

Ultrasonographic elastography, no longer for the “select few”

Monica Lupșor-Platon

Department of Medical Imaging, “Prof. Dr. Octavian Fodor” Regional Institute of Gastroenterology and Hepatology, “Iuliu Hațieganu” University of Medicine and Pharmacy, Cluj-Napoca, Romania

Elastography is the science creating, through non-invasive means, a representation of the mechanical characteristics of tissues; it may be seen as a type of “remote palpation”, allowing the measurement and display of the biomechanical properties of tissues.

In chronic liver diseases, the composition and the structure of tissues changes due to excessive connective tissue deposition, leading to alteration of the liver tissue mechanical properties (increased stiffness) and precisely these alterations can be assessed using an elastographic method.

All elastographic techniques focus on assessing the tissue stiffness under the influence of a shear waves; the result is displayed either as a black-and-white or colour image, or as numerical quantification of some parameters correlated with the shear wave [1]. According to the elastography guidelines [2-4], the ultrasound elastographic techniques can be classified as either quantitative (“Shear Wave Elastography”, SWE) or qualitative (“Strain Elastography”).

Apparently, ultrasound elastography methods are becoming more numerous and widely available on different ultrasound machines. Vibration controlled transient elastography is the only method not integrated in a standard ultrasound device. The rest of elastographic techniques can be implemented on ultrasound systems and are based on the acoustic radiation force impulse technique (ARFI), i.e. the force of the ultrasound beam [5]. The tissue stiff-

ness can be assessed at a single location, as in point shear wave elastography (pSWE), or in a larger area inside a sample box, as in 2D-SWE. Each manufacturer has developed a proprietary software for pSWE or 2D-SWE; however, all of them rely on the ARFI technique [5]. A novel idea of several manufacturers is to introduce elastographic modules not only on high-class machines (very expensive and therefore less affordable), but also on middle-class US machines that are accessible to more medical specialties, including general practitioners.

It is important to note that each method may yield different values, expressed in different units (meters per second, kilopascals) or indices [2]. As stated in the EF-SUMB guidelines [4], known stiffness thresholds for each specific equipment should not be used for another equipment. Unless proven otherwise, this recommendation should be applied not only to different type of equipment from different manufacturers, but even to different type of equipment of the same manufacturer or to different settings for the same equipment [4]. As expected, further studies are necessary to define the predictive cut-offs for each fibrosis stage, for each equipment and each liver disease etiology.

In this context, in the last issue of this journal, Sporea et al set out to analyse, in 2 different studies, the range of liver stiffness cut-off values for predicting liver fibrosis stages using the 2D-SWE technique implemented on three different systems from General Electric Healthcare [6], as well as the utility of two elastographic techniques (pSWE and 2D-SWE) integrated in the same ultrasound machine (Samsung-Medison RS85) [6].

Sporea et al [6] states that the LS cut-off values for 2D-SWE-GE implemented on different systems (LOGIQ E9, LOGIQ S8, LOGIQ P9) are not significantly different, ranging between 6.7- 6.9 kPa for $F \geq 2$ and 7.6 - 8.2 kPa for $F \geq 3$, while for the prediction of cirrhosis, the value obtained on each of the 3 types of equipment was 9.3

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Corresponding author: Monica Lupșor-Platon
Department of Medical Imaging, Regional
Institute of Gastroenterology and Hepatology,
19–21 Croitorilor Street,
400162 Cluj-Napoca, Romania
E-mail: monica.lupsor@umfcluj.ro

kPa. The performance of the 3 types of equipment was found to be very good, with areas under the ROC curve above 0.9 for every fibrosis stage. Although these observations must be validated on larger groups of patients, using liver biopsy as a reference, their practical value is compelling because they prove that, the LS cut-off values are not significantly different, for the same manufacturer (in this case General Electric Healthcare), regardless of the GE equipment performance class (from medium to high). In these conditions, there is a higher accessibility to liver elastography examination and it is likely that in the future, the screening of liver fibrosis in high-risk patients will be performed using middle-class US machines, accessible to more medical specialties, including general practitioners.

Another study performed by Professor's Sporea team (Foncea et al [7]) set out to assess the utility of two elastographic techniques (pSWE and 2D-SWE) integrated in the same ultrasound machine (Samsung-Medison RS85), in liver fibrosis assessment, using TE as the reference method. The results of the study found a strong positive correlation between LS values obtained by TE, 2D-SWE and pSWE. With TE as reference, the LS cut-offs yielded by pSWE were >5.9 kPa for $F \geq 2$ (AUROC=0.95, Se=94.1%, Sp=89.5%, PPV=82.1%, NPV=96.8%), and >8 kPa for F4 (AUROC=0.98, Se=94.4%, Sp=95.1%, PPV=81%, NPV=98.7%); the 2D-SWE cutoffs were the following >6.1 kPa for $F \geq 2$ (AUROC=0.93, Se=91.1%, Sp=80.6%, PPV=70.5%, NPV=94.7%), and >7.6 kPa for the prediction of F4 (AUROC=0.98, Se=100%, Sp=91.5%, PPV=72%, NPV=100%). Apparently, the cut-off values are similar for significant fibrosis and liver cirrhosis for both elastographic methods (pSWE and 2D-SWE) integrated in the same ultrasound machine (Samsung-Medison RS85). We must again state that, although without the liver biopsy as a reference, the results hold great importance, since the resulting values are very helpful in guiding the prediction of significant fibrosis and cirrhosis, using the elastographic techniques implemented on this type of equipment.

Liver biopsy is indeed the "gold standard" in the evaluation of any elastographic method, but lately the num-

ber of biopsies has dramatically decreased and therefore, TE must be used as reference in many instances when an elastographic technique is assessed.

In conclusion, the increasing number of ultrasound elastography methods are widely available on various types of ultrasound equipment, from high to medium class, and therefore, not before long, the screening of liver fibrosis in high-risk patients will be possible using US machines accessible to a wider range of medical specialties. Testing and validating each newly-introduced technique must be performed by reference centres, in order to develop interpretation guidelines for each particular technique.

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