

## Gas-forming splenic abscess due to *Salmonella enterica* serotype Enteritidis in a chronically hemodialyzed patient

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Received: February 1, 2007 Revised: February 14, 2007 Accepted: March 30, 2007

We describe a diabetic patient who was chronically hemodialyzed due to end-stage renal disease and developed a gas-forming splenic abscess and bacteremia caused by *Salmonella enterica* serotype Enteritidis. Fever persisted despite urgent splenectomy and intravenous ceftriaxone and metronidazole for 14 days. He recovered completely after intravenous ciprofloxacin/metronidazole treatment for a further 14 days. The isolate was susceptible to ciprofloxacin and ceftriaxone and did not exhibit extended-spectrum beta-lactamase phenotype.

**Key words:** Abscess; Male; Renal dialysis; *Salmonella enteritidis*; Splenic diseases

### Introduction

Splenic abscess usually occurs as a consequence of systemic bacteremia due to infective endocarditis or due to secondary infection in a spleen damaged by infarct or trauma [1]. While several reports have documented non-suppurative gas formation in abdominal organs [2-4], in most of these cases the gas formation occurred in infarcts which resulted from transcatheter therapeutic embolization of tumors. Here we present a case of splenic infarct with suppurative gas collection in a chronically hemodialyzed patient who developed *Salmonella enterica* serotype Enteritidis septicemia.

### Case Report

This 51-year-old diabetic man had a 4-year history of end-stage renal disease on dialysis. He complained of a four-day history of persistent left upper abdominal pain and a one-day history of intermittent fever. Hepatitis B virus-related liver cirrhosis had been diagnosed four years prior to this visit. There was no history of trauma,

blood access site infection or immunosuppressive therapy.

Physical examination revealed a body temperature of 40.3°C and tachycardia (123/min). There was tenderness in the left upper abdominal quadrant. There was no sign of hepatomegaly, ascites or arteriovenous graft infection.

Laboratory examinations revealed hemoglobin 8.9 mg/dL, leukocyte count 7700/mm<sup>3</sup> (2% band forms, 87% segment, 8% lymphocytes), and platelet count of 116,000/mm<sup>3</sup>. The C-reactive protein level was 16.15 mg/dL. Liver function test initially showed mild elevations of aspartate aminotransferase (43 U/L) and alanine aminotransferase (36 U/L). Blood sugar level was 488 mg/dL.

Computed tomography of the abdomen revealed a splenic gas-forming abscess (Fig. 1) and gas formation over the portal vein was observed. Splenectomy was performed due to congestion and focal infarction. The spleen was 920 g and 20 × 16 × 6 cm in diameter. Microscopic sections of the lesion showed coagulative necrosis surrounded by a rim of inflammatory cell infiltration comprised predominantly of neutrophils.

Ceftriaxone (1 g every 12 h) and metronidazole (500 mg every 12 h) were given for 14 days initially. However, because of persistent fever, therapy was switched to a combination of intravenous ciprofloxacin

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**Fig. 1.** Computed tomography of the abdomen showing a gas-forming splenic abscess (arrow).

(200 mg every 12 h) and metronidazole (500 mg every 12 h). Fever subsided 5 days later. The patient was treated with ciprofloxacin and metronidazole for 14 days.

Two sets of blood culture obtained on admission and postoperative sample of the splenic abscess were positive for *S. Enteritidis* and negative for anaerobic bacteria. The isolate was susceptible to ampicillin (minimal inhibitory concentration [MIC] of  $\leq 4$   $\mu\text{g/mL}$ ), ciprofloxacin (MIC,  $\leq 0.5$   $\mu\text{g/mL}$ ), trimethoprim-sulfamethoxazole (MIC,  $\leq 0.5/9.5$   $\mu\text{g/mL}$ ), chloramphenicol (MIC,  $\leq 4$   $\mu\text{g/mL}$ ) and ceftriaxone (MIC,  $\leq 4$   $\mu\text{g/mL}$ ) by the BD Phoenix<sup>TM</sup> automated identification system (Beckon Dickinson Diagnostic Systems, Franklin Lakes, NJ, USA). As determined by the agar dilution method, the isolates had a ceftriaxone MIC of 2  $\mu\text{g/mL}$  and a cefepime MIC of 1  $\mu\text{g/mL}$ . Addition of 10  $\mu\text{g/mL}$  clavulanic acid did not change the cefepime MIC of the isolate, indicating the absence of extended-spectrum beta-lactamases.

