CME CREDIT *EDUCATIONAL OBJECTIVE:* Readers will appreciate the danger of infections in patients without a functioning spleen

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Man's best friend, fatal in the end

A dog bite in a patient without a spleen can have serious consequences

FIGURE 1. A 1-cm laceration (arrow) on patient's right thumb from a dog bite 2 days before presentation.

A previously healthy 59-year-old woman with a remote history of splenectomy following a motor vehicle accident presented to the emergency department with a chief complaint of fever. She had been in her usual state of health until the day before, when she developed chills and fever, with temperatures as high as 39.4°C (102.9°F). She also began to have nausea, vomiting, and diffuse body weakness and had to be brought to the emergency department in a wheelchair. She denied upper-respiratory or urinary symptoms, headache, stiff neck, recent travel, or sick contacts.

She had sustained a minor dog bite on her right hand 2 days before, but she denied swelling, erythema, or exudate. The dog, a family pet, was up to date on all of its vaccinations, including rabies.

Her temperature was 39.3°C (102.7°F), heart rate 121 beats per minute, and blood pressure 113/71 mm Hg. She had a clean, nonerythematous, healing, 1-cm laceration on her right thumb (**Figure 1**).

Initial laboratory values (**Table 1**) and a radiograph of her right thumb were unremarkable.

FEVER IN ASPLENIC PATIENTS

1 What is the appropriate next step in this patient's management?

- ☐ Discharge her from the emergency department and have her follow up with her primary care physician within 48 hours
- ☐ Admit her for observation and defer antibiotic therapy
- ☐ Admit her and start empiric antibiotic therapy
- ☐ Admit but wait for culture results to come back before starting antibiotic therapy

The patient's history of splenectomy and presentation with fever raise the concern that she may be going into sepsis. In addition to fever, patients with sepsis may present with flulike symptoms such as myalgias, headache, vomiting, diarrhea, and abdominal pain.[1]

Sepsis in asplenic patients, also known as

doi:10.3949/ccjm.84a.16061

overwhelming postsplenectomy infection, can have a sudden onset and fulminant course, with a mortality rate as high as 50%.[2] It is important to recognize those who are susceptible, including patients without a spleen from splenectomy or congenital asplenia, as well as those with functional asplenia from diseases such as sickle cell disease. Without the spleen, the immune system cannot clear immunoglobulin G-coated bacteria and encapsulated bacteria that are not opsonized by antibodies or complement.[3]

Any asplenic patient presenting with fever or other symptoms of systemic infection warrants immediate antibiotic treatment, without delay for cultures or further testing.[1]

CASE CONTINUED: RAPID DETERIORATION

With no clear source of infection, the patient's clinical presentation was presumed to be due to a viral infection, and antibiotics were deferred. She was admitted to the hospital for observation.

By the next morning, her mental status had declined. Her temperature at that time was 39.6°C (103.2°F), heart rate 115 per minute, and blood pressure 113/74 mm Hg. Her skin became mottled, and her lactate level increased from 1.9 mmol/L to 4.9 mmol/L (reference range 0.5–1.9 mmol/L) within 9 hours and continued to climb (**Table 2**).

TABLE 1

The patient's laboratory values on presentation

Test	Result	Reference range
Complete blood cell count		
Hemoglobin (g/dL)	12.9	11.5–15.0
Hematocrit (%)	38.2	34.0–46.0
Platelet count (x 10^9/L)	277	140–400
White blood cell count (x 10^9/L)	11.2	3.5–12.5
Neutrophils (%)	96	41–81
Lymphocytes (%)	4	13–46
Monocytes (%)	0	4–12
Eosinophils (%)	0	0–4
Basophils (%)	0	0–1
Neutrophils (x 10^9/L)	10.7	2.1–7.7
Basic metabolic panel		
Sodium (mmol/L)	135	137–145
Potassium (mmol/L)	3.5	3.5–5.3
CO_2 (mmol/L)	25	22–30
Blood urea nitrogen (mg/dL)	16	9.0–20.0
Creatinine (mg/dL)	0.83	≤ 1.11 mg/dL
Lactate (mmol/L)	1.9	0.5–1.9

