

Septic Arthritis of Native Knee Joint Due to *Capnocytophaga* species. Report of Second Adult Case and Review of the Literature

Christian Seif¹, Phoebe Otchere¹ and Joseph P. Myers^{2,3*}

¹Northeast Ohio Medical University, Rootstown, Ohio, USA

²Division of Infectious Disease, Department of Medicine, Summa Health, Akron, Ohio, USA

³Section of Infectious Disease, Department of Internal Medicine, Northeast Ohio Medical University, Rootstown, Ohio, USA

Abstract

Introduction: *Capnocytophaga* species (CS) are facultatively anaerobic, nonmotile, Gram-negative rods with gliding motility that allows for translocation from their normal oral cavity habitat to systemic sites. The incidence of infection due to CS is extremely low. We report a patient who developed spontaneous *Capnocytophaga* species bilateral septic arthritis of native right and left knee joints 3 months after partial right medial meniscectomy and we review the literature for such CS orthopedic infections.

Case Report: A 62-year-old man with past history of aortic stenosis (bicuspid aortic valve), alcohol use disorder, and right knee medial meniscectomy 3 months previously presented to the emergency department (ED) with 24-hour history of fever, chills, bilateral knee pain (R>>L). Exam showed T=38.4°C, BP=98/63 mmHg, RR=22/min, HR=102/min. Extremity exam revealed the right knee to be warm, swollen, erythematous, and tender to palpation. Left knee was warm to touch but without palpable effusion. Patient was unable to bear weight on either leg. Labs showed WBC=15,700/mm³; CRP=87.1 mg/L; ESR=14 mm/hr. Knee X-rays revealed a moderate right knee effusion. Right knee arthrocentesis revealed 120 ml of cloudy fluid with positive string test, 14,255 WBC/mm³ (95% PMN), negative crystal exam and negative Gram-stain. Left knee aspirate revealed 12 ml of cloudy fluid, 12,275 WBC/mm³, and negative crystal and Gram-stain exams. Patient was begun on intravenous vancomycin and piperacillin/tazobactam. Right and left knee aspirate cultures remained negative. 5 days after collection, *Capnocytophaga* species was isolated from both sets of blood cultures obtained in the ED. Treatment was changed to intravenous ertapenem. Transesophageal echocardiogram revealed no evidence of endocarditis. Patient received 4 weeks of IV ertapenem at home with gradual resolution of all symptoms by week 3.

Discussion: A 2013 literature review of CS bone/joint infection revealed 18 cases of bone/joint infection. This is the first reported case of bilateral septic native knee arthritis due to CS in an adult patient and only the seventh overall case of septic arthritis of the knee due to *Capnocytophaga* species. He was successfully treated with bilateral knee aspiration and IV ertapenem and remains well 2 years later. His risk factor for CS infection was alcohol use disorder.

Introduction

Capnocytophaga spp. are long, thin, slow-growing Gram-negative bacilli that are facultatively anaerobic and capnophilic and take 2-4 days to grow on blood or chocolate agar [1]. *Capnocytophaga* spp. are part of the normal oral microflora of humans and animals including dogs and cats and are often considered opportunistic pathogens especially in alcoholic, asplenic and other compromised hosts [1,2]. All *Capnocytophaga* species (CS) share an enhanced capacity to produce periodontitis, arthritis, endocarditis, osteomyelitis and, in asplenic patients, fulminant sepsis [1,2]. The incidence of infection with CS is extremely low with a recent study from the Netherlands reporting 0.67 cases of CS/million population/year [3]. We report a 62 year old man who developed *Capnocytophaga* species bilateral native knee septic arthritis 3 months after right partial medial meniscectomy and we review the literature associated with this entity.

Case presentation

A 62-year-old man with past medical history of aortic stenosis (bicuspid aortic valve), alcohol use disorder, and right knee medial meniscectomy 3 months previously presented to the emergency department with 24-hour history of fever, chills, bilateral knee pain

(right>>left). The pain worsened significantly in the 24 hours before admission and was constant and throbbing in nature. Physical exam showed T=38.4°C, BP=98/63 mmHg, RR=22/min, HR=102/min. Patient was unable to bear weight on either leg. Right knee was warm, swollen, erythematous and tender to palpation while the left knee was normal in appearance and without palpable effusion. Cardiac exam revealed systolic murmur loudest over aortic flow area and without diastolic component. Remainder of examination was within normal limits. Radiograph of right knee revealed moderate knee effusion. Laboratory data revealed a White Blood Cell count=15,700/mm³; C-Reactive Protein=87.1 mg/L; Erythrocyte Sedimentation Rate=14 mm/hr. Two sets of blood cultures were obtained and both right and left knee

***Correspondence to:** Joseph P. Myers, M.D., Division of Infectious Disease, Department of Medicine, Summa Health/Akron City Hospital, 55 Arch Street, Suite 1A, Akron, Ohio 44304, Tel: +1-330-375-3741/+1-330-819-7385; Fax: +1-330-375-3760; E-mail: myersj@summahealth.org

