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A case of *Capnocytophaga canimorsus* sacral abscess in an immunocompetent patient

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Abstract We report a unique case of sacral *Capnocytophaga canimorsus* abscess successfully treated with surgery and antibiotics. Close contact to a dog was assumed to be the most likely source of infection. Established risk factors for invasive *C. canimorsus* infection such as splenectomy, alcoholism or overt immunosuppression could not be identified. The role of cigarette smoking, portal of entry and the possible relevance of altered skin microbiota as well as the diagnostic value of polymerase chain reaction are discussed in the light of the scarce literature of spinal *C. canimorsus* infections.

Keywords *Capnocytophaga canimorsus* · Sacral abscess · Broad-range 16S rRNA gene PCR · Skin microbiota

Introduction

Dysgonic fermenter 2 is a Gram-negative fusiform bacterium, discovered in 1976, which was later renamed *Capnocytophaga canimorsus* (latin: canis = dog,

morsus = bite) [1] due to its commensalism in the oral flora of dogs and isolation from infected bite wounds [1]. The majority of previously described human infections relates to some form of canine exposure (mostly bites with an incubation period of about 5 days). Symptoms may range from mild local infections to fulminant sepsis with disseminated intravascular coagulation, endocarditis, peritonitis or meningitis [1]. Known risk factors for invasive infections are alcohol abuse, splenectomy or other forms of immunosuppression [1]. So far, only two reports account for vertebral/discal involvement [2, 3]. We report the first case of epidural *C. canimorsus* sacral abscess in an immunocompetent patient.

Case

A 51-year-old male smoker was treated by his general practitioner for radiologically proven pneumonia of the left lower lung as an outpatient. The antibiotic regimen consisted of a 10-day course of Amoxicillin and Clavulanic acid 1 g p.o. b.i.d. followed by Moxifloxacin 400 mg p.o. daily for another week. A bronchoscopy to exclude malignancy revealed an unspecific inflammation and failed to detect any microorganisms. The patient recovered completely and C-reactive protein (CRP) values normalized (Table 1). Six weeks after the first consultation, the patient presented to his general practitioner again with fever, arthralgia and headache. Clinical examination revealed crepitating rales of the left lower lung field and recurrent pneumonia was diagnosed on clinical grounds. An empiric antimicrobial therapy with Clarithromycin 500 mg p.o. b.i.d. was started. On follow-up visit 3 days later, the patient's condition had worsened and he was referred to the nearest hospital.

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Table 1 Timeline showing the course of the infection parameters

	General practitioner			Regional hospital		Tertiary hospital			Follow-up			
	First visit	+19d	Referral	+8d	+14d	Surgery	POD #7	POD #14	POD #21	2 mt	3 mt	6 mt
HB (g/l)	131	92	139	116	126	113	118	114	–	135	139	151
LC (G/l)	19.1	6.9	8.1	12.9	14.4	10.4	13.1	11.6	25.7	9.4	11	8.3
leukocytes, <i>PLT</i> platelets, <i>CRP</i>	343	474	241	791	790	606	480	480	410	302	421	245
C-reactive protein, <i>POD</i>	207	<5	116	52	146	104	31	10	<5	9	<5	<5
postoperative day												

On admission, his body temperature was 38.2 °C and he displayed signs of meningism. Otherwise, his neurological exam was unremarkable. Lumbar puncture revealed 1,552 leucocytes/ μ l (667 mononuclear cells and 885 polynuclear cells), protein of 0.9 g/l and glucose of 2.29 mmol/l. This constellation was highly suspicious of meningitis and an empiric treatment with intravenous Ceftriaxone 2 g q12 h and Aciclovir 500 mg q8 h was commenced. Aciclovir was discontinued after a viral meningitis due to Herpes simplex virus 1 and 2 was ruled out with a negative polymerase chain reaction (PCR) from the cerebrospinal fluid (CSF). PCR for *Mycobacterium tuberculosis* and Gram stain of the CSF were also negative. Both, CSF and blood cultures were sterile. An HIV test was negative. Eventually, all symptoms resolved completely. Antimicrobial treatment was discontinued after 10 days regardless of persistently raised CRP, elevated leukocytes and thrombocytes (Table 1). On day 14, the patient complained about new and progressive pain in his buttock, which was accompanied by a rise of CRP (146 mg/l) and thrombocytes (790 G/l) (Table 1). Subsequent lumbar magnetic resonance imaging (MRI) revealed a sacral epidural abscess (Fig. 1). An ultrasound-guided puncture of the abscess through the sacral hiatus was attempted. Only a small volume could be aspirated, which showed an abundance of polynuclear leucocytes, but no bacterial growth. The patient was transferred to our Neurosurgery Department for surgical exploration and removal of the abscess. A right sacral hemilaminectomy was performed from S1 to S4. Intraoperatively, mostly solid, organized tissue with liquid compartments of pus was identified. This was carefully dissected from the cauda and sent for microbiological and histological examination. Due to dural adhesions, dissection was made extremely difficult. It resulted in a dural tear of a sacral nerve root sheath, which was subsequently covered with TachoSil® (Takeda Pharmaceuticals International GmbH). An estimated two-thirds of the abscess could only be removed. Postoperatively, intravenous Ceftriaxone 2 g q12 h was re-commenced and like before, the patient responded well to it. Thus, Ceftriaxone was tapered after

