Detection and Characterization of Solid Pancreatic Lesions (Contrast-Enhancement, Elastography, EUS-Guided Fine Needle Aspiration)

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Received 21 June 2012; Revision submitted 21 June 2012; Accepted 9 July 2012

Abstract

For detection of small pancreatic tumors and characterization of focal pancreatic masses, endoscopic ultrasound (EUS) is the most sensitive of the imaging procedures currently available. Differential diagnosis between benign and malignant focal pancreatic masses based on the EUS appearance is difficult and frequently requires EUS-guided fine needle aspiration (EUS-FNA) for confirmation of malignancy. New techniques improve the sensitivity, specificity, and accuracy of the differential diagnosis, as well as diagnosis of small pancreatic tumors (less than 2 cm diameter) by using real-time elastography or contrast-enhanced EUS. Nevertheless, EUS-FNA is still required for the final diagnosis in most of the cases, which allows an evidence-based management with referral to either curative surgery or palliative chemoradiotherapy. This article is part of an expert video encyclopedia.

Keywords

Contrast enhancement; Endoscopic ultrasound; EUS-guided fine needle aspiration; Pancreatic cancer; Real-time elastography; Video.

Video Related to this Article

Video available to view or download at doi:10.1016/S2212-0971(13)70238-3

Materials

- Echoendoscope: EG-3870 UTK; Hoya/Pentax Corporation, Tokyo, Japan.
- Ultrasound system: HV-Preirus; Hitachi Medical Corporation, Tokyo, Japan.
- Fine needle aspiration system: 22 G needle of 1400 mm, EZ Shot (NA-200H-8022); Olympus, Tokyo, Japan.

Technique

Endoscopic ultrasound (EUS) procedures begin after patient's anesthesia, with the echoendoscope inserted into the second part of the duodenum. The head of the pancreas and uncinate process are usually best viewed through the medial wall of the duodenum. Then the echoendoscope is withdrawn in the stomach, with the body and tail of the pancreas seen through the posterior wall of the stomach. Both the parenchyma and the ductal system are examined, with careful description of pancreatic tissue characteristics, as well as visualization of the main pancreatic duct and common bile duct.

If necessary, at the the end of the procedure, EUS-guided fine needle aspiration (EUS-FNA) is performed. Puncture aspiration is EUS-guided via an echoendoscope with longitudinal view, including examinations in power Doppler mode (to avoid puncture of interposed vessels with possible bleeding complications). A total of three to six passages are performed, with the needle contents expelled on several glass slides that are stained with various smears (Diff-Quik, Papanicolaou, etc.); additional content may be collected to obtain cell blocks.

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Background and Endoscopic Procedures

Ductal pancreatic adenocarcinoma is the most common malignant pancreatic neoplasm as it accounts for more than 95% of all malignant solid pancreatic tumors.[1] For detection of small pancreatic tumors and characterization of focal pancreatic masses, EUS, especially with the addition of EUS-FNA, represents the most sensitive and specific of the imaging procedures currently available.[1,2] Available EUS devices include radial and linear echoendoscopes, as well as thin catheter ultrasound probes. EUS has various applications, such as staging of gastrointestinal malignancy and evaluation of submucosal tumors, and has developed into an important modality for the assessment of the pancreaticobiliary system.

Pancreatic adenocarcinomas typically have the EUS appearance of a heterogeneous, hypoechoic mass with irregular margins.[1] Differential diagnosis between benign and malignant focal pancreatic masses or locoregional lymph nodes based on the EUS appearance is however difficult and frequently requires EUS-FNA for confirmation of malignancy.[3,4] The accuracy of EUS-FNA for the diagnosis of pancreatic carcinoma is reported to be 80–95%,[5] with a pooled sensitivity and specificity of 85% and 98%, respectively, in a recently published meta-analysis.[2]

Furthermore, color flow imaging in Doppler or power Doppler mode can be used to describe the peripancreatic

vasculature. Use of contrast enhancement in EUS (based on second-generation microbubble ultrasound contrast agents) has been shown to improve the characterization of the vasculature inside the lesion of interest, to better delineate benign from malignant pathology and to aid in staging and directing therapeutic procedures.[6] Thus, pancreatic adenocarcinomas are hypovascular, whereas pseudotumoral chronic pancreatitis or neuroendocrine tumors are either isovascular or hypervascular as compared with the surrounding parenchyma.[1]

