Queensland Tick Typhus

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Introduction
Rickettsiae are obligate intracellular bacteria that are spread by arthropods and cause zoonotic infections (1). Queensland tick typhus is caused by *Rickettsia australis* and is endemic to the Sydney region (2). It belongs to the spotted fever group of rickettsial infections (3).

Another spotted fever infection found in Australia is caused by *Rickettsia honei*, including the subspecies *marmionii* (4-7). *Rickettsia felis* causes murine typhus and this was first described in Australia (3). *Rickettsia typhi* causes scrub typhus in northern Australia (3). These, and rickettsial illnesses imported from overseas, may need to be considered in the differential diagnosis of Queensland tick typhus (1).

Historical Background and Epidemiology
Queensland tick typhus was the first Australian spotted fever to be characterised. Andrew *et al.* described a series of tick typhus cases amongst troops training in the Atherton tablelands during World War 2 (10). They cultured the rickettsial organism, and identified the likely vector (10). Plotz *et al.* then carried out further tests on the organism and confirmed it was a novel cause of tick typhus (11). The organism was subsequently called *Rickettsia australis* (12).

The main vector is *Ixodes holocyclus*, the paralysis tick of eastern Australia (figure 1) (13). It feeds on mammals, including bandicoots and domestic dogs (3, 13). *R. australis* has been identified from ticks of the larval, nymph and adult stages of development (13). *Ixodes holocyclus* feed separately for each stage (14). Larvae and nymphs are smaller than adults and may drop off a host without being noticed.

Queensland tick typhus has only been identified on the east coast of the mainland, from Far North Queensland to Victoria (3). A ‘hot spot’ for Queensland tick typhus in the Sydney region is the “northern beaches” area (15, 16). The peak incidence for reported cases of Queensland tick typhus has been in late winter (17).

Clinical Characteristics
Incubation periods from 48 hours to 2 weeks have been described (10, 15). The original case series described abrupt onset of headache, fevers, rigors, myalgias and malaise (10). Untreated, the total duration of fever lasted from 2-12 days (10). Generalised lymphadenopathy was present in all the cases (10). Eschars are circular necrotic lesions at the site of inoculation of the organism (18). They were seen in 9 of the 12 cases (10). A rash developed 3-5 days after the development of symptoms, in 11 of the 12 cases (10). The rash was most commonly macular and papular, and ranged from sparse to confluent in coverage (10). One individual had macular rash and another had vesicles, which were initially confused with chickenpox (10). Subsequent descriptions of cases where the identity of the organism was confirmed have shown similar presentations (figure 2) (2, 10, 19, 20).

One published fatality and life-threatening cases of spotted fever have been described in rural Queensland (21-23). Manifestations included respiratory distress and tissue necrosis (21-23). While serology in these cases was positive for *R. australis*, there can be cross-reactivity between spotted fever group rickettsias (22, 24). Similarly, in a case of spotted fever associated with prolonged fatigue, serology was non-specific (25).

Investigations
On full blood count examination, the leukocyte count may be normal or decreased with mild lymphopenia (17). Thrombocytopenia may be present (17). There may be some minor derangements of the liver function tests and minor elevation of serum creatinine (17). In severe illness with positive *R. australis* serology, acute renal failure and hepatitis may be detected on blood tests and pulmonary infiltrates seen on chest x-rays (21-23).

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Figure 1: *Ixodes holocyclus*, paralysis tick.
Photo: Stephen Doggett. Medical Entomology, ICPMR.
The current standard serological technique is an indirect fluorescent antibody (IFA) assay using acute and convalescent sera (3, 24, 26). A positive result is regarded as a four fold or greater increase in antibody titre (26). Seroconversion can take up to 28 days so acute serology is commonly negative. Precise serological diagnosis is limited by serum cross reactivity between antigens of different spotted fever organisms (22, 24). In Sydney, clinical tick typhus may occur in the absence of sero-conversion. This may be more likely if effective treatment is started early in the illness course (27).

Polymerase chain reaction (PCR) amplification of the citrate synthetase gene (gltA) has been used for the diagnosis of R. australis (2, 28). PCR is particularly useful in that the identity of the pathogen can be confirmed (2). Suitable specimens include blood collected in EDTA or sodium citrate (29). Blood specimens may be negative on PCR and, in the case of Rocky Mountain Spotted fever, this is attributed to low numbers of organisms (26). Rickettsial nucleic acid has been amplified from ticks and biopsies of skin lesions, in particular eschars (18, 24, 30). One effective method of specimen collection for R. australis PCR has been to swab an eschar or a de-roofed vesicular lesion (2). Diagnosis has been successful even after the commencement of therapy (2).

Other techniques to identify rickettsial infection that are not routinely used for the diagnosis of Queensland tick typhus, include immunohistochemistry on tissue biopsies and culture (20, 24, 26).

Treatment

Doxycycline, azithromycin and ciprofloxacin are effective treatments for tick typhus (31-33).

Conclusion

Queensland tick typhus is a relatively common infection in parts of Sydney and should be considered by medical practitioners who see patients with an acute febrile illness and a history of potential tick exposure. A swab of an eschar or a vesicular skin lesion is a useful specimen for PCR. Otherwise, acute and convalescent serology is useful in confirming the diagnosis of an acute rickettsial infection.

Figure 2: Queensland tick typhus eschar and pustulovesicular rash. Eschar swabpositive for R. australis by PCR. Photo: Dr Bernie Hudson.

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References