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Capnocytophaga canimorsus Mycotic Abdominal Aortic Aneurysm: Why the Mailman Is Afraid of Dogs

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We describe the first case report of a mycotic abdominal aortic aneurysm secondary to *Capnocytophaga canimorsus* in an immunocompetent 65-year-old man. The exposure occurred after his dog scratched his arm and subsequently licked the wound. A review of *C. canimorsus*, a rarely pathogenic but potentially devastating bacterium, is also presented.

CASE REPORT

A 65-year-old male presented to his local emergency department with 3 days of lower abdominal pain, nausea, vomiting, fevers, and chills. Additionally, the patient had new midline low back pain, progressive over the preceding 3 months that acutely worsened over the 3 days prior to admission. A noncontrast computed tomography (CT) scan of the abdomen revealed a 5.8-cm para-renal abdominal aortic aneurysm (AAA) extending to just above the aortic bifurcation (Fig. 1). The aneurysm contacted the anterior aspect of the first and second lumbar vertebral bodies, and its indistinct margins were suggestive of a leak. The AAA was not a typical fusiform degenerative type, but a localized phenomenon of concern for either a penetrating atheromatous ulcer or a mycotic aneurysm. The patient was emergently transferred to our institution for surgical intervention.

His past medical history included hypertension, hyperlipidemia, coronary artery disease, and prostate carcinoma with radical prostatectomy in 2001. The patient had no known history of an abdominal aortic aneurysm and had undergone CT scanning 3 years prior during evaluation of his prostate cancer. The patient was a United States Postal Service mail carrier who lived with his wife and two dogs. He smoked one to two packs of cigarettes daily, and although he had previously used alcohol heavily, he had not consumed any for over 15 years.

Upon arrival at our institution, the patient's temperature was 100.9°F (38.2°C), the heart rate was 105/min, the respiratory rate was 20/min, and the blood pressure was 138/78 mm Hg. Physical examination revealed a soft abdomen with a faint, macular, purpuric rash, but no palpable aorta. He was tachycardic without a cardiac murmur. His lower extremities were cool, with palpable pulses throughout. Laboratory evaluation revealed a white blood cell count of 21,000/cubic mm, hemoglobin of 16.8 g/dl, blood urea nitrogen of 31 mg/dl, and creatinine of 2.0 mg/dl. The patient was emergently taken to the operating room for repair of a presumed ruptured AAA.

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During surgery, the aortic wall was thick with surrounding inflammatory debris and pus, but was without acute hemorrhage. A large posterior aortic perforation opened directly onto the spine, appearing to be a penetrating ulcer that had eroded through the aortic wall; however, given the patient's low-grade fever, leukocytosis, and operative findings of aortic wall inflammation and pus, an infectious etiology was considered. A sample of aortic wall and peri-aortic debris was sent for gram stain, culture, and histopathology (Fig. 2). The aorta was successfully repaired with a Dacron graft.

The gram stain from the aortic wall revealed neutrophils but no organisms. After 7 days, the anaerobic aortic wall culture grew slender, fusiform, gram-negative rods. The culture was sent to the Minnesota Department of Health for identification. Colony morphology revealed slow-growing, spreading, grayish colonies on tryptic soy agar with 5% sheep blood in 6% carbon dioxide. The isolate was oxidase positive, catalase positive, and indole negative. The isolate did not ferment or oxidize carbohydrates. The growth characteristics, microscopic morphology, and relatively inactive biochemical profile were consistent with *Capnocytophaga*, even though glucose and lactose fermentation are typically present. 16S rRNA gene sequencing definitively identified the isolate as *Capnocytophaga canimorsus.*

The patient was initially treated for *C. canimorsus* with intravenous piperacillin-tazobactam (2.25 g intravenously every 8 h in light of acute renal failure), and fevers resolved after 10 days. Antibiotics were changed to imipenem after the development of recurrent fevers with negative blood cultures and new neutropenia. A trans-thoracic echocardiogram revealed no evidence of endocarditis. After 6 weeks, the patient was converted to oral amoxicillin-clavulanate and subsequently to ciprofloxacin at discharge due to concern about beta-lactam-induced neutropenia. Blood cultures were negative throughout his hospital stay despite multiple recurrent fevers. Sputum, bile, urine, and stool cultures were all negative for *C. canimorsus*. The patient's hospital course was complicated by hemodialysis-dependent renal failure and ventilator-dependent respiratory failure.

