ABSTRACT

Background: Capnocytophaga canimorsus infections are associated with dog bites, especially in patients who are immunocompromised. The majority of patients (59%) reported recent dog bite (mean time between bite and presentation: 14 days). C. canimorsus is part of the normal flora in the mouths of dogs and has been isolated from sites of infection such as skin wounds in immunocompromised patients. A comprehensive review of C. canimorsus meningitis cases to provide summary data on the clinical manifestations, diagnosis, and outcomes of C. canimorsus meningitis.

Methods: A systematic review of the peer-reviewed English literature from January 1966 to March 2019 was conducted to identify cases of C. canimorsus meningitis. Data collected included demographics, risk factors, cerebrospinal fluid (CSF) findings, PCR results, treatment, and outcomes. CSF cultures included a median white cell count of 1024/mm3 (range 0-80,000/mm3) with neutrophil predominance (mean of 81%). Nineteen cases were positive for C. canimorsus (median of 4 days) and 26 cases (70%) had positive CSF cultures (median of 5 days). PCR established the diagnosis in eight (22%) cases. Antibiotic therapy was given for a median of 15 days (range 7 to 42 days). Prognosis was overall favorable with only one (3%) case of death reported and adverse neurological and/or physical sequelae in 19% of the survivors.

Conclusion: C. canimorsus meningitis is a rare but important clinical entity that occurs in patients of all ages, typically following dog bite exposure. While most cases occur in immunocompromised patients, this unusual infection is also associated with exposures to immunocompetent persons. Diagnosis may be rapidly established by PCR, and this testing should be considered in culture-negative cases associated with exposures.

PATHOPHYSIOLOGY/MICROBIOLOGY

Figure 1: (A) Capnocytophaga canimorsus is a common bacterial colonizer of the oral cavity of dogs with estimates of up to 75% of canines carrying the organism. (B) 5 of 6 colonies isolated from canine oral cavity. Images from panels B and C adapted from CDC MicrobeNet.

Table 1: Summary of Capnocytophaga canimorsus Meningitis Cases (n=37)

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Race</th>
<th>Occupation</th>
<th>CSF TLC</th>
<th>CBC WBC</th>
<th>CSF Glucose</th>
<th>CSF Protein</th>
<th>PCR</th>
<th>CSF Culture</th>
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<td>17,500</td>
<td>88</td>
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</tr>
</tbody>
</table>

CASE REPORT

A 71-year-old Caucasian female complained of fever, confusion, and severe headaches. She was febrile to 38.8°C. On examination, she had an altered mental status and was disoriented to person and place, with a head injury. She owned a dog and frequented a beach where many people walked their dogs. No reported dog bites.

Laboratory data was notable for a WBC count of 19,900 cells/mm³ with 92% neutrophils, hemoglobin 13 g/dL, and platelets 196 x 10⁹/mm³. Lactate level was 2.4 mmol/L, creatinine was 1.0 mg/dL, and glucose was 109 mg/dL.

MRI with and without gadolinium showed left occipital and parietal acute infarcts without mass effect and subtle bilateral frontal subdural hematomas. A lumbar puncture revealed pleocytosis (59% PMNs, 95% PMR), red cell count of 2,600 cells/mm³, low glucose of 12 mg/dL, and elevated protein of 413 mg/dL. Gram stain did not show any organisms.

The patient was started on empiric antibiotic therapy with IV vancomycin and piperacillin-tazobactam prior to the lumbar puncture, but antibiotics were changed after the lumbar puncture showed meningitis to IV vancomycin 500 mg every 8 hours, ampicillin 2 grams every 4 hours, and ceftriaxone 2 grams every 12 hours. No steroids were administered.

Blood cultures were drawn on admission using BD Plus Aerobic and BD Lytco10 Anaerobic/F media. The first set was positive at approximately 4 days (98 hours) and the second set at 4.6 days (110 hours), both in the BD Lytco10 Anaerobic/F media for Gram negative rods with bacterial growth on plates by day 6. Matrix Assisted Laser Desorption Ionization Time Of Flight Mass Spectrometry (MALDI-TOF MS) was performed and the organism was identified as C. canimorsus. PCR was used for a biochemical identification and Capnocytophaga was identified. The organism was unable to be successfully grown on culture for susceptibility testing. A CSF culture was negative, but a specimen was sent to the University of Washington for multiple bacterial polymerase reaction (PCR) testing which was positive for C. canimorsus.

Antibiotic therapy was modified to meropenem 2 grams IV OD. A transcranial echocardiogram did not show vegetations and a transesophageal echocardiogram performed subsequently made a full recovery.

RESULTS

- Median age at presentation was 63 years (0-83 yr) with male predominance (76%).
- 24% of cases had one of these immunosuppressive conditions: 5 splenectomy, 1 splenectomy and lymphoma, 2 steroid use, and 1 RA.
- Alcoholism (19%) was the most common medical condition identified.
- The majority of patients (95%) reported recent dog bite (mean time between bite and presentation 6 days) while 11% had no known animal contact.
- Presenting symptoms were those of classic meningeal signs: fever, headache, neck stiffness, and photophobia, as well as altered mental status.
- CSF cultures demonstrated a pattern consistent with bacterial meningitis with elevated CSF white blood count, elevated CSF protein, and low CSF/serum glucose ratio.
- CSF cultures were positive in 70% of cases with a median growth time of 5 days. PCR was used to establish diagnosis in the current case and 22% of all cases.
- Treatment was with penicillin, third generation cephalosporins, or carbapenems with the median treatment duration of 15 days.
- Outcomes were generally favorable: 1 reported death, 4 with hearing loss, 1 with chronic Halitosis, and 1 with extremely amputations and 1 chronic neurologic deficits.

CONCLUSIONS

- Capnocytophaga canimorsus should be considered in cases of meningitis in both immunocompetent and immunocompromised patients of all ages especially after dog exposure.
- As organism grows slowly using traditional culture methods, PCR can serve as a useful adjunctive diagnostic test.