



## CASE REPORT

# Massive Tick Bites Causing Spotted Fever Rickettsial Infection: A Hazard in a Tea Plantation, Sri Lanka

Sithara Warnasooriya, BSc<sup>1</sup>; Damsara Kularatne<sup>2</sup>; Sathya Kularatne<sup>3</sup>; Kosala Weerakoon, MBBS, MPhil, PhD<sup>4</sup>

<sup>1</sup>Centre for Research in Tropical Medicine (CRTM), Faculty of Medicine, University of Peradeniya, Peradeniya, Sri Lanka; <sup>2</sup>Faculty of Medicine, University of Peradeniya, Peradeniya, Sri Lanka; <sup>3</sup>Manipal College of Medical Sciences, Pokhara, Nepal; <sup>4</sup>Department of Parasitology, Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka, Anuradhapura, Sri Lanka

Tea plantations in Sri Lanka cover the central hills of the island, where spotted fever group (SFG) rickettsial infection is common. In most cases, the history of tick bite is obscure and eschars are not present. A 45-y-old female experienced massive tick bites while working in her tea plantation. She developed fever 2 d after exposure, but the diagnosis of SFG infection was not considered until a skin rash appeared on the eighth day. She had a very high titer of antirickettsial antibodies detected by immunofluorescence assay and responded to doxycycline. Here, we highlight the high risk of exposure to ticks and tick bites within tea estates and its causal relationship to SFG infection, which is increasing in Sri Lanka. Active case detection, notification, surveillance, and community awareness are imperative. Possible preventative measures for tick bites have to be introduced. There is a need to explore the effectiveness of local remedies currently in use.

**Keywords:** rickettsioses, occupational hazard, environmental hazard, tick infestations, re-emergence

## Introduction

Sri Lanka, an island in the Indian Ocean situated at latitudes 5° and 10°N and longitudes 79° and 82°E, has been known for its tea industry from the industry's inception in 1867 in the central highlands when historic coffee plantations began to fail. The tropical climatic conditions and low temperature in the high altitude hilly terrain are conducive for an abundance of both flora and fauna.

Early reports of rickettsial infections in Sri Lanka found that tick-borne spotted fever group (SFG) infection is widely distributed in the hilly central province of the island.<sup>1,2</sup> Classically, patients with SFG rickettsioses present with fever and a skin rash. Fever is generally of abrupt onset and is high grade and intermittent, and the skin rash is erythematous and maculopapular, often with the presence of eschar.<sup>1-4</sup> In most cases of SFG rickettsial infections, history of tick bite is obscure and eschars are

not apparent. Therefore, the link of the 2 entities is not very apparent. Tick infestations and tick bites are so common that people tend to ignore them. The ticks commonly attracted by humans are *Amblyomma integrum* or *Dermacentor auratus*, particularly in Sri Lanka (Figure 1). Rickettsiae are groups of gram-negative coccobacilli found as obligatory intracellular pathogens that require eukaryotic cells to proliferate.<sup>3,4</sup> Today, rickettsial infections are endemic in Sri Lanka and burden the health care system with an increasing number of cases.<sup>1,2,5</sup> The aim of this case report is to show the burden of tick infestation in the highlands of Sri Lanka and its direct link to SFG, a diagnosis often overlooked.

## Case Presentation

A 45-y-old previously healthy female from a hamlet in the hilly central province of Sri Lanka presented to the Teaching Hospital, Peradeniya, with a 9-d history of high-grade fever. She was a housewife and worked in her own home-garden tea plantation. Her tea plantation was about 1 acre in size and had provided a living for the family over the past 30 y. Family members together

Corresponding author: Kosala Weerakoon, MBBS, MPhil, PhD, Department of Parasitology, Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka, Saliyapura, Sri Lanka; e-mail: [kosalagadw83@gmail.com](mailto:kosalagadw83@gmail.com).

Submitted for publication June 2020.

Accepted for publication May 2021.



**Figure 1.** Adult female tick of *Dermacentor* species (adapted from Kularatne et al, 2018<sup>2</sup>; reprinted with permission from BMC).

maintained the tea bushes and plucked leaves alternatively in 4 divided plots. They plucked tea leaves in a quarter of the land and harvested about 350 kg of leaves in the course of a month. The tea harvest was sold to a nearby tea factory to generate their family income. The family house was located at a corner of the tea garden, which had a concrete slab as the roof and a cement floor. Her neighbors also had similar small tea estates, and there were no well-developed roads to access their houses directly by automobile (Figure 2). She did not have pet cats or dogs at home, but it was usual to see wild animals such as monkeys in the daytime and wild boar and small deer at night.

