Introduction

The liver biopsy is a gold standard for diagnosing liver steatosis in children and adults. However, in 2012, the European Society for Pediatric Gastroenterology, Hepatology and Nutrition proclaimed that liver biopsy should not be used as a screening procedure for children with nonalcoholic fatty liver disease. Indications for liver biopsy is still being discussed, and now there is no enough evidence to formulate a list of indications for this procedure in children with the primary diagnosis of nonalcoholic fatty liver disease (NAFLD), biopsy indication is stronger in the case of difficulties in carrying out differential diagnosis and in case of risk of progression to liver cirrhosis [1].

Non-invasive methods for diagnosing liver steatosis in children are important because they can be used to monitor the course of the disease for a long period [2]. Non-invasive methods for diagnosing liver steatosis and fibrosis in children.
ultrasound methods for diagnosing steatosis include standard ultrasound examination, sonographic quantification of a hepatorenal index, transient elastography, shear wave elastography.

**Ultrasound.** Ultrasound is the most common imaging method used to diagnose liver steatosis. Due to its wide availability, economic feasibility and simplicity of usage, ultrasound can be used as a liver pathology screening tool. A healthy liver parenchyma has a homogeneous echo texture and echogenicity similar to the echogenicity of the right kidney. In the case of liver steatosis, the presence of lipid drops within hepatocytes violates the propagation of the sound wave, causing the scattering and attenuation of ultrasound waves. The dispersion of ultrasound waves is manifested in the form of a more vivid visualization of liver parenchyma compared with the kidneys. The attenuation of ultrasound waves also causes loss of signal, which leads to darkening of vessels and bile ducts and blurred diaphragm [2]. Distal attenuation of ultrasound is usually typical for steatosis in the liver with lesions > 30 % of hepatocytes [1].

Classification of the degree of liver steatosis according to ultrasound data:
1. Absence of steatosis (echogenicity of the liver is similar to the kidney);
2. Slight degree of steatosis (diffusely increased echogenicity of the liver);
3. Moderate degree of steatosis (echogenicity of the liver reduces imaging of the walls of vessels and diaphragm);
4. Severe degree of steatosis (no imaging of the hepatic vessels and diaphragm) [3].

However, ultrasound study has some disadvantages: operator and machine dependence, as well as the lack of objective quantitative analysis [1]. Ultrasound has low sensitivity for the differentiation between healthy liver and early steatosis and other pathological conditions such as fibrosis and/or inflammation, which may increase the echogenicity of the liver, sometimes can mimic liver steatosis. Therefore, an ultrasound evaluation of liver steatosis should be performed taking into account these constraints; the results should be carefully interpreted and this procedure should not be recommended as the only tool for diagnosing or monitoring NAFLD in children.

**Hepatorenal index (HI).** To calculate this indicator, the echogenicity of the liver and kidneys is evaluated in the study of the gray scale (value 0–255) using the built-in histogram. It is used with the average value of three repetitive measurements based on the ratio of the average echogenicity of the liver to the echogenicity of the kidney. A value below 1.0 is considered to be normal. The degree of steatosis is considered to be mild (HI 1.05–1.24), moderate (HI 1.25–1.64) or severe (HI ≥ 1.65). One of the disadvantages of using HI is its variability and dependence on the operator and ultrasound apparatus [4].

**Assessment of ultrasound attenuation.** Quantitative estimation of the echo signal intensity can be used to objecti vize the diagnosis of steatosis. There are methods for evaluating the parameters of the images in B-mode or analysis of the signal backscatter ultrasound waves [5]. Several studies have found an increase in liver attenuation coefficients and backscattering designed by ultrasound in patients compared with healthy persons [6]. However, most studies have been focused on differentiation of pathological and altered liver and did not estimate the severity of the NAFLD.

The attenuation coefficient represents the summation of ultrasound energy losses due to the echo reflection, scattering, and absorption. Studies showed that scattering has only a very small contribution to the attenuation coefficient in normal liver, but the dispersion of fat drops significantly affects the attenuation of US. In addition, studies of Kanayama et al. have shown that the number of lipid drops and their size in the liver tissues can greatly contribute to energy absorption in the spread of ultrasound [6].

