Urban rickettsiosis in the Waikato region of New Zealand

Anurag Sekra, James Irwin, Paul Reeve

Abstract

Murine typhus is the only endemic rickettsia that has been shown to cause human disease in New Zealand (NZ). We present a case report of a rickettsial infection in the Waikato region which was not typical for murine typhus. We outline the features which made this case unusual, and discuss the diagnostic uncertainty in assessing rickettsial disease. Rickettsial infection should be suspected in all patients presenting with an undifferentiated febrile illness in NZ, even if they do not fit the typical clinical and epidemiological picture of murine typhus.

Rickettsial infections are zoonoses transmitted by ticks, mites, fleas or lice, and all cause a clinically similar illness. Murine typhus, the only rickettsiosis endemic in NZ, is caused by *Rickettsia typhi* and is transmitted by rat fleas (*Xenopsylla cheopis*). It classically causes a clinical triad of fever, headache and rash.

Two case series of murine typhus in NZ have previously been published in this Journal and in the New Zealand Health Report. They demonstrate that the illness usually occurs in people living or working in a rural environment, with a median duration of symptoms before presentation of 5 days. All cases in these two series occurred in winter or spring (between April and October).

Case report

A 26 year old man presented to the emergency department at Waikato Hospital on the 27 January 2009 (midsummer) with a 4-week history of intermittent central abdominal pain, mild jaundice, fevers, vomiting and increasing tiredness. He had not recently travelled overseas. No-one in his household had a similar illness. He lived with his partner and two cats in a townhouse in Hamilton, and worked as a handyman in a residential area on the outskirts of the city. He smoked 10–15 cigarettes per day and drank alcohol only on special occasions. He had previously used intravenous drugs, but not in the 6 months before presentation.

On examination he was afebrile and had mild yellowing of his sclera. His abdomen was soft, non-tender and his liver and spleen were not palpable. He had no rash, and he had no photophobia or neck stiffness.

Routine blood testing revealed (normal values in parentheses) Na=138 (135–145) mmol/L, K=3.8 (3.6–5.2) mmol/L, Creatinine=75 (45–90) µmol/L, Urea=3.6 (3.2–7.7) mmol/L, Bilirubin=86 (0–24) µmol/L, GGT=419 (0–50) U/L, ALP=320 (40–130) U/L, ALT=671 (0–45) U/L, AST=454 (0–35) U/L, CRP=1 (0–5) mg/L, Hb=143 (115–160) g/L, Platelets=245 (150–400) × 10^9/L, White Cell Count=9.1 (4–11) × 10^9/L, Neutrophils=5.8 (1.9–7.5) × 10^9/L, Lymphocytes=2.2 (1.0–4.0) × 10^9/L, Monocytes=0.9 (0.2–1.0) × 10^9/L, Eosinophils=0.2 (0.0–0.5) × 10^9/L. He had negative serology for hepatitis A, B and C, for HIV and for leptospirosis.
Serology for *R. typhi* was positive to a dilution of 1/1024 (IgM) and 1/1024 (IgG). Serology for *Rickettsia rickettsia* was positive to a dilution of 1/256 (IgG), IgM not recorded. (Waikato Hospital uses an Indirect Immunofluorescent Assay (IFA) test manufactured by Focus Diagnostics. The antigens used are taken from *R. typhi* as a representative of the typhus fever group of rickettsia, and *R. rickettsia* as a representative of the spotted fever group). An ultrasound of his abdomen showed no evidence of biliary obstruction.

He was treated with a 2 week course of oral doxycycline at a dose of 100mg twice per day and made a slow recovery.

**Discussion**

The rickettsiae are gram negative coccobacilli which grow strictly in eukaryotic cells. They are broadly divided into three groups; the spotted fever group (including *R. rickettsii*, *R. conorii*, *R. africae*, *R. felis*), the typhus group (*R. typhi*, *R. prowazekii*), and the scrub typhus group (*Orientia tsutsugamushi*). The spotted fever group are transmitted by ticks (except *R. felis* which is transmitted by fleas) whilst the typhus group are transmitted by fleas or lice. They all cause a similar clinical illness, with varying presence of fever, rash, headache, myalgia, altered liver tests and thrombocytopenia.

Severity may vary from a mild febrile illness, to a more severe illness with multi-organ involvement. Patients with tick-borne spotted fevers may have an eschar at the site of the tick bite. Rickettsiae are generally sensitive to doxycycline.

