

CASE REPORT

Mary H. Dudley,¹ M.D.; Lawrence A. Czarnecki,¹ D.O.; and Mark A. Wells,¹ B.S.

Fatal *Capnocytophaga* Infection Associated with Splenectomy*

ABSTRACT: A case of fatal sepsis due to *Capnocytophaga* species is described. *Capnocytophaga canimorsus* and *C. cynodegmi* can cause localized wound infections and/or systemic infections in people who have been bitten, licked, scratched, or merely exposed to cats or dogs, especially splenectomized individuals. A thorough social, medical, and surgical history, the clinical presentation, and cultures are important in making the diagnosis of *Capnocytophaga* infections. It is important that the forensic pathologist be aware of this zoonotic disease.

KEYWORDS: forensic science, microbiology, zoonotic, splenectomy, acute respiratory distress syndrome, *Capnocytophaga*, autopsy

The bacteria of the *Capnocytophaga* species can cause rapidly progressive sepsis leading to adult respiratory distress syndrome (ARDS), disseminated intravascular coagulation (DIC), and death in humans. Patients with impaired immune systems, especially asplenic individuals, are particularly susceptible. The forensic pathologist should be aware of the characteristic features and clinical presentations of *Capnocytophaga* infections in order to make this rare diagnosis. The clinical presentation of *Capnocytophaga* may mimic other diseases including plague, tularemia, and hantavirus.

Case Report

A 44-year-old man presented to the emergency room complaining of "not feeling well" for several days. On admission, he was hypotensive and febrile. He was treated with oxygen, but became progressively worse over the subsequent 4 h, and he developed radiographic changes consistent with ARDS. The clinical differential diagnoses included hantavirus, plague, and tularemia. A Wright stain of the peripheral blood smear revealed rod-shaped intracellular bacterial forms in polymorphonuclear cells (Fig. 1). Cerebral spinal fluid (CSF), serum, whole blood, urine, and stool cultures were sent to the Centers for Disease Control (CDC) in Atlanta, GA, and were found to be negative for plague and tularemia. Rapid progression of DIC led to death 4 h after presentation. The medical and social history obtained in the emergency department included a past motorcycle accident that resulted in rib fractures, pleural adhesions, and a splenectomy for a lacerated spleen. The patient had lived in a trailer and spent time outside collecting scrap metal to sell. He hunted squirrels and rabbits and had been recently given a German Shepherd puppy. Several cuts and scratches were observed on his forearms and hands. There

was a history that the puppy had licked the open abrasions on his hands, but there was no reported dog bite.

Autopsy revealed congested lungs, weighing over 1000 g each, bilateral pleural effusions, scattered petechial hemorrhagic skin lesions over both legs, generalized lymphadenopathy, and status-postremote splenectomy. There were healing abrasions over the fingers of both hands. At autopsy, blood and lymph node, lung, brain, and liver tissue cultures were obtained and sent to the state health department and the CDC. Histology of the lung showed diffuse alveolar damage with hyaline membrane formation. Sections of the brain, heart, liver, and kidneys were unremarkable. The slow growing bacteria of *Capnocytophaga* species were considered in the differential diagnoses, and after several days the organism that grew on chocolate agar was speciated as *C. canimorsus*.

Discussion

If there is a dog bite, an eschariform lesion, characterized as an irregular tender necrotic blackened lesion, forming at the bite site appears to be unique to this organism and may be a clue to this infection (1). An illness preceded by a dog bite with manifestations of DIC, symmetrical peripheral gangrene, and renal cortical necrosis was first described in 1970 as caused by the organism dysgenic fermenter-2 (DF-2) (2,3). CDC group DF-2 was first isolated in 1976 from the blood and spinal fluid cultures of a patient who became symptomatic following a dog bite (3). In 1989, Brenner et al. (4) suggested the name *Capnocytophaga canimorsus* (*capnocytophaga*). Canine *Capnocytophaga* [*C. canimorsus* (CDC Group DF-2) and *C. cynodegmi* (CDC Group DF-2 like)] are found in normal flora of the oral cavity of healthy dogs and cats. *C. canimorsus* was cultured as normal gingival flora from 17% of cats and 24% of dogs (5). *C. canimorsus* and *C. cynodegmi* can cause localized wound infections and/or systemic infections in people who have been bitten, licked, scratched, or merely exposed to cats or dogs. In the reported case, the cuts and scratches on the decedent's hands may have been the exposure site for the zoonotic infection.

¹Sedgwick County Regional Forensic Science Center, 1109 North Minneapolis, Wichita, KS 67214-3129.

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Those at highest risk for *Capnocytophaga* infection are generally individuals with a predisposing condition, most commonly impaired immune status, but death can also occur in apparently healthy individuals (5). Up to 40% of those infected have no predisposing condition (6). Risk factors for *Capnocytophaga* commonly include asplenia due to splenectomy, sickle cell anemia, chronic alcoholism, chronic obstructive pulmonary disease, pulmonary fibrosis, Hodgkin's disease, hairy cell leukemia, Waldenström's macroglobulinemia, malabsorption syndrome, renal disease, and steroid use (7). The frequent association with asplenia suggests that the reticuloendothelial system plays an important role in containing the infection. In patients with fatal outcomes and an intact spleen, defective serum lytic activity associated with complement abnormalities has been described as a possible explanation (8).