Three days before the onset of fever, she worked in the tea plot plucking tea leaves as usual. In the afternoon, she had to take her son to the local hospital in a rush, postponing her usual bath after the day's work. The next morning, she developed itching of the skin on her abdomen. Immediately, she had her daughter examine her; the daughter found more than 50 tiny ticks firmly attached to her skin where there was itching, including the abdomen and uncovered area of her back between her skirt and blouse.

There were no ticks attached under the areas covered by clothing. The patient applied a medicinal oil called *Sarwawishadhiya* (made of multiple herbal plant extracts) to the tick-infested skin, left it for a while, and rubbed off the ticks. The patient revealed that this particular medicinal oil is available in the local shops and is used for a number of ailments as a quick remedy. It is



**Figure 2.** Tea plucking in central hills of Sri Lanka (photograph courtesy of Mr. Iroshan Weerakoon, MBA, deputy general manager of Maskeliya Plantations PLC in Sri Lanka).

also believed to be a good repellent of ticks and leeches, according to her experience. The patient believed that wearing long-sleeved tops and long dresses up to the ankle helps to prevent tick bites. Generally, tea pluckers work barefoot and apply lime or coconut oil as repellents on their feet.

Two days after the tick bites, the patient developed a fever and was admitted to a nearby peripheral hospital; she stayed for 3 d and then went home. This initial presentation had been unremarkable except for fever, and no further records could be retrieved. However, fever recurred 2 d later (day 7 after tick bite), and she was readmitted to the same hospital, where she stayed an additional 2 d. Because she was becoming increasingly ill, she was transferred by ambulance to Teaching Hospital, Peradeniya.

In addition to high fever, the patient had severe headache, significant upper and lower limb joint pain, myalgia, difficulty walking, back pain, lethargy, nausea, and vomiting. There was no icterus or lymphadenopathy. Her blood pressure was 100/60 mm Hg, and her pulse rate was 88 beats·min<sup>-1</sup>. Newly developing skin rash on both upper and lower limbs was noted on the 10th day after tick bite. On the 15th day, she had a distinctive and discrete erythematous macular rash over both upper and lower limbs. She did not have any eschar. She had insomnia due to the joint pain.

Basic laboratory investigation findings were as follows: white blood cell count  $10.81 \times 10^3 \cdot \mu\text{L}^{-1}$ , neutrophils  $6.34 \times 10^3 \cdot \mu\text{L}^{-1}$ , and lymphocytes  $3.46 \times 10^3 \cdot \mu\text{L}^{-1}$  on the 11th day of illness. The lowest platelet count was  $65 \times 10^3 \cdot \mu\text{L}^{-1}$  on the eighth day of fever. Erythrocyte sedimentation rate (ESR) was  $64 \text{ mm} \cdot \text{h}^{-1}$ , and the

C-reactive protein level was  $157.1 \text{ mg}\cdot\text{L}^{-1}$ . Alanine transaminase was  $41 \text{ u}\cdot\text{L}^{-1}$ , and aspartate transaminase was  $129 \text{ u}\cdot\text{L}^{-1}$ . No significant abnormality was found in the urine full report. The clinical diagnosis of tick-borne SFG rickettsial infection was made; this was confirmed with strongly positive IgG antibodies against *Rickettsia conorii* on an immune fluorescence antibody test. The titer value was 1:2460. The patient was treated with oral doxycycline 100 mg twice a day for 7 d, which resulted in defervescence and clinical improvement within 24 h.

## Discussion

We found tick infestation and bites to be an environmental and occupational hazard in tea plantations in Sri Lanka. Reports of massive tick bites of this nature are not found in the literature, despite their frequent occurrence. In addition to transmission of rickettsial infections, tick bites can lead to skin ulceration, secondary infections, and related complications. Vulnerable populations have their own remedies for tick bites and bite prevention, including wearing protective clothing, applying locally identified plant materials, and avoiding potentially risky areas. However, such methods, particularly the local application of plant materials, have not been specifically tested for their efficacy, and these avenues need to be explored.

