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Splenic abscess in southern Taiwan

Chen-Hsiang Lee[1,2], Hsieh-Shong Leu[2], Tsung-Hui Hu[3], Jien-Wei Liu[1]

Divisions of [1]Infectious Diseases and [3]Hepato-gastroenterology, Department of Internal Medicine, Chang Gung Memorial Hospital, Kaohsiung Medical Center; and [2]Division of Infectious Diseases, Department of Internal Medicine, Chang Gung Memorial Hospital, Lin-Kou Medical Center, Taiwan, ROC

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The clinical characteristics and isolated pathogens from 49 cases of splenic abscess treated at a medical center in southern Taiwan between 1981 and 2001 were retrospectively analyzed. Male patients were predominant (63%). Mean age at presentation was 55 years (range, 19 to 78 years). The most common presentations were fever (95.9%, 47/49), abdominal pain confined to the left upper quadrant (67.3%, 33/49), left pleural effusion (55.1%, 27/49) and splenomegaly (55.1%, 27/49). Leukocytosis occurred in 39 patients (79.6%), and leukopenia in 3 (6.1%). Blood cultures were positive in 32 patients (65.3%). The most common pathogen was *Klebsiella pneumoniae* (16.3%, 8/54), a well-known Gram-negative bacillus causing liver abscess in Taiwan, followed by *Escherichia coli* and *Salmonella* spp. (each 11.1%, 6/54). Multiple splenic abscesses occurred predominantly in patients with underlying malignancies. Due to the rarity of splenic abscess and the increasing number of immunocompromised patients, multicenter study is needed to determine the epidemiological features and optimal management of this disease.

Key words: Abscess, diabetes mellitus, *Klebsiella pneumoniae,* splenic diseases, Taiwan

Splenic abscess is uncommon, occurring in 0.14% to 0.7% of autopsy studies before 1977 [1]. The key to successful treatment is early diagnosis, effective empirical antimicrobial therapy, and surgical management when needed. However, the variety of pathogens and clinical features cited in the literature offer little specific guidance in clinical management. To clarify the clinical characteristics of splenic abscess, we performed a retrospective study of patients with a diagnosis of splenic abscess at Chang-Gung Memorial Hospital, Kaohsiung, a 2500-bed medical center in southern Taiwan, and reviewed the literature on this subject.

Patients and Methods

All patients with a discharge diagnosis of splenic abscess between January 1981 and December 2001 according to records of the Medical Coding Section were included in this retrospective analysis. The diagnosis of splenic abscess required meeting at least 1 of the following criteria: (1) spleen aspirate or dissected splenic specimen with histopathologically confirmed abscess; (2) pus was macroscopically found in spleen during operation; and (3) in the presence of compatible clinical manifestations and finding on computed tomography (CT), the patient's condition was improved after medical treatment in cases without surgical intervention. Data collected included the following: demographic, clinical and laboratory characteristics including gender, age, signs and symptoms; medical history; underlying conditions/diseases; and clinical course and isolated pathogens. Leukocytosis was defined as a peripheral white cell count ≥10,000/μL; leucopenia as ≤3,000/μL; thrombocytosis as a platelet count ≥400,000/μL; and thrombocytopenia as ≤150,000/μL. Medical treatment was regarded as appropriate if the pathogen isolated from abscess or blood was susceptible in vitro to the prescribed antibiotic(s). Susceptibility testing was performed on a clinical-service-basis with the Kirby-Bauer diffusion method, in accordance with National Committee for Clinical Laboratory Standards (NCCLS) at the time of tests [2]. The mortality rates for patients receiving different therapeutic modalities were adjusted for the numbers of cases of solitary and multiple abscesses. Chi-squared test was used to compare the adjusted mortality rates of patients with the varied therapeutic treatments. A 2-tailed $p<0.05$ was considered statistically significant. A MEDLINE

Corresponding author: Dr. Jien-Wei Liu, Division of Infectious Diseases, Department of Internal Medicine, Chang Gung Memorial Hospital-Kaohsiung Medical Center, 123, Ta-Pei Road, Niao Sung Hsiang, Kaohsiung Hsien 833, Taiwan, ROC.
E-mail: 88b0@adm.cgmh.org.tw

search and supplemental manual search of the literature were performed. Demographic, clinical and laboratory data of patients in this series were compared with those reported in the literature.

