How to diagnose splenic abscesses?

M. Nieciecki[1], M. Kożuch[2], M. Czarniecki[3], R.K. Mlosek[1], A. Michno[4], W. Olszewski[5], A. Danowska[6], L. Królicki[7]

(1) Department of Diagnostic Imaging, Second Faculty of Medicine, Medical University of Warsaw, Poland ; (2) Clinic of Gastroenterology, National Food and Nutrition Institute, Warsaw, Poland ; (3) Department of Radiology, MedStar Georgetown University Hospital, Washington DC, USA ; (4) Department of Diagnostic Imaging, Mazovian Brodno Hospital, Warsaw, Poland ; (5) Department of Pathology, Maria Skłodowska-Curie Memorial Cancer Center and Institute of Oncology, Warsaw, Poland ; (6) First Department of General and Vascular Surgery, Second Faculty of Medicine, Medical University of Warsaw, Poland ; (7) Department of Nuclear Medicine, First Faculty of Medicine, Medical University of Warsaw, Poland.

Abstract

Splenic abscess is a rare but potentially fatal entity, occurring mainly in patients with underlying risk factors. Mortality of the disease depends on the time of diagnosis and treatment. Due to low sensitivity and specificity of clinical symptoms and laboratory markers, imaging plays the vital role in the diagnostic work-up. The aim of this article is to give a concise overview of the methods of splenic abscess diagnosis. (Acta gastroenterol. belg., **2019**, 82, **421-426**).

Key words : splenic disease, pancreatitis, ultrasound, computed tomography, nuclear medicine, magnetic resonance imaging.

Introduction

Splenic abscess is an uncommon entity found in less than 1% of autopsy studies (1,2). Predisposing factors associated with its occurrence include pyogenic infections, splenic trauma, immunosuppression and infectious spread from neighboring organs (2). Mortality of patients with splenic abscesses depends on diagnosis and treatment. A significant delay in management may have an influence on prognosis (3). Mortality ranges from 0% to 24.5% in properly diagnosed and treated patients, which may include a splenectomy or abscess drainage in selected cases, intravenous antibiotic therapy or antifungal treatment. However, in case of suboptimal management, it may reach 100%. Unfortunately, the most commonly reported clinical symptoms of splenic abscess, such as fever and abdominal pain are non-specific. Leukocytosis is frequent, but non-pathognomonic, and found in about 60%, with negative blood cultures in more than the half of the cases (4). Due to low sensitivity and specificity of clinical signs and laboratory markers, imaging plays a key role in diagnosing splenic abscesses.

Case study

A 67-year-old female presented to the emergency department with epigastric pain, nausea and bloating for several days. Physical examination demonstrated pain on palpation in the epigastrium. Laboratory tests showed markedly increased urinary amylase activity 2340 U/L (reference range 30-640 U/L). and slightly elevated serum amylase activity 129 U/L (reference range 25-125 U/L). Inflammatory marker levels were increased: white blood cells (WBC). 13,000 cells/mcL (reference range 4000-10,000 cells/mcL). and C-reactive protein (CRP). plasma concentration 90 mg/L (reference range <5 mg/L). were found. Blood culture tests were negative. On review of the patient's history, the woman was previously hospitalized in the gastroenterology department due to acute on chronic pancreatitis. In the course of the last hospitalization a few days before, endoscopic retrograde cholangiopancreatography (ERCP). was performed.

The patient was admitted to the gastroenterology department with a diagnosis of acute pancreatitis and conservative treatment was applied. On the 6th day of hospitalization, a one-day episode of 40°C fever was observed. Abdominal ultrasound revealed an extensive hypoechogenic area located between the tail of the pancreas and involving the splenic hilum consistent with peripancreatic inflammation with the infiltration of the splenic capsule (Fig. 1A-1B). Numerous calcifications within the non-enlarged pancreas and two stents within the non-dilated pancreatic duct were also noted. Moreover, the examination showed an ovoid, centrally located hypoechogenic lesion, more than 5 cm in size, and several smaller peripheral lesions within the splenic parenchyma (Fig. 1C). The multiple echogenic foci suggested the presence of internal gas bubbles in the largest lesion. On B-mode images, no capsule was seen around the lesion and color-doppler did not demonstrate vascularity (Fig. 1D).