**Elastography.** Ultrasound elastography is now increasingly used in the diagnosing diffuse liver disease. This method provides the possibility of differentiation between simple steatosis and nonalcoholic steatohepatitis that has signs of inflammation and fibrosis [2]. There are several methods for ultrasound elastography, including transient elastography, shear wave elastography (SWE) and acoustic radiation force impulse elastography (ARFI).

**Transient elastography.** Transient elastography (FibroScan 502 Touch) is a new non-invasive method for diagnosing fibrosis and most recently, due to the equipment of the apparatus with a new function, for the diagnosing steatosis as well [7]. Measuring the degree of steatosis is based on lipids ability to impact the spread of ultrasound. The calculation of the indicator characterizing steatosis degree — the controlled attenuation parameter (CAP) — is due to the complicated process of ultrasound attenuation with its reverse propagation at an average frequency of 3.5 MHz [8]. CAP is an effective parameter for the determination of even low degree of steatosis. The study of V. de Ledinghen et al. showed that CAP significantly correlated with SteatoTest and the fat content of the liver, which was determined from the morphological study [9]. A 2014 meta-analysis by the Chinese scientists for the diagnostic accuracy of CAP to determine the degree of liver steatosis in various diseases has revealed that CAP has high sensitivity and specificity for determining the presence of liver steatosis, but is limited to precisely determining the degree of steatohepatitis that somewhat limits its wide application in clinical practice [10]. A recent study conducted in a small cohort of children who had a liver biopsy according to clinical indications identified a limit of 225 dB/m for predicting steatosis, 0.87 sensitivity, 0.83 specificity and AUROC 0.93 [11].

Therefore, transient elastography with FibroScan is a sufficiently sensitive method for non-invasive diagnosis of steatosis, which can be used for primary diagnosis and monitoring of the effectiveness of treatment in children.

**Shear wave elastography.** The basis of SWE lies in the property of the ultrasound to excite the mechanical shear wave transverse to its direction. The velocity of propagation of these waves depends on tissue rigidity or viscoelastic properties [12]. The real-time SWE has some advantages over TE. First, this function is integrated in the usual ultrasound apparatus, and therefore, can use the real-time image in the B-mode to assess morphological changes or to detect of focal lesions of the liver. Advantage of SWE, as well as
ARFI, is to provide a quantitative map of liver tissue stiffness in real time. The spatial heterogeneity of the liver stiffness can be visualized, and the area of interest used for measurement can be corrected. The area of interest for liver stiffness measurements can be adjusted in size and location to avoid such artifacts as those occurring near large pulsating vessels [13].

The purpose of our work is to compare the possibilities of diagnosing steatosis and liver fibrosis by using standard ultrasound study, SWE with steatometry and transient elastography using the CAP function.

Materials and methods

The survey included 90 patients aged 5 to 17 years: boys — 54 (60 %), girls — 36 (40 %). The average age of patients was (12.08 ± 2.71) years. The assessment of BMI was carried out according to the WHO recommendations (gender and age specific) [14].

Determination of the presence and degree of liver steatosis was carried out with FibroScan 502 Touch (Echosens, France) with CAP measurement (Table 1) [15]. An M-sensor with an ultrasonic frequency of 3.5 MHz was used. Also we determined the changes in elasticity or stiffness of the liver (LSM) which indicates the development of fibrosis, and the CAP, which corresponds to steatosis degree. The liver stiffness was evaluated in kilopascals (kPa), viscosity or steatosis — in decibels per meter (dB/m).

The obtained parameters of liver stiffness were evaluated as follows: elastometric parameters up to 5.9 kPa corresponded to the stage of fibrosis F0; 6–7.0 kPa corresponded to the stage of fibrosis F1, from 7.1 to 8.7 kPa — stage F2, over 8.7 kPa — F3 on Metavir score [16].

Also ultrasound examination of the liver parenchyma by the B-method with simultaneous shear wave elastography and steatometry on the Ultima Expert (Radmir, Kharkiv) with a cone-shaped sensor at frequencies of 2–5 MHz at a depth of 10–50 mm from the capsule was performed. The number of successful measurements should have been at least 3. Then, from the indicated measurements, the median characterizing the liver stiffness in kilopascals as well as the average coefficient of ultrasound attenuation (UAC) (dB/m) were determined.

Depending on steatosis presence, determined on the basis of CAP, and presence of overweight and obesity the patients were divided into 3 groups: the 1st group consisted of 45 patients with liver steatosis and overweight/obesity (50.0 %), the 2nd group included 35 patients with excessive weight and obesity without steatosis (38.9 %), the 3rd group (control group) consisted of 10 patients with normal weight without steatosis (11.1 %). The exclusion criteria were the presence of secondary causes of steatosis (viral, autoimmune hepatitis, storage diseases) and concomitant chronic or acute diseases.

Results

Standard ultrasound data

Average values of the size of the liver and gallbladder are given in Table 2.

The largest liver size was observed in the 1st group of patients (p < 0.01). A detailed analysis of these parameters, depending on the growth of a child, also showed that almost all (88.9 %) of the children in the 1st group experienced an increased size of the liver due to all the lobes.

The echogenicity of the liver was increased in 3/4 of the patients with overweight/obesity (73.7 % in the 1st group patients and 61.1 % in the 2nd group). For the analysis of structural changes in the liver, the following characteristics of the parenchyma were assessed: granularity, echogenicity, and distal attenuation of ultrasound. Specific for patients with steatosis was granular structure of the liver, which was observed in 36 patients (80.0 %).

In children of the 1st group the changed structure of the liver parenchyma was detected 2.2 times more frequently than in the 2nd and 3rd groups (37.1 and 30.0 %, respectively) (Fig. 1). In the majority of the 1st group patients elevated and uneven liver echogenicity was observed (75.6 and 71.1 %, respectively). Distal ultrasound attenuation was detected 2 times more frequently in this group than in the 2nd group children.

Table 1 — CAP parameters to determine the presence and degree of steatosis [15]

<table>
<thead>
<tr>
<th>CAP indicator</th>
<th>Degree of steatosis</th>
<th>The percentage of hepatocytes with fat inclusions according to morphometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 232 dB/m</td>
<td>$S_0$</td>
<td>Less than 10 %</td>
</tr>
<tr>
<td>233–255 dB/m</td>
<td>$S_1$</td>
<td>11–33 %</td>
</tr>
<tr>
<td>256–289 dB/m</td>
<td>$S_2$</td>
<td>34–66 %</td>
</tr>
<tr>
<td>Above 290 dB/m</td>
<td>$S_3$</td>
<td>67–100 %</td>
</tr>
</tbody>
</table>

Table 2 — Results of ultrasound measurements of the liver and gallbladder volume in the studied groups, $M \pm m$

<table>
<thead>
<tr>
<th>Indicator</th>
<th>General group (n = 90)</th>
<th>Group 1 (n = 45)</th>
<th>Group 2 (n = 35)</th>
<th>Group 3 (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver right lobe, mm</td>
<td>127.49 ± 1.77</td>
<td>133.38 ± 2.39**</td>
<td>122.57 ± 2.88</td>
<td>118.20 ± 2.77</td>
</tr>
<tr>
<td>Liver left lobe, mm</td>
<td>58.62 ± 1.01</td>
<td>61.64 ± 1.69*</td>
<td>56.03 ± 1.00</td>
<td>54.10 ± 2.22</td>
</tr>
<tr>
<td>Gallbladder volume, mm$^3$</td>
<td>27.08 ± 0.80</td>
<td>29.71 ± 1.25*</td>
<td>25.66 ± 0.93</td>
<td>20.20 ± 1.56</td>
</tr>
</tbody>
</table>

Notes: * — $p < 0.05$ — significance of differences between indicators in children of the 1st and 3rd groups; ** — $p < 0.01$ — the significance of the differences between indicators in children of the 1st and 2nd groups.
It should be noted that in children with steatosis imaging of the hepatic veins significantly worsened: in the 1st group children hepatic veins imaging deterioration was observed 2 times more often than in the 2nd group.

**Data of transient elastography**

The parameters of liver parenchyma stiffness and CAP in children with obesity and overweight according to transient elastography data are given in Table 3.

The liver stiffness in the examined patients varied from 2.3 to 8.8 kPa, and the CAP index — from 108 to 349 dB/m. In the overwhelming majority (96.1%) of patients, fibrosis was absent; the first and second degree of fibrosis was registered only in 3 patients (3.9%) in the 1st group.

As can be seen from the data in Table 3, liver stiffness rates, although not exceeding the norm, were significantly increased in children with steatosis.

