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Management of splenic abscess: report on 16 cases from a single center

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Summary
Objectives: Splenic abscess is an uncommon disease, with a reported incidence of 0.14—0.7% in autoptic series. The best treatment option remains unclear. We report our experience of percutaneous drainage of splenic abscess under ultrasound (US) guidance.
Methods: From 1979 to 2005, 16 consecutive patients (12 male and four female; mean age 39.9 years, range 16—72 years) were diagnosed with splenic abscess by means of US, and were treated with medical therapy alone or combined with US-guided percutaneous aspiration or catheter drainage.
Results: Ten of 16 patients had bacterial abscesses (including one case of tubercular abscess), two had an amebic abscess, and four had fungal abscesses. Seven of ten patients with bacterial abscesses were successfully treated with fine needle aspiration alone, one patient was successfully treated with fine needle aspiration for one abscess and catheter drainage for another, and one patient, who subsequently required a splenectomy for an abdominal trauma, successfully underwent percutaneous catheter drainage alone. Four patients with fungal lesions were treated with medical therapy alone, and two patients later required a splenectomy. One patient with a bacterial abscess due to endocarditis was treated with medical therapy alone, and his recovery was uneventful.
Conclusions: US-guided percutaneous aspiration of splenic abscesses is a safe and effective procedure. It can be used as a bridge to surgery in patients who are critically ill or have several comorbidities. Percutaneous aspiration may allow complete non-operative healing of splenic abscesses or temporize patients at risk for surgery.

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Introduction

Splenic abscess is an uncommon disease, with a reported incidence of 0.14—0.7% in autoptic series.[1] It has been reported that 70% develop in patients with concurrent infections.[2] In recent years, splenic abscesses have been diagnosed more frequently owing to the increased number of immunocompromised patients,[3—6] who are particularly at risk for this disease, and the widespread use of diagnostic imaging modalities such as computed tomography (CT) and ultrasonography (US). US plays a valuable role due to its advantages of safety, repeatability, diagnostic accuracy, ease of bedside use, and low cost. In the diagnosis of splenic abscesses, the sensitivity of US is up to 90%.[7,8]

The management of splenic abscesses is based on medical therapy with antibiotics and surgery or percutaneous drainage.[9—17] The best treatment option remains unclear. While it is recognized that percutaneous drainage may be appropriate for some patients initially, the high failure rate (14.3—75%) reported in the literature demonstrates that surgery still remains the standard treatment.[3—6,9—11]

The purposes of this study were to analyze the relevant clinical aspects of splenic abscesses in our series and to report our experience with US-guided percutaneous drainage of splenic abscesses.

Patients and methods

Patients

The data of patients admitted to our division of infectious and tropical diseases between November 1979 and August 2005 were retrospectively collected. The medical files of 16 consecutive patients (12 male and four female; mean age 39.9 years, range 16—72 years) diagnosed with splenic abscess were retrieved. The diagnosis of splenic abscess was made by US alone in five patients, and by US and CT in 11 patients. Arteriography was required by the surgeon in two of the three patients who underwent splenectomy. In all patients, a chest radiograph was also obtained.

Methods

Patient presentation on admission and underlying pathologies were recorded. Size, number, and US features of the abscesses were determined.

Laboratory methods

Cultures of blood from peripheral veins were performed with the BACTEC system (BACTEC 9240, Becton Dickinson, Italy) with BACTEC PLUS Aerobic/F and PLUS Anaerobic/F culture vials. Exudates collected from abscesses were inoculated on routine agars and incubated in a moist atmosphere of 5% CO_2 at 35 °C for 48 h and on anaerobic media incubated in an anaerobic atmosphere for 72 h. The microorganisms isolated were identified on the basis of Gram stain and biochemical, enzymatic, and sugar fermentation characteristics. Susceptibility tests were performed by the disk diffusion method on Mueller—Hinton agar with 24 h of incubation at 35 °C. The results were expressed as susceptible, intermediate, or resistant according to the criteria of the Clinical and Laboratory Standards Institute (M100-S17, 2007) for the modified Kirby—Bauer method.

