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Community-acquired methicillin-resistant *Staphylococcus aureus* liver abscess in a patient with end-stage renal disease

Chih-Yu Chi, Benjamin Ing-Tiau Kuo, Chang-Phone Fung, Cheng-Yi Liu

Division of Infectious Diseases, Department of Medicine, Taipei Veterans General Hospital, Taipei, Taiwan, ROC

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Community-acquired methicillin-resistant *Staphylococcus aureus* (MRSA) infections are an emerging problem. Although most liver abscesses are caused by *Escherichia coli* and *Klebsiella pneumoniae*, *S. aureus* can occasionally be isolated as the pathogenic organism. Liver abscess caused by MRSA is rarely reported. Here, we report a case of liver abscess due to MRSA in a 34-year-old man with end-stage renal disease and a 13-year history of hemodialysis treatment.

Key words: End-stage renal disease, liver abscess, methicillin resistance, *Staphylococcus aureus*

Impaired immunity in uremic patients makes them more susceptible to infectious processes. Infection can have a major impact on patients with end-stage renal disease. Both typical and opportunistic organisms can infect patients with end-stage renal disease. Pyogenic hepatic abscess is an uncommon disease entity, even in uremic patients. Most bacterial liver abscesses are caused by Enterobacteriaceae and anaerobes [1]. Occasionally, *Staphylococcus aureus* is isolated, usually in children [1]. The presumed route for liver abscess caused by *S. aureus* is hematogenous in origin. Liver abscess caused by methicillin-resistant *S. aureus* (MRSA) is quite rare, especially when community-acquired. We describe such an infection in an adult patient with end-stage renal disease receiving long-term hemodialysis treatment.

Case Report

A 34-year-old man presented with a 1-week history of intermittent fever, general malaise and watery diarrhea. He had a history of polycystic kidney disease and had been receiving hemodialysis, 3 times weekly, for 13 years. He was regularly followed up in the nephrologic outpatient clinic and had required no hospital admissions in the past few years. He presented with fever, generalized malaise, and mild epigastric tenderness 1 week prior to this admission.

On admission, temperature was 37.8°C, pulse rate was 120/min, and blood pressure was 130/69 mm Hg. On physical examination, rales were noted over the right lower lung field, and mild tenderness was found over the right upper quadrant of the abdomen. Laboratory investigations revealed leukocytosis ($12.4 \times 10^3/\mu L$), elevated C-reactive protein (25.5 mg/dL), elevation of blood urea nitrogen (72 mg/dL), and serum creatinine (14.5 mg/dL). Plain film of the chest showed right hemidiaphragmatic elevation (Fig. 1). Due to suspicion

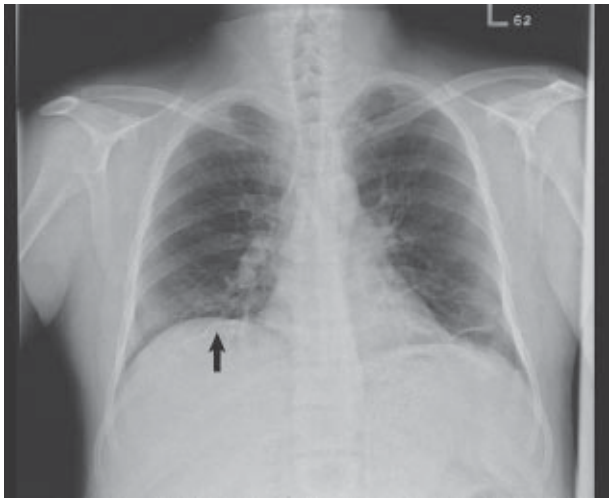

Fig. 1. Chest X-ray shows elevated right hemidiaphragm and passive atelectasis of the right lower lung (arrow).

