



## Case report

## Capnocytophaga aortitis: A dog's gift to its owner

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## ARTICLE INFO

## Keywords:

Aortitis  
Capnocytophaga  
Bacteremia

## ABSTRACT

We present a case of *Capnocytophaga* aortitis in an 82-year-old male with fever, weakness, confusion, and back pain. Diagnosis was established following a ruptured abdominal aortic aneurysm and subsequent blood culture growth of *Capnocytophaga* species. He was treated with endovascular aortic repair in addition to a six-week course of ceftriaxone followed by long-term antibiotic suppression with amoxicillin-clavulanate. *Capnocytophaga* aortitis is exceedingly rare and poorly described in current literature.

## Introduction

*Capnocytophaga* is a genus of facultative anaerobic gram-negative bacilli. These organisms are commonly found as a part of the microbiota of dogs [1]. Contact with these animals poses a major risk factor for infection. Diagnosis and treatment may be delayed due to slow growth of the organism. This pathogen more frequently manifests as fever, sepsis, or soft tissue infection. Aortitis is an uncommon clinical manifestation [2]. Aortitis is the inflammation of the aorta which can be due to various phenomena and often presents with non-specific symptoms, including back pain, abdominal pain, fever, and fatigue [3].

## Case report

An 82-year-old male presented to the emergency department with a three-day history of self-reported fever with a maximal temperature of 102 °F, weakness, mild confusion, decreased oral intake, and worsening back pain. He denied cough, shortness of breath, chest pain, abdominal pain, vomiting, diarrhea, dysuria, hematochezia, melena, headache, and dizziness. The past medical history was significant for infrarenal abdominal aortic aneurysm with stent placement in 2007, coronary artery disease, gastroesophageal reflux disease, hypertension, hyperlipidemia, and peripheral artery disease with percutaneous intervention in 2007. On presentation he was afebrile at 36.6 °C, had a heart rate of 55 bpm, blood pressure of 77/43 mmHg, and SpO<sub>2</sub> of 97 %. His blood pressure improved to 130/60 mmHg after fluid resuscitation. Electrocardiogram showed sinus bradycardia. His physical exam was otherwise benign aside from a scabbed 4 cm scratch in the right groin with surrounding ecchymoses that was caused by one of the patient's dogs.

Laboratory studies were significant for a white blood cell count of  $14.86 \times 10^9/L$ , BUN of 40 mg/dL, and creatinine elevated at 2.16 mg/dL from baseline of 0.8 mg/dL (Table 1), consistent with acute kidney injury (AKI). Blood cultures were drawn at this time.

The patient was evaluated for fever and leukocytosis, and a chest x-ray was ordered in the ED which showed patchy bilateral basilar opacities. Though the patient did not have any respiratory symptoms or pertinent exam findings, he was diagnosed with suspected community acquired pneumonia. He was admitted for management of pneumonia, AKI, and poor oral intake. On hospital day two, a lumbar spine x-ray showed no acute pathologic findings; no further evaluation was performed. After receiving fluids, ceftriaxone, and azithromycin, his renal function and neurologic status improved to baseline. Thus, he was discharged on hospital day two with instructions to complete a course of outpatient antibiotics (cefdinir 300 mg twice a day for four additional days). Blood cultures remained negative on discharge.

He returned to the emergency department two days after discharge for worsening right-sided back pain that made it difficult to ambulate. At presentation, he was afebrile, had a heart rate of 88 bpm, blood pressure of 173/80, and SpO<sub>2</sub> of 96 %. Physical exam was only significant for mild tenderness to palpation of the R paraspinal area. Labs were significant for white blood cell count of  $17.25 \times 10^9/L$  (Table 1). Computed tomography (CT) of the abdomen and pelvis showed a ruptured infrarenal abdominal aortic aneurysm (Fig. 1, 2). The patient was started on an esmolol drip, and subsequently transferred to our tertiary referral center.