Results

Splenic abscess was diagnosed in a total of 49 patients during the study period. The male/female ratio was 31/18 (63.3% vs 36.7%). Mean age was 55 years (range, 19 to 78 years). Demographic and clinical data of our patients and those reported in other series are summarized in Table 1. The mean time interval from clinical onset to diagnosis was 10 days (range, 1 day to 4 weeks). With the exception of 2 asymptomatic patients, 1 with *Salmonella* splenic abscess and the other with tuberculous splenic abscess, all symptomatic patients were febrile. Of the 49 patients, 41 complained of abdominal pain. Pain was confined to left upper quadrant (LUQ) of the abdomen in 33 patients (67.3%), and the remaining 8 (16.3%) had diffuse abdominal pain. Physical examinations, by either palpation or percussion or both, detected splenomegaly in 53.1% of patients.

Leukocytosis was found in 39 patients (79.6%), with a mean peripheral white cell count of 19,550/μL (range, 10,100 to 50,000/μL). Leukopenia was found in 3 patients (6.1%), thrombocytosis in 7 (14.3%), and thrombocytopenia in 7 (14.3%). Left pleural effusion was noted on chest roentgenogram, sonography or CT in 27 patients (55.1%). Splenic abscess was detected by sonography and CT in 36 patients (73.5%), by sonography alone in 4 (8.2%), and by CT alone in 8 (16.3%). Laparotomy for peritonitis detected splenic abscess in 1 patient (2.0%).

The original site of infection as a source of septic emboli was detected in 13 of 49 cases as follows: endocarditis in 8 patients (2 patients were intravenous drug abusers), dental abscess in 2, iliac mycotic aneurysm in 1, urinary tract infection in 1 and anal

Table 1. Demographic and clinical data of patients with splenic abscess

Category	Chun et al [3] (1900-1977) n = 173	Nelken et al [4] (1977-1986) n = 189	Ooi and Leong [5] (1987-1995) n = 287	Present study (1980-2001) n = 49
Male/female ratio	63% (109:64)	66% (125:64)	67% (192:95)	63% (31:18)
Age range	6 months to 83 years	6 months to 82 years	6 months to 92 years	19 years to 78 years
Mean age (years)	36.8	NA	41.1	55.1
Fever (%)	42.1	84	90.8	95.9
LUQ pain and/or tenderness (%)	53.9	39	49.8	67.3
Splenomegaly (%)	19.7	40	30.7	53.1
Left pleural effusion (%)	19.7	NA	22.3	55.1

Abbreviations: NA = not available; LUQ = left upper quadrant

Table 2. Comparison of pathogens of splenic abscess

Microorganism	Chun et al [3] (1900-1977) n = 129 (%)	Nelken et al [4] (1977-1986) n = 159 (%)	Ooi and Leong [5] (1987-1995) n = 255 (%)	Present study (1980-2001) n = 54 (%)
Aerobic organisms				
Staphylococcus spp.	26 (20.2)	25 (15.7)	44 (17.3)	3 (5.6)
Streptococcus spp.	28 (21.7)	11 (6.9)	26 (10.2)	3 (5.6)
Enterococcus spp.	31 (24.1)	10 (6.3)	10 (3.9)	3 (5.6)
Klebsiella pneumoniae		3 (1.9)	5 (1.9)	8 (14.8)
Escherichia coli		17 (10.7)	32 (12.5)	6 (11.1)
Others		15 (9.5)	39 (15.3)	1 (1.9)
Pseudomonas spp.	0	2 (1.3)	16 (6.3)	5 (9.3)
Salmonella spp.	14 (10.9)	17 (10.7)	41 (16.1)	6 (11.1)
Anaerobic organisms	7 (5.4)	28 (17.6)	18 (7.1)	8 (14.8)
Mycobacterium tuberculosis	0	0	14 (5.5)	2 (3.7)
Non-tuberculous mycobacteria	0	0	6 (2.3)	0
Fungi	1 (0.8)	41 (25.8)	18 (7.1)	1 (1.9)
Sterile cultures	37 (28.7)	19 (11.9)	29 (11.4)	8 (14.8)