Among the patients with steatosis 45.2% had the first stage (up to 33% of hepatocytes contained fat) and 16.7% had the third stage of fatty degeneration — almost all hepatocytes had fat inclusion (Fig. 2).

**Data of shear wave elastography and steatometry**

Taking into account liver structural changes, SWE of the liver was performed to evaluate the stiffness of the parenchyma in the examined children. The average values of liver stiffness are given in Table 4.

When comparing liver parenchyma stiffness in groups, a significant increase in this parameter in obese children was established in comparison with the control group. In children with steatosis, higher stiffness rates (although not exceeding normal) were observed compared to children with simple obesity without fatty liver (p < 0.05).

According to liver steatometry findings, the average coefficient of ultrasound attenuation in the 1st group children was significantly higher compared to the control group (Table 5).

**Comparison of SWE and TE data**

When comparing SWE with TE (FibroScan) according to contingency table (Table 6) a match in fibrosis detection in 47 of the 76 surveyed (presence of fibrosis in 5 children out of 6 children and lack in 42 patients out of 70) was found, which corresponds to 61.8% diagnostic efficiency.
SWE sensitivity for liver fibrosis detection compared with transient elastography was 83.33 %, specificity — 60.0 %, positive predictive value — 15.15 %, negative predictive value — 97.67 % (Table 7).

When comparing the steatometry findings and CAP in the diagnosis of liver steatosis in children the coincidence was found in 15 out of 26 cases (steatosis in 14 out of 23 and steatosis absence in 1 patient out of 3), which corresponds to 57.7% diagnostic efficacy (Table 8).

**Table 5 — Average coefficient of ultrasound attenuation of liver in studied groups, M ± m**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>General group (n = 57)</th>
<th>Group 1 (n = 26)</th>
<th>Group 2 (n = 21)</th>
<th>Group 3 (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAC, dB/m</td>
<td>1.98 ± 0.03</td>
<td>2.06 ± 0.05*</td>
<td>1.98 ± 0.05**</td>
<td>1.75 ± 0.04</td>
</tr>
</tbody>
</table>

Notes: * — p < 0.05 — significance of differences between the 1st and 3rd groups; ** — p < 0.05 — significance of differences between the 2nd and 3rd groups.

**Table 6 — The contingency table of TE and SWE for the liver fibrosis detection**

<table>
<thead>
<tr>
<th>FibroScan</th>
<th>Elastography</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fibrosis</td>
<td>Absence of fibrosis</td>
</tr>
<tr>
<td>Fibrosis (n = 6)</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Absence of fibrosis (n = 70)</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>43</td>
</tr>
</tbody>
</table>

**Table 7 — SWE sensitivity, specificity and predictive values for the liver fibrosis detection**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity, %</td>
<td>83.33</td>
<td>35.88 to 99.58</td>
</tr>
<tr>
<td>Specificity, %</td>
<td>60.00</td>
<td>47.59 to 71.53</td>
</tr>
<tr>
<td>Positive coefficient of likelihood</td>
<td>2.08</td>
<td>1.32 to 3.30</td>
</tr>
<tr>
<td>Negative coefficient of likelihood</td>
<td>0.28</td>
<td>0.05 to 1.68</td>
</tr>
<tr>
<td>Prevalence of the disease, %</td>
<td>7.89</td>
<td>2.95 to 16.40</td>
</tr>
<tr>
<td>Positive predictive value, %</td>
<td>15.15</td>
<td>5.11 to 31.90</td>
</tr>
<tr>
<td>Negative predictive value, %</td>
<td>97.67</td>
<td>87.71 to 99.94</td>
</tr>
</tbody>
</table>

**Table 8 — The contingency table of TE and SWE for the liver steatosis detection**

<table>
<thead>
<tr>
<th>FibroScan</th>
<th>Steatometry</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steatosis</td>
<td>Absence of steatosis</td>
</tr>
<tr>
<td>Steatosis (n = 23)</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Absence of steatosis (n = 3)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>10</td>
</tr>
</tbody>
</table>

