IDCases 31 (2023) e01717

Contents lists available at ScienceDirect

IDCases

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Case report

# Hematogenous septic arthritis of a non-prosthetic shoulder caused by *Capnocytophaga canimorsus*: A case report and review of the literature

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ARTICLE INFO

*Keywords:*
*Capnocytophaga canimorsus*
Zoonosis
Septic arthritis
Native joint
Hematogenous infection
Dog
Review

ABSTRACT

*Capnocytophaga canimorsus*, oral inhabitants of dogs and cats is a cause of zoonotic infections. It is transmitted to humans by bites, scratches, licks, or close exposure to these animals. Infections due to *Capnocytophaga canimorsus* have a wide range of severity and can sometimes be fatal. We report the case of an 89-years-old man who suffered from a sudden swollen native right shoulder. The blood test revealed an inflammatory syndrome and cytologic evaluation of joint aspiration showed an elevated nucleated cells count suspicious of infection. A Gram-negative bacillus grew after 48 h in the arthrocentesis and was identified as *Capnocytophaga canimorsus.* After 4 days, blood culture also grew *Capnocytophaga canimorsus* leading to the diagnosis of hematogenous septic arthritis of a non-prosthetic right shoulder. Antimicrobial therapy was empirically started with cefuroxime then switched to doxycycline for seven weeks with good clinical outcomes. It is important to inquire about patients' environment including their proximity to animals as it can lead to zoonotic infections that can be of high severity. Moreover, hygiene rules must be applied when dog scratches or lick wounds occurred to avoid the spread of zoonotic germs. Prophylactic antibiotic therapy should be given for animal bites.

## Introduction

*Capnocytophaga canimorsus* (*C. canimorsus*) is a fastidious, fusiform, Gram-negative bacillus and oral inhabitants of dogs and cats. Those animals can transmit it to humans by bites, scratches, licks, or close exposure. *C. canimorsus* implicated in bite wound infections can lead to a large range of severity, from localized to systemic infection, and septic shock. Both immunocompetent and non-immunocompetent patients can be affected. We describe here the case of an 89-years-old man suffering from hematogenous septic right shoulder arthritis caused by *C. canimorsus*. The transmission was caused by dog scratches and licks. To the best of our knowledge, this is the first case of hematogenous septic arthritis of non-prosthetic-shoulder due to *C. canimorsus,* reported in the literature.

## Case report

An 89-years-old man, known for rheumatoid arthritis treated sporadically with methylprednisolone (none in the last 3 months), presented at the emergency department for an acute painful and swollen right shoulder without any traumatism [Fig. 1]. No fever or chill was observed either at home or during his hospital stay. He didn't present another symptom. Physical examination showed an ascended and swollen right shoulder with subtotal impotence on abduction, rotation, flexion, and extension in either active or passive mobilization. Cardiac examination did not reveal any heart murmur.

A conventional x-ray revealed severe excentric omarthrosis and a large peri humeral effusion with several calcifications on its periphery [Fig. 2]. Previous x-ray of right shoulder showed pre-existing total rotator cuff tear. Laboratory evaluation revealed an inflammatory

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https://doi.org/10.1016/j.idcr.2023.e01717
Received 22 November 2022; Received in revised form 12 February 2023; Accepted 12 February 2023
Available online 13 February 2023