EMPIRIC ANTIBIOTICS IN ASPLENIC SEPSIS

2 Which first-line antibiotics should have been started on initial presentation?

- ☐ Intravenous vancomycin and intravenous ceftriaxone
- ☐ Intravenous vancomycin and intravenous metronidazole
- ☐ Oral levofloxacin
- ☐ Oral amoxicillin

At initial presentation to the hospital, the most appropriate regimen for this patient would have been vancomycin and ceftriaxone or cefepime in meningitis-level (ie, high) doses.[2,4]

Due to impaired immunity, asplenic patients are highly susceptible to encapsulated gram-positive organisms such as *Streptococcus pneumoniae* and gram-negative organisms such as *Haemophilus influenzae*, *Neisseria meningitidis*, and *Capnocytophaga canimorsus*. These organisms are all susceptible to ceftriaxone, with the exception of methicillin-resistant *S pneumoniae*, which is best covered with vancomycin.[1] Patients with beta-lactam hypersensitivity can be treated with moxifloxacin instead.[4,5]

Vancomycin and metronidazole alone would not be adequate. Oral levofloxacin or amoxicillin would be appropriate initial treatment if the patient did not have access to a hospital within 2 hours. Ideally, the patient would have had one of these medications on hand and taken it at the first sign of fever.[4]

CASE CONTINUED: TRANSFER TO ICU

The patient was empirically started on vancomycin and ceftriaxone and transferred to the intensive care unit. She required intuba-

TABLE 2

The patient's laboratory values during her hospital course

Test	Result: Admission	Day 2 12 PM	Day 2 8 PM	Day 3 12 PM	Reference range
Complete blood count					
White blood cell count (× 10^9/L)	11.2	12.8	17.2	19.1	3.5–12.5
Hemoglobin (g/dL)	12.9	12.6	11.5	8.2	11.5–15.0
Hematocrit (%)	38.2	40.3	37.2	26.1	34.0–46.0
Platelet count (× 10^9/L)	277	12	107	21	140–400
Basic metabolic panel					
Sodium (mmol/L)	135	142	140	138	137–145
Potassium (mmol/L)	3.5	3.2	4.8	6.0	3.5–5.3
Chloride (mmol/L)	102	117	115	104	98–107
Carbon dioxide (mmol/L)	25	11	38	8	22–30
Blood urea nitrogen (mg/dL)	16	19	23	23	9.0–20.0
Creatinine (mg/dL)	0.83	1.91	2.65	3.86	≤ 1.11
Lactate (mmol/L)	1.9	4.9	9.1	22	0.5–1.9
Liver function tests					
Aspartate aminotransferase (U/L)		716		6,633	14–36
Alanine aminotransferase (U/L)				3,514	11–66
Alkaline phosphatase (U/L)		81		95	38–126
Total bilirubin (Mg/dL)		3.2		3.3	0.2–1.3
International normalized ratio		3.8		> 9	

Arterial blood gases	Day 2 7 AM	Day 2 12 PM	Day 2 9 PM	Reference range
pH	7.17	7.02	6.92	7.35–7.45
Pco_2 (mm Hg)	25	28	23	34–46
Po_2 (mm Hg)	89	283	81	85–95
Bicarbonate (mmol/L)	8.9	6.7	4.4	22–26

With no clear source of infection, viral infection was presumed, and antibiotics were deferred

tion for airway protection. She became hypotensive despite receiving intravenous fluids and multiple vasopressors. She continued to rapidly decline and developed lactic acidosis, which resulted in a severe anion gap metabolic acidosis with respiratory compensation. Her course was further complicated by disseminated intravascular coagulation, acute kidney failure, and ischemic hepatitis ("shock liver") (**Table 2**).