Abdominal CT confirmed the presence of a hypodense, heterogenous 7x3x5 cm lesion corresponding to the splenic abscess. Numerous smaller peripheral lesions were also seen (Fig. 2A). The examination showed extensive peripancreatic fat stranding and a loculated fluid collection (Fig. 2B). Scattered pancreatic calcifications were also visualized (Fig. 2C). Two stents within the dilated pancreatic duct (4 mm). were shown (Fig. 2D).

The patient was qualified for an open splenectomy and was discharged after 3 weeks of further IV treatment in a good general condition. Gross pathology and microscopic

Correspondence to : Michał Niecieck i, MD, Department of Diagnostic Imaging, Medical University of Warsaw, 8 Kondratowicza St., 03-242 Warsaw, Poland. Tel. +48 22 3265810.
E-mail : msniecieck i@gmail.com

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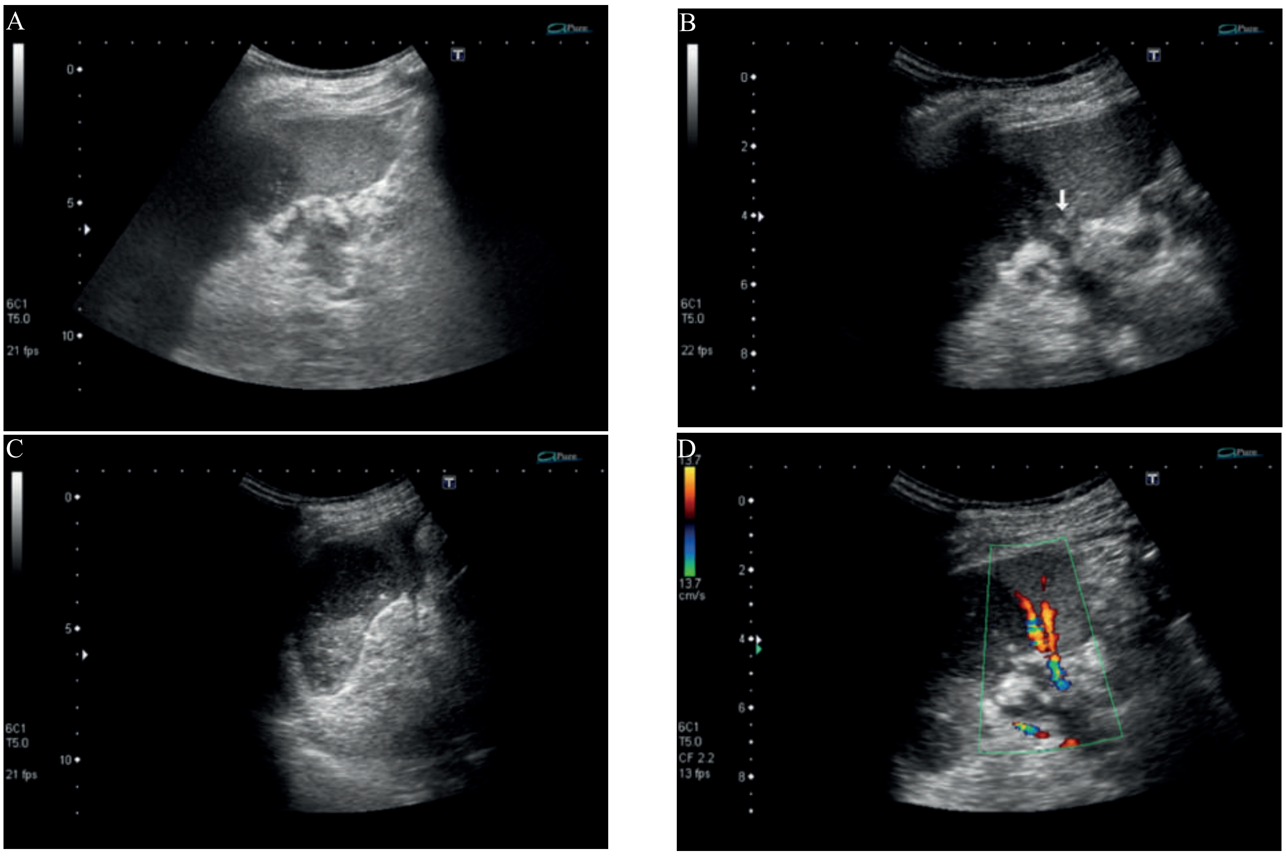