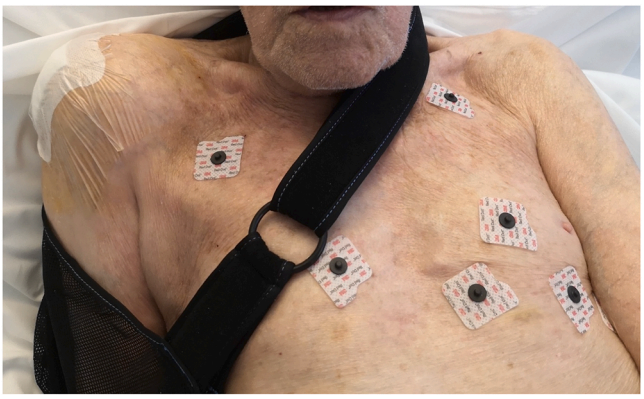

**Fig. 1.** Swollen right shoulder after joint aspiration.

**Fig. 2.** X-ray of the right shoulder, showing severe omarthrosis with large peri humeral effusion.

syndrome characterized by white blood cell count of 19 390/μL with a predominance of neutrophils (17 210/μL) and a c-reactive protein level of 281,7 mg/L. Ultrasonography of the right shoulder showed acromioclavicular synovitis, and a heterogeneous and hyperemic bursitis with multiple hyperechoic spots. Extension of the bursa was noted to the mid-humerus [Fig. 3]. A joint aspiration revealed a thick hemorrhagic liquid with some macrocalcifications [Fig. 4]. Samples collected on EDTA were sent for biochemical and microbial examination. Before starting antibiotics, two sets of blood cultures were collected and incubated in the BACTEC TM$^2$ System (Bactec Plus Aerobic-anaerobic/F med, Becton Dickinson, Erembodegem, Belgium). Cytologic examination of joint fluid revealed a lumpy hematic liquid with 67 459 neutrophils/μL and 475 600 red blood cells/μL. The hemorrhagic character could be explained by anticoagulation with apixaban for paroxysmal atrial fibrillation. Empiric antibiotic therapy with cefuroxime was initiated while waiting for micro-bacteriological results.

At day 2, the Columbia agar showed small, flat and smooth colonies. Identification was performed by Matrix-Associated Laser Desorption

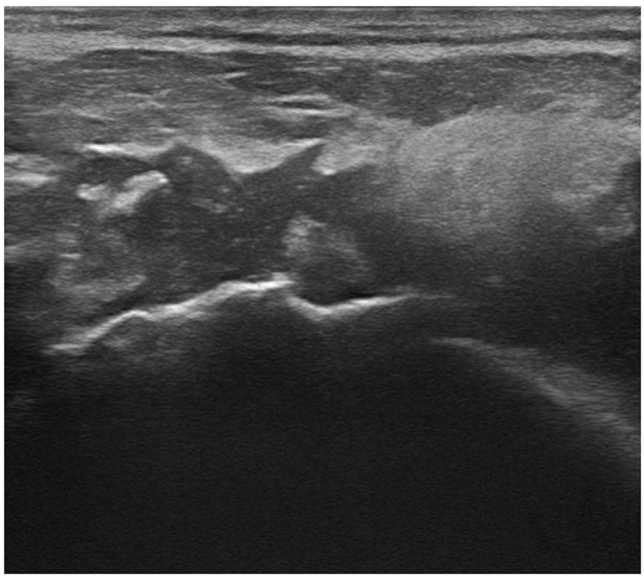

**Fig. 3.** Ultrasonography of the right shoulder, revealing acromioclavicular synovitis.

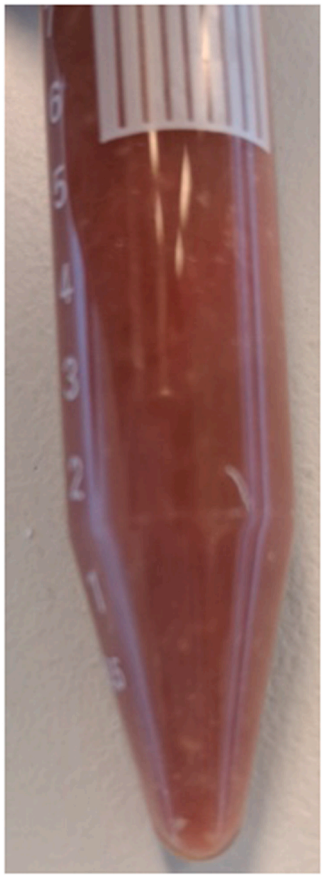

**Fig. 4.** Thick hemorrhagic joint liquid with some macrocalcifications.

Ionization-Time Of Flight Mass Spectrometry (MALDI-TOF MS, Biotyper Sirius IVD version 4.2.100; Bruker Daltonics, Bremen, Germany), according to manufacturer instructions. [1] The Gram-negative rod was identified as *C. canimorsus* with a reliable score of 2.1 [Fig. 5]. Therefore, cefuroxime was switched to doxycycline. It appeared that the patient had a dog that regularly scratched him on the legs and licked the