Documented infections usually present as sepsis or meningitis and have a mortality of *c.* 30% (6). *Capnocytophaga* infection can range from self-limited disease to severe infection characterized by DIC and death. Some of the major clinical features have included cellulitis, meningitis, Sweet's syndrome, fulminant bacteremia with septic shock, renal failure, hemorrhagic skin lesions reminiscent of meningococcal disease, pneumonias with empyema, and bacterial endocarditis (9,10). Waterhouse-Friderichsen syndrome secondary to *Capnocytophaga* has been described (5).

The microbiologic diagnosis of *Capnocytophaga* spp. is definitively made by culture, and the organism can be provisionally identified by biochemical tests. These Gram-negative bacteria are curved, fusiform, and can sometimes be seen with the cytoplasm of neutrophils and in the peripheral blood with Gram stains of a peripheral blood smear or buffy coat (11,12) (Fig. 1). *Capnocytophaga* is a fastidious Gram-negative bacillus that grows slowly on blood agar, agar with 5% rabbit blood, 5% sheep blood, heart or brain-heart infusion or chocolate agar, leaving a yellow pigment (13). Selective media have been developed for *Capnocytophaga* spp., and fastidious anaerobe agar supports growth of all strains (14). Because it grows slowly (2–7 days) and will not grow on MacConkey's agar, it is advisable to inform the laboratory that this diagnosis is being considered (11). *Capnocytophaga* spp. has gliding motility, requires carbon dioxide under either anaerobic or aerobic conditions, ferments glucose, and has a preferred temperature of 37°C (11). Canine *Capnocytophaga*, including *C. canimorsus* and *C. cynodegmi*, are oxidase and catalase negative, two reactions that differentiate them from other *Capnocytophaga* spp. The *Capnocytophaga* organisms are speciated by several different

chemical reactions and studies including reduction of NO₃ to NO₂, hydrolysis of esculin, hydrolysis of glycogen, and the production of acid from fructose, sucrose, mannose, raffinose, inulin, galactose, and melibiose (7).

Dog bites are very common and most bite infections are not due to *C. canimorsus*. However, since the initial report in 1976 (3), *C. canimorsus* has been associated with dog bites or contact with dog saliva in an increasing number of cases. The CDC estimates that up to 4.5 million dog bites occur per year, of which nearly 800,000 of these requiring medical attention (15). Half of all dog bites occur in children. *Pasturella multocida*, which causes cellulitis and suppurative, is usually associated with dog bite infections (1). In addition to *P. multocida*, there are many other bacterial infections associated with dog bites. Aerobic organisms include *Staphylococcus aureus*, *S. intermedius*, *Streptococcus* spp., *Neisseria* spp., *Corynebacterium* spp., *Moraxella* spp., *Enterococcus* spp., *Bacillus* spp., *Pseudomonas* spp., *Actinomyces* spp., and *Eikenella corrodens* (11). Anaerobic organisms include *Fusobacterium* spp., *Bacteroids* spp., *Porphyromonas* spp., *Prevotella* spp., *Propionibacterium* spp., *Peptostreptococcus* spp., and *Eubacterium* spp. (16). However, only *P. multocida* causes presenting symptoms of sepsis, ARDS, and DIC in a splenectomized individual, similar to the presentation of *C. canimorsus*. *C. canimorsus* is not a required reportable disease to the health department.

In summary, it is important for emergency personnel and forensic pathologists to be aware of canine *Capnocytophaga* (*C. canimorsus* and *C. cynodegmi*) infections. Infections with this organism can result in overwhelming sepsis and death in patients with impaired immune systems, asplenia, and rarely in healthy individuals, after bites, scratches, or even trivial contact with the saliva of cats or dogs. Although a thorough social and medical history and clinical presentation may suggest a bacterial infection associated with dog bites, definitive diagnosis requires a positive blood culture.

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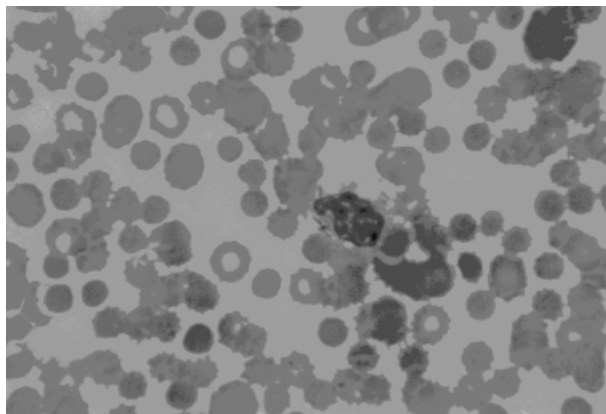


FIG. 1—A Wright stain of the peripheral blood smear revealed rod-shaped intracellular bacterial forms in polymorphonuclear cells.

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Additional information and reprint requests:
Mary H. Dudley, M.D.
Sedgwick County Regional Forensic Center
1109 N. Minneapolis
Wichita, KS 67214-3129
E-mail: mdudley@sedgwick.gov