The remaining part of the specimen was streaked onto two Petri plates of Sabouraud dextrose agar plus chloramphenicol (Oxoid SpA, Italy) for isolation of fungi, one incubated at 25 °C and one at 30 °C for 3 weeks. A slide culture performed by the Riddell technique showed the fungal morphological characteristics.

Primary mycobacterial isolation was performed by means of Lowenstein—Jensen medium and BBL MGIT medium (BACTEC MGIT 960 system, Becton Dickinson, Italy) using standard laboratory techniques. Biochemical identification of *Mycobacterium tuberculosis* complex isolates was assessed by niacin production and results were subsequently confirmed by the use of DNA probes (Gene Probe hybridization assay, Biomerieux, France). Susceptibility testing was carried out according to the standard variation of the proportion method.

Fresh specimens were collected for the recovery of parasitic organisms. Results obtained by microscopic examination of wet smears were confirmed by permanent stained smears. Serologic examination for *Entamoeba histolytica* was performed with indirect hemagglutination antibody assay.

Percutaneous treatments

In all patients, a freehand US-guided fine needle diagnostic aspiration was performed before any treatment to obtain a microbiologic diagnosis and to evaluate the physical aspect of the abscess fluid. Blood and pus cultures for aerobes, anaerobes, mycobacteria, and fungi were carried out.

US-guided fine needle aspiration was the first line treatment in patients with pyogenic or amebic abscesses unless the lesion was peripherally located. In that case, percutaneous US-guided catheter drainage was the preferred choice. Patients with fungal abscesses were treated with medical therapy alone.

Coagulation status was assessed before the procedure. The following values were considered acceptable: a prothrombin time of less than 15 s, a partial thromboplastin time of less than 42 s, an international normalized ratio (INR) of less than 1.8, and a platelet count greater than 50×10^9/l.

During the puncture, patients were asked to limit respiratory excursion to a minimum to avoid tearing of the splenic parenchyma. All procedures were carried out under real-time US guidance using either an AU940 or AU450 real-time scanner (Esaote Biomedica, Genoa, Italy) with 3.5 MHz curved-array and 5.0 MHz linear array transducers. Therapeutic US-guided aspiration was done using an 18- or 20-G 20 cm long needle (Ecojekt, modified Chiba needle, Hospital Service, Hakko Shoji, Japan) under local anesthesia with 10 ml of lidocaine hydrochloride 2% (Lidocaina, Molteni, Italy). The one-step technique was used for placing the drainage catheters. A 5—7 F standard pigtail was inserted. The catheter was removed when there was no draining fluid for 24 hours and abscess resolution was confirmed on imaging. All percutaneous treatments were performed by the same experienced operator (CF).

After the aspiration, rifampin (Rifadin, Lepetit, Milan, Italy) or metronidazole (Deflamon, Spa, Milan, Italy) was injected into the lesion, in a quantity of about half the volume of the drained pus. A thorough US examination was

Table 1 Demographics, management, and outcomes of 16 patients with splenic abscesses.

Case No.	Sex	Age	Predisposing factors	No. of abscesses	Abscess size (cm)[a]	Treatment	Outcome
1	F	16	Post surgical sepsis	1	6.3	FNA (5)	Recovered
2	M	37	Abdominal trauma	1	7.2	CD + splenectomy	Recovered
3	M	72	Leukemia	1	4.5	FNA (4)	Died after 26 days for leukemia
4	M	27	AIDS	2	5.0; 1.8	FNA on 5 cm lesion (2)	Recovered/ died after 8 month
5	M	25	AIDS	3	2.0; 2.4; 3.5	FNA (1; 1; 1)	Recovered/ died after 5 month
6	F	23	Staphylococcal endocarditis in drug addict	2	3.5; 4.2	FNA on 3.5 cm lesion (1); CD on 4.2 cm lesion	Recovered
7	F	63	Travel to Africa; amebic enteritis; breast cancer	1	6.8	FNA (2)	Recovered
8	F	22	Travel to Africa; amebic enteritis; alcoholism; drug addiction	1	5.4	FNA (3)	Recovered
9	M	46	Psychopathology; alcoholism; abdominal trauma	1	6.0	FNA (3)	Recovered
10	M	64	Lymphoma	1	5.6	Medical therapy	Died after 13 months
11	M	28	AIDS	3	1.5; 1.7; 2.0	Medical therapy	Recovered
12	M	35	AIDS	1	4.5	FNA (1)	Recovered
13	M	53	Underlying acute myeloid leukemia; mycotic endocarditis	multiple	4.5; 2.5	Medical therapy + splenectomy	Died after 3 months
14	M	29	Acute myeloid leukemia	multiple	3.1	Medical therapy + splenectomy	Died
15	M	40	AIDS	1	2.8	FNA (1)	Recovered
16	M	59	Endocarditis	1	3.8	Antibiotics	Recovered

