



CONTINUING EDUCATION PROGRAM: EDITORIAL

Ultrasound elastography: A new modality in routine practice

With the Ultrasound Imaging Group of the French Society of Radiology (SFR-US), we wanted to dedicate a special issue of *Diagnostic and Interventional Imaging*, to an emerging technique: ultrasound elastography. This issue provides the readers with information necessary to understand this new modality on the eve of its clinical expansion.

Analogies with the development of pulsed wave and color Doppler modes are important, especially for techniques providing two-dimensional color-coded elasticity maps in real time in a window superimposed on a B-mode image. As for Doppler, this new mode, ultrasound elastography, can be activated by pressing a single control on the ultrasound diagnostic imaging device. One dimensional shear wave elastography allows tissue stiffness measurements in a small region-of-interest that can be moved on a B-mode image, with quantitative measurements in kPa (pulsed wave Doppler allowing velocity measurements obtained from the Doppler gate moved on the B-mode image). Quasi-static elastography (qualitative) or shear wave elastography (quantitative) also allows tissue stiffness evaluation in a region-of-interest with a color map. While the displayed frame rates of real-time shear wave based techniques are still low (about 1 Hz), it compares with those of color Doppler imaging in its infancy. On this two-dimensional map, one can position a measuring region-of-interest, which provides quantitative information: it is the equivalent of pulsed Doppler mode.

As for color Doppler, elastography imaging principles may seem complicated, but didn't we say in the 1990's that Doppler should be doomed to research university department only due to an increased examination time and to its complexity of implementation and interpretation?

However, the difference that remains today between these two techniques is their level of clinical impact. For Doppler, the ability to have hemodynamic information was obviously sufficient. For elastography, several steps remain, which are linked to multiple factors: the diversity of existing techniques that do not produce similar results (qualitative,

semi-quantitative and quantitative), performance which vary with techniques and clinical applications and finally the relatively limited number of validation studies, apart from liver stiffness assessment for chronic liver disease applications.

Indeed, this new approach provides access to a new way of characterizing the mechanical properties of tissues. As with any novel technique, validation phases are needed to master its acquisition, to obtain reliable and reproducible results and to understand the response mechanisms of normal and pathological tissues. These are the mandatory steps for this technique to be performed before being adopted clinically, although one senses several clinical applications.

It is the role of SFR-US group, invested in the development of ultrasound in French radiology practice, and which took part in the French Federation of Ultrasound (FFU) creation, to spread knowledge on new technologies and stimulate research in this area. This is the case at the JFR (French annual radiology congress) and within the inter-university degree in ultrasound imaging.

We are very grateful to all the authors who have contributed to the realization of this special issue of *Diagnostic and Interventional Imaging* and who are experts in this field. The articles presented here cover all the techniques developed in this area and the main clinical applications. Thus, Jean-Luc Gennisson, physicist and researcher at Institut Langevin in the team of Dr. Tanter and Professor Fink, presents the principles of ultrasound elastography techniques developed to date. Stephanie Franchi reports the results of an evaluation of these techniques on an elastography phantom, providing also information on advantages, limitations and artifacts specific to each technique. The first clinical applications involve breast, liver and thyroid, which are respectively reviewed by Corinne Balleyguier, Nora Frulio and Hervé Monpeyssen. Nicolas Grenier relates his experience with elastography for renal disease application, still in its infancy due to many technical challenges. Our group presents the different elastographic imaging

techniques and their performances for the application of prostate derived from our experience and the literature. Finally, Emmanuel Messas reported his experience with elastography in vascular diseases, and more particularly for arterial wall stiffness evaluation.

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Disclosure of interest

The authors have not supplied their declaration of conflict of interest.

J.-M. Correas^{a,*}, J. Roumy^b, N. Grenier^c

^a *Department of Adult Radiology, hôpital Necker-Enfants Malades, 149, rue de Sèvres, 75743 Paris cedex 15, France*

^b *Department of ultrasound and nuclear medicine, hôpital Bretonneau, 2, boulevard Tonnellé, 37044 Tours cedex 9, France*

^c *Adult Diagnostic and Interventional Imaging Department, groupe hospitalier Pellegrin, CHU de Bordeaux, place Amélie-Raba-Léon, 33076 Bordeaux cedex, France*

* Corresponding author.

E-mail address: jean-michel.correas@nck.aphp.fr

(J.-M. Correas)