into the R environment. For continuous variables with a normal distribution, the mean (M) and standard deviation (SD) were calculated; when comparing two groups, the t-test was applied, and the p-value of Student's t-test (p_t) was determined. For continuous variables with a non-normal distribution, the median (Me), first (Q1), and third (Q3) quartiles were calculated; group comparisons were performed using the Mann-Whitney U test and its p-value (p_{mu}). When the

variables compared were ordinal or numerical, Spearman's rank correlation coefficient and its p-value ($r(p)$) were calculated for each pair of such variables. To identify associations between categorical variables, the chi-square test of the corresponding contingency table and its p-value ($p(\chi^2)$) were used. If the expected frequency in some cells of the table was <5 , Yates' continuity correction was applied. Hierarchical clustering using the "ward.D2" linkage method was employed to demonstrate relationships between clinical symptoms. In comparative tests, the critical p-value was set at 0.05. Data processing and analysis were performed in the R environment (statistical computing environment; <https://www.r-project.org>).

The study found that among people with disabilities, men accounted for 208 individuals (31%) and women for 93 individuals (69%). The distribution by education level was as follows: primary education – 3%, basic general education – 25%, secondary general education – 42.7%, secondary vocational education – 12.5%, higher education – 16.8%; in 23% of cases, the education level was not reported.

The largest proportion consisted of individuals with disability group II – 132 persons (44%); the share of individuals with disability group III was 27.3% (82 persons), disability group I – 66 persons (22%), and disability since childhood – 6.7% (20 persons).

Analysis of the etiological factors of liver cirrhosis showed that viral etiology was identified in 234 patients, accounting for 78% of cases, including chronic viral hepatitis C in 161 patients (53%), chronic viral hepatitis B in 84 patients (28%), and chronic viral hepatitis D in 30 patients (10%). Liver cirrhosis of toxic etiology was observed in 31 patients (10%). Liver cirrhosis of unknown and mixed etiology was identified in 15 (5%) and 12 patients (4.0%), respectively.

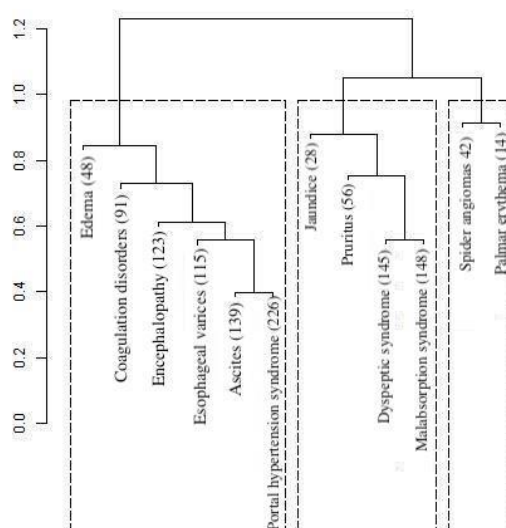


Figure 1. Dendrogram of clinical symptoms in liver cirrhosis

The dendrogram presents three clusters of clinical symptoms. The first cluster is dominated by complaints associated with the underlying disease: jaundice, pruritus, dyspeptic syndrome, and malabsorption syndrome. The second

cluster includes complaints related to cardiovascular disorders: spider angiomas and palmar erythema. The third cluster encompasses the following complaints: coagulation disorders, encephalopathy, esophageal varices, ascites, edema, and portal hypertension syndrome (Figure 1).

The most common clinical and functional indicators used to assess the severity of persistent impairments of body functions in persons with disabilities were analyzed. The main clinical symptoms were represented by portal hypertension syndrome (75%), malabsorption syndrome (49%), dyspeptic syndrome (49%), ascites (46%), encephalopathy (41%), esophageal varices (38%), coagulation disorders (30%), pruritus (19%), edema (16%), spider angiomas (14%), jaundice of the skin and sclera (9.3%), and palmar erythema (4.7%) (Table 1).

Table 1. Main clinical signs in individuals with disabilities due to liver cirrhosis (n; %)

Clinical symptoms	n	%
Portal hypertension syndrome	226	75
Malabsorption syndrome	148	49
Dyspeptic syndrome	145	48
Ascites	139	46
Encephalopathy	123	41
Esophageal varices	115	38
Coagulation disorders	91	30
Pruritus	56	19
Edema	48	16
Spider angiomas	42	14
Jaundice	28	9,3
Palmar erythema	14	4,7

Digestive system dysfunction was moderate in 31% of cases, pronounced in 44%, and severe in 22.0%.

