



Sonographic Features of The Liver and Spleen in Newborn Children with Early Congenital Syphilis

TE Taranushenko* and NV Matyskina

Department of Pediatrics of Institute of Postgraduate Education, Krasnoyarsk State Medical University Named After Professor Voyno-Yasenetsky, Institute of Postgraduate Education for Pediatricians, Krasnoyarsk, Russia

***Corresponding Author:** TE Taranushenko, Department of Pediatrics of Institute of Postgraduate Education, Krasnoyarsk State Medical University Named After Professor Voyno-Yasenetsky, Institute of Postgraduate Education for Pediatricians, Krasnoyarsk, Russia.

Received: June 16, 2022

Published: July 04, 2022

© All rights are reserved by **TE Taranushenko and NV Matyskina.**

Abstract

The purpose of the study to analyze the indicators of sonographic examination of the liver and spleen with an assessment of portal hemodynamics in children born to women with syphilitic infection and to identify the most significant signs accompanying early congenital syphilis in the neonatal period.

The paper analyzes the data of a comprehensive examination of 397 newborns who were under observation from birth to 1 month of life, included in the studies with an indication of the fact, born to women with a documented history of syphilitic infection.

Based on the total sample, three groups of children were formed from birth to 28 days of life, taking into account Federal Clinical guidelines for the management of patients with syphilis (Moscow, 2015)

- Group 1: 114 newborns with early congenital syphilis (RVS) with symptoms
- Group 2: 117 patients with early congenital latent syphilis
- Group 3: 166 newborns with specific treponemal antibodies as a consequence of transplacental transfer.

In observation groups 1 and 2, a significant increase in the oblique vertical size of the right lobe was revealed - 74.3 ± 0.7 mm. ($p < 0.05$) and 73.9 ± 0.4 mm ($p < 0.05$), against 68.8 ± 0.3 mm in the control, as well as the thickness of the left lobe of the liver - 35.3 ± 0.4 mm. ($p < 0.05$) and 34.8 ± 0.6 mm. ($p < 0.05$), versus 31.4 ± 0.7 mm. in the control group. Along with this, in these groups, a higher indicator of the maximum blood flow rate in the portal vein was noted, which in these 1 and 2 groups was 0.26 ± 0.02 m/sec ($p < 0.05$) and 0.25 ± 0.02 m/sec ($p < 0.05$), respectively, against 0.20 ± 0.02 m/sec in the control. Along with sonographic signs, there was a significant prevalence of hyperbilirubinemia in groups 1 and 2 of newborns - 24.1% ($p < 0.001$) and 19.9%, respectively, against 9.0% in the control group (neonatal hepatitis was diagnosed in 11.4% of newborns with early congenital syphilis).

Ultrasound features of the liver and in early congenital syphilis should include an increase in size, structural changes in the liver (only with RVS with symptoms) and hemodynamic features characterized by increased blood flow due to an increase in the absolute value of linear velocities (maximum systolic and minimum diastolic) with a reduced resistance index.

Keywords: Early Congenital Syphilis; Newborn; Ultrasonographic Examination

Introduction

Liver damage in congenital syphilis in children of the first months of life is observed clinically in 74-86% in the form of an increase in size and compaction during palpation. Pathoanatomic studies reveal in 100% of cases typical changes in the liver, which are reduced to diffuse round-cell infiltration, proliferation of connective tissue and the formation of gum. One of the methods for detecting structural changes in the liver is ultrasound. Ultrasound assessment of the density and homogeneity of the liver parenchyma is one of the main components of the integral characteristics of this organ. This study makes it possible to detect violations of the portal - hepatic blood flow in a number of diseases, including congenital infections, omphalitis, umbilical vein periflebitis, hepatitis with periportal fibrosis and hepatic vein phlebitis, cholestasis. Changes in portal hemodynamics can begin to form both in the antenatal period and in the neonatal period [1-6].

Diagnosis of structural disorders of the liver and spleen in early congenital syphilis presents significant clinical difficulties, however, the use of modern screening diagnostic methods, including ultrasound with color Doppler mapping, allows timely detection of changes in these organs even in the absence of clinical manifestations of the disease. The data of scientific studies on the diagnostic significance of these techniques in RVS in newborns are very few and not unambiguous [7-12]. The studies of liver ultrasound in congenital syphilis presented in the literature do not allow us to draw conclusions in the echographic aspect about the final stage of the development of the pathological process with an intrauterine onset [13-16].