## Discussion

This is the first report of an association of splenic infarct with gas-forming abscess due to *S. Enteritidis* infection in a hemodialyzed patient. This patient initially presented with persistent left upper abdominal pain and intermittent fever, which were probably a consequence of septic thrombotic episodes in the spleen.

Based on the pathological findings in this case, we speculated that a splenic infarct secondary to atheroma initially developed in this patient with superimposed thrombosis in one of the vessels supplying the spleen.

This infarct may have subsequently become infected with *S. Enteritidis* perhaps secondary to a transient bacteremia such as is known to occur intermittently in healthy people [5]. The development of a splenic abscess from infection of a splenic infarct is a recognized complication in infective endocarditis and in sickle cell disease [1]. Splenic abscess can also occur secondary to urinary tract infection, appendicitis, trauma, contiguous neoplasm, and typhoid fever [1]. Septic embolism following bacterial endocarditis and embolism arising from other septic foci cause the reactivation of the existing infection [6]. Although our patient did not have any of these conditions, he did have severe vascular disease secondary to longstanding diabetes mellitus and uremia.

The most frequent microorganism found in the splenic abscess is *Streptococcus* spp.; *Staphylococcus* and members of *Enterobacteriaceae* are less frequent. Several cases of splenic abscess were also reported to be caused by *Chlamydia pneumoniae*, *Brucella*, *Clostridium*, or even other microorganisms such as fungi [6-9]. Splenic abscess in hemodialysis patients has only been reported to be due to *Staphylococcus* spp., as a consequence of septicemia, and acquired through dialysis access sites [10,11]. This is the first report of a case of splenic abscess in a hemodialysis patient due to Gram-negative bacteria. It is assumed that functioning phagocytic mononuclear cells are important in the control of *Salmonella* infection, and uremic patients have increased susceptibility to *Salmonella* infection due to early activated T-cell apoptosis, T-cell lymphopenia, progressive immunodeficiency, and increased infection risk [12].

An epidemiological study showed that as much as 26% and 10% of infection caused by *S. Choleraesuis* in Taiwan is related to liver cirrhosis and chronic renal impairment, respectively [13]. Our patient might have been more susceptible to infection caused by *Salmonella* spp. because of the underlying conditions of end-stage renal disease due to diabetes mellitus and liver cirrhosis. Infection caused by *Salmonella* spp. can cause hepatic or splenic abscess or cholecystitis, but infectious gas accumulation in an infarcted spleen has not been reported. The conditions of portal venous gas and emphysematous pyelonephritis (EPN) are similar to gas accumulation in the spleen of our patient. Portal venous gas, which was also found in our patient, usually indicates severe bowel disease with septicemia, bowel infarction or ulcerative colitis [14]. Previous studies have shown that mixed acid fermentation of glucose by

*Enterobacteriaceae* under relatively anaerobic conditions is the major pathway for gas production in EPN [15,16]. Moreover, diabetes mellitus with poor glycemic control and urinary tract obstruction with impaired renal circulation are the most important host factors predisposing patients to the development of EPN [17]. Our patient had diabetes mellitus with poor glycemic control and developed *Salmonella* septicemia with an infarcted spleen and gas accumulation in the spleen. While splenectomy has usually been considered to be indicated, successful treatment with conservative measures such as percutaneous drainage has also been reported [18]. The reasons why our patient responded poorly to ceftriaxone and metronidazole treatment although the infected spleen had been removed and the isolate was susceptible to ceftriaxone (non-extended-spectrum beta-lactamase-producing isolates) remain unclear.

In conclusion, *Salmonella*-related splenic abscess should be suspected in hemodialysis patients when fever develops in association with left upper abdominal pain. The combination of surgery and medical treatment is considered to be a suitable method of treatment.

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