We report a case of *Rickettsia sibirica mongolitimonae* infection, an emerging tickborne rickettsiosis, with associated encephalitis in a 66-year-old man. Diagnosis was rapidly confirmed by quantitative PCR obtained from an eschar swab sample. The patient was successfully treated with oral doxycycline.

In July 2018, a 66-year-old man was admitted to the emergency department in Marseille, France, because of fever (40°C) and confusion. His medical history included arterial hypertension controlled with amiodipine and dyslipidemia and coronary artery disease treated with pravastatin and aspirin. He lived in a rural area near Marseille and owned dogs, pigs, pheasants, pigeons, and chickens. In the hospital emergency department, he received acyclovir (1 g every 8 h), amoxicillin (4 g every 6 h), and ceftriaxone (3 g every 12 h) for suspected meningoencephalitis.

At admission to the infectious diseases department, he had a general maculopapular rash over his trunk, palms of his hands, and soles of his feet of 3 days’ duration (Figure, panel A). Blood pressure was 130/80 mm Hg. A 15-mm black eschar was noted on his right ankle, associated with rope-like lymphangitis (Figure, panel B). He had a 4/5 right corporal hemiparesis with ankle, associated with rope-like lymphangitis (Figure, panel C). He had a 4/5 right corporal hemiparesis with signs of right hemisensory loss and right Babinski sign. Lumbar puncture results were unremarkable, and C-reactive protein was 65.4 mg/L (referent <3 mg/L). Oral doxycycline (300 mg 1×/d) was added to his drug regimen 3 days after symptom onset. Results of brain computed tomography scan were unremarkable. Magnetic resonance imaging showed multiple bilateral brain lesions compatible with acute encephalitis related to vasculitis (Figure, panel C). Positron emission tomographic scan showed cerebral cortical diffuse hypometabolism (Appendix Figure, https://wwwnc.cdc.gov/EID/article/26/2/18-1667-App1.pdf). Results of microbiological tests performed on cerebrospinal fluid and indirect immunofluorescence assay for spotted fever group (SFG) rickettsiae were negative. DNA obtained from eschar swab samples was positive by quantitative PCR for all SFG *Rickettsia* species (*gltA* and *ompA* genes) (1). Positive samples tested with species-specific *R. massiliae*, *R. conorii*, and *R. sibirica mongolitimonae* primers were positive for *R. sibirica mongolitimonae* (35 cycles quantification) (1).

Oral doxycycline was continued for 10 days; other drugs were discontinued. The cutaneous lesions regressed at day 3, and neurologic symptoms progressively improved after administration of doxycycline. A low seroconversion for the SFG rickettsiae was observed (IgM 1:16; IgG 1:16) 3 weeks after symptom onset; at 7 weeks postinfection, serology became negative.

One month after symptom onset, the patient had 4/5 muscular strength in his right leg. Magnetic resonance imaging performed at 7 weeks and 1 year after symptom onset showed cerebral sequelae lesions (Figure, panel C). At 1 year, the Babinski sign in the right foot persisted, but muscular testing was 5/5 with the exception of lifting the right foot, which was 4/5.

*R. sibirica mongolitimonae* infection is an emerging rickettsiosis; <40 human cases have been described. It is seasonal in France (spring and summer). It has been referred to as lymphangitis-associated rickettsiosis because of the typical rope-like lymphangitis sign (2). Other clinical signs include the classic triad of fever, rash, and eschar. SENLAT (scalp eschar and neck lymphadenopathy after tick bite) also has been reported (3).

Most *R. sibirica mongolitimonae* infections have been reported in the Mediterranean area (France, Spain, Portugal, Greece, and Turkey), Africa (Algeria, Egypt, Cameroon, South Africa), and China (4,5). In Europe, vectors include the tick species *Hyalomma excavatum*, *H. marginatum*, *H. turanicum*, *Rhipicephalus pusillus*, *R. bursa*, and *Haemaphysalis parva* (1,2,4). *R. sibirica mongolitimonae* infection usually causes mild disease, but severe manifestations have been described, including retinal vasculitis, lethargy with hyponatremia, septic shock, myopericarditis, and acute renal failure (2,6).