**Table 9 — SWE sensitivity, specificity and predictive values for the liver steatosis detection**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity, %</td>
<td>60.87</td>
<td>38.54 to 80.29</td>
</tr>
<tr>
<td>Specificity, %</td>
<td>33.33</td>
<td>0.84 to 90.57</td>
</tr>
<tr>
<td>Positive coefficient of likelihood</td>
<td>0.91</td>
<td>0.38 to 2.17</td>
</tr>
<tr>
<td>Negative coefficient of likelihood</td>
<td>1.17</td>
<td>0.22 to 6.30</td>
</tr>
<tr>
<td>Prevalence of the disease, %</td>
<td>88.46</td>
<td>69.85 to 97.55</td>
</tr>
<tr>
<td>Positive predictive value, %</td>
<td>87.50</td>
<td>61.65 to 98.45</td>
</tr>
<tr>
<td>Negative predictive value, %</td>
<td>10.00</td>
<td>0.25 to 44.50</td>
</tr>
</tbody>
</table>

The steatometry sensitivity for liver steatosis detection was 60.87 %, the specificity was 33.33 %, the positive predictive value was 87.50 %, and the negative predictive value was 10.00 % (Table 9).

**Discussion**

Thus, the sonographic signs of fatty liver in obese/overweight children were a significant elevation in the liver size, which was accompanied by increasing the liver parenchy-
ma echogenicity in 75.6 % (p < 0.05) of cases, changes in the liver granularity (80.0 %), by increasing the length of the spleen. The liver size increasing and liver parenchyma structure alteration (changes in contours and granularity, increased echogenicity) were also found more frequently in patients with fatty liver.

The liver steatosis according to TE was detected in 22 children (44.4 %) with no evidence of steatosis in standard ultrasound study. These data indicate that CAP can diagnose early stages of liver steatosis.

It should be noted that the use of TE has some limitations. Thus, the presence of ascites excludes the possibility to carry out transient elastography, i.e. elastic waves are not able to pass through the liquid; the presence of morbid obesity with BMI > 30 kg/m² requires the use of XL sensor, the use of M sensor in such patients is associated with high variability of values and the impossibility of obtaining an average CAP. LSM is also limited by a number of factors: The presence of acute hepatitis is accompanied by changes in liver parenchyma, which can lead to an increase in LSM levels; the presence of chronic hepatitis with ALT level > 5 U/L is accompanied by a re-assessment of fibrosis stage; the presence of extra-hepatic cholestasis is also accompanied by an increase in liver stiffness, and the presence of narrow intercostal spaces may reduce the possibility of the method [17].

Taking into account these limitations, an algorithm for interpreting the data of transient elastography for the diagnosing liver fibrosis in adult patients was offered (by Chan in the Wong modification) (Fig. 3) [18].

However, we want to focus attention on the fact that transient elastography is one of the most valid non-invasive diagnostic methods for liver steatosis and fibrosis detection, characterized by high reproducibility, high sensitivity and specificity in the diagnosis of cirrhosis. The unconditional benefits are painlessness, short duration of the examination, which makes TE almost an ideal method for liver pathology screening in the general population.

In our study children with fatty liver showed higher LSM values compared with children without steatosis on 0.7 kPa. Although this profile was not clinically relevant, since in most patients the liver stiffness remained within the normal range, we would like to emphasize that signs of liver fibrosis were observed in a small percentage of children with liver steatosis and any child without it. This conclusion confirms that liver steatosis is not always a benign condition; therefore, measures should be taken to evaluate the disease at an early stage.

It should be noted that according to Tokuhara et al. study, TE was performed in 139 healthy children aged 1 to 18 years, the setting of LSM was proportional to age (which is probably due to physiological changes in the liver connective tissue in children and adolescents), while the CAP value did not distinguish in children of different age groups, which testifies to the absence of age-related changes in the lipids distribution in the parenchyma of healthy liver [19].

Concerning the SWE, studies conducted in adults have shown that early stages of fibrosis are difficult to detect by elastographic imaging: measurements obtained in early fibrosis are similar to those obtained in healthy patients [20]. The literature data on the influence of steatosis on the elastography values revealed contradictory results. Marginean et al. [21] found that the liver stiffness values according to ARFI in children with steatohepatitis were significantly higher than in the control group, suggesting that liver steatosis leads to increase in the liver parenchyma stiffness. Instead, Wong et al. [22] report that liver steatosis does not impact the degree of liver fibrosis.