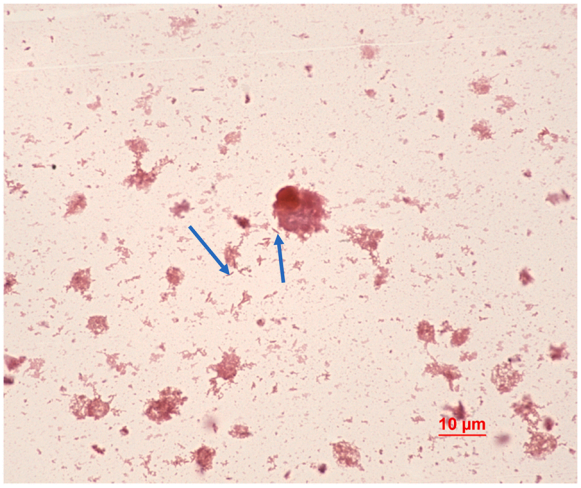


**Fig. 5.** Microscopic image of a Gram-stained smear of Capnocytophaga carnimorsus from blood culture, demonstrating small and thin Gram-negative rods. Magnification, x1000.

wounds. These scratches were still visible on both legs during his hospital stay.

At day 4, anaerobic and aerobic blood cultures grew small and thin rod-shaped Gram-negative bacteria. MALDI-TOF MS-Septityper module identified *Capnocytophaga canimorsus* with a reliable score of 2.1.

A diagnosis of hematogenous septic arthritis of the native right shoulder caused by *C. canimorsus* was made. A transthoracic echocardiogram was performed. There was no suspicion of endocarditis. Pending the antibiogram, amoxicillin/clavulanic acid was administered intravenously (1 g each 6 h) in addition to doxycycline (100 milligrams twice a day) for two days. Once sensibility to doxycycline has been confirmed, this latter was continued alone for seven weeks. Beta-lactamase test were negative. The patient also underwent surgical joint drainage by arthroscopy, revealing severe omarthrosis and a total rotator cuff tear. We noticed a good biological and clinical outcome.

## Discussion

*Capnocytophaga species* are Gram-negative fastidious facultative anaerobic bacteria. They are fusiform, non-spore-forming, gliding and non-flagellated. [2–4] First described in 1976 by *Bobo & al.* in a case of septicemia and meningitis associated with dog bites [5], they were initially called *Bacteroïdes ochraceus* or *Center for Disease Control group Dysgonic Fermenter-1* (*CDC group DF-1*). Later, *CDC group DF-1* will be denominated *Capnocytophaga*. [3] In 1983, *CDC group DF-2* and *CDC group DF-2-like* was included in the genus of *Capnocytophaga* due to common characteristics. The first group was named *C. canimorsus* and the second one *Capnocytophaga cynodegmi*. They are commensal oral cavity inhabitants of mammalian. Some of them are found in human oral cavity when *C. canimorsus* and *Capnocytophaga cynodegmi* are found in normal oral and nasal flora of dogs and cats. [5].

*Capnocytophaga species* share common characteristics with the HACEK group in which bacteria are *Haemophilus parainfluenzae*, *Haemophilus aphrophilus*, *Haemophilus paraphrophilus*, *Aggregatibacter actinomycetemcomitans*, *Aggregatibacter aphrophilus*, *Cardiobacterium hominis*, *Eikenella corrodens,* and *Kingella kingae*. As bacteria from this group, *Capnocytophaga species* are involved in several infectious diseases as endocarditis, arthritis, osteomyelitis, or periodontitis. [2] Some authors use the acronym HACCEK to denote shared similarities between HACEK Group and Capnocytophaga: Gram-negative bacilli, require an increased CO2 (5%−10%) environment, are a significant cause of endocarditis, are part of the usual flora of the oral cavity, are opportunists in immunocompromised hosts.

Human infection by *C. canimorsus* is rare with an incidence of 0.5–0.67 cases/1 million population. It is generally transmitted by animal bites or scratches. According to an epidemiologic study from France, 82% of infection is secondary to dog contact in which dog bites represent 51% of cases, and 12% of infections are associated with cat exposure. [7] They are some cases where the source of infection is unknown. [6,7].