FNA, fine needle aspiration; CD, catheter drainage. Figures in parenthesis are number of fine needle aspirations performed; in cases with multiple abscesses the number of fine needle aspirations performed for each one is separated by a semicolon.
[a] In cases with multiple abscesses a semicolon separates the size of each one.

then performed to detect any postprocedural complication. Pending results of pus and blood cultures, intravenous broad-spectrum antibiotics, such as second- or third-generation cephalosporins, gentamicin, and quinolones, were administered. Afterwards, the most effective antibiotics chosen on the basis of antibiograms were given. In patients with negative cultures but purulent material on visual inspection and a cytological diagnosis of an abscess, broad-spectrum antibiotic therapy was continued. The patients were discharged from the hospital when fever, clinical signs, and imaging findings disappeared.

Patient outcomes, including procedure-related complications, treatment failure, and death, were recorded. The follow-up was based on US and clinical examinations performed in all patients every 3 days in the first month, and then monthly over 6 months.

Results

Patient presentation on admission

Patient characteristics, including age, sex, predisposing factors, and number and size of splenic abscesses are shown in Table 1. The most important signs and symptoms are shown in Table 2. Ten of 16 patients (62.5%) had a white cell count over 13×10^9 cells/l (range $2.2–39 \times 10^9$/l, mean 14.673×10^9/l). Abnormalities of the chest radiograph were found in nine (56.3%): left pleural effusion in three patients (18.8%), atelectasis of the left lung lower lobe in two patients (12.5%), and elevated left hemidiaphragm in four patients (25%).

In three patients the liver and the brain were also affected, and in one patient the abscess also involved the

Table 2 Clinical findings on admission in 16 patients with splenic abscess.

Symptoms and signs	No.
Fever	15/16 (93.8%)
Abdominal pain	13/16 (81.3%)
Palpable splenomegaly	7/16 (43.8%)
Abdominal mass	2/16 (12.5%)
Chest X-ray abnormalities[a]	9/16 (56.3%)
Leukocytosis $>13 \times 10^9$ cells/l	10/16 (62.5%)

[a] Left pleural effusion, atelectasis of left lung lower lobe, and elevated left hemidiaphragm.

Table 3 Splenic abscess causative pathogens.

Case No.	Etiology	Pus culture	Blood culture
1	Bacterial	Streptococcus/*Bacteroides fragilis*/coccobacillus	Positive for Staphylococcus
2	Bacterial	Proteus spp	Proteus spp
3	Bacterial	Staphylococcus aureus	Negative
4	Bacterial	Negative	Negative
5	Bacterial	*Escherichia coli*/Klebsiella	Positive for *Escherichia coli*
6	Bacterial	Staphylococcus aureus	*Staphylococcus aureus*
7	Amebic	*Negative*	Negative
8	Amebic	*Negative*	Negative
9	Bacterial	*Staphylococcus aureus*/Peptostreptococcus	Positive for Staphylococcus
10	Fungal	Aspergillus spp	Negative
11	Fungal	Aspergillus spp	Negative
12	Bacterial	Multiple pathogens	Multiple pathogens
13	Fungal	Candida glabrata	*Candida glabrata*
14	Fungal	Aspergillus spp	Negative
15	Bacterial	Mycobacterium tuberculosis	Negative
16	Bacterial	N/A	Viridans Streptococcus

N/A, not available.

diaphragm, the tail of the pancreas, and the left adrenal gland. All patients had acceptable coagulation parameters.

