NOVATEUR PUBLICATIONS
JournalNX- A Multidisciplinary Peer Reviewed Journal
ISSN No: 2581 - 4230
VOLUME 7, ISSUE 2, Feb. -2021

THE VALUE OF SHEAR WAVE ELASTOGRAPHY IN THE COMPLEX DIAGNOSIS OF CHRONIC VIRAL HEPATITIS C

AKRAM AKMALOVICH FAZILOV
Doctor of Medicine, Professor 1-Center for Professional Education of Medical Specialists under the Ministry of Health of the Republic of Uzbekistan. Tashkent, Uzbekistan.

GUZALOY GULOMIDDINOVNA SAIPOVA
Doctoral student at the 2-Andijan State Medical Institute
Andijan, Uzbekistan

ABSTRACT:

The diagnostic capabilities of ultrasound elastography in the two-dimensional shear wave (2D SWE) mode were studied in 120 patients with chronic viral hepatitis C. The control group consisted of 40 healthy volunteers with a body mass index of 24-27 without clinical, virological changes. It has been shown that 2D SWE ultrasound is an integral part of gray-scale, doppler studies in the system of standard examination of patients with CVHC and can provide valuable additional qualitative and quantitative information about the degree of development of the process in the liver. It was shown that in the stage of fibrosis F1 according to METAVIR, the liver stiffness indices are 6.2 kPa, and the shear wave velocity is 1.3±0.2 m/sec. With the further development of fibrosis F2-F4, these indicators increase, respectively, from 6.3 kPa to 30.3 kPa, and the shear wave velocity up to 2.3±0.3 m/sec. in the F4 stage according to METAVIR. The results of 2D SWE elastography make a significant contribution to the timely detection of the degree of fibrosis development in Chronic viral hepatitis C.

KEY WORDS: Chronic viral hepatitis C, diagnostics, indicators, shear wave elastography, stiffness / elasticity index.

INTRODUCTION:

The timely diagnosis of diffuse liver disease of viral etiology C (CVD) has attracted the attention of specialists from various clinical disciplines. Carriers of the virus are known to have a latent disease with no particular clinical manifestations until a certain time. According to the Nobel Prize 2020 experts, this "gentle killer" will cause liver cirrhosis in the next 7-10 years. There is a high risk of developing primary cancer of the organIn the system of multidisciplinary diagnosis of CHB, modern medical imaging technologies - abdominal radiography in combination with artificial contrast, angiography, computed tomography (CT), positron emission tomography (PET), magnetic resonance imaging (MRI) make a significant contribution to the recognition of diffuse and focal liver lesions. It is necessary to note, that complex ultrasound investigations - two-dimensional seroscan echography (2D), Doppler spectra of vascular studies currently occupy a worthy place in diagnostics of liver diseases. They, following clinical and laboratory examinations, have been brought to the forefront of basic diagnostic examination of patients.

At the same time, recent studies suggest that sensitivity of ultrasound in 2D-mode in diffuse liver disease does not exceed 70-75%. Scientific and technical progress in the field of ultrasonic diagnostics at the beginning of XXI century introduced a new direction of clarifying

diagnostics ultrasonic elastography. To date, researchers continue to study the role and value of various methods of ultrasound elastography: compression elastography, shear-wave elastography in various modifications - point elastography, shear-wave elastography with assessment of qualitative and quantitative parameters.

Researchers note that ultrasound elastography is particularly in demand in clinical hepatology because of the ability to determine the stiffness and elasticity of the parenchyma in diffuse and focal liver disease. With this technology, two-dimensional shear wave elastography (2D SWE) is considered to be the most promising trend in hepatology. It is regarded as an important part of ultrasound-guided multiparametric diagnosis of liver disease. At the same time, studies aimed at determining the role and significance of this method in the comprehensive diagnosis of chronic viral hepatitis C are few. Therefore, accumulation of clinical experience in this direction is relevant to accelerate the development of evidence-based clinical protocols for ultrasound examination of patients with CHCV.

RESEARCH OBJECTIVE:

Improvement of comprehensive diagnosis of liver fibrosis by using shear wave ultrasound elastography (2DSWE) to clarify the stage of the disease in patients with chronic viral hepatitis C.

RESEARCH MATERIALS AND METHODS:

Comprehensive diagnosis of CHCV was carried out in 120 inpatients and outpatients. Among them 76 (54.3%) were men and 64 (46.4%) were women, aged 24-58 years. The diagnosis of CHCV was based on clinical, physical, laboratory, virological and ultrasound findings. The control group included 40 nearly healthy subjects with a body mass index (BMI) of 24-27 who had no history of chronic hepatitis and whose clinical and laboratory parameters (serological markers for HCV infection, bilirubin value, biochemical parameters), ultrasound quality and biometric parameters of the liver were unchanged. The technology of two-dimensional seroscale ultrasonography (2D) of the liver and other abdominal organs was performed according to the standards recommended in the clinical guidelines of the World (WFUMB), European (EFUMB) federations of ultrasonographers in medicine and biology. In recent years, multicenter studies on optimization of the technology of liver elastography and interpretation of the obtained data have been carried out by ultrasound diagnostic specialists in Russia with the participation of specialists from Uzbekistan.

The 2D SWE examination is based on transverse acoustic pulse flow, which is used to create shear waves with an ultrasound transducer. Important conditions for improving the quality of ultrasound elastography in 2D SWE mode are the determination of the indication for the examination, its performance by a specially trained ultrasound diagnostician. Ultrasound elastography is indicated in all patients with CHCV for the timely detection of hepatic fibrosis, clarification of the stage of inflammatory-degenerative changes according to the international METAVIR classification, and determination of the dynamics of changes in organ density/elasticity during retroviral therapy. Relative limitations are overweight and the presence of ascitic fluid in the pleural and abdominal cavities. After performing 2D ultrasound and Doppler ultrasound, patients underwent shear wave elastography on a Logiq S8 (General Electric, USA). The patient was placed horizontally on the couch and the right arm was moved up behind the head. This widened the space between the ribs. The examination was carried out with a convex transducer through VII- VIII intercostal space,

along the anterior and middle axillary line providing access to V, VI, VII segments of the liver and through the right subcostal space (access to IV, V, VI, VII segments of the liver). According to 2D-mode examination, the area of interest was determined at a depth of not less than 2 cm and not more than 6 cm from the liver capsule. When elastography is performed on the area under study, a colour chart is automatically displayed on the monitor screen of the device. Blue shows the densest (toughest) tissue, red shows less dense tissue, and green shows healthy, softer tissue (4). The device can automatically quantify tissue stiffness in kPa. The ultrasound device can also measure shear wave velocity in m/sec. The ultrasound findings were evaluated according to the international classification of chronic diffuse liver disease - METAVIR.

RESEARCH RESULTS:

In the group of 40 healthy patients, the echostructure of the liver parenchyma vascular architectonics of the organ corresponded to age-related echographic criteria. The mean 2D SWE was 4.9 (3.9 - 6.5) kPa, shear wave velocity did not exceed 1.1-1.2 m/s. (Fig.1)

Fig. 1 Ultrasound images of the liver parenchyma in 2D (left) and 2D SWE (right). Colour mapping of the area of interest. The bottom left shows the results of 6 quantitative 2D SWE measurements, with an average value of 4.7 kPa

Clinical and laboratory, virological studies of 120 patients with chronic viral hepatitis revealed fibrosis stage F1 according to METAVIR in 56 (48.4%), F2 - in 32 (28.4%), F3 - in 26 (21.8%), F4 - in 6 (5.0%) patients. In the F1 fibrosis stage, portal vein dilation was observed in 6 patients, and splenic vein dilation at the level of its gate - in 24 patients, enlargement of the spleen was observed in every third patient. The mean 2D SWE was 6.2 (4.8-8.0) kPa and shear wave velocity 1.3±0.2 m/s (Figure 2a).

In patients with F2 fibrosis stage, along with the above signs, there was a decrease of blood flow rate in portal vein and increased peripheral resistance in intrinsic hepatic artery in 12.5% of observations, dilation of splenic vein at its gate in 93.7% with a simultaneous increase of spleen size. The mean elastometry was 8.5 (6.3-10.7) kPa and shear wave velocity increased to 1.7±0.2 m/s (Fig.2b). In every seventh to eighth patient a dilated portal vein was detected in the F3 stage. The leading sign of fibrosis in this group of patients was significant dilation of the splenic vein and increased spleen size in 96.1% of observations. Doppler investigations (spectral, CDC, ED) showed decreased blood flow velocity in the portal vein in 84,6% of cases, increase of peripheral resistance in 38,4% of patients, recanalization of the umbilical vein in own hepatic artery was observed in 3,8%. The elastometric values averaged 10.8 (8.1-13.5) kPa, the swig wave velocity reached 1.8±0.2 m/s (Fig.2c). In the F4 fibrosis stage, splenorenal anastomosis formation was observed in 66.7% of patients, umbilical vein recanalization and ascites in 33.3% of patients. At the same time in all patients with CHCV a decreased velocity of blood flow in the portal vein, increased peripheral resistance in the common hepatic artery, dilated splenic vein and enlarged spleen were registered. 2D SWE data indicated an increase in organ parenchyma stiffness to 24.6