Patients with impairment of immune defenses (immunocompromised patients, alcoholics, asplenic patients) are more at risk to develop bacteremia and disseminated infections. Nevertheless, non-immunocompromised patients may also develop a wide variety of infections. [6–9] *C. canimorsus* is known to lead to severe infections in 30% of cases, with septic shock or disseminated intravascular coagulation. [8] Our patient was known for a rheumatoid arthritis. Degenerative bone disease is known to be a contributing factor for arthritis development. We report the first case of native shoulder septic arthritis caused by *C. canimorsus* bacteremia. We reviewed cases of arthritis due to *C. canimorsus* previously reported in the literature [Table 1]. We found 9 case reports with a sex ratio of 6 males for 3 females. The mean age is 57 years old. Although risk factors weren't always described, two patients were known to have Waldenström's disease. One of the nine patients had HIV, nevertheless with good immune control. This one was an intravenous drug user and had chronic hepatitis C. All cases were attributable to dog exposure (33% of bites, 44% of licks, 11% of scratches, 11% of close exposure, and 11% were unknown). 55% of septic arthritis caused by *C. canimorsus* occurred in a prosthetic joint (two knees, two hips, and one shoulder). About native joint localizations, two cases of knees arthritis and two cases of lumbar discitis were reported. Except for two of them, they all needed surgery for revision, cleaning, or drainage. The antimicrobial therapy was different for each patient, but the duration was on average 6 weeks, going from 4 to 9 weeks. The outcome available for 8 of the 9 patients was favorable.

Virulence mechanisms of *C. canimorsus* include its gliding ability aimed to violate biological barriers, to translocate and spread systemically. Due to its lipopolysaccharide, *C. canimorsus* is resistant to polymorphonuclear neutrophils-mediated phagocytosis and killing as well to complement killing. [2] It can interfere with the innate immune system, contributing to the release of lysosomal enzymes from polymorphonuclear neutrophils. It also can downregulate the Human Toll-like receptor 4 (TLR-4). The consequence is that nuclear factor kappaB (NF-ƙB) is not activated, contributing to a lack of pro-inflammatory response. Other virulence factors are the presence of surface-exposed sialidase, permitting it to invade macrophages and being resistant to phagocytosis and destruction. [10].

*C. canimorsus* is a fastidious bacterium, so that 1–14 days are necessary for its growth in blood culture. In our case, it took 96 h for a Gram-negative bacillus to appear. [5,9] Identification is difficult due to its slowness of growth. To enhance growth, incubation at 37 °c during 5- or 7-days using blood or chocolate agar in an anaerobic or capnophilic atmosphere (10% $CO_2$) is recommended. [2,11] Antimicrobial susceptibility testing for this fastidiousness germ is also difficult. In our case, a capnophilic atmosphere was required. [6] Today, MALDI-TOF MS facilitates the identification of *C. canimorsus*, avoiding enrichment of cultures. Furthermore, 16 S RNA sequencing is another tool to specifically identify this germ. It can be directly used on clinical samples as biopsies or synovial fluids. [2].

*Capnocytophaga species* are sensitive to amoxicillin/clavulanic acid, which is the treatment of choice in the case of infected wounds. Other possibilities, for β-lactam-allergic patients, are tetracyclines, clindamycin, linezolid, fluoroquinolone, or rifampicin. Nevertheless, the choice of antimicrobial agent is also dependent on the infection localization. In our case, the need for good joint diffusion and long term tolerance supported the use of doxycycline. [12] A surgical treatment such as drainage or joint debridement, is also recommended in severe septic arthritis or in case of a poor response to initial antimicrobial therapy. [2] Duration of treatment is not consensual in the literature, but authors usually propose 6–8 weeks of therapy. [2,12].

**Table 1**
Review of septic arthritis caused by *C. canimorsus* – Legend: i.v.: Intravenously; THA: Total Hip Arthroplasty; TKA: Total Knee Arthroplasty.