Causative agents

The etiology of the splenic abscess was bacterial in 10 of 16 cases (62.5%), amebic in two (12.5%), and fungal in the remaining four (25%) (Table 3). No abscess was secondary to hydatid disease. Blood culture was positive in eight of 16 (50%) cases. Fine needle aspiration was performed as a diagnostic procedure in 15 of the 16 patients (93.7%). Pus culture was positive in 12 of 15 (80%) patients who underwent diagnostic fine needle aspiration, and was polymicrobial in four of nine (44.4%) aspirated bacterial abscesses.

Blood cultures were negative in both patients with amebic abscess, and positive in only one of the four cases of fungal abscess. Pus cultures were positive in eight of the nine aspirated bacterial abscesses (88.9%) and *Staphylococcus aureus* was the more frequently isolated agent ($n = 3$).

In the two cases of amebic abscess, pus culture did not yield *E. histolytica* and diagnosis was based on epidemiological data, the anchovy paste appearance of the pus, the increase in serological titers for *E. histolytica*, and demonstration of the parasite in stools.

In the four cases of fungal abscess, the fluid aspirated from the lesion grew *Aspergillus spp* ($n = 3$) and *Candida spp* ($n = 1$).

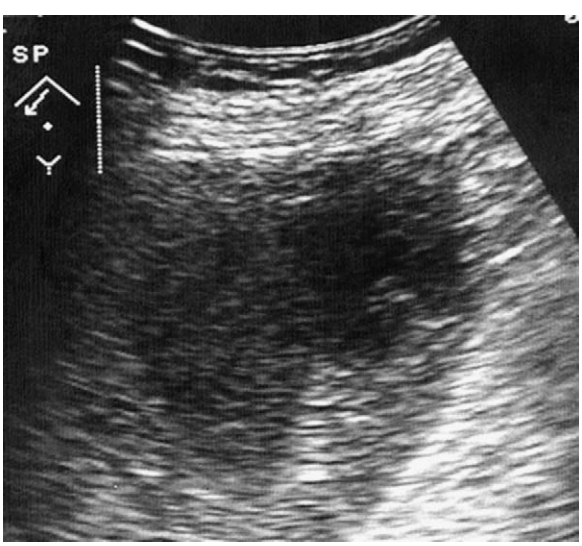

Figure 1 Bacterial abscess. The ultrasound scan shows a hypoechoic, ill-defined bilobate lesion in the lower third of the spleen.

Sonographic features of the abscesses

Ten of 16 patients had a single abscess (62.5%) and six had multiple splenic abscesses (37.5%). Two of 16 patients (12.5%) had a multiloculated abscess.

Bacterial and amebic abscesses appeared as hypoechoic, poorly defined round lesions with low level echoes in the most dependent part, with amebic abscesses showing on average a larger size (Figures 1 and 2). Fungal abscesses larger than

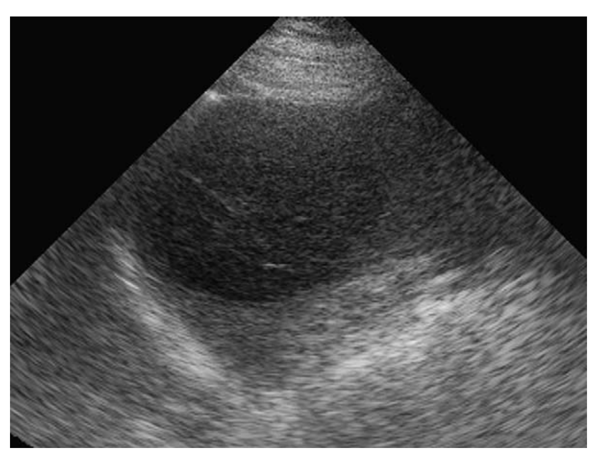

Figure 2 Amebic abscess. The ultrasound scan of the spleen shows a large hypoechoic mass in the upper pole.

Figure 3 Fungal abscess. A longitudinal ultrasound scan shows multiple round, hypoechoic lesions in the spleen parenchyma.

4 cm had a 'target-like' pattern, with a hypoechoic center, while smaller (less than 4 cm) lesions were round, smooth hypoechoic lesions (Figure 3).

Bacterial abscesses were single in seven of 10 (70%) cases; the size ranged from 1.8 to 7.2 cm (mean 3.0 cm). The amebic abscesses were both single; diameters were 5.4 cm and 6.8 cm. Fungal abscesses were multiple in all but one case; size ranged from 1.5 to 5.6 cm (mean 3.0 cm).