Corresponding author: Dr. Benjamin Ing-Tiau Kuo, Division of Infectious Diseases, Department of Medicine, Taipei Veterans General Hospital, 201, Shih-Pai Road, Section 2, Taipei, Taiwan 11217, ROC.
E-mail: cychyi@vghtpe.gov.tw

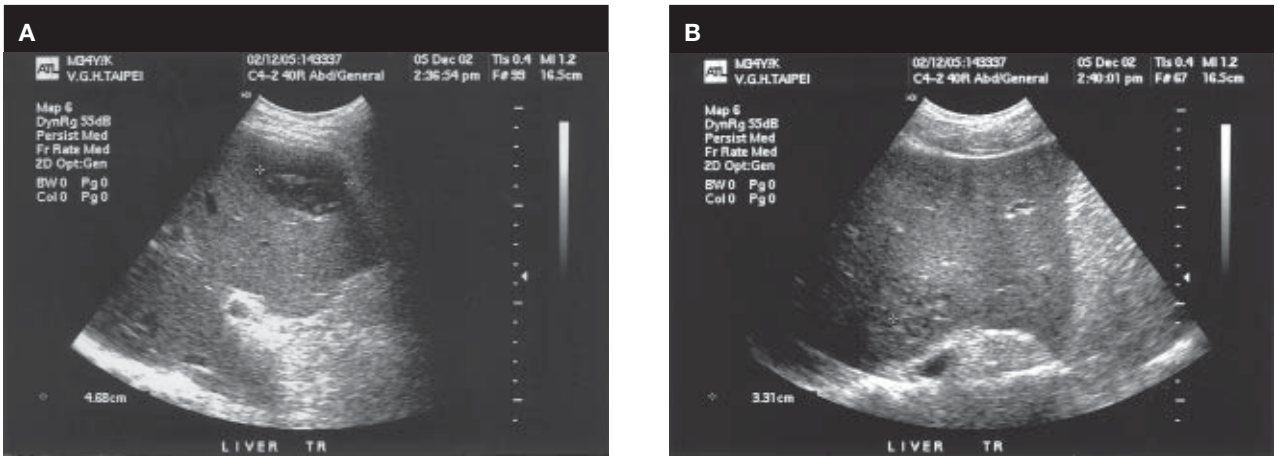

Fig. 2. Abdominal sonogram shows complex intrahepatic lesions in the anterior (**A**, asterisk) and posterior portions of the liver (**B**, asterisk).

of liver abscess, abdominal ultrasonography was arranged, which revealed 2 complex hypoechoic cystic lesions (the largest one was 5 × 4 cm) with septation in the liver and numerous cysts of various sizes in both kidneys (Fig. 2). The hepatic lesion was drained and pus-like material was obtained. Gram stain of the aspirated material identified Gram-positive cocci in cluster that were heavily infiltrated with polymorphonuclear neutrophils (Fig. 3).

Indirect hemagglutination test for amoebic infection, anti-human immunodeficiency virus enzyme immunoassay test and Widal test were all negative. No pathogens were isolated from blood cultures and other laboratory data were also unremarkable. Subsequent cultures of the aspirate grew *S. aureus*, which was susceptible only to gentamicin, trimethoprim-sulfamethoxazole, and vancomycin. Gallium inflammation scan of the whole body showed no signs of metastatic infection. The patient was treated with teicoplanin 400 mg intravenously twice weekly and discharged 2 weeks later after he became afebrile, leukocytosis and C-reactive protein had normalized, and the size of the liver abscess had decreased. There was no recurrence of symptoms or signs during 3 months of outpatient follow-up.