Fig. 1. — Abdominal ultrasound examination.
A : B-mode image. Inflammatory infiltration of the pancreatic tail and splenic hilum region. B : B-mode image. The site of inflammatory infiltration into the splenic capsule (arrow). C : B-mode image. Multiple hypoechoic lesions - splenic abscesses. D : Color Doppler ultrasound examination of the vessels in the splenic hilum - splenic abscess as an avascular lesion.

examination confirmed the presence of multiple splenic abscesses and microabscesses (Fig. 3A-B).

Conventional x-ray

Initial imaging of patients with clinical symptoms in the upper quadrants of the abdomen can be performed by abdominal (AXR). or chest X-ray (CXR). Although abnormalities in plain radiographs are common, findings are usually non-specific and variable. Changes are found in 33-82% of CXR conducted in patients with splenic abscess, while on AXR abnormalities are visible in 25-69% (2,5,6). Ooi et al. showed that features on CXR and/or AXR suggestive for splenic abscess were demonstrated in 32,9% (4). Chun et al. revealed, that the most common sign in CXR was an elevation of the left hemidiaphragm, which was present in almost 1/3 of patients (2,3). Left pleural effusion (28.4%). and left basilar pulmonary infiltrates (17.9%). were also described (2,3). The results of AXR most commonly showed features of soft-tissue mass in the left upper quadrant (35,6%). (2,3). Extraluminal gas shadowing or air-fluid levels in the left epigastrium were also observed (2,5,6,7,8,9,10). In some cases, displacement of the left kidney outline was also identified (4). Barium contrast radiographs may show displacement of the stomach or splenic flexure (3,10).

Although radiological signs of splenic abscesses in plain radiographs are non-specific, in correlation with clinical symptoms and laboratory tests, they may indicate further diagnostic work-up.

Abdominal ultrasonography

Abdominal ultrasonography (US). is a safe, low-cost and easily available imaging modality, which plays the main role in the early diagnosis of splenic abscess. It can be repeatedly performed in patients with risk factors of splenic disease. High-frequency transducers (3,5-5 MHz). are applied for the evaluation of the spleen. An intercostal approach along the long axis of the 10th rib posterolaterally on the left side is usually used (11). The normal spleen has a homogeneous echotexture and its echogenicity is slightly higher than that of the kidney but lower than that of the liver (11). Its dimension in the long axis usually does not exceed 12 cm (12). Splenic abscesses may be formed both in an enlarged and normal-sized spleen (13,14). Abscesses appear as round, ovoid or fusiform focal lesions with an irregular wall (13, 14,15). They typically demonstrate an anechogenic or hypoechogenic pattern, in some cases with foci of mixed or high echogenicity (4,13,14,15). Highly echogenic foci within the abscess are usually found in gas-containing

