New Imaging Techniques

Endoscopic Ultrasound-Guided Elastography

Julio Iglesias-García, MD, PhD*, Jose Lariño-Noia, MD, Juan Enrique Domínguez-Muñoz, MD, PhD

KEYWORDS

• Endoscopic ultrasound • Elastography • Stiffness • Diagnosis

KEY POINTS

- Endoscopic ultrasound (EUS) is considered a major imaging method in the management of several diseases of the gastrointestinal tract and surrounding structures.
- Elastography is a real-time method, based on ultrasound techniques, allowing the evaluation of tissue stiffness.
- EUS-guided elastography is considered an excellent tool in the differential diagnosis of solid pancreatic tumors and lymph nodes.
- There are emerging indications for EUS-guided elastography, such as the evaluation of liver lesions, subepithelial lesions, and left adrenal gland masses.

INTRODUCTION

The introduction of endoscopic ultrasound (EUS) in clinical practice is an important advancement in the management of a wide variety of diseases. EUS has been demonstrated to have significantly changed the diagnosis and/or management of up to 25% to 50% of cases.[1–4] Nevertheless, an accurate diagnosis cannot always be determined using only conventional B-mode EUS imaging. In many cases, EUS-guided tissue acquisition can provide a definitive diagnosis. Overall diagnostic accuracy of EUS-guided tissue acquisition can be considered to be very high, with sensitivities between 80% and 85%, and specificities approaching 100%.[5–7] However, EUS-guided tissue sampling is technically demanding and multiple punctures may be necessary to obtain a sufficient amount of tissue.[8,9] Furthermore, despite repeated sampling, cytohistologic assessment can be falsely negative and EUS-guided tissue acquisition is

Disclosure Statement: J. Iglesias-García: International Advisor for Pentax-Medical, Boston-Scientific. J. Lariño-Noia: No disclosures. J.E. Domínguez-Muñoz: No disclosures.

Department of Gastroenterology and Hepatology, Health Research Institute (IDIS), University Hospital of Santiago de Compostela, c/Choupana s/n, Santiago de Compostela 15706, Spain
* Corresponding author.
E-mail address: julioiglesiasgarcia@gmail.com

Gastrointest Endoscopy Clin N Am 27 (2017) 551–567
http://dx.doi.org/10.1016/j.giec.2017.06.001
giendo.theclinics.com

associated with small but not insignificant morbidity rates.[10] Hence, new methods have been warranted, allowing for a more accurate but still noninvasive characterization of lesions, limiting the need for EUS-guided tissue sampling and guided biopsies of areas with the highest suspicion of malignancy in cases in which tissue sampling is still necessary. Among them, EUS-guided elastography has arisen as a very promising technique.

Elastography is a real-time method for evaluation of tissue stiffness. Initial investigations occurred in the 1990s. Currently, the strain technique is available to be used under EUS guidance.[11] Strain elastography is a qualitative method to evaluate tissue stiffness based on eternal or internal generated force, which in EUS is based on the internal force concept.[12] The method is based on stiff tissues presenting lower strain so that they deform less under compression when compared with soft tissues. With strain elastography, the compression-induced tissue deformations within a region of interest (ROI) are assessed in a comparative fashion. Several different diseases, including cancer, can induce alterations in tissue stiffness.[13–15] Elastography was initially developed for evaluation of lesions accessible from the body surface and was performed with external probes. Today, elastographic evaluation can be performed from inside the gastrointestinal tract combined with conventional EUS.[15] Promising results have been reported for EUS elastography in several studies, indicating its high accuracy in differentiating benign from malignant lesions in the pancreas and lymph nodes. The aim of this article is to review the technical aspects and clinical applications of EUS elastography and to identify related areas for further study.

TECHNIQUE

Preparation

No specific preparation is needed from the patient point of view for performing the EUS-guided elastography. Patient positioning does not differ from the position needed for the performance of a standard EUS exploration.

Approach and Theory

Elastography has emerged from the development of the fremitus technique in breast ultrasonography, which demonstrates that healthy breast tissue vibrates more than solid malignant lesions, despite their isoechoic appearance under B-mode ultrasound.[13] Elastography is based on the knowledge that many different pathologic processes, such as fibrosis, inflammation, and cancer, induce alterations in tissue stiffness.[13–15] Elastography evaluates this stiffness through the application of slight compression using an ultrasound transducer to the targeted tissue and recording the resulting tissue displacement from the region evaluated. Physiologic vascular pulsations and respiratory movements provide the vibrations and compressions necessary for the study. Measurement of displacement is made using an algorithm based on the extended combined autocorrelation method.[16] Elastography can be performed in real time using a conventional EUS probe attached to a processor with the specific software installed.[15] First-generation EUS elastography allowed only qualitative evaluation. Today, second-generation EUS elastography also allows for the quantitative evaluation of tissue stiffness with 2 different approaches: strain ratio and strain histogram.

Technique or Procedure

Two different systems of elastography are available. The first is based on the qualitative evaluation of the pattern obtained from the elastographic study, whereas the second is based on an evolution of the software, allowing a quantification of the stiffness.