(18.5 - 30.7) kPa and shear wave velocity to 2.3±0.3 m\sec (Fig.2d).

The results of these studies indicate a direct correlation between the qualitative and quantitative indices of 2D SWE and the degree of development of hepatic fibrosis in CHCV.

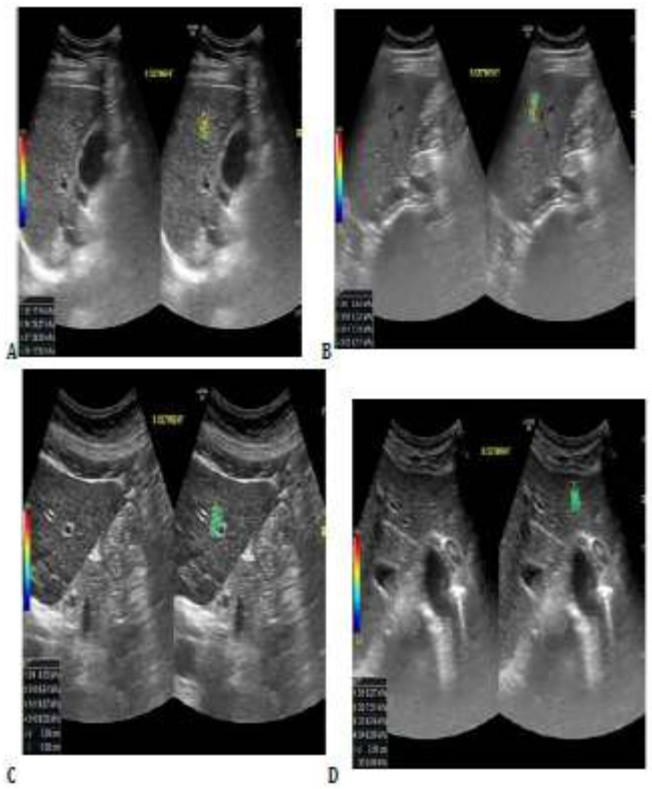

Fig. 2 Ultrasound images of the liver parenchyma at different stages of fibrosis in 2D (left) and 2D SWE (right). A - liver fibrosis at stage F1; B - liver fibrosis at stage F2; C - liver fibrosis at stage F3; D - liver fibrosis at stage F4 (explanation in text).

Modern technologies of ultrasound elastography are considered by many researchers to be one of the most important components in the clarifying diagnosis of diffuse and focal liver lesions. The accumulated experience to date shows that various methods of elastography - compression elastography, shear wave elastography, both in point and two-dimensional modes have undoubted advantages in determining the elasticity/stiffness of the liver parenchyma. This additional ability to qualitatively and quantitatively determine liver stiffness has become a sought-after ultrasound-based multiparametric diagnosis of hepatic fibrosis in CHC.

Our investigations in this direction using 2D ultrasound elastography (2D SWE) in 120 patients with CVC showed the possibility of clarifying stiffness (elasticity) due to the dynamic development of local or diffuse inflammatory-destructive remodelling of the organ and assess the findings according to the standard METAVIR scale. According to this scale F0 means absence of fibrosis, F1-portal liver fibrosis, F2-portal and slightly expressed liver fibrosis, F3-portal and expressed septal liver fibrosis, F4-liver cirrhosis. Interpretation of elastography data in 2D SWE mode showed that hepatic elastic moduli were equally significant in both kPa and m/s and had a direct correlation (table1).

Table 1. Elasticity modulus values of the liver parenchyma at different stages of CVHS.

