



FEATURES OF TWO-DIMENSIONAL SHEAR WAVE ELASTOGRAPHY DEPENDING ON MORPHOLOGICAL CHANGES IN CHRONIC VIRAL HEPATITIS C.

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Article history:	Abstract:
<p>Received: December 8th 2021 Accepted: January 10th 2022 Published: February 19th 2022</p>	<p>Clinical echographic and morphological analysis of the results of ultrasonic shear wave elastography (2D SWE) was performed in 44 patients with chronic viral hepatitis C (CVHC), verified by enzyme immunoassay. It has been established that in viral hepatitis C, depending on the morphological changes in the liver, there are dynamically increasing tendencies of inflammatory-dystrophic changes in the liver tissue. The results obtained are of practical importance in clarifying the stage of liver fibrosis according to the METAVIR scale and planning the treatment and rehabilitation of patients with CVHC.</p>

Keywords: Chronic viral hepatitis C, shear wave elastography, Morphological changes in the liver.

RELEVANCE.

Timely diagnosis of chronic viral hepatitis C (CVHC) is one of the most urgent problems of modern hepatology. With untimely treatment, the disease can progress to cirrhosis of the liver and hepatocellular carcinoma [2, 6].

Until now, the "gold" standard for the diagnosis of liver fibrosis remains an organ biopsy. However, in practical health care, it is not widely used, due to the invasiveness of the procedure. The presence of a number of contraindications to its implementation and the risk of complications.

With the advent of the method of ultrasonic elastography in different versions, new opportunities have opened up in the diagnosis of liver diseases [3,7].

Currently, a number of studies have been carried out to evaluate the diagnostic capabilities of ultrasound compression and pinpoint (ARFI) elastography in diffuse and focal liver diseases [1,7]. The advent of 2D shear wave elastography (2D SWE) opens up new perspectives in clarifying the diagnosis of chronic liver diseases. In this aspect, studies aimed at further improving the quality of ultrasound diagnostics using new technologies of ultrasound elastography seem to be clinically important.

TARGET.

Improving the diagnosis of CVHC by a comparative analysis of the morphological, elastographic method in the 2D SWE study mode in determining the severity of liver fibrosis.

MATERIALS AND METHODS.

In the period 2018-2020 180 patients with CVHC were examined. Assessment of the degree of liver fibrosis (F) was carried out according to the METAVIR classification recommended by the International Association of Hepatologists. Of these, stage F1 was detected in 45 patients, stage F2 - in 55, stage F3 - in 62 and stage F4 - in 18 patients.

The diagnosis of the disease was based on clinical, laboratory, virological data and ultrasound examinations. In 44 (24.4%) patients, the stage of the disease was verified using liver biopsy under ultrasound guidance.

All patients underwent a step-by-step standard polypositional and polyprojective ultrasound examination of the liver in 2D, Doppler, (2D SWE) modes on expert-class ultrasound devices GE Logic S8 and Toshiba 450. At the same time, at least 8-10 2D SWE measurements were carried out at a depth of 2-6 cm from the skin surface in a zone free from the main vessels (segments 6-8). The value of the elastic Young's modulus of the liver was expressed in kilo Pascals (kPa), and the shear wave velocity in meter seconds (m/s) [4,5].

RESULTS.

Analysis of the results of multiparametric ultrasound studies and their comparison with the results of histological studies in 44 patients with CVHC showed that there are certain criteria for 2D SWE indicators in

accordance with morphological changes in the organ parenchyma.

In 9 patients with CVHC in stage F1 according to METAVIR, according to the results of gray-scale echography, minor diffuse changes were detected without changing the size of the organ. When using 2D SWE, the liver stiffness/elasticity index was in the range of 5.8 (4.6-7.5) kPa, and the shear wave velocity was 1.3 ± 0.2 m/s (Fig. 1) and differed from the data of other groups ($p < 0.05$). Histomorphological examination showed dystrophic changes in 2 out of 9 patients, trabeculae of hepatocytes were preserved,