Seven weeks later, once the patient was off the ventilator, he showed us three linear scars on his right forearm. Further

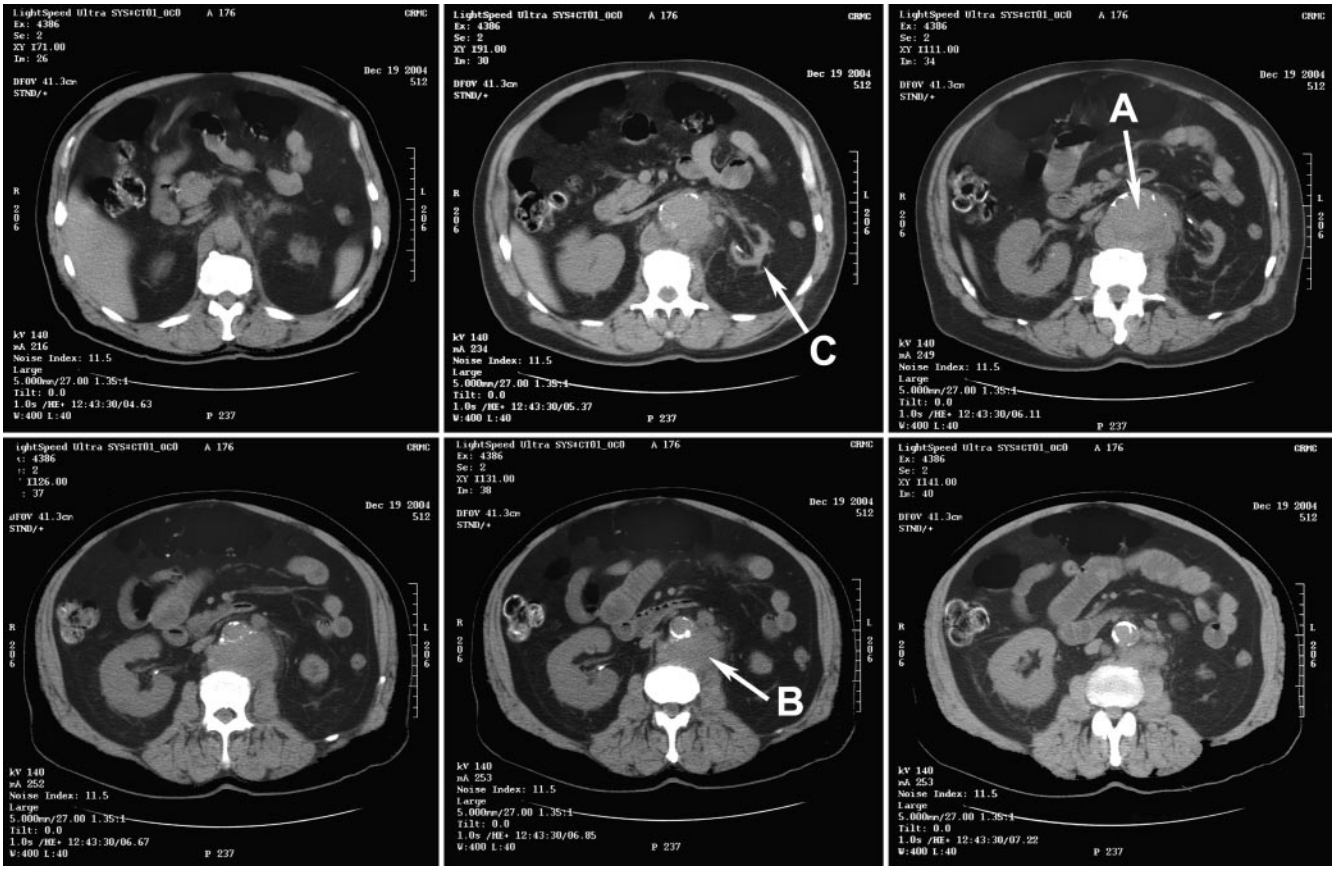

FIG. 1. Patient's preoperative abdominal CT showing mycotic abdominal aortic aneurysm (A), peri-aortic abscess and debris (B), and atrophic left kidney (C).

questioning revealed that 3 months prior to admission, and several days prior to the onset of low back pain, the patient's dog had scratched him deeply on the right forearm and he had subsequently allowed the dog to lick these wounds. This information revealed the vector for the diagnosis of a *C. canimorsus* mycotic abdominal aortic aneurysm.

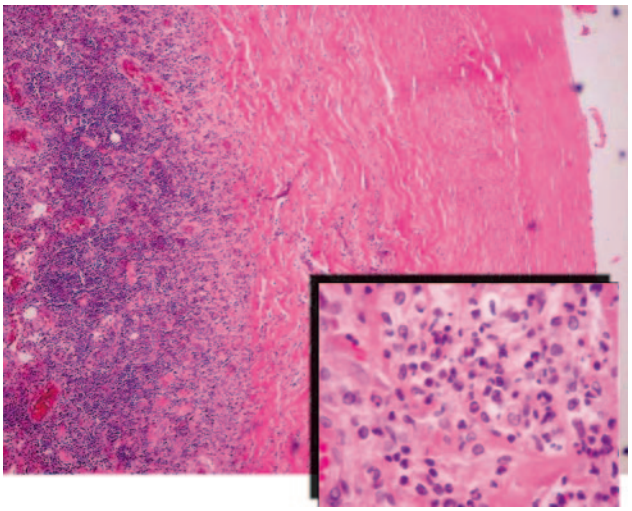

FIG. 2. Pathology specimen: fibrotic aortic wall with adventitial inflammation. (Inset) Aortic mural abscess.

Background. First described in a 1976 case of gram-negative septicemia with meningitis following a dog bite (1), dysgonic fermenter 2 (DF-2) was classified by the Centers for Disease Control and Prevention based on its characteristic slow growth (average of 4 to 5 days in blood culture, but reported up to 14 days) (5) and carbohydrate fermentation. It was given its current name in 1989 based on its CO_2 requirement (*Capnocytophaga* = "eater of carbon dioxide") and usual vector of transmission (*canimorsus* = "dog bite"). This gram-negative, nonspore-forming rod is commensal in dog and cat saliva. It shares common characteristics with other members of the *Capnocytophaga* genus, including morphology and gliding method of motility without a flagellum.

Pathogenicity. *C. canimorsus* has been reported in approximately 125 cases of human infection (7). In a review of 103 cases, the most common clinical presentation was septicemia (94 cases). Septicemia was concurrent with meningitis in 13 cases, endocarditis in 9, tricuspid myxoma in 1, infectious arthritis in 3, and possible myocardial infarction secondary to *C. canimorsus* in 1. There have been rare cases of isolated infection without bacteremia: meningitis alone was present in two cases, pleural infection was present in one case, and ocular

infections were present in six cases (5). There have been 12 reported cases of *C. canimorsus* endocarditis described through 2002 (8); however, to our knowledge there has not been a published case of *Capnocytophaga* causing a mycotic aneurysm.

The majority of mycotic aneurysms are caused by bacteria, despite the name coined by Sir William Osler in his 1885 Gulstonian Lecture describing an appearance reminiscent of "fresh fungal vegetations". The misnomer, mycotic aneurysm, has since been used for aneurysms that develop as a result of an infectious etiology.