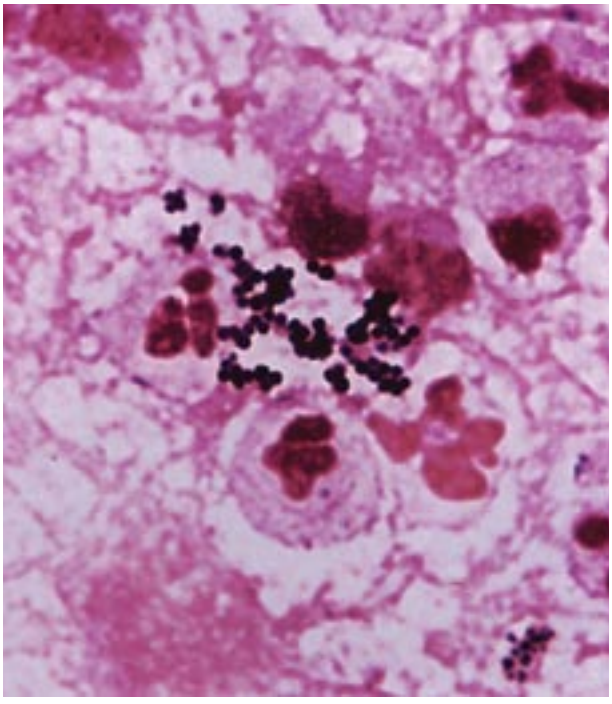

Fig. 3. Gram stain of liver abscess aspirate shows Gram-positive cocci in clusters (× 1000).

Discussion

With the introduction of more potent antibiotics, resistant bacterial infections have become a global problem. In Taiwan, MRSA was first described in the early 1980s [2], and it is now an important nosocomial pathogen. In recent years, community-acquired MRSA infections have been emerging as a worldwide problem [3-7]. Most cases of community-acquired MRSA infections occur in patients with underlying medical conditions who are in frequent contact with the health care system, such as hemodialysis patients [8-10].

Immune function impairment in patients with chronic renal failure has a multifactorial and complex etiology. The impairment arises from: the uremic state; underlying diseases that led to the renal failure; and therapy-related causes [11]. Few aspects of host defense are unaffected by uremia or its metabolic complications,

predisposing such patients to infections with both typical and atypical pathogens. The immune impairment may improve a little with dialysis, but dialysis itself can also impair immune function [11]. Factors predisposing to the development of pyogenic liver abscess include diabetes mellitus, cardiopulmonary disease, malignancy, chronic granulomatous disease, and cirrhosis [12,13]. Most patients who develop these diseases have some flaws in their immune system. The impairment of the immune system in uremic patients also predisposes them to the development of pyogenic liver abscess.

Pyogenic liver abscess is a relatively uncommon but important disease category. The incidence of pyogenic liver abscess ranges from 8 to 20 cases per 100,000 hospital admissions, usually affecting the elderly [12]. Possible routes of infection include: the biliary tree; the portal vein; the hepatic artery; direct extension from contiguous structures; penetrating or non-penetrating trauma to the liver; and cryptogenic [1,12,14]. Pyogenic abscesses can be single or multiple. The right hepatic lobe, as in this case, is more commonly involved than the left [1,12]. Biliary system infection is the most common cause of pyogenic liver abscess and is generally associated with multiple lesions, whereas abscesses arising via the portal vein are usually solitary [1,12,15].

Although pyogenic liver abscess can be monomicrobial or polymicrobial, polymicrobial cases are the most common [1,12,14]. *Escherichia coli* and *Klebsiella pneumoniae* are the most common isolates [1,12]. In contrast to other areas of the world, *K. pneumoniae* is the leading cause of pyogenic liver abscess in Taiwan and cases of *K. pneumoniae* liver abscess are more likely to be of monomicrobial origin [16]. Other less common pathogens, such as anaerobes, mycobacteria, and fungi, have also been reported as the cause of pyogenic liver abscess. *S. aureus* is isolated in 20% or less of cases, and is most frequently isolated in children younger than 5 years old. *S. aureus* liver abscesses presumably arise from hematogenous spread and are sometimes associated with abscesses in other organ systems [1]. In our patient, bloodstream infection via the procedure of hemodialysis with subsequent hepatic seeding was the most likely route of infection. Strictly speaking, patients in frequent contact with the health care system may acquire MRSA infection or colonization via hospital visits and these so-called community-acquired MRSA infections should thus be regarded as nosocomial infections.