Emergently after transfer, the patient underwent endovascular repair of abdominal aortic aneurysm for rupture utilizing a Medtronic aortoiliac device. Post-operatively, he was placed on piperacillin-

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<https://doi.org/10.1016/j.idcr.2023.e01763>

Received 8 February 2023; Received in revised form 7 April 2023; Accepted 10 April 2023

Available online 11 April 2023

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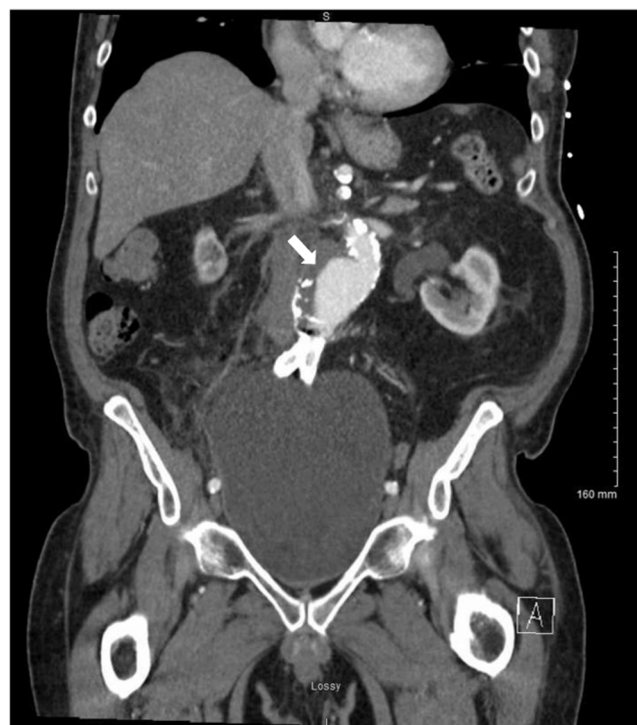
**Table 1**

Laboratory values.

	1st Hospital Admission Labs	2nd Hospital Admission Labs	Reference Ranges
WBC	14.86 × 10(9)/L	17.25 × 10(9)/L	4.80–10.80 × 10 (9)/L
RBC	4.49 × 10(12)/L	4.41 × 10(12)/L	4.35–5.80 × 10 (12)/L
Hgb	12.9 g/dL	12.5 g/dL	13.6–18.0 g/dL
Hct	37.7 %	36.8%	40.0–54.0 %
MCV	84.0 fL	83.4 fL	80.0–95.0 fL
MCH	28.7 pg	28.3 pg	28.0–33.0 pg
MCHC	34.2 g/dL	34.0 g/dL	30.4–36.7 g/dL
RDW	13.80 %	14.20 %	11.5–14.5 %
PLT	137 × 10(9)/L	272 × 10(9)/L	135–400 × 10(9)/L
MPV	11.1 fL	10 fL	9.0–12.0 fL
% Neutrophils	82.90 %	84.20 %	NA
Abs Granulocytes	12.31 × 10(9)/L	14.53 × 10(9)/L	1.40–6.50 × 10(9)/L
% Immature Granulocytes	0.90 %	1.10 %	NA
Abs Immature Granulocytes	0.14 × 10(9)/L	0.19 × 10(9)/L	0.00–0.03 × 10(9)/L
% Lymphocytes	8.80 %	7.30 %	NA
Abs Lymphocytes	1.31 × 10(9)/L	1.26 × 10(9)/L	1.20–3.40 × 10(9)/L
% Monocytes	7.30 %	7.10%	NA
Abs Monocytes	1.08 × 10(9)/L	1.22 × 10(9)/L	0.00–1.00 × 10(9)/L
% Eosinophils	0.00 %	0.10 %	NA
Abs Eosinophils	0.00 × 10(9)/L	0.01 × 10(9)/L	0.00–0.30 × 10(9)/L
% Basophils	0.10 %	0.20 %	NA
Abs Basophils	0.02 × 10(9)/L	0.04 × 10(9)/L	0.00–0.10 × 10(9)/L
Sodium	136 mmol/L	138 mmol/L	136–145 mmol/L
Potassium	3.1 mmol/L	3.5 mmol/L	3.5–5.1 mmol/L
Chloride	101 mmol/L	100 mmol/L	98–109 mmol/L
CO2	29.0 mmol/L	27 mmol/L	21.0–32.0 mmol/L
Anion Gap	6 mmol/L	14 mmol/L	5–15 mmol/L
Glucose	164 mg/dL	115 mg/dL	Critical Low 41 Critical High 449
BUN	40 mg/dL	17 mg/dL	7–18 mg/dL
Cr	2.16 mg/dL	0.86 mg/dL	0.70–1.30 mg/dL
Estimated GFR for Adults	-	86 mL/min/1.73 m <sup>2</sup>	> 90 mL/min/1.73 m <sup>2</sup>
Calcium	9.2 mg/dL	9.3 mg/dL	8.3–10.1 mg/dL
Magnesium	2.7 mg/dL	-	1.8–2.6 mg/dL
Phosphorus	3.7 mg/dL	-	2.5–4.9 mg/dL
Total Protein	6.5 g/dL	6.1 g/dL	6.4–8.2 g/dL
Albumin	2.7 g/dL	3.0 g/dL	3.4–5.0 g/dL
Total Bilirubin	0.91 mg/dL	1.38 mg/dL	0.20–1.00 mg/dL
Alkaline Phosphatase	105 U/L	185 units/L	45–136 units/L
AST	29 units/L	58 units/L	15–37 units/L
ALT	29 U/L	72 units/L	13–61 units/L
CK	-	60 units/L	20–200 units/L
CK-MB	-	1.6 ng/mL	1.0–10.4 ng/mL