Key words: *Capnocytophaga* species; Septic Arthritis

Received: November 05, 2022; **Accepted:** December 22, 2022; **Published:** December 29, 2022

Table 1. *Capnocytophaga* species Septic Arthritis of Knee

No.	Year Published	Reference	Age (Yrs)	Sex	Native / Prosthetic	Unilateral / Bilateral	Underlying Disease	Knee Fluid White Cell Count	Knee Culture	Blood Culture	<i>Capnocytophaga</i> species	Animal Contact	Antimicrobial Therapy	Lived/ Died
1	1977	[6]	50	M	Native	Unilateral	Alcohol Use Disorder	ND	ND	Positive	<i>C. canimorsus</i>	ND	ND	Lived
2	1977	[6]	ND	M	Native	Unilateral	ND	ND	ND	Positive	<i>C. species</i>	ND	ND	Lived
3	1980	[7]	40	M	Native	Unilateral	Alcohol Use Disorder	4,200/ μ L (80% PMN)	Negative	Positive	<i>C. canimorsus</i>	Dog	ND	Lived
4	2009	[9]	59	M	Prosthetic	Bilateral	Alcohol Use Disorder; Waldenström's Macroglobulinemia	Right: 18,564/ μ L (92% PMN); Left: 25,064/ μ L (86% PMN)	Positive (Tissue)	Negative	<i>C. canimorsus</i>	2 Dogs	IV Ertapenem	Lived
5	2019	[10]	54	M	Prosthetic	Unilateral	None	ND	Positive (Tissue)	Negative	<i>C. canimorsus</i>	None	IV Cefuroxime then PO Ciprofloxacin	Lived
6	2022	[8]	57	M	Native	Unilateral	HIV Disease (CD4>800); Hepatitis C	44,800/ μ L (80% PMN)	Positive	Negative	<i>C. canimorsus</i>	Dog	IV Ceftriaxone + IV Cloxacillin then PO Clindamycin	Lived
7	2023	Current	62	M	Native	Bilateral	Alcohol Use Disorder	Right: 14,500 (95% PMN) Left: 12,275 (97% PMN)	Negative	Positive	<i>Capnocytophaga</i> species	None	IV Piperacillin/Tazobactam then IV Ertapenem	Lived

M: Male; ND: No Data Available; PMN: Polymorphonuclear Leukocytes; IV: Intravenous; HIV: Human Immunodeficiency Virus; PO: Oral

aspirates were performed. Right knee aspirate revealed white blood cell count of 14,500 cells/ μ L with 95% PMN. Crystal and Gram stain exams were negative. Left knee aspirate revealed 12,275 cells/ μ L with 97% PMN and negative crystal and Gram stain examinations. Intravenous vancomycin and piperacillin/tazobactam were then administered. After 2 days of antimicrobial therapy, the patient noted a significant decrease in knee pain and complete resolution of fever. On hospital day 5, *Capnocytophaga* species was isolated from both sets of admission blood cultures. Treatment was then changed to parenteral ertapenem for its once daily simplicity. Transesophageal echocardiogram revealed no evidence of endocarditis on his stenotic aortic valve or on any other cardiac structure. Peripherally inserted central catheter was placed and the patient was discharged from hospital and successfully completed four weeks of parenteral ertapenem at home. Both knees returned to baseline/normal by week 3 of antimicrobial therapy. He remains well 2 years after completion of antimicrobial therapy.

Literature Review

Google Scholar™ and PubMed® searches were conducted using each combination of *Capnocytophaga*, septic arthritis, pyogenic arthritis, and joint infection. References from the search were reviewed and the reference list of each article was also reviewed for similar cases.

A 2013 literature review of *Capnocytophaga* spp. bone and joint infections found 18 cases of CS bone/joint involvement [4]. *C. canimorsus* caused 8 of 18 infections and non-*canimorsus* CS accounted for 10 of 18 cases [4]. In a 2021 literature review of *Capnocytophaga* spp. infections in immunocompetent patients, there were only 5 of 128 *Capnocytophaga* spp. infections that were bone and joint infections, either septic arthritis or spondylodiscitis [5]. This is the first reported adult case of *Capnocytophaga* spp. bilateral septic arthritis of the knee, the fifth native knee arthritis [6-8]. There have also been 2 reported cases of infected prosthetic joints with this organism [9,10]. Almost all *Capnocytophaga* spp. are exquisitely susceptible to 2nd/3rd/4th generation cephalosporins and to the fluoroquinolones [11,12]. Our patient's alcohol use disorder appears to have placed him at an increased risk of invasive CS infection. The presence of an abnormal bicuspid aortic valve also gave us cause to worry about the presence of occult aortic valve endocarditis despite transesophageal echocardiogram without evidence for same.