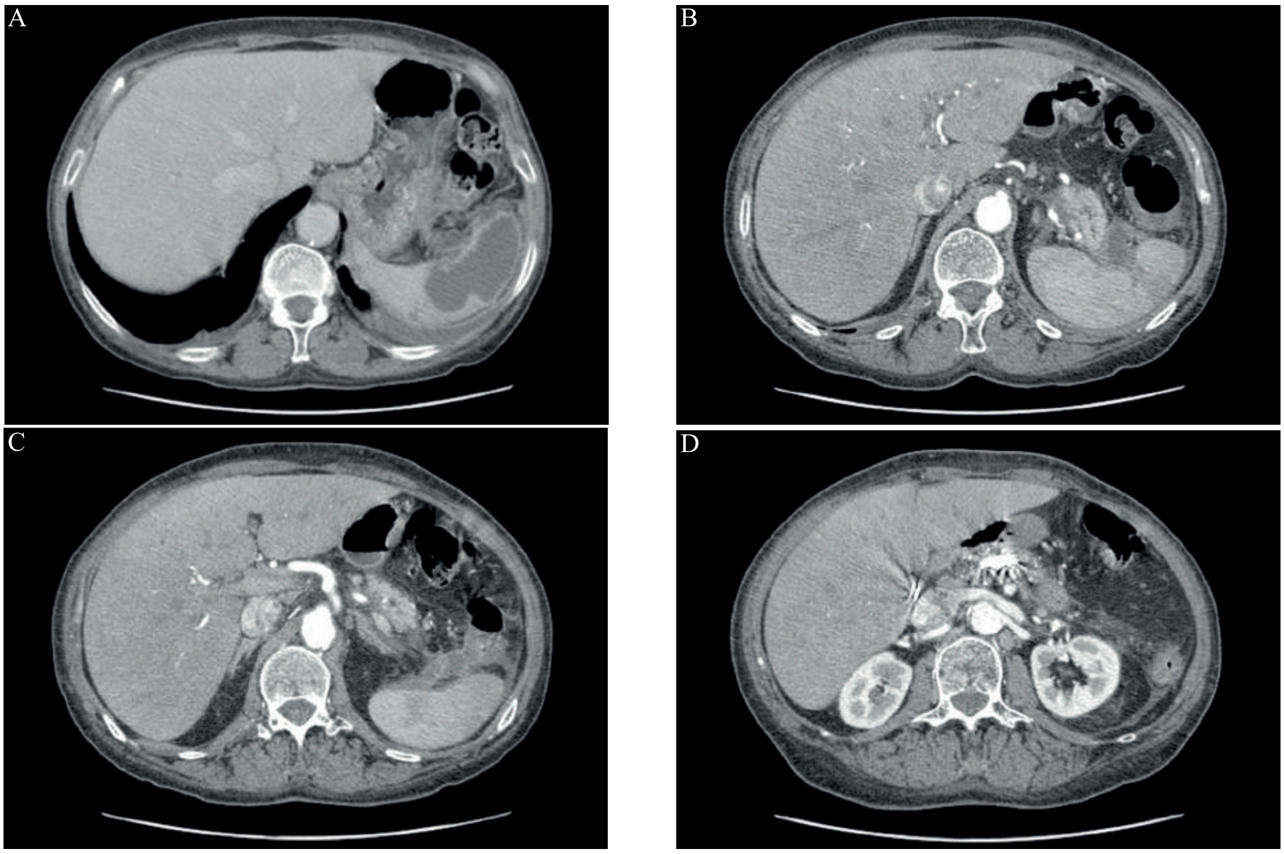

Fig. 2. — Contrast-enhanced abdominal CT scan
A : Splenic abscesses as multiple hypodense lesions. B : Inflammatory infiltration of the splenic hilum - features of acute pancreatitis.
C : Calcifications within the pancreatic tail - features of chronic pancreatitis. D : Stent in the pancreatic duct.