> "I have met with one remarkable instance of ulcerative endocarditis in which there was also ulcerative endarteritis, involving the arch and producing multiple aneurysms. . .The arch of the aorta presented four aneurysms, three small, not larger than cherries, and one the size of a billiard ball. . .the appearance of fresh fungous vegetations. It may be presumed that, in this instance, the ulcerations led directly to the production of the aneurysms. . .and the larger sac presented a condition of mycotic endarteritis unique in my experience of aortic aneurysms."
>
> Sir William Osler (6)

The mode of *C. canimorsus* infection involves an animal bite in 54% of cases, an animal scratch in 8.5%, and an animal exposure alone in 27%, with dogs and cats accounting for 91% and 8% of these cases, respectively. The remaining 10.5% of cases have no identifiable source of infection (5). Other reviews support the high frequency of a dog bite etiology in human infections ranging from 43 to 56% of cases (2, 3, 7). Infection typically occurs 2 to 3 days after contact, while some infections take up to 4 weeks to appear (5). Our patient had deep dog scratches that were licked by his dog several days prior to the onset of his back pain, approximately 12 weeks prior to admission.

Clinical signs and symptoms. The clinical presentation of *C. canimorsus* infection usually involves sepsis: however, there are other clinical findings frequently present. A maculopapular rash is present in 13% of cases and is usually purpuric (37%) (5), with erythema multiforme also being described in several cases (7). Our patient had a macular purpuric rash on his abdomen at presentation that resolved over several days. Disseminated intravascular coagulation has commonly been associated with *C. canimorsus* septicemia (34 to 36% of cases) (5, 7). Gangrenous involvement of the bite site and other areas is encountered in 15% of cases; it can involve digits, as well as entire limbs. As in our patient, gastrointestinal complaints including abdominal pain (26%), vomiting (31%), and diarrhea (26%) are also commonly associated with *C. canimorsus* infection (7).

Predisposing factors. While *C. canimorsus* is frequently present in dog bite wounds, it rarely results in documented clinical infections. This is likely due to its slow growth, low virulence, and susceptibility to antibiotics frequently used for post-dog bite prophylaxis. Therefore, most cases of systemic infection appear in immunocompromised patients. In one comprehensive review, 33% of systemic infections occurred in asplenic patients, 24% in alcoholics, and 5% in other immunocompromised patients. Only 41% of infections occurred in patients without any known risk factor (5). Our patient had a history of significant alcohol use in the past, but had not consumed alcohol for 15 years. He had no evidence of compromised splenic function based on a normal peripheral smear, normal splenic size on CT scan, and normal platelet count. He had no other identifiable risk factors.

Mortality. Juxtaposed with *C. canimorsus*' low virulence is its high mortality rate once systemic infection has developed. Although the majority of infections occur in immunocompromised hosts, mortality is actually higher in patients without the aforementioned predisposing conditions (32% versus 28%) (5). The reason for this phenomenon is unclear.

Treatment. *C. canimorsus* infection is classically treated with penicillin G. However, the frequency of polymicrobial animal bite infections and the increasing prevalence of beta-lactamase-producing strains of *Capnocytophaga* warrant broader first-line coverage with antibiotics such as beta-lactam/beta-lactamase inhibitors, of which multiple combinations are effective (4). *Capnocytophaga* is typically resistant to aminoglycosides and narrow-spectrum cephalosporins. Other active antibiotics for *C. canimorsus* include imipenem, doxycycline, rifamycin, ofloxacin, ciprofloxacin, erythromycin, and clindamycin (5).

In retrospect, the onset of this patient's back pain in relation to his dog scratch and its persistence for 3 months prior to hospitalization, dovetailed with the chronic inflammatory changes seen in the aorta, support the clinical and pathological diagnosis of a mycotic abdominal aortic aneurysm secondary to *Capnocytophaga canimorsus*, an entity that has not been previously described. This case report highlights an uncommon disease process, attributable to a rare bacterium, and puts an unusual twist on the common cliché of mailman and dog.

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No conflicts of interest exist for any participating author.

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