Only *R. conorii conorii*, *R. rickettsii*, *R. japonica*, and *R. slovaca* have been associated with encephalitis in the literature (Appendix Table); no patients who had received doxycycline were reported to have died. Doxycycline has proven to be superior.
to chloramphenicol and ciprofloxacin in rickettsial infection and should be the treatment of choice for rickettsial-associated encephalitis (1,7).

SFG rickettsiosis can be diagnosed by serology, culture, or molecular assay on blood, skin biopsy, or eschar swab sample. Seroconversion generally appears in the second and third weeks of illness; culture is fastidious and performed only in expert laboratories. Molecular tools using eschar cutaneous swab samples appeared as the best method for detecting and identifying *Rickettsia* spp. (1). The sensitivity of this technique is comparable with that of rickettsial detection on skin biopsy samples using molecular tools. It is a noninvasive and nonpainful diagnostic method that can be performed easily where molecular facilities are available (3,8).

The discrepancy observed in this case between PCR and serology has been reported in cases of *R. africae* infection, in which seroconversion is delayed (28 days for IgG and 25 days for IgM) and doxycycline treatment within 7 days after symptom onset prevents development of antibodies (9,10). In this patient, we observed very low serologic response 3 weeks after symptom onset, which might have been affected by the early administration of doxycycline. Moreover, the lack of serologic response observed...
here may be precisely related to the severity of the disease. The case we described illustrates the rapid efficacy of doxycycline to treat the severe neurologic consequences of rickettsial diseases, as well as the effectiveness and rapidity of the swab sample diagnostic test.

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Human Alveolar Echinococcosis, Croatia

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Alveolar echinococcosis is a parasitic disease caused by the tapeworm larval stage of *Echinococcus multilocularis*. This zoonotic disease has not been known to occur in Croatia. We report a confirmed case of human alveolar echinococcosis in a patient in Croatia who had never visited a known *E. multilocularis*-endemic area.

A 63-year-old male patient was sent to the University Hospital for Infectious Diseases in Zagreb, Croatia, in September 2017 for treatment of cystic liver lesions and pleural effusion. The patient had grown up and still lived in a rural area in Vukovar (45°21′N, 18°59′E/45.35°N, 18.99°E), where he worked for a waste management company. He spent free time in the woods picking mushrooms.

Before his referral, in November 2014, the patient underwent kidney ultrasonography, which also detected cystic formations in his liver. A subsequent multislice computed tomography (MSCT) scan in
# Appendix