Thus, the paucity of data on the frequency, nature of the lesion and dynamics of sonographic changes of the liver and spleen in syphilitic infection in newborns determines the need to continue research on this problem.

The purpose of the study

To analyze the indicators of sonographic examination of the liver and spleen with an assessment of portal hemodynamics in children born to women with syphilitic infection and to identify the most significant signs accompanying early congenital syphilis in the neonatal period.

Materials and Methods

The paper analyzes the data of a comprehensive examination of 397 newborns who were under observation from birth to 1 month of life, included in the studies with an indication of the fact, born to women with a documented history of syphilitic infection.

The analysis of each case was carried out according to a single protocol, including the data of the mother's anamnesis, clinical manifestations in a newborn child, X-ray examination data and the results of serological reactions (RMP, ELISA (IgM and IgG) and RPGA). All children were examined by an oculist, an otorhinolaryngologist and a dermatovenerologist.

Based on the total sample, three groups of children were formed from birth to 28 days of life, taking into account Federal Clinical Guidelines for the management of patients with syphilis (Moscow, 2015) [17]

- Group 1: 114 newborns with early congenital syphilis (RVS) with symptoms
- Group 2: 117 patients with early congenital latent syphilis
- Group 3: 166 newborns with specific treponemal antibodies as a consequence of transplacental transfer.

Criteria for the formation of groups

- Indication in the anamnesis of documented confirmed syphilitic infection in the mother
- Clinical symptom complex characteristic of congenital syphilis
- Laboratory results confirming the diagnosis.

Early congenital syphilis was exposed in accordance with the International Statistical Classification of Diseases X revision (section A 50 "Congenital syphilis").

Diagnosis of early congenital latent syphilis was carried out on the basis of the Order of the Ministry of Health of the Russian Federation dated 30.07.2001 №. 291 "On measures to prevent the spread of sexually transmitted infections", Appendix 3 "Tactics of interaction of obstetricians - gynecologists, dermatovenerologists, neonatologists and pediatricians for the prevention and diagnosis of congenital syphilis" and Federal clinical guidelines for the management of patients with syphilis, Moscow, 2015.

Early congenital syphilis with symptoms was diagnosed on the basis of specific clinical signs corresponding to this disease, as well as taking into account positive serological reactions. 397 patients aged 3-7 days were transferred from maternity hospitals to the Department of pathology of newborn children. The reason for hospitalization is the need to clarify the diagnosis and resolve the issue of treatment. The control group included 150 children of the II health group in the early neonatal period (the first 7 days of life) from healthy mothers.

The clinical examination data included the identification of specific clinical symptoms of early congenital syphilis and concomitant conditions; X-ray examination of long tubular bones, ultrasound examination of the brain, liver and spleen, examination of the cerebrospinal fluid.

Complex ultrasound of the liver and spleen was performed using an ultrasound scanner "ACUCON 128hr/4" using a 5 MHz multi-frequency sensor and included

- Ultrasound examination in real time and In - mode according to a standard technique with an assessment of contours, sizes, echostructure of liver tissue, spleen with an assessment of anatomical features of vessels in this area (diameter, length).
- Color Doppler mapping (CDK), which is based on the coding of different colors of the directions and velocities of blood flow in two-dimensional visualization of vessels. The red color of the ultrasound image shows the direction of blood movement to the sensor; and blue - from the sensor; lighter shades of color characterize blood flow rates, and dark and saturated - low speeds. The complex of vessels of the port-hepatic region was studied: portal vein - trunk trunk; splenic vein in the pancreas; common hepatic and splenic arteries in the abdominal trunk. With color visualization of the vessels of the studied area, after receiving their image in a gray scale, indicators for venous vessels with a value of 15 m/sec were set on a color velocity scale. and below; for arterial - from 36 m/sec and above. If a detailed examination of the area of interest was necessary, the depth of the ultrasonic beam was reduced and the "Zoom" program was turned on, which allows you to enlarge the image of the area under study.

To obtain an ultrasound image of the portal vein along the entire length of the CDC, the sensor was positioned so that the scanning plane coincided as much as possible with the anatomical course of the examined vessel.

Visualization with measurement of the diameter of the splenic vein throughout its entire length was carried out from different approaches.

Transverse scanning in the epigastric region made it possible to determine the splenic vein in its horizontal and descending parts (in the projection of the tail and body of the pancreas) and at its confluence with the portal vein.

Visualization of the spleen gate was performed by oblique scanning along the mid-axillary line from the intercostal access in the position of the newborn on the right side.

The common hepatic and splenic arteries in CDK were visualized by transverse scanning in the epigastric region slightly to the left of the midline, in the projection of the pancreas over the splenic vein in the form of an ultrasound symptom of a "seagull". It is important to note that the measurement of the diameters of the studied vessels was carried out repeatedly, the average size was fixed.

- Pulse dopplerography of the above vessels was performed with a qualitative and quantitative assessment of blood flow parameters - the shape of the Doppler frequency shift curve, the maximum linear blood flow velocity (A, m/sec.), the minimum linear blood flow velocity (B, m/sec.), the average blood flow velocity (TAMX, m/sec.), peripheral resistance indices - resistant (RI) and pulsatory (PI). The results of the spectral analysis were displayed as a curve on a graphical spectral display.

Directly measurable blood flow indicators

- V max: Maximum systolic velocity
- V min: Minimum diastolic velocity
- V mean (TAMX): Average blood flow rate per cardiac cycle.

To obtain quantitative parameters of blood flow that do not depend on the slope of the sensor, the indices were determined:

- $Ri = (V_{max} - V_{min}) / V_{max}$ (Pourcelot, 1975)
- $Pi = (V_{max} - V_{min}) / V_{mean}$ (Gosling, 1974).

IBM SPSS Statistics 20 programs were used for statistical processing. The comparison of the indicators measured in the nominal scale was carried out using the Pearson criterion χ^2 , which allows us to assess the significance of differences between the actual (revealed as a result of the study) number of outcomes or qualitative characteristics of the sample falling into each category, and the

theoretical number that can be expected in the studied groups if the null hypothesis is valid. The calculated values of the criterion χ^2 were compared with the critical values for a given number of degrees of freedom. In the event that the obtained value of the criterion χ^2 exceeded the critical one, it was concluded that there was a statistical relationship between the studied risk factor and the outcome at the appropriate level of significance.

The Results of the Study and their Discussion

In the four groups of newborns considered above, the size and structure of the liver and spleen, as well as the state of the port-hepatic blood flow, were studied by ultrasound and CDC.

At the first stage of the study, the average sizes of the liver and spleen were studied (Table 1). The measurement of the three main liver sizes showed a significant increase in the oblique vertical size of the right lobe in groups 1 and 2 - 74.3 ± 0.7 mm. ($p < 0.05$) and 73.9 ± 0.4 mm ($p < 0.05$), against 68.8 ± 0.3 mm in the control and the thickness of the left lobe of the liver - 35.3 ± 0.4 mm. ($p < 0.05$) and 34.8 ± 0.6 mm. ($p < 0.05$), versus 31.4 ± 0.7 mm. in the control group. Indicators of the cranio-caudal size of the left lobe had no significant differences in the groups under consideration.

The cause of liver enlargement may be cellular infiltration caused by hepatitis, reaction of the reticuloendothelial system, cholestasis [18-20].

Groups of children	Number of examined n (abc)	Liver size M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)			Spleen dimensions M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)	
		Dimensions of the right lobe (mm)	Dimensions of the left lobe (mm)	Thickness of the left lobe (mm)	Length (mm)	Diameter (mm)
1 group	117 (100)	$74.3 \pm 0.7^*$ (64 - 78) 75 (66 - 76)	44.6 ± 0.5 (40 - 47) 45 (43 - 46)	$35.3 \pm 0.4^*$ (28 - 38) 35 (30 - 37)	$43.9 \pm 0.1^*$ (38 - 47) 44 (40 - 46)	$22.5 \pm 0.1^*$ (17 - 25) 23 (19 - 24)
2 group	114 (100)	$73.9 \pm 0.4^*$ (63 - 78) 73 (65 - 76)	43.1 ± 0.8 (39 - 47) 43 (41 - 45)	$34.8 \pm 0.6^*$ (28 - 39) 35 (30 - 37)	$44.1 \pm 0.4^*$ (38 - 47) 44 (40 - 46)	$22.2 \pm 0.3^*$ (18 - 25) 22 (20 - 24)
3 group	166 (100)	67.5 ± 0.8 (62 - 72) 68 (64 - 70)	44.4 ± 0.3 (40 - 48) 45 (42 - 47)	31.6 ± 0.5 (26 - 34) 32 (28 - 32)	41.6 ± 0.8 (34 - 44) 42 (37 - 43)	20.3 ± 0.4 (18 - 24) 21 (20 - 23)
4 group	150 (100)	68.8 ± 0.3 (61 - 72) 69 (64 - 70)	44.1 ± 0.4 (39 - 47) 44 (41 - 46)	31.4 ± 0.7 (26 - 35) 32 (28 - 34)	40.7 ± 0.6 (34 - 45) 41 (36 - 43)	19.7 ± 0.3 (18 - 24) 20 (19 - 22)