tazobactam due to leukocytosis with unknown etiology of aortitis. The vascular surgery team reported inflammatory findings suspicious for infectious aortitis during his procedure. White blood cell count began trending down. At this time, five days after obtaining blood cultures during the patient's first admission, a gram-negative rod was identified. Nine days after obtaining blood cultures, the anaerobic culture ultimately grew *Capnocytophaga* species, with no available susceptibility data. Repeat blood cultures were obtained and remained negative, though the patient had received antibiotics prior to these. The final diagnosis was infectious aortitis due to *Capnocytophaga* leading to aneurysm rupture, as a result of the patient's dog scratches.

Patient had a PICC line placed and was discharged on 6 weeks of IV ceftriaxone 2 g daily, to be given via outpatient infusion. Following a 6-week course of IV ceftriaxone, he was placed on long-term antibiotic suppression with amoxicillin-clavulanate 875 mg twice a day due to



**Fig. 1.** Pre-operative coronal computed tomography image of ruptured infrarenal abdominal aortic aneurysm.



**Fig. 2.** Pre-operative axial computed tomography image of ruptured infrarenal abdominal aortic aneurysm.

placement of endovascular prosthetic material during aortic repair. To date, this patient has had no further complications from his illness course, operation, or treatment.

## Discussion

*Capnocytophaga* is a genus of gram-negative facultative anaerobic bacilli with nine known species members. Specifically, *C. canimorsus* is known to be part of the oral microbiota of dogs and cats [1,2]. The types of *Capnocytophaga* can be divided into zoonotic-associated and

human-oral-associated species. Isolation of these species from a culture requires a minimum of two days as these are slow growing bacteria. They are best grown on Trypticase soy agar with sheep blood under anaerobic conditions [4].

