Case Report

Capnocytophaga canimorsus infection led to progressively fatal septic shock in an immunocompetent patient

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Background: Capnocytophaga canimorsus infection is rare, with a high fatality rate; however, there are few cases of death with a rapid course. This study reports a progressively fatal case of C. canimorsus.

Case Presentation: A 68-year-old immunocompetent Japanese man was bitten and scratched on his right hand by a dog 6 days before emergency transportation to the emergency room with abdominal pain, back pain, and melena. The patient developed multiple-organ failure. Despite antibiotic therapy, transfusion, vasopressor therapy, and continuous renal replacement therapy, the patient died from uncontrolled metabolic acidosis 4.5 h after admission. Approximately 80 h after admission, blood cultures were positive for C. canimorsus.

Conclusions: Capnocytophaga canimorsus infection can lead to rapid progression even in immunocompetent patients.

Key words: Capnocytophaga canimorsus, disseminated intravascular coagulation, dog bite, metabolic acidosis, septic shock

INTRODUCTION

Capnocytophaga canimorsus is an anaerobic Gram-negative bacterium in the oral commensal flora of dogs and cats that can be transmitted to humans by penetrating bites, causing sepsis and septic shock.1 In Japan, C. canimorsus has been found in 74% of dogs and 57% of cats.2 Although the prevalence of infection in Japan is unknown, the incidence rate of infection has been reported to be 0.67 and 0.5 per million population in the Netherlands3 and Denmark,4 respectively. Furthermore, a case fatality rate of 24%–30% was reported between 1990 and 2014. The risk factors for C. canimorsus infection include splenectomy, hypoplasenemia, alcoholism, cirrhosis, malignancies, and other immunosuppressive causes, such as glucocorticoid use. Immunodeficient individuals are more vulnerable to C. canimorsus infection than immunocompetent ones.5 A small number of cases have been reported where the infection was progressively fatal in immunocompetent patients.6–8 Herein, we report a progressively fatal case with some risk factors due to C. canimorsus, resulting in death 4.5 h after admission to the hospital.

CASE REPORT

A 68-year-old Japanese man was brought to the Department of Emergency Medicine, Hakodate Municipal Hospital, due to persistent lower abdominal pain, back pain, and melena. His medical history included benign prostatic hyperplasia and distal gastrectomy without splenectomy for gastric cancer when he was 46 years old; the latter had an uneventful course and required no chemotherapy. He smoked 20 cigarettes per day and consumed alcohol occasionally, although he was not an alcoholic. He was sufficiently active daily. The patient was bitten and scratched on his right hand by his dog 6 days before emergency transportation. He was asymptomatic until 2 days before transport, when the symptoms of general malaise and mild fever began.
On arrival, the patient was conscious and afebrile. His blood pressure was 142/68 mmHg, with a regular heart rate (76 b.p.m.), respiratory rate of 21 breaths/min, and SpO$_2$ of 99%. He had tenderness in the lower abdomen without peritoneal irritation. Petechiae were observed on his face and peripheral limbs. A scratch wound was evident on his right hand without any local signs of infection, such as swelling or redness. Blood laboratory data indicated high anion gap metabolic acidosis, thrombocytopenia, coagulopathy, liver failure, renal failure, and elevated C-reactive protein (Table 1). Enhanced computed tomography did not reveal the specific cause of the patient’s condition. Sepsis and multiorgan failure with disseminated intravascular coagulation (DIC) of unknown etiology were suspected. At this point, we considered *C. canimorsus* and *Pasteurella* to be potential causative agents.

After a computed tomography scan, his condition was seen to progressively worsen, and he was intubated and transferred to the intensive care unit 3 h after his arrival. Three sets of blood cultures were undertaken before initiating empiric antibiotic therapy with intravenous meropenem and vancomycin for septic shock. Despite empiric antibiotic therapy, aggressive fluid resuscitation (30–40 mL/kg crystalloids), transfusion (platelets, fresh-frozen plasma, and red blood cells), vasopressors, steroid application, and continuous renal replacement therapy, the purpura spread throughout his body, and blood was present in his stool and stomach tube. Blood laboratory data at 4 h after admission showed total bilirubin at 2.6 mg/dL, indirect bilirubin at 0.6 mg/dL, and no schistocytes, which did not suggest obvious hemolysis. Approximately 2 days after symptom onset and 4.5 h after admission, the patient died of uncontrolled metabolic acidosis.

Approximately 80 h after admission, one of three blood cultures grew Gram-negative aerobic rod-shaped bacteria (Fig. 1). This strain was identified as *C. canimorsus* by matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF MS) and 16S rRNA polymerase chain reaction results from the National Institute of Infectious Diseases, Tokyo, Japan. ETEST (bioMérieux) showed that this bacterium is susceptible to penicillin, ceftriaxone, and imipenem.

**DISCUSSION**

We have described a case of *C. canimorsus* infection with few risk factors that became...
progressively severe, resulting in death within a few hours from the onset of septic shock. Fulminant fatal cases of C. canimorsus can cause gastrointestinal symptoms, bleeding, coagulopathy, and death even in immunocompetent individuals.

Polymerase chain reaction is necessary to distinguish C. canimorsus from other Capnocytophaga species. Currently, the community health center hospitals in Japan, such as Hakodate Municipal Hospital, have MALDI-TOF MS, which can identify C. canimorsus from positive blood cultures. However, identification takes several days, and the disease may progress in the meantime.

A previous study showed that C. canimorsus did not activate signals that lead to the release of pro-inflammatory cytokines, chemokines, and nitric oxide, and mouse and human macrophages were unable to mount a potent inflammatory response when infected with C. canimorsus. In addition, the lipopolysaccharides of C. canimorsus protect against deposition of complement membrane attack complex and phagocytosis by polymorphonuclear leukocytes. These mechanisms suggest that C. canimorsus can evade the immune system, explaining its lethal pathogenesis.

To date, only three immunocompetent cases of progressively fatal C. canimorsus infection resulting in death within a day of hospitalization have been reported (Table 2). The common features between our case and previously reported cases were that the patients initially had abdominal symptoms, did not respond to antimicrobials, fluid resuscitation, blood transfusion, or vasopressors, and had a tendency to bleed, such as in gastrointestinal hemorrhage or purpura, which were associated with thrombocytopenia and coagulopathy. Two cases involved pathological dissection, and autopsy results revealed bilateral adrenal hemorrhage and necrosis consistent with Waterhouse–Friderichsen syndrome. Similarly, systemic bleeding and DIC could be the causes of death in our patient. Some previous reports have indicated that C. canimorsus sepsis causes secondary thrombotic microangiopathy, which improves with antimicrobial agents, plasma transfusion, and plasma exchange. However, these reports did not include a progressively fatal case.

| Ref. | Age (years)/sex | Exposure | Medical history | Initial symptoms before admission | Interval between admission and death | Antibiotics | Corticosteroid | Other treatment | Bleeding tendency |
|------|-----------------|----------|----------------|-----------------------------------|-------------------------------------|-------------|---------------|----------------|------------------|
| 6    | 47/F            | Dog      | Pneumonia      | Nausea, vomiting, diarrhea, abdominal pain, back pain | 12 h | Ceftriaxone Vancomycin Imipenem | N/A | Transfusion | + |
| 7    | 53/M            | Dog bite | None           | Nausea, myalgia, abdominal pain, lethargy | 90 min | Ceftriaxone Vancomycin + | | Transfusion | + |
| 8    | 80/F            | Dog bite | Depression     | Altered mental status, fever, abdominal pain | 12 h | Piperacillin-tazobactam + | Blood | | |
| Our case | 68/M         | Dog bite | Cured gastric cancer | Malaise, fever, abdominal pain | 4.5 h | Meropenem Vancomycin + | Transfusion CRRT + | |

CRRT, continuous renal replacement therapy; F, female; M, male, N/A, not available; Ref., reference.

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similar to ours. In our case, few findings suggested hemolysis, and fibrinogen levels decreased, which is not typical for thrombotic microangiopathy. This suggests DIC as the main cause of coagulation abnormalities. Type 7 dipeptidyl peptidase of C. canimorsus has been reported to inhibit factor X and contribute to bleeding and coagulopathy in vivo, which could be one of the factors of DIC. According to a recent systematic review, the case fatality rate of C. canimorsus infection in immunocompetent patients was 29.7% between 2002 and 2019. Therefore, physicians should be aware of the risk of rapid progression of C. canimorsus infection even in immunocompetent cases and should inform the public and provide early wound cleansing and prophylactic antimicrobial administration to patients bitten or scratched by dogs or cats.

CONCLUSION

Capnocytophaga canimorsus infection with abdominal symptoms can lead to rapid progression, even in immunocompetent patients. Physicians should inform the public about this risk and provide early wound cleansing and prophylactic antimicrobial administration to patients bitten or scratched by dogs or cats.

DISCLOSURE

Approval of the research protocol: N/A.
Informed consent: Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.
Registry and registration no. of the study/trial: N/A.
Animal studies: N/A.
Conflicts of interest: None.

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