CAUSES OF SEPSIS IN ASPLENIC PATIENTS

3 The patient's septic shock is likely the result of which bacterial pathogen?

- ☐ *S pneumoniae*
- ☐ *H influenzae*
- ☐ *C canimorsus*
- ☐ *N meningitidis*

Encapsulated organisms including *S pneumoniae*, *H influenzae*, and *N meningitidis* account for

almost 70% of infections in postsplenectomy patients, including those with overwhelming postsplenectomy infection.[6] *S pneumoniae* is the most common culprit. However, the patient's history of a recent dog bite suggests that the most likely cause was *C canimorsus*.

C canimorsus is a gram-negative bacillus commonly associated with exposure to dogs or cats through saliva, scratches, or bites.[7,8] Even a seemingly small, benign-appearing wound, as seen in this case, can be a portal of entry for this organism. About 84 cases leading to fulminant sepsis were reported in the United States from 1990 to 2014.[9] Patients infected with this organism can progress to fulminant sepsis with multiorgan failure with disseminated intravascular coagulation, anuria, and hypotension.[10–12]

CASE CONCLUDED

The patient died 40 hours after admission. Her blood cultures grew a slow-growing gram-negative rod within 2 days, subsequently identified as *C canimorsus*.

4 What is the best strategy for prevention of sepsis in an asplenic patient?

- ☐ Vaccinate against *S pneumoniae* (with PCV13 and PPSV23), *H influenzae* type b, and *N meningitidis*
- ☐ Prescribe antibiotics that the patient can take in case of fever
- ☐ Both of the above
- ☐ Prescribe lifelong daily antibiotic prophylaxis
- ☐ All of the above

Asplenic patients should receive pneumococcal, *H influenzae* type b, and meningococcal vaccines.[13] Invasive bacterial infections, particularly with encapsulated organisms, occur 10 to 50 times more often in this population than in a healthy population and can be fatal.[13] These vaccines have been shown to reduce the rate of life-threatening infections. Patients should receive the vaccines at least 2 weeks before an elective splenectomy or 2 weeks after a nonelective splenectomy.[2]

For the pneumococcal vaccines, PCV13 should be given first, followed by PPSV23 at least 8 weeks later. If the patient has already received PCV13, PPSV23 should be given at least 2 weeks after splenectomy. A second dose of PPSV23 should be given 5 years later.

The *H influenzae* type b vaccine should be administered if not already given.

For the meningococcal vaccine, the two-dose series should be administered with an interval of 8 to 12 weeks between doses. A booster meningococcal dose should be given every 5 years.

The patient should also receive the flu vaccine annually.[2,14]

Patients should also be given antibiotics (typically an antibiotic with activity against *S pneumoniae*, such as amoxicillin or levofloxacin) to carry with them. They should be told to take them if fever or chills develop and they cannot see a physician within 2 hours.[2]

Daily antibiotic prophylaxis with penicillin is typically given to patients younger than age 5, as studies have shown benefit in reducing pneumococcal sepsis. In adults, some experts recommend daily antibiotic prophylaxis for 1 year after splenectomy.[2] However, there is a lack of data and expert consensus to recommend lifelong daily antibiotic prophylaxis for all asplenic patients. Thus, it is not recommended in adults unless the patient is immunocompromised or is a survivor of pneumococcal sepsis.[4]

The patient died 40 hours after admission

KEY POINTS

- In an asplenic patient, fever can be an early sign of sepsis, which can have a rapid and fulminant course.
- Asplenic patients are particularly susceptible to infection by encapsulated organisms such as *S pneumoniae*, *H influenzae*, *N meningitidis*, and *C canimorsus* due to impaired immunity.
- If an asplenic patient has been exposed to a dog bite, scratch, or saliva, one should suspect *C canimorsus*.
- Asplenic patients who present with fever should be treated immediately with intravenous vancomycin and ceftriaxone without delay for laboratory tests or imaging.
- To help prevent fulminant sepsis, asplenic patients should receive vaccines (pneumococcal, meningococcal, and *H influenzae* type b) as well as a prescription for antibiotics (levofloxacin) to be used if they develop fever and cannot see a physician within 2 hours. ■

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