## Appendix Table. Encephalitis and *Rickettsia* spp.*

| Case | Country | Rural | Date  | Age/Sex | Previous Illness | Clinical Manifestation | Diagnostic Test | Treatment | Outcome | Ref |
|------|---------|-------|-------|---------|------------------|------------------------|-------------------|-----------|---------|-----|
| 1    | Italy   | NA    | 2013  | Aug     | 78 y/F           | Arterial hypertension, type 2 diabetes, stroke | Fe + R + S, renal failure | Coma GCS3 | – CFS: meningitis  – CT scan: normal  – MRI: ND | IFA, ELISA | Chloramphenicol, levofloxacin, corticosteroids | Death  | (1) |
| 2    | Portugal| Dogs  | 2010  | Sep     | 59 y/M           | None                     | Fe + R + S, myalgia | Headache, hemisensory loss | – CFS: no meningitis  – CT scan: hypodensities frontal lobes and 1 lesion in left ventricle  – MRI: multiple noncontrast enhancement, periventricular | IFA | Doxycycline 200 mg/12 h 4 d, doxycycline 100 mg/12 h 3 d | Hemisensory loss on the left | (2) |
| 3    | Morocco | Dogs  | 2009  | Jan     | 1.2 y/M          | None                    | Fe + R + S          | Convulsions | – CFS: meningitis  – CT scan: normal  – MRI: normal | IFA | Josamycin 12 h, corticosteroids | Bilateral decreased vision, seizures, Aphasia and right hemiplegia | (3) |
| 4    | Spain   | Dogs  | 2008  | Jun     | 66 y/M           | Type 2 diabetes         | Fe + R + S, myalgia, renal failure, thrombocytopenia | Headache, confusion, quadriplegia, aphasia | – CFS: no meningitis  – CT scan: normal  – MRI: diffuse lesions in frontal, parietal, occipital, corpus callosum, cerebellar peduncles, pons, and limbic area | IFA | Doxycycline 100 mg/12 h 10 d | | (4) |
| 5    | Morocco | NA    | 2004  | Jul     | 49 y/F           | None                     | Fe + R          | Headache, confusion | – CFS: meningitis  – CT scan: normal  – MRI: meningeal contrast enhancement and lesion in right frontal lobe | IFA | Ceftriaxone, ampicillin, doxycycline | Remission | (5) |
| Case | Country | Rural | Date | Age/s | Sex | Previous illness | Clinical manifestation | Diagnostic test | Treatment | Outcome | Ref |
|------|---------|-------|------|-------|-----|------------------|-----------------------|------------------|-----------|---------|-----|
| 6    | India   | Dogs  | 2009 | 4 y/F | None| Fe + R           | Convulsions           | CFS, CT scan, MRI | Well-Felix, IFA | Chloramphenicol 75 mg/kg/d in 4 doses and doxycycline 2.2 mg/kg/12 h 10 d | Remission | (6) |
| 7    | Portugal | NA    | 2003 | 47 y/M| None| Fe + R+S, myalgia, renal failure, thrombocytopenia | Headache, convulsions, shock | CFS: ND | Immunohistochemistry | None | Death | (7) |
| 8    | Spain   | NA    | 2002 | 27 y/F| None| Fe, myalgia, nausea, abdominal pain | Headache, paresis on left side, convulsions | CFS: no meningitis | IFA | Valproate, clonazepam, ceftriaxone, doxycycline, phenobarbital, corticotherapy | Remission | (8) |
| 9    | Spain   | None  | 1999 | 53 y/F| Adult celiac disease | Fe + R, myalgia, arthralgia, thrombocytopenia, hypotension | Confusion, paraplegia | CFS: meningitis | IFA | Cefotaxime, acyclovir, isoniazid, rifampin, ethambutol, streptomycin, doxycycline, methylprednisolone | Paraplegia | (9) |
| 10   | Spain   | NA    | 1994 | 65 y/M| Type II diabetes | Fe + R+S, myalgia | Confusion, incontinence, ataxia | CFS: meningitis. CT scan: hypodensity in white matter | IFA | Doxycycline 100 mg/12 h 7 d | Remission | (10) |
| 11   | Morocco | NA    | 1991 | 6 y/M | None | Fe + R + S, arthralgia | Confusion, convulsions | CFS: meningitis. CT scan: hypodensity in both internal capsules | IFA | Thiamphenicol 15 d, corticosteroids 21 d | Mutism and quadriplegia | (11) |
| 12   | Spain   | NA    | 1987 | 77 y/F| Arterial hypertension, type 2 diabetes | Fe + R+S, myalgia, renal failure, thrombocytopenia | Headache, stupor, shock | CFS: meningitis | IFA | Amoxicillin 11 d, tetracycline 1 d | Death | (12) |