Neuromuscular, skeletal, and statodynamic functions related to movement were moderate in 1.3% of cases, pronounced in 1.3%, and severe in 2.7%.

Cardiovascular system dysfunction was moderate in 3.7% of cases and pronounced in 1.3%.

Hematologic and immune system dysfunction was moderate in 2.0% of cases, pronounced in 4.7%, and severe in 3.3%.

Mental function impairment was moderate in 1.0% of cases and pronounced in 2.0%.

Overall functional impairments were moderate in 33.0% of cases, pronounced in 45.0%, and severe in 22.0% (Table 2).

Table 2. Characteristics of impaired body functions in individuals with disabilities due to liver cirrhosis by severity (n; %)

Impaired body functions	Severity									
	Normal		Minor		Moderate		Pronounced		Severe	
	n	%	n	%	n	%	n	%	n	%
Neuromuscular, skeletal, and	281	93,0	4	1,3	4	1,3	4	1,3	8	2,7

statodynamic functions										
Mental functions	292	97,0	-	-	3	1,0	6	2,0	-	-
Digestive system functions	7	2,3	1	0,3	94	31,0	132	44,0	67	22,0
Cardiovascular system functions	283	94,0	3	1,0	11	3,7	4	1,3	-	-
Hematologic and immune system functions	271	90,0	-	-	6	2,0	14	4,7	10	3,3
Overall functional impairments	-	-	1	0,3	98	33,0	135	45,0	67	22,0

Table 3. Correlations between cardiovascular system impairments and clinical symptoms (n; %)

Parameter	Total		Severity								p(χ ²)	r(p)
			Normal		Minor		Moderate		Pronounced			
	n	%	n	%	n	%	n	%	n	%		
Pruritus	56	18,6	49	173	2	66,7	5	45,5	-	-	0,019	0,13 (0,027)
Edema	48	15,9	38	13,4	2	66,7	4	36,4	4	100	0,001	0,28 (0)
Dyspeptic syndrome	145	48,2	132	46,6	3	100	9	81,8	1	25	0,012	0,12 (0,042)
Malabsorption syndrome	148	49,2	134	47,3	3	100	7	63,6	4	1000	0,030	0,14 (0,012)

The study revealed statistically significant correlations between complaints and cardiovascular system dysfunction. Pruritus was observed in 5 individuals (45.5%) with moderate dysfunction, showing a weak correlation ($r = 0.13$; $p \leq 0.019$). Edema was noted in 4 individuals (36.4%) with moderate cardiovascular dysfunction and in 100% of cases with pronounced dysfunction ($r = 0.28$; $p < 0.001$). Dyspeptic syndrome was present in 81.9% of cases (9 individuals) with moderate dysfunction and in 25% of cases with pronounced dysfunction ($r = 0.12$; $p < 0.012$) (Table 3).

Table 4. Correlations between digestive system impairments and clinical parameters (n; %)

Parameter	Total		Severity								p(χ2)	r(p)
			Normal		Moderate		Pronounced		Severe			
	n	%	n	%	n	%	n	%	n	%		
Jaundice	28	9,3	-	-	3	3,2	20	15,2	5	7,5	0,027	0,09 (0,114)
Encephalopathy	123	40,9	1	14,3	18	19,1	60	45,5	44	65,7	<0,001	0,36 (0)
Esophageal varices (EV)	115	38,2	1	14,3	13	13,8	59	44,7	42	62,7	<0,001	0,38 (0)
Ascites	13	46,	2	28,6	1	10,	65	49,	62	92,5	<0,	0,59

	9	2			0	6		2			001	(0)
Edema	48	15,9	1	14,3	5	5,3	24	18,2	18	26,9	0,002	0,21(0)
Portal hypertension syndrome	226	75,1	4	57,1	40	42,6	116	87,9	66	98,5	<0,001	0,51(0)
Coagulation disorders	91	30,2	3	42,9	15	16	37	28	36	53,7	<0,001	0,27(0)
Encephalopathy (repeated)	123	40,9	1	14,3	18	19,1	60	45,5	44	65,7	<0,001	0,36(0)
Surgery	40	13,3	-	-	9	9,6	14	10,6	17	25,4	0,030	0,17(0,004)

