ORIGINAL ARTICLE

The usefulness of contrast-enhanced harmonic EUS-guided fine-needle aspiration for evaluation of hepatic lesions (with video)

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Background and Aims: Small hepatic masses often do not have distinct margins on B-mode EUS images. Contrast-enhanced harmonic EUS (CEH-EUS) is widely used for evaluating ambiguous pancreatic lesions. However, its role in detecting hepatic lesions and the use of EUS-guided FNA are not well evaluated. We investigated the usefulness of CEH-EUS–guided FNA for evaluating hepatic lesions.

Methods: Thirty consecutive patients with hepatic masses underwent CEH-EUS and CEH-EUS–guided FNA between September 2010 and November 2016.

Results: Twenty-eight patients (93.3%) had malignant tumors and 2 patients (6.7%) had benign hepatic masses. Before contrast enhancement, 73.3% of the hepatic lesions (22/30) in the patient cohort were visible on B mode. After contrast enhancement, 93.3% of these hepatic lesions (28/30) were distinguishable from the surrounding liver parenchyma. The technical success rate was 100%. The median tumor size on EUS and the number of needle passes were 24.5 mm (interquartile range [IQR], 14.5-40.8) and 2 (IQR, 2-3), respectively. The diagnostic accuracy of CEH-EUS–guided FNA was 86.7% (26/30 cases). There were no procedure-related adverse events.

Conclusions: CEH-EUS–guided FNA can be a safe and efficient method for the diagnosis of hepatic masses. It can result in high diagnostic accuracy in cases where the hepatic lesions are poorly visible on conventional EUS. (Gastrointest Endosc 2018;■:1-7.)

INTRODUCTION

The pathologic diagnosis of hepatic masses is traditionally made via a percutaneous approach under US or CT guidance.[1] Confident visualization of a target lesion is one of the prerequisites for a successful and safe biopsy. However, target lesions cannot always be visualized on US when they are less than 2 cm in size or when they are difficult to distinguish from the surrounding tissue (ie, isoechoic lesions).[2] It is also difficult to identify hepatic lesions on US in patients with a large body habitus because of poor sound penetration.[2,3]

EUS is widely used for the diagnosis of pancreatobiliary diseases, and EUS-guided FNA; in particular, it is commonly used for obtaining a histologic diagnosis.[3-6] CT, transabdominal US, and magnetic resonance imaging have been the principal tools for evaluating hepatic lesions for a long time.[7] However, considering the parenchymal features of the liver, small hepatic lesions detectable on contrast-enhanced cross-section imaging may sometimes be difficult to identify and to sample by conventional EUS. Contrast-enhanced harmonic endoscopic ultrasound (CEH-EUS) has been proposed as an adjunctive method to enable a better differential diagnosis of pancreatobiliary

Abbreviation: CEH-EUS, contrast-enhanced harmonic endoscopic ultrasound; CEUS, contrast-enhanced ultrasound.

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diseases.[8] Currently, CEH-EUS has been applied primarily for pancreatic diseases for the characterization of tumors, particularly differentiation of inflammatory tumors from neoplasms.[9] It improves diagnostic yield because it can correctly classify 80% to 100% of the false-negative cases identified by EUS-FNA.[10-12] Although second-generation US contrast agents enable real-time continuous imaging of focal hepatic lesions over several minutes with abdominal ultrasound, no studies have evaluated the utility of CEH-EUS–guided FNA for focal hepatic lesions.[13] Therefore, in our current study, we investigated the role of CEH-EUS in improving localization of the target biopsy site and evaluated the diagnostic accuracy of CEH-EUS–guided FNA in patients with hepatic masses.

