Gastric Cancer Staging by Endoscopic Ultrasound – Contrast Enhancement and Real-Time Elastography

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Abstract

Endoscopic ultrasonography (EUS) is the most efficient diagnostic method for local staging of gastric cancer, being able to differentiate between early and advanced primary gastric tumors with high performance rates. Although the accuracy of EUS for node (N) staging is lower than for the tumor (T) stage, ultrasound elastography could be used as a complementary method for the characterization and differentiation of benign and malignant lymph nodes in real time. EUS-guided fine-needle aspiration is indicated in gastric cancer if the positive result has a special impact on the clinical management of the patient. This article is part of an expert video encyclopedia.

Keywords

Endoscopic ultrasound; Gastric cancer; Video.

Video Related to this Article

Video available to view or download at doi:10.1016/S2212-0971(13)70067-0

Technique

Endosonography.

Materials

- Endosonography: Ultrasound system EUB 8500; Hitachi Medical System, Japan.
- Linear endoscopic ultrasound (EUS): Pentax EG 3830UT; Pentax, Tokyo, Japan.

Background and Endoscopic Procedure

Correct assessment of tumor, node and metastasis (TNM) stage is essential for the management of patients with gastric cancer. Patient prognosis and therapeutic decisions depend on tumor extension of the gastric wall and the presence of local lymph node metastasis, becoming more important as nonsurgical treatment regimens have improved.

EUS is the most efficient diagnostic method for staging of gastric cancer locally, and it has clearly managed to change the therapeutic decision in a substantial number of patients. In a recent meta-analysis of the literature, EUS had 86% sensitivity and 91% specificity for T staging, though it is nevertheless lower for N staging. Furthermore, it is able to differentiate between early to intermediate (T1–2) and advanced (T3–4) primary gastric tumors with high performance rates.

There are two scanning methods for the examination of the stomach: the water-filling method (by introducing 300–500 ml of 0.9% isotonic saline solution into the stomach) and the balloon contact method. Filling the stomach with liquid allows a good definition of the gastric wall structure, but it is difficult to examine the cardia and prepyloric areas, where the water-filled balloon method is more helpful. However, most of the authors prefer to work without filling the stomach with liquid. It is important to keep the transducer tip perpendicular to the lesion in order to obtain a clear image. The gastric wall is visualized by EUS with 7.5–12-MHz transducers as a five-layered structure. From the digestive tract lumen inward, the first hyperechoic and the second hypoechoic layers correspond to the mucosa, the third hyperechoic layer to the submucosa, the fourth hypoechoic layer to the muscularis propria, and the fifth hyperechoic layer to the subserosa and serosa. Cancer of the stomach is usually imaged as a hypoechoic disruption of the wall layers. In the seventh edition of the AJCC Cancer Staging Manual, the tumor mass is classified as follows: T is carcinoma in situ (intraepithelial without invasion of the lamina propria). T1 is subdivided: T1a tumor invades lamina propria or muscularis mucosae and T1b tumor invades submucosa. T2 tumor invades muscularis propria. T3 tumor penetrates subserosal connective tissue without invasion of visceral peritoneum or adjacent structures. T4 is subdivided: T4a tumor invades serosa and T4b tumor invades adjacent structures. Tumors arising at the esophagogastric junction, or in the stomach 5 cm or less from the junction and crossing the esophagogastric junction, are staged using the TNM system for esophageal carcinoma.

Locoregional staging of gastric tumors by EUS might be incorrect because of overstaging, which is more frequently encountered than understaging. This is due, most likely, to misinterpretation of peritumoral inflammatory reaction, presence of necrosis or peritumoral fibrosis (especially in ulcerative forms and small tumors), or tangential view of the gastric wall. Given the new TNM classification according to the
seventh edition of the AJCC Cancer Staging Manual, it will be even more difficult in the future to distinguish stage T2 tumors (muscularis propria invasion) from T3 tumors (subserosal invasion), respectively, from T4a tumors (infiltrating the serosa). Understaging usually occurs when there are micrometastases in the deep layers of the gastric wall or focal invasion of certain layers, which cannot be detected by EUS.

New techniques of image enhancement in EUS, using microbubble ultrasound contrast agents, could lead to better characterization of tumor vascularity, as well as differentiation of tumor stages or detection of resectability, through better visualization of vascular structures. In the authors’ experience, gastric cancer shows significant enhancement after intravenous injection of a second-generation contrast agent (SonoVue; Bracco Diagnostics, Inc, Bracco, Italy), with significant intratumoral arterial type vascular signals. The role of contrast-enhanced EUS in gastric cancer is not clearly established yet, but the correlation between intratumoral microvesSEL density, different angiogenic factors (including vascular endothelial growth factor), and the microvascularity of tumors has been demonstrated. This could allow early monitoring of the efficacy of antiangiogenic agents based on tumor perfusion quantification, before morphological changes become apparent and prognosis assessment of patients.

Likewise, EUS elastography has been suggested for characterization of tumors or enhanced detection of tumor stages. Furthermore, both techniques might be more important during follow-up in locally advanced or metastatic gastric cancer patients who are not referred to surgery but undergo chemotherapy and/or antiangiogenic treatment.

Differentiation of benign from the malignant lymph nodes is often difficult because of the low accuracy of EUS imaging criteria of malignancy, and limited penetration of the ultrasound beam. The authors consider metastatic a lymph node that fulfills at least three of the following four criteria: size over 1 cm, round in shape, with well-defined margins, and hypoechogenicity. Ultrasound elastography could be used as a complementary method for the characterization and differentiation of benign and malignant lymph nodes in real time; recent studies reporting sensitivity, specificity, and high accuracy (91.7%, 94.4%, and 92.86%). This is especially important for peritumoral lymph nodes where EUS fine-needle aspiration (FNA) cannot be performed because the needle would pass through tumor tissue.

To differentiate malignant nodes, EUS-guided FNA (EUS-FNA) can be used with very good specificity, although it is not routinely indicated in gastric cancer, unless the positive result has a special impact on the clinical management of the patient (e.g., presence of mediastinal adenopathies). EUS-FNA can confirm the presence of distant metastases located in the mediastinum, but also in the liver (left lobe), para-aortic, portal, and celiac lymph nodes, omentum, adrenal glands, and neoplastic ascites.

### Key Learning Points/Tips and Tricks

- EUS is the most efficient diagnostic method for local staging of gastric cancer, for both T and N stages.
- Locoregional staging by EUS might be incorrect because of understaging due to micrometastases present in the deeper layers of the digestive tract or lymph nodes, respectively, overstaging due to the presence of peritumoral fibrosis and inflammation (especially in stages T1 and T2, and/or ulcerative types), or large reactive lymph nodes.
- EUS-FNA is not routinely indicated in gastric cancer, unless it can confirm the presence of distant metastases.

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References