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Community-acquired *Capnocytophaga canimorsus* meningitis in adults: report of one case with a subacute course and deafness, and literature review

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ABSTRACT

Introduction: An adult with community-acquired *Capnocytophaga canimorsus* meningitis presented with a subacute course, deafness, and a predominantly lymphocytic CSF cell count.

Methods: Eighteen reported cases of *C. canimorsus* meningitis in adults were analyzed.

Results: In about half the cases, CSF contained less than 1,000 leukocytes/ μ L or lymphocyte percentages $\geq 30\%$. These figures differ from those usually seen in meningitis caused by the classic meningeal pathogens.

Conclusions: *C. canimorsus* should be included among the causes of sporadic lymphocytic meningitis in adults, in particular if the presentation involves deafness.

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Meningitis por *Capnocytophaga canimorsus* de adquisición comunitaria en adultos: presentación de un caso con evolución subaguda y sordera, y revisión de la bibliografía

RESUMEN

Introducción: se presenta el caso de un adulto con meningitis comunitaria por *Capnocytophaga canimorsus* (MCCC) de presentación subaguda, con sordera y un líquido cefalorraquídeo (LCR) de predominio linfocitario.

Métodos: se han analizado los 18 casos de MCCC descritos en adultos.

Resultados: en aproximadamente la mitad de los casos el LCR muestra menos de 1.000 leucocitos/ μ L, o un porcentaje de linfocitos $\geq 30\%$, lo que difiere de la meningitis causada por los patógenos meníngeos clásicos.

Conclusiones: *C. canimorsus* se debe incluir en la lista de causas de meningitis linfocítica de presentación esporádica en adultos, especialmente si cursa con sordera.

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Palabras clave:

Meningitis

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Introduction

Capnocytophaga canimorsus (formerly referred to as DF-2) is a slow-growing, facultative anaerobic, gram-negative bacillus found in the oral flora of certain animals, such as dogs and cats. The microorganism was first described in 1976 by Bobo and Newton¹. Typically, following a dog bite or close contact with dogs, *Capnocytophaga canimorsus* can cause systemic infections, most

often in individuals with a previous splenectomy, alcohol abuse, or other types of immunosuppression, although up to 41% of cases have occurred in healthy individuals².

To the best of our knowledge, we report the 30th case of *Capnocytophaga canimorsus* meningitis in the literature. Our patient was a previously healthy adult male who presented with a prolonged clinical course without fever, a predominantly lymphocytic CSF cell count, and deafness as an outstanding sign. This clinical presentation prompted us to review data that had not been thoroughly analyzed in previous reviews of this disease^{3,4}, such as the duration of the illness before diagnosis, CSF white cell count, and sensorial and neurological complications.

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Methods

All 30 cases of *C. canimorsus* meningitis reported in the English, Spanish and French literature were reviewed. Seven patients reported as having meningitis and whose specific clinical and CSF data were lacking were excluded, as well as 3 other patients who presented with severe sepsis and shock, because their clinical presentation was completely different from the presentation of patients with meningeal syndrome. One pediatric case and one hospital-acquired case were also excluded. In total, 18 cases of community-acquired *C. canimorsus* meningitis (CACCM) in adults (Table 1) were analyzed.

Case report

The patient was a previously healthy 64-year-old man who was admitted to our hospital on 23 May 2006 with fever, headache, and severe hearing loss. Seven days prior to admission, he had chills and one episode of vomiting. Two days later he noticed a transient erythematous skin rash and reported moderate holo-cranial headache, severe hearing loss, and dizziness, which persisted when he came to the emergency room. The main reason for his decision to come to the hospital was the hearing loss. He had received three doses of 600 mg ibuprofen, but no antibiotic treatment. He reported that his dog had bitten his right hand seven days before his symptoms appeared.

Physical examination disclosed slight neck stiffness, horizontal nystagmus to the right, and severe bilateral hearing deficit. Axillary temperature was 37.1 °C. His right hand showed no signs of an animal bite or inflammation. The cranial CT study was normal. The results for routine hematological and chemical blood components were normal, with the exception of blood glucose at 172.8 mg/dL, and C-reactive protein at 68.6 mg/L. Analysis of lumbar puncture specimens revealed clear CSF with 730 white blood cells (WBC)/ μ L (78% lymphocytes and 22% neutrophils), 142 mg/dL proteins, and 21.6 mg/dL glucose. CSF Gram stain was negative. Therapy with intravenous ampicillin (4.5 g every 6 h) and dexamethasone (4 mg every 6 h) was started, and the patient experienced rapid clinical improvement with the exception of his hearing loss, which persisted unchanged. Audiometric study demonstrated severe bilateral neurosensory deafness, whereas CT of the ears was normal.