The most common risk factors associated with *Capnocytophaga* infection include animal bites and scratches, immunosuppressive medications, immunocompromised states (e.g. asplenia, alcoholism, HIV/AIDS), cirrhosis, and presence of central lines [5]. In this case, the patient had 12 dogs at home with lacerations on his right arm and right groin, but denied alcohol usage and did not have evidence of splenic dysfunction or other medication usage. It is important to note that visible animal bites and scratches may not be present upon physical examination, but proximity to these animals should prompt consideration of this bacteria in patients with no other obvious source of infection. Additionally, some patients may develop *Capnocytophaga* infection without any known risk factors [6].

Infection with *Capnocytophaga* is most commonly a result of zoonotic spread from *C. canimorsus* [5]. Common clinical manifestations of this pathogen include fever, sepsis, soft tissue infection, respiratory tract infection, and meningitis. *C. canimorsus* has also been reported to cause mycotic aneurysm, endocarditis, brain abscess, and orthopedic infections [2,4,7]. Mortality rates of invasive *Capnocytophaga* infection are greater than 30 % [2].

Aortitis is an uncommon manifestation of *Capnocytophaga* infection, though there have been a few documented case reports [4,7]. Typically, the differential for aneurysm rupture includes, but is not limited to, a preceding aortitis. Aortitis itself is often non-infectious in the modern era, and may be a sequela of rheumatologic disease, especially the large vessel vasculitides. Infectious aortitis most commonly occurs due to preexisting damage to the vascular wall, which can then be seeded by bacteria via the vasa vasorum. Leading bacteria implicated in infectious aortitis include species of *Salmonella*, *Staphylococcus*, and *Streptococcus* [3].

Identification of *Capnocytophaga* aortitis can be difficult because patients may present with nonspecific symptoms and poorly localized pain. Index of suspicion should increase with known underlying aortic disease, as evidenced in this patient with a preexisting abdominal aortic aneurysm. An additional barrier to diagnosis is the slow-growing nature of this organism, as noted in this case and others. Upon suspicion of aortitis from infection, the empirical selection of broad-spectrum antibiotic therapy is important for maximizing the clinical outcome of patients. Selected agents should cover both gram-positive and gram-negative bacteria, as well as extended coverage for beta-lactamase producers [8]. Antibiotic therapy can later be narrowed based on culture results. As seen in this case, cultures took nine days to identify the pathogen, and susceptibility data was ultimately unable to be obtained. Other cases in literature have reported up to a 24-day delay for cultures and sensitivities to antibiotics to return [7].

At this time there are no official guidelines for antimicrobial therapy for *Capnocytophaga* infections. A proportion of *Capnocytophaga* strains produce beta lactamase, though the prevalence among *C. canimorsus* is thought to be infrequent. As such, the presence or absence of a beta-lactamase can help guide antibiotic therapy, but this takes time, making close monitoring of clinical response crucial. Combination beta-lactam antibiotics with beta-lactamase inhibitors, third- and fourth-generation cephalosporins, and carbapenems have proven to be successful agents for treating *Capnocytophaga* [9,10]. Duration of antibiotic therapy is dictated by clinical manifestations (e.g. sepsis versus soft-tissue infection). Previously, this organism was known to be susceptible to fluoroquinolones, but resistance to these medications has been increasing [11]. Additionally, fluoroquinolones increase the risk for aneurysm and dissection, and as such, these agents likely should not be first-line for suspected aortitis secondary to *Capnocytophaga* [7]. Considerations for the management of *Capnocytophaga* aortitis include prompt initiation of empiric antibiotics upon clinical suspicion and surgical intervention as indicated. While no clinical trials have

investigated the duration of treatment for infectious aortitis, a six-to-twelve-week course of IV antibiotic therapy is typically recommended for *Capnocytophaga*-related aortitis in addition to surgical intervention as necessary [12–14].

## Conclusion

*Capnocytophaga* aortitis is an uncommon clinical manifestation of this organism that presents unique barriers to diagnosis and treatment. Diagnosis may be delayed due to the slow growth of this microbe, which can also impede identification of susceptibility data. Thorough history taking and recognition of risk factors for these bacteria are necessary for early detection and maximization of clinical outcome. Due to high mortality rates, early empiric antibiotic therapy and necessary surgical intervention are vital. Agents used can include combination beta-lactam antibiotics with beta-lactamase inhibitors, third- and fourth-generation cephalosporins, and carbapenems.