The classic triad of fever, right upper quadrant pain or fullness, and jaundice are now seen in only 10% of patients [12]. The presentation is highly variable, and jaundice is rarely a clinical manifestation unless biliary tree infection is the cause or there is extensive hepatic involvement [1,12]. Other clinical manifestations, none of which are specific to pyogenic liver abscesses, include chills, cough, pleuritic pain radiating to the right shoulder, malaise, vomiting, and nausea.

Around half of patients will present with hepatomegaly and right upper quadrant tenderness [1]; the latter was found in this case. As in our patient, leukocytosis is present in most cases. Abnormal liver function tests are noted in most patients, but elevations are usually mild and normal liver function tests do not exclude the diagnosis. Although alkaline phosphatase elevation was not observed in our patient, it is present in the majority of patients with liver abscess [15]. In approximately 50% of patients, plain chest films will show abnormalities, including elevation and limited movement of the right diaphragm, basilar atelectasis, and right pleural effusion [1]; similar findings were also noted in our patient. Blood cultures are positive in 50% of patients [12]. Other laboratory tests lack specificity for the diagnosis of liver abscess. Though scintigraphy using technetium 99m, magnetic resonance imaging, ultrasonograpy and computed tomography (CT) scanning are useful imaging modalities, with ultrasonography and CT scan having particularly good sensitivities [13,15], a definitive diagnosis relies on cultivation of purulent material obtained from the abscess cavity.

Untreated pyogenic liver abscess is almost invariably fatal. Treatment traditionally consists of antibiotic administration and drainage. Percutaneous drainage is the preferred approach for the initial management of pyogenic liver abscesses, having a cure rate of 69 to 90% when used in combination with antimicrobial therapy [12]. Surgical intervention is usually reserved for patients with persisting fever lasting more than 2 weeks despite percutaneous catheter drainage and appropriate antibiotic therapy; those with concomitant intra-abdominal disease requiring surgical management; those with hepatic abscesses resulting from biliary obstruction; and those with loculated or highly viscous abscesses or multiple large abscesses [1,15]. The aspirated material should be examined by Gram staining and cultivated for anaerobic and aerobic bacteria. Percutaneous aspiration without drainage may be considered as an alternative method for treating pyogenic liver abscess. In combination with antibiotic therapy, percutaneous aspiration can achieve cure

rates between 58 and 88% [12]. Treatment with antibiotics alone without drainage should be considered only in patients with small liver abscesses not amenable to drainage or for patients in whom drainage would be risky [12].

Antibiotics should be commenced as soon as a pyogenic liver abscess is suspected. Initial empirical antibiotic therapy should cover anaerobes and the Enterobacteriaceae [1], and adjustment of antimicrobial agents according to the results of microbiologic susceptibility tests is necessary. The duration of treatment is usually at least 4 to 6 weeks [14]. A previous study reported that a shorter duration of therapy, such as the 2-week therapeutic course in this case, might be curative in the presence of adequate drainage [15]. Despite the success of short-term antimicrobial treatment, this therapeutic method should be given to selected cases and close follow-up for the recurrence of symptoms and signs is crucial. In general, abscesses completely resolve after a full course of therapy. On occasion, a residual cavity may persist despite prolonged therapy. If the cavity does not change in size in serial imaging studies, and the patient is asymptomatic, antibiotic cessation can be tried with close follow-up. In such situations, a follow-up CT scan is recommended 1 to 2 months after antibiotic cessation [12].

Liver abscess is an uncommon but serious disease in clinical practice, both in the general population and in patients with end-stage renal disease. This case highlights the necessity for consideration of liver abscess in patients presenting with right upper quadrant abdominal pain, and fever with or without an elevated serum alkaline phosphatase, especially when accompanied by elevated right hemidiaphragm and passive collapse of the right lower lung. Patients with liver abscess are at increased risk for acquiring *S. aureus* infections, and MRSA should be considered as a potential pathogen, especially in those who are in frequent contact with the health care system. To exclude the associated metastatic lesions, a whole body gallium inflammatory scan should be seriously considered in a patient with liver abscess caused by *S. aureus*. Early diagnosis and appropriate treatment will reduce morbidity and mortality in patients with pyogenic liver abscess.

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