METHODS

Patients

Thirty consecutive patients who underwent CEH-EUS–guided FNA for hepatic lesions between September 2010 and November 2016 at Asan Medical Center were included in this study. All patients were >20 years of age. All targeted hepatic lesions were known by radiologic examination before EUS. The indications for conducting CEH-EUS–guided FNA in our study included a pancreatic lesion with a hepatic mass, failure of percutaneous liver biopsy, contraindications for a percutaneous liver biopsy, liver mass to assess the primary lesion and to establish tissue diagnosis. None of the patients received antiplatelet agents within the 5 days before the EUS-FNA. The exclusion criteria for our study cohort were as follows: (1) pregnancy, (2) age <20 years, and (3) contraindications for receiving a contrast agent (such as allergic reactions, severe pulmonary hypertension, severe coronary heart disease, severe heart failure, or serious arrhythmias). Written informed consent was obtained from all patients before the procedure. This study was approved by the institutional review board (IRB) of Asan Medical Center (IRB number, 2017-1038).

Equipment

CEH-EUS–guided FNA was performed using a linear-array echoendoscope (GF-UCT 260; Olympus Optical, Tokyo, Japan). A Prosound F75 (Aloka Co Ltd, Tokyo, Japan) was used to analyze the image with extended pure harmonic detection, which selectively receives signals from microbubbles by synthesizing the phase-shift signals with the second harmonic components.[14]

Classification of hepatic lesions on B mode before contrast enhancement

Before starting EUS, a linear-array echoendoscope was introduced into the stomach or the duodenum to visualize the hepatic lesions. For CEH-EUS, second-generation US contrast agents were used. SonoVue (Bracco, Milan, Italy) was used in our patient series from 2010 to 2015. From 2016 onward, Sonazoid (Daiichi Sankyo, Tokyo, Japan) was used because it was available. A 2-step algorithm was used for the procedure with SonoVue. Before the biopsy procedure, the contrast agent was prepared in accordance with the manufacturer's instructions in 2 doses of 2.5 mL each. The first dose was administered to identify the target lesion, and the second dose was administered to enable CEH-EUS–guided biopsy. Each dose was immediately followed by injection of 10 mL of saline solution. When Sonazoid was used, a 0.015 mL/kg bolus of this agent was administered followed by injection of 10 mL of saline solution before beginning CEH-EUS.

Before CEH-EUS–guided FNA, the target lesions were classified into the following 4 categories according to the intensity of enhancement relative to the surrounding tissue based on a classification scheme from a previous report on contrast-enhanced harmonic imaging with transabdominal US: nonenhancement, hypoenhancement, isoenhancement, and hyperenhancement.[15] Nonenhancement lesions were characterized by a lack of enhancement. Hypoenhancement lesions were characterized by a heterogeneous distribution and a lower intensity of enhancement relative to the surrounding liver tissue. Isoenhancement lesions were characterized by a homogeneous distribution and a similar intensity of enhancement relative to the surrounding liver tissue without any margins. Hyperenhancement lesions were characterized by a higher intensity of enhancement relative to the surrounding liver tissue (Fig. 1).

The changes in the margins and the internal echogenicity were also compared before and after contrast enhancement. The visibility of the hepatic lesions was graded, using the following 4-point scoring system: score 0, invisible; score 1, suspected lesion; score 2, faintly visible lesion; and score 3, clearly visible lesion (Fig. 2). Clearly visible hepatic lesions were defined when the echogenicity of the target lesion was distinctly different from that of the surrounding liver and >90% of the lesion was visible. Faintly visible lesions were defined as slightly different from the surrounding liver and >50% of the lesion had a well-defined margin. Suspected lesions were defined as cases where the target lesion was nearly isoechoic to the surrounding liver and <50% of the lesion had a well-defined margin.[16]

EUS-FNA procedure

EUS-FNA was performed by an experienced endosonographer (D.W.S.). All procedures were performed with the patient under conscious sedation with intravenous midazolam and meperidine using a linear-array echoendoscope. A baseline investigation under B-mode EUS was performed. Briefly, after localization of the lesion, the transducer was kept in a stable position and the imaging mode was shifted to contrast harmonic imaging mode. Contrast agent was then administered as a bolus injection followed by an additional 10 mL of saline solution flush. The CEH-EUS–guided FNA procedure was performed in