As shown in Table 4, jaundice was reported in 3.2% of cases with moderate digestive system dysfunction, in 15.2% with pronounced dysfunction, and in 7.5% with severe dysfunction, showing a weak correlation ($r = 0.11$; $p = 0.03$). Encephalopathy was observed in 19.1% of cases (18 individuals) with moderate dysfunction, in 45.5% (60 individuals) with pronounced dysfunction, and in 65.7% (44 individuals) with severe dysfunction ($r = 0.36$; $p < 0.001$). Esophageal varices were recorded in 44.7% of cases with pronounced digestive dysfunction and in 62.7% with severe dysfunction ($r = 0.38$; $p < 0.001$). Ascites was observed in 10.6% of patients with moderate dysfunction, in 49.2% with pronounced dysfunction, and in 92.5% with severe digestive dysfunction ($r = 0.53$; $p < 0.001$), indicating a moderate positive correlation. Portal hypertension syndrome was noted in 42.6% of cases (40 individuals) with moderate dysfunction, in 87.9% (116 individuals) with pronounced dysfunction, and in 98.5% (66 individuals) with severe digestive dysfunction, showing a moderate positive correlation ($r = 0.51$; $p < 0.001$).

Table 5. Correlations between hematologic and immune system impairments and clinical parameters (n; %)

Parameter	Total		Severity								p(χ ²)	r(p)
			Normal		Moderate		Pronounced		Severe			
	n	%	n	%	n	%	n	%	n	%		
Encephalopathy	123	40,9	105	38,7	2	33,3	7	50	9	90	0,008	0,14 (0,017)
Ascites	139	46,2	120	44,3	1	16,7	9	64,3	9	90	0,005	0,12 (0,033)
Edema	48	15,9	35	12,9	2	33,3	3	21,4	8	80	<0,001	0,26 (0)

Table 5 presents the statistical values of correlation indicators between clinical data and dysfunction of the hematologic and immune systems. Encephalopathy was observed in 33.3% of cases (2 individuals) with moderate dysfunction, in 50% with pronounced dysfunction, and in 90% with severe dysfunction, showing a weak positive correlation ($r = 0.14$; $p = 0.008$). Ascites was noted in 16.7% of cases with moderate dysfunction, in 64.3% with pronounced dysfunction, and in 90% with severe dysfunction ($r = 0.12$; $p < 0.005$). Edema was recorded in 33.3% of cases with moderate dysfunction, in 21.4% with pronounced dysfunction, and in 80% with severe dysfunction of this system, showing a weak positive correlation ($r = 0.26$; $p < 0.001$).

Table 6. Correlations between overall functional impairments and clinical parameters (n; %)

Table 3: Correlations between several functional impairments and clinical parameters (n, %)												
Parameter	Total		Severity								p(x2)	r(p)
			Normal		Moderate		Pronounced		Severe			
	n	%	n	%	n	%	n	%	n	%		
Jaundice	28	9,3	-	-	3	3,1	20	14,8	5	7,5	0,013	0,09

												(0,139)
Encephalopathy	123	40,9	-	-	20	20,4	60	44,4	43	64,2	<0,001	0,33(0)
Esophageal varices (EV)	115	38,2	-	-	14	14,3	60	44,4	41	61,2	<0,001	0,37(0)
Ascites	139	46,2	-	-	11	11,2	67	49,6	61	91	<0,001	0,59(0)
Edema	48	15,9	-	-	5	5,1	25	18,5	18	26,9	<0,001	0,23(0)
Portal hypertension syndrome	226	75,1	-	-	42	42,9	118	87,4	66	98,5	<0,001	0,51(0)
Coagulation disorders	91	30,2	-	-	18	18,4	38	28,1	35	52,2	<0,001	0,26(0)

Overall functional impairments were pronounced and severe in 14.8% (20 individuals) and 7.5% (5 individuals), respectively, among persons with jaundice. In individuals with encephalopathy, overall functional impairments were pronounced in 44.4% and severe in 64.2% ($r = 0.33$; $p < 0.001$). Pronounced overall functional impairments were observed in 44.4% (60 individuals) and 61.2% (41 individuals) of persons with esophageal varices ($r = 0.37$; $p < 0.001$). Pronounced and severe overall functional impairments were noted in 49.2% and 91.0%, respectively, among individuals with ascites ($r = 0.59$; $p < 0.001$). Among persons with portal hypertension syndrome, pronounced overall functional impairments were recorded in 87.4% and severe in 98.5% ($r = 0.51$; $p < 0.001$) (Table 6).

