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ORIGINAL ARTICLE

Splenic abscesses at a tertiary medical center in northern Taiwan

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Background/Purpose: Splenic abscesses are uncommon. This study aimed at assembling the demographics, clinical features, microbiologic etiologies, imaging, treatments, and outcomes of patients with splenic abscesses at a tertiary medical center in northern Taiwan.
Methods: The diagnosis of splenic abscess was made either by imaging studies associated with clinical symptoms and signs of infection, or by imaging studies associated with microbiological data or pathologic results. The clinical characteristics, isolated pathogens, and treatments diagnosed at a medical center in northern Taiwan between 2000 and 2011 were analyzed retrospectively.
Results: Of 28 patients with splenic abscess, male patients accounted for 46% of the study population. The mean age of the patients at the time of presentation was 46.5 years (range 4 months to 85 years). Common presentations were fever (71.4%, 20 cases), abdominal pain (46.4%, 13 cases), cough or dyspnea (35.7%, 10 cases), splenomegaly (32.1%, 9 cases), and left-sided pleural effusion (32.1%, 9 cases). Leukocytosis was noted in 22 patients (78.5%). Gram-negative bacilli and Gram-positive cocci were cultivated from six patients (21%). No specific pathogen was predominant in patients with splenic abscesses. The overall mortality was 14.3%, while the mortality among the patients treated with antimicrobial therapy alone was 5.6%.
Conclusion: The survival rate was high in patients with splenic abscesses who received antimicrobial therapy alone. Percutaneous drainage can be used as an alternative choice for patients with severe co-morbidities or patients who are critically ill.

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Introduction

Splenic abscesses are uncommon, with a prevalence of 0.14—0.7% in autopsy studies.[1—3] Splenic abscesses generally occur in patients with splenic trauma, malignancies, diabetes mellitus, immunodeficiency disorders, or systemic infections.[4—6] The diagnosed incidence of splenic abscesses has increased over recent decades due to the increasing number of immunocompromised patients and the widespread use of imaging modalities such as computed tomography (CT) and ultrasonography (US).[4,7—9] The management of splenic abscesses includes early diagnosis, medical therapy with antimicrobial or antifungal agents, and surgery or percutaneous drainage. The objective of the current study was to report the clinical features, microbiologic etiologies, treatments, and outcomes of patients with splenic abscesses at a tertiary medical center in northern Taiwan over the previous 12 years.

Materials and methods

Study design and data collection

The diagnosis of splenic abscess was made if one of the following criteria was met: (1) causative pathogens were isolated from a splenic aspirate or blood culture with compatible imaging studies, such as US or CT; (2) histologic examination of resected splenic tissue indicated the presence of an abscess; (3) there were operative findings of a splenic abscess during exploratory laparotomy; and (4) there were clinical manifestations and imaging findings consistent with the condition and an improvement in the patient's clinical condition after antibiotic therapy. Leukocytosis or leukopenia was defined as a peripheral white cell count $>$10,000/μL or $<$4000/μL, respectively. All of the medical charts were reviewed to collect data, including sex, age, clinical manifestations, underlying diseases, imaging studies, treatment course, isolated pathogens, and clinical outcome. The patients were followed up for 6 months as an end-point to determine the outcome.

Statistical analysis

A univariate analysis of prognostic factors for splenic abscess (e.g., age, sex, abscess number, underlying disease, microorganism, and treatment) was performed using Fisher's exact test. The mean age was evaluated using the Wilcoxon rank-sum test.

Results

Between January 2000 and December 2011, 214 patients with a diagnosis of suspected splenic abscess were reviewed, and 28 met the criteria for splenic abscess. The current study comprised 13 males and 15 females, with a mean age of 46.5 years (range 4 months to 85 years). The patients' characteristics, age, sex, predisposing factors, number of splenic abscesses, microbiologic etiologies, treatments, and outcomes are shown in Table 1. Of the 28 patients, 7 (25%) had diabetes mellitus, 5 (17.9%) had undergone previous abdominal surgery, 5 (17.9%) had leukemia, 4 (14.3%) had end-stage kidney disease and were undergoing hemodialysis, 2 (7.1%) had HIV infection, 1 (3.6%) had cervical cancer, 1 (3.6%) had colon cancer, 1 (3.6%) suffered from systemic lupus erythematosus (SLE), and 1 (3.6%) was an intravenous drug user.