abscess in 1. Blood cultures were positive in 32 patients (65.3%), with *Klebsiella pneumoniae* and *Escherichia coli,* each isolated in 6 different patients, being the most commonly isolated pathogens. Twenty-seven of the total 38 abscess specimens had positive culture results. Of these 27 specimens, 3 grew multiple pathogens, and 19 had pathogens identical to bacteria isolated from blood culture. Blood and abscess cultures were negative in 8 of 49 patients (16.3%). Microorganisms isolated from patients with splenic abscess are summarized in Table 2.

The underlying diseases that predisposed patients to the development of splenic abscess were diabetes mellitus (n = 22, 44.9%), steroid use (7, 14.3%), malignancies (5, 10.2%), cirrhosis (3, 6.1%), alcoholism (3, 6.1%), intravenous drug abuse (2, 4.0%) and end-stage renal disease (1, 2.0%). Twenty-one percent of patients had more than 1 underlying disease. The distributions of solitary as well as multiple splenic abscesses in patients with various underlying diseases are summarized in Table 3. Remarkably, 7 of 8 patients with *K. pneumoniae* splenic abscess had a concurrent liver abscess caused by the same pathogen, and 4 of these 7 patients had underlying diabetes mellitus. Multiple abscess was found in 17 (34.7%) of splenic abscess. Multiple abscesses developed in 80.0% of patients with malignancy, 43.0% with steroids use, 33.3% with liver cirrhosis, alcoholism or AIDS, and 22.7% with diabetes mellitus.

Table 3. Distribution of solitary and multiple splenic abscess in patients with various underlying diseases

Underlying disease	Solitary abscess	Multiple abscess
Diabetes mellitus (n = 22)	17	5
Liver cirrhosis (n = 3)	2	1
Steroids usage (n = 7)	4	3
Alcoholism (n = 3)	1	2
Malignancies[a] (n = 5)	1	4
AIDS (n = 3)	2	1
IVDA (n = 2)	2	0
ESRD (n = 1)	1	0
Unknown (n = 9)	8	1

Abbreviations: AIDS = acquired immunodeficiency syndrome; IVDA = intravenous drug abuser; ESRD = end-stage renal disease
[a]Malignancies included prostate cancer, lung cancer, acute lymphatic leukemia, myelodysplastic syndrome in leukemic stage, and essential thrombocytosis.

Mortality rates for patients with solitary and multiple splenic abscesses are shown in Table 4. All patients received antibiotics. In addition, splenectomy was performed in 23 patients (46.9%), percutaneous drainage in 12 (24.5%) and percutaneous aspiration in 2 (4.1%). The mortality rate was 13.0% in patients treated with splenectomy, 16.7% in patients treated with percutaneous drainage, and 25.0% in patients treated with antibiotic therapy alone. Two patients with multiple splenic abscess treated with fine needle aspiration died. The adjusted mortality rates between cases receiving different therapeutic modalities were not significantly different (p=0.745) [Table 4].