10 days to a single dose of 2 g daily. Specimen Gram stain showed no microorganisms and cultures were sterile after incubation for 14 days. Eventually, analysis of the specimen using broad-range 16S ribosomal ribonucleic acid (rRNA) gene PCR, as described by Bosshard et al. [4], detected *C. canimorsus* deoxyribonucleic acid (DNA). The 16S rDNA sequence of the isolate was identical to *C. canimorsus* reference sequences according to the public NCBI database [5] and allowed identification at the species level and discrimination against other *Capnocytophaga* species. As a consequence of this finding, intravenous Ceftriaxone 2 g daily was continued. Within 3 weeks, CRP and thrombocytes decreased to 4 mg/dl and 410 G/l (Table 1), respectively. In the further course, the patient reported persistent severe pain in his buttock with circumferentially radiating pain in both thighs due to a radiologically evident pseudomeningocele from L5 to S4. As the pain remained refractory to fentanyl and pregabalin, the CSF fistula was surgically revised. After 2 months of antimicrobial treatment with intravenous Ceftriaxone, repeat MRI showed a regressive pseudomeningocele with no signs of superinfection while CRP remained normal. Consequently, intravenous Ceftriaxone was discontinued. No recurrent infection was noted until the last follow-up after a total of 1 year (Fig. 1). However, chronic pain still had not settled to his satisfaction.

During hospitalization, a thorough search for another infectious focus or entry site was undertaken. No further infectious lesions were found in the MRI of the remaining neuraxis. An otorhinolaryngeal/dental consultation including fiber endoscopic examination and an orthopantomogram could not find an enoral or endonasal lesion site or dentogenic focus. Repeat transthoracic echocardiography did not show any signs of endocarditis. Other than heavy cigarette smoking (65 pack-years) and a codeine abuse from which the patient was being weaned, intake of other drugs and regular consumption of alcohol were denied. Apart from chronic depression, bilateral hearing impairment acquired in his youth, for which he used hearing devices and removal of his tonsils in his childhood, he was healthy. He had no travel history.

Fig. 1 *Left* preoperative T1 MRI with contrast revealed a sacral rim-enhancing fluid collection (*arrow*). *Right* 1-year follow-up T1 MRI with contrast showed a sacral pseudomeningocele with no signs of superinfection (*arrow*)



However, the patient owned a Labrador dog. His dog had never bitten him but used to lick his hands, which showed excoriations caused by his work as a cable car station worker in a Swiss ski resort.

Discussion

To the best knowledge of the authors, this is the first report of a case of sacral epidural abscess caused by *C. canimorsus*.

In spinal epidural abscesses, culturing of the causative microorganism is vital to guide antimicrobial treatment. As blood cultures remain negative in 40 % of the cases, cultures of CT-guided needle aspiration or from surgical drainage are mandatory and should be performed early [6]. Since preceding antimicrobial therapy decreases the culture sensitivity, administration of antibiotics should be held until appropriate cultures are obtained unless the patient is septic, critically ill, or shows neurologic deficits. With this approach a causative germ can be isolated in more than 90 % [6]. The most commonly isolated pathogen in spinal epidural abscesses is *Staphylococcus aureus*, followed by Gram-negative rods and *Streptococcus* spp. [6]. In samples taken under antimicrobial treatment and when cultures remain sterile, broad-range 16S rRNA gene PCR followed by sequencing was shown to be effective to detect fastidious or intracellular microorganisms [7]. In our case, diagnosis could only be established by broad-range 16S