Two days after the start of therapy, CSF culture (blood agar and chocolate agar plates, both incubated in 5% CO₂ at 35–37 °C) yielded a number of small, smooth, shiny, non-hemolytic bacteria. Gram stain identified some long, thin, spindle-shaped, gram-negative rods. Catalase and cytochrome oxidase reactions were positive. On conventional biochemistry reactions, the bacilli did not reduce nitrates, did not hydrolyze urea, and did not produce indole. Glucose and lactose were fermented, but raffinose, sucrose, and inulin were not. Esculin was not hydrolyzed. The ONPG assay and arginine dihydrolase reaction were both positive. The rods were identified as *C. canimorsus*. Antibiotic susceptibility of the microorganism was investigated by disk diffusion method using Mueller-Hinton agar with 5% sheep blood, and incubation in 5% CO₂ atmosphere at 35–37 °C for 48 h. The microorganism did not produce beta lactamase, was susceptible to ampicillin, cefotaxime, imipenem and ciprofloxacin, and was resistant to aminoglycosides. Minimal inhibitory concentrations of antibiotics were not performed. Blood cultures were negative. Intravenous treatment with ampicillin (at the same initial dosage) plus dexamethasone (at tapering doses) was maintained for 14 days. A new lumbar puncture was performed five days after admission, and clear CSF was obtained, with 42 WBC/ μ L (85% lymphocytes), 79 mg/dL proteins, and 55.8 mg/dL glucose. No additional lumbar punctures

were performed. Blood glucose levels were normal at discharge. The patient was discharged with severe hearing loss as the only sequela. A second audiometric study performed one month later showed no changes relative to the previous one, and nearly total deafness persisted 6 months later.

Discussion

In the cases we reviewed, the duration of symptoms before hospitalization of adults with community-acquired *Capnocytophaga canimorsus* meningitis varied from less than 24 h to 5 days (median of 2 days), a period similar to that seen in classical bacterial meningitis. However, the clinical presentation can be subacute⁴, as was the case of our patient.

The authors of previous reviews of *C. canimorsus* meningitis concluded that the clinical manifestations and CSF findings are similar to those of classical bacterial meningitis^{3,4}. They state that, apart from a possible bite wound found upon physical examination, no other symptom is known to discriminate between this rare form of meningitis and meningitis caused by other microorganisms. The authors of these studies conclude that a recent bite or contact with dogs should be investigated in cases of bacterial meningitis with no apparent microbiological cause. Overall, we agree with these conclusions. After reviewing the CSF data of published cases, however, we found that the CSF characteristics were not necessarily indistinguishable from those of classical bacterial meningitis. In about 20% of cases of community-acquired pyogenic meningitis, CSF contains less than 1000 WBC/ μ L^{5,6}. However, CSF WBC count was less than 1000 cells/ μ L in 50% (9 of 18 cases) of CACCM in adults. In addition, CSF analysis in most cases of community-acquired pyogenic meningitis showed a more than 80% neutrophil content, with only 10% of cases showing a predominance of lymphocytes^{6,7}. Nonetheless, lymphocytes predominated in 3 of the 15 cases (20%) of CACCM in adults in which CSF differential WBC count was reported, and the percentage of lymphocytes was higher than or equal to 30% in 7 of them (47%) (Table 1). Therefore, it seems that CSF in *C. canimorsus* meningitis often exhibits a lesser degree of pleocytosis and a higher percentage of lymphocytes than meningitis caused by classical pyogenic meningeal pathogens. These findings are similar to those usually seen in adults with meningitis due to *Listeria monocytogenes*^{6,8}. This fact is interesting, because if CSF Gram stain is negative, as in 39% of the cases we analyzed (Table 1), proper diagnosis and antibiotic treatment may be delayed. Hence, we believe that previous contact with dogs (or cats) should be investigated not only in cases of clearly purulent meningitis without an apparent cause, but also in sporadic acute, and particularly, subacute meningitis with a significant or predominant percentage of lymphocytes in CSF.

Among the published cases, we found one that was quite similar to ours, a patient who presented with headache of 3 days' duration, a high percentage of lymphocytes in CSF, and deafness⁹. The patient was diagnosed as having viral meningitis complicated with deafness and received no antibiotic treatment. He recovered spontaneously from the infection, but remained deaf. The authors of that report concluded that *C. canimorsus* should be added to the list of causes of acute deafness, and our case confirms that assertion. With the exception of this patient, the remaining patients with *C. canimorsus* meningitis received correct empirical antibiotic treatment, most often ampicillin and/or a third generation cephalosporin.