Discussion

Because of its rarity, discussions of splenic abscess are generally limited to case reports or small institutional series. However, large series reviews are capable of shedding light on the pathogenesis of splenic abscess, which has been attributed to metastatic infection, contagious infection, secondary infection of splenic infarct, trauma and immunodeficiency [3-5]. Reports on splenic abscess between 1900 and 1977 [3], between 1977 and 1986 [4], and between 1987 and 1995 [5] show a great variety of causative pathogens from different geographic locations and in association with a wide range of demographic and clinical conditions. Changing lifestyles resulting in an increasing prevalence of diabetes

Table 4. Treatment modalities and mortality rates of 49 patients with splenic abscess

Treatment modality	No. of mortality/No. of total cases (%)		Mortality rate (%)	Adjusted mortality rate[a] (%)
	Solitary abscess	Multiple abscess		
AT + splenectomy (n = 23)	1/14 (7.1)	2/9 (22.2)	13.0	12.7
AT + PD (n = 12)	2/10 (20.0)	0/2 (0.0)	16.7	12.6
AT + FNA (n = 2)	0/2	-	-	-
AT alone (n = 12)	1/5 (20.0)	2/7 (28.6)	25.0	23.2
Total	4/31 (12.9)	4/18 (22.2)	16.3	

Abbreviations: AT = antimicrobial therapy; PD = percutaneous drainage; FNA = fine needle aspiration
[a]The adjusted mortality rates were not significantly different among patients receiving different therapeutic modalities (p=0.745, chi-squared test).

mellitus, malignancies, trauma, intravenous substance abuse, increasing incidence of immunosuppression from advanced therapeutic modalities, and the emergence of human immunodeficiency virus (HIV) infection have all altered the clinical patterns of splenic abscess. The distributions of these predisposing factors vary among different populations. Therefore, updated epidemiological information about splenic abscess is important for appropriate therapy.

Unlike other studies in which children have accounted for around 15% of all patients [3-5], this study had no pediatric cases; moreover, no case of splenic abscess in a pediatric patient has been reported in Taiwan. This suggests that splenic abscess in children is rare or under-reported in Taiwan.

Abdominal pain or tenderness is common in patients with splenic abscess. In this series it was confined to the LUQ of the abdomen in 67.3% of cases. Previous reports have indicated that only 39.0% to 49.8% of patients suffered from LUQ pain [3-5]. Our findings may be due to comparatively thinner abdominal walls in Asian patients which facilitate physical examination of the LUQ. Left pleural effusion was present in 55.1% of our patients. Previous reports indicated that only 19.7% to 22.3% of patients with splenic abscess had left pleural effusion [3-5]. The much higher percentage of patients with pleural effusion in this study may have been due to the careful search for the presence of pleural effusion in sonography and CT, in addition to chest X-ray films.

In agreement with other series [3-5], septic embolism was the most common cause of splenic abscess in our patients. Endocarditis is frequently the source and is commonly associated with intravenous drug abuse [6]. The comparatively low prevalence of intravenous drug abuse over the past 2 decades in Taiwan [7-9] may account for the low incidence of *Streptococcus* spp. and *Staphylococcus* spp. in the present study. Jang and Fung speculated that early diagnosis and prompt treatment of infective endocarditis in Taiwan accounts for the low incidence of indigenous Gram-positive coccal splenic abscess [10].

In contrast to other series in which, among members of the Enterobacteriaceae, *E. coli* was the most common pathogen causing splenic abscess [3-5], *K. pneumoniae* was the most frequently encountered pathogen in this study. Although metastatic lesions resulting from liver abscess caused by *K. pneumoniae* are not uncommon, splenic abscess due to *K. pneumoniae* has received little attention. *K. pneumoniae* is notorious for being the most commonly encountered pathogen in liver abscess in Taiwan [11]. Although *K. pneumoniae* serotype K_1 was significantly prone to cause liver abscess and liver abscess due to *K. pneumoniae* serotype K_1 was associated with complicated endophthalmitis, especially in diabetics [12], it is uncertain whether any specific serotype of *K. pneumoniae* is involved in the development of splenic abscess. Study of *K. pneumoniae* serotypes, capsular polysaccharides, and their interaction with host cells may provide clues to understanding the pathogenesis of *K. pneumoniae* septic metastasis, including metastatic splenic abscess.