## CRedit authorship contribution statement

**Michael Miller:** Study design, data collection, Writing – original draft, Writing – review & editing. **Jessie Li:** Study design, data collection, Writing – original draft, Writing – review & editing. **Suha Abu Khalaf:** Study design, data collection, writing. **Taylor B. Nelson:** Study design, data collection, Writing – original draft, Writing – review & editing.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Ethical approval

Not applicable.

## Consent

Written consent was obtained from the patient for writing and publishing this case report.

## Conflict of Interest

The authors declare no conflicts of interest.

## References

- [1] Oba PM, Carroll MQ, Alexander C, Valentine H, Somrak AJ, Keating SCJ, et al. Microbiota populations in supragingival plaque, subgingival plaque, and saliva habitats of adult dogs. *Anim Microb* 2021;3(1):38.
- [2] Chesdachai S, Tai DBG, Yetmar ZA, Misra A, Ough N, Abu Saleh O. The characteristics of *Capnocytophaga* infection: 10 years of experience. *Forum Infect Dis* 2021;8(7):ofab175.
- [3] Gormik HL, Creager MA. Aortitis. *Circulation* 2008;117(23):3039–51.
- [4] Rougemont M, Ratib O, Wintsch J, Schrenzel J, Hirschel B. *Capnocytophaga canimorsus* prosthetic aortitis in an HIV-positive woman. *J Clin Microbiol* 2013;51(8):2769–71.
- [5] Lion C, Escande F, Burdin JC. *Capnocytophaga canimorsus* infections in human: review of the literature and cases report. *Eur J Epidemiol* 1996;12(5):521–33.
- [6] Janda JM, Graves MH, Lindquist D, Probert WS. Diagnosing *Capnocytophaga canimorsus* infections. *Emerg Infect Dis* 2006;12(2):340–2.
- [7] Ashley PA, Moreno DA, Yamashita SK. Aortitis in an immunocompetent host. *Hawaii J Health Soc Welf* 2020;79(11):324–5.
- [8] Hakim S, Davila F, Amin M, Hader I, Cappell MS, Infectious. Aortitis: a life-threatening endovascular complication of nontyphoidal. *Case Rep Med* 2018;2018:6845617.
- [9] Gomez-Garcés JL, Alos JI, Sanchez J, Cogollo R. Bacteremia by multidrug-resistant *Capnocytophaga sputigena*. *J Clin Microbiol* 1994;32(4):1067–9.
- [10] Roscoe DL, Zemcov SJ, Thornber D, Wise R, Clarke AM. Antimicrobial susceptibilities and beta-lactamase characterization of *Capnocytophaga* species. *Antimicrob Agents Chemother* 1992;36(10):2197–200.

- [11] Geisler WM, Malhotra U, Stamm WE. Pneumonia and sepsis due to fluoroquinolone-resistant *Capnocytophaga gingivalis* after autologous stem cell transplantation. *Bone Marrow Transpl* 2001;28(12):1171–3.
- [12] Bossone E, Pluchinotta FR, Andreas M, Blanc P, Citro R, Limongelli G, et al. Aortitis. *Vasc Pharm* 2016;80:1–10.
- [13] Cinà CS, Arena GO, Fiture AO, Clase CM, Doobay B. Ruptured mycotic thoracoabdominal aortic aneurysms: a report of three cases and a systematic review. *J Vasc Surg* 2001;33(4):861–7.
- [14] Soravia-Dunand VA, Loo VG, Salit IE. Aortitis due to *Salmonella*: report of 10 cases and comprehensive review of the literature. *Clin Infect Dis* 1999;29(4):862–8.