

Fatal Brazilian spotted fever in a healthy military man during field training in Rio de Janeiro city, southeastern Brazil

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ABSTRACT

Brazilian spotted fever, a zoonotic disease transmitted by ticks, is caused by *Rickettsia rickettsii*. We report a fulminant case of this zoonosis in a healthy 46-year-old military man in the urban region of Rio de Janeiro city, in October, 2021. Ticks and capybaras (*Amblyomma sculptum*, *Hydrochoerus hydrochaeris*, respectively) were identified in the military fields, pointing to the participation of this large synanthropic rodent, recognized as an efficient amplifier host of *Rickettsia rickettsii* in Brazil. As the military population is considered a risk group for spotted fever, it is necessary to alert health professionals to the importance of the early detection of the disease and its adequate management, mainly in populations that are particularly at risk of exposure to ticks, in order to avoid fatal outcomes.

KEYWORDS: Spotted fever. *Rickettsia* infection. Vector-borne. Capybaras. Rio de Janeiro city.

INTRODUCTION

Brazilian spotted fever (BSF) is a tick-borne disease of high case fatality rate caused by a Gram-negative obligate intracellular bacterium named *Rickettsia rickettsii* (*R. rickettsii*). In Rio de Janeiro city, the *Amblyomma sculptum* tick (*Amblyomma cajennense* complex) is considered the main reservoir and vector of this proteobacterium. The ticks feed off many different vertebrate hosts, including humans, horses, dogs, and capybaras (*Hydrochoerus hydrochaeris*), the world's largest rodent, an important amplifier host of *R. rickettsii* in several Brazilian endemic areas¹⁻³.

Among the risk groups, personnel with occupational and recreational outdoor activities such as hunting, camping and military training are potentially at risk of spotted fever through contact with infected ticks⁴. After a tick bite, the rickettsia penetrates the human skin, spreads through the bloodstream, invades and proliferates in the endothelial cell, where it causes lyse of the endothelial membrane, increase of the vascular permeability mediated by phospholipase A, protease, and free radicals, causing generalized vasculitis, mainly in the brain and lungs. As a result, microhemorrhages, interstitial edema, the activation of inflammatory mechanisms

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and cell necrosis may occur, consequently leading to bleeding, generalized organ dysfunction and death⁵.

CASE REPORT

On October 20th, 2021, a 46-year-old Brazilian male, military patient, was admitted to an infectious disease referral hospital at the Oswaldo Cruz Foundation (Rio de Janeiro city, Brazil) with fever, abdominal pain, nausea, myalgia, vomiting, diarrhea, pain and paresthesia in the hands and feet. The illness had started six days earlier (October 14th, 2021), as a nonspecific febrile syndrome. The patient's condition was severe, presenting with a generalized purpuric rash showing poor tissue perfusion (cyanosis). Ten days prior to the symptom onset, the patient underwent military training in the urban region of Rio de Janeiro city where capybaras and ticks were found on the training field.

He reported that he found a tick attached to his body 24 h after completing the training. Empirical treatment with intravenous chloramphenicol was initiated upon admission (six days after the symptom onset) based on a high index of suspicion of BSF. Despite the specific antibiotic therapy, the patient developed seizures and altered consciousness in less than 24 h, requiring orotracheal intubation, oxygen therapy, and use of drugs to support blood pressure. Unfortunately, the patient died 6 days after the symptom onset, on the first day of hospitalization. Laboratory tests on hospital admission showed moderate leukocytosis (12,910/mm³), thrombocytopenia (86,000/mm³), an increased C-reactive protein level (29.9 mg/dL), and an increased serum creatinine level (4.23 mg/dL). DNA was extracted from a blood sample of the patient on the sixth day of illness and analyzed for the presence of *Rickettsia* spp. using a polymerase chain reaction targeting the *ompA* and *gltA* genes. The clinical outcome, previously described, and the positive result of PCR tests led to the confirmation of BSF.

On October 25th, 2021 (five days after the date of death), an epidemiological investigation was carried out at a military training site where 200 free-living ticks were collected from vegetation [41 *Amblyomma* spp. (41 larvae), 2 *Amblyomma dubitatum* (1 adult and 1 nymph), and 157 *Amblyomma sculptum* (148 nymphs and 9 adults)] and capybaras were observed at the possible location where the infection occurred. Furthermore, the presence of *R. rickettsii* in ticks collected on the ground was confirmed by molecular biological testing in three samples (a larva of *Amblyomma* sp, an adult and a nymph of *Amblyomma dubitatum*). The [Figure 1](#) shows the patient one day before death, and [Figure 2](#) the collection of a free-living tick where there was evidence of the presence of parasites.



