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## ULTRASONOGRAPHIC CHARACTERISTICS OF MORPHOMETRIC AND HEMODYNAMIC PARAMETERS OF THE LIVER AND SPLEEN IN PEDIATRIC PATIENTS WITH CHRONIC VIRAL HEPATITIS B AND C

Y. M. Demchyshyn<sup>1</sup>, I. I. Nezgoda<sup>1</sup>, S. M. Poprotska<sup>2</sup>, A. A. Asaulenko<sup>1</sup>

<sup>1</sup>National Pirogov Memorial Medical University, Vinnytsya

<sup>2</sup>Communal Nonprofit Enterprise «Vinnytsia Regional Clinical Children's Infectious Diseases Hospital Vinnytsia Regional Council»

### Abstract

Chronic HBV- and HCV-infection in pediatric patients had already become an important social and medical problem due to increasing of its prevalence, specific latent course of these infections and forming of progression process which leads to development of liver fibrosis, cirrhosis and cancer with specific influence to different indexes which shows us the decreasing of quality of life of those patients. Therefore, it is necessary to study the basic risk factors for liver fibrosis progression and ways of their diagnosis, including non-invasive ultrasound techniques, in pediatric patients with chronic HBV- and HCV-infection, as their modification may improve the influence for prognosis and clinical consequences. This article considers the changes of the main ultrasound parameters of the liver and spleen in pediatric patients with chronic HBV- and HCV-infection and ability to use US Grayscale (Y.Davoudi, 2015) for management of pediatric patients.

**Key works:** chronic viral hepatitis; children; ultrasound examination; fibrosis; liver.

## Introduction

Chronic viral hepatitis is one of the urgent medical and social problems of modern hepatology due to their high prevalence, ability to progress to liver cirrhosis and hepatocellular carcinoma, which often leads to form medical disability of the population, including children [7, 10].

Early diagnosis and assessment of the dynamics of progression of liver tissue transformation in children with chronic viral hepatitis C (CVHC) and chronic viral hepatitis B (CVHB) will allow timely initiation of therapy and will reduce the risk of complications [3, 4, 7, 8].

Today, the system of non-invasive laboratory and instrumental methods and techniques of examination is widely implemented in clinical practice in order to optimize the process of liver fibrogenesis monitoring and assess its morpho-functional state [1, 3, 5, 6, 9].

The «gold» standard for the diagnosis of liver fibrosis is puncture biopsy, but due to a number of significant shortcomings, the procedure is significantly limited in use in pediatric practice.

The most accessible method of instrumental examination of patients with CVHC and CVHB is the system of ultrasound techniques of liver examination, which is routinely used in daily practice. In addition, Yasmin Davoudi et al., had implemented the US Grayscale to assess the morphometric parameters of the abdominal organs in patients with CVHC and CVHB (Table 1) [2, 5].

Table 1. US Grayscale for assessing morphometric parameters of the liver and spleen in children (Y. Davoudi et. Al., 2015)

Points	The size of the liver	Echo pattern	Echogenicity	The surface of the liver	The size of the spleen	Wall thickness GB	d v.portae	d v.hepatica	d v.lienalis
0	≥150 mm	Homogeneous	Normal	Smooth	≤130mm	≤3mm	≤13mm	4-10 mm	≤10 mm
1	<150 mm	Heterogeneous	Slightly elevated	Rough	> 130mm	> 3mm	> 13mm	<4 or> 10 mm or not determined	> 10 mm
2			Moderately elevated						
3			Very high						

**Note:** d - diameter, GB - gall bladder.

It should be noted that using of this scale in pediatric practice is a new and promising method.

Summarizing all data above, we see that today it is important to assess the dynamics of changes in morphometric, hemodynamic, echoacoustic characteristics of the liver in pediatric patients with CVHB and CVHC, as possible predictors of liver fibrosis progression.

**The main aim:** to evaluate morphometric and hemodynamic parameters of the liver and spleen in children with chronic viral hepatitis B and C.

**Materials and methods:** In the course of the research we examined 14 patients with confirmed diagnoses of chronic viral hepatitis B and C, aged from 5 up to 17 years (mean –  $12,4 \pm 5,2$  years), which had formed the main group (group I), and 12 healthy children, aged from 6 up to 15 years (mean –  $10,8 \pm 3,9$  years), which had formed group II, in the period from October 2020 to September 2021. All patients with CVHB and CVHC were under dynamic observation on the basis of the communal nonprofit enterprise «Vinnytsia Regional Clinical Children's Infectious Diseases Hospital Vinnytsia Regional Council» and the Department of Pediatric Infectious Diseases of National Pirogov Memorial Medical University, Vinnytsya. The diagnoses of chronic viral hepatitis B and C were confirmed by qualitative and quantitative methods of PCR testing and ELISA with the determination of specific diagnostic markers. Patients underwent of collecting of anamnesis, general clinical examination, determination of the degree of liver fibrosis by non-invasive method (fibrotest or fibroelastometry) and ultrasound examination of the abdominal cavity organs with possibility of Doppler scanning. The analysis and evaluation of ultrasound protocols was performed with morphometric stratification according to Y. Davoudi scale (2015) US Grayscale, analysis of blood flow in v. portae, v. lienalis and a. hepatica also was performed. Examination of patients was performed on an ultrasound machine Samsung HM70A. Clinical anamnestic data and laboratory methods excluded other possible liver lesions in almost healthy children, including viral hepatitis B and C, drug-induced hepatitis, toxic hepatitis, metabolic diseases and hereditary hepatobiliary lesions. Data analysis was performed using the software package "Statistica 10.0" by using the methods of descriptive statistics for parametric quantities. Data were presented as mean (M) and mean error (m) for quantitative values. The reliability of the data difference was established using a paired Student's t-test. The difference was considered clinically significant at  $p < 0,05$ . The study was conducted in accordance with the principles and norms of the Declaration of Helsinki. All patients signed an informed consent form (ICF) to participate in the study.