A bath with strong soap and water at the end of the day's work helps to remove ticks from the skin. As done in this case, rubbing off ticks is contrary to standard protocol and can irritate the ticks, causing worsened disease. The proper method for tick removal is to grasp the tick as close as possible to the skin to where it is attached, to slowly withdraw the tick from the skin using fine-toothed forceps, and to clean the area once done.<sup>6</sup> People generally do not seek hospital treatment for tick bite except for otoacariasis (ticks in the ear), which is a common problem in the central province and can even cause unilateral facial palsy.<sup>5</sup>

Our patient had a confirmed diagnosis of SFG rickettsial infection with gradual development of known clinical manifestations. She developed a fever 3 d after massive tick bites, which may imply a very short incubation period of SFG rickettsial infection. An unnoticed tick bite in the preceding days could also have been responsible for the SFG infection. In her clinical course, the eruption of the skin rash took about 5 to 8 d and helped with the clinical diagnosis, which was later confirmed with very high titer of immunofluorescence assay (IFA) specific for SFG. She responded well to specific antibiotic therapy with doxycycline and commenced her usual activities. Delays in diagnosis may

lead to multiple organ failure and even fatality.<sup>3,7,8</sup> Therefore, a history of tick bite should be inquired in any nonspecific febrile illnesses in Sri Lanka to help in early diagnosis and prompt patient care.

The tick population in Sri Lanka comprises about 31 species under 11 genera.<sup>9,10</sup> Among them, genera such as *Dermacentor*, *Amblyomma*, *Hyalomma*, *Boophilus*, and *Rhipicephalus* are recognized vectors of a range of pathogens causing both animal infections and zoonotic diseases in humans. Ticks take a blood meal by deep attachment to the host over a period of days during their 3 stages of development: larva, nymph, and adult. Ticks in early stages of development are often difficult to notice with the naked eye.<sup>9,10</sup> Because all stages are capable of transmitting disease, there is a high chance of spread of infections due to unnoticed tick bites. Ticks have a wide range of hosts, including domestic animals and humans. Ticks are also found in colonies in the leaves of many plants, including tea bushes, and wait to catch a host, including reptiles, birds, and humans. Farmers and field workers sometimes notice these tick colonies in plants and spray chemicals to kill them. Ticks attach in vascular areas or extremities. Tick attachments are so common in Sri Lankan tea plantations that they are rarely reported; however, when ticks infest the ear canal (otoacariasis), infected individuals come to ear, nose, and throat clinics for removal.<sup>11</sup> There is changing ecology in the hills of Sri Lanka, including temperature changes and expansion of dwellings toward the wilderness, which potentially has led to an increasing tick population and increased contact with humans.<sup>12</sup>

Obvious re-emergence of rickettsial infection in Sri Lanka began in the 1990s but was low in prevalence in some areas. During the early 1940s when Sri Lanka was a British colony, an outbreak of scrub typhus fever was reported.<sup>13,14</sup> Since then, there were no reports until the 1990s when the spread of rickettsial infections (particularly SFG) was detected in the western slope of the hilly central province.<sup>13,15</sup> This was then followed by many publications describing varied epidemiologic and clinical characteristics, including neurologic, hematologic, musculoskeletal, and cutaneous manifestations; however, further research regarding specific pathogens responsible for rickettsioses and the mode of transmission in Sri Lanka is still necessary.<sup>1,2,5,16,17</sup>

## Conclusions

The emergence and spread of rickettsioses in Sri Lanka have posed threats across different communities, from rural outback to urban cities. In this case report, we draw attention to the impact of tick bites and their medical complications in a vulnerable community. Knowledge of

tick-borne diseases, particularly in the local setting, is sparse. As demonstrated in this report, tick bites and associated complications are a significant occupational hazard. Hence, it is imperative to raise public awareness about the potential dangers of tick bites and their complications, including transmission of infectious diseases, and the need to minimize or avoid potential encounters. Active case detection, notification, surveillance, and community awareness are imperative. Possible preventive measures for tick bites have to be introduced, and there is a need to explore the effectiveness of potential remedies considered by the local communities; if proven effective, these should be promoted. Moreover, it is of vital importance to increase awareness among clinicians of the varying epidemiologic and clinical manifestations of these infections to help in early detection and precise management to prevent associated morbidity and mortality. This will help in improving the health of labor communities in plantations, who contribute immensely to the economic development of the island.

Author Contributions: Collection of clinical details (SW); drafting of manuscript (DK, SK); figure and reference development (KW); approval of final manuscript (all authors).

Financial/Material Support: None.