Our patient received empirical treatment with dexamethasone to improve his hearing loss. However, deafness was already established when the treatment was initiated and we did not perceive any favorable effect of the corticoid treatment.

Table 1
Cases of community-acquired *Capnocytophaga canimorsus* meningitis in adults

Patient	First author (year)	Sex, age	Bite/contact with dog/cat	Delay since firstsymptom (days)	WBC/ μ L in CSF	CSF protein (g/L)	CSF glucose (mmol/L)	CSF/serum glucose ratio	Positivity of CSF Gram stain	Correct empiric treatment	Use of corticoids	Outcome
1	Bobo RA (1976)	M, 42	Yes	1	19 (70% L)	1.03	4.7	0.59	No	Yes	No	Cured
2	Ofori-Adjei D (1982)	F, 66	Yes	1	575 (90% N)	2.4	Low	0.24	Yes	Yes	No	Cured
3	Chan PCY (1986)	M, 63	Yes	4	1.121 (80% N)	1.75	2.1	0.45	Yes	Yes	No	Cured
4	Carpenter PD (1987)	M, 26	Yes	1	520 (70% N)	1.43	1.05	0.2	No	Yes	No	Cured
5	Westerink MA (1987)	M, 26	Yes	1	0	0.31	3.4	0.53	No	Yes	No	Cured
6	Imanse JG (1989)	F, 39	Yes	3	480 (70% N)	0.32	3.7	NA	No	No	No	Deafness
7	Krol-van Straaten MJ (1990)	F, 75	Yes	NA	6000 (N)	NA	NA	NA	Yes	Yes	No	Cured
8	Kristensen KS (1991)	M, 74	Yes	2	240 (80% N)	NA	NA	NA	Yes	Yes	No	Cured
9	Blanche P (1994)	M, 57	Yes	NA	434 (74% L)	1.59	2.4	0.3	Yes	Yes	No	Cured
10	Kampaniga GA (2002)	M, 63	Yes	NA	597	2.1	NA	0.32	Yes	Yes	No	Cured
11	Le Moal G (2003)	M, 45	Yes	NA	1240 (65%N)	1.65	1.8	0.21	Yes	Yes	No	Cured
12	Biedermann P (2004)	M, 63	Yes	5	1720 (92%N)	3.89	1.9	0.28	No	Yes	No	Cured
13	Meybeck A (2006)	M, 65	Yes	Hours	1.226 (96% N)	3.28	2	0.24	Yes	Yes	No	Cured
14	Drouet A (2006)	M, 60	Yes	NA	4.000 (83% N)	5.02	Very low	NA	Yes	Yes	No	Cured
15	Gottwein J (2006)	M, 54	Yes	3	1.001 (82% N)	1.69	1.8	0.3	No	Yes	Yes	Cured
16	de Boer MG (2007)	M, 69	Yes	Hours	1.024 (99% N)	1.73	NA	0.43	Yes	Yes	Yes	Cured
17	de Boer MG (2007)	M, 58	No	4	1.566 (54% N)	1.3	NA	0.5	Yes	Yes	Yes	Cured
18	Gasch O.(2007)	M, 64	Yes	5	730 (78% L)	1.42	1.2	0.13	No	Yes	Yes	Deafness

CSF: cerebrospinal fluid; L: lymphocytes; N: neutrophils; NA: not aported; WBC: white blood cells.

Among the cases reviewed, only three recently reported patients received corticoids as adjuvant therapy, as has been recommended for the initial treatment of bacterial meningitis until the cause is known¹⁰. The other reported patients did not receive adjuvant treatment with corticoids and none developed neurological complications attributable to meningitis other than deafness in the two aforementioned patients. This fact might indicate another difference with classic bacterial meningitis, in which neurological complications are frequent.

The duration of antibiotic therapy for *C. canimorsus* meningitis has not been established. Some authorities recommend 21 days of antibiotics, as has been recommended for gram-negative bacillary meningitis⁶. However, in view of the rapid clinical improvement in our patient after initiation of treatment, the duration of antibiotic therapy was limited to 14 days.

In summary, CACCM in adults is an uncommon disease that may present with a subacute course and frequently shows rather mild CSF pleocytosis with a variable but significant percentage of lymphocytes. Therefore, if CSF Gram stain does not demonstrate microorganisms, an initial diagnosis of bacterial meningitis may be difficult, especially if a background of contact with dogs is not found by performing a meticulous anamnesis. Contact with animals should also be investigated in all cases of sporadic meningitis with CSF lymphocyte predominance. Finally, we believe that *C. canimorsus* should be added to the possible causes

of sporadic lymphocytic meningitis in adults, particularly when it presents with a subacute course and deafness.

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