Editorial

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Liver cirrhosis noninvasive assessment with Acoustic Radiation Force Impulse Imaging

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Nowadays, there is an increasing interest in finding new non-invasive methods for the evaluation of fibrosis in patients with diffuse liver diseases, as an alternative to needle biopsy, as well as for methods of monitoring cirrhotic patients, with the focus on elastographic methods.

Among the elastographic methods, Acoustic Radiation Force Impulse Imaging (ARFI) technology is increasingly studied for its uses in different clinical applications, including tumoral conditions of the breast, liver, kidney, colon, and rectum, for the characterization of atherosclerotic plaques, monitoring of radiofrequency ablation [1-10], as well as the noninvasive assessment of liver fibrosis [11-16].

ARFI imaging technology involves the mechanical excitation of tissue using short-duration acoustic pulses (push pulses) in a region of interest chosen by the examiner, producing shear waves that spread away from the region of interest, perpendicularly to the acoustic push pulse, generating localized, micron-scale displacements in the tissue. Simultaneously, detection waves of lower intensity than that of the push pulse are generated. The moment of interaction between the shear waves and the detected waves marks the period of time elapsed between the generating of shear waves and the crossing of the entire region of interest. By recording the shear wavefront at several locations and correlating these measurements with the elapsed time, the shear wave velocity – SWV (m/s) can be quantified; generally, the stiffer a region in the tissue, the greater the SWV as it travels through this region. Thus, the measured SWV is an intrinsic and reproducible property of the tissue [4,5,9].

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The equipment lists the SWV as well as the depth at which the measurement was performed. A single transducer on a diagnostic scanner is used both to generate radiation force and to track the resulting displacement. The theoretical advantage of ARFI, as compared to TE, is its implementation on an ultrasound device, via additional software imaging control and detection algorithms, thus allowing the visualization of B mode, color Doppler mode and ARFI images with the same equipment [1]. Furthermore, the SWV can be measured not only through the intercostals approach in the right lobe, but also through the subcostal approach or even the left lobe. However, when the measurements are taken in the left lobe, it may be influenced by the heart pulsations transmitted through the liver parenchyma.

ARFI technology allows the quantification of the shear wave velocity, in strong correlation with the fibrosis stage. The maximal usefulness of this method comes in the prediction of severe fibrosis and cirrhosis, for which the diagnostic accuracy was highly comparable to transient elastography (Fibroscan), whereas transient elastography has better performance in the earlier stages [12]. The area under the ROC curve for the prediction of cirrhosis using ARFI varied between 0.85-0.93 in various studies [11-16].

In this issue of *Medical Ultrasonography*, the study of Bota *et al* [17] set out to assess, in a group of 211 cirrhotic patients, the influence of liver residual mass on the shear wave velocity as quantified through ARFI elastography. A direct, but very low correlation between the SWV values and the Child-Pugh and MELD scores was found. In addition, a direct, low correlation between SWV and total bilirubin and an inverse, low correlation with albumin, prothrombin time and cholinesterase was obtained. The authors proved that SWV values were significantly higher in patients with Child-Pugh class B vs. A and in Child-Pugh C vs. A. The values were not sig-

nificantly different in patients with Child-Pugh B vs. C. In this study, for a cut-off value of 3.11 m/s, SWV measurements by means of ARFI had 50% sensitivity, 75% specificity, 70 % positive predictive value, 56.2% negative predictive value, with 61.5% accuracy for predicting the presence of cirrhosis of at least class Child-Pugh B. In conclusion, this study proves the existence of a correlation between the shear wave velocity as quantified by ARFI and the liver residual mass in patients with liver cirrhosis.

For the moment, the ARFI elastography should not necessarily be seen as a surrogate for either liver biopsy or other invasive procedures, but rather as a "discrimination" instrument implemented so as to ensure the quick establishment of clinical priorities.

As far as the cirrhotic patient is concerned, further studies on independent groups of patients are necessary, in order to validate the cutoff values of the shear wave velocity predictive for the occurrence of each type of complication, before using ARFI as a method for noninvasive monitoring of these patients.

The ARFI technique can be performed during a usual ultrasonographic examination and may become in the future an integral part of the ultrasonographic protocol.

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