Figure 1 - Patient with generalized purpuric rash and signs of cutaneous hypoperfusion.



Figure 2 - Collection of free-living tick at a military training site in Rio de Janeiro city.

DISCUSSION

BSF is a severe disease that can evolve rapidly and progressively if not treated early, affecting multiple organs and reaching a high lethality rate, which in Brazil was 35.0% in 2021⁷. Severe disease presentation occurs with an acute inflammatory response due to cytokine release (TNF- α and IFN- γ), causing extensive endothelial damage, increased vascular permeability, and a predisposition to a procoagulant state that causes thrombosis of the small vessels of the heart, kidneys, lungs, and brain⁸. The clinical course described above is consistent with what occurred with our patient, who developed tissue hypoperfusion, generalized tonic-clonic seizures, signs of meningism, acute renal failure, refractory mixed shock, and death a few days after the symptom onset.

Risk factors for severe spotted fever, such as age (> 40 and < 10 years), alcohol use, glucose-6-phosphate dehydrogenase deficiency, duration of contact with the tick (> 6 h), and late treatment are described⁴. Although the patient in this clinical report was previously healthy

and athletic, he was in the at-risk age group, had prolonged contact with the tick (> 24 h), and only received proper treatment on the sixth day after symptom onset, which can be considered late. Patients treated after the fifth day of illness are more likely to die than those treated earlier during the course of illness^{4,8,9}.

Doxycycline would be the drug of first choice for the treatment of BSF, but for critically ill patients, intravenous administration is required (not available in Brazil). Chloramphenicol is the only alternative drug used in the treatment of FSB; however, epidemiological studies suggest that patients with rickettsiosis caused by *R. rickettsii* treated with chloramphenicol are at a higher risk of death than people receiving tetracycline (Doxycycline)^{10,11}.

The vertebrate animals commonly associated with the transmission cycle of *R. rickettsii* are dogs, horses, domestic birds, and some rodents^{12,13}. Capybaras, the largest living rodent in the world, contribute strongly to the risk of BSF by feeding ticks and acting as an amplifying host of *R. rickettsii*. Thus, this rodent species plays an important role in spreading the disease in our country because of its high prevalence, which is not limited to wild and rural environments, being frequently found in urban areas such as parks, vacant lots, and pastures near rivers and roads in the Rio de Janeiro city. Luz *et al.*¹⁴ reported a direct relationship between capybaras and BSF in some cities in Sao Paulo state, confirming the risk of this wild rodent in the transmission cycle of the disease.

Therefore, it is crucial to adopt prevention strategies during walks, picnics, and other outdoor activities with the risk of exposure to ticks, mainly military personnel during field training in tick habitats. Preventive measures include avoiding sitting and lying on lawns, wearing long, light-colored clothing that allows easy visualization of the tick, wearing closed shoes, and using adhesive tape to seal the space between shoes and pants. In addition, it is important to perform periodic inspections of the skin every 3 h to reduce the exposure time to the vector. Ticks should be removed carefully with tweezers to avoid crushing, which is associated with greater transmission of bacteria^{6,15}.

Prado *et al.*¹⁶ released a study which analyzed the diversity of ticks present in military training areas in municipalities of the Southeastern region of Brazil, including Rio de Janeiro city. A total of 9,374 ticks were collected, with a diversity of five genera, distributed in ten species. The frequent presence of tick species in the areas of military instruction, and the presence of wild animals, most commonly capybaras, demonstrate a great exposure of the military to tick vectors of rickettsiae of the Spotted Fever Group and the possible occurrence of human cases in the troops.

CONCLUSION

The Rio de Janeiro city is located in a region endemic to BSF but public prevention strategies for the disease are unsatisfactory. Information on transmission (vectors and reservoirs), risk factors, clinical manifestations, and treatment of the disease must be disseminated among the community and health professionals. Rapid clinical suspicion and efficient treatment can prevent fatal outcomes in other cases of BSF.

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CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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