| 13   | France  | Dogs  | 1984 | 20 d/F| None | Fe + R+S, hepatomegaly, splenomegaly, thrombocytopenia | Inactivity, convulsion | CFS: meningitis | IFA | Ampicillin, gentamicin, spiramycin | Death | (13) |
| Case | Country | Rural | Date | Age/s ex | Previous illness | Clinical manifestation | CFS, CT scan, MRI | Diagnostic test | Treatment | Outcome | Ref |
|------|---------|-------|------|----------|------------------|-----------------------|------------------|---------------|-----------|---------|-----|
| 14   | Japan   | Brushy vegetation | 1992 Aug | 58 y/M | NA | Fe + R + S, nausea, vomiting | Confusion | –CFS: meningitis –CT scan: Normal –MRI: NA | IFA | Cefmetazole, clindamycin, aztreonam, imipenem, minocycline | Remission | (14) |
| 15   | Japan   | Bamboo tree | 1998 Apr | 55 y/M | NA | Fe + R, myalgia, nausea, vomiting, renal failure, shock | Headache, confusion, convulsions | – CFS: meningitis – CT scan: subdural hematoma – MRI: NA | IFA | Panipenem, acyclovir, minocycline | Death | (15) |
| 16   | Japan   | NA | Aug | 77 y/M | NA | Fe + R + S | Confusion, convulsions | NA | IFA | Minocycline | Remission | (15) |
| 17   | Japan   | NA | Aug | 78 y/M | NA | Fe + R, thrombocytopenia | NA | IFA | Minocycline | Remission | (15) |
| 18   | Slovakia | Garden | 1978 May | 33 y/F | None | Fe, myalgia, arthralgia, nausea, hepatomegaly | Headache, paresthesia, bradypsychia | –CFS: no meningitis –CT scan: ND –MRI: NA | IFA | Tetracycline, doxycycline | Minimum hemiparesia | (16) |
| 19   | USA | Dog, horses, chickens, parrots, rats, mice | 1993 Aug | 45 y/F | None | Fe + R + S, myalgia, thrombocytopenia | Confusion, convulsions, disorientation | –CFS: no meningitis – CT scan: white matter hypodensity and diffuse cerebral edema – MRI: multiple punctata area of increased signal through cerebral white matter | IFA | Imipenem, doxycycline | Remission | (17) |
| 20   | USA | NA | 1997 | 68 y/M | None | Fe + R, thrombocytopenia | Confusion, disorientation | –CFS: no meningitis – CT scan: normal – MRI: symmetrical zones of hyperintensity in periventricular white matter | IFA | Doxycycline | Attentional deficits, visuospatial difficulties and global impairment in memory | (18) |
| 21   | USA | Farm | 1999 | 7 y/M | None | Fe + R + S, myalgia, arthralgia | Headache, lethargy, convulsions | –CFS: meningitis – CT scan: NA – MRI: multiple foci of hyperintensity in white matter | IFA | Doxycycline, methylprednisolon | Deficit in short-term memory | (19) |
| 22   | USA | NA | 2016 Apr | 15 y/F | None | Fe + R | Convulsions | –CFS: NA – CT scan: NA | IFA | Doxycycline | Speech difficulty | (20) |
| Case | Epidemiologic data | Age/sex | Previous illness | Clinical manifestation | Diagnostic test | Treatment | Outcome | Ref |
|------|--------------------|---------|------------------|-----------------------|-----------------|-----------|---------|-----|
| 23   | USA                | Female  | None             | Headache, confusion, aphasia, tetraparesia | CFS: meningitis | IFA       | Death   | (21) |
|      | Rural              | 43 y/F  | None             | —CT scan: diffuse cerebral edema with cerebellar herniation | —MRI: NA | Ceftriaxone, doxycycline, methylprednisolone |         |      |
| 24   | USA                | Female  | None             | Headache, disorientation, aphasia, dystonic posture | CFS: no meningitis | IFA       | Aphasia | (22) |
|      | NA                 | 7 y/F   | None             | —CT scan: diffuse supratentorial attenuation | —MRI: diffuse hyperintense lesion in white matter | Ceftriaxone, vancomycin, doxycycline |         |      |

*CSF, cerebrospinal fluid; CT, computed tomographic; Fe: fever, GCS: Glasgow coma score; CT: computed tomography; MRI: magnetic resonance imaging; NA: not available; IFA, immunofluorescence assay; ND, not done; R, rash; ref, reference; S, scar.
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Appendix Figure. PET scan imaging showing a cerebral cortical diffuse hypometabolism.