Pathogens were not identified in 9 (32.1%) patients with splenic abscesses. A fungal infection was suspected in patient #15 based on the clinical condition and CT images. Four patients were diagnosed with fungal infections clinically, including patient #15, whose clinical condition improved after treatment with antifungal agents. In our study, six patients showed Gram-positive coccal infections (2 streptococci, 1 enterococci, 2 *Staphylococcus aureus*, 1 *Micrococcus*), six had Gram-negative bacillary infections (3 nontyphoidal salmonellosis, 1 *Klebsiella pneumoniae*, 1 *Pseudomonas aeruginosa*), and one had a mixed infection. Patient #27 had a presentation of intermittent fever for 2 weeks, and her family owned a dog and a cat as pets. She usually slept with the cat, and cat scratches had occasionally been noted. *Bartonella henselae* infection was suggested by polymerase chain reaction on abscess fluid.

The patients' clinical symptoms and signs included fever (20 patients, 71.4%), diffuse abdominal pain (13 patients, 46.4%), cough or dyspnea (10 patients, 35.7%), and left upper quadrant pain or tenderness (4 patients, 14.3%). Physical examination revealed splenomegaly in nine (32.1%) patients. Chest radiographs showed left-sided pleural effusions in nine (32.1%) patients. Leukocytosis was noted in 22 (78.5%) patients. Two patients with acute lymphocytic leukemia had febrile neutropenia 1—2 weeks after chemotherapy.

All patients underwent abdominal US and/or CT; Five patients had abdominal US and CT, 11 abdominal US alone, and 12 abdominal CT alone. A single abscess was noted in 14 (50%) patients and multiple abscesses in 14 (50%) patients (Table 1).

The prognostic factors for splenic abscess are shown in Table 2. Antimicrobial therapy was instituted in all patients. Eighteen (64.3%) patients recovered under medical treatment. Four (14.3%) patients underwent splenectomy and were discharged with oral antibiotics, and four (14.3%) patients received percutaneous drainage of their splenic abscess.

The overall mortality rate was 14.3% (4 patients), and the mortality rate in those receiving medical therapy was 5.6% (1 patient) (Table 2). All four patients who received medical treatment and splenectomy survived, but two (40%) of the five patients who had medical treatment and percutaneous drainage died.

Brief summaries of the four patients who died are as followed. Patient #28, who had underlying SLE, initially received antibiotics, but her symptoms persisted. She then twice underwent percutaneous drainage, but due to inadequate drainage a splenectomy was performed. However, she died of massive intraoperative bleeding. Patient #23 with chronic kidney disease, cervical cancer, and methicillin-resistant *Staphylococcus aureus* septicemia was initially treated with teicoplanin, but 22 days later abdominal CT revealed multiple abscesses in the spleen, perianal area, bilateral psoas muscles, and left hip. Despite their drainage, the patient died 15 days later. Liver and splenic abscesses were present in Patient #19, but she died

Table 1 Demographics, management, and outcomes of patients with splenic abscess

Case number	Sex	Age (years)	Predisposing factors	Number of abscesses	Microbiological etiology and diagnosis	Treatment	Outcome
1	M	49	Alcoholic liver cirrhosis	Single	Not identified	AT	Recovered
2	F	31	AIDS (CD4 count 7 cells/μL, viral load 4020 copies/mL)	Multiple	*Mycobacterium avium intracellulare* complex (sputum and lymph node)	AT	Recovered
3	M	67	ESRD, HTN	Multiple	Not identified	AT	Recovered
4	F	62	Postcholecystectomy	Single	Not identified	AT	Died
5	M	63	Liver cirrhosis, DM	Single	Not identified	AT	Recovered
6	F	73	Cervical cancer, old TB, liver cirrhosis, HTN	Multiple	Not identified	AT	Recovered
7	M	83	ESRD, HTN	Single	Not identified	AT	Recovered
8	M	34	IDU	Single	*Staphylococcus aureus* (blood)	AT	Recovered
9	F	83	Polycystic liver disease, postcholecystectomy for gallbladder stones	Single	Not identified	AT	Recovered
10	F	28	DM, ESRD	Multiple	*Pseudomonas aeruginosa* (blood)	AT	Recovered
11	M	85	Colon cancer, DM	2	Not identified	AT	Recovered
12	M	59	CML, HTN	Single	Nontyphoidal *Salmonella* (blood)	AT	Recovered
13	M	25	HIV (CD4 count 286 cells/μL, viral load 39,898 copies/mL)	Multiple	*Mycobacterium tuberculosis* (sputum, neck lymph node)	AT	Recovered
14	F	4 months	Biliary atresia — post-Kasai's operation	Single	*Micrococcus* species (blood)	AT	Recovered
15	M	51	AML, DM	Multiple	Suspected fungus, blood cryptococcal antigen titer: 1:2	Antifungal agents	Recovered
16	F	19	ALL	Multiple	*Blastochizomyces* species (blood)	Antifungal agents	Recovered
17	F	2	ALL	Multiple	*Penicillium* species (blood)	Antifungal agents	Recovered
18	M	3	ALL	Multiple	*Candida tropicalis*, nontyphoidal *Salmonella* (blood)	AT + antifungal agents	Recovered
19	F	84	HTN	3	Gamma-hemolytic group D *Streptococcus* (abscess)	AT + PD	Died
20	F	50	DM, HTN, ESRD	Single	*Bacteroides fragilis*, *Peptostreptococcus* (abscess)	AT + PD (3 times)	Recovered
21	M	35	DM, chronic pancreatitis, HTN	Single	*Klebsiella pneumoniae* (blood)	AT + PD	Recovered
22	M	65	DM	Single	Viridans streptococci (blood, abscess)	AT + PD	Recovered
23	F	66	Unknown	Multiple	Methicillin-resistant *Staphylococcus aureus* (blood, abscess)	AT + PD	Died
24	F	78	Unknown	Multiple	Not identified	AT + ST	Recovered
25	F	46	Gastric ulcer, duodenal ulcer	Single	*Citrobacter freundii*, *Proteus mirabilis, Klebsiella pneumoniae, Enterococcus*	AT + ST	Recovered
26	M	1	Duplication cyst of duodenum	Single	Nontyphoidal *Salmonella* (abscess)	AT + ST	Recovered
27	F	9	Unknown	Multiple	*Bartonella henselae*	AT + ST	Recovered
28	F	50	SLE	Single	VRE (blood), *Enterococcus* species (abscess)	AT + PD + ST	Died