Table 1: The size of the liver and spleen according to ultrasound data in newborns in the study groups.

M $\pm$ m; (min - max), Me (Q₁-Q₃).

Note: * - reliability of differences in comparison with group IV ($p < 0.05$)

Notation: n - the number of surveyed groups

M - average value; m - standard error of the average value; min - minimum value; max - maximum value

Me - median; Q₁-Q₃ - lower and upper quartile.

The size of the spleen was also significantly increased in newborns in groups 1 and 2 - a length of 43.9 ± 0.1 mm. ($p < 0.05$) and 44.1 ± 0.4 mm ($p < 0.05$), respectively, against 40.7 ± 0.6 mm. in the control; the diameter is 22.5 ± 0.1 mm. ($p < 0.05$) and 22.2 ± 0.3 mm. ($p < 0.05$), respectively, against 19.7 ± 0.3 mm. in control. There were no data for hypersplenism. The combination of liver and spleen lesions is explained by the close connection of these organs, the commonality of their innervation and lymph flow pathways [21-24]. The echostructure of liver tissue was characterized by the presence of changes in the parenchymal homogeneous type, in which an echographic picture of liver homogeneity with mod-

erately reduced echogenicity was noted. Diffuse heterogeneous structural changes of the liver were detected in 20% of cases in children with early congenital syphilis with symptoms. At the second stage of the study, the data of pulse Dopplerography revealed no significant differences in the diameter of the portal vein in newborns of the examined groups (Table 2). The maximum blood flow velocity in the portal vein was significantly higher in groups 1 and 2 and was 0.26 ± 0.02 m/sec ($p < 0.05$) and 0.25 ± 0.02 m/sec ($p < 0.05$), respectively, versus 0.20 ± 0.02 m/sec in the control. An increase in blood flow may be a reflection of the compensatory organism of increased blood supply in the pathological process [2-3,18-20].

Groups of children	Number of examined n (abc)	Portal vein M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)		Splenic vein M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)	
		Diameter (mm)	V max (m\sec)	Diameter (mm)	V max (m\sec)
1 group	117 (100)	$3,9 \pm 0,2$ (3,3 - 4,3) 3,9 (3,7 - 4,1)	$0,26 \pm 0,02^*$ (0,16 - 0,29) 0,26 (0,19 - 0,28)	$2,2 \pm 0,05$ (2,1 - 2,4) 2,2 (2,1 - 2,3)	$0,20 \pm 0,01$ (0,16 - 0,23) 0,20 (0,18 - 0,22)
2 group	114 (100)	$3,8 \pm 0,3$ (3,1 - 4,3) 3,8 (3,4 - 4,1)	$0,25 \pm 0,02^*$ (0,17 - 0,29) 0,25 (0,19 - 0,28)	$2,1 \pm 0,03$ (2,0 - 2,4) 2,1 (2,0 - 2,3)	$0,19 \pm 0,02$ (0,15 - 0,22) 0,19 (0,17 - 0,21)
3 group	166 (100)	$3,9 \pm 0,2$ (3,4 - 4,4) 3,9 (3,6 - 4,2)	$0,22 \pm 0,03$ (0,16 - 0,26) 0,22 (0,18 - 0,24)	$2,2 \pm 0,5$ (2,1 - 2,4) 2,2 (2,1 - 2,3)	$0,21 \pm 0,04$ (0,16 - 0,23) 0,21 (0,18 - 0,22)
4 group	150 (100)	$4,0 \pm 0,2$ (3,5 - 4,3) 4,0 (3,7 - 4,2)	$0,20 \pm 0,02$ (0,16 - 0,24) 0,20 (0,18 - 0,22)	$2,1 \pm 0,04$ (2,0 - 2,4) 2,1 (2,0 - 2,3)	$0,19 \pm 0,01$ (0,15 - 0,22) 0,19 (0,17 - 0,21)

Table 2: Indicators of blood flow in the portal and splenic veins according to ultrasound data in newborns in the study groups.

