REVIEW Print ISSN 2234-2400 / On-line ISSN 2234-2443
Clin Endosc 2012;45:321-323 http://dx.doi.org/10.5946/ce.2012.45.3.321

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Endoscopic Ultrasound, Where Are We Now in 2012?

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Topics related with endoscopic ultrasound (EUS) made up considerable portion among many invited lectures presented in International Digestive Endoscopy Network 2012 meeting. While the scientific programs were divided into the fields of upper gastrointestinal (UGI), lower gastrointestinal, and pancreato-biliary (PB) categories, UGI and PB parts mainly dealt with EUS related issues. EUS diagnosis in subepithelial lesions, estimation of the invasion depth of early gastrointestinal cancers with EUS, and usefulness of EUS in esophageal varices were discussed in UGI sessions. In the PB part, pancreatic cystic lesions, EUS-guided biliopancreatic drainage, EUS-guided tissue acquisition, and improvement of diagnostic yield in indeterminate biliary lesions by using intraductal ultrasound were discussed. Advanced techniques such as contrast-enhanced EUS, EUS elastography and forward-viewing echoendoscopy were also discussed. In this paper, I focused mainly on topics of UGI and briefly mentioned about advanced EUS techniques since more EUS related papers by other invited speakers were presented afterwards.

Key Words: Endosonography; Early gastrointestinal cancer; Subepithelial lesion; Technique

INTRODUCTION

In International Digestive Endoscopy Network 2012 meeting which was held on June 9 to 10, 2012 in Seoul, Korea, many endoscopic ultrasound (EUS) related topics were presented. Among them, EUS diagnosis in subepithelial lesions, estimation of the invasion depth of early gastrointestinal cancers with EUS, and advanced EUS techniques are reviewed in this article.

EUS IN SUBEPITHELIAL LESIONS

The wall of the gastrointestinal tract is well viewed as a five-layered wall structure by conventional EUS. Therefore EUS is a good tool to differentiate the nature of subepithelial lesions with the information of originating wall layers and echofeatures.[1] EUS can show specific echofeatures that can differentiate some subepithelial lesions such as lipoma or cyst. However, for definite differential diagnosis of subepithelial lesions, histologic access is usually needed. To obtain tissue specimen for diagnosis, EUS-guided fine needle aspiration (FNA) or EUS-guided Trucut biopsy may be used. Unfortunately, however, diagnostic efficacy of these procedures is limited. Therefore many other endoscopic procedures such as unroofing, endoscopic enucleation, or full-thickness resection have been introduced. If endoscopic resection is considered for a subepithelial lesion regarded as gastrointestinal stromal tumor (GIST), originating wall layer of the mass from the gut wall should be carefully evaluated with EUS.[2] Because endosonographic gut wall layers almost correspond with histologic wall layers, origin of GIST is the fourth layer-muscularis propria. In addition, benign EUS appearance of well circumscribed, homogeneously hypoechoic tumor with no cystic area or calcification and the size of less than 4 cm should be confirmed before considering endoscopic resection.

EUS IN ESTIMATION OF THE INVASION DEPTH OF EARLY GASTROINTESTINAL CANCERS

Recently, endoscopic therapy has been accepted as an excellent alternative modality to treat superficial gastrointestinal cancers showing no lymph node metastasis.[3] It is very critical to accurately determine the invasion depth of luminal malig-

Received: July 19, 2012 **Revised:** July 23, 2012
Accepted: July 23, 2012

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nancy in the selection of therapeutic options for the best treatment result.[4] EUS plays an important role in the evaluation of invasion depth of hollow viscus cancer including esophageal cancer, gastric cancer, and rectal cancer.

Accuracy of EUS in evaluation of esophageal cancer

Recent studies have shown that if the targets were properly selected, endoscopic resection of early esophageal cancer results in a 5-year survival rate of 98% and low recurrence rate. According to a meta-analysis, the pooled diagnostic sensitivity and specificity of EUS for T1 stage were 86.1% and 99.4%, respectively.[5] Among T1 cancer, mucosal esophageal cancer is subclassified into M1, M2, and M3, which respectively correspond to the cancer invasion of the epithelium, lamina propria, and muscularis mucosa. M1 and M2 cancers are the candidates for endoscopic resection with no risk of lymph node metastasis. High frequency miniprobe demonstrates well defined nine-layered structure of esophageal wall, which is in good correspondence with histological layers and provides high accuracy in decision making process for the selection of treatment options of early esophageal cancer. Shimoyama et al.[6] performed EUS with 12 to 20 MHz miniprobes for T staging and they were able to select correctly all candidates of endoscopic therapy. But there are also other conflicting studies insisting EUS does not appear to be sufficiently accurate in T staging.[7] To reach a definite conclusion, further studies with larger numbers of patients using adequate instrument and long term follow-up results would be necessary since most of the reports have small patient populations and used various low- and high-resolution instruments.