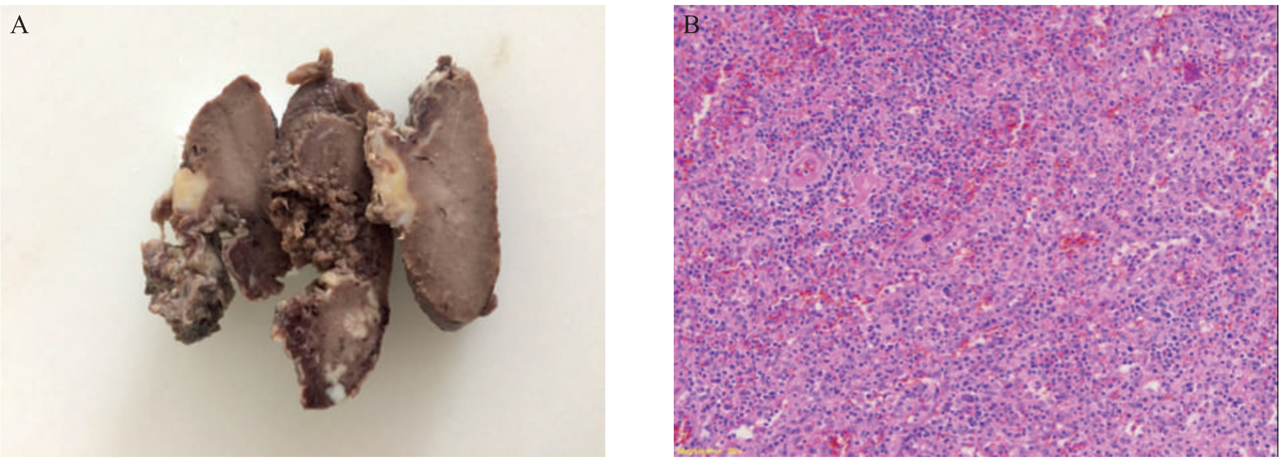

Fig. 3. — Histopathology- abscesses and microabscesses
A Gross pathology. B : Microscopic examination (hematoxylin-eosin staining)

lesions (4,13,14,15). In some cases, fluid-fluid levels or septations are depicted (14,15). Minimal to moderate posterior acoustic enhancement may be present behind the lesion. However, in some patients, this was not seen (13,14,15).

The sensitivity of abdominal ultrasonography in the diagnosis of splenic abscesses is estimated at 75-93% (4,13). At the same time, some authors underline its limited specificity (13). Areas of infarcts, hematomas, as well as primary and secondary malignancies, should be considered in the differential diagnosis (4,13). However, certain sonographic patterns were recognized to correlate with an etiology of a splenic abscess. The wedge-shaped lesions may be formed as a consequence of infectious spread from distant locations, e.g. in the course of endocarditis (14,16). Such changes may be similar to areas of infarction (16). Moreover, abscesses may evolve from infarcts or hematomas, which justifies the necessity of frequent follow-up examinations in this group of patients (14).

Abscesses of fungal etiology were described as small multiple lesions with a highly reflective center and hypoechogenic rim ("bull's eye", "target", or "wheel-within-a-wheel" sign). (12,16,17). Such micro-abscesses may be easily mistaken as tuberculosis, lymphoma, metastases or sarcoidosis (12,14,16,17). In these cases, high-frequency linear transducers may be applied (16).

Vascular perfusion is usually evaluated in power- and color-doppler imaging (PD, CD). Contrast-enhanced ultrasound (CEUS). may also be utilized. Splenic abscesses are typically described as avascular lesions (18). Unfortunately, more than 2/3 of splenic lesions in CD show a similar pattern, limiting its utility in differentiation (18). In CEUS, splenic abscesses typically appear as unenhancing areas. However, an enhanced border may be seen, especially in microabscesses (19)

Although abdominal US is a well-established tool for initial assessment in the suspicion of splenic diseases, a wide range of ultrasonographic patterns and lack of pathognomonic features make it difficult to diagnose splenic abscess, basing only on sonographic appearance. Further limitations may be revealed as abdominal US is highly operator-dependent and difficult to perform examination, especially in obese patients or in case of excessive bowel gas.