Percutaneous treatments

All but one of 12 patients with bacterial and amebic abscesses were treated by percutaneous US-guided fine needle aspiration or catheter drainage, whereas medical therapy was the only treatment in all four cases of fungal abscess. Patient 16, who suffered from endocarditis and had a splenic bacterial abscess due to viridans Streptococcus, which was poorly defined on imaging, was treated with medical therapy alone and fully recovered after 3 weeks.

Fine needle aspiration alone was performed in nine (81.8%) of the 11 patients treated percutaneously, and catheter drainage in two (18.2%). The interval between each fine needle aspiration was 3–5 days. Catheter drainage was performed only in case 2 and case 6, in whom surgery would likely be required. The catheter was left in situ for 12 hours in case 2 who required surgery because of abdominal trauma, and for five days in case 6, who made a full recovery without surgery. In none of the 11 patients treated percutaneously was open surgical drainage required. No patient required conscious sedation. A splenectomy was later required in three patients, two with fungal abscesses and one with a bacterial abscess. Acute necrotizing pancreatitis required surgery 24 hours after a 5-F catheter placement in patient 2 who had a splenic bacterial abscess (*Proteus spp*) treated with catheter drainage after a wide-impact blunt abdominal trauma. The surgeon also performed the splenectomy because of impending spleen rupture. At surgery the abscess had been completely evacuated with catheter drainage.

Patient 14 with leukemia and fungal abscesses due to *Aspergillus spp* required splenectomy after 2 weeks because of no response to treatment, and died during the intervention. Patient 13, who had a fungal endocarditis due to *Candida glabrata*, required splenectomy after 4 weeks because of underlying acute myeloid leukemia, and he died 3 months later.

One of the AIDS patients had an abscess that was shown to be tubercular on microscopic examination. He was treated with fine needle aspiration of the splenic abscess and antitubercular treatment. The spleen with its crucial immunological role was thus preserved. Surgery was obviated in ten of the eleven patients treated percutaneously. Hospital stay ranged from 3 to 34 days (mean 14 days).

Complications

No procedure-related major complications occurred. The only minor complication was mild pain in three (33.3%) of the nine patients treated with fine needle aspiration and in the two (100%) patients treated with catheter drainage. During hospitalization, two patients needed total parenteral nutrition and four required intensive care, with intravenous administration of immunoglobulins and external mechanical ventilation support.

Follow-up

US follow-up showed complete resolution of the lesions in nine cases, while in patient 3 and patient 11 only a reduction of size was obtained. Six patients died because of the underlying disease.

Discussion

Splenic abscess is a rare disease that occurs more often in males and in immunocompromised patients.[3,5,6] In the pre-antibiotic era splenic abscess was mainly related to typhoid fever; nowadays the most frequent cause is AIDS followed by abdominal infections, pneumonia, bacterial endocarditis, and urogenital infections.[18] The rise in international travel accounts for parasitic abscesses, whereas the increased number of AIDS patients, and of subjects undergoing organ transplantation or affected by neoplastic diseases, might explain the rise in fungal abscesses.[4–6,19] In our series, 75% of subjects were male and more than 50% were immunosuppressed. These findings are in accordance with literature data. Fungal abscesses were observed in patients with AIDS ($n = 1$) or malignancies ($n = 3$).

Diagnostic fine needle aspiration of splenic abscesses is crucial to choose the most active antibiotics. Indeed, whereas blood culture isolates are generally monomicrobial, pus cultures from splenic abscesses are polymicrobial in almost half the cases. Therefore, clinical samples should be obtained from both blood and abscess. In immunocompromised patients, fine needle aspiration may also help in differentiating splenic abscesses from other splenic lesions that have the same appearance on imaging, such as lymphoma, metastasis, infarction, or hematoma. Moreover, splenic abscesses caused by disseminated fungal infections may be unrecognized in patients with AIDS who have life-threatening systemic illnesses.[20]