ALL = acute lymphoblastic leukemia; AML = acute myeloid leukemia; AT = antibacterial therapy; CML = chronic myeloid leukemia; DM = diabetes mellitus; ESRD = end-stage renal disease; HIV = human immunodeficiency virus; HTN = hypertension; IDU = intravenous drug use; PD = percutaneous drainage; SLE = systemic lupus erythematosus; ST = splenectomy; TB = tuberculosis; VRE = vancomycin-resistant *Enterococcus*.

Table 2 Prognostic factors for splenic abscess

Variable	Category (*n*)	Outcome: cure ($N = 24$) (*n*, %)	Outcome: fatal ($N = 4$) (*n*, %)	*p*
Sex	Female (15)	11 (73.3)	4 (26.7)	0.10*
	Male (13)	13 (100)	0 (0)	
Number of abscesses	Solitary (14)	12 (85.7)	2 (14.3)	1.00*
	Multiple (14)	12 (85.7)	2 (14.3)	
Underlying disease	Without (4)	2 (50)	2 (50)	0.09*
	With (24)	22 (91.7)	2 (8.3)	
Diabetes mellitus	Without (21)	17 (81)	4 (19)	0.54*
	With (7)	7 (100)	0 (0)	
Microorganism	GNB (6)	6 (100)	0 (0)	0.15*
	GPC (6)	3 (50)	3 (50)	
	GNB + GPC (1)	1 (100)	0 (0)	
	Fungus (4)	4 (100)	0 (0)	
	Sterile (9)	8 (88.9)	1 (11.1)	
Age	Mean ± SD	43.3 ± 28.3	65.5 ± 14.1	0.16**
	Median	47.5	64.0	
Treatment	AT + ST (4)	4 (100)	0 (0)	0.04*
	AT + PD (5)	3 (60)	2 (40)	
	AT or antifungal alone (18)	17 (94.4)	1 (5.6)	
	AT + PD + ST (1)[a]	0 (0)	1 (100)	

* Fisher's exact test.
** Wilcoxon rank-sum test.
AT = antimicrobial therapy; GNB = Gram-negative bacilli; GPC = Gram-positive cocci; ST = splenectomy; PD = percutaneous drainage; SD = standard deviation.
[a] A fatal case with antimicrobial therapy, percutaneous drainage and later splenectomy.

of septic shock. In Patient #4, cellulitis involving left face and left abdominal pain comprised the initial presentation. Surgery was initially deferred, and the sepsis progressed despite appropriate antibiotics.

Discussion

Splenic abscesses are uncommon, occurring in 0.14–0.7% of autopsy studies.[1–3] Discussions pertaining to splenic abscesses are usually limited to case reports or institutional studies. In one study of 501 patients with 540 intra-abdominal abscesses, no splenic abscesses were reported.[10] The causes of splenic infections have mostly been systemic infections, contiguous infections, infections secondary to splenic infarction, and traumatic injuries involving the spleen.[3,7]

Immunodeficiency is a major factor underlying splenic abscesses. With the increasing prevalence of malignancies, organ transplantation, and immunosuppressive therapy, the risk of splenic abscesses has increased.[7,11] In a review involving 287 patients with splenic abscesses, 33.5% of cases had an immunosuppressed state, and nearly half had underlying intravenous drug abuse and AIDS.[3] In the current study, 60.7% of 28 patients had immunodeficiency disorders, such as HIV/AIDS, end-stage kidney disease, hematologic malignancies, solid organ malignancies, SLE, intravenous drug abuse, or liver cirrhosis, suggesting that immunodeficiency is a predisposing risk factor for splenic abscesses. However, because of small patient number in the current study, more studies are warranted.

The mortality rate of splenic abscesses ranged between 13% and 25%.[3,4,12] The overall mortality rate in our study was 14.3%, in agreement with that of previous studies.[3,4,12] The mortality rate of our patients with immunodeficiency disorders may be underestimated as a result of the exclusion of the patients who died without pathogens being identified. In these patients, it was difficult to differentiate splenic lesions in patients with systemic infections from infarctions or infections.[7] Therefore, the case number and mortality rate of splenic abscesses might be being underestimated.

The most common organisms in most series involving splenic abscesses were aerobic microbes, especially staphylococci, streptococci, *Salmonella*, and *Escherichia coli*.[3,5,13] *Mycobacterium tuberculosis* was the most common microorganism in a retrospective study of 22 cases in a single institution in Spain, where all patients with tuberculous abscess in spleen had AIDS.[13] In Taiwan, *Klebsiella pneumoniae* was the major pathogen in patients with liver abscesses. Among splenic abscess caused by Gram-negative bacilli in Taiwan, *Klebsiella pneumoniae* was the most common pathogen, with a higher prevalence in diabetic patients and a higher incidence in patients with concomitant liver abscesses.[4,7,12,14]

The treatment options for splenic abscesses include antimicrobial therapy, percutaneous drainage, and splenectomy. During the 20th century, the use of intravenous antimicrobial therapy alone resulted in a high mortality rate (100%).[3] However, with improvements in imaging technology and the production of new antibiotics, the mortality rate of individuals treated with antimicrobial therapy alone has decreased over time. Successful treatment rates of 75% with antimicrobial therapy alone were mentioned in a study of 29 cases in a single institution in Taiwan.[11] More than 60% of our patients received medical therapy alone, the major therapeutic modality in the

Table 3 Comparison of epidemiology and symptoms among four studies

Variable	Chun et al	Nelken et al	Ooi & Leong	Our study
	1900—1977	1977—1986	1987—1995	2000—2011
Number of cases	173	189	287	28
Male:female	1.7:1	1.95:1	2.04:1	0.87:1
Age, mean (y)	36.8	Not available	41.4	46.5
Age range	6 mo — 83 y	6 mo — 82 y	6 mo — 92 y	4 mo — 85 y
Clinical symptoms and signs				
Fever (*n*, %)	145/152 (95.4)	131/156 (84)	246/171 (90.8)	20/28 (71.4)
Left upper quadrant pain (*n*, %)	64/152 (42.1)	61/156 (39)	126/253 (49.8)	4/28 (14.3)
Splenomegaly (*n*, %)	82/152 (53.9)	62/156 (40)	79/257 (30.7)	9/28 (32.1)
Left-sided pleural effusion (*n*, %)	34/173 (19.7)	Not available	57/256 (22.3)	9/28 (32.1)

The table was modified according to Ooi and Leong (1997).[1—3]

present study, and about 95% of these patients had a favorable outcome, the result being better than those previously reported.[3,7,11,12,14]

Although intravenous antimicrobial therapy with splenectomy has been regarded as the treatment of choice for splenic abscess by some experts,[3,5] percutaneous drainage has been reported to be a reliable technique with a high success rate in patients with splenic abscesses, and costs less than surgery.[9] Moreover, percutaneous drainage can be an alternative choice for critically ill patients and for young patients in whom attempts are made to preserve the spleen.[7,12—14] Percutaneous drainage is considered when the abscess is unilocular or bilocular with a discrete wall and no internal septa, and when the liquid content can be drained.[13] Our patients treated with antibiotics and splenectomy had an optimal outcome, but as the sample size was small, more clinical experience is needed to draw any conclusion. With the advent of broad-spectrum antibiotics and imaging modalities, the mortality rate could be expected to be lower than previously.

A comparison of the epidemiology and symptoms in three published reports is shown in Table 3. In previous studies, males comprised 63—67% of the patients with splenic abscesses, which was greater than the proportion seen in the current study (46%); the small number of cases here could be one of the reasons for this difference.[1—3]

In conclusion, splenic abscesses should be suspected in immunosuppressed patients in the presence of unexplained fever with associated symptoms and signs of abdominal pain, especially in left upper quadrant, and suggestive radiologic findings. A good prognosis was noted in the patients with splenic abscesses receiving antimicrobial therapy alone. However, percutaneous drainage can be used as an alternative choice for patients with severe comorbidities or those who are critically ill.

Conflicts of interest

All authors declare that they have no conflicts of interest related to the material discussed in this article.

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