Computed Tomography

In further diagnostics of splenic abscess, computed tomography (CT). of the abdominal cavity is usually performed. Normal splenic parenchyma on plain CT is homogenous, with attenuation coefficients ranging from 40 to 50 Hounsfield units (HU). (20). During the first minute of examination after contrast administration, inhomogeneous enhancement of splenic tissue is observed. Then its parenchyma becomes gradually homogeneous (20). Splenic abscesses on CT present as solitary or multiple, well-defined, hypodense lesions with attenuation values of 20-40 HU (21). The presence of gas within the lesion is characteristic although an uncommon sign, which can be accurately detected in abdominal CT (20). In cases of abscess rupture, gas may be present also in the peritoneal cavity (9). After contrast administration, the interior of an abscess is unenhanced. Minimal peripheral contrast enhancement is observed in more than half of cases (22). Some authors associate radiological appearance of abscesses with their etiology. Solitary and large lesions were encountered in patients with bacterial abscesses, whereas multiple smaller lesions indicated a fungal infection (21).

The sensitivity of abdominal CT in the diagnosis of splenic abscess ranges from 92 to 96%, and in combination with the ultrasound examination, it is estimated at 94.7% (4,5). Some authors reported limited specificity of abdominal CT, while according to other studies it varies from 90 to 95% (4,6,23). Differential diagnosis of splenic abscess in CT and US is similar. Certain advantages of CT examination include fast, accurate and reliable assessment of the spleen as well as other organs. Nonetheless, CT scan is associated with radiation exposure and its cost is higher than US. Abdominal CT, as well as US, may be used to assist percutaneous drainage of splenic abscess (24,25,26,37).

Magnetic resonance imaging (MRI).

Abdominal MRI is a diagnostic modality used in patients with suspected splenic abscess whose US and CT scan results are inconclusive (4,11). MRI may be also conducted if iodine contrast or radiation exposure is contraindicated. Normal splenic parenchyma on T1-weighted MRI shows lower intensity than liver but higher than muscles. On T2-weighted images, the spleen is hyperintense in comparison to the liver. Abscesses are seen as fluid lesions with low signal intensity in T1-weighted images and hyperintense on T2-weighted images (11,17). Peripheral enhancement may indicate the presence of a capsule or surrounding inflammation (21)

Nuclear medicine

Scintigraphy with the use of indium-111 (^{111}In). and technetium-99m (^{99m}Tc)-labeled leukocytes is a sensitive and specific method for detecting intra-abdominal abscesses (28). An important advantage of whole-body scanning is its ability to visualize distant foci of infection, that may pose as a source of hematogenous spread (7). Unfortunately, high physiological uptake of radiolabeled leukocytes in the liver and spleen limits its utility in detection of abscesses localized in the epigastrium. Lewis et al. assessed the usefulness of ^{111}In-labelled leukocytes scintigraphy in patients with suspected infectious diseases. However, in a series of 137 performed examinations, only 1 was conducted in the patient with a splenic abscess and occurred not to be useful (29).

Gallium-67 citrate (^{67}Ga). is another radiopharmaceutical applied in the diagnostic imaging of intra-abdominal abscesses. Similarly to the radiolabeled leukocytes scintigraphy, high physiological uptake of ^{67}Ga in the liver and spleen makes its interpretation difficult, especially in cases of lesions in the epigastrium. Hopkins et al. reported that ^{67}Ga scintigraphy correctly localized 52 of 56 intra-abdominal abscesses. The most probable cause of false negative results in this series was an insufficient target-to-background ratio of epigastric lesions (30). The combined study with ^{99m}Tc sulfur colloid scan is conducted to improve the diagnostic performance of ^{67}Ga or radiolabeled leukocytes scintigraphy (30). In the presence of an abscess, a photopenic focus of sulfur colloid corresponds with high uptake of ^{67}Ga or radiolabeled leukocytes (1). According to Datz et al., an additional ^{99m}Tc sulfur colloid scan was essential to correctly confirm or exclude the diagnosis in 57% of patients with abscesses located in the epigastrium (31).