Fibrosis stages according to METAVIR	Number of people surveyed	Modulus of elasticity		
		in kPa		in kPa in m/s
		mean	median	
F0(normal)	40	4,9	3,9 - 6,5	1,1 – 1,2
F1	56	6,2	4,8 – 8,0	1,3 +- 0,2
F2	32	8,5	6,3 – 10,7	1,7 +- 0,2
F3	26	10,8	8,1 +- 13,5	1,8 +- 0,2
F4	6	24,6	18,5 +- 30,7	2,3 +- 0,3

Note: The results of the compared groups of liver fibrosis versus unchanged organ parenchyma are significant ($p<0.05$).

The results of these studies are consistent with those of other researchers. We agree with Ferralioli et al. who point out the importance of evaluating elastography and elastometry data with clinical and laboratory findings. It is noted that depending on the activity of chronic viral hepatitis, including CHCV, quantitative measures can vary considerably and multicentre studies in this direction are needed In our opinion, changes detected in the preportal area of the liver by

seroscale echography and Doppler should serve as a signal for elastography for early diagnosis of hepatic fibrosis. Further research towards improving the informative value of 2D SWE elastography appears to be the introduction of dual-frequency echography technique. The introduction of this technology in ultrasound instrumentation will allow to consider the objectivity of elastographic data in cases of combination of chronic hepatitis with fatty liver rearrangement.

CONCLUSIONS:

1. 2DSWE ultrasound shear-wave elastometry is a simple, non-invasive and accessible method of obtaining information about the stiffness status of the liver parenchyma in patients with CHB.
2. 2D SWE elastometry combined with 2D mode and Doppler imaging in one ultrasound unit shortens the period of examination of patients and improves the quality of diagnosis in determining the stage of fibrosis in chronic diffuse liver disease.

REFERENCES:

1) Agaeva Z.A., Avkhadov T.S., Gorbov L.V. Ultrasonic shear wave elastography in differential diagnosis of volumetric liver lesions // Ultrasound and functional diagnostics, 2014 № 6, p.21-29
2) Arisheva O.S., Garmash I.V., Kobalova J.D., Moiseev V.S. Methods of diathesis of liver fchbroea//Experimental and Clinical Gastroenterology. -2013, №7, c. 49-55.
3) Akhmedov R.M., Mirkhojaev I.A., Khamdamov B.Z. Morphostructural changes in the liver in the elderly and old age // Conference proceedings. Journal of Problems of Biology and Medicine. - – 2016. - №3,1(90). - C. 18.56.
4) Azimov M. I., Shomurodov K.E. A technique for Cleft Palate Repair. Journal of research in health science. Vol. 1, No. 2, 2018, pp. 56-59.
5) Vorobyeva N.N., Golovanova E.V. Diagnostic significance of ultrasonic elastometry in evaluation of fibrosis in chronic diffuse liver diseases. // Experimental and clinical gastroenterology, 2010. - №5. - C.10-13.
6) Diomidova V.N., Petrova O.V. Comparative analysis of shear wave and transient elastography in the diagnosis of diffuse liver disease. // Ultrasound and functional diagnostics. 2013, №5, C. 17-23.
7) Zubarev A.V. Elastography - an innovative method of searching for cancer of various localizations // Medical Alphabet Radiology. 2009, №2- c. 39-45.
8) Karpova R.V., Chernoussoe A.F., Horobrykh T.V. Ultrasound diagnosis of diffuse liver diseases // Medical Imaging. - 2013. - № 2. - C. 104-112.A)
9) Kanutoshi Sugimato. Preliminary results of shear wave dispersion imaging for liver tissue viscosity assessment // Visions 30, 2018, p.39-41 (Canon Medical Systems)
10) Kamalova M. I., Islamov Sh. E., Khaydarov N.K.// MORPHOLOGICAL CHANGES IN BRAIN VESSELS IN ISCHEMIC STROKE. Journal of Biomedicine and Practice 2020, vol. 6, issue 5, pp.280-284
11) Khamdamov B.Z. Indicators of immunocitocine status in purulent-necrotic lesions of the lover extremities in patients with diabetes mellitus.//American Journal of Medicine and Medical Sciences, 2020 10 (7) 473-478 DOI: 10.5923/j.ajmm.2020.- 1007.08
12) Khamdamov B. Z. Islomov A. I. Metod of prevention of postoperative complications of surgical treatment of diabetic foot syndrome// European Science Review. Austria, Vienna 2018 Septemba-October. - №9-10. - P. 194-196.