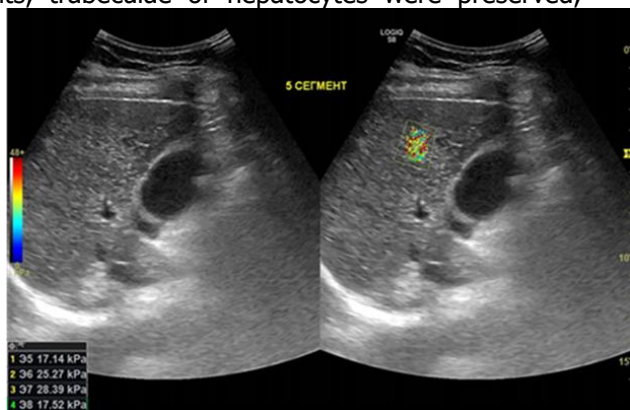


Figure 1. Ultrasound images of the liver parenchyma in the F1 fibrosis stage according to METAVAR in 2D (left) and 2D SWE (right) modes. In the lower left row, 2D SWE values: 6.1 kPa; speed 2D SWE-1.8 m/s.

accumulations of lymphocytes were noted in the interlobular spaces (Fig. 2).

In the second stage of liver fibrosis F2 in 12 patients, the average elastometry values were 7.6 (6.3–10.7) kPa, and the shear wave velocity increased to 1.7 ± 0.2 m/s (Fig. 3). In patients of this group, histological changes were characterized by dystrophic changes in hepatocytes; at the same time, trabeculae were preserved; in some foci, an extensive area of loose fibrous connective tissue was observed (Fig. 4).

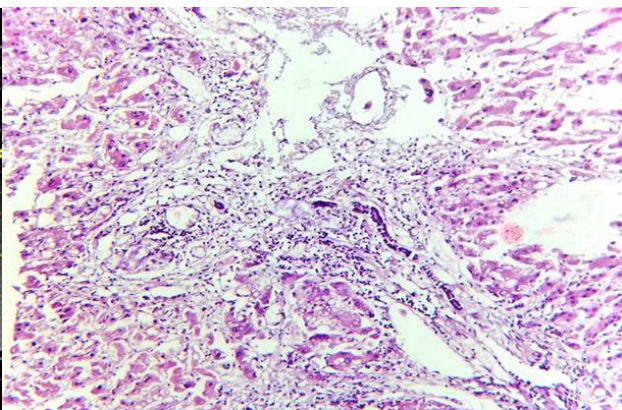


Figure 2. Histological picture of the liver parenchyma in the stage of liver fibrosis F1: hematoxylin-eosin x 20
 Conclusion: chronic hepatitis.

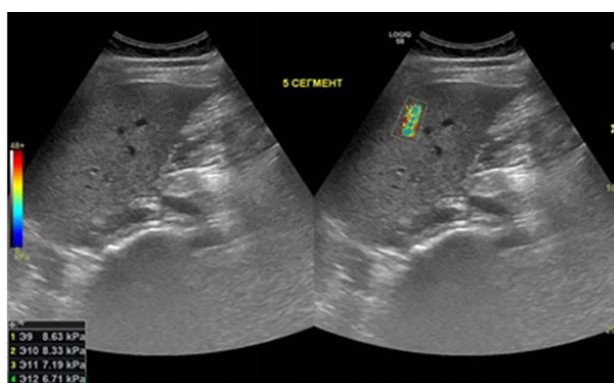


Figure 3. Ultrasound images of the liver parenchyma in stage F2: 2D (left) and 2D SWE (right) modes. In the lower left corner, the average values of 2SWE are 7.6 kPa, the speed of 2D SWE is 1.7 m/s.

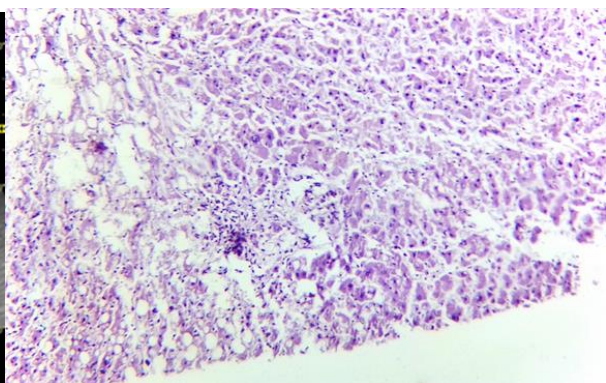


Figure 4. Histological picture in the stage of liver fibrosis F3. Hemotaxilin-eosin x 20.