In our study, the liver stiffness was higher in children with NAFLD. It should be noted that high elastographic values can be mistakenly considered as severe liver fibrosis, but the influence of steatosis on the stiffness cannot be ruled out.

According to Garkovich et al. [23], providing SWE in 68 children with steatohepatitis a strong correlation between liver stiffness and morphological stages of liver steatosis was established. However, there was no association between the liver stiffness parameters and the morphological features of steatosis and necro-inflammation. Relevant data demonstrate the importance of SWE combination with liver steatometry.

Our research demonstrated satisfactory diagnostic efficacy of SWE and steatometry in comparison with transient elastography and CAP function when diagnosing liver fibrosis and steatosis.

Conclusions
Thus, the combination of ultrasound regimes with shear wave elastography and steatometry in the context of multiparameter ultrasound examination for assessing liver structural changes allows evaluating the stage of fibrosis and the degree of steatosis in children with diffuse changes in liver parenchyma.

So, transient elastography allows accurately assessing the degree of fat accumulation in the liver parenchyma at the same time as determining the degree of fibrosis.

**Figure 3 — Algorithm for liver fibrosis assessing according to LSM and ALT (by Chan in the Wong modification) [18]**

- **Normal ALT**
  - < 6 kPa
    - Exclude liver fibrosis (93% sensitivity)
  - 6–9 kPa
    - Gray zone
  - > 9 kPa
    - Diagnose liver fibrosis (100% sensitivity)

- **Increased ALT**
  - < 7.5 kPa
    - Exclude liver fibrosis (92% sensitivity)
  - 7.5–12.5 kPa
    - Gray zone
  - > 12.5 kPa
    - Diagnose liver fibrosis (100% sensitivity)
However, a standard ultrasound study maintains the position as it can exclude hepatic masses, cysts, or gallbladder pathology but according to NASPGHAN guideline (2017) a normal hepatic ultrasound cannot exclude the presence of NAFLD and therefore is not useful for the diagnosis or follow-up [24].

Conflicts of interests. Authors declare no conflicts of interests that might be construed to influence the results or interpretation of their manuscript.

References
Сонологічні методи діагностики стеатозу та фіброзу печінки в дітей

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Гастроентерологічні захворювання у дітей / Gastroenterological Diseases in Children

Резюме. Актуальність. Ультразвукове дослідження є найбільш поширеним методом візуалізації, що використовується для діагностики стеатозу печінки. Метою нашої роботи є порівняння можливостей діагностики стеатозу і фіброзу печінки за допомогою стандартного ультразвукового дослідження, зсувнохвильової еластографії з транзієнтовою еластографією та змінами паренхими печінки від застосування CAP.

Матеріали та методи. В обстеження включено 90 пацієнтів віком від 5 до 17 років. Пацієнти були розділені на 3 групи: 1 групу становили 45 пацієнтів зі стеатозом печінки; 2 групу — 35 пацієнтів з надмірною вагою та ожирінням (50,0 %), 3 групу — 35 пацієнтів із надмірною вагою та ожирінням без стеатоза (38,9 %). У дітей 1 групи в 2,2 раза частіше спостерігалась змінена структура паренхими печінки порівняно з показниками дітей 2 і 3 груп.

Результати. Чутливість методу зсувнохвильової еластографії у дітей 1 групи становила (11,1 %), в дітей 2 і 3 груп ця статистично вірогідно вища порівняно з контрольною групою (p < 0,05). Чутливість методу зсувнохвильової еластографії до виявлення фіброзу печінки порівняно з транзієнтовою еластографією становила 83,33 %, специфічність — 60,0 %, позитивна прогностична цінність — 15,15 %, негативна прогностична цінність — 97,67 %. При порівнянні методів стеатометрії та CAP-функції з транзієнтовою еластографією в дітях 1 групи в 15 з 26 випадках було виявлено збіг коефіцієнта затухання ультразвуку в дітей 1 групи — 35 пацієнтів, що відповідало до структури печінки у обстеженіх хворих, середній вік пацієнтів становив (12,08 ± 2,71) роки. За даними стеатометрії печінки середні показники коефіцієнта затухання ультразвуку в дітях 1 групи були вірогідно вищими порівняно з контрольною групою (p < 0,05).

Ключові слова: ультразвук; зсувнохвильова еластографія; зміни паренхими печінки.