| Age (years old) | Sex | Risk factors | Mode of contamination | Arthritis localization | Surgical treatment | Antimicrobial therapy | Duration | Evolution | Reference |
|---|---|---|---|---|---|---|---|---|---|
| 54 | Man | None | Unknown | Right knee with TKA | Two-stage revision surgery ¤ | Cefuroxime *i.v.* for 4 weeks then ciprofloxacin *p.o.* for 2 weeks. | 6 weeks | Good clinical and biological evolution. No complication | [13] |
| 58 | Woman | Unknown | Dog bite | Left hip with THA | One-stage revision surgery ¶ | Ceftriaxone *i.v.* | 6 weeks | Good biological evolution. Death due to myocardial infarction | [14] |
| 57 | Man | Intravenous drug user, chronic hepatitis C, HIV (good immune control) | Dog licks | Left knee | 2 surgical cleaning and drainage by arthrotomy | Ceftriaxone *i.v.* and cloxacillin *i.v.* (before germ identification) then Piperacillin/tazobactam *i.v.* (after germ identification). Relay by ceftriaxone *i.v.* and finally, by clindamycin *p.o.* | 9 weeks | Good clinical evolution | [15] |
| 59 | Man | Waldenström's disease (Rituximab followed by chronic chlorambucil therapy), Prednisone therapy, Alcohol abuse | Close dog exposure | Bilateral knees | Two-stage revision surgery ¤ | Ertapenem *i.v.* | 6 weeks | Good clinical and biological evolution | [16] |
| 31 | Man | Small congenital ventricular septal defect | Dog bite | L4-L5 osteomyelitis/ discitis | None | Nafcillin *i.v.* and gentamycin *i.v.* (before germ identification), ceftriaxone *i.v.* and gentamycin *i.v.* (after germ identification) then ciprofloxacin *p.o.* | 7 weeks | Good clinical evolution | [17] |
| 54 | Man | Unknown | Dog licks | L3-L4 discitis | None | Third generation cephalosporin *i.v.* | 4 weeks | Disc repair without complications | [18] |
| 66 | Woman | None | Dog scratches | Right hip with THA | Two-stage revision surgery ¤ | Amoxicillin/acid clavulanic *i.v.* and clindamycin *p.o.* for 10 days. Then ertapenem i.v. and ciprofloxacin *p.o.* | 3 months | Good clinical and biological evolution | [19] |
| 66 | Man | None | Dog licks | Right knee with TKA | Surgical cleaning and prosthesis replacement | Third generation cephalosporin *i.v.* relay by rifampicin and levofloxacin *p.o.* | 6 weeks | Good clinical evolution | [20] |
| 70 | Woman | Waldenström's disease (treated by ibrutinib) | Dog bite and licks | Right shoulder with arthroplasty | Revision arthroplasty | Ertapenem *i.v.* and prophylactic daptomycin | 6 weeks | Unknown | [11] |

¤ Two stage revision surgery consists, in the first step, in removing of prosthesis, which one is eventually replaced with antibiotic spacer. The antibiotic treatment is administered during this laps of time and a new prosthesis will be implanted in the second step when the patient will show a good response to treatment. [21]
¶ One stage surgery consists in remove and replacement of the joint prosthesis in the same time.
N.B.: There are more cases of septic arthritis caused by *Capnocytophaga spp.* reported in case series as in the French CANCAN study (6 cases) and in Chesdachai S. and al.'s retrospective review (1 case) [22] but detailed data about each case are not available.

## Conclusion

*C. canimorsus* is a commensal inhabitant of the oropharyngeal dog and cat flora which has the ability to transmit to humans by bites, scratches, wounds licking, or close exposure. It can cause a large panel of infections from localized cellulitis to septic shock. It is usually sensitive to amoxicillin/clavulanic acid.

We described here the case of an hematogenous septic non-prosthetic-shoulder arthritis caused by *C. canimorsus* secondarily to dog scratches and licks. Our patient has been treated with doxycycline for 7 weeks with a good clinical outcome.

This case reminds practitioners about the importance enquire about patient's environment, and, notably, about pet presence to appreciate the risk of zoonosis. It emphasizes the need to disinfect dog and cat scratches, or bites, to avoid licking of wounds, and, to initiate an antibiotic prophylaxis after bites.

## Ethical approval and consent

The patient gave his written informed consent for this publication. Document available on request.

## Funding statement

No funds, grants, or other support was received.

## Author contributions

**Conception and design, acquisition of data or analysis and interpretation of data:** Maxime Vanwielendaele, Mohammad Yassine Chérif, Philippe Clevenbergh. **Drafting the article**: Maxime Vanwielendaele, Mohammad Yassine Chérif, Mony Hing, **Final approval of the version published**: Philippe Clevenbergh.

## Declaration of interest

The authors have no relevant financial or nonfinancial interests to disclose.

## Acknowledgments

We thank the patient for accepting the publication of this report.

*Disclosures*

The authors have no relevant financial or nonfinancial interests to disclose.

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