Another limitation of scintigraphy is low sensitivity in detecting small lesions, which size is below the resolution of a gamma-camera. More precise evaluation of smaller lesions is possible in PET/CT (positron emission tomography/computed tomography), due to its better spatial resolution. As a hybrid modality, it enables both structural and functional assess-ment. 18-fluorodeoxyglucose ([18]FDG). is the radiopharmaceutical that has the established role in imaging of infection and inflammation. Typically, in abscesses, a hypometabolic center with hypermetabolic rim is observed on PET, corresponding to a hypodense lesion on CT (32,33). The literature concerning its utility in the diagnostic imaging of splenic abscess is scant. Guettrot-Ingueart et al. described 5 cases of aseptic abscesses, including splenic lesions. According to the authors, [18]FDG PET/CT not only reveals splenic abscesses but also hypermetabolic areas in splenic parenchyma suspected of inflammatory changes and considered as normal on US or CT (34). Moreover, it was shown in the preclinical study, that [18]FDG PET may be useful in differential diagnosis of septic and aseptic abscesses (35)

Endoscopic ultrasound

Endoscopic ultrasound (EUS). enables obtaining high-resolution images of the structures situated in close proximity to the gastrointestinal tract. The spleen can be visualized endoscopically through the gastric wall. EUS was successfully employed for evaluating both malignant and benign splenic lesions (36, 37). Endoscopic ultrasound–guided fine needle aspiration (EUS-FNA). allows simultaneous detection and biopsy of both cystic and solid lesions (38,39)

Fritscher-Ravens et al. performed EUS-FNA in the series of patients with focal splenic lesion, when US- or CT-guided percutaneous biopsy was not attempted, or its outcome was inconclusive. EUS-FNA successfully diagnosed 10 of 12 patients, including 2 cases of small splenic abscesses. The authors emphasized that EUS-FNA allowed visualization and puncture of lesions as small as 3 mm. Doppler sonography was helpful in finding a safe needle tract. Preliminary data suggest that EUS-FNA is a safe and effective cell-sampling procedure of focal splenic lesions (39)

Notably endoscopic ultrasound was utilized not only to guide a biopsy, but also to assist endoscopic therapy. Lee et al. reported the first case of splenic abscess treated definitively with EUS-guided drainage when classical treatment was contraindicated. Although the endoscopic treatment was successful, observations of larger series are needed to confirm safety of the procedure (40)

Conclusion

Splenic abscesses may occur as a complication of acute pancreatitis as well as in the course of chronic pancreatitis. Careful assessment of the perisplenic and peripancreatic areas during abdominal ultrasound of the spleen and pancreas is of great importance. Inflammatory changes in those areas may evolve and result in abscess formation. As abdominal ultrasound can be repeatedly performed with little detrimental effect, we emphasize the need for follow-up examinations, especially in high-risk groups. Abdominal computed tomography is the modality of choice to confirm the diagnosis and accurately assess the extent and location of splenic abscess before surgical treatment. In patients with contraindications for CT or in cases of an equivocal image, splenic involvement can be evaluated with MRI. High physiological uptake of [67]Ga and radiolabeled leukocytes in the liver and spleen limits the utility of scintigraphy in the diagnosis of splenic abscess. [18]FDG PET/CT is a modality accurately depicting both functional and structural image of inflammatory changes. EUS is a high-resolution endoscopic modality used for imaging of even small splenic abscesses and utilized for accurate guiding of FNA. Although preliminary data concerning the utility of both [18]FDG PET/CT and EUS in the diagnostic process of splenic abscess are very promising, larger studies are needed to determine their actual role.

Conflict of interest

Authors declare no conflict of interest.

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