Table 7. Statistically significant correlations between functional impairments in patients with liver cirrhosis and limitations in activities of daily living

Activity limitation	Mental function impairment	Sensory function impairment	Neuro muscular, skeletal, and postural function impairment	Cardiovascular function impairment	Respiratory function impairment	Digestive function impairment	Hematologic and immune function impairment	Overall impairments
Self-care	0,24		0,24			0,62		0,67
Mobility	0,22		0,22			0,61		0,63
Communication	0,49	0,26		0,16	0,43	0,16	0,34	0,16
Orientation	0,66		0,2			0,17		0,17
Learning							0,19	
Control	0,7		0,37		0,19	0,24	0,24	0,24
Work activities	0,25		0,19			0,91	0,16	0,92

A strong positive correlation was observed between digestive system dysfunction and limitations in work-related activities ($r = 0.91$). A moderate positive correlation was found between digestive system dysfunction and limitations in self-care ($r = 0.62$) and mobility ($r = 0.61$). Overall functional impairments in individuals with disabilities showed

a moderate positive correlation with self-care and mobility ($r = 0.67$ and $r = 0.63$, respectively), and a strong positive correlation with work-related activities ($r = 0.92$) (Table 7).

Table 8. Characteristics of activity limitations in patients with liver cirrhosis according to severity (n; %)

Activity limitation	Severity							
	Normal		First degree		Second degree		Third degree	
	n	%	n	%	n	%	n	%
Communication	294	98	7	2,3	-	-	-	-
Orientation	297	99	2	0,7	2	0,7	-	-
Mobility	33	11	166	55	80	27	22	7,3
Self-care	14	4,7	181	60	79	26	27	9,0
Work activities	21	7,0	83	28	131	44	66	22
Learning	295	98	6	2,0	-	-	-	-
Control over own behavior	293	97	6	2,0	2	0,7	-	-

It was found that among individuals with disabilities due to liver cirrhosis, mobility limitations were of the first degree in 55% of cases, second degree in 27%, and third degree in 7.3%. Limitations in self-care were of the first degree in 60% of cases, second degree in 26%, and third degree in 9.0%. Limitations in work-related activities were of the first degree in 28% of cases, second degree in 44%, and third degree in 22% (Table 8).

CONCLUSION.

Analysis of body function impairments and corresponding limitations in activities of daily living due to liver cirrhosis showed that the most prevalent clinical symptoms in these patients were: portal hypertension syndrome – 75%, malabsorption syndrome – 49%, dyspeptic syndrome – 49%, ascites – 46%, encephalopathy – 41%, and esophageal varices – 38%. Digestive system dysfunction was moderate in 31% of cases, pronounced in 44%, and severe in 22.0%. Neuromuscular, skeletal, and statodynamic functions related to movement were moderate in 1.3% of cases, pronounced in 1.3%, and severe in 2.7%. Overall functional impairments were moderate in 33.0% of cases, pronounced in 45.0%, and severe in 22.0%.

Among the categories of activity limitations, first-degree limitations in mobility and self-care and second-degree limitations in work-related activities were most frequently observed. Conducting an individual assessment of functional impairments in individuals with disabilities due to liver cirrhosis, who have undergone initial and repeated examinations at the Bureau of Medical and Social Expertise, will allow for more effective planning of the scope of examinations, medical care, and rehabilitation services, thereby contributing to improved quality of care for patients with this condition.

Author contributions: Concept development – Zapary N.S., Mamaev S.N.; statistical data processing – Ramazanov Sh.R.; writing and editing of

the manuscript – Ramazanov Sh.R.; selection and review of publications on the research topic – Ramazanov Sh.R.; manuscript review and editing – Ramazanov Sh.R.,

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