Although antibiotics and splenectomy are traditionally considered the treatment of choice, in a few studies spleen-preserving management using percutaneous image-guided drainage is favored.[12,14] Percutaneous US- or CT-guided drainage for single abscesses and splenectomy for multiple abscesses are reported as safe and effective treatment choices.[9] The advantages of percutaneous drainage over surgical drainage are the low risk of intra-abdominal spreading, the absence of postoperative complications, including those due to anesthesia or wound infection, a shorter hospitalization time, lower costs, and better compliance of patients. We treated only two cases with catheter drainage. We relied on our experience with liver abscess drainage because spleen abscesses are a rarity and no general rules have been reported for these in the literature. In liver abscesses, fine needle aspiration under US guidance is an effective and low-cost procedure, and is more acceptable to patients.

Splenectomy entails the risk of fulminant and potentially life-threatening infection. The most common pathogen is *Streptococcus pneumoniae*, but *Haemophilus influenzae* and *Neisseria meningitidis* have also been reported. In a recent review of the literature, the incidence of infection after splenectomy was 3.2% and the mortality rate 1.4%.[21] Although administration of pneumococcal vaccine and antimicrobial prophylaxis[22] have reduced the infection rate and mortality, no prophylactic regimen will eliminate the risk of sepsis.[23] Most infections occur within the first 2 years after splenectomy, but up to a third arise at least 5 years later and cases of fulminating infections have been reported more than 20 years after surgery.[24] Although difficult to quantify, the risk of dying of a serious infection remains clinically significant (38—69% of individuals developing post-splenectomy sepsis will die[22]) and almost certainly lifelong.[21]

Splenic abscess is a rare entity that remains mainly a subject of case reports. The largest series of splenic abscesses reported in the literature is that of Chang et al.[6] They analyzed 67 cases of splenic abscess observed over a period of 19 years. In their series, *Klebsiella pneumoniae* was the most frequently encountered pathogen, similar to observations in other Asian countries. Percutaneous drainage or aspiration was performed in 21 patients (31.3%), and the mortality rate in this group was 28.6%. In the series of Zerem and Bergsland, 37 patients with splenic abscess were treated with percutaneous fine needle aspiration or catheter drainage.[17] Fine needle aspiration was performed in 19 patients and eight of them required percutaneous drainage because of abscess recurrence. In the 29 cases observed by Chiang et al., percutaneous drainage was performed in only two, and it was successful in both.[25]

Percutaneous drainage is reported to be a reliable technique with a high therapeutic success rate and low costs compared to surgery.[12,14,15] Obvious advantages of percutaneous drainage are a more rapid and less traumatic procedure than surgical drainage. The usefulness is even more substantial for large amebic abscesses, in which the drainage is an emergency maneuver. Independently from the etiological agent, introducing antibacterial and antiamebic drugs at a high concentration directly into the abscess cavity might accelerate healing. Percutaneous image-guided catheter drainage of splenic abscesses is usually favored over fine needle aspiration. In the series of Thanos and coworkers[14] all seven patients were treated with percutaneous CT-guided drainage. In our series, we performed fine needle aspiration under US guidance as the first-line treatment and the procedure was successful in eight of nine patients (88.9%).

Multiloculated abscesses with thick septations or necrotic debris respond less favorably to percutaneous drainage and attempts to increase the success rate of percutaneous drainage by using intracavitary fibrinolytic agents have been described.[26] In our series we observed only two cases of multiloculated splenic abscess, and they were effectively treated with percutaneous fine needle aspiration.

The risk of bleeding and damage to adjacent organs should be taken into account. Hemorrhage is the most common complication.[27] Other complications include pneumothorax,[27] pleural effusion, and colonic injury.[28] In our series, no major complications and no mortality related to the procedure were observed.

Percutaneous drainage of splenic abscess under US guidance is an operator-dependent technique that requires a high level of skill and experience. Furthermore, when performing the maneuvre it is advisable to have a standby operating room because of the risk of bleeding.

In conclusion, based on our experience and literature data, sonographically-guided percutaneous aspiration of splenic abscesses is a safe and effective procedure. It can be used as a bridge to surgery in patients who are critically ill or have several co-morbidities. Percutaneous aspiration may allow complete non-operative healing of splenic abscesses or temporize patients at risk for surgery.

Conflict of interest: No conflict of interest to declare.

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