rRNA gene PCR as several cultures remained negative. Our case report highlights the usefulness of broad-range PCR in the diagnosis of infectious diseases in selected cases of osteoarticular and epidural infections. Expected benefit must always be balanced against additional expense as well as the potential of false-positive results. These include persistence of bacterial DNA after cell death as well as water or skin contaminations [7]. Appropriate measures were taken in our laboratory to prevent contamination during analysis and thereby making a false-positive result very unlikely. A drawback of 16S rRNA gene PCR is the impossibility of determining antibiotic susceptibility of the detected strains [7]. In *C. canimorsus* infections this is not problematic, as susceptibility to third-generation Cephalosporins can generally be considered [8]. However, a high prevalence of β -lactam resistance genes was reported in human oral *Capnocytophaga* spp. [9].

After antimicrobial treatment of 4–6 weeks, resolution of an abscess can normally be expected. With concomitant osteomyelitis, antimicrobial therapy should be maintained for 8–12 weeks [6]. Our patient had a pseudomeningocele due to a postoperative CSF leak and, therefore, resolution of the fluid collection was not anticipated.

Although many cases have demonstrated an association of invasive infections by *C. canimorsus* with a distinct underlying immune disorder such as splenectomy, chronic alcohol abuse or use of cortisone, for instance, no identifiable risk factors can be found in 40 % of the cases [1]. In a patient with *C. canimorsus* osteomyelitis/discitis

secondary to a dog bite, heavy cigarette smoking was suggested as a possible risk factor [2]. Successful antimicrobial treatment was achieved with a combination of Ceftriaxone and Gentamicin followed by Ciprofloxacin for a total duration of 2 months. In two *C. canimorsus* sepsis cases in immunocompetent patients, heavy cigarette smoking was explicitly highlighted as well [1]. Weinberg [10] explains the role of smoking as a risk factor as follows: smokers can inhale 1.2 µg of iron per day and, therefore, might become an iron-loaded host that could be more susceptible to potential invaders with otherwise very little iron acquisition capability such as *C. canimorsus*.

In another case of *C. canimorsus* osteomyelitis/discitis, the patient was not immunodeficient and a third-generation Cephalosporin led to complete resolution [3]. Similar to our case, the patient also reported that he had small wounds licked by his dog. Close animal contact with licking of excoriations of the patient's hands was the most probable route of infection in our case. The skin is our most exposed organ and provides a physiological barrier to invading microorganisms. According to research results of recent years on the human skin microbiome, it is reasonable to hypothesize that systemic antibiotic treatment disrupts the normal skin microbiota. Consecutively, this might skew the balance of bacterial skin commensals and, therefore, lower immune defence. This was demonstrated in the gut microbiome, where antibiotics were found to cause dysbiosis with a transient loss in bacterial diversity accompanied by a long-term change in microbiome composition far beyond direct antibiotic targets. As a consequence, colonization by pathogens and subsequent bacteraemia took place [11, 12]. A similar mechanism was proposed in a recent case of endocarditis caused by a skin commensal after prolonged antibiotic treatment [13]. Our patient was exposed to broad-spectrum antibiotics for several weeks shortly before the actual infection occurred. The treatment included Moxifloxacin, which is readily excreted in the sweat and impacts the skin microbiome [14]. Dysbiosis in conjunction with the obvious breakdown of skin barrier in terms of excoriations might have resulted in a higher susceptibility to *C. canimorsus* infection. Theoretically, haematogenous seeding of a lower respiratory tract infection is also conceivable as pneumonia was diagnosed 3 weeks before. Respiratory tract infections such as *Pasteurella multocida*, another commensal of dogs, frequently isolated after bite injuries are well known and generally only occur in patients with underlying respiratory tract disease [15]. To the best of our knowledge this has only been described for the human commensal *Capnocytophaga* spp. [16, 17], but not for *C. canimorsus*. Unfortunately, no bronchoscopic specimens were left for PCR in our case and, therefore, this route of infection remains a matter of speculation.

Conclusion

C. canimorsus infection is rare and probably underdiagnosed in many instances due to its fastidious growth. Thus, PCR is a valuable diagnostic tool in cases with negative microbial cultures. Pet ownership or animal contact should be addressed in the medical history of patients diagnosed with spinal abscesses. Cigarette smoking might represent an independent risk factor for a complicated infection. Our case report is the first to report an epidural sacral abscess with *C. canimorsus* and adds to the very few cases of spinal involvement of this microbe.

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Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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