M $\pm$ m; (min - max), Me (Q₁-Q₃)

Note: * - reliability of differences in comparison with group IV ($p < 0.05$)

Notation: n - the number of surveyed groups

M - average value; m - standard error of the average value; min - minimum value; max - maximum value

Me - median; Q₁-Q₃ - lower and upper quartile.

There were no significant changes in the diameter and maximum linear velocity of the blood flow of the splenic vein in the examined groups.

The maximum blood flow rate in the common hepatic artery significantly increased in children with RVS in groups 1 and 2 - 0.73 ± 0.02 m/sec h 0.72 ± 0.02 m/sec ($p < 0.05$), respectively, against 0.66 ± 0.02 m/sec in the control, which can be explained by in-

creased blood supply to altered areas and liver stroma (Table 3). An increase in diastolic velocity was also observed only in groups 1 and 2 - 0.23 ± 0.02 m/sec ($p < 0.05$) and 0.22 ± 0.01 m/sec ($p < 0.05$), respectively, versus 0.18 ± 0.03 m/sec. in control. A statistically significant increase in the average linear blood flow in groups 1 and 2 - 0.38 ± 0.02 m/sec ($p < 0.05$) and 0.39 ± 0.03 m/sec ($p < 0.05$), respectively, and 0.34 ± 0.03 in the control group confirms an increase in arterial blood flow.

Groups of children	Number of examined n (abc)	V max m\Sec M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)	V min m\Sec M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)	TAMX m\ Sec M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)	Ri M $\pm$ m; (Min - max) Me (Q ₁ -Q ₃)	Pi M $\pm$ m; (Min - max) Me (Q ₁ -Q ₃)	V max\ V min M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)
1 group	117 (100)	$0.73 \pm 0.02^*$ (0,66 - 0,77) 0,73 (0,69 - 0,75)	$0.23 \pm 0.02^*$ (0,18 - 0,26) 0,23 (0,20 - 0,25)	$0.38 \pm 0.02^*$ (0,34 - 0,41) 0,38 (0,36 - 0,40)	$0.71 \pm 0.02^*$ (0,67 - 0,74) 0,71 (0,69 - 0,73)	$1.33 \pm 0.02^*$ (1,26 - 1,37) 1,33 (1,28 - 1,36)	$3.48 \pm 0.1^*$ (3,43 - 3,61) 3,48 (3,44 - 3,53)
2 group	114 (100)	$0.72 \pm 0.02^*$ (0,65 - 0,76) 0,72 (0,67 - 0,74)	$0.22 \pm 0.01^*$ (0,18 - 0,26) 0,22 (0,20 - 0,25)	$0.39 \pm 0.03^*$ (0,34 - 0,42) 0,39 (0,36 - 0,41)	$0.69 \pm 0.03^*$ (0,66 - 0,74) 0,69 (0,67 - 0,72)	$1.28 \pm 0.04^*$ (1,25 - 1,36) 1,28 (1,26 - 1,34)	$3.37 \pm 0.3^*$ (3,32 - 3,54) 3,37 (3,34 - 3,48)
3 group	166 (100)	0.68 ± 0.03 (0,64 - 0,75) 0,68 (0,66 - 0,74)	0.18 ± 0.02 (0,16 - 0,24) 0,18 (0,19 - 0,22)	0.35 ± 0.03 (0,31 - 0,38) 0,35 (0,33 - 0,37)	0.74 ± 0.02 (0,69 - 0,77) 0,74 (0,71 - 0,76)	1.45 ± 0.03 (1,31 - 1,48) 1,44 (1,34 - 1,46)	3.8 ± 0.4 (3,64 - 3,98) 3,8 (3,68 - 3,94)
4 group	150 (100)	0.66 ± 0.02 (0,64 - 0,74) 0,67 (0,65 - 0,71)	0.18 ± 0.03 (0,15 - 0,24) 0,18 (0,19 - 0,22)	0.34 ± 0.03 (0,31 - 0,39) 0,34 (0,32 - 0,37)	0.75 ± 0.03 (0,69 - 0,78) 0,75 (0,71 - 0,77)	1.44 ± 0.05 (1,36 - 1,48) 1,44 (1,38 - 1,46)	4.1 ± 0.2 (3,74 - 4,21) 4,1 (3,80 - 4,18)

Table 3: Indicators of blood flow in the common hepatic artery according to ultrasound data in newborns in the study groups.