Disclosures: None.

## References

1. Kularatne SAM, Rajapakse RPVJ, Wickramasinghe WMRS, Nanayakkara DM, Budagoda SS, Weerakoon KGAD, et al. Rickettsioses in the central hills of Sri Lanka: serological evidence of increasing burden of spotted fever group. *Int J Infect Dis*. 2013;17(11):e988–92.
2. Weerakoon K, Kularatne SAM, Rajapakse J, Adikari S, Waduge R. Cutaneous manifestations of spotted fever rickettsial infections in the Central Province of Sri Lanka: a descriptive study. *PLoS Negl Trop Dis*. 2014;8(9):e3179.
3. Blanton LS. The rickettsioses: a practical update. *Infect Dis Clin North Am*. 2019;33(1):213–29.
4. Rathi N, Rathi A. Rickettsial infections: Indian perspective. *Indian Pediatr*. 2010;47(2):157–64.
5. Kularatne SAM, Fernando R, Selvaratnam S, Narampanawa C, Weerakoon K, Wickramasinghe S, et al. Intra-aural tick bite causing unilateral facial nerve palsy in 29 cases over 16 years in Kandy, Sri Lanka: is rickettsial aetiology possible? *BMC Infect Dis*. 2018;18(1):418.
6. Centres for Disease Control and Prevention. Removing a tick. Available at: [https://www.cdc.gov/ticks/removing\\_a\\_tick.html](https://www.cdc.gov/ticks/removing_a_tick.html). Accessed March 1, 2021.
7. Petri Jr WA. Overview of rickettsial and related infections. MSD manual (professional version). Available at: <https://www.msmanuals.com/professional/infectious-diseases/rickettsiae-and-related-organisms/overview-of-rickettsial-and-related-infections>. Accessed December 12, 2020.
8. Lee SC, Cheng YJ, Lin CH, Lei WT, Chang HY, Lee MD, et al. Comparative effectiveness of azithromycin for treating scrub typhus: a PRISMA-compliant systematic review and meta-analysis. *Medicine (Baltimore)*. 2017;96(36):e7992.
9. Ariyaratne S, Apanaskevich DA, Amarasinghe PH, Rajakaruna RS. Diversity and distribution of tick species (Acari: Ixodidae) associated with human otoacariasis and socio-ecological risk factors of tick infestations in Sri Lanka. *Exp Appl Acarol*. 2016;70(1):99–123.
10. Liyanaarachchi DR, Rajakaruna RS, Dikkumbura AW, Rajapakse RPVJ. Ticks infesting wild and domestic animals and humans of Sri Lanka with new host records. *Acta Trop*. 2015;142:64–70.
11. Suzin A, Vogliotti A, Nunes PH, Barbieri ARM, Labruna MB, Szabó MPJ. Free-living ticks (Acari: Ixodidae) in the Iguazu National Park, Brazil: Temporal dynamics and questing behavior on vegetation. *Ticks Tick Borne Dis*. 2020;11(5):101471.
12. Kottawa-Arachchi JD, Wijeratne MA. Climate change impacts on biodiversity and ecosystems in Sri Lanka: a review. *Nat Conserv Res*. 2017;2(3):2–22.
13. Edirisinghe JS, Kularatne SA. Rickettsioses in Sri Lanka. In: Yano A, Nam HW, eds. *Asian Parasitology*. Chiba, Japan: The Federation of Asian Parasitologists; 2005:262–76.
14. Premaratna R. Rickettsial infections in Sri Lanka: yesterday, today and tomorrow. *J Ceylon Coll Physicians*. 2011;42:11–5.
15. Kularatne SAM, Edirisingha JS, Gawarammana IB, Urakami H, Chenchittikul M, Kaiho I. Emerging rickettsial infections in Sri Lanka: the pattern in the hilly Central Province. *Trop Med Int Heal*. 2003;8(9):803–11.
16. Premaratna R, Loftis AD, Chandrasena TGAN, Dasch GA, de Silva HJ. Rickettsial infections and their clinical presentations in the Western Province of Sri Lanka: a hospital-based study. *Int J Infect Dis*. 2008;12(2):198–202.
17. Kularatne SAM, Weerakoon KGAD, Rajapakse RPVJ, Madagedara SC, Nanayakkara D, Premaratna R. A case series of spotted fever rickettsiosis with neurological manifestations in Sri Lanka. *Int J Infect Dis*. 2012;16(7):e514–7.