Accuracy of EUS in evaluation of gastric cancer

EUS provides higher accuracy of gastric cancer staging compared to that of computed tomography (CT). Accuracy of CT in T and N staging of gastric cancer were 76% and 70%, respectively, but those of EUS were 86% and 90%.[8] EUS is also a reliable method for evaluation of depth of gastric cancer invasion and can assist in selection of correct indication for endoscopic resection. One study from Korea has shown high accuracy of high-frequency catheter probe EUS in diagnosis of mucosal gastric cancer which was suitable for endoscopic submucosal dissection reporting 97.6% of diagnostic accuracy.[9] Main causes of over-staging or under-staging with EUS are ulcer, edema, fibrosis, inflammation, and microinvasion. It is also noted that cancers located in the upper third of the stomach, depressed morphology, and the size of larger than 3 cm show lower diagnostic accuracy on EUS.[10] As a result, the diagnostic accuracy of EUS for T staging of early gastric cancer is reported a wide range of 63% to 95% by different investigators with different experience.

Accuracy of EUS in evaluation of rectal cancer

For staging superficial rectal tumors, EUS has demonstrated accuracy rates ranging from 69% to 97%. The diagnostic accuracy of EUS T staging depends on many factors, such as operator's experience, tumor stenosis, postbiopsy peritumoral inflammation, hemorrhage, villous, or pedunculated tumors.[11] According to a meta-analysis, pooled sensitivity of EUS in diagnosing mucosal rectal cancer was 97.3% and pooled specificity was 96.3%.[12] Authors recommended that EUS should be strongly considered for staging of early rectal cancers to select proper indication of endoscopic treatment.

ADVANCEMENT OF TECHNIQUES IN EUS

In early days, piezoelectric crystal was used to generate ultrasound in EUS, but electronic scanning method has been adopted for both radial and linear echoendoscope these days. As a result, endosonographer can use color/power Doppler flow image. In addition, other advanced techniques such as contrast-enhanced EUS (CE-EUS) and EUS-elastography are available.

With development of linear echoendoscope, EUS-FNA has been employed. Many therapeutic applications of EUS are on the way. For better maneuverability, prototype of forward viewing convex echoendoscope has been developed recently.

CE-EUS

CE-EUS is composed of two main categories; CE power-Doppler EUS (CED-EUS) and CE harmonic EUS (CEH-EUS). After injection of contrast materials, increased intensity of week flow signal can be examined with color or power Doppler. Therefore, by using CED-EUS, differentiation of vascular-rich area and hypovascular area is possible with clarity. After development of harmonic imaging method, it is possible to get images of microcirculation and parenchymal perfusion with CEH-EUS. The use of CE-EUS allows a better visualization and differentiation of hypoenhanced mass suggestive of pancreatic adenocarcinoma and a hyperenhanced lesion which indicates an inflammatory mass.[13,14]

EUS-elastography

Tissue elastic imaging represents a technique that allows calculation and visualization of the hardness of tissue. Real-time tissue elastography with ultrasonographic approach is combined to EUS. With this technique, the real-time visualization of the calculated strain value can provide information on tissue hardness at the area of interest and the distribution pattern of tissue hardness as well. In addition to EUS image, these information can guide to select the most probable malignant

lymph node to approach for EUS-FNA.[15,16]

Forward viewing EUS

EUS-FNA is now indispensable procedure in both diagnosis and treatment of gastrointestinal diseases. Recently forward viewing convex echoendoscope has been developed to overcome the limitations of conventional oblique viewing echoendoscope. Kida et al.[17] reported that even though imaging field is narrower, image quality and penetration of forward viewing echoendoscope is nearly the same as those of conventional oblique viewing echoendoscopes. He also reported that it was easier to perform EUS-FNA with forward viewing echoendoscope compared to oblique viewing echoendoscope.[17] For therapeutic approach, usage of forward viewing echoendoscope was better with easy pass through gastrointestinal wall.[18]

CONCLUSIONS

Since the development of EUS in early 1980's, EUS evolved a lot and it plays an important role in the diagnostic and therapeutic fields of current gastroenterology, especially for subepithelial lesions and early gastrointestinal cancers. EUS is an essential tool that guides therapeutic approach. Development of advanced technology such as CE-EUS and EUS-elastography has elevated the diagnostic power of EUS and EUS-FNA. Development of forward viewing EUS will enhance therapeutic usage of EUS in the near future.

Conflicts of Interest

The author has no financial conflicts of interest.

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