Salmonella infections are common in patients with sickle cell diseases, who are prone to develop splenic infarctions which predispose to abscess formation [13]. The absence of sickle cell disease in Taiwan, despite the high prevalence of salmonellosis [14], probably accounts for the comparatively low incidence of indigenous *Salmonella* splenic abscess in this study [3-5].

Tuberculous splenic abscess has been reported since the emergence of AIDS in the 1980s [4,5]. The low incidence of tuberculous splenic abscess in this series and in another report from Taiwan [15] may be due to the relatively low incidence of HIV infections in Taiwan [16] and infrequent splenic biopsy for pathologic study or culture. The low incidence of HIV in Taiwan also probably accounts for the low incidence of fungal splenic abscess in this study. Hepatosplenic candidiasis is a distinct form of invasive candidiasis in patients with acute leukemia, and its incidence was reported to be as high as 6.8% by Anttila et al [17]. The low incidence of hepatosplenic candidiasis in this study suggests that it has long been underdiagnosed in patients with acute leukemia in Taiwan. In view of the advances in chemotherapy and the increase in the incidence of AIDS in Taiwan [15], an escalating incidence of non-pyogenic splenic abscess should be anticipated. We found that multiple abscess tended to occur in immunosuppressed patients. Study is needed to establish an appropriate treatment strategy for immunocompromised patients with splenic abscess. This is particularly important in Taiwan considering the emergence of melioidosis [18]. Spleen was reported to be the predominant extrapulmonary visceral organ involved in melioidosis in Thailand [19].

The low positive culture rates in patients with splenic abscess before 1977 [3] may have resulted from the relatively primitive culture techniques used at that time. Compared to 2 other reports published after 1977

[4,5], we found that our patients had a relatively higher sterile-culture rate, which might have resulted from a widespread loose and/or less discriminate use of antibiotics in Taiwan [20,21]. Such practice interferes with diagnosis and effective antimicrobial therapy.

Traditional treatment for splenic abscess is appropriate antimicrobial therapy with or without splenectomy [1,22,23]. Percutaneous drainage is an alternative for critically ill patients and for young patients in whom vigorous attempts to preserve the spleen are made [24]. Different forms of treatment including antibiotic therapy alone or in conjunction with varied interventions have been reported, and most have been based on available therapeutic modalities, underlying conditions and identified pathogens [1,22-24]. The insignificant differences in mortality rate between patients treated with different modalities in our series may have been related to the small sample size. There are no data from a well-designed study to indicate that patients with splenic abscess treated with antibiotics alone and those with multiple splenic abscesses, regardless of therapy, have higher mortality rates. However, inferences have been derived from comparison of patients in different series because of the rarity of this disease entity [3,5,25,26]. Only a prospective cohort study with adequate sample size will be able to demonstrate which, if any, of the various treatment modalities is superior to others.

In conclusion, abdominal pain or tenderness confined to the LUQ of the abdomen and the presence of left pleural effusion are important clues suggestive of splenic abscess. The incidence of endocarditis-associated Gram-positive coccal splenic abscess in Taiwan is relatively low and may be due to the comparatively low prevalence of intravenous drug abuse. *K. pneumoniae* is a more common cause of splenic abscess than *E. coli* in Taiwan, especially in diabetics. This is a unique finding worthy of further study, especially regarding its relationship with the high incidence of *K. pneumoniae* liver abscess in Taiwan. In this study, multiple abscesses were more commonly seen in immunosuppressed patients, particularly those with malignancies. Due to the rarity of splenic abscess and the increasing numbers of immunosuppressed patients, a prospective multicenter study is needed to determine optimal therapies for different patient populations.

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