13) Lemeshko Z.A. Radiation diagnostics in gastroenterology // Russian Journal of Gastroenterology, Hepatology, Coloproctology. - 201 1. - №1 - C. 79 - 84.
14) Morozova T.G., Borsukov A.V., Bueverov A.O., et al. Complex elastography as a systematic approach in evaluation of fibrotic process in the liver and its focal pathology // Treatment and prevention. - – 3(23). - – 2017. - – c. 29-34.
15) Fundamentals of Radiation Diagnostics and Therapy: A National Guide / Editor-in-Chief of the volume Acad. RAMS S.K. Ternovoi. - Moscow: GEOTAR-Media, 2012.
16) Postnova N.A., Borsukov A.V., Morozova T.G., Andreev B.V. Using compression elastography for noninvasive assessment of liver fibrosis: results of multicenter study // Ultrasound and functional diagnostics, Moscow, 2016, № 6, P. 10-21.
17) Tukhbatullin M.G., Akunova G.R., Galeeva Z.M. Possibilities of echography in diagnostics of liver cirrhosis and portal hypertension // Practical medicine. Modern issues of diagnosis. - – 2014. №3(79). - – c. 54-61.
18) Liver cirrhosis and its complications. Liver transplantation / J.R. Schiff, M.F. Sorrel, W.S. Maddrey / Translated from English - M.: GEOTAR-Media,2012. - – 592 c.Adebajo CO, Talwalkar JA, Poterucha JJ, Kim WR, et al. Ultrasound0based transient elastography for the detection of hepatic fibrosis in patients with reccurent hepatitis C virus after liver transplantation: a systematic review and meta-analysis. Liver Transpl 2012; 18:323-331.
19) Boursier J., de Ledinghen V Zarski JP Fouchard-Huben I. Gallois Y., Oberti F. et al. Comparison of eight diagnostic algorithms for liver fibrosis in hepatitis C: new algorithms are more precise and entirely noninvasive. Hepatology. 2012; 55: 5867.
20) Cosgrove D, Piscaglia F, Bamber J, Bojunga J, Correas JM, Gilja OH, et al. EFSUMB guidelines and recommendations on the clinical use of ultrasound elastography. Part-2: Clinical applications. Ultraschall Med2013; 34:238-253.
21) Ferraioli, G., Tinelli. C., Dal Bello, B., Zicchetti, M., Filice, G., and Filice, C. Accuracy of real-time shear wave elastography for assessing liver fibrosis in chronic hepatitis C: a pilot study. Hepatology. 2012,56:2125-2133.
22) Heye T., Bashir M.R. Liver imaging today // Magnetom Flash. – 2013. – Vol.2, Issue 52. – P. 111-117.
23) Koizumi Y, Hirooka M, Kisaka Y, Konishi I, Abe M, Murakami H, et al. Liver fibrosis in patients with chronic hepatitis C: noninvasive diagnosis by means of real-time issue elastography—establishment of the method for measurement. Radiology 2011,258:610-617.
24) Nightingale K. Acoustic radiation force impulse (ARFI) imaging: a review. Curr Med Imaging Rev 2011;7: 328-339.
25) Nishikawa T, Hashimoto S, Kawabe N, et al. Factors correlating with acoustic radiation force impulse elastography in chronic hepatitis C. World J Gastroenterol 2014; 20: 1289- 1297.
26) Piscaglia, F; Salvatore, V; Di Donate, R: Accuracy of Virtual Touch Acoustic Radiation Force Impulse (ARFI) imaging for the diagnosis of cirrhosis during liver ultrasonography; Ultraschall in Med 2011.32: 167-175.
27) Richard G. Barr, David Cosgrove, Marko Brock, Vito Cantisani, Jean Michel Correas, Arnoud W. Postema, et al. WFUMB guidelines and recommendations on the clinical use of ultrasound elastography: part 5. Prostate; Ultrasound in Med. & Biol., Vol. 43,№1, pp. 27-48, 2017.
28) Rizzo L., Calvaruso V., Cacopardo B., Alessi N., Attanasio M., Pena S. et al. Comparison of transient elastography and acoustic radiation force impulse for non-invasive staging of liver Fibrosis in patients with chronic hepatitis C. Am J Gastroenterol. 2011; 106: 2112-2120.