Real-time sonoelastography performed during EUS is a promising imaging technique with a high accuracy for the differential diagnosis of solid pancreatic tumors by assessing tissue hardness, which might provide clinical utility in the diagnosis of pancreatic disorders.[7] Knowing that malignant tissues are generally harder than normal surrounding tissue, elastography might provide interesting clinical information to help distinguish benign from malignant tissue based on specific tissue consistency. EUS elastography was also reported to be useful for the differentiation of focal pancreatic masses, especially in pseudotumoral chronic pancreatitis and pancreatic cancer, especially in the presence of false negative EUS-guided FNA results and a strong suspicion of pancreatic cancer.[8] The accuracy of EUS-FNA for the diagnosis of pancreatic adenocarcinoma is reported to be 80–95%, depending on the type of the needle (cytological vs. histological), the technique used (with or without suction), the presence or absence of a cytopathologist in the examination room, etc. The results of initial studies were recently validated in a large multicentric study, indicating high values for sensitivity, specificity, negative predictive value, positive predictive value, and overall accuracy (93.4%, 66.0%, 92.5%, 68.9%, and 85.4%, respectively).[9]

Key Learning Points/Tips and Tricks

- The recent development of low mechanical index contrast harmonic EUS imaging offers hope for improved differential diagnosis, accurate staging, and monitoring of anti-angiogenic treatment in pancreatic adenocarcinoma.
- Real-time sonoelastography performed during EUS is a promising imaging technique with high accuracy for the differential diagnosis of solid pancreatic tumors, based on the assessment of tissue hardness.
- Differential diagnosis between benign and malignant focal pancreatic masses is nevertheless difficult and frequently requires EUS-FNA for confirmation of the malignancy.

Complications and Risk Factors

- Complication rate for EUS without the fine needle aspiration is approximately one in two thousand. This is similar to the complication rate of other advanced endoscopy procedures, especially when general anesthesia is associated.
- Several studies have reported a low rate of EUS-FNA complications, which include: bleeding (0–1.3%),[10–12] perforation (0–0.4%),[10,11] infection (0.3%),[10,11] and pancreatitis (1–2%).[10] The risk of bacteremia is low and prophylactic antibiotics are not recommended except for EUS-FNA of pancreatic cystic lesions.[13,14] Seeding of malignant cells along the FNA needle tract has been reported in EUS-FNA of pancreatic lesions[15]; however, the risk of this occurring is lower than in percutaneous biopsy.[16]

Scripted Voiceover

Time (min:sec)	*Voiceover text*
00:00 Transabdominal ultrasound	A 59-year-old woman was admitted for jaundice and moderate epigastric pain. Abdominal ultrasonography showed a suspicious mass within the head of the pancreas.
00:18 Endoscopic ultrasound: gray-scale, color Doppler, power Doppler	Linear endoscopic ultrasound (EUS) was performed for detailed visualization of the pancreas. EUS revealed a hypoechoic, inhomogeneous mass, 2 cm in diameter, at the level of the pancreatic head, poorly defined and obstructing the pancreatic duct and bile duct. Grayscale examinations are followed by color Doppler and power Doppler examinations, which show collateral vessels, but almost no Doppler signals inside the mass. The mass is adjacent to the mesenteric confluence and splenic vessels, but does not infiltrate them or the celiac trunk. EUS also shows multiple lymph nodes (round-oval), hypoechoic, up-to 1.5 cm diameter, located in the peripancreatic area.
1:39 Contrast-enahencd EUS	Then we performed low mechanical index contrast-enhanced endoscopic ultrasound. After injection of the contrast agent (4.8 ml Sono-Vue), we observe enhancement of the peritumoral tissues, with a hypoenhanced appearance (discrete uptake of the contrast) at the level of the pancreatic mass in the early arterial phase and the late venous phase.
2:10 Real-time sono-elastography	EUS elastography shows a hard mass, as compared with adjacent tissues, suggestive of a malignant tumor mass.

2:20 EUS-guided	Because differential diagnosis between benign and malignant focal pancreatic masses based on the EUS appearance is difficult, we continued the examination with EUS-guided fine needle aspiration for confirmation of malignancy. We performed three passes followed by cytology exam of the slides, indicating a clear-cut diagnosis of pancreatic adenocarcinoma. We thus demonstrated the usefulness of diagnosing a small pancreatic cancer using EUS, contrast-enhancement, real-time sono-elastography and EUS-guided fine-needle aspiration (FNA), which allowed surgery and postoperative staging.
3:18 Surgical sample	This is a picture of the postoperative tumor, which was staged as pT3N1M0.

Acknowledgement

This work was supported by research grant Partnership – PN II of the ANCS, CNDI – UEFISCDI, project number 2011-3,2-0503 and the grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-ID-PCE-2011-3-0589.

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