Murine typhus is the only rickettsial illness that has been detected in humans in NZ, through the demonstration of *R. typhi* DNA in the blood of a patient with a compatible clinical illness.² Cases of human infection with *R. felis* have recently been described overseas,³ and *R. felis* has been detected in cat fleas in NZ.⁴ However, no human infection has been demonstrated in NZ. No other rickettsiae that cause human infection are known to be endemic in NZ.

Murine typhus is a febrile illness caused by the bacteria *R. typhi*. Its lifecycle involves infection of mammalian hosts and flea vectors, transmission occurring through flea bites, the inoculation of infected faeces into pruritic bite lesions or the inhalation of infected faeces. The classic cycle of transmission is between rats (*Rattus rattus* and *Rattus norvegicus*) and the rat flea (*X. cheopis*). Transovarian transmission of *R. typhi* in *X. cheopis* fleas helps maintain a reservoir of infection.⁵

Transmission of murine typhus has also been described in other mammal/flea cycles, for example between opossums (*Didelphis virginiana*) and cat fleas (*Ctencephalides felis*) in the south of the United States.⁶ Human infection occurs incidentally and is not considered a sustaining part of the lifecycle of *R. typhi.*

*R. felis* causes a febrile illness similar to that of murine typhus. It has been detected in *C. felis* fleas, which are the most likely vector for human *R. felis* rickettsiosis. Transmission of infection occurs through flea bites,⁷ but may also occur through inoculation of infected faecal material. Transovarian transmission of *R. felis* occurs, maintaining a reservoir of infection in infected fleas.⁸ This flea lives on a variety of hosts including domestic cats, dogs, rodents and opossums.
Murine typhus was first described in NZ in 1989. Since then there have been two case series describing the epidemiology of murine typhus infection in the Auckland and Waikato regions. Almost all patients in these series lived or worked in a rural environment, which carries more risk of exposure to rats and rat fleas. All patients suffered their illness in winter or spring (April to October).

This case of rickettsiosis was unusual for three reasons. Firstly, the patient lived and worked in the confines of Hamilton city. One of 24 previously described New Zealand patients lived in an urban environment, with the others living or working rurally. Secondly, our patient suffered his illness in January. All previously described patients were unwell between April and October. This pattern is hypothesized to be due to the movement of rats, (hosts of *R. typhi*) closer to human habitation in cold winter weather. Thirdly, our patient presented following a symptomatic period of 4 weeks, demonstrating that rickettsial infection can sometimes cause a prolonged illness. Patients detected in previous case series have had an average duration of symptoms before presentation of 5 days.

The atypical features of this patient’s illness, and the observation that he owned two cats, raises the possibility that his illness was not caused by *R. typhi*, but by *R. felis*, or by another as yet unidentified rickettsia. Serological testing for rickettsiae often shows cross reactivity (as in this case) and does not reliably distinguish between species. A definitive demonstration of the infecting organism can be made by PCR analysis of rickettsial DNA present in patient white blood cells, or by western blot analysis of serum immunoglobulins to species specific antigens. PCR analysis can fail to yield a result due to low rickettsial DNA levels in tested blood.

Taking blood samples after the administration of an effective antibiotic, or during the immune phase of the illness (when serological tests are positive) reduces the likelihood of obtaining a result. This represents a significant barrier to obtaining a species diagnosis with PCR; as most patients with a prolonged febrile illness do not have a rickettsiosis, yet on presentation need blood set aside for PCR analysis. This difficulty is highlighted by the observation that only one of the published cases of murine typhus in NZ was confirmed by PCR analysis. Unfortunately we were not able to pursue a definitive diagnosis for our patient through PCR testing, as the blood specimen had been discarded by the laboratory when we took the decision to write this case report. Serological testing confirmed a rickettsial infection which was most likely to have been murine typhus. From a clinical point of view further definition of the infecting species would not have altered management, as doxycycline was appropriate treatment regardless of the infecting rickettsia.

Further research aimed at identifying the causative agent of rickettsial disease in NZ, using species specific techniques such as PCR or western blot analysis, would help to clarify whether or not *R. felis* (or other rickettsial organisms) cause human disease here in addition to *R. typhi*.

**Summary**—This atypical case of rickettsial infection occurred in a man who lived and worked within the confines of Hamilton city, during summer. It suggests the diagnosis of rickettsiosis should be considered in all patients presenting with undifferentiated fever.
Author information: Anurag Sekra, Medical Registrar; James Irwin, General Medical Registrar; Paul Reeve, Clinical Director; Department of Medicine, Waikato Hospital, Hamilton

Correspondence: James Irwin, General Medical Registrar, Department of General Medicine, Waikato Hospital, Private Bag 3200, Hamilton, New Zealand. Email irwinj@waikatodhb.govt.nz

References:


