Future Directions for Endoscopic Ultrasound

Where Are We Heading?

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KEYWORDS

• Endoscopic ultrasonography • Elastography • Confocal endomicroscopy
• Contrast-enhanced • Device • Drainage • Future directions

KEY POINTS

- Technological advances have provided an expansion of the therapeutic potential of endoscopic ultrasound.
- New imaging modalities, including tissue harmonic echo, elastography, and contrast-enhanced harmonic endoscopic ultrasound, have enhanced the diagnostic capabilities of endoscopic ultrasound.
- Innovations in stent technology and new accessories, as well as echoendoscopes, such as the forward-viewing linear echoendoscopes, offer a broad range of indications for therapeutic endosonography.

DIAGNOSTIC ENDOSCOPIC ULTRASOUND

Endoscopic ultrasound (EUS) is a useful technique for the diagnosis and treatment of gastrointestinal (GI) tract diseases, particularly for the detection of small lesions, tissue acquisition, tumor staging, tumor ablation, and various drainage techniques.[1,2] The recent improvements in EUS technology have enhanced the diagnostic capabilities of EUS. Most recently, a new EUS processor, EU-ME2 Premier Plus (Olympus Medical Systems Corp, Tokyo, Japan) has been introduced to the market. This processor is capable of 3 new functions, including tissue harmonic echo (THE), elastography, and contrast-enhanced harmonic EUS (CH-EUS). The efficacy of THE has been has recently been reported, particularly in providing high-quality images of pancreatic cystic and solid lesion.[3,4] On the other hand, elastography is an important feature of EUS that may enable imaging to differentiate between benign and malignant lesions.[5]

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CH-EUS is another useful technology for the differential diagnosis of pancreatic tumors. However, the usefulness of these 3 new functions for the diagnosis and management of GI tract lesions is still not clear.

Tissue Harmonic Echo

THE imaging is a newly developed sonographic technique that can potentially provide higher quality images compared with conventional B-mode images.[3] THE seems to be an important examination modality because it is superior for imaging of pancreatic cystic lesions and ductal structures. In a consensus meeting, THE function of EU-ME2 Premier Plus was found to be useful in the diagnosis of both cystic lesions and solid lesions of the pancreas. Most participants stated that THE was useful for all pancreas-biliary lesions, including for the bile duct and gallbladder indications.[6] THE might provide more clear images delineating the borders of benign and malignant lesions. It is most likely to gain widespread acceptance in the near future due to its ease of use. Although THE provides an effective enhancement of EUS imaging, its utility in differential diagnosis and tumor staging, or to what extent it would provide information to distinguish between benign and malignant changes is still unclear. These issues should be clarified with further studies. THE provides the maximum intensity at an optimum depth below the surface. It is not useful for the visualization of the superficial tissues because the harmonic waves that are generated within the tissue increase with depth to a point of maximum intensity and then decrease with further depth as a result of attenuation. Therefore, the maximum intensity is achieved at an optimum depth below the surface.[7] However, by the development of new harmonics and technological modifications in the future, THE might be used for identification of the superficial submucosal tumors such as GI stromal tumors and gastric cancer.

Endoscopic Ultrasound–Elastography

Elastography is a new imaging technique that was developed to improve diagnostic EUS examinations.[5] Tissue stiffness is assessed and the differences between various lesions were used for differential diagnosis. In this modality, the elastic features of tissues are evaluated by doing slight compression of the tissue and the differences were compared before and after compression images. It can be useful in the differential diagnosis of a pancreatic solid mass from the normal parenchyma by identifying the margin of a solid mass.[8] However, the elastographic features of some tissues still remain unclear.

There are still some limitations of elastography. Commercially available EUS-elastography is not able to assess tissues quantitatively. It may assess relative stiffness compared with the surrounding tissue, which is a subjective evaluation with operator dependency. The new generation EUS-elastography devices are able to measure the mean strain ratio within a selected area between the targeted lesion and the surrounding tissue, providing a numeric value, but multiple measurements are needed to be performed in each patient for obtaining an optimal evaluation.[9] Furthermore, EUS-elastography has a high sensitivity but a low specificity (**Table 1**). It is usually able to diagnose solid masses, but it is not able to differentiate a mass from fibrotic tissue. That is why many endosonographers think that it is still very difficult to differentiate a pancreatic cancer from chronic pancreatitis based on elastography.[6] Shear wave elastography, including acoustic radiation force impulse imaging and supersonic shear wave imaging, may offer new imaging modalities to assess the stiffness of lymph nodes and the pancreas.[10]