The added value of contemporary ultrasound technologies in the diagnosis of malignant tumours of the gastrointestinal system – a case report

Johannes Rübenthaler, Maximilian Reiser, Dirk-André Clevert

Department of Clinical Radiology, Interdisciplinary Ultrasound Center, LMU Munich, Grosshadern Campus, Munich, Germany

Abstract

Ultrasound of the gastrointestinal system has become more popular among clinicians and is an important tool for evaluation and follow-up. Ultrasound has a special value in patients with Crohn's disease for the evaluation of disease activity but also for the evaluation of abdominal complications and shows comparable results to other imaging modalities. With the introduction of elastography and contrast-enhanced ultrasound into clinical routine, THE sonographic evaluation of the small bowel is even more sophisticated and even more precise. This case report summarizes all available modern ultrasound imaging technologies and highlights the possibilities in daily clinical use.

Keywords: Contrast-enhanced ultrasound; abdominal imaging; dynamic perfusion

Introduction

Recently the European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) task force for Gastrointestinal Ultrasound (GIUS) published recommendations and guidelines based on the necessity to standardize examination techniques and to train and educate inexperienced clinicians [1]. Contrast-enhanced ultrasound (CEUS) and Elastography have been proposed on a strong consensus to clinically add benefit and to supplement B-mode and color/power-Doppler ultrasound in the evaluation of the gastrointestinal system. One of the most widespread uses of GIUS, beside acute abdominal conditions, is the evaluation and follow-up of patients with Crohn's disease [2-4]. Beyond assessing disease

activity, ultrasound has been shown to have a high diagnostic accuracy, comparable to computed tomography (CT) and magnetic resonance imaging (MRI), in the detection of abdominal complications [5-8]. Ultrasound can furthermore detect abdominal lesions that were initially unsuspecting using other imaging modalities [9].

This case report summarizes in a synopsis, all available contemporary ultrasound technologies and shows the added value of these dynamic examination techniques in comparison to CT in the evaluation of the gastrointestinal system.

Case Report

A 43-year-old woman with a known history of Crohn's disease presented to our emergency department with acute abdominal pain located in the right lower abdomen. Two months previously, the patient had undergone a right hemicolectomy in our hospital with a histopathologically confirmed diagnosis of a caecum carcinoma. The patient was referred from her general practitioner who already performed a native B-mode ultrasound with the suspected diagnosis of an abscess in the right lower abdomen. Physical examination with palpation revealed

Received 09.05.2017 Accepted 17.06.2017

Med Ultrason

2018, Vol. 20, No 1, 105-107

Corresponding author: Dr. Johannes Rübenthaler

Department of Clinical Radiology,

University of Munich

15 Marchioninstr. 81377 Munich, Germany

Phone: +4989/4400-73620

Fax: +4989/4400-78832

E-mail: Johannes.Ruebenthaler@med.uni-muenchen.de

Fig 1. Initial contrast-enhanced CT scan in axial (a) and coronal (b) reconstruction. In the right lower abdomen ventral to the psoas right muscle a contrast-enhancing structure can be depicted (yellow arrows) with surrounding fluid. Since the patient had a known history of Crohn's disease the initial report stated that this is in line with inflammatory changes of the bowel wall and an additional ultrasound for further validation was recommended.

a pain in the right lower abdomen but laboratory results were normal (CRP 0.3 mg/dl; reference ≤ 0.5 mg/dl). An additional contrast-enhanced CT for exclusion/confirmation of an abscess was performed, showing inflammatory changes in the bowel walls in the right lower abdomen and surrounding fluid collections (fig 1). An additional ultrasound scan was recommended for further verification.

Ultrasound examination was performed using a 1-7 MHz multifrequency curved-array probe with color/power-Doppler and CEUS capabilities and additional elastography was performed using a high-frequency probe with elastography-capabilities. The acquired dynamic image sequences were digitally stored on the ultrasound system (RS80A with Prestige, Samsung Medison Co., Ltd., Seoul, Korea) and SonoVue (Bracco, Milan, Italy) was administered as ultrasound-contrast agent.

Fig 2. Ultrasound examination. Native B-mode ultrasound of the right lower abdomen (a) found a hypoechoic mass (yellow arrows) adjacent to a bowel wall (white arrows). Color- (b) and power-Doppler (c) ultrasound revealed a major hypervascularization of the hypoechoic mass (yellow arrows) compared to the bowel structures (white arrows). Additional elastography with a high-frequency probe (d) revealed differing tissue stiffness of the mass (yellow arrows) compared to the bowel (white arrows) in line with a solid hypoechoic lesion. The initial suspected diagnosis by the referring general practitioner of an abscess could be excluded due to the vascularization and stiffness of the mass and also the suggested diagnosis of an inflammatory bowel could be excluded due to strong hypervascularization and elastography findings.

Fig 3. Contrast-enhanced ultrasound (a) in side-by-side mode with native B-mode ultrasound (b) shows major vascularization of the hypoechoic mass (yellow arrows) also visible on B-mode ultrasound (white arrows). In the central area of the lesion a hypovascularization can be depicted in line with central necrotic changes of this mass. Since this patient had a known history of a caecum tumour, these findings were in line with local recurrence of this tumour, which was later on histopathologically confirmed after resection.

Ultrasound showed a solid hypoechoic and hypervascularized lesion adjacent to the bowel wall in the right lower abdomen. The lesion was stiffer compared to the adjacent bowel wall (fig 2). After the single intravenous administration of 2.4 ml SonoVue followed by a 10 ml 0.9 saline-solution bolus, CEUS showed a distinctive perfusion pattern of the lesion in line with local recurrence of the initially resected caecum carcinoma (fig 3). A complete surgical resection was realized and the diagnosis was confirmed by histopathology.

Discussions

Compared to the initial contrast-enhanced CT, CEUS and elastography were able to clearly differentiate between the bowel wall and adjacent structures. CEUS revealed a separate perfusion pattern of the hypoechoic mass and elastography clearly showed a harder tissue stiffness indicating a different tissue adjacent to the

bowel wall [10]. Even on native B-mode ultrasound the hypoechoic mass could be clearly delineated from the bowel wall because of the superior spatial resolution of the ultrasound system [11]. Although in clinical routine mostly CT scans are requested for the initial work-up of unclear abdominal pain, ultrasound should always be the first imaging modality of choice, as in this case the cause for the pain could be diagnosed solely using modern ultrasound imaging methods. Especially in young and elderly patients with impaired renal function, ultrasound, elastography, and CEUS are radiation-saving, almost contraindicating free imaging technologies for the initial evaluation of GIUS. These techniques have recently been enhanced with guidelines and should be further implemented into clinical routines.

In **conclusion** we portrayed the evaluation of an unclear mass in the right lower abdomen using contemporary ultrasound technologies including color/power-Doppler, CEUS, and elastography in a patient with a known history of Crohn's disease. Modern ultrasound was the reference imaging modality in this setting for the correct evaluation and diagnostic work-up and should always be kept in mind not only as an additional but also as initial tool for the work-up of lesions in the gastrointestinal system.

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