M $\pm$ m; (min - max) Me (Q₁-Q₃)

Note: * - reliability of differences in comparison with group IV ($p < 0.05$)

Notation: n - the number of surveyed groups

M - average value; m - standard error of the average value; min - minimum value; max - maximum value

Me - median; Q₁-Q₃ - lower and upper quartile.

These changes may be associated with a reflex mechanism of increased blood flow and characterize relative arterial hyperemia, which is consistent with the features of hemodynamics of the hepatic artery.

The pulsator index in newborns of groups 1 and 2 significantly decreased (1.33 ± 0.02 and 1.28 ± 0.04) and the resistance index

(0.71 ± 0.02 and 0.69 ± 0.03), versus 1.44 ± 0.05 and 0.75 ± 0.01 , due to acceleration due to an increase in diastolic velocity. The maximum systolic, minimum diastolic and average blood flow velocity, as well as the systolic-diastolic ratio, resistance and pulsator indices in the splenic artery had no significant differences in the examined groups (Table 4).

Groups of children	Number of examined n (abc)	V max m\Sec M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)	V min m\Sec M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)	TAMX m\Sec M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)	Ri M $\pm$ m; (Min - max) Me (Q ₁ -Q ₃)	Pi M $\pm$ m; (Min - max) Me (Q ₁ -Q ₃)	V max\ V min M $\pm$ m; (min - max) Me (Q ₁ -Q ₃)
1 group	117 (100)	0.72 ± 0.03 (0,64 - 0,75) 0,73 (0,66 - 0,74)	0.20 ± 0.04 (0,16 - 0,24) 0,20 (0,18 - 0,22)	0.41 ± 0.02 (0,36 - 0,44) 0,41 (0,38 - 0,43)	0.72 ± 0.02 (0,66 - 0,75) 0,72 (0,69 - 0,74)	1.24 ± 0.03 (1,21 - 1,31) 1,25 (1,23 - 1,29)	3.42 ± 0.3 (3,26 - 3,57) 3,42 (3,30 - 3,53)
2 group	114 (100)	0.73 ± 0.02 (0,65 - 0,76) 0,72 (0,68 - 0,74)	0.21 ± 0.02 (0,16 - 0,24) 0,20 (0,18 - 0,22)	0.41 ± 0.03 (0,36 - 0,45) 0,41 (0,38 - 0,43)	0.71 ± 0.03 (0,66 - 0,74) 0,71 (0,68 - 0,73)	1.23 ± 0.04 (1,20 - 1,27) 1,23 (1,22 - 1,26)	3.26 ± 0.3 (3,16 - 3,54) 3,27 (3,21 - 3,48)
3 group	166 (100)	0.70 ± 0.03 (0,64 - 0,74) 0,71 (0,66 - 0,73)	0.22 ± 0.03 (0,17 - 0,24) 0,22 (0,19 - 0,23)	0.42 ± 0.02 (0,37 - 0,45) 0,42 (0,39 - 0,44)	0.69 ± 0.03 (0,66 - 0,75) 0,70 (0,68 - 0,74)	1.22 ± 0.03 (1,18 - 1,26) 1,22 (1,20 - 1,25)	3.32 ± 0.4 (3,19 - 3,49) 3,33 (3,24 - 3,44)
4 group	150 (100)	0.73 ± 0.02 (0,66 - 0,75) 0,73 (0,68 - 0,74)	0.22 ± 0.03 (0,16 - 0,25) 0,22 (0,19 - 0,24)	0.43 ± 0.02 (0,38 - 0,46) 0,43 (0,39 - 0,45)	0.69 ± 0.02 (0,66 - 0,75) 0,69 (0,71 - 0,73)	1.23 ± 0.02 (1,19 - 1,27) 1,23 (1,21 - 1,26)	3.36 ± 0.2 (3,24 - 3,51) 3,36 (3,28 - 3,47)

Table 4: Indicators of blood flow in the splenic artery according to ultrasound examination in newborns in the study groups.