In the F3 stage (n=15), the elastometric parameters averaged 10.2 (8.1 – 13.5) kPa, the shear wave velocity reached 1.8 ± 0.2 m/sec. (Fig. 5). In these cases, morphological changes were characterized by changes in hepatocytes in the form of hydropic and

vacuolar dystrophy, with foci of necrosis. In the portal tract there is a cellular infiltrate consisting of lympho-leuko-macrophage cells. At this stage, there was an increase in fibrous tissue, a violation of the beam structures of the lobules, an expansion of most portal

tracts, the formation of porto-central septa, a violation of the architectonics of the lobules, obstruction and
 At the F4 fibrosis stage (n=5), 2D SWE data indicated an increase in the stiffness of the organ parenchyma up to 16.6 (18.5–30.7) kPa, and shear wave velocities up to 2.3 ± 0.3 m/s (Fig. 7).

The morphological picture in patients of the F4 subgroup indicated disorganization of the liver structures with the formation of false lobules. It was noted the development of fibrosis of the septa with

restructuring of the bile ducts, and the development of cholestasis. (Fig. 6)
 pronounced wide porto-portal and porto-central septa. There was an increase in the number of venous vessels in the newly formed false lobules, venous plethora. At the same time, obstruction of the bile ducts, peripheral cholestasis, lymphoid infiltration in the portal tract, protein and fatty degeneration of hepatocytes were noted (Fig. 8).

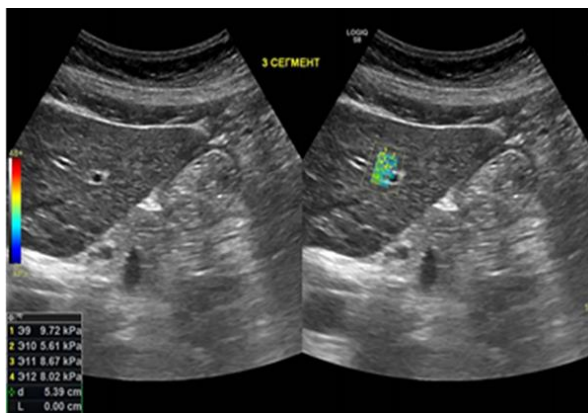


Figure 5. Ultrasound images of the liver parenchyma in the stage of fibrosis F3 according to METAVIR. 2D SWE values: 10.2 kPa, shear wave velocity 4.8 m/s.

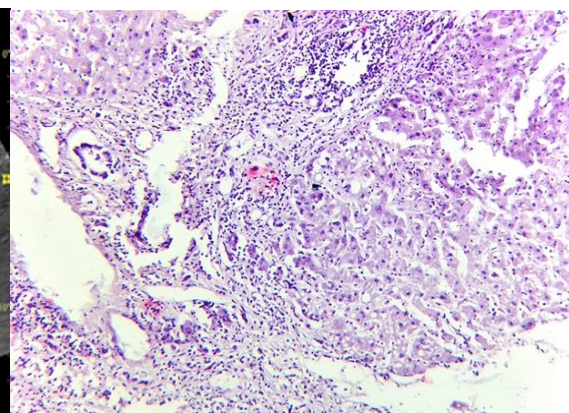


Figure 6. Histological picture of the liver parenchyma in the stage of fibrosis F3 according to METAVIR: Hemotaxilin-eosin x 20. Severe liver fibrosis.

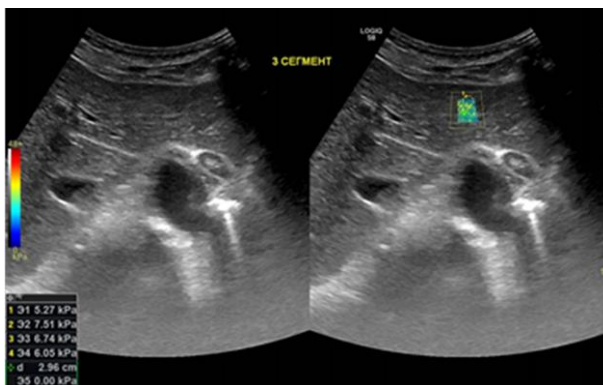


Figure 7. Ultrasound images of the liver parenchyma in the F4 fibrosis stage according to METAVIR in 2D (left) and 2D SWE (right) modes. 2D SWE ratings: 25 kPa, shear wave velocity 1.3 m/s