Discussion

This is the first reported adult case of bilateral *Capnocytophaga* species native knee joint infection and the fifth native knee joint infection overall [6-10]. There are also two published cases of *Capnocytophaga* species prosthetic joint infection, one of which was bilateral [9,10]. Table 1 summarizes these patient reports. Patient age range was 40-62 years with a mean age of 53.7 years. All 7 patients were male. There are 5 native joint infections and 2 prosthetic joint infections. Knee fluid White Blood Counts were available in 4 patients with a range of 4,200 WBC/ μ L to 44,800 WBC/ μ L and a mean of 19,900 WBC/ μ L. Alcohol use disorder was the most common underlying disease as it was present in 4 patients. The isolated *Capnocytophaga* species was *canimorsus* in 5 patients and *Capnocytophaga* species (not further identified) in 2 patients. *Capnocytophaga* was isolated from blood cultures in 4 of 7 patients and from knee joint (2 joint tissue, 1 joint fluid) in 3 of 7 patients. Data on animal contact was available in 5 of 7 patients: 3 had dog contact and 2 had no animal contact. All 7 patients survived. In the 3 who reported contact with a dog, there was no bite wound to or near the knee joint in any of those patients.

Conclusion

Capnocytophaga species should be considered as a primary knee pathogen in patients usually due to bacteremic seeding of the joint. Diagnostic joint or blood cultures may require 3-5 days or longer incubation to positivity rather than the usual 1-2 days of incubation seen with more common bacterial joint pathogens. Since this is an organism that can also cause infective endocarditis, the presence of *Capnocytophaga* as a joint pathogen should incite a search for coexistent endocarditis in these patients. Routine susceptibility testing is difficult to perform so treatment is usually based upon known patterns of susceptibility. *Capnocytophaga* species are routinely susceptible to penicillin and its derivatives; to second, third and fourth generation cephalosporins; and to fluoroquinolone antibiotics.

Funding

The authors received no specific funding for this work.

Conflicts of interest

The authors hereby declare that they have no conflicts of interest.

References

1. Zbinden, R., 2015. Aggregatibacter, Capnocytophaga, Eikenella, Kingella, Pasteurella, and other fastidious or rarely encountered Gram-negative rods. In: JH. Jorgensen, KC. Carroll, G. Funke G, et al., eds. Manual of Clinical Microbiology. 11th ed. ASM Press, Washington, DC pp.652-666.
2. Lion C, Escande F, Burdin JC (1996) Capnocytophaga canimorsus infections in human: review of the literature and cases report. *Eur J Epidemiol* 12: 521-533. [[Crossref](#)]
3. van Dam AP, Jansz A (2011) Capnocytophaga canimorsus infections in The Netherlands: a nationwide survey. *Clin Microbiol Infect* 17: 312-315. [[Crossref](#)]
4. Piau C, Arvieux C, Bonnaure-Mallet M, Jolivet-Gougeon A (2013) Capnocytophaga spp. involvement in bone infections: a review. *Int J Antimicrob Agents* 41: 509-515. [[Crossref](#)]
5. Chesdachai S, Tai DBG, Yetmar ZA, Misra A, Ough N, et al. (2021) The Characteristics of Capnocytophaga Infection: 10 Years of Experience. *Open Forum Infect Dis* 8: ofab175. [[Crossref](#)]
6. Butler T, Weaver RE, Ramani TK, Uyeda CT, Bobo RA, et al. (1977) Unidentified gram-negative rod infection. A new disease of man. *Ann Intern Med* 86: 1-5. [[Crossref](#)]
7. Schoen RT, Wohlgelemer D, Barden GE, Swartz TJ (1980) Infection with CDC group DF-2 gram-negative rod: report of two cases. *Arch Intern Med* 140: 657-658. [[Crossref](#)]
8. Fernández Vecilla D, Aspichueta Vivanco C, Angulo López I, Baraia-Etxaburu Artetxe JM, Renzi F, et al. (2022) A case of septic arthritis caused by Capnocytophaga canimorsus in an HIV patient. *Access Microbiol* 4: acmi000368. [[Crossref](#)]
9. Larson AN, Razonable RR, Hanssen AD (2009) Capnocytophaga canimorsus a novel pathogen for joint arthroplasty. *Clin Orthop Relat Res* 467: 1634-1638. [[Crossref](#)]
10. Orth M, Orth P, Anagnostakos K (2017) Capnocytophaga canimorsus - An underestimated cause of periprosthetic joint infection? *Knee* 24: 876-881. [[Crossref](#)]
11. Hawkey PM, Smith SD, Haynes J, Malnick H, Forlenza SW (1987) In vitro susceptibility of Capnocytophaga species to antimicrobial agents. *Antimicrob Agents Chemother* 31: 331-332. [[Crossref](#)]
12. Rummens JL, Gordts B, Van Landuyt HW (1986) In vitro susceptibility of Capnocytophaga species to 29 antimicrobial agents. *Antimicrob Agents Chemother* 30: 739-742. [[Crossref](#)]