M $\pm$ m; (min - max) Me (Q₁-Q₃)

Note: * - reliability of differences in comparison with group IV ($p < 0.05$)

Notation: n - the number of surveyed groups

M - average value; m - standard error of the average value; min - minimum value; max - maximum value

Me - median; Q₁-Q₃ - lower and upper quartile.

Along with sonographic signs, the frequency of detection of jaundice syndrome in the newborn period was analyzed. A significant prevalence of this syndrome was found in groups 1 and 2 of newborns - 24.1% ($p < 0.001$) and 19.9%, respectively, against 9.0% in the control group. The average value of the maximum rise in total bilirubin on the third day of life was 298.6 ± 12.4 mmol/l

($p < 0.01$) in group 1 and significantly exceeded the control - 179.8 ± 9.6 mmol/l. Hepatitis, which was accompanied by jaundice and hepatolienal syndromes, was diagnosed in 11.4% of newborns (the maximum concentration of total bilirubin in hepatitis ranged from 296.8 to 416.8 mmol/l with a predominance of the direct fraction).

Conclusion

Thus, the performed study allows us to attribute to the sonographic features of the liver and spleen in early congenital syphilis an increase in the size of these organs, structural changes in the liver (with RVS with symptoms) and hemodynamic features characterized by increased blood flow due to an increase in the absolute value of linear velocities (maximum systolic and minimum diastolic) with a reduced resistance index.

Funding Source

The authors of this article confirmed absence of financial support of this research to declare.

Conflict of Interest Statement

All the authors do not have any possible conflicts of interest.

Bibliography

1. Mitkov VV. "Practical guide to ultrasound diagnostics". *General Ultrasound Diagnostics*. M.: Vidar (2019): 756
2. Kholin AV. "Dopplerography and duplex scanning of vessels". M.: MEDpress-inform (2019): 96
3. Nemati M., *et al.* "Normal Values of Spleen Length and Volume: An Ultrasonographic Study in Children". *Ultrasound in Medicine and Biology* 42.8 (2016): 1771-1778.
4. Sukhov MN. "Extrahepatic portal hypertension in children". Complicated course and concomitant diseases. M.: BINOM-Press (2019): 240
5. Perepelitsa SA., *et al.* "Early ultrasound signs of splenomegaly in newborns". *General Resuscitation* 15.4 (2019): 58-66.
6. Moreira M., *et al.* "Fetal Splenomegaly: A Review". *Ultrasound Quarterly* 34.1 (2018): 32-33.
7. Back SJ., *et al.* "Ultrasound of congenital and inherited disorders of the pediatric hepatobiliary system, pancreas and spleen". *Pediatric Radiology* 47.9 (2017): 1069-1078.
8. Ivleva SA., *et al.* "Modern noninvasive methods of diagnosis of liver fibrosis in children". *Russian Pediatric Journal* 20.5 (2017): 300-306.
9. Matyskina NV., *et al.* "Ultrasound characteristics of the liver in early congenital syphilis in children". *Medical Council* 10 (2020): 172-178.
10. Ven Well GTJ., *et al.* "Human perinatal immunity in physiological conditions and during infection". *Molecular and Cellular Pediatrics* 4.1 (2017): 4.
11. Xiao T., *et al.* "The analysis of etiology and risk factors for 192 cases of neonatal sepsis". *BioMed Research International* (2017): 8617076.
12. Federal clinical guidelines for the management of patients with syphilis. Moscow (2015): 45.
13. Matyskina NV and Taranushenko TE. "Clinical and laboratory manifestations of the infectious process in children with early congenital syphilis". *Mother and child in Kuzbass* 1 (2015): 25-29.
14. Matyskina NV., *et al.* "Early congenital syphilis: clinical and laboratory features in the neonatal period". *Childhood Infections* 14.1 (2015): 43-46.
15. Rotbain EC., *et al.* "Splenomegaly - Diagnostic validity, work-up, and underlying causes". *PLoS One* 12.11 (2017): e0186674.
16. Pelizzo G., *et al.* "Spleen size evaluation in children: Time to define splenomegaly for pediatric surgeons and pediatricians". *PLoS One* 13.8 (2018): e0202741.