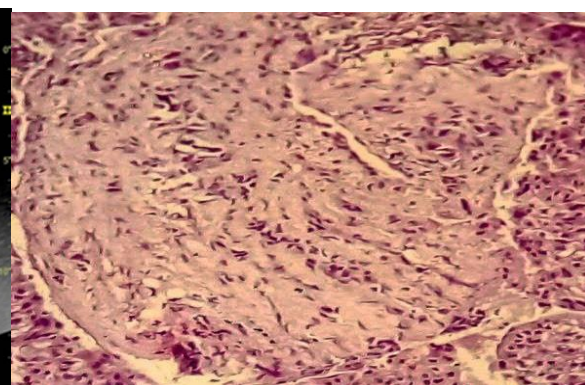


Figure 8. Histological picture in the stage of liver fibrosis F4. Hemotoxylin-eosin. Histopathological conclusion: Cirrhosis of the liver (portal cirrhosis of the liver).

The coincidence of the stage of fibrosis, determined by the results of elastometry with the results of a morphological study of liver biopsy, was observed in 40 (90.9%) of the 44 examined patients.

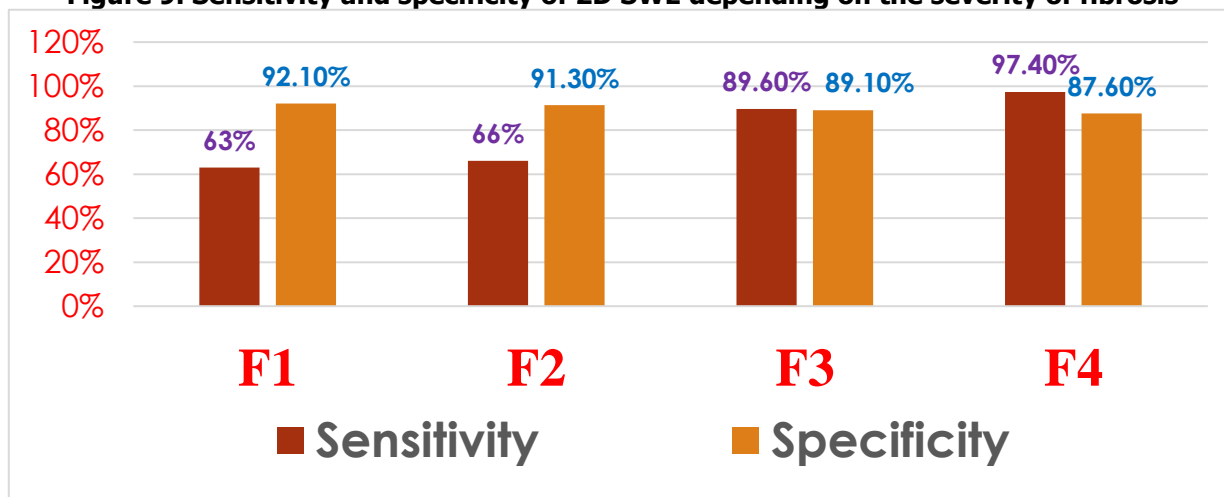
Discrepancies between histological data and elastometry results in patients with CVHC were

observed in subgroups F1-F2 and they occurred in 2D SWE. In these cases, the results of dopplerometry of the liver vessels contributed to the improvement of the complex diagnosis of CVHC.

The results obtained by us (Fig. 9) coincide with the data of researchers in this direction [5, 7]



Figure 9. Sensitivity and specificity of 2D SWE depending on the severity of fibrosis



DISCUSSION.

The conducted studies indicate that elastography is a non-invasive, painless, quickly performed method, representing quantitative indicators of 2D SWE on the stiffness / elasticity of the liver parenchyma in CVHC. These data contribute to clarifying the stage of liver fibrosis and elastography in the mode (2D SWE) is the method of choice in clarifying diagnosis of the severity of liver fibrosis in CVHC.

Taking into account the availability of ultrasound devices, sufficiently high sensitivity (97.4%) and specificity (87.6%), 2D SWE technology can be more widely used in clinical practice.

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