**Results:** Among the examined patients of the first group – in 57,1% (n=8) patients were diagnosed CVHB and 42,9% (n=6) patients with diagnosed CVHC. In addition, among patients with diagnosed CVHB 3 patients received antiviral therapy with entacavir, and among patients with CVHC 3 patients received antiviral therapy (sofosbovir-ledipasvir) according to the approved clinical guidelines in Ukraine. It should be noted that in the group of patients with CVHB and CVHC 57,1% (n=8) patients had a F0 degree of liver fibrosis according Metavir diagnostic scale, 28,5% (n=4) - F0-1, 14,4% (n=2) - F1, which were confirmed by fibroelastometry or Fibrotest.

After analyzing the protocols of ultrasound examination of abdominal organs and evaluation of morphometry of the abdominal cavity organs according to the Davoudi scale (2015), it was found that in patients of group I the score was  $2,4 \pm 0,14$  points, and in children of group II –  $0,6 \pm 0,12$  points ( $p < 0,05$ ) (Table 2).

Table 2. Evaluation of abdominal organs morphometry using the Davoudi's scale (2015) ( $M \pm m$ ).

Morphometric assessment of abdominal organs in patients of group I, points	Morphometric assessment of abdominal organs in patients of group II, points
$2,4 \pm 0,14^*$	$0,6 \pm 0,12$

Note: \* - established clinically significant difference of the data using the paired Student's t-test with  $p < 0,05$ .

Regarding the analysis of blood flow velocity in v.portae, it was found that in patients of group I the indicators were  $15,7 \pm 0,68$  cm/s, and in group II –  $14,1 \pm 0,36$  cm/s ( $p < 0,05$ ). The blood flow velocity in v.lienalis in patients of group I was  $13,8 \pm 0,78$  cm/s, and in turn in patients of group II –  $11,2 \pm 0,72$  cm/s ( $p < 0,05$ ). The blood flow velocity in a.hepatica in patients of group I was  $18,1 \pm 0,77$  cm/s, and in patients of group II –  $15,9 \pm 0,72$  cm/s ( $p < 0,05$ ) (Table 3).

Table 3. Estimation of blood flow velocities in the vessels of the liver and spleen ( $M \pm m$ ).

Velocity of blood flow in blood vessels	Group I (n=14)	Group II (n=12)
Vq v.portae, cm/s	$15,7 \pm 0,68^*$	$14,1 \pm 0,36$
Vq v.lienalis, cm/s	$13,8 \pm 0,78^*$	$11,2 \pm 0,72$
Vq a.hepatica, cm/s	$18,1 \pm 0,77^*$	$15,9 \pm 0,72$

Note: \* - established clinically significant difference of the data using the paired Student's t-test with  $p < 0,05$ .

Echoacoustic changes of the liver by the type of increased of its echogenicity were detected in 78,5% (n=11) of patients of group I and 16,6% (n=2) of patients of group II, changes in the vascular component of the liver were observed in 64,2% (n=9) of children of group I and 25% (n=3) of patients of group II (Table 4).

Table 4. Evaluation of the echoacoustic pattern of the liver (according to the protocols of ultrasound examination of the abdominal cavity organs).

Echoacoustic pattern	Group I (n=14)	Group II (n=12)
Enhanced echogenicity of liver tissue	78,5% (n=11)	16,6% (n=2)
Change in the vascular component of the liver	64,2% (n=9)	25% (n=3)
Lymphadenopathy syndrome	7,1% (n=1)	-

### Conclusions:

1. There was no significant difference between morphometric, hemodynamic and echoacoustic characteristics between patients with CVHB and CVHC ( $p > 0,05$ ).
2. Morphometric parameters of the liver and spleen, taking into account the diagnostic scale Davoudi (2015), were significantly more determined in patients of group I ( $2,4 \pm 0,14$ ) than in pediatric patients of group II ( $0,6 \pm 0,12$ ) ( $p < 0,05$ ).
3. Blood flow velocities in v.portae, v.lienalis and a.hepatica were significantly higher in patients with CVHB and CVHC compared to healthy children ( $p < 0,05$ ).

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